AtkinsRéalis

Hydrogeological Risk Assessment

21 May 2026

CFIL03 Challonsleigh HRA Rev2

CHALLONSLEIGH FARM INERT LAND RAISE

AtkinsRéalis - Baseline / Référence

Notice

This document and its contents have been prepared and are intended solely as information for DDE (SW) ltd and use in relation to the HRA to assess the risk from the propose land raise to sensitive receptors

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1. Introduction

1.1 General

AtkinsRéalis UK Limited (AtkinsRéalis) formerly Atkins Limited (Atkins) was commissioned by proposed operator DDE (SW) Limited (DDE) to prepare a Hydrogeological Risk Assessment (HRA) for a planned inert land raise site at Challonsleigh Farm herein referred as the site.

This HRA will form part of the documentation to support the application for an Environmental Permit after the former application (reference EPR/LB3207US/A001) to the Environment Agency was withdrawn.

1.2 Background

A planning permission for the construction of the above site was granted on 1 April 2020 by Devon County Council, ref. DCC/4038/2018, for a waste transfer building and associated infrastructure, and land raise operations for the importation of inert waste material over a ten-year period requiring a change of use from agriculture and incorporating landscaping.

Atkins previously prepared an Environmental Setting and Site Design (ESSD) report, Landfill Gas Risk Assessment (LfGRA) and HRA [1] report in January 2022 in support of a bespoke Environmental Permit application on behalf of DDE to support the permit application for the planned inert land raise at Challonsleigh Farm which was duly made 3 August 2022.

In response to the Environmental Permit application, the Environment Agency issued a Schedule 5 Notice on 19 April 2023 and requested the following information:

- *"Detailed hydrogeological cross sections for each stage of the proposed development in the direction of groundwater flow and perpendicular to the site. Also provide a related map showing their alignments and relevant features, such as groundwater contours. You must include all hydrogeological details for the sources-pathways-receptors and their linkages, including the River Yealm and other surface water courses. You must include details of the artificial geological barrier, the historic landfilled waste and leachate levels within it, and monitoring infrastructure."*
- *"Update the HRA to revise risk screening for groundwater and the non-hazardous and hazardous determinants that comprise inert WAC. Hazardous substances need to be assessed against the Minimum Reporting Value (MRV) or Limit of quantification (Loq), background [pre-development] quality, and not the EQS or Drinking Water Standards (DWS). This assessment should include all hazardous determinants within the proposed Waste Acceptance Criteria (WAC) – hazardous determinants within the inert landfill WAC include Arsenic, Chromium (VI), Mercury, Lead, BTEX and PAH."*
- *"Provide a quantitative hydrogeological risk assessment (HRA) for the whole site, including a rogue load assessment"*
- *"Review and amend your groundwater compliance limit proposals based on the output of the revised source term and HRA, and provide the raw data, ideally in a spreadsheet format, together with your calculations used to derive new groundwater compliance limits."*
- *"Provide details of how you will monitor and set compliance criteria for the groundwater outflow region at the south-east boundary of the proposed landfill where it will be constructed over the historic landfill."*

In discussion with the Environment Agency, the Permit application (reference EPR/LB3207US/A001) was withdrawn to enable the above review to be completed, with a view to resubmitting following the completion of the additional necessary monitoring to enable a robust quantitative risk assessment to be provided as part of a future HRA.

1.3 Aims and objectives

This HRA constitutes a Tier 3 controlled waters detailed quantitative risk assessment per Environment Agency guidance [2]. It includes an updated hydrogeological Conceptual Site Model (CSM), based on the findings of site-specific Ground Investigation (GI) and monitoring.

The Tier 1 and Tier 2 assessments have been completed as part of the ESSD [3] and previous Atkins' HRA [1].

This HRA presents the following objectives:

- review desk study and GI information to inform the CSM;
- produce relevant CSM cross section;
- assess proposed source and undertake a generic quantitative risk assessment to identify contaminants of concern;
- assess groundwater and surface water quality to establish baseline prior to the land raise construction;
- undertake a DQRA using appropriate software that represents the CSM considering proposed engineering and the use site-specific parameterisation to represent the numerical CSM or appropriate literature values in their absence;
- propose infrastructure to monitor site performance with respect to control waters and propose, based on available data, action levels and compliance limits; and
- provide details on monitoring and set compliance criteria for the groundwater outflow region at the south-east boundary of the proposed land raise where it will be constructed over the historic inert landfill.

1.4 Assumptions and limitations

This HRA has been prepared to meet the client objectives. Additional assessment may be required in support of the Permit application.

The findings, opinions and recommendations presented in this report are based on information obtained from a variety of third-party sources as detailed within this report. AtkinsRéalis has not independently verified third-party information and for the purposes of this assessment has assumed that such information is accurate and complete.

The report findings are based on the assessment of GI data from exploratory holes. Inferences about subsurface conditions may involve assumptions and extrapolation between sampling points and the heterogeneity of the subsurface means that variable ground conditions may be encountered between the exploratory holes.

Site conditions are based on observations made at the time of the investigations and may be subject to temporal variability such as atmospheric, seasonal or other effects and further recommendations are provided where relevant.

No liability can be accepted for the retrospective effects of any future changes or amendments to current legislation and guidance.

Where site-specific data is not available, literature values have been assigned for the relevant parameters, to reflect expected site conditions.

2. Site setting

2.1 Location

The site is located at Challonsleigh Farm, Smithaleigh (near Lee Mill, Ivybridge) centred on National Grid Reference (NGR) SX 59570,55362 (Easting 259570, Northing 055362). The nearest post code is PL7 5AX.

The site is located immediately south of the A38. It is bounded to the south by Strashleigh Hams historical landfill, to the east and south-east by two existing waste management facilities operated by DDE (SW) Ltd previously operated by SITA UK Ltd and Wood Yew Waste Ltd, and to the west by the Recycling Way road.

A location plan is included in below in Figure 2-1.

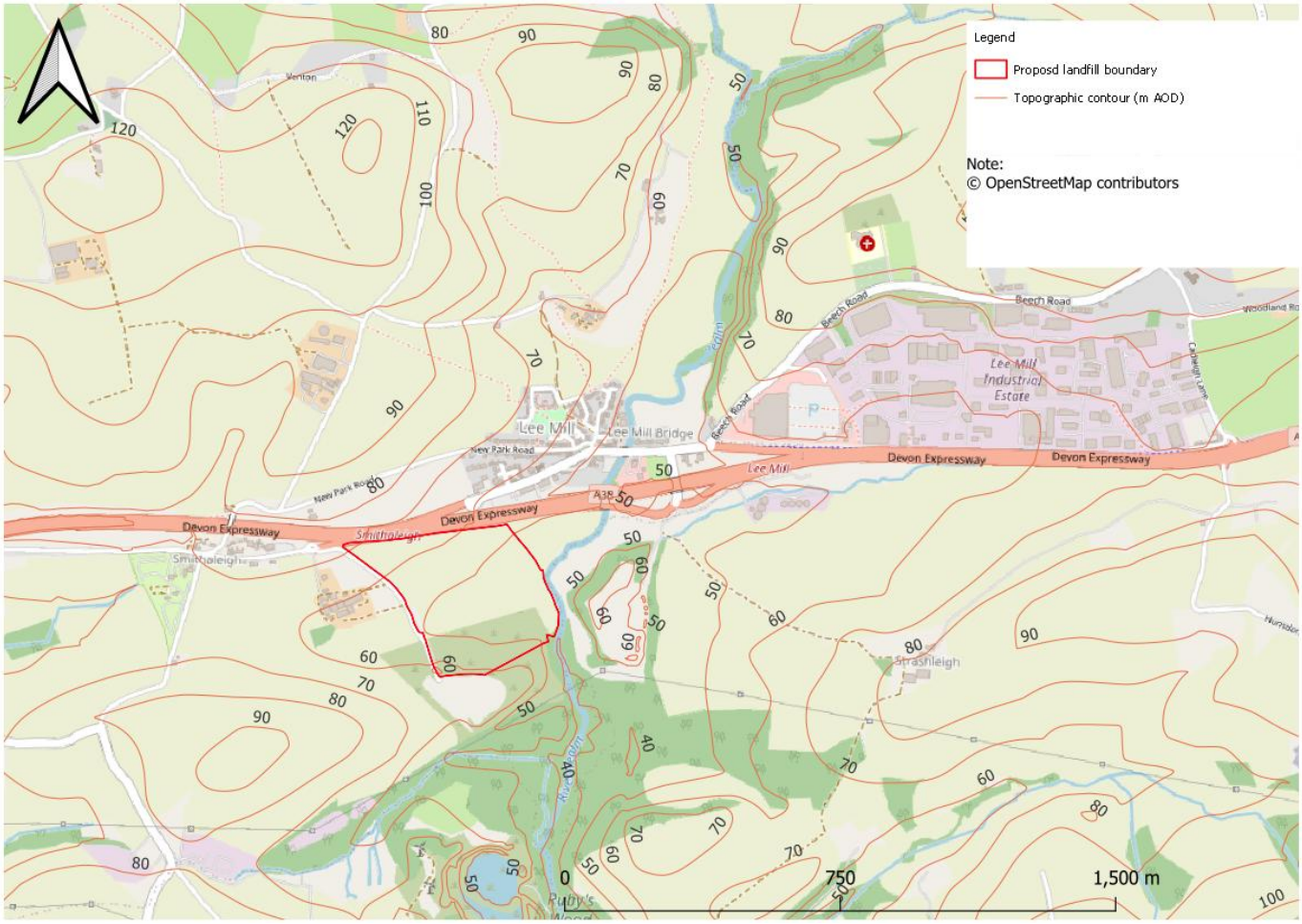


Figure 2-1 - Location plan

2.2 Topography and current land use

The proposed site is predominantly farmland used for grazing, but there are trees and dense shrub vegetation areas on an old landfill area which exists around and under the existing Site C waste management facility immediately to the south of the proposed site. An access track runs along the western boundary of the site to the Site C waste

management facility, with the River Yealm close to the eastern boundary of the planned inert landfill. A small unnamed ephemeral stream with hedgerow and trees either side, runs from west to east through the middle of the proposed inert land raise site. There are two fields to the north of the watercourse where the land slopes from approximately 71.00 metres (m) above Ordnance Datum (AOD) in the north-west to 51.00 m AOD in the south and 44.50 m AOD in the east adjacent to the watercourse. There are two fields in a central area south of the watercourse which slope gently from approximately 49.00 m AOD in the west to 42.00 to 44.00 m AOD in the east to south-east near the River Yealm.

Further to the south, the land rises to the south by approximately 3.0 to 4.0 m within 15 m to a terraced area covered with shrub vegetation, merging into the former landfill to the east and south around the existing operational waste management facility. The former landfill surface elevation varies from around 52.0 m AOD in the north to a plateau of approximately 62.0 to 64.0 m AOD east of the existing waste management facility.

Topography and land use is shown in Figure 2-1.

2.3 Rainfall

The Environment Agency Plympton weather station [4], which is located at approximately 900 m south-west of the site, indicates that the annual rainfall between 2009 to 2025 was recorded to range from 934 millimetre (mm) to 1,559 mm, with an annual average over this period of 1,207 mm/yr. The AtkinsRéalis ESSD report [3] states that the indicative annual average actual evapotranspiration is 417 to 470 mm/yr, suggesting that effective rainfall when compared to annual average is typically between 735 to 788 mm/yr.

Monthly rainfall distribution and average monthly rainfall for data collected from 2009 to 2025 is shown in Figure 2-2.

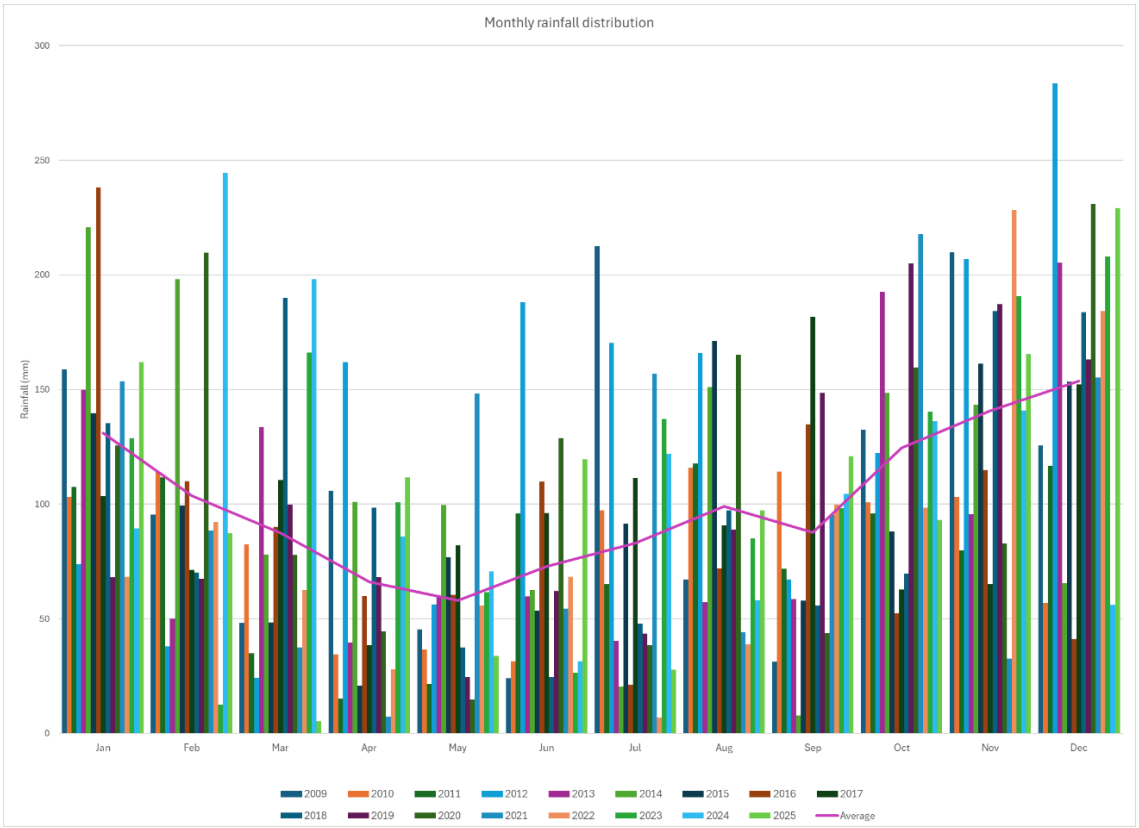


Figure 2-2 - Monthly rainfall distribution

The rainfall data during 2009 to 2025 is unevenly distributed with wet weather from October to March and relatively dry weather from April to September.

2.4 Published geology

Superficial deposits

The British Geological Survey (BGS) online tool [5] records Head and Alluvium present in the east of the site towards the river as shown on the plan in Appendix A.1 .The Head and Alluvium Deposits are described by the BGS as clay, silt, sand and gravels.

Bedrock

The BGS online tool indicates that Middle Devonian Slates bedrock underlies the site. A plan showing the Bedrock on site is included on the plan in Appendix A.2.

2.5 Published hydrogeology

The bedrock at site is classified by the DEFRA Magic Map tool [6] as a secondary A aquifer which is defined by the Environment Agency [7] as an aquifer capable of supporting large quantities of water on a local rather than strategic scale and in some cases forming an important source of base flow to rivers.

The Alluvium Deposits are also designated as secondary A, whilst the Head Deposits are designated as secondary (undifferentiated) aquifers. Secondary undifferentiated aquifers are defined by the Environmental Agency as aquifers where it is not possible to apply either a secondary A or B definition because of the variable characteristics of the rock type.

There are no Source Protection Zones (SPZ) designated within the site and immediate vicinity of the site nor are there any permits for water abstraction relating to groundwater sources. The closest SPZ is approximately 4 kilometres (km) south south-west of the site where two abstractions are shown at approximate NGRs SX5730,5189 and SX5730,5179. The site does not fall within a Drinking Water safeguard Zone (Surface water or Groundwater).

The groundwater vulnerability of the aquifer is classified as medium to high [6].

The South Hams District Council advised in 2020 that no private water supplies were registered within two miles radius of the site.

The regional groundwater flow is expected to flow towards the River Yealm and potentially provide baseflow to it.

2.6 Hydrology

The site is located within the catchment of the River Yealm main river (Water Framework Directive (WFD) Water Body ID GB108047004010). A plan showing the immediate watercourses is included in Appendix A.3

River Yealm

The River Yealm is located immediately adjacent to the eastern boundary of the site [8] at an approximate elevation of 39.00 and 41.00 m AOD and flows to the south. Groundwater levels obtained from boreholes proximal to the watercourse, specifically in BHL05, BH06 and BHL09, indicate approximate elevation between 40.00 to 42.00 m AOD. Therefore, it is likely that groundwater provides baseflow to the River Yealm.

According to Flood Map for Planning Rivers and Sea by Environmental Agency [9], the River Yealm falls under the category of Flood Zones 2 and 3. A small part of the site used for landscaping only to the eastern boundary situated nearby the River Yealm, also falls under Flood zones 2 and 3.

Unnamed watercourse

An unnamed ephemeral stream is located in the centre of the site. It has an approximate length of 400 m and between 300 to 400 millimetres (mm) depth, although rising to 1 m in some sections. The stream crosses the centre of the site, from west to east, and discharges into the River Yealm.

Based on site observations, the stream is ephemeral with small amounts of flow observed seasonally during the period of October to February, but normally dry.

Furthermore, groundwater levels collected in BHL04 (Section 3.7), adjacent to the unnamed stream, vary between 0.74 and 4.55 m bgl. It is likely that groundwater may be a stream flow contributor, but not the main mechanism due to the lack of yearly flow. The unnamed stream is fed mainly by overland run off from adjacent agricultural land and from an intermittent spring in the bedrock located 150 m west of the site. It is not proposed to fill over or culvert this stream.

2.7 Designated Sites

According to the DEFRA Magic Map tool [6] there are no Site of Special Scientific Interest (SSSI), statutory designated Special Areas of Conversation (SAC), Local Nature Reserves (LNR), Special Protection Areas (SPA), RAMSAR, Areas of Outstanding Natural Beauty, National Parks, or National Nature Reserves (NNR) within 1 km of the site.

2.8 Waste sites

A drawing showing the location of historical waste facilities are included Figure 2-3.

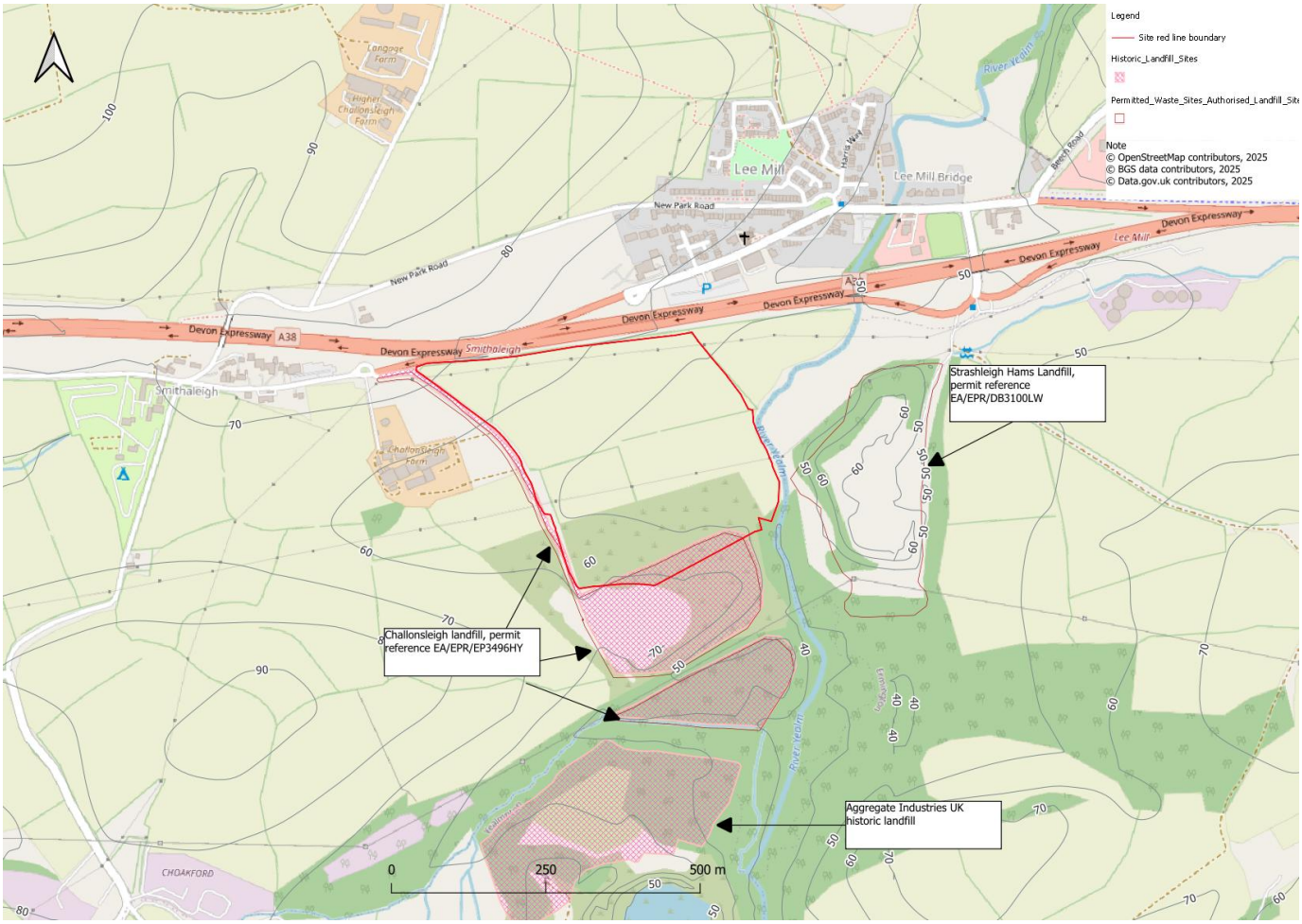


Figure 2-3 – Historical landfill locations

Historical landfill and permitted landfill

The Environment Agency historic landfill dataset [6] indicates that there are three historic landfill sites, two of which were also permitted, within 250 m of the proposed site. In order of increasing distance, these are:

- **Challonsleigh, R J L Hall landfill** (Environment Agency holding ref: EAHLD08685, permit number EA/EPR/EP3496HY)

  The red line boundary of the proposed landfill site, including the current haul road to the west, partially overlaps with Challonsleigh Farm historic inert landfill, immediately south of the site.

  From the plan a separate area is located approximately 160 m south of the southern site boundary, beyond Challonsleigh Farm historic landfill. Licence granted 8 June 1988 for the acceptance of inert industrial waste input from 1 June 1991. The last waste input date, closure and/or license surrender dates of the historical landfill are unknown.
- **Aggregate Industries UK landfill** (ref: EAHLD08683, historical landfill with unknown licence number)

  Located approximately 270 m south of the southern boundary of the site. Granted 18 April 1994. Surrendered on 14 June 2002. The nature of waste accepted is unknown.
- **Strashleigh Hams Landfill** (permit reference EA/EPR/DB3100LW)

Located approximately 30 m east of the eastern boundary of the site. Licence granted 12 December 1990 for acceptance of inert waste. The last waste input date, closure and/or license surrender of the historical landfill are unknown.

Other waste sites

There are four waste permits and one waste exemptions associated with the existing waste management facility operated by DDE within 250 m of the site:

- Permit ref HB3208UP, issued 5 May 1993 for operation of a household, commercial and industrial waste transfer station at Challonsleigh Transfer Station (SX 59200,55300);
- Permit ref HB3208TQ, issued 20 March 2002 for operation of a household, commercial and industrial waste transfer station at Challonsleigh Farm Waste Transfer Station (SX 59210,55400);
- Permit ref JP3196EW issued 8 April 2011 for operation of a non-hazardous waste physical treatment facility at Challonsleigh Farm (SX 59600,55100);
- Permit GB3402FP, issued 15 April 2019 for operation of a materials recycling facility at Lower Challonsleigh Farm (SX 58281,55330); and
- Waste exemption WEX355306 registered 8 December 2022 (SX 59260,55345).

Additionally, there are two waste exemptions associated with the JBH Ltd waste management facility present approximately 100 m to the east of the site boundary: WEX296398 and WEX328319.

2.9 Groundwater chemistry

Based on DEFRA Catchment Data explorer [10], The operational catchment relating to groundwater is the Tamar groundwater body (Water Body ID GB40802G806700) which covers an area of 1,817.4 square kilometres (km^2). The overall groundwater body is classified as ‘Poor’, based on its chemical status, the DEFRA Catchment Data Explorer also suggest that the reasons for not achieving good may be the result of agricultural and land management practices in the area. The quantitative status of the groundwater body is ‘Good’ by 2027.

3. Ground investigation

3.1 Site specific geology

To verify the published geology, a GI was undertaken on site in 2020 by Geotechnics with the findings included in the '*Ground Investigation Inert Landfill at Challonsleigh Farm Factual Report*' [11]. This investigation included 26 trial pits and seven boreholes (BHL01 to BHL06 and BHL08). Based on the comments provided by the Environment Agency Schedule 5 Notice [12], a supplementary GI was undertaken in 2024 and an additional groundwater monitoring well (BHL09)to provide borehole coverage in the south-east boundary of the site was installed. The findings were included in the 2024 '*Geotechnics Supplementary Ground Investigation Inert Landfill at Challonsleigh Farm Factual Report*' [13].

The following ground conditions were encountered on site and are summarised in Table 3-1 below. GI locations are included in Appendix A.5.

Table 3-1 - Summary of ground conditions

Stratum	Depth to top of strata (m bgl)	Typical descriptions
Topsoil / subsoil	0.10 to 0.30	Grass over firm brown sandy clay, occasionally slightly gravelly, with frequent rootlets.
Made Ground	0 to 6.10	Firm brown slightly sandy slightly gravelly clay, sand is fine to coarse, gravel is angular to subrounded fine to coarse slate, quartz, chert, asphalt, black organic matter dark grey sandstone, limestone, concrete, brick and quartz and electrical cable
Superficial deposits	0.10 to 6.45	Soft to firm or firm greyish brown, reddish brown or brown, occasionally yellowish brown, slightly sand slightly gravelly silt, sand is fine to coarse, gravel is angular fine to coarse very weak to weak slate occasional quartz.
Weathered slate (Bedrock)	1.5 to >13.00	Greyish brown or orangish brown sandy slightly silty to very silty gravel, sand is fine to coarse, gravel is angular fine to coarse extremely to very weak decomposed slate. Relict structure visible indicates cleavage dipping 40 to 50 degrees. Cleavage planes at less than (<) 1 millimetre (mm) to 3 mm spacing, dipping 30 to 70 degrees. Cleavage plane fractures are extremely to very closely spaced, planar, smooth, frequent slickenside on surfaces, clean. Multiple other discontinuity sets in various orientations, generally 50 to 80 degrees, spacings variable <1 to 3 mm, planar, smooth, reddish brown clay infill <1 mm.

Notes:
m bgl denotes 'meters below ground level'

Borehole logs have been included within the factual reports included in Appendix B.

3.2 Groundwater strikes

Groundwater strikes were encountered during the advancement of boreholes in the 2020 and 2024 GIs, as summarised below in Table 3-2 and Table 2-3.

Table 3-2 - Groundwater strikes encountered in 2020 GI

Location	Ground level (m AOD)	Borehole depth (m bgl)	Water strike (m bgl)	Rise after 20 minutes (m bgl)	Strata water strike	Strata water rise after 20 minutes
BHL01	70.85	13.00	12.00	6.30	Cleaved slate	Cleaved slate
BHL02	48.99	12.00	7.09	6.75	Weathered slate (medium dense sandy silty to very silty gravel)	Weathered slate (medium dense sandy silty to very silty gravel)
BHL03	52.94	6.50	3.30	3.30	Weathered slate (medium dense silty gravel)	Weathered slate (medium dense silty gravel)
BHL04	47.00	8.30	5.80	4.55	Weathered slate (medium dense sandy silty gravel)	Weathered slate (medium dense sandy silty gravel)
BHL05	44.52	7.50	5.50	3.06	Cleaved slate	Cleaved slate
BHL06	42.95	7.50	3.31	3.16	Weathered slate (medium dense sandy silty gravel)	Weathered slate (medium dense sandy silty gravel)
BHL08*	57.26	11.70	6.52	5.34	Slightly sandy slightly gravely clay	Slightly sandy slightly gravely clay

Note: *borehole installed within natural ground below the historical landfill

Table 3-3 - Groundwater strikes encountered in 2024 GI

Location	Ground level (m AOD)	Borehole depth (m bgl)	Water strike (m bgl)	Rise after 20 minutes (m bgl)	Strata water strike	Strata water rise after 20 minutes
BHL09	47.14	8.05	8.05	4.60	Mudstone slate	Mudstone slate

3.3 Groundwater levels during GI

Post monitoring of groundwater levels after drilling were undertaken as part of both sets of GIs undertaken in 2020 and 2024. A summary of groundwater levels in boreholes screened in both superficial deposits and the bedrock and in boreholes screened in the bedrock as part of the 2020 GI is included in Table 3-4 to Table 3-5 respectively. Groundwater levels for BHL09 undertaken in 2024 GI and screened in the bedrock are shown in Table 3-6.

Table 3-4 - Groundwater levels in boreholes screened superficial deposits/bedrock monitored during 2020 GI [11]

Location	3 Aug 2020 m bTOC (m AOD)	08 Sept 2020 m bTOC (m AOD)	29 Sept 2020 m bTOC (m AOD)
BHL02	5.13 (46.16)	4.37 (45.92)	4.55 (44.74)
BHL03	3.45 (49.75)	2.77 (50.43)	-
BHL04	4.50 (42.81)	3.73 (43.58)	3.98 (43.33)
BHL06	2.88 (40.37)	2.33 (40.92)	2.54 (40.71)
BHL08 D	9.80 (47.83)	9.59 (48.04)	9.76 (47.87)

Note: m b TOC: meters below top of casing.

Table 3-5 - Groundwater levels in boreholes screened in the bedrock monitored during 2020 GI [11]

Location	3 Aug 2020 m bTOC (m AOD)	08 Sept 2020 m bTOC (m AOD)	29 Sept 2020 m bTOC (m AOD)
BHL01	6.09 (65.04)	5.58 (65.55)	5.93 (64.92)
BHL05	3.23 (41.67)	2.55 (42.35)	2.80 (42.10)

Note: m b TOC: meters below top of casing

Table 3-6 - Groundwater levels monitored in borehole screened in the bedrock as part of 2024 GI [13]

Location	1 November 2024 m b TOC (m AOD)
BHL09	4.63 (42.51)

Note: m b TOC: meters below top of casing

3.4 Aquifer properties

As part of the 2021 [11] and 2024 [13] GIs, rising head tests were conducted in selected groundwater monitoring boreholes to calculate the permeability of the superficial deposits and bedrock (weathered slate) on three occasions:

- September 2020 (Geotechnics Ltd);
- February 2021 (Atkins), and
- November 2024 (Geotechnics Ltd).

Atkins used the data obtained by Geotechnics in 2020 to interpret the permeability values for each of the tests undertaken. The permeability values obtained from the rising head data are show in Table 2-7 and Table 3-8.

Table 3-7 - Hydraulic conductivity values 2020 and 2021 values

Location (Screened)	Aquifer tested in 2020	2020 values (m/s)	Aquifer tested in 2021	2021 values (m/s)
BHL01 (Slate)	Slate	$6.84X10^{-06}$	Slate	$4.00X10^{-06}$
BHL02 (Superficial deposits/Slate)	Superficial deposits/Slate	$6.30\ X10^{-07}$	Superficial deposits/slate	$9.80X10^{-07}$
BHL03 (Superficial deposits/Slate)	Superficial deposits/Slate	$2.90x10^{-05}$	Superficial deposits/Slate	$8.10X10^{-06}$
BHL04 (Superficial deposits/Slate)	Slate	$4.44X10^{-06}$	Superficial deposits/Slate	$8.70X10^{-07}$
BHL05 (Slate)	Slate	$6.01X10^{-07}$	Slate	$6.80X10^{-06}$
BHL06 (Superficial deposits/Slate)	Superficial deposits/slate	n/a	Superficial deposits/Slate	$1.21X10^{-05}$
BHL08D (Superficial deposits/Slate)	Slate	$7.28\ X10^{-06}$	N/A	N/A

Notes:
m/s meters per second. N/A no test performed. Aquifer tested is based on where groundwater levels was at the time of the test. For example, in BHL04 although it is screened in both geologies, groundwater was only found at the time of the test in the Slate deposits. Groundwater added/removed stayed in these deposits

Table 3-8 - Hydraulic conductivity values 2024 values

Location (Screened)	Aquifer tested in 2024	2024, values (m/s)
BHL09 (Slate)	Slate	$4.76X10^{-06}$

Notes:
m/s meters per second. N/A no test performed. Aquifer tested is based on where groundwater levels was at the time of the test. For example, in BHL04 although it is screened in both geologies, groundwater was only found at the time of the test in the Slate deposits. Groundwater added/removed stayed in these deposits.

It is noted that borehole testing was undertaken in boreholes with screens across both superficial and bedrock aquifer potentially showing a combined hydraulic conductivity as well as boreholes screened solely in the slate aquifer.

The testing undertaken consisted of six rising heads tests in 2020 and 2021 investigation, four of which in the same location, and one rising head test in 2024. From the tests undertaken, six hydraulic conductivity values were derived. The values are of similar magnitude for boreholes screened in the slate, one order of magnitude difference and are broadly in line with the range of hydraulic conductivity for this material [14], whilst the boreholes screened in both superficial and bedrock aquifer vary by two orders of magnitude and similar magnitude to silty clays and shales [14]. From the derived values, all result were considered moderate confidence. The level of confidence is established by the number of tests undertaken at a location, repeatability of the values in subsequent test and comparison to literature values.

Aquifer testing results are presented within Appendix C.

3.5 Historical leachate monitoring during GI

One borehole location was installed within the historical landfill, with a response installed approximately 1.5 m above the base of the historical landfill (approx. 52.5 m AOD) in the southern part of the site during the 2020 GI. The borehole was used to assess leachate presence in the historical waste. A summary of the monitoring is presented in Table 3-9. A borehole location plan is included in Appendix A.4

Table 3-9 – Leachate borehole characteristics

Location	Ground level (m AOD)	Screen range (m AOD)	Screened	Water found during GI monitoring
BHL08S	57.26	55.26 to 52.76	Waste	Dry, no water strikes recorded

Leachate was monitored in three occasions during the GI and the well was recorded dry at 52.76 m AOD in all three occasions.

3.6 Groundwater monitoring

A monitoring network of eight boreholes has been installed across the site during the 2020 and 2024 GIs. A borehole location plan is included in Appendix A.4. These boreholes were installed to monitor both the superficial aquifer and the underlying bedrock aquifer.

Borehole logs have been reviewed to identify the response zone for each of the boreholes. A summary table of the current monitoring network and corresponding response zone is provided in Table 3-10.

Table 3-10 - Screen and corresponding geology

Location	**Ground level (m AOD)**	**Screen range (m AOD)**	**Screened**	**Strata during GI monitoring**
BHL01	70.85	66.85 to 57.85	Slate	Slate
BHL02	48.99	46.99 to 36.99	Superficial deposits/Slate	Superficial deposits/Slate
BHL03	52.94	50.94 to 46.44	Superficial deposits/Slate	Superficial deposits/Slate
BHL04	47.00	45.00 to 38.70	Superficial deposits/Slate	Superficial deposits/Slate
BHL05	44.52	42.02 to 37.02	Slate	Slate
BHL06	42.95	40.95 to 35.45	Superficial deposits/Slate	Superficial deposits/Slate
BHL08D	57.26	50.76 to 45.56	Superficial deposits/Slate	Superficial deposits/Slate
BHL09	47.14	44.14 to 39.09	Slate	Slate

3.7 Groundwater levels

Groundwater levels were obtained by AtkinsRéalis during the period of July 2020 to October 2022 and October 2024 to April 2026 on up to 19 occasions for boreholes BHL01 to BHL06 and BHL08S&D and seven occasions in BHL09. Groundwater levels are summarised in Table 3-11. Full dataset including GI data for the period of 2020 to 2026 is found in Appendix D.1 and hydrograph included in Appendix D.2.

Table 3-11 - Summary of groundwater elevations between June 2020 and April 2026

Monitoring well	Ground Level	Minimum		Average		Maximum	
		(m bgl)	(m AOD)	(m bgl)	(m AOD)	(m bgl)	(m AOD)
BHL01 (Slate)	70.85	4.61	64.65	5.44	65.41	6.21	66.25
BHL02	48.99	0.43	43.73	2.81	46.18	5.26	48.56
BHL03	52.94	1.72	49.70	2.56	50.41	3.45	51.22
BHL04	47.00	0.74	42.80	2.56	44.49	4.55	46.26
BHL05 (Slate)	44.52	0.30	40.98	1.91	42.67	3.54	44.22
BHL06	42.95	0.62	39.95	1.64	41.36	3.00	42.33
BHL08D	57.26	5.51	46.97	8.34	48.99	10.29	51.75*
BHL09 (Slate)	47.14	3.56	41.97	4.26	42.88	5.17	43.58

Note: unless stated, well is screened in both superficial deposits/bedrock. * groundwater level above base of the historical landfill (51.16 m AOD)

Groundwater levels plotted on a groundwater hydrograph, included in Appendix D.2, show that the highest groundwater levels were recorded in December 2024, whilst the lowest were recorded in October 2022. The hydrograph shows seasonal variation with higher groundwater levels recorded in winter/spring months (November to March) and lower levels in the summer/autumn months (April to October).

It is noted that on one occasion during the monitoring period, groundwater levels in BHL08D were above the base of the historical landfill, whilst BHL08S was dry. This suggests that leachate from recharge from the top of the site is possible, as well as water in contact with the waste mass dissolving contaminants.

Boreholes BHL02 to BHL04 and BHL06 to BHL08D are screened across both the superficial deposits and the bedrock therefore the groundwater levels are likely to represent a composite of both aquifers, potentially influenced towards the aquifer with higher transmissivity and/or pressure. Conversely, boreholes BHL01, BHL05 and BHL09 are screened in the Slate. Regarding hydraulic continuity between superficial aquifer and bedrock aquifers the following was observed:

- borehole logs do not indicate the presence of any low permeability layers in between both units that could separate them;
- groundwater in BHL01 screened solely in the bedrock is 20 m higher than the remaining boreholes, possibly as a result of being located uphill; and
- comparing groundwater levels monitoring the bedrock, apart from BHL01, to groundwater levels in boreholes monitoring both units, located in similar location/elevation, groundwater levels are of a similar magnitude. For example, groundwater levels in BH05, BH06 and BH09 are around 42 to 44 m AOD, and BHL04 is approximately 0.5 to 2.5 m higher than BHL05.

Based on the groundwater levels obtained across all boreholes, this suggests that they are also likely to be controlled by topography.

3.8 Groundwater flow regime

Two groundwater contour plans have been produced on utilising data from October 2022 and one utilising data from December 2024, the lowest and highest groundwater levels recorded.

Both contour plans show that groundwater flow is inferred towards the east following the topography and towards the River Yealm, also suggesting that groundwater provides baseflow to the River. In addition, the groundwater contour plans also show groundwater converged towards the middle of the site adjacent to the ephemeral stream. Groundwater contour plans are included in Appendix E.

Based on the inferred groundwater flow direction once the site is operational, the boreholes characterization is in line with the findings of the 2022 HRA [1]. This included in Table 3-12 as follows:

Table 3-12 - Borehole characterisation

Borehole ID	Location
BHL01 and BHL02	Upgradient
BHL04, BHL05, BHL06 and BHL09	Downgradient
BHL03 and BHL08S&D*	Cross gradient

Note: BHL08S and BHL08D were not characterized in the 2022 HRA [1].

3.9 Leachate monitoring in historical site

BHL08S was monitored 15 times from the period of 2020 to 2025 and the borehole was recorded as dry. It is expected that the historical landfill would have been designed and operated on the dilute and attenuate principle due to when the site was constructed. Therefore, it is unlikely that an engineering basal liner would be present, and consequently any recharge entering the historical site would likely exit through the base of the landfill into the aquifer, potentially leading to minimal or absent leachate head. During the monitoring rounds, groundwater levels have been recorded in BHL08D below the base of waste mass on all but one occasion on 11 March 2025, where the groundwater was recorded just above the base of the historic waste.

3.10 Groundwater quality

Groundwater samples have been collected across the site in BHL01 to BHL06 and BHL08D on 12 occasions from the period of 2020 to 2022 and 2024 to 2026 and in three occasions in BHL09 for the period of 2024 and 2026. The groundwater data has been analysed to understand current background conditions prior land raise construction and to aid the development of future groundwater compliance limits. A monitoring plan is included in Appendix A.6.

Based on the site setting for the site the secondary A aquifer, the intermittent watercourse and the River Yealm are identified to be the future receptors of the proposed inert site. Therefore, the groundwater quality results have been compared to the Environmental Quality Standards (EQS), as per the EU Water Framework Directive as implemented by the Water Framework Directive (England and Wales) 2017 [15] and the UK Drinking Water Standards (DWS), as set out in The Water Supply (Water Quality) Regulations (England and Wales) 2018 [16].

A summary of exceedances for both DWS and EQS are provided in Table 3-13 and Table 3-14 respectively and screening sheets are presented in Appendix F.3.

Table 3-13 – Summary of DWS exceedances

Constituent	Unit	LOD	GAC (mg/l)	No. of Samples	Min. Value	Max. Value	No. of Exceedances	Locations of Exceedances
Chloride	mg/l	1.0	250	88	15	1600	6	BHL08D (6x)
Ammoniacal Nitrogen	mg/l	0.050	0.39	81	<0.015	1.2	9	BHL01; BHL04; BHL05; BHL06; BHL08D (5x)
Aluminium	mg/l	0.01	0.2	62	<0.005	0.98	7	BHL01; BHL02; BHL03; BHL04; BHL05; BHL06; BHL08D
Iron (Dissolved)	mg/l	0.01	0.2	62	<0.005	1.1	12	BHL01 (2x); BHL02 (2x); BHL03; BHL04; BHL05 (2x); BHL06; BHL08D (3x)
Manganese (Dissolved)	mg/l	0.0005	0.05	62	<0.0005	3.4	10	BHL02; BHL03; BHL05; BHL08D (7x)
Nickel (Dissolved)	mg/l	0.0005	0.02	88	<0.0005	0.044	2	BHL08D (2x)
Sulphate	mg/l	1.0	250	50	6.6	660	4	BHL08D (4x)
Sodium	mg/l	1.50	200	44	11	740	4	BHL08D (4x)
Ammonium	mg/l	0.050	0.5	7	<0.05	1.7	1	BHL08D

Table 3-14 – Summary of EQS exceedances

Constituent	Unit	LOD	GAC (mg/l)	No. of Samples	Min. Value	Max. Value	No. of Exceedances	Locations of Exceedances
Chloride	mg/l	1.0	250	88	15	1600	6	BHL08D (6x)
Ammoniacal Nitrogen	mg/l	0.050	0.2	81	<0.015	1.2	25	BHL01 (2x); BH02 (2x); BH03 (3x); BHL04 (3x); BHL05 (2x) BHL06 (4x); BH08D (8x), BHL09
Cadmium (Dissolved)	mg/l	0.00011	0.00008	88	<0.00002	0.00063	4	BHL02; BHL08D (3x)
Copper (Dissolved)	mg/l	0.0005	0.001	88	<0.0005	0.26	25	BHL01; BHL02 (2x); BHL03 (3x) BHL04 (3x); BH05; BH06 (3x); BH08D (11x), BHL09
Iron (Dissolved)	mg/l	0.01	1	62	<0.005	1.1	1	BHL01
Manganese (Dissolved)	mg/l	0.0005	0.123	62	<0.0005	3.4	9	BHL02; BHL05; BHL08D (7x)
Nickel (Dissolved)	mg/l	0.0005	0.004	88	<0.0005	0.044	11	BHL03; BHL08D (10x)
Lead (Dissolved)	mg/l	0.0005	0.0012	88	<0.0002	0.0047	2	BHL08D (2x)
Zinc (Dissolved)	mg/l	0.0025	0.0123	88	0.0014	0.064	6	BHL01 (2x); BHL06; BHL08D (3x)
Sulphate	mg/l	1.0	400	50	6.6	660	3	BHL08D (3x)
Ammonium	mg/l	0.050	0.26	7	<0.05	1.7	1	BHL08D

Ammoniacal nitrogen

Transient exceedances of ammoniacal nitrogen have been detected in both up and downgradient boreholes. BHL06 has recorded one DWS exceedance and four EQS exceedances, while BHL08D has recorded five DWS exceedances and eight EQS exceedances, with higher concentrations observed in BHL08D. Ammoniacal nitrogen is normally used as leachate marker and as BHL08D is located directly below the historical landfill, groundwater quality below the historical site could be affected any leachate leaving the base of the site. AtkinsRéalis also notes that as the site is surrounded by agricultural land this could potentially be also affecting the groundwater quality.

Chloride

Low and stable chloride have been recorded in the majority of boreholes on site with the only exceedances recorded in BHL08D. Chloride is an unretarded (conservative) compound and it used as leachate marker for putrescible landfills. Concentrations in BHL08D range between 150 and 1,600 mg/l suggesting that the historical site may be impacting groundwater quality below the site.

It is noted that although the concentrations are below the respective standards, chloride concentrations were recorded between 110 and 200 mg/l. Chloride concentrations in the majority of boreholes (apart from BHL08D) range between 15 and 110 mg/l. BHL01 is near the A38 road and could possibly be affected by road salting activities in the winter or other external influences.

Sulphate

Similar to chloride, sulphate exceedances have only been recorded in BHL08D. Sulphate has been recorded to up 660 mg/l. Sulphate is also a conservative compound used as a leachate marker, and the exceeding concentrations suggest a potential impact from the historical site to groundwater quality.

Copper, manganese, nickel and zinc

Transient exceedances of metals have been detected across the site, but these are primarily focussed on BHL08D. Metal concentrations tend to be normally higher in BHL08D when compared to the remaining boreholes apart from a few exceptions.

Iron

Transient concentrations of iron have been detected in both up-gradient and down-gradient of the proposed inert site and therefore are potentially background concentrations.

Summary

In the absence of any inert waste being deposited at the site, it is considered that analysis of groundwater samples collected to-date from all boreholes (BHL01 to BHL06, BHL08D and BHL09) across the site are representative of background concentrations, although based on the exceedances recorded in BHL08D, the historical landfill could be affecting groundwater quality in boreholes downgradient of the historical site, BHL06 and BHL09 based on the inferred groundwater flow direction.

Based on the exceedances of ammoniacal nitrogen, chloride, sulphate and copper, manganese, nickel and zinc recorded in BHL08D, with groundwater levels having been detected above the base of the site, the data suggest that groundwater below the historical landfill is potentially being influenced by leachate percolating through the waste mass. The exceedances seem to be limited to the area around borehole BHL08D as chloride, sulphate have not been detected downgradient of the historical site, potentially suggesting that the concentrations have been attenuated or the peak concentration has not reached these boreholes yet.

Consideration of the potential impact of the historical landfill to groundwater quality have been considered when setting groundwater compliance limits.

3.11 Surface water quality

Surface water quality has been collected within four monitoring locations between 3 and 11 occasions from the period of 2020 to 2022 and 2024 to 2026. Surface water quality data has been screened against EQS, results are shown in Table 3-15.

Based on the surface water monitoring locations RL4 is upstream of the site, RL1 midstream (proposed discharge location and RL3 downstream of the site. A plan showing the monitoring locations is included in Appendix A.7.

Table 3-15 – Summary of surface water EQS exceedances

Constituent	Unit	LOD	GAC (mg/l)	No. of Samples	Min. Value	Max. Value	No. of Exceedances	Locations of Exceedances
Ammoniacal Nitrogen	mg/l	0.050	0.2	28	0.015	1.7	6	RL1; RL2; RL3(2x); RL4 (2x)
Copper (Dissolved)	mg/l	0.0005	0.001	30	0.00079	0.0029	27	RL1 (11x); RL2 (3x); RH3 (9x); RL4 (4x)
Zinc (Dissolved)	mg/l	0.0025	0.0123	30	0.0015	0.058	4	RL1 (3x); RL3

Summary

Exceedances of ammoniacal nitrogen, copper and zinc have been recorded on site have been recorded upstream as well as in downstream locations. Ammoniacal nitrogen concentrations were slightly higher in the downstream monitoring point than the upstream monitoring point and these may be the result of the site setting or contribution of the various historic waste facilities in the surrounding area of the site.

4. Hydrogeological conceptual site model

4.1 Introduction

Sources of contamination and associated contaminants, receptors to that contamination and the pathways, have been identified and assessed to determine whether all three are present or are likely to be present. If all three are present, then they form a potential contaminant linkage (PCL). These PCLs can then be subjected to the risk assessment process.

The approach adopted in this assessment is in accordance with the guidance presented in the Environment Agency Land Contamination Risk Management (LCRM) document [17]. LCRM provides a technical framework for identifying and remediating contamination through the application of a risk management process. The question of whether risk is unacceptable in any particular case involves not only scientific and technical assessments, but also appropriate criteria by which to judge the risk and conclude exactly what risk would be unacceptable.

Decisions regarding a site may be informed by:

- Tier 1 preliminary risk assessment (PRA) – typically a desk study and site walkover inspection with development of an initial CSM and preliminary qualitative assessment of risk considering the likelihood and severity of the potential consequences associated with the contaminant linkage(s);
- Tier 2 Generic Quantitative Risk Assessment (GQRA) – a review of site investigation and monitoring data, the development of an updated CSM with an assessment of risk using precautionary, Generic Assessment Criteria (GACs) relevant to the contaminant linkage(s) that represent minimal or tolerable risk; or
- Tier 3 Detailed Quantitative Risk Assessment (DQRA) – an assessment of risk based on the use of detailed GI and monitoring data to develop a further refined CSM and using Site Specific Assessment Criteria (SSACs) relevant to the contaminant linkage(s) to identify the likelihood of unacceptable risk

The review of the CSM is presented below.

4.2 Sources

General

Planning permission was granted by Devon County Council (ref. DCC/4038/2018) and allowed the construction and infilling with inert waste at Challonsleigh Farm over the period of 10 years. For the purpose of this review, the principal source of contamination is considered to be any leachate that is generated by the inert fill material; described in further detail in AtkinsRéalis ESSD report [3]

It is assumed that the composition of fill material will comply with the standard Waste Acceptance Criteria (WAC) limits set out in EC Council Decision 2003/33/EC [18]. Therefore, the initial source term modelled in this risk assessment includes these parameters.

Phasing

The inert waste will be placed in two areas, one north and one south of the ordinary watercourse that crosses the site from west to east in 10 different phases. Further detail on phasing is included in the AtkinsRéalis ESSD report [3] and a brief summary is outlined in Table 4-1. A plan of the phasing is included in 0.

Table 4-1 - Site phasing and phase size

Location	Stage	Time scales (years)	Plan Area
North of the ordinary water course	Phase A1	Year 1	4,620 m^2 to Phase F, but working area 14,860 m^2 for northern bund
	Phase A3	Year 1	951 m^2 to Phase F, but working area 2,442 m^2
	Phase E	Year 6/7	3,500 m^2
	Phase F	Year 6/7	27,990 m^2
	Phase G	Year 8/9	19,722 m^2
South of the ordinary water course	Phase A2	Year 1	3,210 m^2
	Phase B	Year 1	14,100 m^2
	Phase C	Year 3/4	12,612 m^2
	Phase D	Year 5/6	27,813 m^2
	Phase H	Year 8/9	6,236 m^2
North of the ordinary water course	Subtotal Phases A1, A3, E, F & G		56,783 m^2
South of the ordinary water course	Subtotal Phases A2, B, C, D & H		63.971 m^2
	Total		120,754 m^2

Engineering

Basal and side wall lining system

The basal lining system is proposed to be a fully engineered to Construction Quality Assurance (CQA) requirements. The basal liner will be composed of an established geological barrier of at least 0.5 m thickness and no more than 5 x 10^{-8} meters per second (m/s) hydraulic conductivity to provide the equivalent attenuation of a 1 m thick layer with hydraulic conductivity of not more than 1 x 10^{-7} m/s.

The artificial geological barrier will comprise site won recompacted soil or recovered fines from the aggregate recycling plant at the waste management facility or suitable incoming inert waste soil which will be placed over areas where topsoil has been removed and over the subgrade. It is noted that a small section of the engineered liner in the south of the site of approximately 26 m in length and 140 m in width will be “piggy backing” into historical waste.

Side bunds of 1.5 m height and 1 m width will be constructed at the edge of the site in both land raise areas (north and south of the ordinary watercourse in a west to east direction) and they will have the same engineering characteristics as the basal liner described above.

Leachate drainage system

Due to the inert nature of the proposed waste to be land raised on site, no leachate drainage system or active leachate extraction system are proposed as they are not a requirement for inert landfills/land raise within the Landfill Regulations 2002 [19]. Furthermore, only inert waste is proposed to be placed on site therefore unlikely that hazardous leachate will be generated.

Capping system

No specific capping engineered measures are proposed on site due to the inert nature of the waste. It is anticipated that once the site has reached the accepted elevation contours, the site will be covered with previously stripped topsoil and subsequently seeded.

Surface water management system

A water management strategy has been proposed for the site. The strategy restricts runoff from the site to greenfield runoff rates, including climate change events, through the provision of attenuation storage. The strategy includes the following:

- The ephemeral stream in the centre of the site will not be filled over, but will be protected from land raise runoff by the installation of a silt fence, a drainage channel and a low bund;
- Temporary surface water channels to intercept surface runoff will be constructed downslope of any operational areas and in the perimeter of any operational area. Soil from any constructed ditches will be place on the downslope side, and silt fences installed on the upslope to filter runoff and reduce sediment load.
- Surface channels will convey water to two unlined detention basins, east of site in both sites of the ordinary watercourse. Outflows to restrict discharge to greenfield runoff rate will be installed in both attenuation basins.

Land raise operation and management

Leachate levels

Due to the nature of the inert materials placed on site, no leachate levels monitoring is required on site and no monitoring infrastructure is proposed. It is likely that part of the rainfall will infiltrate within the inert waste, percolate and potentially accumulate at the base of the site. The leachate level may potentially follow the landform of the land raise and perched leachate layers may develop where materials of high hydraulic conductivity have been placed. This head will subsequently slowly drain downwards through the engineered liner into the unsaturated zone travelling downwards into the aquifer.

Leachate quality

The site is in the initial stages of the permit application; therefore, no inert waste has been deposited on site as yet, consequently site-specific leachate quality data is not yet available. However, as inert waste is proposed to be accepted on site, the concentrations derived from legislation (WAC) are proposed. The values from legislation are included in Table 4-2 [18]. It is noted that no values are assigned to benzene and naphthalene in legislation, as these compounds should not be present within the imported inert waste minimum reportable values have been used for modelling purposes.

Table 4-2 - Inert WAC and Other Substances Often Detected in the Water Environment

Component	Percolation test (mg/l)
Arsenic, As	0.06
Barium, Ba	4.00
Cadmium, Cd, (and its compounds)	0.02
Total chromium, Cr(total)	0.1
Copper, Cu	0.6
Mercury, Hg	0.002
Molybdenum, Mo	0.20
Nickel, Ni	0.12
Lead, Pb	0.15
Antimony, Sb	0.1
Selenium, Se	0.04
Zinc, Zn	1.2
Chloride, Cl	460
Fluoride, F	2.5
Sulphate, SO4	1,500
Phenol index, PI	0.3
Dissolved organic carbon	160
BTEX compounds (benzene) as it is used as a marker value	0.001
Mineral oil (C10 to C40)	n/a
PAHs (naphthalene) used as a marker	0.00001
TOC (total organic carbon)	-
Polychlorinated biphenyls (PCBs)	-

Notes:

Bold indicates hazardous substances,

mg/l milligrams per litre,

L/S liquid to solid,

l/kg litres per kilogram,

mg/kg milligram per kilogram

Soils including BTEX (benzene, toluene, ethylbenzene, xylenes) and PAH (polycyclic aromatic hydrocarbon) compounds should be excluded from any imported inert soil, therefore, the determinand DWS value has been used.

4.3 Pathways

AtkinsRéalis considers that the potential pathways for leachate egress into the water environment are the following:

- Advective flow through the engineered base of the inert land raise into the unsaturated zone and downward movement into the groundwater contained in the underlaying superficial deposits / bedrock. Subsequent horizontal movement following groundwater flow direction; and
- Advective lateral migration within the superficial deposits / bedrock towards the River Yealm where the groundwater is likely to provides baseflow to the River Yealm.

Unsaturated zone thickness

Using groundwater levels from borehole data and the proposed land raise base, approximately 0.25 m below the current sloping ground surface and ranging between approximately 42 and 70 m AOD, the thickness of the unsaturated zone can be determined. Calculations to determine the unsaturated zone are based on the comparison between the proposed basal elevation of the of the site at the borehole and groundwater levels recorded and are shown in Table 4-3.

Table 4-3 - Unsaturated zone thickness calculation

Borehole ID	Maximum groundwater level (m AOD)	Average groundwater level (m AOD)	Minimum groundwater level (m AOD)	Approximate base of the land raise (m AOD)*	Min thickness unsaturated zone (m)	Average unsaturated zone (m)	Max unsaturated zone thickness (m)
BHL01 (Slate)	66.25	65.41	64.65	70.60	4.35	5.19	5.95
BHL02	48.56	46.18	43.73	48.74	0.18	2.56	5.01
BHL03	51.22	50.41	49.7	52.69	1.47	2.28	2.99
BHL04	46.26	44.49	42.8	47**	0.74	2.51	4.2
BHL05(Slate)	44.22	42.67	40.98	44.27	0.05	1.6	3.29
BHL06	42.33	41.36	39.95	42.70**	0.37	1.34	2.75
BHL08S (Waste)	Dry	Dry	Dry	57.01	-	-	-
BHL08D	51.75	48.99	46.97	57.01	5.26	8.02	10.04
BHL09 (Slate)	42.88	41.97	42.36	47.04	4.16	5.07	4.78

Note: if not indicated borehole measure both superficial and bedrock aquifer. *based on borehole ground level elevation minus 0.25 m. **no land raise proposed, so used ground level

Based on the above groundwater levels and the proposed base of the land raise, the unsaturated zone ranges from a minimum of 0.18 m to a maximum of 10.04 m. An average unsaturated zone has been calculated from the average unsaturated zone at 3.53 m.

4.4 Receptor

The principal controlled waters (hydrogeological) receptors are considered to be groundwater, present in the underlying Secondary A aquifer (superficial deposits and bedrock) and the River Yealm (surface water receptor).

The Landfill Directive (LFD) and Groundwater Daughter Directive (GWDD) requires hazardous substances to be prevented from entering groundwater and non-hazardous substances to be prevented as far as practicable.

For Hazardous substances, the receptor/ compliance point will be the point at which the substance will enter groundwater below or adjacent to the site; however, monitoring directly underneath the site is not possible, so in practise the compliance point would be the groundwater immediately downgradient of the land raise (i.e. the Permit boundary).

For non-hazardous pollutants, the primary receptor/compliance point are considered to be groundwater 100 m downgradient of the site boundary which is at the approximate location of the River Yealm.

Selection of groundwater and surface water as the primary receptor, immediately downgradient of the land raise, is considered to be protective of downstream receptors further away due to the combined effects of additional dilution, dispersion and retardation that will likely occur.

4.5 Summary

Review of the available data confirms that the previous HRA CSM remains valid. Specifically:

Table 4-4 - Conceptual model summary

SPR	Comments
Source	Leachate generated within the inert waste mass
Primary pathway	Vertical and lateral migration of contaminants through the basal lining into the superficial and bedrock aquifer
Secondary pathways	Mixing with groundwater, advection and dispersion in the direction of groundwater flow
Receptors	Secondary A and secondary undifferentiated aquifer underlying the site and the River Yealm.
Compliance point	Hazardous substances: compliance point immediately downgradient of the land raise cells Non-hazardous substances: 100 m groundwater compliance point. Where the groundwater discharges into the watercourse.

A pictorial representation of the CSM and location of the cross sections are included in Appendix G.

5. Hydrogeological Risk Assessment

5.1 The nature of the HRA

The HRA assesses the impact of the land raise on Controlled Water receptors from the identified source and pathway linkages detailed in Section 4.

Based on Environment Agency guidance for an inert landfill situated on a secondary A aquifer with moderately permeably strata outside a SPZ, DQRA should be conducted (Complex Risk Assessment). On this basis the DQRA includes:

- Screening of leachate data (Table 4-2) against WAC criteria to determine Principal Contaminants of Concern (PCoCs);
- Identification of PCoCs to be carried forward for further DQRA; and
- Stochastic modelling of the PCoCs using LandSim v2.5.17 to determine if a risk exists to the principal receptors and what, if any, further mitigation is required following definitive closure and during the aftercare period of the landfill.

5.2 Proposed assessment scenarios

There are three main phases of a land raise's lifecycles:

- Development, the stages from the initial concept through site investigation, planning, design and obtaining the necessary permissions;
- Operational, the construction (or preparation) of the land raise and the deposition of waste; and
- Closure and aftercare, when the land raise has ceased accepting waste for disposal, and restoration and aftercare maintenance measures are carried out until the permit is surrendered. The permit can only be surrendered when relevant closure procedures have been complied with, an appropriate period of aftercare has passed to allow the waste to stabilise and when the waste deposits are in a satisfactory state that, if left undisturbed, will not cause pollution of the environment.

The land raise is in their initial permit application stage, so no waste has been input at the proposed site.

The development and operational phases of the land raise lifecycle have not been considered further within this assessment.

5.3 Justification for modelling approach and software

A 'complex risk assessment' has been undertaken in accordance with the Environment Agency's '*Guidance on Hydrogeological Risk Assessments for Landfills* [20]' using LandSim 2.5 software.

LandSim is deemed to be appropriate software to model the land raise as it uses Monte Carlo (stochastic) modelling which accounts or variation and uncertainty in input parameters.

The results of the model are presented probabilistically reporting the 50th and 95th percentile results. The 50th percentile represents the value at which 50% of the results are greater and typically approaches the average case. In contrast, the 95th percentile represents the value at which only 5% of results are greater and represents 'reasonably worst case', which is conservative for assessing receptor concentrations associated with the modelled priority contaminants.

Retardation has been enabled in LandSim to replicate the likely processes within the proposed engineer liner, the unsaturated pathways and the aquifer pathway.

5.4 Environmental assessment limits

For the purpose of this HRA, the potential risks to the identified receptors can be assessed through application of Environmental Assessment Limits (EALs) to the results of predictive modelling. EALs are dependent on the nature of the receptors identified.

Based on the hydrogeological CSM summarised above, EALs have been selected based on applicable Water Quality Standards (WQS) in the following order of priority:

Hazardous substances

- Minimum reporting values presented in Environment Agency guidance "Hazardous substances to groundwater: minimum reporting values" 2017 [21], and
- Laboratory limits of detection.

Non-hazardous substances

- Environmental quality standards for freshwater (EQS) presented in "The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2017 [22];
- United Kingdom Drinking Water Standards (DWS), or
- Where a standard is not available within the water supply regulations, World Health Organisation (WHO) Guidelines for Drinking-Water Quality [41].

Appropriate EALs for hazardous and non-hazardous compounds are summarised in Table 4-1 and Table 4-2.

Table 5-1 - Summary of appropriate WQS

Compound	Compliance point	WQS
Hazardous compounds	Groundwater in the aquifer immediately downgradient of the land raise	Minimum Reporting value (MRV) or laboratory limit of detection
Non-hazardous	100 m downgradient of the site	Lowest between DWS and EQS

Predicted No Effect Concentrations (PNECs) for copper, manganese, nickel and zinc have been derived using site-specific surface water quality data, obtained from the River Yealm (samples: RL1, RL2 and RL3). The UK metal bioavailability assessment tool (mBAT) [23] maintained by the UK Technical Advisory Group on the Water Framework Directive (UK TAG WFD) has been used to calculate the site-specific PNECs, in place of EQS values. In order to present a conservative assessment, the lowest calculated PNECs have been selected in the assessment to be protective of the most sensitive receptor. The calculated PNECs are as follows:

- Copper 9.96 micrograms per litre (µg/l);
- Nickel 7.94 µg/l; and
- Zinc 15.67 µg/l.

AtkinsRéalis has not calculated the PNEC for manganese and lead. The proposed inert waste does not include manganese, and the MRV is used for lead as it is hazardous substance.

Table 5-2 – Assigned WQS at groundwater compliance point

Component	Lowest DWS/EQS (mg/l)
Arsenic, As	MRV
Barium, Ba	1.3
Cadmium, Cd, (and its compounds)	0.00008
Total chromium, Cr(total)	0.0034
Copper, Cu	0.00996*
Mercury, Hg	0.00001
Molybdenum, Mo	N/A
Nickel, Ni	0.00794*
Lead, Pb	MRV
Antimony, Sb	0.005
Selenium, Se	0.01
Zinc, Zn	0.01567*
Chloride, Cl	250
Fluoride, F	1.5
Sulphate, SO4	250
Phenol index, PI	0.0077
Benzene	0.001
Naphthalene	0.002

Note: bold hazardous substances. *PNEC value

5.5 Priority contaminants to be modelled

Screening assessment

To identify potential CoCs and therefore, determine the priority contaminants to be modelled and reviewed in these assessments, a comparison of leachate against WQS has been undertaken.

On the site groundwater and a surface water course have been identified, the secondary A aquifer and the River Yealm and both are considered principal receptors of contaminants that would be present in the inert land raise leachate. Therefore, leachate concentrations have been screened against both UK DWS and EQS with the lowest value chosen as the WQS.

Table 5-3 – Comparison source term to screening assessment values

Component	Source term Concentration (mg/l)	EQS (mg/l)	DWS (mg/l)
Arsenic, As	0.06	MRV	MRV
Barium, Ba	4.00	N/A	1.30

Component	Source term Concentration (mg/l)	EQS (mg/l)	DWS (mg/l)
Cadmium, Cd, (and its compounds)	0.02	0.00008	0.005
Total chromium, Cr(total)	0.10	0.0034	0.05
Copper, Cu	0.60	0.00996*	2
Mercury, Hg	0.002	MRV	MRV
Molybdenum, Mo	0.20	N/A	0.07
Nickel, Ni	0.12	0.00794*	0.02
Lead, Pb	0.15	0.0012	0.01
Antimony, Sb	0.10	N/A	0.005
Selenium, Se	0.04	N/A	0.01
Zinc, Zn	1.20	0.01567	3
Chloride, Cl	460	250	250
Fluoride, F	2.50	N/A	1.5
Sulphate, SO4	1,500	400	250
Phenol index, PI	0.30	0.0077	0.05
Benzene	0.001	MRV	MRV
Naphthalene	0.00001	0.002	BaP

Notes:
Red denotes exceedances
* denotes m-bat values
Bold indicates hazardous substances.

Based on the comparison of leachate concentrations against the WQS all determinands have been put forward to include in the LandSim model source term.

5.6 Model parametrisation

A summary of the input model parameters is provided below. Input values have been conservatively selected to be representative of the re-use area. Where site-specific data is not available, published data has been used in this assessment. Physical input information for Challonsleigh Farm Land raise is presented in Table 5-4. Chemical information is presented in Table 5-5 and half-life analysis is presented in Table 5-6.

The following has been considered in the development of numerical modelling:

- A declining source term which represents the reduction of contaminants leaching from the waste mass over time;
- Biodegradation and retardation in both the unsaturated and aquifer pathways;
- Site-specific hydraulic conductivity testing;
- The aquifer thickness is based on 10 m effective aquifer from the boreholes closest to the stream and worked to the rest of the locations;
- Vertical dispersivity is taken as 10% of the thickness of the unsaturated zone;

- Longitudinal and transverse dispersivity are taken as being 10% and 1% of the aquifer pathway distances respectively;
- Infiltration rates have been taken from publicly available information, evapotranspiration rates have obtained from ESDD report [3] and based on the slope of the site a 60% runoff has been assumed. Therefore, the effective infiltration has been calculated from annual infiltration and removing the annual evapotranspiration and runoff coefficient due to the site slope;
- The model was run for 1001 iterations to ensure stability within the model and represents the maximum number of iterations permissible in the model software.

One model has produced based on the available data and proposed land raise engineering and it is described below

- Model 1 (labelled as landSim model reference 9.3):
  0.5 m thickness EB at 5.80 $x10^{-8}$ m/s hydraulic conductivity and triangular hydraulic conductivity for unsaturated zone and aquifer at Log uniform (6.65 $x10^{-6}$, 1.00 $x10^{-4}$). Phase 1 corresponds to the northern area of the site and Phase 2 to the southern area.

Table 5-4– Summary of Modelled Parameters

Site Parameters	Units	Distribution	Value	Justification
Infiltration				
Infiltration to open waste	mm/year	Uniform	294	Based on average rainfall and subtracting expected evapotranspiration (730 mm/year) [3]. Based on slope of the site a run-off coefficient of 0.6 has been considered with a 0.4 coefficient of infiltration
Infiltration once capped	mm/year	Triangular	50, 73,140	Minimum value based on default infiltration for a cap, which will depend on the soil utilized. Average based on 10 % of infiltration to waste and maximum value based on default LandSim value of 140 mm/year for grassland, once site has been restored.
Cell geometry				
Phase 1				
Cell width at base	m	-	225	Based on measurements of phase width perpendicular to groundwater flow.
Cell length at base	m	-	235	Based on measurements of length parallel to groundwater flow

Site Parameters	Units	Distribution	Value	Justification
Number of cells	-	Single	1	Site modelled as two phases with one cell in each phase due to the absence of engineering separation in the phase
Final waste thickness	m	Triangular	0.3, 6.27, 10.56	Based on minimum, average and maximum thickness of the waste from restoration plan, which will provide a representative value based on proposed waste thicknesses (ESID XXX)
Waste porosity	kg/l	Single	0.25	Conservative value based on proposed inert waste, which will be construction waste expected to be similar to gravelly clay
Waste dry density	kg/l	Uniform	1.2	LandSim manual
Waste field capacity	-	Uniform	0.2	LandSim manual
Head of leachate where surface water breakout occur	m	Single	1.5	Height of perimeter bund and lowest height
Phase 2				
Cell width at base	m	Single	208	Based on measurements of phase width perpendicular to groundwater flow.
Cell length at top	m	Single	269	Based on measurements of length parallel to groundwater flow
Number of cells	-	Single	1	Site modelled as two phases with once cell in each phase due to the absence of engineering separation in the phase
Final waste thickness	m	Triangular	0.99, 6.62, 11.4	Based on minimum, average and maximum thickness of the waste from restoration plan, which will provide a representative value based on proposed waste

Site Parameters	Units	Distribution	Value	Justification
				thicknesses (CSM model Appendix G)
Waste porosity	kg/l	Single	0.25	Conservative values based proposed inert waste, which will be construction waste likely to be similar to gravelly clay
Waste dry density	kg/l	Uniform	1.2	LandSim manual
Waste field capacity	-	Uniform	0.20	LandSim manual
Head of leachate where surface water breakout occur	m	Single	1.5	Height of perimeter bund and lowest height
Drainage system				
Phase 1 and 2				
Head on EBS	m	Triangular	1.5	No drainage proposed on site, set to 1.5.
Engineered layer Phase 1 and Phase 2				
Design thickness of mineral liner	m	Single	0.5	Based on proposed engineered layer
Moisture content	-	Single	0.1 to 0.2	Based on testing undertaken on site
Hydraulic conductivity	m/s	Single	$5.8X10^{-8}$	Based on proposed engineering
Longitudinal dispersivity	m	Single	0.05	10% of pathway length
Pathway density	kg/l	Uniform	1.67	Average based on geotechnical analysis.
Unsaturated pathway Phase 1				

Site Parameters	Units	Distribution	Value	Justification
Pathway length	m	uniform	0.3 and 5.96	Based on unsaturated thickness looking at borehole levels in this area (BH1, BH3, BH4 and BH5)
Hydraulic conductivity	m/s	Log Uniform	$6.65X10^{-7}$, $3X10^{-5}$)	Based on site testing and compared to literature values. Minimum hydraulic conductivity value based on slate/head average onsite value which is similar to recorded literature values [24]. Maximum hydraulic conductivity based on ConSim value [25] for gravels, as no site testing was done the lower value has been used to represent the silt and sand between the gravel grains. Reduced by one order of magnitude to represent UZ travel.
Moisture content	-	Single	0.2	Assumed moisture content of unsaturated pathway
Longitudinal dispersivity	m	Uniform	0.03 and 0.596	10% of pathway length
Pathway density	kg/l	Uniform	1.37 and 2.15	Borehole logs described as Described as slightly sandy, slightly gravelly silt or slightly sandy slightly gravelly silt with occasional silty gravel bands for the superficial deposits and weathered slates described as gravels and gravels with clay infill and close fractures for the bedrock. Used minimum value from the superficial deposits and maximum from the bedrock
Unsaturated pathway Phase 2				
Pathway length	m	Single	0.18 and 5.01	Based on borehole logs in this area (BH2, BH6, BH8D and BH9)
Hydraulic conductivity	m/s	Log Uniform	$6.65X10^{-7}$, $3X10^{-5}$)	Based on site testing and compared to literature values. Minimum hydraulic conductivity value based on slate/head average onsite value which is similar to recorded literature values [24]. Maximum hydraulic

Site Parameters	Units	Distribution	Value	Justification
				conductivity based on ConSim value [25] for gravels, as no site testing was done the lower value has been used to represent the silt and sand between the gravel grains. Reduced by one order of magnitude to represent UZ travel.
Longitudinal dispersivity	m	Uniform	0.018 and 0.501	10% of pathway length
Pathway density	kg/l	Uniform	1.36 and 2.15	Described as silt for the superficial deposits and gravel for the bedrock. Used minimum value from the superficial deposits and maximum from the bedrock
Moisture content	-	Single	0.2	Assumed moisture content of unsaturated pathway
Vertical pathway				
Not modelled				No aquitard separating both aquifers present on site
Aquifer Pathway (Superficial deposits, Devonian Slate)				
Pathway width Phase 1	m	single	225	Based on onsite measurements
Pathway width Phase 2	m	Single	208	Based on onsite measurements
Mixing zone thickness	m	Single	-	Calculated by model
Aquifer thickness	m	Uniform	10 and 15	Assumed aquifer effective thickness
Relative dispersivity	m	Uniform	1 and 1.5	10% of aquifer thickness
Longitudinal dispersivity	m	Uniform	10	10% of aquifer pathway (receptor at 100)
Transversal dispersivity	m	Uniform	0.01	1% of aquifer pathway (receptor at 100)

Site Parameters	Units	Distribution	Value	Justification
Hydraulic conductivity	m/s	Log uniform	6.65 x10^{-6}, 1.00 x10^{-4})	Based on site testing and compared to literature values. Minimum hydraulic conductivity value based on slate/head average onsite value which is similar to recorded literature values [24]. Maximum hydraulic conductivity based on ConSim value [25] for gravels, as no site testing was done the lower value has been used to represent the silt and sand between the gravel grains.
Hydraulic gradient	-	Log Uniform	0.06	Calculated
Pathway porosity	Fraction	Single	0.2	Porosity of fractured slate
Receptors				
Hazardous compounds	m	N/A	-	Immediately downgradient of the site boundary
Non-hazardous	m	N/A	100	Distance used as a compliance point for non-hazardous compounds
Pathway density	kg/l	Uniform	1.36 and 2.15	Described as silt for the superficial deposits and gravel for the bedrock. Used maximum value from the bedrock and minimum from the superficial deposits

Notes:

m/s metres per second
mm/y millimetres per year
kg/l kilograms per litre
m^2 square metres

Retardation parameters have been considered in Table 5-5. Values selected consider that there is silt present within the superficial deposits and clay within the bedrock fissures.

Table 5-5 - Summary of modelled chemical input parameters

Determinand	Kd / KoC	Reference
Antimony	501	Mean value of table 3 of partition coefficients for metals in surface water, soil and waste
Arsenic	1585	Mean value of table 3 of partition coefficients for metals in surface water, soil and waste
Barium	2.05	RAIS database (Risk Assessment Information System, http://rais.ornl.gov/tools/)
Benzene*	83	TPH Criteria Working Group Series, Volume 3: Selection of Representative TPH Fractions based on Fate and Transport Considerations
Cadmium	794	Mean value of table 3 of partition coefficients for metals in surface water, soil and waste
Chloride	0	Not retarded
Chromium	35	RBCA Risk Assessment Software (USEPA)
Copper	295	RBCA Risk Assessment Software (USEPA)
Fluoride	150	RAIS database (Risk Assessment Information System, http://rais.ornl.gov/tools/)
Lead	5012	Mean value of table 3 of partition coefficients for metals in surface water, soil and waste
Mercury	3981	Mean value of table 3 of partition coefficients for metals in surface water, soil and waste
Molybdenum	110	Mean value of table 3 of partition coefficients for metals in surface water, soil and waste
Naphthalene*	844	TPH Criteria Working Group Series, Volume 3: Selection of Representative TPH Fractions based on Fate and Transport Considerations
Nickel	66	RBCA Risk Assessment Software (USEPA)
Phenol*	27	Environment Agency 2002. The effects of contaminant concentration on the potential for natural attenuation. R&D Technical Report P2-228/TR. Table 3.1

Determinand	Kd / KoC	Reference
Selenium	9.5	RBCA Risk Assessment Software (USEPA)
Sulphate	0	Not retarded
Zinc	500	USEPA, 1989 (October). EPA/540/2-89/057. Determining Soil Response Action Levels Based on Potential Contaminant Migration to Groundwater: A Compendium of Examples. Office of Emergency and Remedial Response.

Notes:
*Kd calculated using KoC and a fraction of organic carbon of 1% to be conservative in engineered barrier and unsaturated pathway, 0.1% in aquifer pathway.

Half-life is considered for organic determinands, and it is shown in Table 5-6.

Table 5-6 - Half-life parameters

Determinands	Half-Live	Reference
Benzene	100 (aerobic) and 50 (anaerobic)	Lowest value in ConSim library
Naphthalene	100 (aerobic) and 50 (anaerobic)	Lowest value in ConSim library
Phenol	200 (aerobic) and 100 (anaerobic)	Lowest value in ConSim library

5.7 Model results

Table 5-7 summarises the model output, found in Appendix H.1, maximum concentrations for the modelled species, as well as the expected year of maximum concentration, at each of the identified receptor points, immediately downgradient of the site for hazardous substances and at 100 m from the site for non-hazardous substances.

Table 5-7 – Model 1 hazardous substances 95% concentrations results

Determinand	EQS (mg/l)	DWS (mg/l)	MRV (mg/)	Phase 1 (mg/l)	Phase 2 (mg/l)	Breakthrough time (years)	Time to peak (years)
Arsenic	0.05	0.01	0.005	5.00E-04	8.00E-04	8,500	20000
Benzene	0.01	0.001	0.0001	4.00E-08	8.00E-08	2800	1100
Lead	0.0012	0.01	0.0002	1.38E-07	1.25E-06	17000	20000
Mercury	0.00007	0.001	0.00001	1.00E-06	2.00E-07	15000	20000

Table 5-8 – Model 1 non-hazardous substances 95% concentrations results

Determinand	EQS (mg/l)	DWS (mg/l)	Offsite well (mg/l)	Breakthrough time (years)	Time to peak (years)
Antimony	N/A	0.005	0.0053	3300	20000
Barium	N/A	1.3	0.33	17	200
Cadmium	0.00008	0.005	4.50E-04	4000	20000
Chloride	250	250	100	20	6
Chromium	0.0034	0.05	0.005	150	1800
Copper	**0.00996**	2	0.024	1500	12000
Fluoride	N/A	1.5	0.11	900	6000
Molybdenum	N/A	0.07	0.024	700	18000
Naphthalene	0.002	BaP	No breakthrough	N/A	N/A
Nickel	**0.00794**	0.02	0.005	460	3000
Phenol	0.0077	0.05	8.00E-06	120	350
Selenium	N/A	0.01	2.30E-03	50	700
Sulphate	400	250	339	5	20
Zinc	**0.01567**	3	0.044	3000	20000

Exceedances have been highlighted, in bold PNEC values

The table highlights which model output concentrations are expected to exceed the relevant standard. Therefore, the proposed source term has been reduced to allow compliance at the monitoring point. Table 5-9 shows the proposed reduced source term concentrations, the rest of the determinands were not changed.

Table 5-9 – Proposed source term

Determinands	Landfill directive inert waste concentration (mg/l)	Proposed concentration (mg/l)
Antimony	0.1	0.08
Cadmium	0.02	0.001
Chromium	0.1	0.05
Copper	0.6	0.2
Sulphate	1500	1100
Zinc	1.2	0.3

The model output results using the reduced source term values are shown in Appendix H.2 and there are no exceedances of the WQS on the 95% concentrations for all determinands

Table 5-10 – Modelling output showing 95% output results non-hazardous compounds

Determinand	EQS (mg/l)	DWS (mg/l)	Offsite well (mg/)	Breakthrough time (years)	Time to peak (years)
Antimony	N/A	0.005	0.0043	3300	20000
Cadmium	0.00008	0.005	0.0000241	4500	20000
Copper	0.00996*	2	0.008	1500	12000
Sulphate	400	250	242	5	20
Zinc	0.01567*	3	0.012	3000	20000

Note: * PNEC value used

5.8 Sensitivity analysis

In order to incorporate uncertainties and sensitivities within the LandSim modelling (appended in Appendix H.3), parameter distribution functions were conservatively kept as broad as possible.

A quantitative analysis has been undertaken to determine the sensitivity of the LandSim model, a range of hydraulic conductivity was used based on the site testing, therefore as a sensitivity analysis the maximum and the minimum hydraulic conductivity was used to see the change in concentrations.

The priority contaminants assessed in the sensitivity analysis have been chosen as arsenic, chloride, lead, nickel and sulphate as they are conservative tracers within the groundwater environment (i.e. due to being non-biodegradable and have low or not retardation). Therefore, changes in the priority contaminant concentrations as a result of sensitivity analysis can be attributed to the change in this parameter only, rather than a result of increased or decreased chemical assimilation processes.

A summary of the results of the sensitivity analysis can be seen in Table 5-11 and shows the 95% of the selected determinands at the site boundary.

Table 5-11 - Sensitivity analysis hydraulic conductivity at groundwater point of 95% values

Compliance point	Reduce source term concentrations		Max K= 3E-005		Min K= 6.65e-007	
	Peak concentration (mg/l)	Time to peak (years)	Peak concentration (mg/l)	Time to peak (years)	Peak concentration (mg/l)	Time to peak (years)
Arsenic	0.0043	20,000	0.02	20,000	No breakthrough	N/A
Lead	0.0000241	20,000	8.43E-8	20,000	No breakthrough	N/A
Chloride	0.008	20	37	21	1,800	28
Sulphate	242	19	93	17	3,300	29
Nickel	0.012	3,300	0.003	1,500	0.06	11,000

Note: Hazardous substances in bold

The change from a range on hydraulic conductivity distribution to a sole parameter shows that, when using maximum hydraulic conductivity, the time to peak concentration is similar or shorter, but the maximum concentrations are lower, presumably as a result faster travelling times and further dilution. With lower hydraulic conductivities, the time to peak concentration is longer, but the concentration is greater, therefore using a hydraulic conductivity range in the model is likely to be more representative of site conditions

Upon the first review of this HRA, once the site has been operational and further monitoring data has been collected, this data can be used to calibrate the LandSim model.

5.9 Rogue load

In order to model a rogue load, the source term (previous subsection) has been modified in the whole land raise based on recommendations of the Environment Agency article [26].

Table 5-12 - Rogue load leachate concentrations in mg/l

Determinand	Minimum	Most Likely	Max
Arsenic	0.001	0.007	0.06
Lead	0.002	0.007	0.15
Chloride	100	300	800
Sulphate	200	1200	1800
Nickel	0.002	0.02	0.12

Table 5-13 and Table 5-14 contain modelling output results obtained from the rogue load. Model is included in Appendix H.4.

Table 5-13 – Modelling output showing 95% concentration results hazardous compounds

Determinand	EQS (mg/l)	DWS (mg/l)	MRV (mg/l)	Phase 1 (mg/l)	Phase 2 (mg/l)	Breakthrough time (years)	Time to peak (years)
Arsenic	0.05	0.01	0.005	7.53E-05	1.60E-04	6000	20000
Lead	0.0012	0.01	0.0002	3.78E-08	1.71E-06	16000	20000

Table 5-14 – Modelling output showing 95% concentration results non-hazardous compounds

Determinand	EQS (mg/l)	DWS (mg/l)	Offsite well (mg/)	Breakthrough time (years)	Time to peak (years)
Chloride	250	250	83	6	21
Nickel	0.00794*	0.02	0.012	400	3800
Sulphate	400	250	219	6	23

Note: highlighted denotes exceedances, * PNEC value used

The model output results from the rogue load assessment, considering the proposed design including a 0.5 m engineering basal liner with a hydraulic conductivity of 5.8 x 10^{-8} m/s, show that nickel concentrations are likely to exceed the EQS at the 95% concentration monitoring location. To that extent a robust management plan will be required to ensure compliance with the proposed inert waste. In addition, subsequent HRA reports, on a six yearly basis, will assess the collected data and use the data to calibrate the LandSim model.

5.10 Historical site

AtkinsRéalis expects that leachate peak concentration in the historical site was likely to have occurred when the site was completely filled and stopped accepting waste. As no capping was installed, recharge rainfall continued to percolate through the historical site dissolving any particles within the waste and passing through the unlined base, mixing with the underneath aquifer and moving towards the River Yealm. Consequently, it is expected that aquifer quality has improved since the historical site was closed.

Once the proposed inert land rise engineering basal liner is constructed over the historical site, the low hydraulic conductivity material will act as a cap limiting rainfall infiltration and increasing running off which will be captured by the surface water management system. As waste is placed over the historical site, any infiltrated recharge will take longer to reach the historical site and the amount of leachate exiting its base will significantly reduce. Therefore, it is expected that groundwater quality beneath the historical site will further improve.

AtkinsRéalis notes that any the leachate exiting through the base of the proposed engineered basal liner is likely to be concentrated with some dissolved determinands as infiltration percolates through the inert waste mass, however, the flow at the base of the site is expected to be low. As this leachate continues to percolate through the historical waste mass, the leachate will enrich further and exiting the base of the historic site. Although the leachate will be more concentrated as a result of the inert site, the reduced flows will be attenuated by the unsaturated zone and further into the aquifer.

BHL08D is directly underneath the site and groundwater samples has been collected. The dataset shows that chloride concentrations, a leachate marker, range between 60 and 1,600 mg/l with an average of approximately 380 mg/l indicating impact of the historical site.

The current dataset will be used to calculate baseline concentrations in this borehole for specific leachate markers also found in the proposed inert waste (arsenic, chloride, lead, nickel and sulphate) to set action limits. It is noted that any further groundwater quality collected prior to the placement of the engineered baseline and waste on the historical site can be used to refine these action limits in future HRA reviews.

Further information of stability of the basal liner and the proposed site is included in the AtkinsRéalis Stability Risk Assessment (SRA) [27].

5.11 Accidents and their consequences

A qualitative risk assessment of the potential impacts of accidents from activities undertaken at the proposed inert site are described in Table 5-15.

Table 5-15– Potential Accidents and Possible Failure Scenarios

Uncontrolled Emissions	Likelihood of Occurrence	Implications of Occurrence	Consequence
Compactor driver error causing damage to artificially established geological barrier.	Very unlikely. The site will be engineered to a high standard with Construction Quality Assurance. Therefore, damage occurring during construction would be repaired and it is extremely unlikely that the artificially established geological barrier will fail in its entirety or leak suddenly	Increase of leachate leakage through areas where the geological barrier is damaged	Significant
Flooding	Very unlikely. The land raise on a slope and therefore unlikely to flood	Increase in leachate heads if water gets through the low permeability cap. Potential over-topping of the land raise, i.e. leachate overflowing out of the land raise	Significant
Drilling	Unlikely. Drilling may be proposed in the future and any additional borehole investigation is unlikely to lead to failure of the land raise system	Perforation of cap. Increased infiltration leading to increased leachate generation.	Significant
Subsidence/ Landslide	Unlikely. Stability risk assessment undertaken and unlikely that subsidence or sub-grade failure of the natural ground is unlikely to occur. Potential for settlement of the historical landfill has also been evaluated by the stability risk assessment. It is expected that mineral liner will move with the underlying historical landfill if settlement occurs.	Failure of sidewall or basal liner and subsequent leachate leakage.	Significant
Failure of waste input screening procedures and controls resulting in localised areas with unexpected	Unlikely. The waste types will be 'inert' and will be subject to 'Basic Characterisation' and the site's waste	Resulting leachate of a different quality and proposed engineering measures may be insufficient to attenuate.	Significant

leachable hazardous or non-hazardous substances.	acceptance procedures which will include visual inspection prior to tipping, and prior to incorporation into the land raise. If it is suspected that 'non inert' waste has been received and tipped on-site the site management procedures will ensure it will be removed to a suitable permitted facility, and a failure of the site management procedures resulting in significant 'non inert' waste is not foreseen.	Potential for groundwater and subsequent surface water contamination.

The likelihood of an accident occurring at the proposed site is unlikely to very unlikely and additional quantitative assessment of the potential events is not considered necessary.

5.12 Review of technical precautions

The following technical precautions are included in the design of Challonsleigh Farm inert land raise.

- 0.50 m artificially enhanced geological barrier with a hydraulic conductivity of at least 5.00 x10-8 m/s;
- 1.50 m engineered perimeter bund along the majority of the site, to provide protection to the adjacent surface water receptors, ordinary watercourse and the River Yealm;
- Control measures to prevent excess discharge of suspended solids in surface water runoff; and
- Surface water management systems to collect any surface runoff from the working phase and divert it to two attenuation lagoons before they are discharged into the River Yealm. In addition, the provision of silt fences along the site to reduce the amount of silt going into the drainage system.

5.13 Hydrogeological completion criteria

Landfill surrender completion requires a consideration of whether the site, as a result of the disposal of controlled wastes, is likely or unlikely to cause pollution of the environment.

To assess potential impacts to control waters, monitoring of groundwater quality and of the River Yealm will be utilised to determine the time at which the site no longer presents a potential risk to the environment or human health, with regular reviews of the monitoring data and of hydrogeological risk on a six yearly basis.

In order to ensure the site presents no significant risk to controlled waters after the cessation of filling and restoration, monitoring will continue after restoration until the groundwater quality remains consistent or shows an improved trend over at least four consecutive bi-annual monitoring events post completion of the inert land raise, including acceptable surface water quality of runoff post restoration with no adverse impact to the River Yealm.

6. Requisite surveillance

6.1 Leachate monitoring

Due to the nature of the waste to be accepted at the site and based on current Environment Agency guidance and regulations no monitoring of leachate levels or quality are proposed. It is noted that visual and chemical soil waste analysis will be undertaken on site, this data can be used to inform HRA in particular source term characterisation.

6.2 Groundwater monitoring

The proposed groundwater monitoring schedule during the operational phase of the planned inert land raise is detailed in the following table. The locations of the groundwater monitoring points are shown on Appendix A.6.

Table 6-1 – Proposed groundwater schedule

Monitoring Point	Borehole location	Parameter	Frequency
BHL01 and BHL02	Upgradient	Water level.	Quarterly
BHL03 and BHL08S&D	Cross gradient	pH, alkalinity, electrical conductivity, antimony, arsenic, barium, cadmium, calcium, chromium, copper, fluoride, lead, nickel, selenium, zinc, chloride, molybdenum, nitrate, sulphate, dissolved organic carbon, total organic carbon, alkalinity, ammoniacal nitrogen.	
BHL04, BHL05, BHL06, and BHL09	Downgradient		Quarterly for two years, then twice annually until review of HRA
		Total petroleum hydrocarbons (C10-C40), naphthalene and total polyaromatic hydrocarbons (PAHs), well depth.	Annually

Note: proposed frequency includes all monitoring points.

6.3 Surface water monitoring

The proposed surface water monitoring schedule during the operational phase of the planned inert land raise is detailed in the following table. The locations of the groundwater monitoring points are shown on drawing Appendix A.7.

Table 6-2 – T-HRA11a Risk based monitoring scheme – groundwater

Monitoring Point	Parameter	Frequency
Attenuation pond, RL1, RL3 and RL4	pH, alkalinity, electrical conductivity, antimony, arsenic, barium, cadmium, calcium, chromium, copper, fluoride, lead, nickel, selenium, zinc, chloride, molybdenum, nitrate, sulphate, dissolved organic carbon, total organic carbon, alkalinity, ammoniacal nitrogen. Total dissolved solids.	Quarterly

Monitoring points RL1 will provide up-stream data, RL2 will provide mid-stream data after the lagoon discharge and RL3 will provide the down-stream data.

6.4 Proposed action level / compliance limits

Groundwater

To date, no inert waste has been on site, consequently the monitored groundwater quality to date is representative of baseline conditions. However, based on BHL08D data the historical landfill is likely to be altering groundwater quality at the site and this needs to be considered when setting action levels and compliance limits in the downgradient boreholes.

Based on the proposed waste source term to infill the site, the nature of the determinands (unretarded/retarded) and breakthrough time, arsenic, chloride, lead, nickel and sulphate are considered adequate to monitor site performance to set compliance limits on the downgradient

The current dataset includes at least 77 data points for chloride and nickel and 51 data points for lead and 50 data points for arsenic. The data is not uniformly distributed as higher concentrations of the proposed determinands are recorded in BHL08D when compared to the remaining boreholes.

To that extent the proposed method to deriving action level and compliance limits is based on the analysis of the whole dataset of groundwater quality collected on site and derive the 95% value for the identified CoC. This approach is proposed as groundwater quality is likely to be influenced by the historical site. Control levels for the downgradient boreholes are based on the 95% concentration of the collected groundwater quality samples whilst action levels are based on 95% + 10 %. In line with P1-471 guidance [28] any values at LOD results, the result has been divided by 2.

Table 6-3 - Proposed compliance / action limits BHL04, BHL05, BHL06 and BHL09

Determinand	Action Level (mg/l)	Compliance limit (mg/l)
Non-hazardous		
Chloride	298	328
Sulphate	418	459
Nickel	11	12.1
Hazardous		
Arsenic	1.2	1.27
Lead	0.6	0.67

Action plans to investigate and report exceedances will be included in the site environmental management plans.

It is proposed that action levels and compliance limits are reviewed once more data has been collected prior to the installation of the basal liner over the historical site.

At the moment only 11 dataset points for each of the determinands are available for BHL08D, in order to assess potential changes in groundwater quality as a result of the installation of the proposed inert site over the historical waste mass further groundwater quality prior to the installation of the engineered liner is necessary.

Surface water

Runoff water will be collected at the attenuation pond, where any suspended solids will be settled. Monitoring the River Yealm will be undertaken to assess the potential effect of surface water discharge form the proposed inert site.

Based on the proposed identified source term and similar to the groundwater compliance limits have been set for the same determinands as the groundwater. A 19 to 27 samples have been obtained to date from all the monitoring points, and similar to the groundwater these are likely to represent baseline conditions. Surface water samples seem to show a normal distribution; therefore, based on approach LFTGN02 guidance, the action levels have been worked out using the average + 2 standard deviation approach. Action levels for the proposed determinands are shown in Table 6-4.

Table 6-4 – Proposed action level discharge point

Determinand	Action Level	Comment
Chloride	42 mg/l	
Sulphate	17 mg/l	
Nickel	2.25 µg/l	
Suspended solids	100	
Visual oils	N/A	Visible inspection
Arsenic	6.67 µg/l	
Lead	MRV	

Note: bold indicates hazardous substances

.

7. Conclusions and recommendations

7.1 Conclusions

The following conclusions are made:

- The inert site is proposed as a land raise over agricultural land and part of a historical landfill site.
- The superficial and bedrock aquifer are in continuity, in addition, based on the analysed data the River Yealm is likely to be in hydraulic continuity with the groundwater. Therefore, groundwater and surface water are the principal receptors to potential vertical and subsequent lateral migration from any leachate exiting the base of the site.
- The on site ephemeral stream is dry most of the year and it is likely that feed by surface water runoff with a very small component of baseflow.
- Based on the groundwater quality assess the historical site is having an impact on groundwater quality, specifically around BHL08D and this needs to be considered when setting action levels and compliance limits.
- The source term for the proposed inert land rise has been determined by the landfill directive compounds and all the determinands have been put forwards for DQRA analysis.
- Based on the LandSim modelling, antimony, cadmium, chromium, copper, sulphate and zinc exceeded the WQS at the receptor point, therefore, source term concentrations were reduced until the determinands were compliant at the receptor point.
- Rogue load analysis was undertaken and all determinands passed apart from nickel.
- To set up compliance limits, chloride, sulphate, nickel, arsenic and lead were selected and based on the low retarded nature and travelling times. These are considered the potential leachate indicators and therefore action levels and compliance limits have been set for at downgradient groundwater boreholes, and action levels for surface water discharge points.
- The HRA has established that input of hazardous substances above the MRV to the inert land raise will not occur, and that an adverse effect on the key receptor the River Yealm, which will receive baseflow from groundwater, is unlikely from substances which may leach from the inert waste. It is therefore considered the planned inert land raise complies with the requirements of Schedules 10 (Landfill) and 22 (Groundwater Activities) of the Environmental Permitting Regulations (2016).

7.2 Recommendations

The following are recommended:

- Ensure robust management systems are in place to determine the accepted complies with the proposed source term;
- Continue to collect groundwater on a quarterly basis on BHL08D to characterize baseline groundwater quality prior to the installation of the land raise liner and to set compliance criteria for the groundwater outflow in the area where the land raise is constructed over the historic landfill; and
- Collect waste samples to aid future source characterisation and HRA updates.

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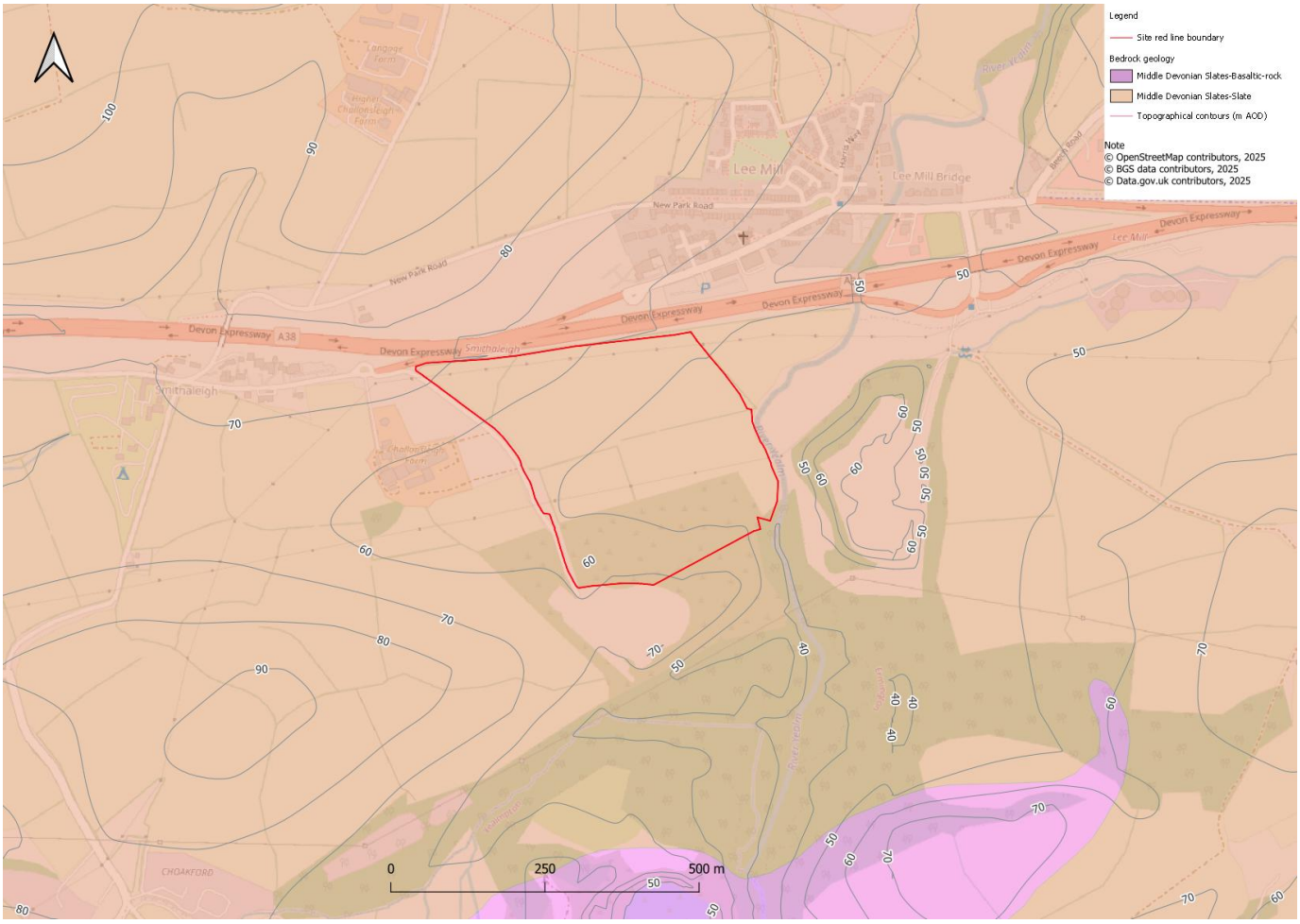
APPENDICES

Appendix A. Drawings

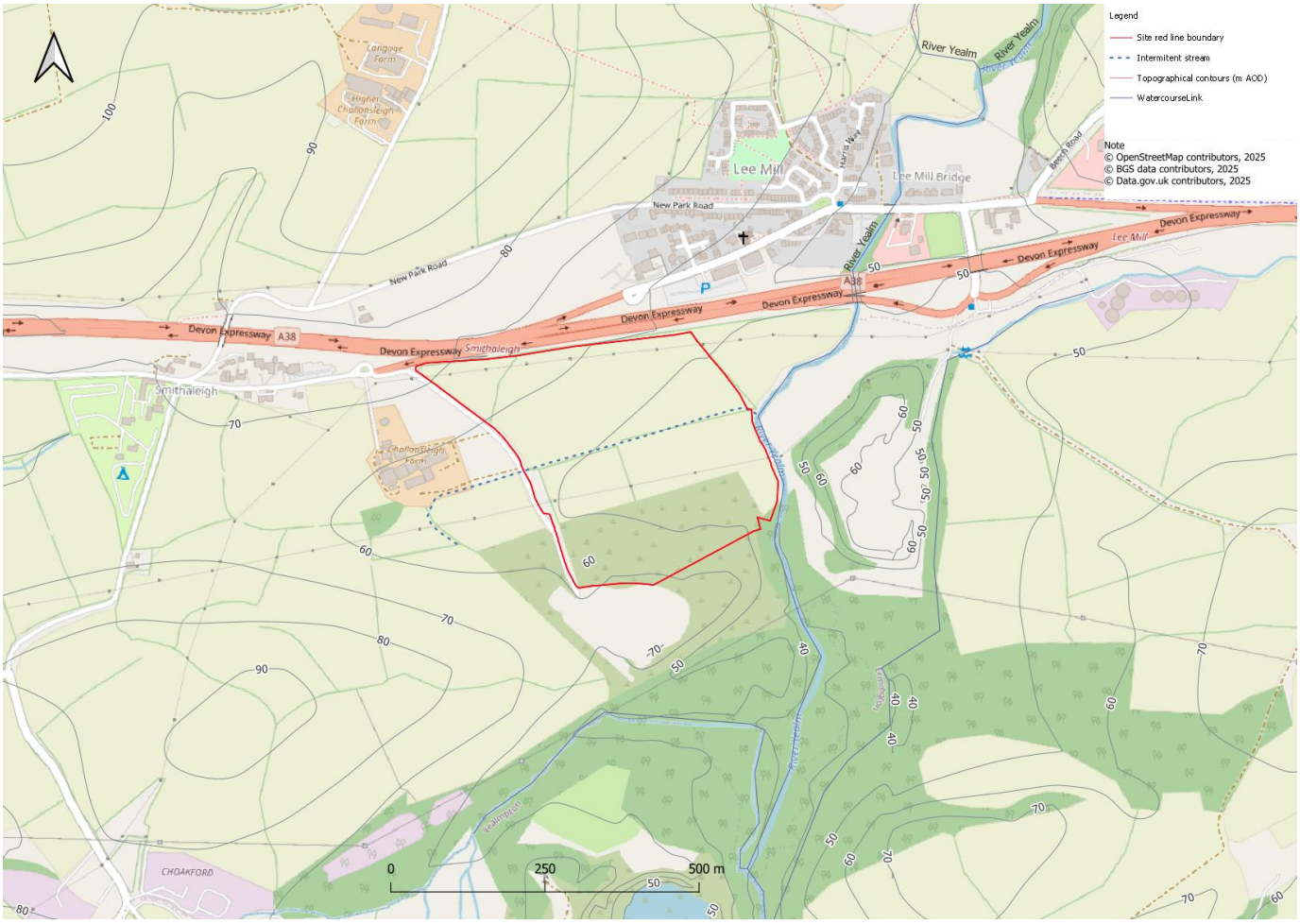
A.1 Superficial Geology



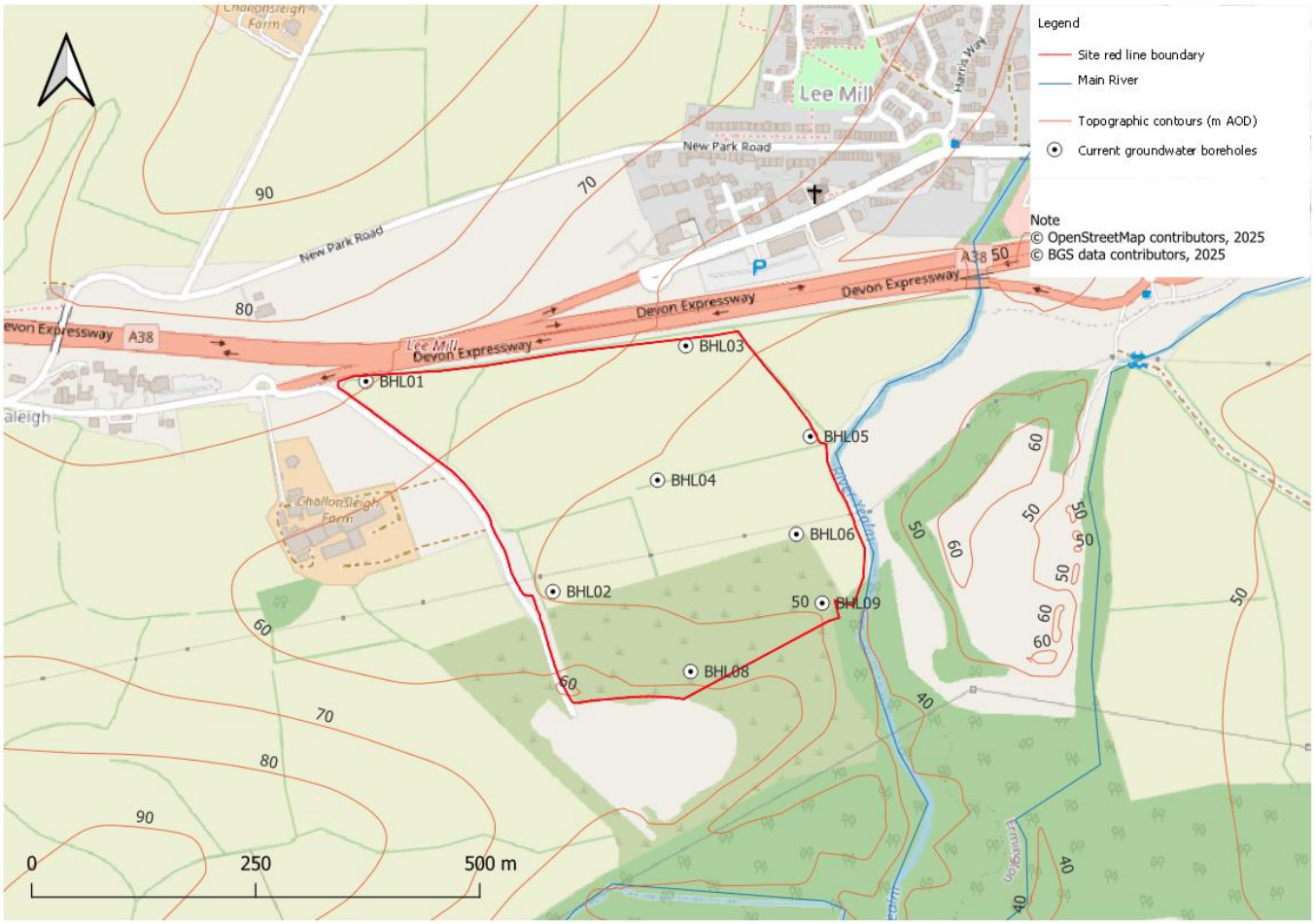
A.2 Bedrock Geology



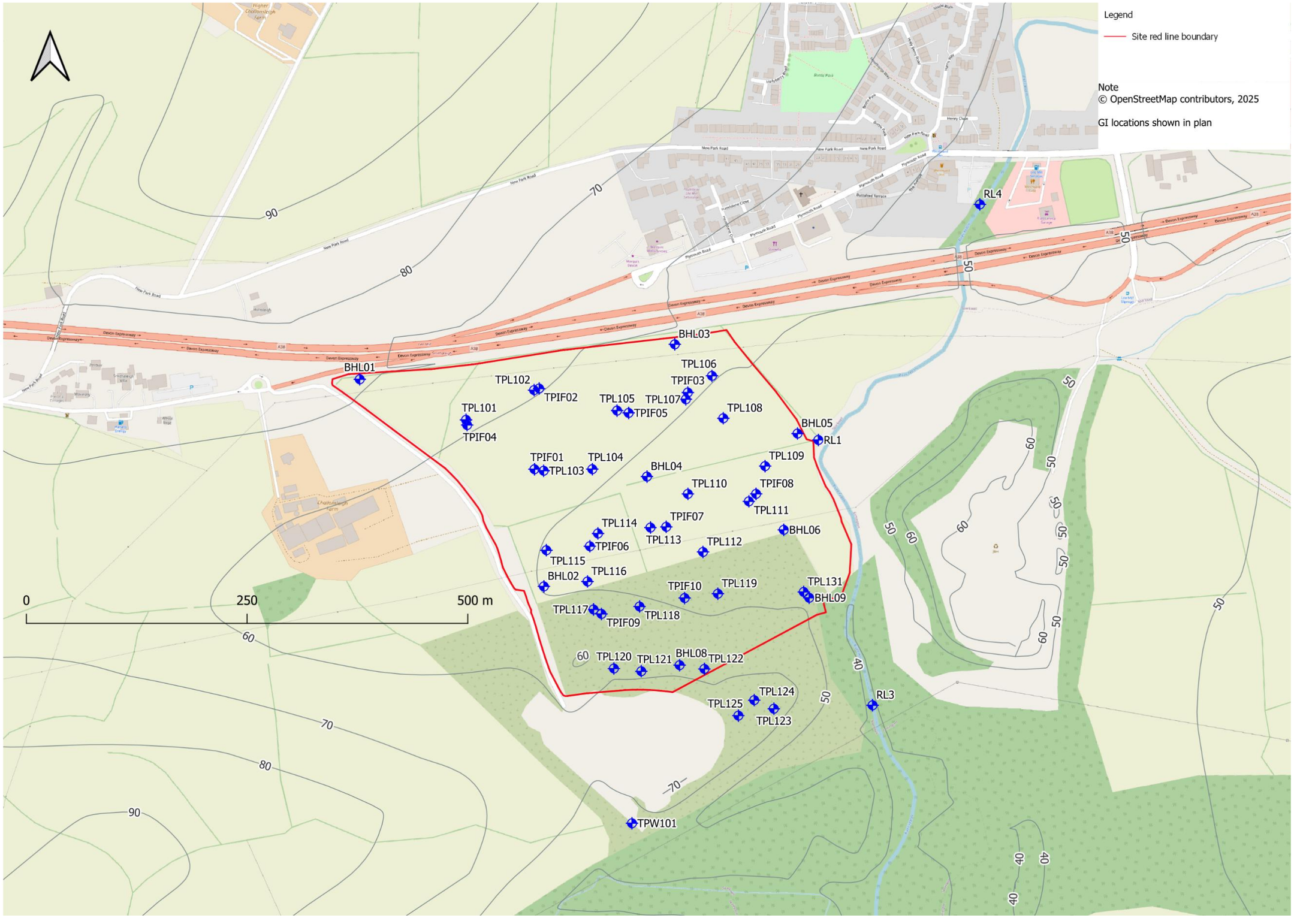
A.3 Hydrology plan



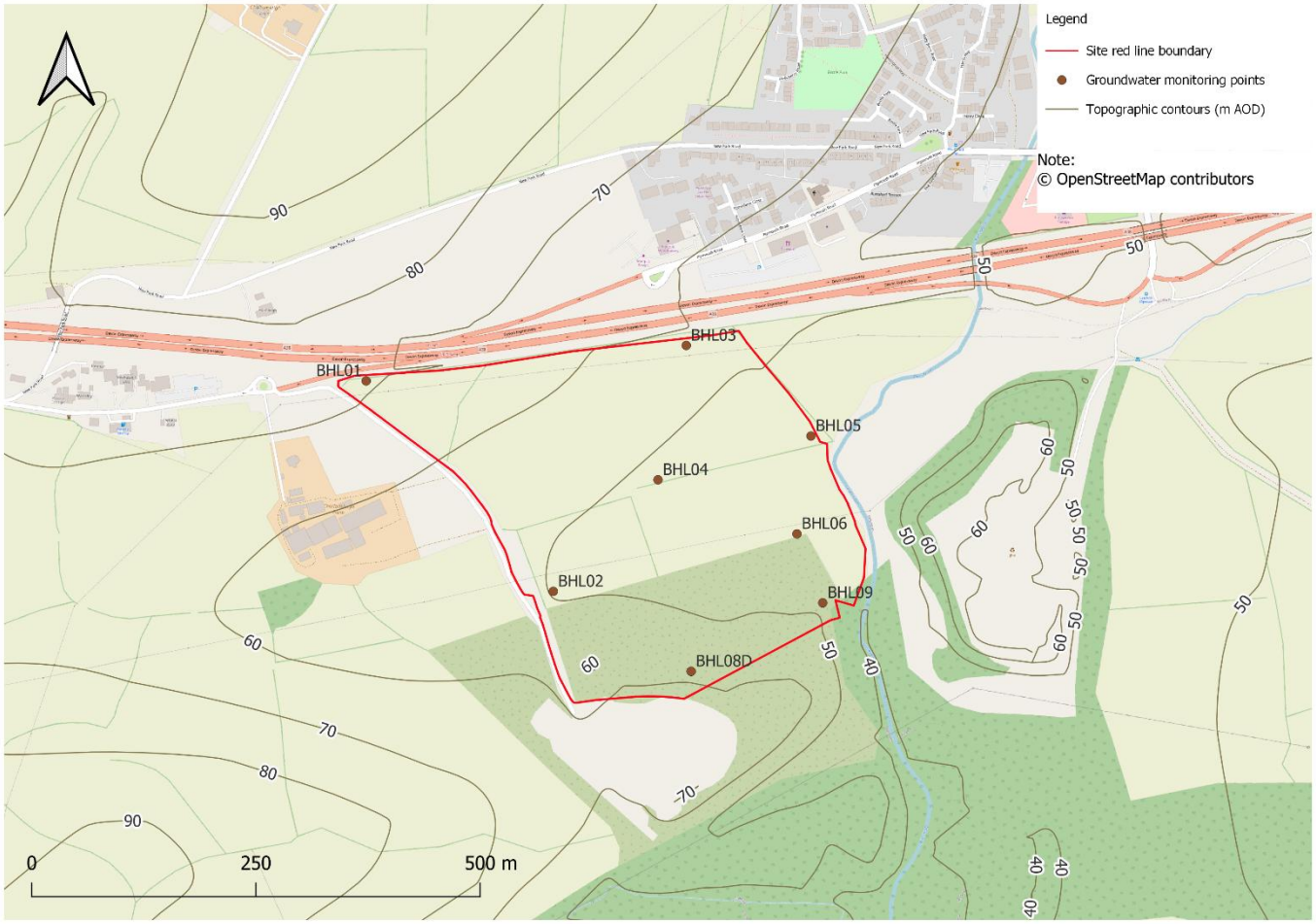
A.4 Land raise groundwater monitoring locations



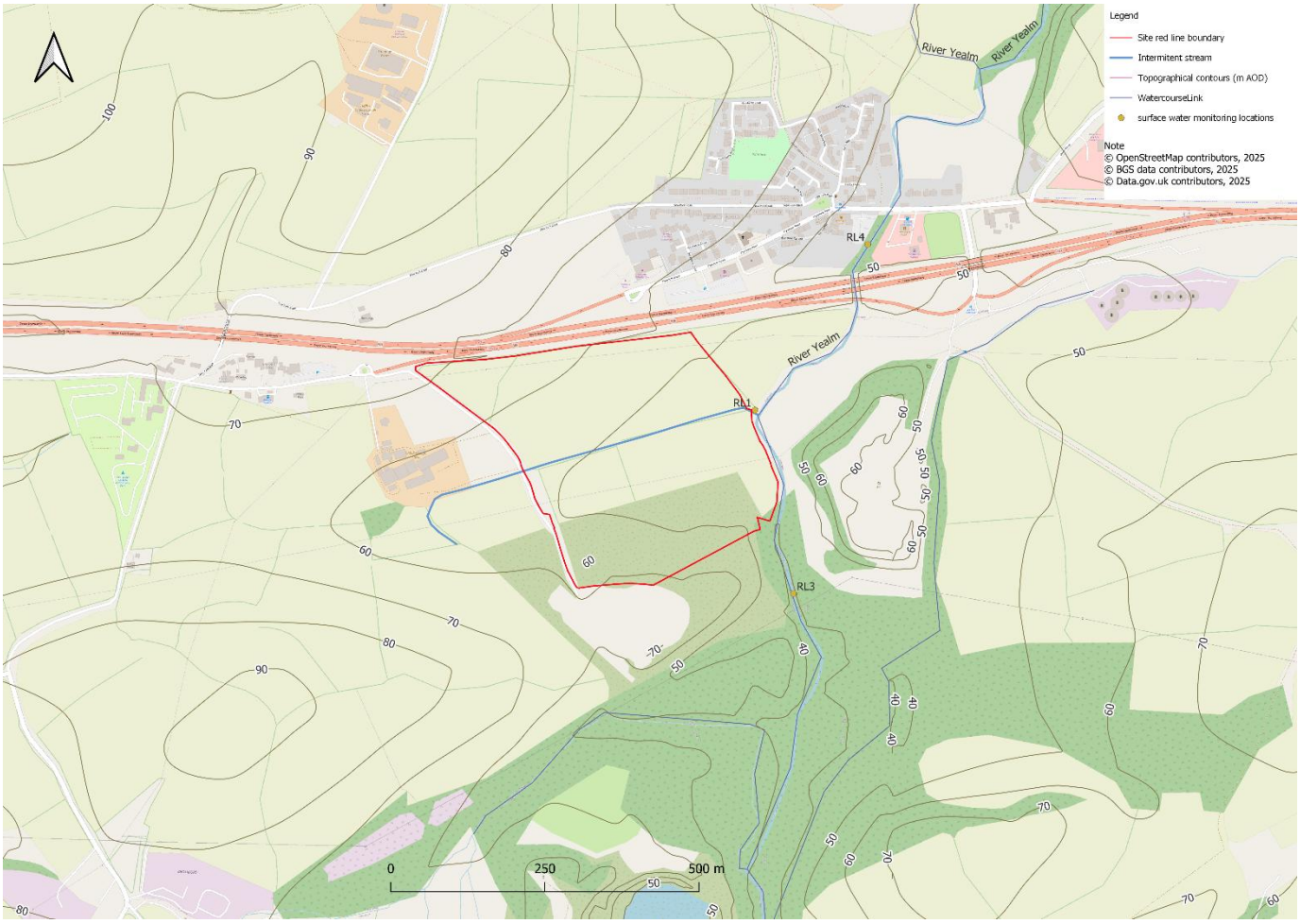
A.5 GI locations


Legend
Site red line boundary
Note
© OpenStreetMap contributors, 2025
GI locations shown in plan
BHL01
BHL02
BHL03
BHL04
BHL05
BHL06
BHL08
BHL09
RL1
RL3
RL4
TPL101
TPL102
TPL103
TPL104
TPL105
TPL106
TPL107
TPL108
TPL109
TPL110
TPL111
TPL112
TPL113
TPL114
TPL115
TPL116
TPL117
TPL118
TPL119
TPL120
TPL121
TPL122
TPL123
TPL124
TPL125
TPL131
TPIF01
TPIF02
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TPW101
0
250
500 m

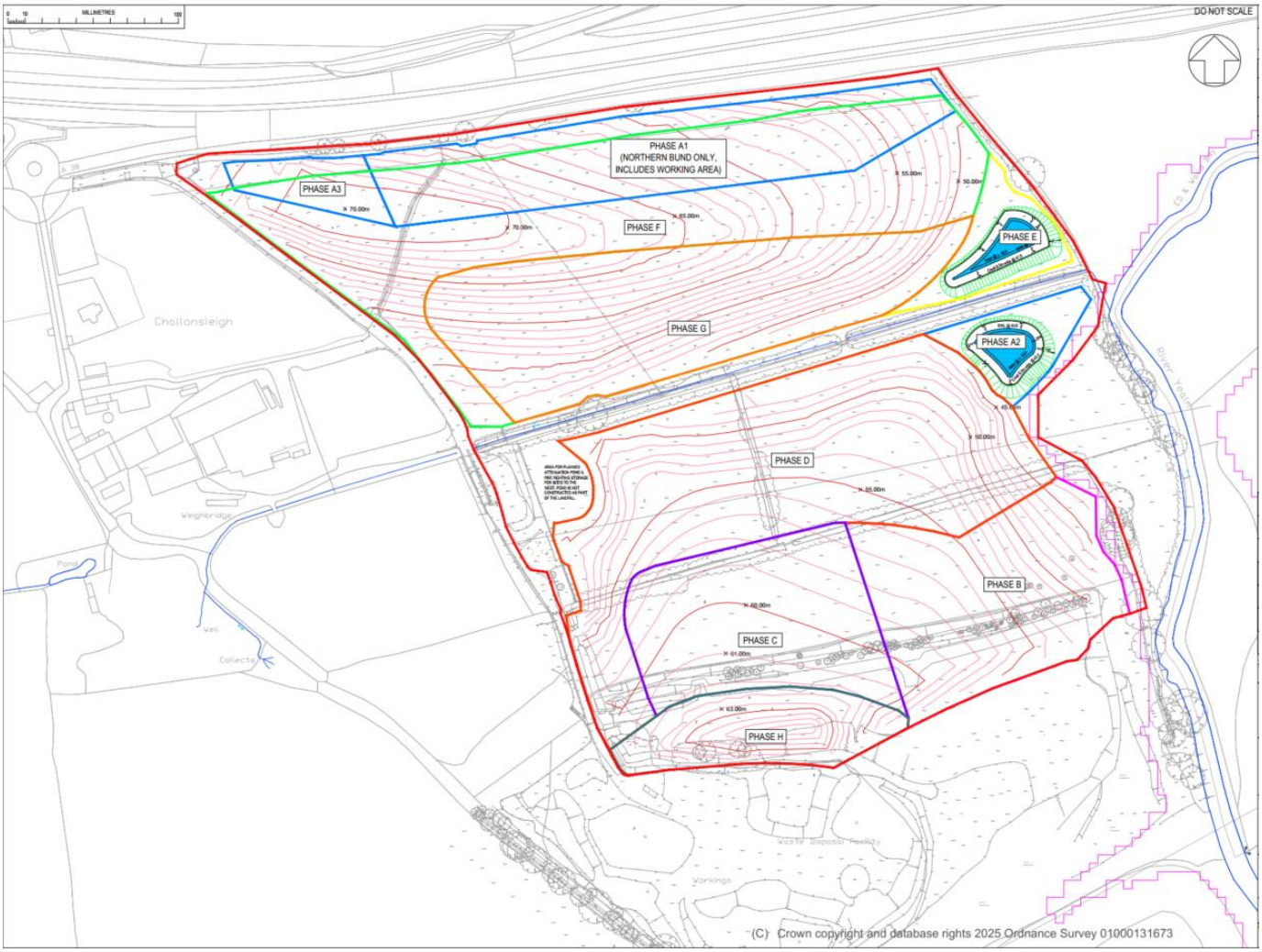
A.6 Groundwater monitoring plan



A.7 Surface water monitoring plan



A8 Land raise phasing plan

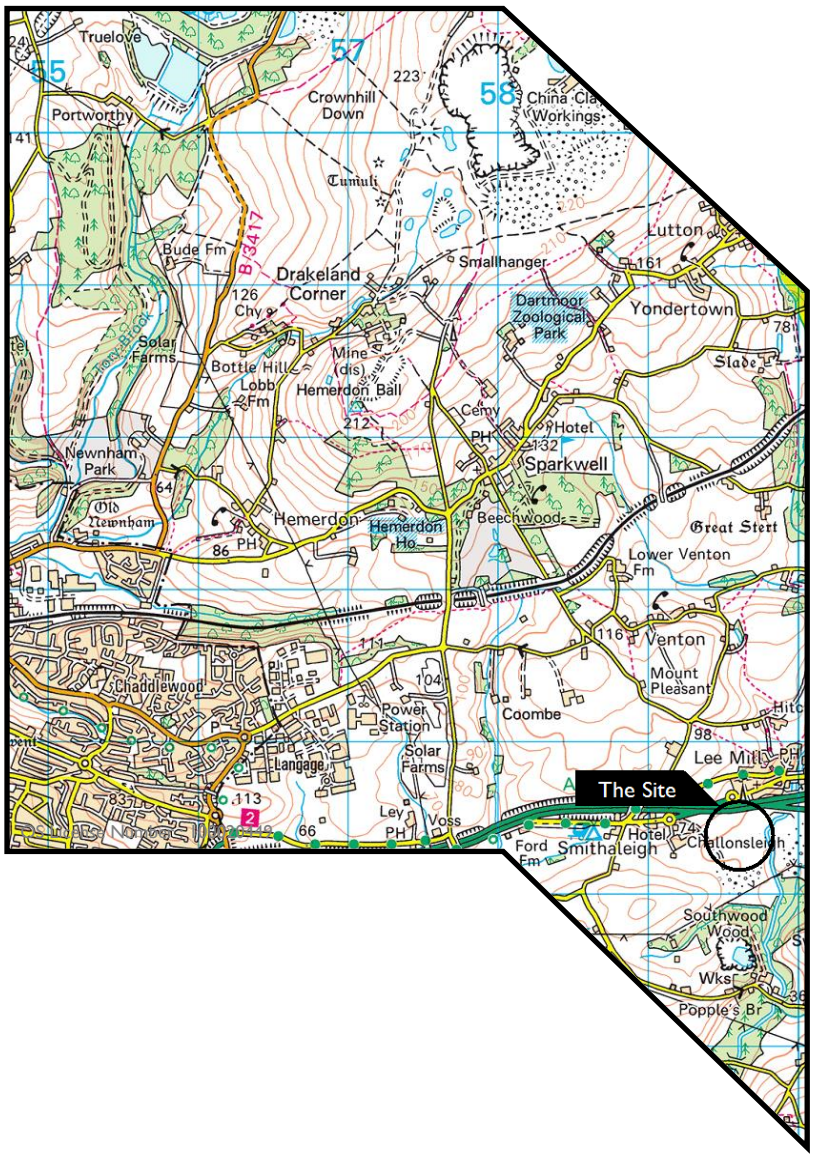


Appendix B. Site Investigation Reports

GEOTECHNICS

geotechnical and geoenvironmental specialists

Ground Investigation



www.geotechnics.co.uk

Inert Landfill at Challonsleigh Farm

Factual Report

for

Dorton Group

Engineer : Atkins Global

Project Number PE201646

January 2021

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Ground Investigation
at

Factual Report

Inert Landfill at Challonsleigh Farm

for
Dorton Group

Engineer :
Atkins Global

Project No:
PE201646
January 2021

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Ground Investigation
For an
Inert Landfill,
Challonsleigh Farm

Factual Report

Project No : PE201646
January 2021

1.0 INTRODUCTION

A geotechnical and geo-environmental investigation was undertaken by Geotechnics Limited at the site of a proposed inert landfill. The investigation was carried out to the instructions of the Engineer, Atkins Global on behalf of the Client, the Dorton Group. This report describes the work undertaken and presents the data obtained.

2.0 OBJECT AND SCOPE OF THE INVESTIGATION

The object of the investigation was to obtain information on the ground and groundwater conditions relating to the design of the proposed works within the limitations posed by trial hole numbers, locations, depths, methods adopted and the scope of approved in situ and laboratory testing. The Brief for the project is included in Appendix 1. The investigation comprised combined dynamic sample and rotary boreholes, inspection pits, trial pits and in situ and laboratory testing and reporting. A Factual Report was also commissioned.

3.0 PRESENTATION

A description of the site and a summary of the procedures followed during the investigation process are presented in Sections 4 to 6. The factual data so obtained are presented in Appendices 2 to 14 of this report. Attention is drawn to the General Notes and Investigation Procedures presented in Appendix 15 to aid an understanding of the procedures followed and the context in which the report should be read.

In addition, data in electronic format in accordance with "The Electronic Transfer of Geotechnical Data from Ground Investigations" published by the AGS (the AGS Format) are presented together with a copy of the report in electronic PDF format.

4.0 THE SITE

4.1 Location

The site is located immediately south of the A38, between the towns of Plympton to the west and Ivybridge to the east, Devon.

The approximate Ordnance Survey National Grid Reference for the centre of the site is SX 596 553 and an extract from the relevant 1:50,000 Scale O.S. Map (Sheet No. 201) is included as Appendix 2.

4.2 Description

The site is approximately rectangular in shape and covers an area of about 19 hectare and measures approximately 550m north to south and 390m east to west. The site sits in a valley, with topographic highs in the north and south of the site. The site also generally falls in elevation to the east.

The site is bounded by the A38 to the north, by the access track to the aggregates yard to the west, by the River Yealm and more pasture to the east and by overgrown rough ground and a line of electricity pylons to the south.

The site is mostly pasture, comprising large fields divided by hedgerows formed from medium and large trees. There is a field towards the south that is no longer grazed and has been allowed to become overgrown with brambles and small trees. This field has been partially mown in the recent past. The remaining pasture was being grazed by sheep at the time of the investigation.

In the far south of the site is a former landfill site. This is topographically raised above the natural ground level and covered in scrub consisting of brambles and small trees. The south-western corner of the site is taken up with an operational aggregates yard.

The site was generally dry and the ground firm during the fieldwork. The central area at the bottom of the valley showed evidence of historic rutting. A drainage

ditch runs across the site from west to east along the base of one of the dividing hedgerows.

Parts of the site were not accessible during the fieldwork due to the density of the vegetation. These were around the former landfill, to the east of the aggregates yard.

4.3 Site Geology

The British Geological Survey website, http://mapapps.bgs.ac.uk/geologyofbritain/home.html? accessed on the 6th August 2020, shows the site to be underlain by superficial deposits of sand, gravel and alluvium in the central part, corresponding to the topographic low. Beneath the superficial deposits (where present), the BGS website shows the site to be underlain by the Middle Devonian Slates.

5.0 PROCEDURE

5.1 Commissioning

The work was awarded following submission of a tender for work designed by the Engineer for ground investigation of the site in accordance with their requirements (see Appendix 1).

5.2 General

The procedures followed in this site investigation are based on *BS 5930: 2015 – Code of Practice for Site Investigations*. The soils and rocks encountered have been described in accordance with BS5930:2015 and BS EN ISO 14688-1:2018 and BS EN ISO 14689:2018. The, Dynamic Sample and Rotary Borehole, Inspection Pit and Trial Pit Records are included in Appendices 4 to 9 and their approximate positions are shown on the Exploratory Hole Location Plan in Appendix 3.

The Exploratory Hole locations were specified by the Engineer. The co-ordinates and levels shown on the Exploratory Hole Records were measured using a Leica GPS survey device. The depths quoted on the exploratory hole records are in metres below ground level.

At each exploratory hole location with the exception of the trial pits an inspection pit was excavated using hand tools to a depth of 1.20m below ground level or refusal to check for the presence of underground services. Prior to and on completion of the excavation, the location was scanned using a cable avoidance tool (CAT).

5.3 Rotary Boreholes

Seven (7 No.) boreholes (numbered BHL01 to BHL06 and BHL08), up to 150mm in diameter, were sunk utilising a combination of dynamic sampling, rotary coring and rotary open-hole techniques to depths varying between 6.50 and 13.00m below ground level. The work was carried out between the 22nd and the 30th July 2020.

The dynamic sample sections of the boreholes were carried out using a compressed air percussive apparatus fitted to the rotary drilling rig which drives lined steel tubes into the ground in 1.0m lengths. Samples are retrieved in the plastic liners. The liners are extruded from the sampler and placed into suitable core boxes. The retrieved liners were split and the recovered soils described before being sub-sampled into ES, D and B samples as shown on the Borehole Records presented in Appendix 4.

Rotary coring, 93mm diameter, commenced at depths of between 1.20 and 8.20m below ground level. The drilling equipment used in the rotary sections of the boreholes on this particular contract utilised air-mist or water (BHL08) as the flushing medium.

The strata descriptions in the open-hole sections of the Borehole Records are the Drilling Foreman's estimate based on sediment and also on chipping returns in the flushing medium. The rate of penetration is also used as an indicator of the type of material being drilled, particularly where there is loss of flush returns. Definitive classification in terms of geology or degree of disturbance is not usually possible from these sources.

Rock cores were extruded horizontally in transparent liners and placed into suitable core boxes. Photographs of the individual core boxes are included in Appendix 6.

Standard Penetration Tests (SPTs) were undertaken at the depths indicated on the borehole records in accordance with BS EN ISO 22476-3:2005+A1:2011 to obtain a measure of the engineering properties of the proved strata. A summary of the SPTs undertaken is presented in Appendix 5.

Groundwater observations are included on the Borehole Records where appropriate and any rise in water level was recorded over 20 minutes whilst drilling operations were suspended. It should be noted that the addition of water to the borehole as part of the drilling process may have masked the presence of groundwater in the borehole. Where

water was added it has been noted on the Borehole Records. In general a minimal amount of water was added in order to be able to accurately determine ground water strikes. The air compressor broke down during the final part of BHL02 and was therefore not available to be used on the final hole, BHL08. In order to expedite completion of the investigation, this hole was drilled with water as the flushing medium.

On completion, standpipes were installed in all Boreholes (see Section 5.8).

5.4 Inspection Pits

Ten (10 no.) Inspection Pits numbered TPIF01 to TPIF10 were excavated by hand to depths between 1.00 and 1.10m. The pits were excavated between the 23rd and 30th July 2020. This work was supervised on site by a geotechnical / geo-environmental engineer.

The profiles of strata or other features were recorded as excavation proceeded and measurements taken from ground level. Representative samples were taken at the depths indicated on the Trial Pit Records. Groundwater observations and trench stability notes are included on the Inspection Pit Records presented in Appendix 7.

Soakaway tests were carried out in all Inspection Pits as detailed in Section 5.6 below.

5.5 Trial Pits

Twenty five (25 No.) Trial Pits (numbered TPL101 to TPL125) were excavated to depths varying between 1.80 and 3.10m below ground level using a 14 tonne excavator between the 20th and 24th July 2020. This work was supervised on site by a geotechnical / geo-environmental engineer.

The profiles of strata or other features were recorded as excavation proceeded and measurements taken from ground level. Representative samples were taken, where appropriate, for laboratory examination and analysis and in addition, Environmental samples (ES) were recovered at the depths indicated on the Trial Pit Records. Samples were taken directly from excavated materials deposited at the surface. Groundwater observations and trench stability notes are included on the Trial Pit Records presented in Appendix 8. Photographs of the pits are presented in Appendix 9.

Hand vane tests were carried out to obtain a measure of the undrained shear strength of cohesive soils within the trial pits at the depths indicated on the Trial Pit Records. In the trial pits tests were taken in the sides of the pit where access could be safely made, otherwise they were carried out on intact blocks of the excavated soil deposited at the surface. Typically, each test comprised three measurements of the undrained shear strength with the mean value being reported. The hand vane tests were carried out using an EDECO Pilcon Hand Vane in accordance with the manufacturer's instructions and the results reported in kN/m^2.

5.6 Soakaway Tests

One (1 No.) soakaway test was carried out in Trial Pit TPW101 at a depth of 3.0m below ground level in accordance with the method given in *BRE Digest 365 "Soakaway Design", 2016*. Following the test procedures in the Digest the test was repeated three times at each location. The results of the test are presented in Appendix 10.

Ten (10 No.) soakaway tests were carried out in Inspection Pits TPIF01 to TPIF10 at a depths of between 1.0 and 1.10m below ground level in accordance with the method given in *BRE Digest 365 "Soakaway Design", 2016*. The Digest requires the test to be repeated three times at each location, however, due to the slow soakage of the water from the test pit it was only possible to carry out one test in some locations. In locations where the water soaked away quickly, a second test was undertaken. On the instruction of the Engineer, soakaway testing was terminated after the second test.

The water level in the inspection pits was measured using automatic water level loggers suspended in the pits. A record of the barometric pressure on site during the tests was made and the water levels corrected for this. On the instruction of the Engineer, the water level in any test which was slow was topped up after a period of 1 to 2 hours, and the test left to run until the following day. In this case the soil infiltration rate has been calculated only using data after the pit was topped up. In pits where the water soaked away quickly, a second full test was conducted and both sets of results are reported. The results of the tests are presented in Appendix 10.

5.7 River Water Monitoring

The water in the River Yealm was monitored in situ for various parameters using an Aqua Troll 500 device on the 3rd August 2020. Three locations were monitored for 25 minutes each, and the results are

presented in Appendix 11. The approximate monitoring locations are marked on the Exploratory Hole Location Plan (see Appendix 3).

5.8 Instrumentation and Monitoring

Long-term monitoring of the gas and groundwater levels was made possible by the installation of standpipes as follows:

Exploratory Hole	Standpipe Slotted Pipe & Filter Zone (m)
BHL01	4.0 to 13.0m
BHL02	2 to 12.0m
BHL03	2.0 to 6.5m
BHL04	2.3 to 8.3m
BHL05	2.5 to 7.0m
BHL06	2.0 to 7.0m
BHL08 (19mm)	2.0 to 4.5m
BHL08 (50mm)	6.5 to 11.0m

Samples were obtained (where possible) following a purging of 3 volumes of water in the standpipes on the 29th July 2020.

Monitoring of the gas and groundwater levels at the site commenced on the 3rd August 2020 with further visits for water monitoring on the 7th August, 8th September and 29th September 2020.

On each of the monitoring visits a record of the groundwater level in the standpipes was obtained.

In addition to the groundwater levels, the following parameters were measured and recorded in each standpipe using a Gas Data GFM436 Gas Analyser:-

- Concentrations (% Vol) of CH_4, O_2, CO_2, along with (% LEL) CH_4 and (ppm) H_2S, CO
- Flow Rate
- Differential Pressure
- Barometric Pressure
- Air Temperature
- Down Hole Temperature

The results of the monitoring are presented in Appendix 12.

6.0 LABORATORY TESTING

6.1 Geotechnical

The laboratory testing schedule was specified by the Engineer in order to relate to the proposed development. Unless otherwise stated, the tests were carried out in Geotechnics Limited's UKAS accredited Laboratory (Testing No. 1365) and were undertaken in accordance with the appropriate Standards as indicated below and on the Laboratory Test Certificate in Appendix 13. Any descriptions, opinions and interpretations are outside the scope of UKAS accreditation.

The tests undertaken can be summarised as follows:-

BS EN ISO 17892-1:2014

46 No. Water Content Determination

BS EN ISO 17892-3:2015

7 No. Particle Density Determination

BS EN ISO 17892-4:2016

20 No. Particle Size Distribution Determination – Sieving Method

10 No. Particle Size Distribution Determination – Pipette Method

BS EN ISO 17892-12:2018

25 No. Determination of Liquid and Plastic Limits

BS 1377:1990

Test No.		Test Description
Part 4		
3.3	8 No.	Dry Density/Moisture Content relationship determination. Compaction Test - British Standard (2.5 kg Hammer)
Part 7		
4	2 No.	Shear Strength Measurement - Shear Box Test Drained
9	4 No.	Unconsolidated Undrained Triaxial Test – Multistage

The following testing was carried out at the laboratories of Professional Soils Laboratory (UKAS Accredited Laboratory, Number 4043):

BS 1377:1990 Test No.		**Test Description**
Part 2		
9.2 & 9.3	2 No.	Mechanical Analysis - Sieving
9.4	2 No.	Mechanical Analysis - Sedimentation
Part 6		
6	4 No.	Permeability in a Triaxial Cell

6.2 Contamination

Selected samples of soil, groundwater and river water were tested at the laboratories of Eurofins ChemTest Ltd (UKAS accredited Laboratory (Testing No. 2183) for a number of determinands in order to check on potential site contamination. The determinands were specified by the Engineer and are detailed on the results sheets in Appendix 14 together with the test result as well as the test method, accreditation and detection limit.

In addition, Waste Acceptance Criteria (WAC) analyses were carried out on selected samples including tests on solid waste and two stage leaching tests on eluates. The determinands tested for are detailed on the results sheets in Appendix 14.

Signed for and on behalf of Geotechnics Limited.

Prepared by:

Michael Kerr
BSc, FGS
Senior Engineer

Reviewed by:

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BSc (Hons) MSc(Eng), CEng, IOM3, FGS
Principal Engineer

APPENDIX I

The Brief

Ground Investigation for an Inert Landfill at Challonsleigh Farm, near Lee Mill, Devon

Conditions of Contract

The Employer shall be the DDE (SW) Limited, and the conditions of contract shall be the Infrastructure Conditions of Contract, the Ground Investigation Version, 1 August 2011 (and subsequent amendments, if any), subject to the following amendments.

Cl. 21.1	In lines 2 and 3, delete “in the joint names of the Contractor and the Employer” and insert “in the name of the Contractor”.
Cl. 23(1)	In lines 2 and 3, delete “in the joint names of the Contractor and the Employer” and insert “in the name of the Contractor”.
Cl. 23(2)	Delete clause.

Specification

The specification shall be the UK Specification for Ground Investigation, 2nd Edition, published by ICE Publishing, 2012, with information, amendments and additions as described in the Schedules.

Schedules

Schedule 1: Information		
S1.1	Name of Contract	Ground Investigation for an Inert Landfill at Challonsleigh Farm, near Lee Mill, Devon, PL21.
S1.2	Investigation Supervisor	Atkins Ltd.
S1.3	Description of site	The proposed inert landfill site is mainly agricultural farmland but has also been partially landfilled on its south side boundary extending under an existing waste recycling site.
S1.4	Main works proposed and purpose of this contract	To determine ground conditions and provide baseline ground condition characterisation data for environmental permit application for the inert landfill, particularly regarding the geological barrier.
S1.5	Scope of investigation	Trial pits, rotary borehole drilling into bedrock, geotechnical and environmental sampling and laboratory testing.
S1.6	Geology and ground conditions	The Geology of Britain viewer indicates the 1:50,000 scale bedrock geology to be Middle Devonian Slates – Slate. The Middle Devonian Slates regional dip steeply to the south. In the east of the site there are superficial deposits comprising Alluvium and Head which are likely to be heterogeneous clay, silt sand and gravel.
S1.7	Schedule of drawing(s) and documents	Drawing 5149237-ATK-GEN-ZZ-PL-C-0050 Ground Investigation Exploratory Hole Location Plan. Drawing 5149237-ATK-GEN-ZZ-PL-C-0051 Ground Investigation Exploratory Hole Location Plan - Geology.

Schedule 1: Information		
S1.8	General requirements (Specification Section 3) Particular restrictions / relaxations	None envisaged but contractor to check with Employer / Investigation Supervisor prior to commencement on site.
S1.8.1	Quality management system (Clause 3.3)	Not applied.
S1.8.2	Professional Attendance (Clause 3.5.2)	As per Clause 3.5.2.
S1.8.3	Provision of ground practitioners and other personnel (Clauses 3.6.1 and 3.6.2)	None envisaged.
S1.8.4	Hazardous ground, land affected by contamination and invasive weeds (Clauses 3.7.1 and 3.22)	Hazardous substances are not expected within the 'greenfield' land outside that shown as 'historic landfill' which is an area previously used as a licensed inert landfill. Therefore the 'greenfield' area is designated "GREEN", whereas the area shown as 'historic landfill' are designated 'YELLOW', in accordance with the Guidelines for the safe investigation by drilling of landfills and contaminated land, 1993, published by Thomas Telford.
S1.8.5	Additional information on services not shown on Contract Drawings (Clause 3.7.2)	Underground utility service information is not available yet but will be procured. Exploratory hole locations should be moved to avoid suspected services or evidence of possible services.
S1.8.6	Known/suspected mine workings mineral extractions, etc. (Clause 3.7.3)	None known.
S1.8.7	Protected species (Clause 3.7.4)	None known.

Schedule 1: Information		
S1.8.8	Archaeological remains (Clause 3.7.5)	An Archaeology & Heritage Assessment was carried out by BSA Heritage reported December 2017 which followed an archaeological trench evaluation reported November 2017, which summarised its work as follows: *"An archaeological trench evaluation on land at Challonsleigh Farm, Lee Mill, Devon (NGR SX 5956 5538), was undertaken by AC archaeology during October 2017. The evaluation comprised the machine-excavation of 14 trenches totalling 694m in length and each 1.8m wide. These were positioned to target anomalies and 'blank' areas from a previous geophysical survey, including a possible settlement-type enclosure in the western part of the site.* *The results of the evaluation largely support the geophysical survey interpretation, in that the blank areas contained negative results. A settlement enclosure was indeed present in the western part of the site, with a sub-oval ditch surrounding a scooped terrace for a probable roundhouse. Finds recovered indicate a Middle Bronze Age date for the enclosure. Documentary sources indicated a chapel might lie within or close to the site. A substantial wall footing and associated medieval ridge roof tiles on the western edge of the site look to be the remains of this or another high-status medieval building".* Planning condition 13 requires the implementation of a programme of archaeological work in accordance with a written scheme of investigation approved by the Waste Planning Authority. The interface between that archaeological investigation to this ground investigation will be communicated to the Contractor prior to mobilisation.
S1.8.9	Security of the site (Clause 3.11)	As per Clause 3.11.
S1.8.10	Traffic management measures (Clause 3.12)	None envisaged.
S1.8.11	Restricted working hours (Clause 3.13)	None envisaged.
S1.8.12	Trainee site operatives (Clause 3.14.1)	Permitted subject to prior approval by the Investigation Supervisor.
S1.8.13	Contamination avoidance and/or aquifer protection measures required (Clauses 3.15.2 and 3.15.3)	Not envisaged.

Schedule 1: Information		
S1.8.14	Maximum period for boring, pitting or trenching through hard material, hard stratum or obstruction (Clauses 2.8, 4.3 and 6.4)	One hour, as per Clauses 4.3 and 6.4.
S1.8.15	Reinstatement requirements (Clause 3.16)	Reinstatement of surfaces to be as per existing ground surfaces.
S1.8.16	Hygiene facilities required (Clauses 2.20 and 3.16.1)	Additional hygiene facilities may be required to comply with latest government guidance on COVID19. The Contractor shall ensure that their Risk Assessments and Method Statements (RAMS) contain suitable mitigation measures in accordance with the latest government guidance to protect their workforce and minimise the risk of the spread of infection.
S1.8.17	Unavoidable damage to be reinstated by Contractor (Clause 3.16.1)	No additional requirements.
S1.8.18	Accuracy of exploratory hole locations (Clauses 3.19 and 3.20)	To be surveyed to National Grid co-ordinates and elevation.
S1.8.19	Photography requirements (Clause 3.25)	Of trial pits and rotary core (if collected).
S1.9	**Percussion boring (Specification Section 4) Particular restrictions / relaxation**	
		Not required.
S1.10	**Particular Rotary drilling (Specification Section 5) Particular restrictions / relaxations**	
S1.10.2	Particular rotary drilling techniques (Clause 5.2)	Rotary open hole drilling required, rotary core drilling for 3m into bedrock at selected locations. Minimum hole diameter to be as necessary to achieve the borehole target depth. Depth to bedrock to be recorded.
S1.10.12	Backfilling (Clause 5.7)	Backfill with clean gravel below the water table, then cement bentonite grout above the water table.
S1.10.13	Core photographic requirements (Clause 5.8)	If coring is carried out, photographs of cores in a fresh condition will be required.
S1.11	**Pitting and trenching (Specification Section 6) Particular restrictions / relaxations**	

Schedule 1: Information		
S1.11.1	Indirect detection of buried services and inspection pits (Clauses 3.8.3 and 6.1)	Each exploratory hole location is to be CAT scanned. An inspection pit is to be dug to ensure the avoidance of underground services.
S1.12	**Sampling and monitoring during intrusive investigation (Specification Section 7) Particular restrictions / relaxations**	
S1.12.11	Frequency of sampling (Clause 7.9.4)	In addition to Clause 7.9.4 a minimum of two environmental samples per trial pit are to be collected and also wherever an environmental land quality concern is suspected, e.g. stained soils or Made Ground i.e. non engineered fill, environmental samples are to be collected of that ground for testing for potential contaminants. Samples should be collected beneath topsoil and then typically within 0.5-1m deeper except where a greater thickness of Made Ground is encountered.
S1.13	**Probing and cone penetration testing (Specification Section 8) Particular restrictions / relaxations**	
		Not required.
S1.14	**Geophysical testing (Specification Section 9) Particular restrictions / relaxations**	
		Not required.
S1.15	**In situ testing (Specification Section 10) Particular restrictions / relaxations**	
S1.15.1	Tests in accordance with British Standards (Clause 10.3)	Standard penetration tests required in boreholes to confirm rock. Variable head permeability tests required at boreholes (these are to be below topsoil and at ≤1m below base of topsoil/subsoil so if no groundwater these would be infiltration tests).

Schedule 1: Information		
S1.15.6	Soil infiltration test (Clause 10.6)	At trial pits and boreholes, to be carried out below topsoil and at ≤1m below base of topsoil/subsoil. Alternatively tests can be carried out in specifically formed auger holes or inspection pits (0.15m diameter) near trial pit locations, formed to 1m below topsoil/subsoil. Tests in boreholes to be carried out from below base of topsoil/subsoil to ≤1m below base of topsoil/subsoil. Tests at trial pits to be carried out with infiltration test pit minimum dimensions 0.3m x0.3m at base, 0.3m deep, filled with water water, with e.g. base of pit for test 1 to be 0.5mbgl, and e.g. for test 2 to be 0.8mbgl. For tests in auger holes the holes are to be filled with water to base of topsoil/subsoil and then the fall in water level monitored for up to 24hrs. Contractor will have to provide and transport (bowser) water to the location of each infiltration test. The aim of the tests is to demonstrate negligible infiltration (i.e. ≤ 1E-7m/s) and if that is not apparent after 60 minutes for test 1 (e.g. the fall in water level is more than negligible), the test can be terminated, and a test 2 carried out deeper. If negligible infiltration a test may need to be left overnight. If at the start of a test there is a drop in the water level due to flow into the soil pores, additional water can be added and the test recommenced to then check for negligible infiltration. If the water level continues to fall notably a test can be terminated, and the details of the test recorded.
S1.16	**Instrumentation (Specification Section 11) Particular restrictions / relaxations**	
S1.16.1	Protective covers for installations (Clause 11.2)	Raised covers will need to be installed.
S1.16.3	Standpipe and standpipe piezometer installations (Clauses 11.4.1 and 11.4.2)	Standpipes (minimum 50mm diameter) to be installed to enable monitoring of ground gas, groundwater elevation, and to enable groundwater sampling. Standpipes to be developed post installation by pumping or air flushing.
S1.17	**Installation monitoring and sampling (Specification Section 12) Particular restrictions / relaxations**	
S1.17.1	Groundwater level readings in installations (Clause 12.2)	Groundwater level at each installation to be taken on completion of standpipe installation and at least once again prior to completion of the fieldwork or until an automatic water level recording device has been installed.
S1.17.2	Groundwater sampling from installations (Clause 12.3.1)	Required from each standpipe installation.

Schedule 1: Information		
S1.17.3	Purging/micro-purging (Clause 12.3.2	Required after each standpipe installation and prior to groundwater sampling.
S1.17.4	Ground gas monitoring (Clause 12.4)	Ground gas monitoring at each installation to be carried out at least once prior to completion of the fieldwork.
S1.17.6	Other monitoring	Selected standpipe installations may have automatic water level recording devices, to supplied by the Contractor, if requested, but installed by the Installation Supervisor.
S1.17.7	Sampling and testing of surface water bodies (Clause 12.9)	To be carried out at locations identified on Exploratory Hole Location Plan to sample the River Yealm at upstream, intermediate and downstream locations, and include measurement of field parameters pH, EC/TSS, DO, temperature and turbidity.
S1.18	**Daily records (Specification Section 13) Particular restrictions / relaxations**	
		No additional requirements.
S1.19	**Geotechnical laboratory testing (Specification Section 14) Particular restrictions / relaxations**	
S1.19.1	Preparation of test schedule (Clause 14.1.1)	Contractor to prepare a list of samples for scheduling of tests by the Investigation Supervisor.
S1.19.2	Tests Required (Clause 14.1.2)	May include but not restricted to: natural moisture content, Atterberg Limits, particle size distribution, sulphate (2:1 water / soil extract), moisture content / dry density compaction, shear box (remoulded), shear strength (remoulded) and hydraulic conductivity (remoulded).
S1.19.2	Rock testing requirements (Clause 14.5)	May include but not restricted to: natural moisture content, dry density, point load index, unconfined compressive strength with Young's modulus.
S1.19.6	Chemical testing for aggressive ground / groundwater for concrete (Clause 14.6)	Suite A Greenfield site (pyrite absent).
S1.20	**Geo-environmental laboratory testing (Specification Section 15) Particular restrictions / relaxations**	
S1.20.1	Preparation of test schedule (Clause 15.1)	Contractor to prepare a list of environmental samples for scheduling of tests by the Investigation Supervisor.

Schedule 1: Information		
S1.20.3	Chemical testing for contamination (Clause 15.3)	Suite E – Soil samples, to comprise the following determinands: As, Cd, Cr (total), Cu, Pb, Hg, Ni, Se, Zn, pH, sulphate, total organic carbon, total petroleum hydrocarbons, speciated polyaromatic hydrocarbons, asbestos (screen). Suite F – Water samples, to comprise the following determinands: As, B, Cd, Cr (total), Cu, Hg, Ni, Pb, Se, Zn, pH, sulphate, total organic carbon, total petroleum hydrocarbons, speciated polyaromatic hydrocarbons, phenol, cyanide (total). Total and dissolved values required for metals.
S1.20.5	Waste Acceptance Criteria testing (Clause 15.5)	Anticipated Suite H – Inert waste landfill, may be required.
S1.20.7	Special laboratory testing	For water quality Suite F1 – Water samples, to comprise the following determinands: pH, Al, Ca, Fe, Mg, Mn, Na, K, chloride, nitrate, fluoride, phosphate, ammonia/ammoniacal nitrogen, dissolved organic carbon, total hardness, alkalinity, total dissolved solids, conductivity. Total and dissolved values required for metals.
S1.21	**Reporting (Specification Section 16) Particular restrictions / relaxations**	
S1.21.3	Variations to final digital data supply requirements (Clause 16.5.1)	No additional groups, fields or codes shall be accepted without the prior agreement of the Investigation Supervisor, and then only in exceptional circumstances. The Contractor shall be responsible for assigning GEOL_GEOL and GEOL_GEO2 codes, in collaboration with the Investigation Supervisor. AGS Format data shall be issued as a single file. The following associated files are to be included in the AGS data submission. The formats for specific associated files are given below: - Photographs of cores and trial pits (Cl. 5.8 & 6.12) in JPEG format. - Open hole logging data in Excel or other appropriate format as agreed with the Investigation Supervisor.
S1.21.4	Digital Data – Preliminary data (Clause 16.5.3)	Preliminary digital data shall be supplied with the first digital copy of the Ground Investigation Report.
S1.21.5	Type(s) of report required (Clause 16.6)	The Contractor is to prepare a Factual Report as per BS EN 1997-1:2004 Eurocode 7: Geotechnical design – Part 1 General rules Section 3.4. Contractor is not required to carry out evaluation of the geotechnical information or prepare a Geotechnical Design Report.

Schedule 1: Information		
S1.21.8	Contents of Ground Investigation Report (Clause 16.8)	As per Clause 16.8.1 and BS EN 1997-1:2004 Eurocode 7: Geotechnical design – Part 1 General rules Sections 3.4.2.
S1.21.10	Submission of electronic information – Timing (Clause 16.10.1)	Complete set of electronic information to be supplied with draft and approved final copies of the report.
S1.21.11	Submission of electronic information – Media (Clause 16.10.2)	Via email, CD or DVD ROM.
S1.21.12	Approval of report (Clause 16.11)	One digital copy of a draft Factual Report required within two weeks of completion of the main site work (which excludes any subsequent visits) and as such may not include all laboratory tests. One digital copy of the final Factual Report required within two weeks of receipt of the Investigation Supervisor's comments on a second draft report which shall include all laboratory test results.

Schedule 2: Exploratory Holes					
Hole ID.	**Type**	**Scheduled Depth**	**NGR**	**Anticipated Ground Surface**	**Remarks**
As per each exploratory hole location.	Hand dug inspection pit.	0-1.2m	At each exploratory borehole location, see Exploratory Hole Location Plan.	As indicated below.	To check for underground services.
BHL01 BHL03 BHL04 BHL05 BHL08	Rotary drilled borehole, rotary core for 3m then open hole, + standpipe, raised cover. SPTs in soils above bedrock.	35m 20m 10m 10m 20m All aiming to be at least 3m below water table.	See Exploratory Hole Location Plan for indicative location.	Grass.	To determine ground conditions, carry out permeability test, and install ground gas and groundwater monitoring standpipes.
BHL02 BHL06 BHL07	Rotary drilled borehole, open hole, + standpipe, raised cover. SPTs in soils above bedrock.	15m 5m 10m All aiming to be at least 3m below water table.	See Exploratory Hole Location Plan for indicative location.	Grass.	To determine ground conditions, carry out permeability test, and install ground gas and groundwater monitoring standpipes.
TPL101 to TPL107, TP110 to TPL114, TPL116 to TPL119	Mechanically dug trial pits.	0-3m	See Exploratory Hole Location Plan for indicative location.	Grass.	To determine ground conditions and obtain samples for testing in area of proposed landfill.
TPL108, TPL109, TPL115	Mechanically dug trial pits.	0-3m	See Exploratory Hole Location Plan for indicative location.	Grass.	To determine ground conditions and obtain samples for testing in area of proposed attenuation ponds.
TPL120 to TPL125	Mechanically dug trial pits.	0-4.5m	See Exploratory Hole Location Plan for indicative location.	Grass.	To characterise ground conditions in area of previous landfill.

Schedule 2: Exploratory Holes					
Hole ID.	**Type**	**Scheduled Depth**	**NGR**	**Anticipated Ground Surface**	**Remarks**
Ten selected locations from TPL101 to TPL120 or adjacent auger holes	Mechanically dug trial pits or adjacent auger holes.	At 0.5 to 1m below topsoil /subsoil	Up to ten locations to have infiltration testing.	Grass.	To determine ground infiltration rate in slate, head deposits and alluvial deposits.

Schedule 3: Engineer's Facilities		
S3.1, S3.2, S3.3, S3.4, S3.5, S3.6	Accommodation, Furnishings, Services, Equipment, Transport, Personal Protective Equipment for Investigation Supervisor	Not required.
Schedule 4: Specification Amendments		
None.		
Schedule 5: Specification Additions		
None.		

Bill of Quantities

Included as separate spreadsheet.

APPENDIX 2

Site Location Plan

SITE LOCATION PLAN



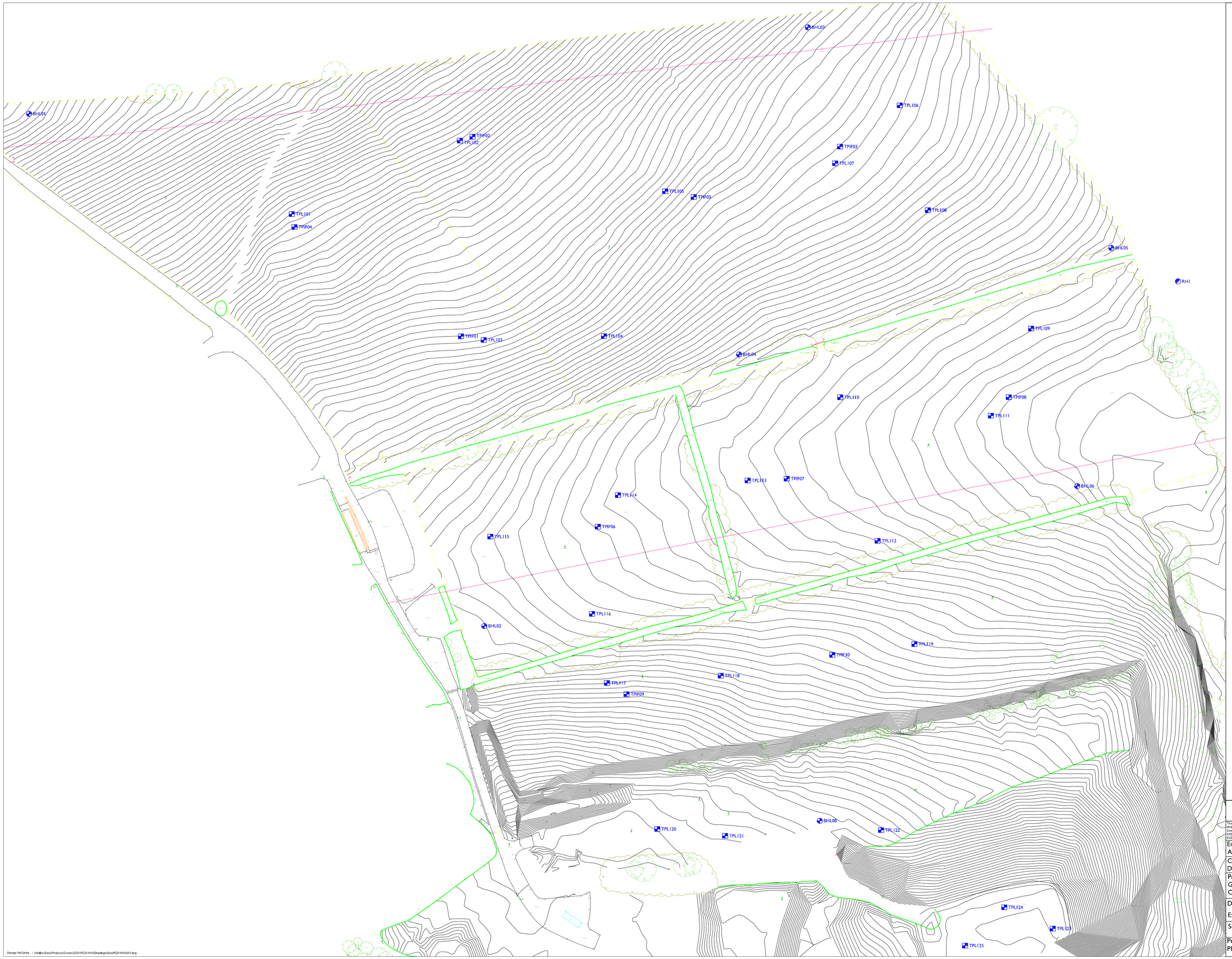
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Ground Investigation
at
Inert Landfill at Challonsleigh Farm
for
Dorton Group

GEOTECHNICS
geotechnical and geoenvironmental specialists

APPENDIX 3

Exploratory Hole Location Plan



Key

- Borehole
- Trial Pit
- Water Monitoring Location

Hole ID	Easting (mE)	Northing (mN)	Level (mOD)
BHL01	259257.44	55499.77	70.85
BHL02	259466.07	55265.07	48.99
BHL03	259614.38	55539.41	52.94
BHL04	259582.83	55389.51	47.00
BHL05	259753.42	55438.31	44.52
BHL06	259737.81	55329.19	42.95
BHL08	259619.82	55175.81	57.26
RH1 Approximate	259764.00	55423.00	0.00
RH2 Approximate	259823.00	55277.00	0.00
RH3 Approximate	259828.00	55133.00	0.00
TPIF01	259455.41	55397.85	53.65
TPIF02	259460.66	55489.29	59.13
TPIF03	259629.13	55484.75	50.80
TPIF04	259379.07	55447.91	59.08
TPIF05	259562.05	55461.64	52.34
TPIF06	259518.12	55310.59	47.33
TPIF07	259604.69	55332.58	45.60
TPIF08	259706.46	55369.92	43.33
TPIF09	259531.28	55233.84	50.93
TPIF10	259625.54	55251.86	48.32
TPL101	259377.85	55453.84	59.47
TPL102	259454.90	55487.49	59.30
TPL103	259465.81	55396.14	53.35
TPL104	259520.91	55397.91	51.18
TPL105	259548.97	55464.29	53.37
TPL106	259656.51	55503.67	50.38
TPL107	259626.89	55477.11	50.65
TPL108	259669.35	55455.62	48.42
TPL109	259716.67	55401.38	44.36
TPL110	259629.21	55369.89	45.37
TPL111	259698.25	55361.45	43.38
TPL112	259646.33	55304.12	45.47
TPL113	259586.80	55331.75	45.94
TPL114	259527.31	55325.08	46.96
TPL115	259468.88	55306.05	48.38
TPL116	259515.47	55270.63	47.86
TPL117	259522.30	55238.94	50.23
TPL118	259574.44	55242.30	49.48
TPL119	259663.19	55256.80	47.37
TPL120	259545.36	55172.04	58.48
TPL121	259576.42	55168.93	58.31
TPL122	259647.91	55171.56	56.82
TPL123	259726.57	55126.43	64.00
TPL124	259704.34	55136.18	64.15
TPL125	259686.40	55118.62	63.88
TPW101	259565.85	54996.65	55.35

GEOTECHNICS
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www.geotechnics.co.uk

Engineer:
Atkins Group

Client:
Dorton Group

Project:
Ground Investigation for an Inert Landfil at Challonsleigh Farm

Drawing Title:
Exploratory Hole Location Plan

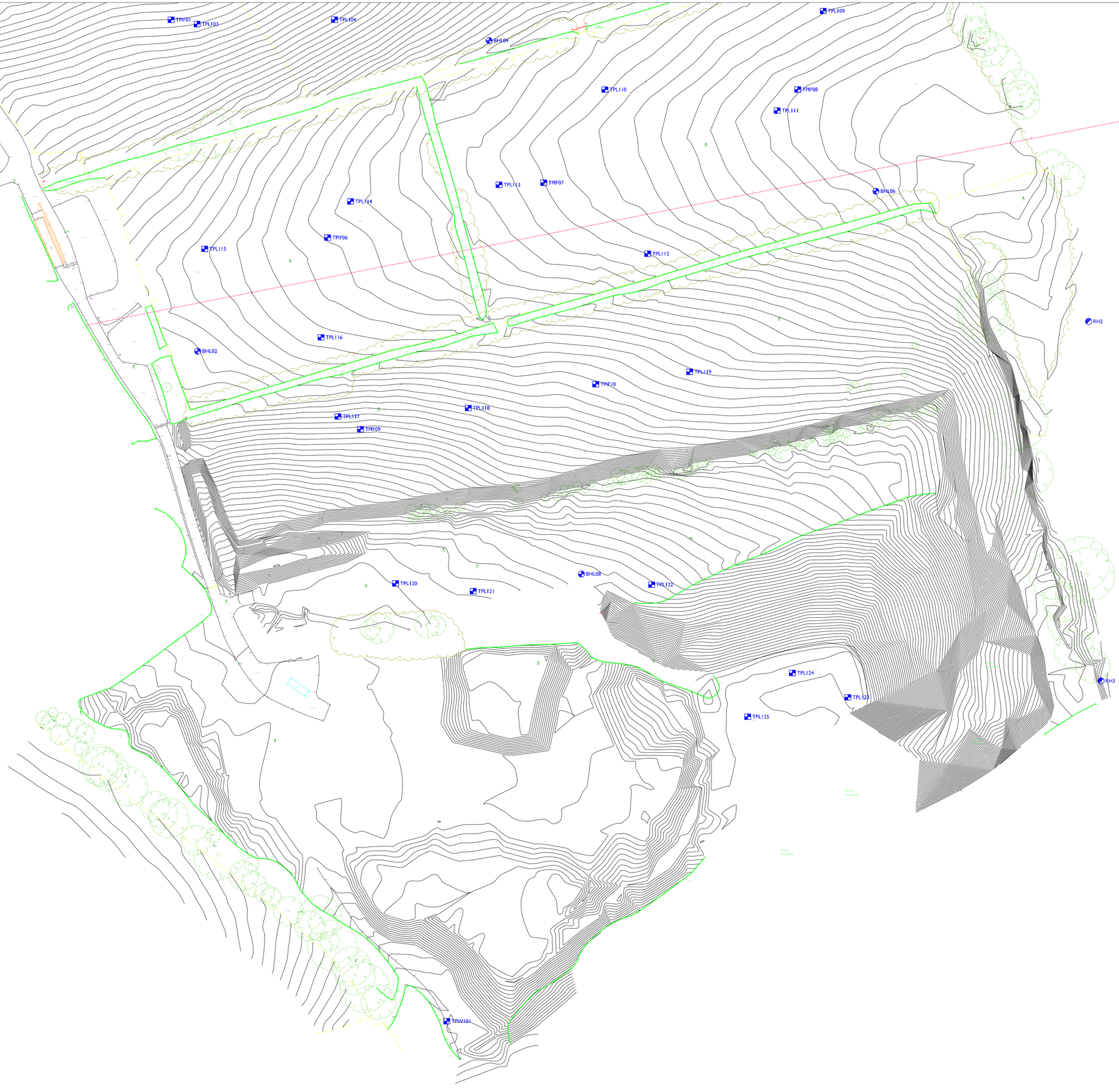
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Date:
August 2020

Project No:
PE201646

File Name:
Geo-PE201646-001(1)

George McCarthy : \\Hollow\Data\Projects\Exeter\2020\PE201646\Drawings\Geo-PE201646-001.dwg



Key

- Borehole
- Trial Pit
- Water Monitoring Location

Hole ID	Easting (mE)	Northing (mN)	Level (mOD)
BHL01	259257.44	55499.77	70.85
BHL02	259466.07	55265.07	48.99
BHL03	259614.38	55539.41	52.94
BHL04	259582.83	55389.51	47.00
BHL05	259753.42	55438.31	44.52
BHL06	259737.81	55329.19	42.95
BHL08	259619.82	55175.81	57.26
RH1 Approximate	259784.00	55423.00	0.00
RH2 Approximate	259823.00	55277.00	0.00
RH3 Approximate	259828.00	55133.00	0.00
TPIF01	259455.41	55397.85	53.65
TPIF02	259460.66	55489.29	59.13
TPIF03	259629.13	55484.75	50.80
TPIF04	259379.07	55447.91	59.08
TPIF05	259562.05	55461.64	52.34
TPIF06	259518.12	55310.59	47.33
TPIF07	259604.69	55332.58	45.60
TPIF08	259706.46	55369.92	43.33
TPIF09	259531.28	55233.84	50.93
TPIF10	259623.54	55251.86	48.32
TPL101	259377.85	55453.84	59.47
TPL102	259454.90	55487.49	59.30
TPL103	259465.81	55396.14	53.35
TPL104	259520.91	55397.91	51.18
TPL105	259548.97	55464.29	53.37
TPL106	259656.51	55503.67	50.38
TPL107	259626.89	55477.11	50.65
TPL108	259669.35	55455.62	48.42
TPL109	259716.67	55401.38	44.36
TPL110	259629.21	55369.89	45.37
TPL111	259698.25	55361.45	43.38
TPL112	259646.33	55304.12	45.47
TPL113	259586.80	55331.75	45.94
TPL114	259527.31	55325.08	46.96
TPL115	259468.88	55306.05	48.38
TPL116	259515.47	55270.63	47.86
TPL117	259522.30	55238.94	50.23
TPL118	259574.44	55242.30	49.48
TPL119	259663.19	55256.80	47.37
TPL120	259545.36	55172.04	58.48
TPL121	259576.42	55168.93	58.31
TPL122	259647.91	55171.56	56.82
TPL123	259726.57	55126.43	64.00
TPL124	259704.34	55136.18	64.15
TPL125	259686.40	55118.62	63.88
TPW101	259565.85	54996.65	55.35

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Engineer:
Atkins Group

Client:
Dorton Group

Project:
Ground Investigation for an Inert Landfil at Challonsleigh Farm

Drawing Title:
Exploratory Hole Location Plan

Scale: 1:750@A1

Date:
August 2020

Project No:
PE201646

File Name:
Geo-PE201646-001(2)

George McCarthy : \\Holbos\Data\Projects\Exeter\2020\PE201646\Drawings\Geo-PE201646001.dwg

APPENDIX 4

Rotary Borehole Records

DATA SHEET - Symbols and Abbreviations used on Records

Sample Types

B	Bulk disturbed sample
BLK	Block sample
C	Core sample
D	Small disturbed sample (tub/jar)
E	Environmental test sample
ES	Environmental soil sample
EW	Environmental water sample
G	Gas sample
L	Liner sample
LB	Large bulk disturbed sample
P	Piston sample (PF - failed P sample)
TW	Thin walled push in sample
U	Open Tube - 102mm diameter with blows to take sample. (UF - failed U sample)
UT	Thin wall open drive tube sampler - 102mm diameter with blows to take sample. (UTF - failed UT sample)
V	Vial sample
W	Water sample
#	Sample Not Recovered

Insitu Testing / Properties

CBRP	CBR using TRL probe
CHP	Constant Head Permeability Test
COND	Electrical conductivity
TC	Thermal Conductivity
TR	Thermal Resistivity
HV	Strength from Hand Vane
ICBR	CBR Test
IDEN	Density Test
IRES	Resistivity Test
MEX	CBR using Mexecone Probe Test
PID	Photo Ionisation Detection (ppm)
PKR	Packer Permeability Test
PLT	Plate Load Test
PP	Strength from Pocket Penetrometer
Temp	Temperature
VHP	Variable Head Permeability Test
VN	Strength from Insitu Vane
w%	Water content

(All other strengths from undrained triaxial testing)

S	Standard Penetration Test (SPT)
C	SPT with cone
N	SPT Result
-/-	Blows/penetration (mm) after seating drive
-*/- (mm)	Total blows/penetration
( )	Extrapolated value

Groundwater

Water Strike

Depth Water Rose To

Instrumentation



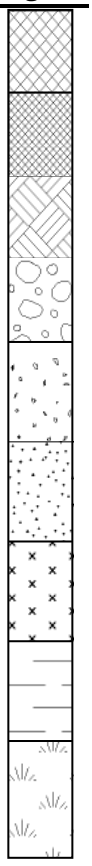
Seal

Filter

Seal

Strata

Legend



Made Ground Granular

Made Ground Cohesive

Topsoil

Cobbles and Boulders

Gravel

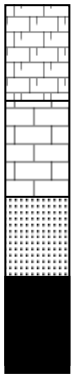
Sand

Silt

Clay

Peat

Note: Composite soil types shown by combined symbols



Chalk

Limestone

Sandstone

Coal

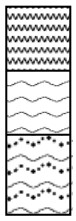
Strata, Continued



Mudstone

Siltstone

Metamorphic Rock

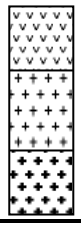


Fine Grained

Medium Grained

Coarse Grained

Igneous Rock



Fine Grained

Medium Grained

Coarse Grained

Backfill Materials



Arisings

Bentonite Seal

Concrete

Fine Gravel Filter

General Fill

Gravel Filter

Grout

Sand Filter

Tarmacadam

Rotary Core

RQD	Rock Quality Designation (% of intact core >100mm)
FRACTURE INDEX	Fractures/metre
FRACTURE SPACING (m)	Maximum Minimum
NI	Non-intact core
NR	No core recovery
AZCL	Assumed zone of core loss

(where core recovery is unknown it is assumed to be at the base of the run)

BOREHOLE RECORD - Dynamic Sampler and Rotary

Project: GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM
Engineer: ATKINS GLOBAL
Borehole: BHL01
Project No: PE201646
Client: DORTON GROUP
National Grid Coordinates: 259257.437E 55499.771 N
Ground Level: 70.85 m OD
Scale: 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description	Depth	Legend	Level m OD
							G.L.		70.85
0.10- 0.25	B					MADE GROUND: Grass over firm brown slightly sandy clay. Sand is fine to coarse. Frequent rootlets.	0.10		70.75
0.10- 0.25	D						0.25		70.60
0.10- 0.25	ES								
0.40- 0.50	B					MADE GROUND: Firm brown slightly sandy slightly gravelly clay. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse slate, quartz, chert and asphalt.			
0.40- 0.50	D								
0.40- 0.50	ES								
0.80	B								
0.80	D								
1.20- 1.50	D					Soft to firm brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is angular fine to coarse very weak to weak slate occasional quartz. [RESIDUAL SOIL] At 1.20m, Soft/ loose.			
1.20- 1.65	D				S4				
1.50	D						1.50		69.35
1.60- 2.90	B								
						Weathered SLATE recovered as: Greyish brown sandy slightly silty GRAVEL. Sand is fine to coarse. Gravel is angular fine to coarse extremely to very weak decomposed slate. Relict structure indicates cleavage dipping 40 degrees. [WEATHERED SLATE] At 1.50m, Cobble of quartz. Between 2.10 and 2.20m, Band of weak slate.			
2.90	D								
3.00- 3.38	D				S50/ 225		3.00		67.85

Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General	Detail	Depth	Legend	Level m OD
3.00- 4.50 (93mm)	3.00	77 0		0	(NR) (NI) (>50)	Extremely weak greyish brown SLATE. Recovered as soft greyish brown sandy SILT. Sand is fine to coarse. [MIDDLE DEVONIAN SLATES]		3.75		67.10
4.50- 6.00 (93mm)	3.00	67 67		0	(NR) (>50)	Extremely weak to very weak greyish brown cleaved SLATE. Cleavage planes at <1mm spacing, dipping 30 deg. Set 1 discontinuities are cleavage plane fractures, extremely to very closely spaced, planar, smooth, frequent slickensides on surfaces, clean (10,15,20). Multiple other discontinuity sets in various orientations, generally 30, 60 and 80 degs, spacings unknown, planar, smooth, reddish brown clay infill <1mm. [MIDDLE DEVONIAN SLATES]	Between 4.50 and 4.75m, Poor recovery. At 5.50m, Joint dipping 80 degrees, planar, rough and clean. From 5.80m, Extremely to very weak.	6.00		64.85
						Light grey very weathered SLATE.**	Rotary Open-Hole to Target Depth			
						Thick quartz bands.**		9.00		61.85

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.30	Inspection Pit	J Mars
3.00	0.15	Rotary Percussive Sampling	J Mars
6.00	0.12	Rotary Core	J Mars
13.00	0.14	Rotary Open Hole	J Mars

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			23/07/20	08:00
13.00	3.00	6.30	23/07/20	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
12.00		6.30	20		

Remarks

** Drillers description.
Inspection pit hand excavated to 1.20m depth and no services were found.
A 50mm gas monitoring pipe was installed to 13.00m with a slotted section from 4.00m to 13.00m with upright lockable protective cover. Backfill details from base of hole: gravel filter up to 4.00m, bentonite seal up to 0.20m, concrete up to ground level.
Flush: 1.20-9.00m, Air, Grey, 80% returns; 9.00-10.40m, Air, Grey, 100% returns; 10.40-11.50m, Air, Grey/Orang, 0% return.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

Logged by MK
Checked by MAK
Figure 1 of 2
06/01/2021

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BOREHOLE RECORD – Dynamic Sampler and Rotary

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Borehole	BHL01
				Project No	PE201646
Client	DORTON GROUP	National Grid Coordinates	259257.437 E 55499.771 N	Ground Level	70.85 m OD

Drilling | Properties/Sampling | Strata — Scale 1:50

Core Run/Depth (Core Dia/Time)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD
						Light grey SLATE.**		10.40		60.45
						Orangish brown SLATE.**		11.50		59.35
						End of Borehole		13.00		57.85

Drilling

Depth	Hole Dia	Technique	Crew

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

Logged by MK
Checked by MAK
Figure 2 of 2
06/01/2021

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BOREHOLE RECORD - Dynamic Sampler and Rotary

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Borehole	BHL02
				Project No	PE201646
Client	DORTON GROUP	National Grid Coordinates	259466.065E 55265.072 N	Ground Level	48.99 m OD

Sampling | Properties | Strata — Scale 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description	Depth	Legend	Level m OD
							G.L.		48.99
0.10- 0.25	B					Grass over soft brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular fine to coarse slate and quartz. Rare quartz cobble. Frequent rootlets to 0.10m depth.			
0.10- 0.25	D								
1.20- 1.65	D				S11				
1.20- 1.30	D								
1.30- 2.00	B								
							1.55		47.44
2.00- 2.10	D					Firm light greyish brown mottled orangish brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is angular fine to coarse extremely to very weak slate occasionally quartz. [RESIDUAL SOIL]			
2.10- 2.70	B								
2.70- 3.15	D				S15				
3.00- 3.10	D								
3.10- 4.00	B								
4.00- 4.10	D								
4.20- 4.65	D				S15				
5.00- 5.10	D								
5.10- 5.70	B								
5.70- 6.45	B								
5.70- 6.15	D				S20				
6.45- 6.55	D						6.45		42.54
6.55- 7.20	B					Weathered SLATE recovered as: Medium dense orangish brown sandy silty to very silty GRAVEL. Gravel is angular fine to coarse extremely to very weak slate. Cleavage structure visible, dipping 50 degrees.			
7.20- 7.65	D				S20	[WEATHERED SLATE]			
8.10- 8.20	D					From 8.10m, Orangish brown mottled grey.			
8.20- 8.41	D	7.20			S50/ 100		8.20		40.79

Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General	Detail		
8.20- 9.00 (93mm)	7.20	100 80		0	(24)	Very weak greyish brown cleaved SLATE. Cleavage planes at <1mm spacing, dipping 50 to 70 deg. Set 1 discontinuities are cleavage plane fractures, very closely to closely spaced, planar, smooth with <1mm to 3mm orangish brown clay infill or	Between 8.30 and 8.50m, Frequent quartz mineralisation in lenses up to 30mm thick, random orientations. From 9.50m, Weak, grey. Between 9.58 and 9.65m, Frequent quartz mineralisation, random orientations.		
9.00-10.00 (93mm)	7.20	65 65		0	(NR)			10.00	38.99

Boring | Progress | Groundwater

Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20	0.30	Inspection Pit	J Mars	G.L.		Dry	28/07/20	08:00	7.09		7.01	5		
8.20	0.12	Dynamic Sampler	J Mars	10.00	7.20	5.34	28/07/20	18:00			6.84	10		
10.00	0.12	Rotary Core	J Mars	10.00	7.20		29/07/20	08:00			6.75	20		
12.00	0.11	Rotary Open Hole	J Mars	12.00	7.20		29/07/20	18:00						

Remarks

AGS A 50mm standpipe piezometer was installed to 12.00m with a slotted section from 2.00m to 12.00m with upright lockable protective cover. Backfill details from base of hole: gravel filter up to 2.00m, bentonite seal up to 0.20m, concrete up to ground level.

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Figure 1 of 2
06/01/2021

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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BOREHOLE RECORD - Dynamic Sampler and Rotary

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Borehole	BHL02
				Project No	PE201646
Client	DORTON GROUP	National Grid Coordinates	259466.065 E 55265.072 N	Ground Level	48.99 m OD

Drilling | Properties/Sampling | Strata — Scale 1:50

Core Run/Depth (Core Dia/Time)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD
						staining (10,20,100). Multiple other discontinuity sets, dipping 50 to 80 degrees, spacings unknown, generally planar, smooth, occasional planar, stepped with quartz mineralisation up to 8mm. [MIDDLE DEVONIAN SLATES]		10.00		38.99
						Open-hole Drilling to Target Depth: SLATE.				
						End of Borehole		12.00		36.99

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

Logged by MK
Checked by MAK
Figure 2 of 2
06/01/2021

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BOREHOLE RECORD - Dynamic Sampler and Rotary

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL
Client	DORTON GROUP	National Grid Coordinates	259614.378 E, 55539.405 N
Borehole	BHL03	Project No	PE201646
Ground Level	52.94 m OD	Scale	1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description	Depth	Legend	Level m OD
							G.L.		52.94
0.20	B					Grass over firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse slate and occasional quartz. Frequent rootlets.	0.30		52.64
0.20	D								
0.40	B								
0.40	D								
0.90- 1.35	D				S21	Firm reddish brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is angular fine to coarse extremely to very weak slate and occasional becoming frequent quartz. [RESIDUAL SOIL]	0.80		52.14
0.90- 1.00	D								
1.00- 1.22	D						1.22		51.72
1.40	D					Medium dense brown sandy very silty GRAVEL. Sand is fine to coarse. Gravel is angular fine to coarse very weak slate and occasional quartz. [RESIDUAL SOIL]			
1.50- 2.20	B								
2.20- 2.30	D					Firm yellowish brown mottled grey gravelly SILT. Gravel is angular fine to coarse extremely to very weak slate. [RESIDUAL SOIL]	2.20		50.74
2.30- 3.00	B								
3.00- 3.45	D				S20	Greyish brown sandy silty GRAVEL. Sand is fine to coarse. Gravel is angular fine to coarse extremely to very weak slate. [RESIDUAL SOIL]	3.00		49.94
3.35- 3.50	D					Weathered SLATE recovered as: Medium dense brownish grey silty GRAVEL. Gravel is angular fine to coarse extremely weak and decomposed slate. Relict structure indicates cleavage dipping 50 degrees. [WEATHERED SLATE]			
3.50- 4.50	B								
4.50- 4.95	D				S29		4.50		48.44

Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General	Detail	Depth	Legend	Level m OD
4.50- 6.00 (93mm)	4.50	50 0		0	(NR)	No Recovery.		5.25		47.69
					(>50)	Weathered SLATE recovered as: Brownish grey silty GRAVEL. Gravel is angular fine to coarse extremely weak and decomposed slate. Relict structure indicates cleavage dipping 50 degrees. [WEATHERED SLATE]		5.40		47.54
6.00- 6.50 (93mm)	4.50	100 70		0				6.50		46.44
						Extremely weak greyish brown cleaved SLATE. Cleavage planes at <1mm spacing, dipping subvertical to 80 deg. Set 1 discontinuities are cleavage plane fractures, extremely to very closely spaced, planar, smooth, clean occasional <1mm clay infill (5,10,20). Multiple other discontinuity sets in various orientations, 10, 40, 60 and 70 degrees, spacing unknown, generally planar, smooth and clean. [MIDDLE DEVONIAN SLATES]	From 6.20m, Very weak, grey with reddish brown staining on fracture surfaces.			
						End of Borehole				

Boring

Depth	Hole Dia	Technique	Crew
0.90	0.30	Inspection Pit	J Mars
4.50	0.12	Dynamic Sampler	J Mars
6.50	0.12	Rotary Core	J Mars

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			24/07/20	08:00
6.50	4.50	4.50	24/07/20	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
3.30		3.30	20		

Remarks

Inspection pit hand excavated to 0.90m depth and no services were found.
A 50mm gas monitoring pipe was installed to 6.50m with a slotted section from 2.00m to 6.50m with upright lockable protective cover. Backfill details from base of hole: gravel filter up to 2.00m, bentonite seal up to 0.20m, concrete up to ground level.
Flush: 4.50-6.00m, Air, Orange, 50% returns; 6.00-6.50m, Air, Grey, 100% return.

Logged by MK
Checked by MAK
Figure 1 of 1
06/01/2021

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

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BOREHOLE RECORD - Dynamic Sampler

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Borehole	BHL04
				Project No	PE201646
Client	DORTON GROUP	National Grid Coordinates	259582.831E 55389.507 N	Ground Level	47.00 m OD

Sampling			Properties			Strata			Scale 1:50
Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N	Description	Depth	Legend	Level m OD
							G.L.		47.00
0.10- 0.20	B					Grass over firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse slate and quartz. Frequent rootlets.	0.20		46.80
0.10	D								
0.50	B								
0.50	D								
0.80	B					Soft to firm greyish brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is angular fine to coarse extremely to very weak slate.			
0.80	D								
1.20- 1.65	D				S11	[RESIDUAL SOIL]			
1.30- 1.70	B					From 0.75m, Gravelly.			
						Between 1.30 and 1.70m, Yellowish brown, slightly gravelly.			
1.70	D					From 1.70m, Orangish brown mottled grey.			
1.80	D						1.80		45.20
1.90- 2.30	B					Medium dense greyish brown sandy silty GRAVEL. Sand is fine to coarse. Gravel is angular fine to coarse extremely to very weak slate.			
2.30- 3.00	B					[RESIDUAL SOIL]			
						From 2.30m, Gravel is very weak slate.			
3.00- 3.45	D				S19				
3.00	D								
3.50- 3.60	D						3.45		43.55
3.60- 4.15	B					Weathered SLATE recovered as: Medium dense sandy silty orangish brown GRAVEL. Sand is fine to coarse. Gravel is angular fine to coarse extremely weak decomposed slate. Relict structure indicates cleavage dipping 60 degrees.			
4.15- 4.25	D					[WEATHERED SLATE]			
4.50- 5.15	B								
4.50- 4.95	D				S21				
5.15	D								
5.25- 6.00	B					At 5.45m, Subvertical joint, spacing unknown, planar, clean.			
6.00- 7.00	B								
6.00- 6.45	D				S17				
7.00	D								
7.15- 7.50	B								
7.50- 8.20	B								
7.50- 7.95	D				S22				
8.20	D					At 8.30m, Dynamic sampler refused.			
8.30- 8.71	D				S50		8.30		38.70
						End of Borehole			

Boring				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
1.20	0.30	Inspection Pit	J Mars	G.L.			22/07/20	08:00	5.80	4.50	4.55	20	6.00	
8.30	0.12	Dynamic Sampler	J Mars	8.30	7.50		22/07/20	18:00						

Remarks

Inspection pit hand excavated to 1.20m depth and no services were found.
A 50mm gas monitoring pipe was installed to 8.30m with a geowrapped slotted section from 2.30m to 8.30m with upright lockable protective cover. Backfill details from base of hole: gravel filter up to 2.30m, bentonite seal up to 0.20m, collapsed material up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

Logged by MK
Checked by MAK
Figure 1 of 1
06/01/2021

geotechnics

BOREHOLE RECORD - Dynamic Sampler and Rotary

Project: GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM
Engineer: ATKINS GLOBAL
Borehole: BHL05
Project No: PE201646
Client: DORTON GROUP
National Grid Coordinates: 259753.415E 55438.307 N
Ground Level: 44.52 m OD
Scale: 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (Fl)	Description	Depth	Legend	Level m OD
							G.L.		44.52
0.10	B					Grass over soft to firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse slate occasional quartz. Frequent rootlets.	0.25		44.27
0.10	D								
0.40	B								
0.40	D								
0.60- 1.00	B					Brown sandy silty GRAVEL. Sand is fine to coarse. Gravel is angular fine to coarse very weak slate. [RESIDUAL SOIL]			
1.10- 1.20	D						1.10		43.42
1.20- 1.65	D				S41	Extremely weak greyish brown cleaved SLATE. Cleavage planes at <1mm spacings, dipping 80 degrees. Set 1 discontinuities are cleavage plane fractures, extremely to very closely spaced, planar, smooth, clean (5,10,20). Set 2 discontinuities are joints closely to medium spaced, dipping 60 to 70 degrees, planar, smooth, generally orangish brown clay infill <1mm or clean (50, 100, 250). [MIDDLE DEVONIAN SLATES] From 2.30m, Weak.			
					(>50)				
2.70- 2.86	D	1.20			S50/60		2.70		41.82

Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (Fl)	Continued by Rotary techniques General	Detail	Depth	Legend	Level m OD
2.70- 4.00 (93mm)	1.20	85 85		85	(NI) (NR)	Weak becoming medium strong greyish brown cleaved SLATE. Cleavage planes at <1mm spacing, dipping 80 deg. Set 1 discontinuities are widely spaced, planar, smooth, clean with brown discolouration and weakening to very weak, extending up to 3mm from fracture surface (150, 200, 300). Set 2 discontinuities not observed. [MIDDLE DEVONIAN SLATES]	Below 2.70m, Set 1 joints not observed. From 3.00m, Medium strong.			
4.00- 5.50 (93mm)	1.20	77 77		77	(2)			5.50		39.02
						Rotary Open-Hole to Target Depth: SLATE				
						End of Borehole		7.50		37.02

Boring

Depth	Hole Dia	Technique	Crew
0.60	0.30	Inspection Pit	J Mars
2.70	0.12	Dynamic Sampler	J Mars
5.50	0.12	Rotary Core	J Mars
7.50	0.10	Rotary Open Hole	J Mars

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			27/07/20	08:00
7.50	1.20		27/07/20	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
5.50	1.20	3.06	20		

Remarks

Inspection pit hand excavated to 0.60m depth and no services were found.
Dynamic sample recovery: 1.20-2.00m,78%; 2.00-2.70m,100%.
A 50mm gas monitoring pipe was installed to 7.00m with a slotted section from 2.50m to 7.00m with upright lockable protective cover. Backfill details from base of hole: gravel filter up to 2.50m, bentonite seal up to 0.20m, concrete up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

Logged by MK
Checked by MAK
Figure 1 of 1
06/01/2021

geotechnics

BOREHOLE RECORD - Dynamic Sampler and Rotary

Project: GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM
Engineer: ATKINS GLOBAL
Borehole: BHL06
Project No: PE201646
Client: DORTON GROUP
National Grid Coordinates: 259737.811E 55329.185 N
Ground Level: 42.95 m OD
Scale: 1:50

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description	Depth	Legend	Level m OD
							G.L.		42.95
0.10- 0.30	B					Grass over soft brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular fine to coarse slate rarely quartz. Frequent rootlets.	0.30		42.65
0.10- 0.30	D								
0.50- 0.70	B					Soft light greyish brown mottled orangish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular fine to coarse slate occasional quartz. Occasional 1 - 3mm pockets of black staining.			
0.50- 0.70	D								
0.90- 1.10	B								
0.90- 1.10	D								
1.20- 1.65	D				S9				
1.20- 1.30	D								
1.30- 2.00	B					Firm light greyish brown mottled orangish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular fine to coarse decomposed slate occasional quartz. Relict cleavage structure. [RESIDUAL SOIL] From 1.70m, Gravelly, gravel is extremely to very weak slate.	1.40		41.55
2.00- 2.10	D								
2.10- 2.70	B						2.10		40.85
2.70- 3.15	B					Weathered SLATE recovered as: Medium dense brown sandy silty GRAVEL. Sand is fine to coarse. Gravel is angular fine to coarse extremely weak slate. Relict cleavage structure. [WEATHERED SLATE]			
2.70- 3.15	D				S14				
3.15- 3.25	D								
3.50- 3.60	D						3.50		39.45
						Very weak grey cleaved SLATE. [MIDDLE DEVONIAN SLATES]	3.60		39.35

Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General	Detail
3.60- 4.00 (93mm)	3.60	100 35		0	(NI) (3)	Very weak grey cleaved SLATE. Cleavage planes at <1mm spacing, dipping 50 deg. Set 1 discontinuities are cleavage plane fractures, very closely to closely spaced, planar, smooth with orangish brown staining on surfaces. [MIDDLE DEVONIAN SLATES]	Between 3.82 and 3.86m, Brown, extremely weak. At 3.90m, Weak. Between 4.40 and 5.10m, Cleavage indistinct to dipping 70 degrees and undulating. Frequent quartz mineralisation in multiple orientations <1 to 10mm thick, frequent brown discolouration and weakening to extremely weak. At 5.37m, Weak. From 5.68m, Cleavage plane fractures are medium spaced and clean. Between 5.83 and 5.90m, Extremely weak brown slate band parallel to cleavage. Between 6.15 and 6.20m, Joint dipping 50 degrees perpendicular to cleavage planar, smooth, brown staining and slickensides on surface. Spacings unknown.
4.00- 5.10 (93mm)	3.60	64 0		0	(NR) (NI)		
5.10- 5.50 (93mm)	3.60	100 100		68	(1) (0)		
5.50- 6.20 (93mm)	3.60	100 100		81	(3) (5)		
6.20							6.20 36.75
						Rotary Open-Hole to Target Depth: SLATE	7.50 35.45
						End of Borehole	

Boring

Depth	Hole Dia	Technique	Crew
1.20	0.30	Inspection Pit	J Mars
3.60	0.12	Dynamic Sampler	J Mars
6.20	0.12	Rotary Core	J Mars
7.50	0.11	Rotary Open Hole	J Mars

Progress

Depth of Hole	Depth Cased	Depth to Water	Date	Time
G.L.			27/07/20	08:00
7.50	3.60		27/07/20	18:00

Groundwater

Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater
3.31		3.24	5		
		3.21	10		
		3.16	20		

Remarks

Inspection pit hand excavated to 1.20m depth and no services were found.
A 50mm standpipe piezometer was installed to 7.00m with a slotted section from 2.00m to 7.00m with upright lockable protective cover. Backfill details from base of hole: gravel filter up to 2.00m, bentonite seal up to 0.20m, concrete up to ground level.

Logged by: MK
Checked by: MAK
Figure: 1 of 1
06/01/2021

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

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BOREHOLE RECORD – Dynamic Sampler and Rotary

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL
Client	DORTON GROUP	National Grid Coordinates	259619.820 E, 55175.814 N
Borehole	BHL08	Project No	PE201646
Ground Level	57.26 m OD	Scale	1:50

Sampling / Properties / Strata

Depth	Sample Type	Depth Cased & (to Water)	Strength kPa	w %	SPT N (FI)	Description	Depth	Legend	Level m OD
							G.L.		57.26
0.10- 0.20	B					MADE GROUND: Firm dark brown slightly sandy slightly gravelly clay with a low cobble content. Sand is fine to coarse. Gravel is angular to subangular fine to coarse slate. Frequent root remains. Occasional pockets of black organic matter. From 0.60m, Gravel of slate, dark grey sandstone, limestone, concrete, brick and quartz.			
0.10- 0.20	D								
0.30- 0.40	B								
0.30- 0.40	D								
0.60- 0.80	D								
0.70- 0.80	B								
1.20- 1.65	D				S15				
1.50- 1.70	ES								
2.00- 2.10	D					At 2.00m, Fragment of electrical cable.			
2.50- 2.70	ES								
2.70- 3.50	B								
2.70- 3.15	D				S6				
3.50- 3.70	ES								
3.70- 3.80	D								
4.20- 4.65	D				S7				
4.50- 4.70	ES								
						From 5.50m, Orangish brown gravel becoming dominated by slate.			
5.40- 5.50	D					Between 5.70 and 6.00m, Poor recovery.			
5.50- 5.70	ES								
5.70- 6.15	D				S16				
						At 6.00m, Cobble of strong dark grey igneous rock.			
							6.10		51.16
6.30- 6.40	D					Soft to firm grey slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular fine to coarse slate. Frequent partially decomposed rootlets.	6.30		50.96
6.40- 6.60	ES								
6.64- 7.20	B						6.65		50.61
						Firm light orangish brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is angular fine to medium slate. [RESIDUAL SOIL]	6.80		50.46
7.20- 7.65	D				S24		7.20		50.06
						Weathered SLATE recovered as: Orangish brown sandy silty GRAVEL. Sand is fine to coarse. Gravel is angular fine to coarse extremely to very weak slate. [WEATHERED SLATE]			
						Extremely weak greyish brown cleaved SLATE. [MIDDLE DEVONIAN SLATES]			

Core Run/Depth (Core Dia/Time)	Depth Cased	TCR/SCR / Type	Length Max/Min	RQD %	SPT (FI)	Continued by Rotary techniques General	Detail
7.20- 8.70 (93mm)	7.20	53 27		0	(NR) (NI)	Extremely weak greyish brown cleaved SLATE with medium spaced laminations up to 10mm of orangish brown clay. Cleavage planes at <1mm spacings, dipping 60 deg. Occasional very thin to thin beds of firm gravelly silt.	From 8.18m, Set 1 discontinuities are cleavage plane fractures, extremely to very closely spaced, dipping 60 degrees, planar, smooth and clean (5,10,20).
8.70-10.20 (93mm)	7.20	60 47		0	(>50)		
8.70- 9.15		D			(NR) S31 (>50)		

Boring / Progress / Groundwater

Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	In Mins	Depth Sealed	Remarks on Groundwater
1.20	0.30	Inspection Pit	J Mars	G.L.			30/07/20	08:00	6.52		6.49	5		
7.20	0.12	Dynamic Sampler	J Mars	11.70	7.20		30/07/20	18:00			6.42	10		
11.70	0.12	Rotary Core	J Mars								6.34	20		

Remarks A 50mm standpipe piezometer was installed to 11.00m with a slotted section from 6.50m to 11.00m with upright lockable protective cover and a 19mm gas monitoring pipe was installed to 4.50m with a slotted section from 2.00m to 4.50m with upright lockable protective cover. Backfill details from base of hole: gravel filter up to 6.50m, bentonite seal up to 4.50m, gravel filter up to 2.00m, bentonite seal up to ground level.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

Logged by MK
Checked by MAK
Figure 1 of 2
06/01/2021

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BOREHOLE RECORD - Dynamic Sampler and Rotary

Project **GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM**

Engineer **ATKINS GLOBAL**

Borehole **BHL08**
Project No **PE201646**

Client **DORTON GROUP**

National Grid Coordinates **259619.820** E **55175.814** N

Ground Level **57.26** m OD

Scale 1:50

Core Run/Depth (Core Dia/Time)	Depth Cased & (to Water)	Type TCR/SCR%	Length Max/Min	RQD %	SPT N (FI)	Description General	Description Detail	Depth	Legend	Level m OD
						[MIDDLE DEVONIAN SLATES]				
10.20-11.00 (93mm) 10.20-10.48	**7.20**	**63 19 D**		**19**	**(NI) (NR) S50/ 130**		**Between 10.70 and 11.00m, Recovered non-intact.**			
11.00-11.70 (93mm)	**7.20**	**100 100**		**86**	**(NI) (0) (NI) (8)**	**Weak grey cleaved SLATE. Cleavage planes at <1mm spacings, dipping 40 degrees. Set 1 discontinuities are cleavage plane fractures, planar, smooth with brown staining on surface. Frequent slickensides on surfaces. Frequent quartz lenses parallel to cleavage up to 2mm thick. Occasional quartz lenses and pockets in random orientations up to 10mm thick. [MIDDLE DEVONIAN SLATES]**		**11.00**		**46.26**
						End of Borehole		**11.70**		**45.56**

Drilling				Progress					Groundwater					
Depth	Hole Dia	Technique	Crew	Depth of Hole	Depth Cased	Depth to Water	Date	Time	Depth Struck	Depth Cased	Rose to	in Mins	Depth Sealed	Remarks on Groundwater

Remarks

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

Logged by **MK**
Checked by **MAK**
Figure **2 of 2**
06/01/2021

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APPENDIX 5

SPT Summary

Fieldwork Results - *SPT Results Summary*

Project GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM

Project No PE201646

Client Dorton Group

Hole	Depth m bgl	Level m OD	Type	SWP (mm)	Seating Drive		Test Drive				SPT 'N' Value	Uncorrected SPT 'N' 10 20 30 40 50
					0-75 (mm)	75-150 (mm)	0-75 (mm)	75-150 (mm)	150-225 (mm)	225-300 (mm)		
BHL01	1.20	69.65	S	-	1	1	1	1	1	1	4	*
BHL01	3.00	67.85	S	-	9	13	19	24	7		50/225	>

Remarks

-/- Blows/penetration (mm) after seating
-*/- Total blows/penetration (mm)
SWP Penetration under own weight (mm)

S - Standard Penetration Test (SPT)
C - SPT with cone
L - Split Spoon with liner used

GEOTECHNICS

Fieldwork Results - *SPT Results Summary*

Project GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM

Project No PE201646

Client Dorton Group

Hole	Depth m bgl	Level m OD	Type	SWP (mm)	Seating Drive 0-75 (mm)	Seating Drive 75-150 (mm)	Test Drive 0-75 (mm)	Test Drive 75-150 (mm)	Test Drive 150-225 (mm)	Test Drive 225-300 (mm)	SPT 'N' Value	Uncorrected SPT 'N' 10 20 30 40 50
BHL02	1.20	47.79	S	-	1	1	2	2	3	4	11	*
BHL02	2.70	46.29	S	-	2	2	4	4	4	3	15	*
BHL02	4.20	44.79	S	-	2	3	3	2	4	6	15	*
BHL02	5.70	43.29	S	-	2	4	4	6	5	5	20	*
BHL02	7.20	41.79	S	-	4	4	4	6	5	5	20	*
BHL02	8.20	40.79	S	-	16	9/35	37	13/25			50/100	>

Driller	
Hammer No.	MDL01
Energy Ratio, Er (%)	74.00
Calibration Date	29/01/2020

Remarks

-/- Blows/penetration (mm) after seating
-*/- Total blows/penetration (mm)
SWP Penetration under own weight (mm)

S - Standard Penetration Test (SPT)
C - SPT with cone
L - Split Spoon with liner used

GEOTECHNICS

Fieldwork Results - *SPT Results Summary*

Project GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM

Project No PE201646

Client Dorton Group

Hole	Depth m bgl	Level m OD	Type	SWP (mm)	Seating Drive		Test Drive				SPT 'N' Value	Uncorrected SPT 'N'
					0-75 (mm)	75-150 (mm)	0-75 (mm)	75-150 (mm)	150-225 (mm)	225-300 (mm)		10 20 30 40 50
BHL03	0.90	52.04	S	-	3	4	6	6	5	4	21	
BHL03	3.00	49.94	S	-	2	3	4	5	6	5	20	
BHL03	4.50	48.44	S	-	6	6	5	7	8	9	29	

Remarks

-/- Blows/penetration (mm) after seating
-*/- Total blows/penetration (mm)
SWP Penetration under own weight (mm)

S - Standard Penetration Test (SPT)
C - SPT with cone
L - Split Spoon with liner used

GEOTECHNICS

Fieldwork Results - SPT Results Summary

Project GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM

Project No PE201646

Client Dorton Group

Hole	Depth m bgl	Level m OD	Type	SWP (mm)	Seating Drive		Test Drive				SPT 'N' Value	Uncorrected SPT 'N'
					0-75 (mm)	75-150 (mm)	0-75 (mm)	75-150 (mm)	150-225 (mm)	225-300 (mm)		10 20 30 40 50
BHL04	1.20	45.80	S	-	2	2	2	2	3	4	11	
BHL04	3.00	44.00	S	-	4	3	3	4	6	6	19	
BHL04	4.50	42.50	S	-	3	3	4	5	6	6	21	
BHL04	6.00	41.00	S	-	3	2	2	3	5	7	17	
BHL04	7.50	39.50	S	-	2	3	4	6	6	6	22	
BHL04	8.30	38.70	S	-	25/30	-	50	-	-	-	50	

Remarks

-/- Blows/penetration (mm) after seating
-*/- Total blows/penetration (mm)
SWP Penetration under own weight (mm)

S - Standard Penetration Test (SPT)
C - SPT with cone
L - Split Spoon with liner used

GEOTECHNICS

Fieldwork Results - *SPT Results Summary*

Project GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM

Project No PE201646

Client Dorton Group

Hole	Depth m bgl	Level m OD	Type	SWP (mm)	Seating Drive 0-75 (mm)	Seating Drive 75-150 (mm)	Test Drive 0-75 (mm)	Test Drive 75-150 (mm)	Test Drive 150-225 (mm)	Test Drive 225-300 (mm)	SPT 'N' Value	Uncorrected SPT 'N' 10 20 30 40 50
BHL05	1.20	43.32	S	-	7	9	10	9	10	12	41	*
BHL05	2.70	41.82	S	-	19	6/25		50/60			50/60	>

Driller	
Hammer No.	MDL01
Energy Ratio, Er (%)	74.00
Calibration Date	29/01/2020

Remarks

-/- Blows/penetration (mm) after seating
-*/- Total blows/penetration (mm)
SWP Penetration under own weight (mm)

S - Standard Penetration Test (SPT)
C - SPT with cone
L - Split Spoon with liner used

GEOTECHNICS

Fieldwork Results - SPT Results Summary

Project GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM

Project No PE201646

Client Dorton Group

Hole	Depth m bgl	Level m OD	Type	SWP (mm)	Seating Drive		Test Drive				SPT 'N' Value	Uncorrected SPT 'N' 10 20 30 40 50
					0-75 (mm)	75-150 (mm)	0-75 (mm)	75-150 (mm)	150-225 (mm)	225-300 (mm)		
BHL06	1.20	41.75	S	-	2	1	2	3	2	2	9	*
BHL06	2.70	40.25	S	-	3	3	2	4	3	5	14	*

Driller	
Hammer No.	MDL01
Energy Ratio, Er (%)	74.00
Calibration Date	29/01/2020

Remarks

-/- Blows/penetration (mm) after seating
-*/- Total blows/penetration (mm)
SWP Penetration under own weight (mm)

S - Standard Penetration Test (SPT)
C - SPT with cone
L - Split Spoon with liner used

GEOTECHNICS

Fieldwork Results - SPT Results Summary

Project GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM

Project No PE201646

Client Dorton Group

Hole	Depth m bgl	Level m OD	Type	SWP (mm)	Seating Drive		Test Drive				SPT 'N' Value	Uncorrected SPT 'N' 10 20 30 40 50
					0-75 (mm)	75-150 (mm)	0-75 (mm)	75-150 (mm)	150-225 (mm)	225-300 (mm)		
BHL08	1.20	56.06	S	-	3	2	3	4	4	4	15	
BHL08	2.70	54.56	S	-	2	2	2	1	2	1	6	
BHL08	4.20	53.06	S	-	2	2	1	2	2	2	7	
BHL08	5.70	51.56	S	-	3	6	9	3	2	2	16	
BHL08	7.20	50.06	S	-	3	5	5	6	6	7	24	
BHL08	8.70	48.56	S	-	5	6	7	8	7	9	31	
BHL08	10.20	47.06	S	-	7	11	14	36/55			50/130	

Remarks

-/- Blows/penetration (mm) after seating
-*/- Total blows/penetration (mm)
SWP Penetration under own weight (mm)

S - Standard Penetration Test (SPT)
C - SPT with cone
L - Split Spoon with liner used

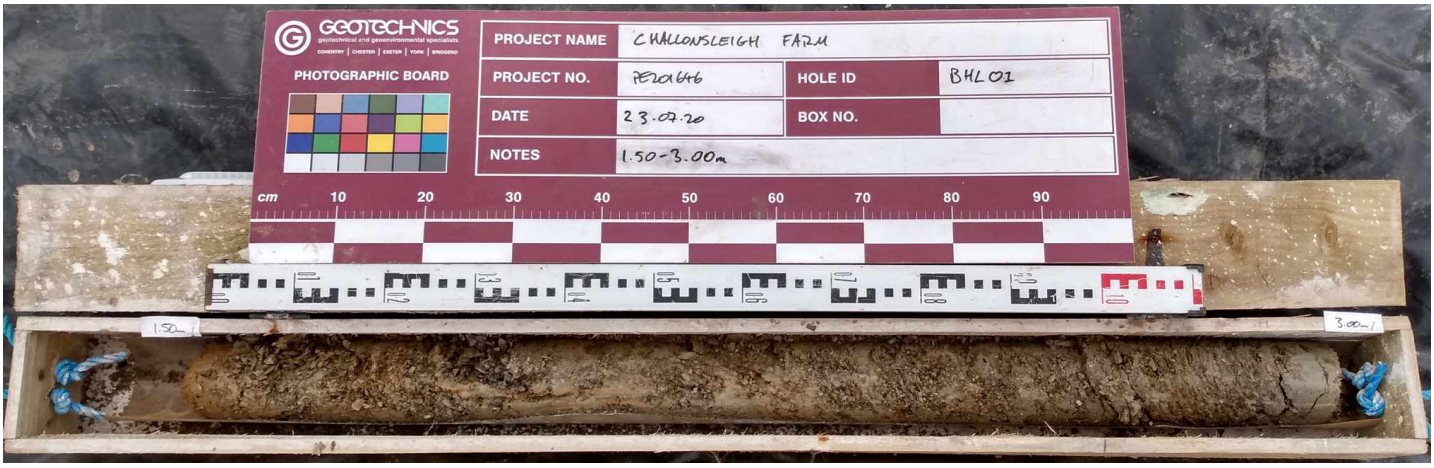
GEOTECHNICS

APPENDIX 6

Core Photos

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL01 1.50-3.00m

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL01 3.00-4.50m

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL01 4.50-6.00m

Project Number : PE201646

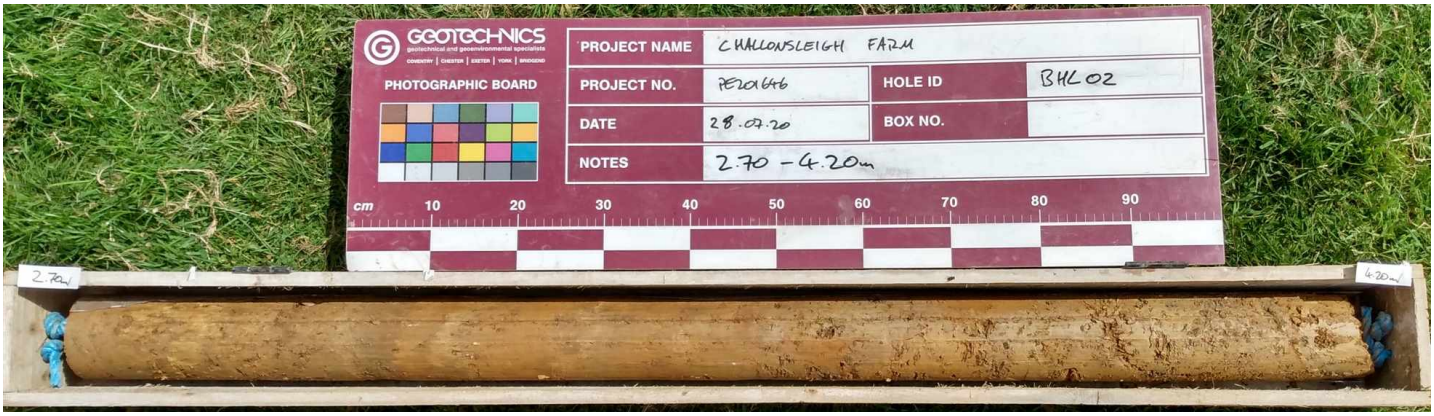
Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL02 1.20-2.70m

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL02 2.70-4.20m

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL02 5.70-7.20m

Project Number : PE201646

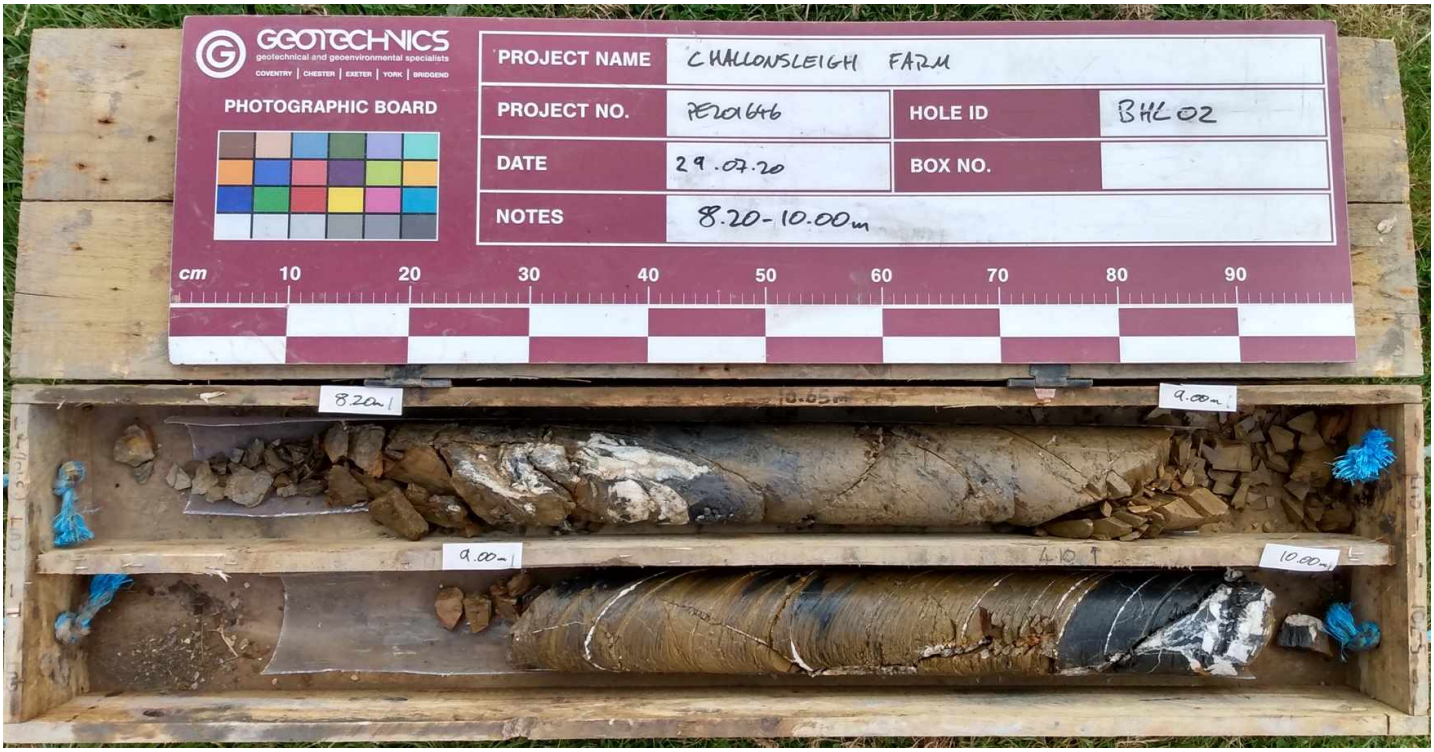
Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL02 7.20-8.20m

Project Number : PE201646

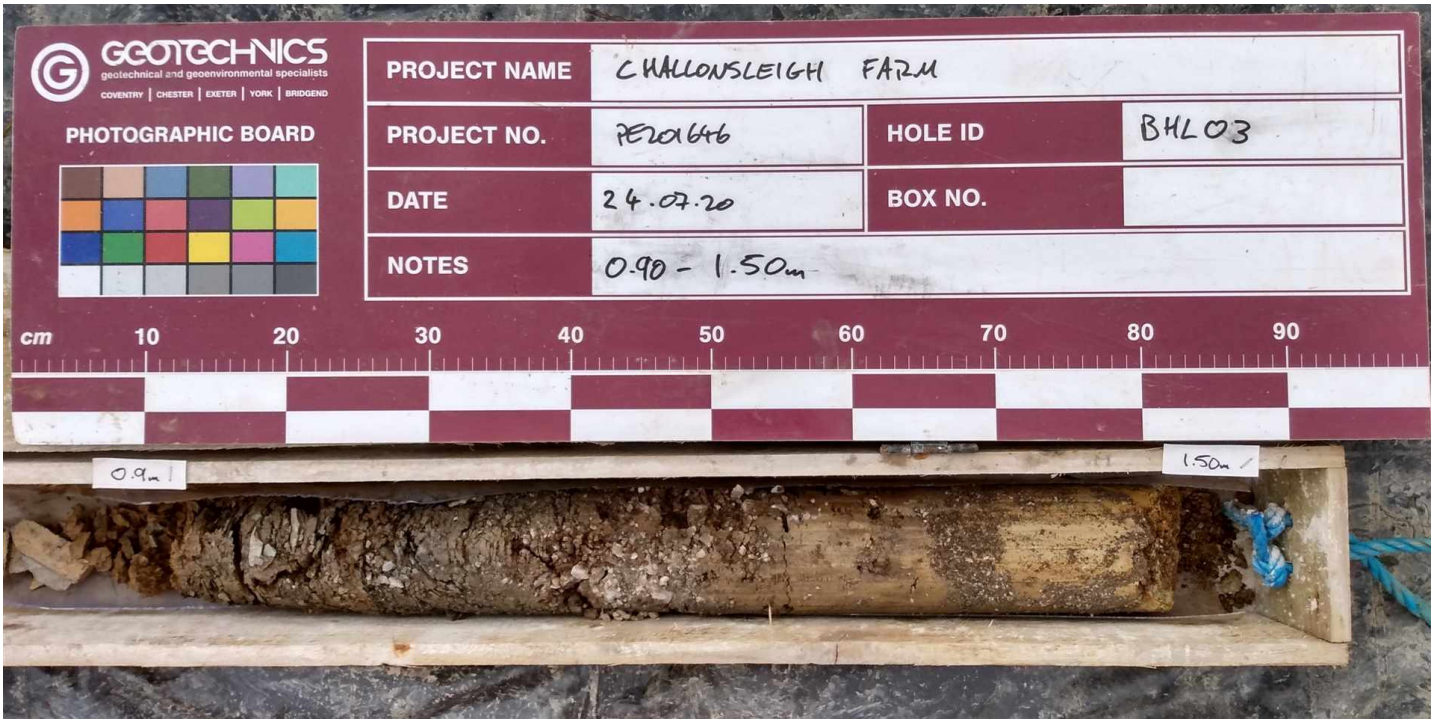
Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL02 8.20-10.00m

Project Number : PE201646

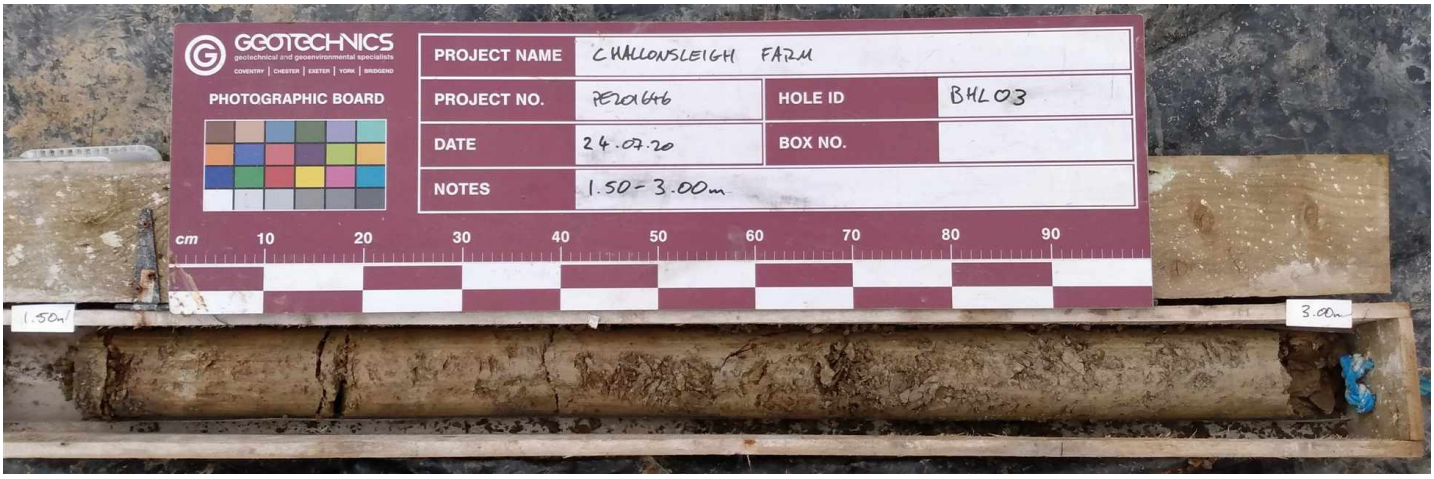
Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL03 0.90-1.50m

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL03 1.50-3.00m

Project Number : PE201646

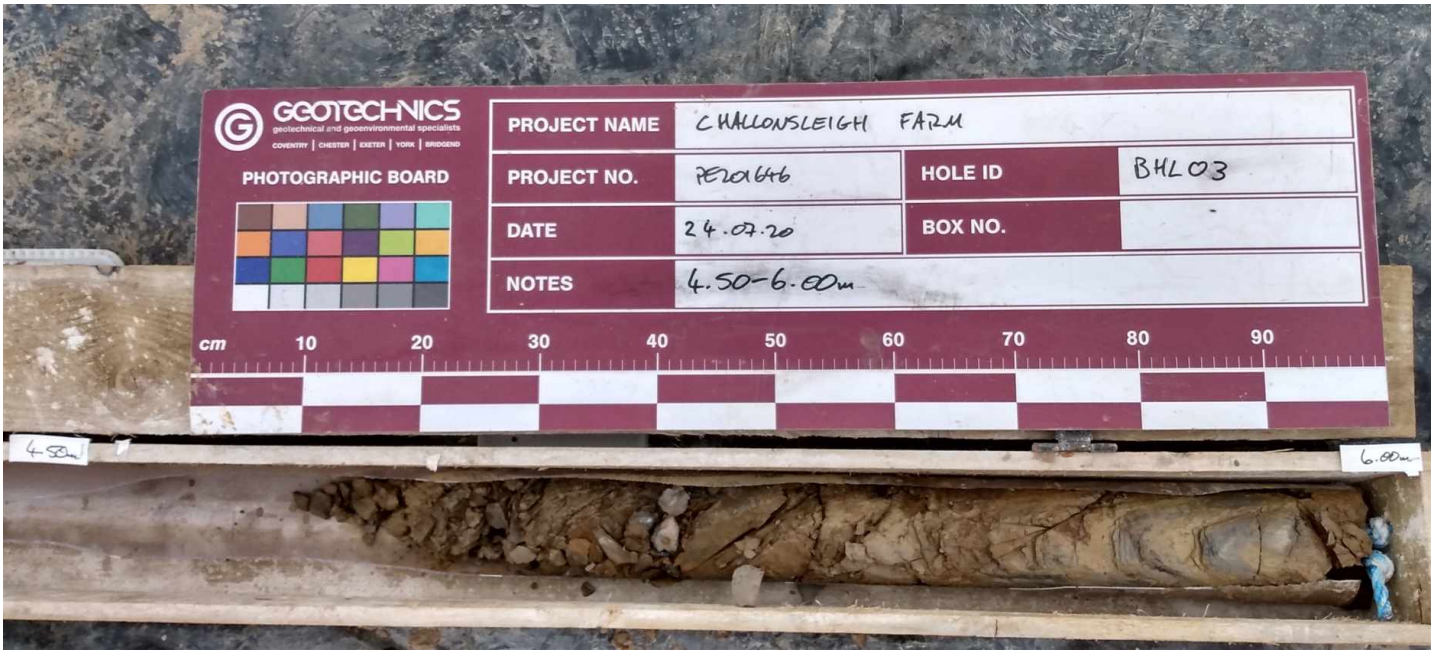
Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL03 3.00-4.50m

Project Number : PE201646

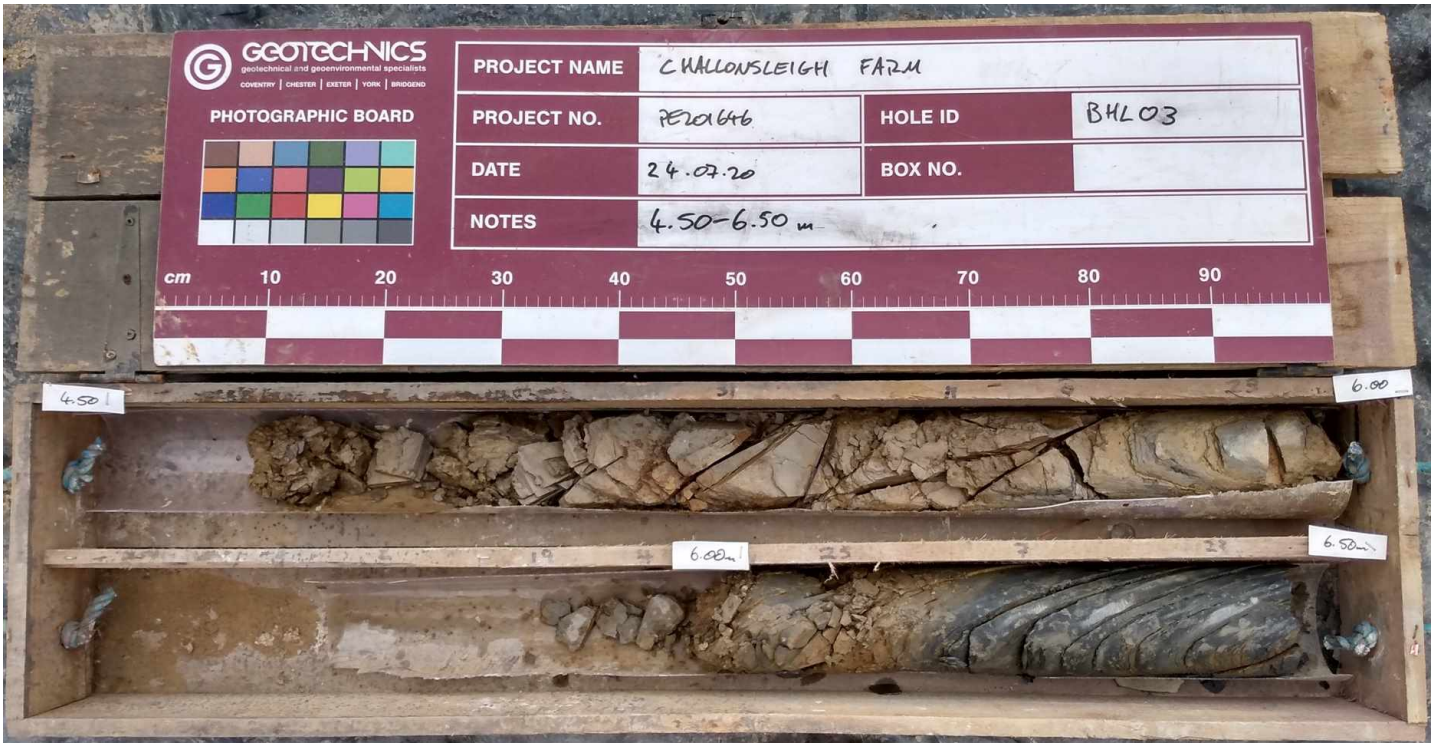
Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL03 4.50-6.00m

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL03 4.50-6.50m

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL04 1.20-3.00m

Project Number : PE201646

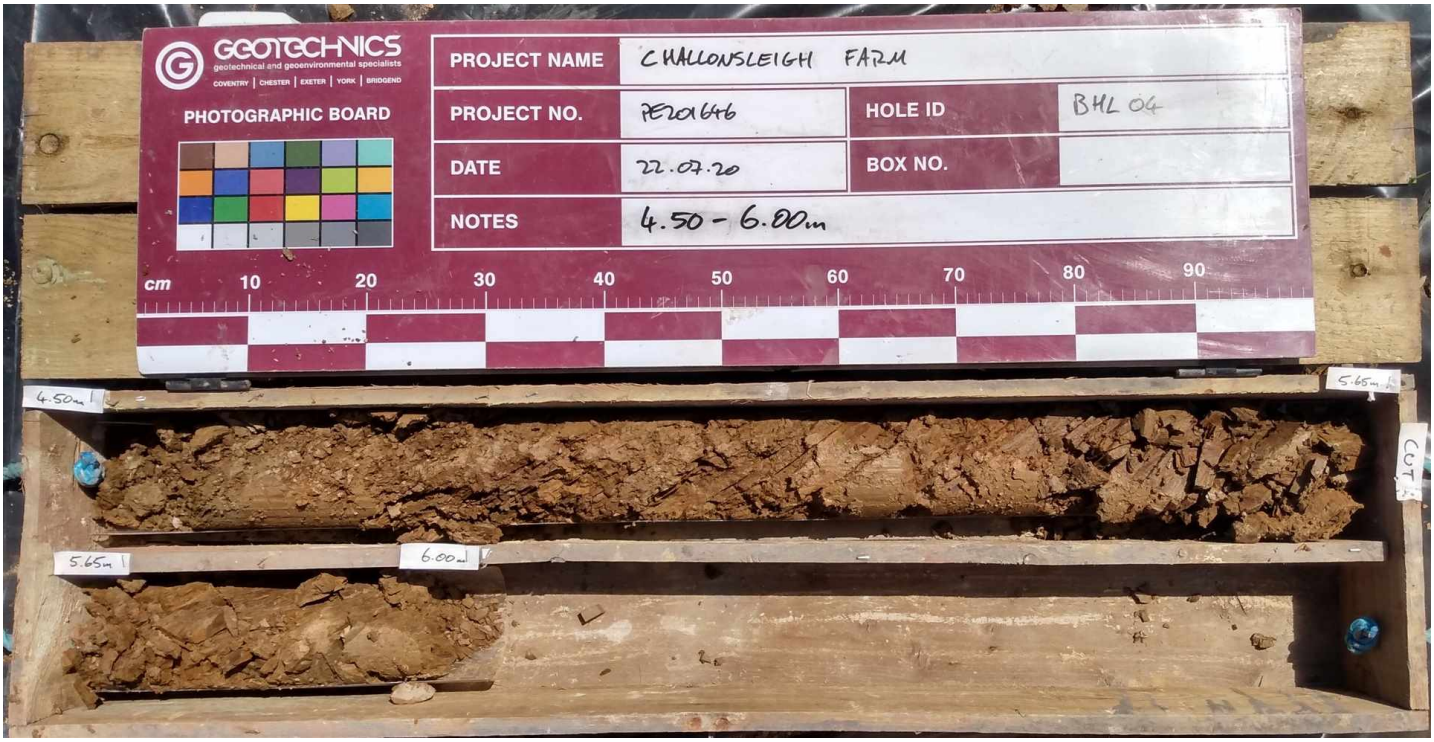
Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL04 3.00-4.50m

Project Number : PE201646

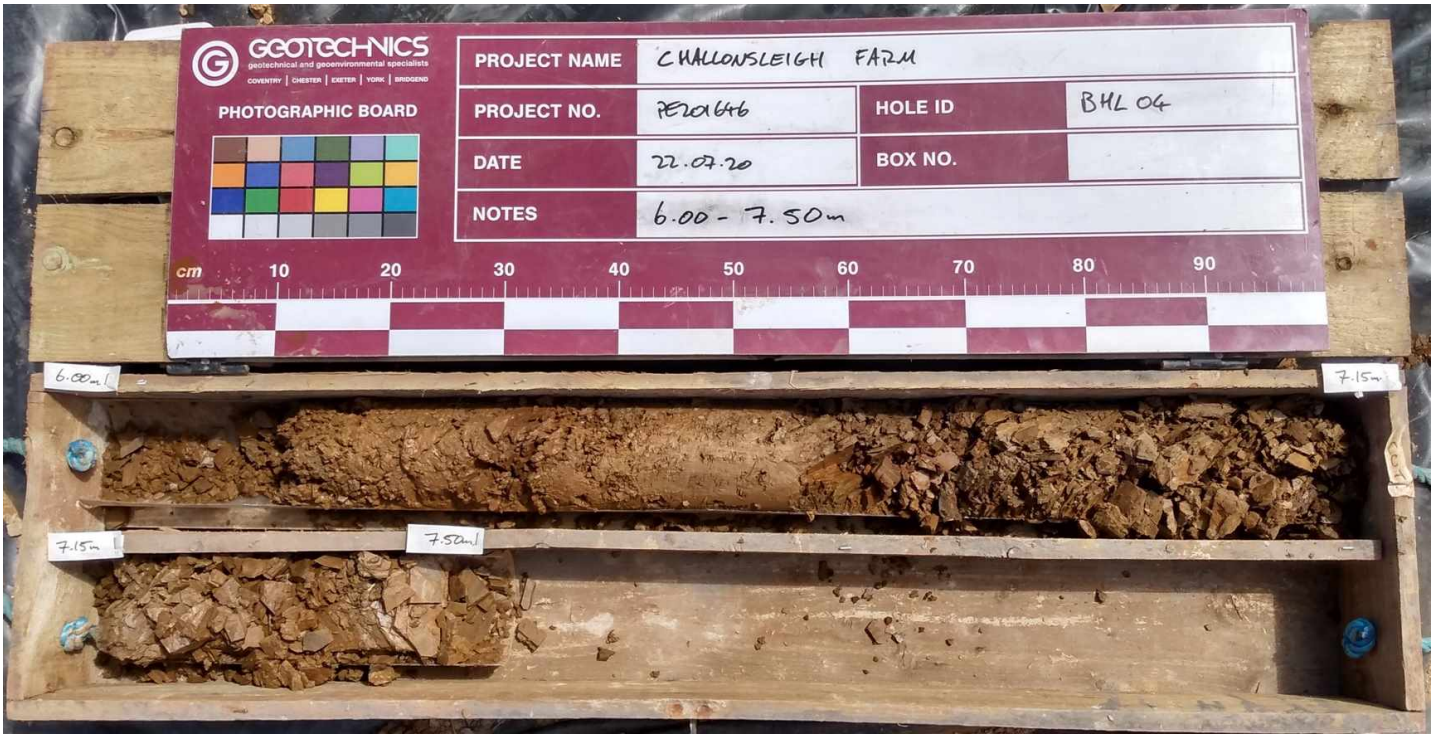
Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL04 4.50-6.00m

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL04 6.00-7.50m

Project Number : PE201646

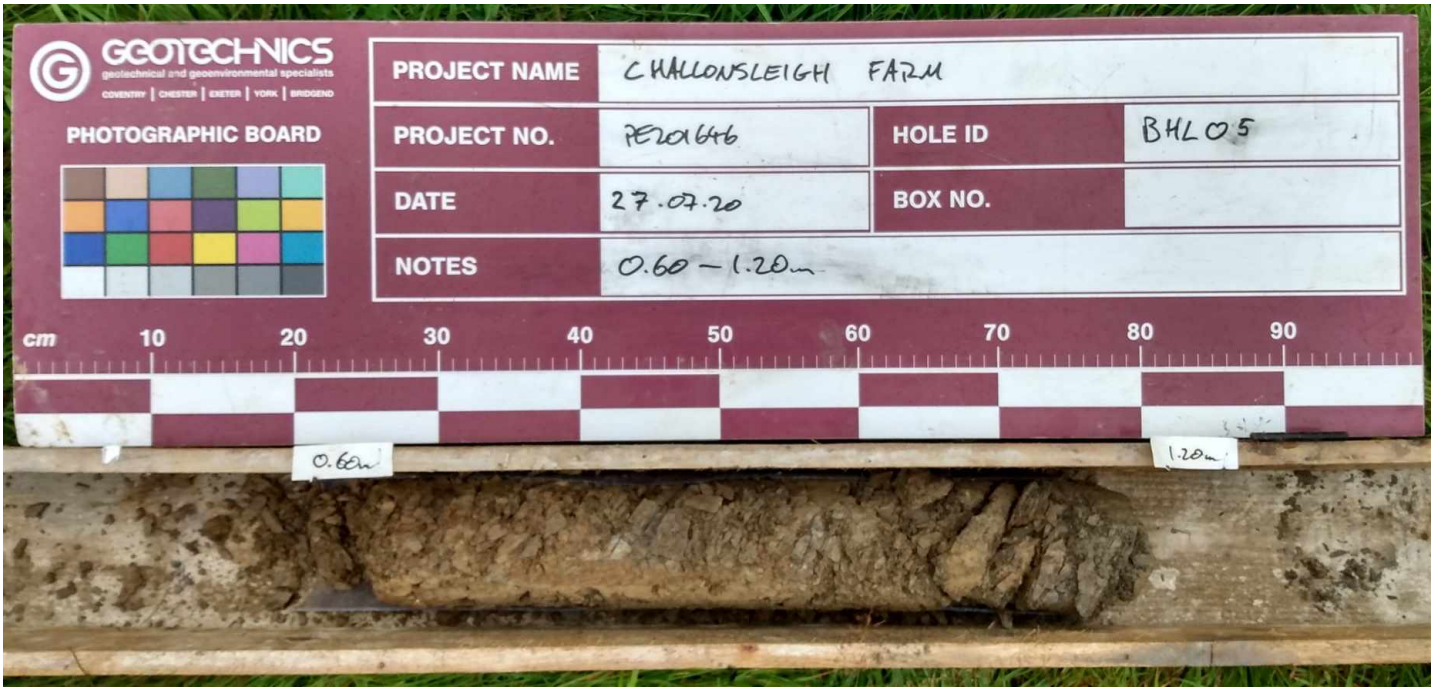
Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL04 7.50-8.30m

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL05 0.60-1.20m

Project Number : PE201646

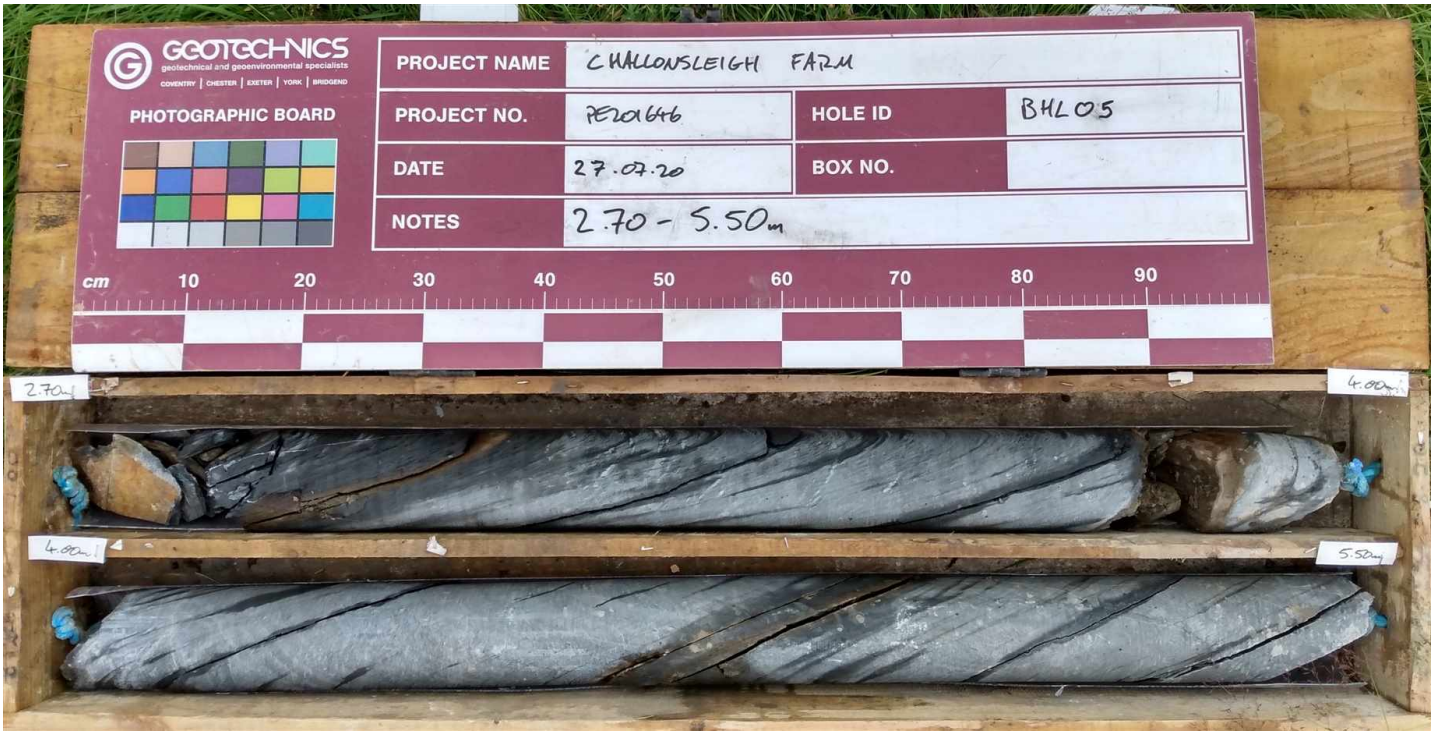
Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL05 1.20-2.70m

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL05 2.70-5.50m

Project Number : PE201646

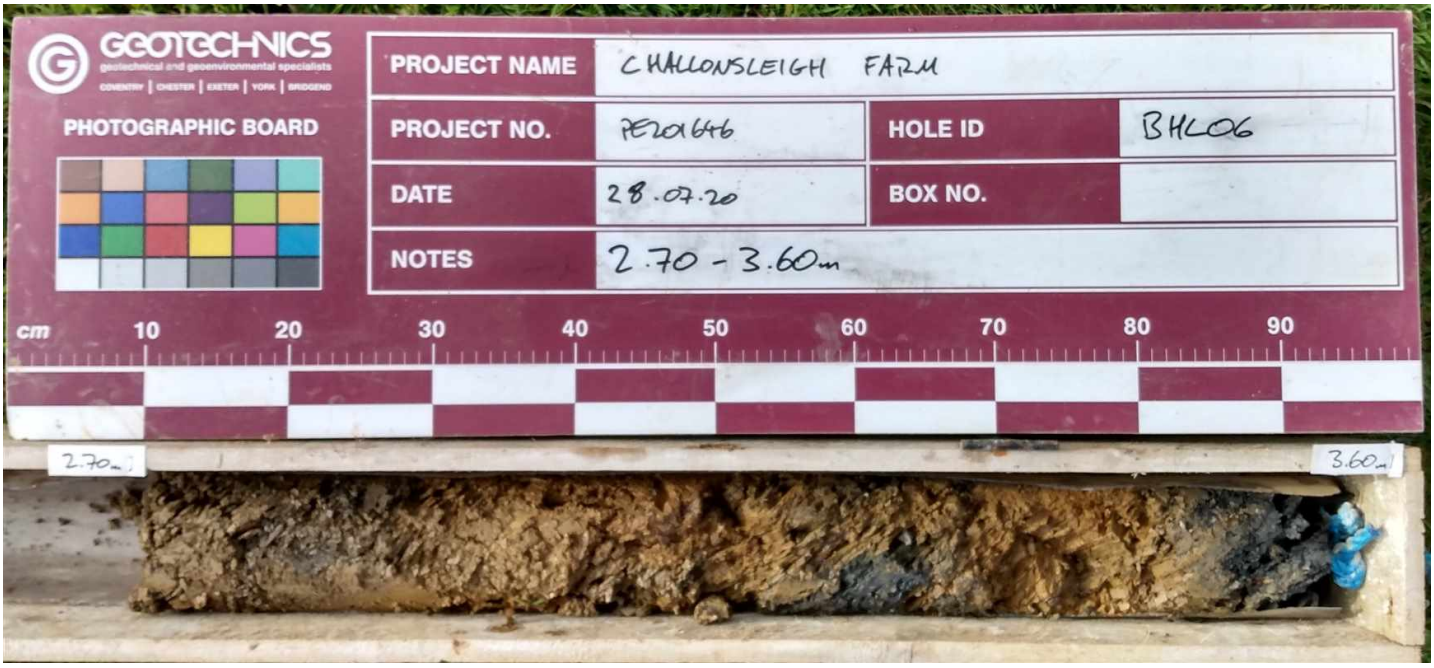
Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL06 1.20-2.70m

Project Number : PE201646

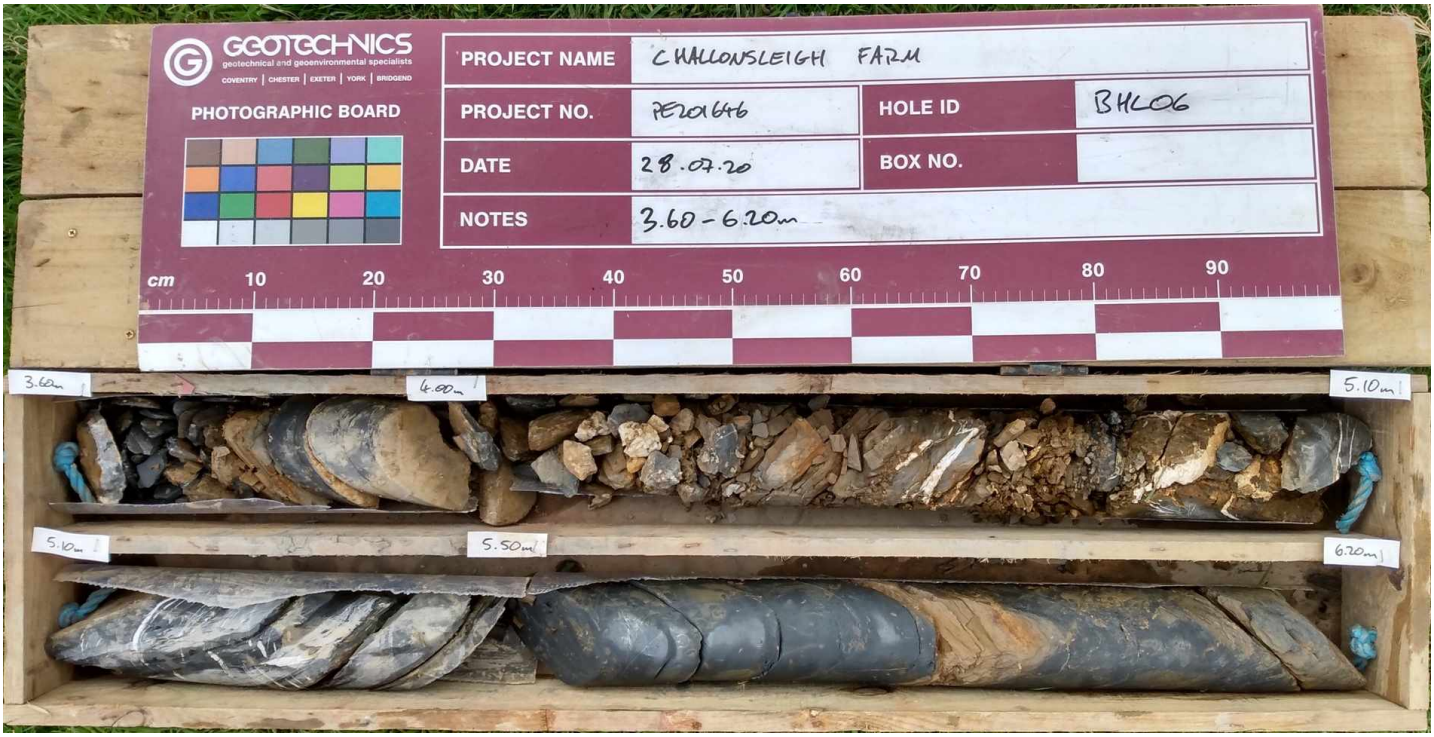
Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL06 2.70-3.60m

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL06 3.60-6.20m

Project Number : PE201646

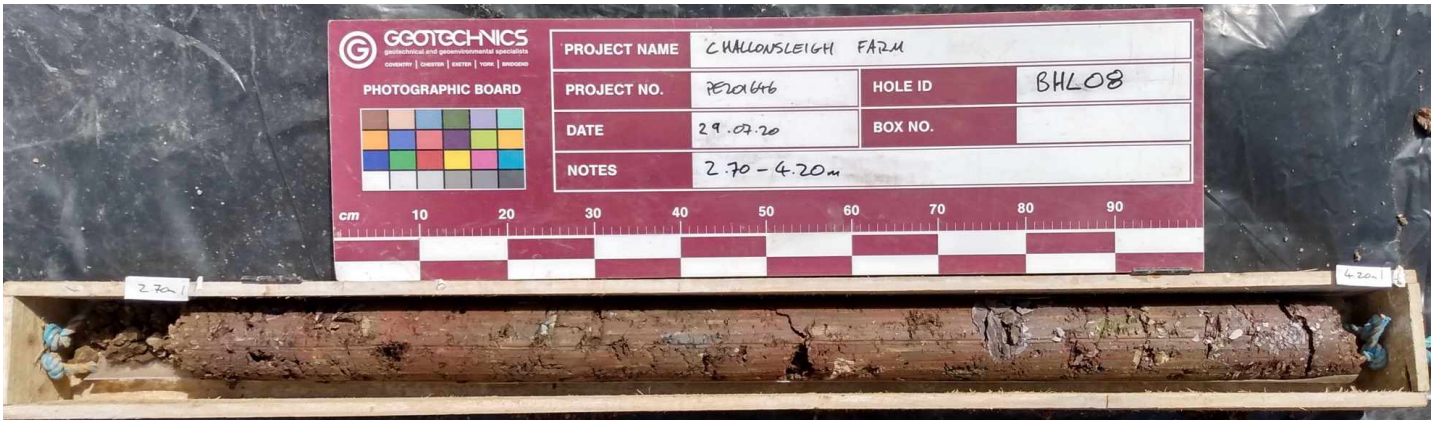
Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL08 1.20-2.70m

Project Number : PE201646

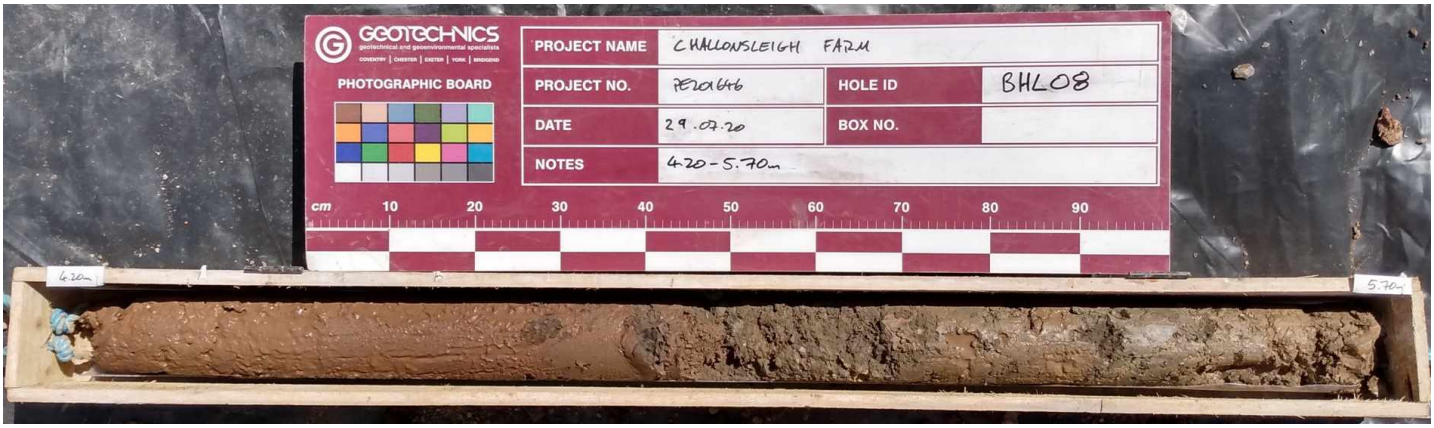
Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL08 2.70-4.20m

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL08 4.20-5.70m

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL08 5.70-7.20m

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL08 7.20-10.20m

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



BHL08 10.20-11.70m

APPENDIX 7

Inspection Pit Records

TRIAL PIT RECORD — Inspection Pit

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit / Project No	TPIF01 / PE201646
Client	DORTON GROUP	National Grid Coordinates	259455.413 E, 55397.846 N	Ground Level	53.65 m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.10- 0.20	B		
0.10- 0.20	D		
0.30- 0.50	B		
0.30- 0.50	D		
0.80- 0.90	B		
0.80- 0.90	D		

Strata

Scale 1:25

Description	Depth	Legend	Level m OD
	G.L.		53.65
Grass over firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse slate and occasional quartz. Frequent rootlets.	0.25	1	53.40
Firm brown slightly sandy gravelly SILT. Sand is fine to coarse. Gravel is angular fine to coarse extremely to very weak slate and rare quartz.	0.80	2	52.85
Brown sandy silty GRAVEL. Sand is fine to coarse. Gravel is angular fine to coarse extremely to very weak slate and rare quartz.	1.00	3	52.65
End of Excavation			

Excavation

Plant	Hand Excavation Tools	Width (B)	0.30
Date	23/07/2020	Length (C)	0.30
Shoring	None.	Date Backfilled	23/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks: A Percolation Test was carried out at 1.00m depth. The results are presented separately.

Logged by MK
Checked by MAK
Figure 1 of 1
06/01/2021

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

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TRIAL PIT RECORD *Inspection Pit*

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit / Project No	TPIF02 / PE201646
Client	DORTON GROUP	National Grid Coordinates	259460.658 E, 55489.289 N	Ground Level	59.13 m OD

Scale 1:25

Samples and Tests				Strata			
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		59.13
0.10- 0.20	B			Grass over firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse slate occasional quartz. Frequent rootlets.		1	
0.10- 0.20	D				0.20		58.93
0.30- 0.40	B			Firm brown slightly sandy gravelly SILT. Sand is fine to coarse. Gravel is angular fine to coarse slate.		2	
0.30- 0.40	D						
0.60- 0.80	B				0.60		58.53
0.60- 0.80	D			Brown sandy silty GRAVEL. Sand is fine to coarse. Gravel is angular fine to coarse extremely to very weak slate.		3	
				End of Excavation	1.00		58.13

Excavation

Plant	Hand Excavation Tools	Width (B)	0.30
Date	23/07/2020	Length (C)	0.30
Shoring	None.	Date Backfilled	23/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks AGS A Percolation Test was carried out at 1.00m depth. The results are presented separately.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

Logged by MK
Checked by MAK
Figure 1 of 1
06/01/2021

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TRIAL PIT RECORD *Inspection Pit*

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit / Project No	TPIF03 / PE201646
Client	DORTON GROUP	National Grid Coordinates	259629.125 E, 55484.751 N	Ground Level	50.80 m OD

Scale 1:25

Samples and Tests				Strata			
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		50.80
0.10- 0.20	B			Grass over firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse slate occasional quartz. Frequent rootlets.		1	
0.10- 0.20	D		mc=26%		0.30		50.50
0.40- 0.60	B			Firm to stiff greyish brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is angular fine to coarse very weak slate.		2	
0.40- 0.60	D		mc=17%		1.00		49.80
				End of Excavation			

Excavation

Plant	Hand Excavation Tools	Width (B)	0.30
Date	24/07/2020	Length (C)	0.30
Shoring	None.	Date Backfilled	24/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks AGS A Percolation Test was carried out at 1.00m depth. The results are presented separately.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

Logged by MK
Checked by MAK
Figure 1 of 1
06/01/2021

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TRIAL PIT RECORD *Inspection Pit*

Project	**GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM**	Engineer	**ATKINS GLOBAL**	**Trial Pit** Project No	**TPIF04** **PE201646**
Client	**DORTON GROUP**	National Grid Coordinates	**259379.074** E **55447.908** N	Ground Level	**59.08** m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.10- 0.30	B		cu(R)=108kPa mc(R)=24%
0.10- 0.30	D		mc=24%
0.55- 0.70	B		cu(R)=111kPa mc(R)=14%
0.55- 0.70	D		mc=12%

Strata

Scale 1:25

Description	Depth	Legend	Level m OD
Grass over firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular fine to medium slate. Frequent rootlets.	G.L.	1	59.08
Firm brown slightly sandy gravelly SILT. Sand is fine to coarse. Gravel is angular to subangular fine to coarse extremely weak slate and quartz.	0.30	2	58.78
Brown sandy silty GRAVEL. Sand is fine to coarse. Gravel is angular fine to coarse extremely weak slate.	0.50	3	58.58
End of Excavation	1.00		58.08

Excavation

Plant	**Hand Excavation Tools**	Width (B)	**0.30**
Date	**30/07/2020**	Length (C)	**0.30**
Shoring	**None.**	Date Backfilled	**30/07/2020**
Stability	**Stable during excavation.**		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks **A Percolation Test was carried out at 1.00m depth. The results are presented separately.**

Logged by **MK**
Checked by **MAK**
Figure **1 of 1**
06/01/2021

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

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TRIAL PIT RECORD *Inspection Pit*

Project **GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM**

Engineer **ATKINS GLOBAL**

Trial Pit **TPIF05**
Project No **PE201646**

Client **DORTON GROUP**

National Grid Coordinates **259562.051**E **55461.639** N

Ground Level **52.34** m OD

Scale 1:25

Samples and Tests				Strata			
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		52.34
0.10- 0.20	B			Grass over firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse slate and quartz. Frequent rootlets.		1	
0.10- 0.20	D				0.20		52.14
0.40- 0.60	B		cu(R)=108kPa mc(R)=17%	Firm brown slightly sandy gravelly SILT. Sand is fine to coarse. Gravel is angular fine to coarse slate and rare quartz.		2	
0.40- 0.60	D		mc=19%		0.40		51.94
				Brownish grey sandy silty GRAVEL. Sand is fine to coarse. Gravel is angular fine to coarse extremely weak slate.		3	
				End of Excavation	1.00		51.34

Excavation

Plant **Hand Excavation Tools**
Date **30/07/2020**
Shoring **None.**
Stability **Stable during excavation.**

Width (B) **0.30**
Length (C) **0.30**
Date Backfilled **30/07/2020**

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks **A Percolation Test was carried out at 1.00m depth. The results are presented separately.**

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

Logged by **MK**
Checked by **MAK**
Figure **1 of 1**
06/01/2021

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TRIAL PIT RECORD *Inspection Pit*

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit / Project No	TPIF06 / PE201646
Client	DORTON GROUP	National Grid Coordinates	259518.115 E, 55310.594 N	Ground Level	47.33 m OD

Scale 1:25

Samples and Tests				Strata			
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.	1	47.33
0.15- 0.30	B		cu(R)=89kPa mc(R)=38%	Grass over soft brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subrounded fine to coarse slate and quartz. Frequent rootlets.	0.15		47.18
0.15- 0.30	D		mc=38%				
				Soft to firm brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is angular to subangular fine to coarse slate and quartz.		2	
0.55- 0.70	B						
0.55- 0.70	D						
				At 0.75m, Gravelly, frequent quartz, gravel, low quartz cobble content.			
				End of Excavation	1.00		46.33

Excavation

Plant	Hand Excavation Tools	Width (B)	0.30
Date	29/07/2020	Length (C)	0.30
Shoring	None.	Date Backfilled	29/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks AGS A Percolation Test was carried out at 1.00m depth. The results are presented separately.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

Logged by MK
Checked by MAK
Figure 1 of 1
06/01/2021

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TRIAL PIT RECORD *Inspection Pit*

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit / Project No	TPIF07 / PE201646
Client	DORTON GROUP	National Grid Coordinates	259604.685 E, 55332.583 N	Ground Level	45.60 m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.10- 0.30	B		
0.10- 0.30	D		mc=36%
0.50- 0.70	B		
0.50- 0.70	D		

Strata

Scale 1:25

Description	Depth	Legend	Level m OD
Grass over soft to firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse slate and quartz. At 0.10m, Frequent rootlets.	G.L.	1	45.60
Soft to firm brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is angular to subangular fine to coarse quartz occasional slate. From 0.85m, Gravelly, generally quartz.	0.45	2	45.15
End of Excavation	1.00		44.60

Excavation

Plant	Hand Excavation Tools	Width (B)	0.30
Date	29/07/2020	Length (C)	0.30
Shoring	None.	Date Backfilled	29/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks: A Percolation Test was carried out at 1.00m depth. The results are presented separately.

Logged by MK
Checked by MAK
Figure 1 of 1
06/01/2021

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

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TRIAL PIT RECORD *Inspection Pit*

Project	**GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM**	Engineer	**ATKINS GLOBAL**	**Trial Pit** Project No	**TPIF08** **PE201646**
Client	**DORTON GROUP**	National Grid Coordinates	**259706.461** E **55369.917** N	Ground Level	**43.33** m OD

Samples and Tests | Strata | Scale 1:25

Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		43.33
0.15- 0.30	B			Grass over firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular fine to coarse slate. Frequent rootlets.	0.15	1	43.18
0.15- 0.30	D						
				Firm light orangish brown mottled grey slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is angular fine to coarse slate.			
0.50- 0.60	B						
0.50- 0.60	D			From 0.40m, Gravel is angular to subangular slate and quartz.		2	
				End of Excavation	1.00		42.33

Excavation

Plant: **Hand Excavation Tools**
Date: **29/07/2020**
Shoring: **None.**
Stability: **Stable during excavation.**
Width (B): **0.30**
Length (C): **0.30**
Date Backfilled: **29/07/2020**

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks: **A Percolation Test was carried out at 1.00m depth. The results are presented separately.**

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

Logged by **MK**
Checked by **MAK**
Figure **1 of 1**
06/01/2021

geotechnics

TRIAL PIT RECORD *Inspection Pit*

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit / Project No	TPIF09 / PE201646
Client	DORTON GROUP	National Grid Coordinates	259531.283 E, 55233.841 N	Ground Level	50.93 m OD

Scale 1:25

Samples and Tests				Strata			
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		50.93
0.10- 0.20	B			Firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to medium quartz, occasional slate. Gravel content increasing with depth.		1	
0.10- 0.20	D		mc=35%				
				At 0.25m, Frequent roots.			
					0.45		50.48
				Brown sandy very silty GRAVEL. Sand is fine to coarse. Gravel is angular fine to coarse extremely to very weak slate.		2	
0.60	B				0.55		50.38
0.60	D			Grey mottled orangish brown sandy slightly silty GRAVEL. Sand is fine to coarse. Gravel is angular fine to coarse very weak slate.		3	
					1.00		49.93
				End of Excavation			

Excavation

Plant	Hand Excavation Tools	Width (B)	0.30
Date	30/07/2020	Length (C)	0.30
Shoring	None.	Date Backfilled	30/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks AGS A Percolation Test was carried out at 1.00m depth. The results are presented separately.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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TRIAL PIT RECORD *Inspection Pit*

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit / Project No	TPIF10 / PE201646
Client	DORTON GROUP	National Grid Coordinates	259625.535 E, 55251.855 N	Ground Level	48.32 m OD

Scale 1:25

Samples and Tests				Strata			
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		48.32
0.10- 0.20	B			Soft brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse quartz and slate. Frequent roots.		1	
0.10- 0.20	D						
					0.30		48.02
0.40- 0.60	B			Firm orangish brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is angular to subangular fine to medium slate and occasional quartz.		2	
0.40- 0.60	D						
				End of Excavation	1.10		47.22

Excavation

Plant	Hand Excavation Tools	Width (B)	0.30
Date	30/07/2020	Length (C)	0.30
Shoring	None.	Date Backfilled	30/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks AGS A Percolation Test was carried out at 1.10m depth. The results are presented separately.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

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APPENDIX 8

Trial Pit Records

DATA SHEET - Symbols and Abbreviations used on Records

Sample Types

B	Bulk disturbed sample
BLK	Block sample
C	Core sample
D	Small disturbed sample (tub/jar)
E	Environmental test sample
ES	Environmental soil sample
EW	Environmental water sample
G	Gas sample
L	Liner sample
LB	Large bulk disturbed sample
P	Piston sample (PF - failed P sample)
TW	Thin walled push in sample
U	Open Tube - 102mm diameter with blows to take sample. (UF - failed U sample)
UT	Thin wall open drive tube sampler - 102mm diameter with blows to take sample. (UTF - failed UT sample)
V	Vial sample
W	Water sample
#	Sample Not Recovered

Insitu Testing / Properties

CBRP	CBR using TRL probe
CHP	Constant Head Permeability Test
COND	Electrical conductivity
TC	Thermal Conductivity
TR	Thermal Resistivity
HV	Strength from Hand Vane
ICBR	CBR Test
IDEN	Density Test
IRES	Resistivity Test
MEX	CBR using Mexecone Probe Test
PID	Photo Ionisation Detection (ppm)
PKR	Packer Permeability Test
PLT	Plate Load Test
PP	Strength from Pocket Penetrometer
Temp	Temperature
VHP	Variable Head Permeability Test
VN	Strength from Insitu Vane
w%	Water content

(All other strengths from undrained triaxial testing)

S	Standard Penetration Test (SPT)
C	SPT with cone
N	SPT Result
-/-	Blows/penetration (mm) after seating drive
-*/- (mm)	Total blows/penetration
( )	Extrapolated value

Groundwater

Water Strike

Depth Water Rose To

Instrumentation



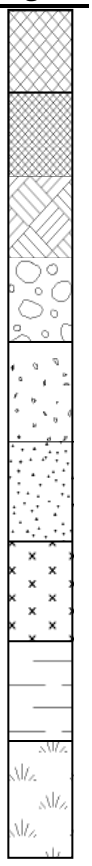
Seal

Filter

Seal

Strata

Legend



Made Ground Granular

Made Ground Cohesive

Topsoil

Cobbles and Boulders

Gravel

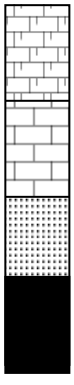
Sand

Silt

Clay

Peat

Note: Composite soil types shown by combined symbols



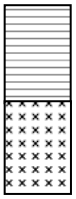
Chalk

Limestone

Sandstone

Coal

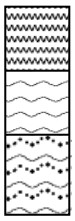
Strata, Continued



Mudstone

Siltstone

Metamorphic Rock

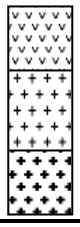


Fine Grained

Medium Grained

Coarse Grained

Igneous Rock



Fine Grained

Medium Grained

Coarse Grained

Backfill Materials



Arisings

Bentonite Seal

Concrete

Fine Gravel Filter

General Fill

Gravel Filter

Grout

Sand Filter

Tarmacadam

Rotary Core

RQD	Rock Quality Designation (% of intact core >100mm)
FRACTURE INDEX	Fractures/metre
FRACTURE SPACING (m)	Maximum Minimum
NI	Non-intact core
NR	No core recovery
AZCL	Assumed zone of core loss

(where core recovery is unknown it is assumed to be at the base of the run)

TRIAL PIT RECORD — Trial Pit

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit	TPL101
				Project No	PE201646
Client	DORTON GROUP	National Grid Coordinates	259377.854 E 55453.843 N	Ground Level	55.35 m OD

Scale 1:30

Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		55.35
				Grass over firm brown slightly sandy gravelly SILT. Sand is fine to coarse. Gravel is angular to subangular fine to coarse slate and quartz.		1	
0.30	B				0.25		55.10
0.30	D		mc=18%	Greyish brown sandy silty GRAVEL. Sand is fine to coarse. Gravel is angular to subangular fine to coarse weak to very weak slate and quartz.		2	
0.30	ES				0.60		54.75
0.70	HV		Av=78kPa	Firm to stiff yellowish brown slightly gravelly SILT. Gravel is angular fine to coarse extremely weak slate. [RESIDUAL SOIL]		3	
0.80	B		mc=20%				
0.80	D		mc=19%				
					1.40		53.95
				Stiff yellowish brown gravelly SILT with a low slate cobble content. Gravel is angular fine to coarse extremely to very weak slate. [RESIDUAL SOIL]		4	
2.10	B						
2.10	D		mc=29%				
2.10	ES						
					2.80		52.55
				Orangish brown sandy silty GRAVEL. Sand is fine to coarse. Gravel is angular fine to coarse very weak to weak slate. Thick beds up to 100mm of firm orangish yellowish brown silt. [RESIDUAL SOIL]		5	
3.00	B				3.00		52.35
3.00	D						
				End of Excavation			

Excavation

Plant	14 Tonne Excavator	Width (B)	0.60
Date	21/07/2020	Length (C)	3.50
Shoring	None.	Orientation	010 deg
		Date Backfilled	21/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks AGS Trial Pit terminated at 3.00m at scheduled depth.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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TRIAL PIT RECORD *Trial Pit*

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit	TPL102
				Project No	PE201646
Client	DORTON GROUP	National Grid Coordinates	259454.896 E 55487.490 N	Ground Level	59.30 m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.25	D		
0.25	ES		
0.50	B		
0.50	D		mc=14%
0.50	ES		
1.50	B		
1.50	D		
2.50	B		
2.50	D		

Strata

Scale 1:30

Description	Depth	Legend	Level m OD
Grass over firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse slate.	G.L.	1	59.30
Greyish brown sandy silty GRAVEL. Sand is fine to coarse. Gravel is angular fine to coarse very weak to weak slate. [RESIDUAL SOIL]	0.30		59.00
From 1.00m, Rare quartz cobbles.		2	
End of Excavation	2.50		56.80

Excavation

Plant	14 Tonne Excavator	Width (B)	0.60
Date	21/07/2020	Length (C)	3.50
Shoring	None.	Orientation	010 deg
		Date Backfilled	21/07/2020
Stability	Poor below 1.50m depth.		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks AGS Trial pit terminated at 2.50m depth due to pit walls collapsing.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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TRIAL PIT RECORD — Trial Pit

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit / Project No	TPL103 / PE201646
Client	DORTON GROUP	National Grid Coordinates	259465.809 E, 55396.140 N	Ground Level	53.35 m OD

Scale 1:30

Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		53.35
0.10- 0.30	D			Grass over soft brown slightly sandy slightly gravelly CLAY. Sand is fine. Gravel is angular fine to coarse slate and quartz. Frequent rootlets.		1	
0.10- 0.30	ES				0.30		53.05
0.50- 0.60	B			Brown sandy silty GRAVEL. Sand is fine to coarse. Gravel is angular fine to coarse very weak slate. Occasional large pockets up to 300mm of quartz.			
0.50- 0.60	D		mc=14%	[RESIDUAL SOIL]			
1.30	B		mc=11%			2	
1.30	D		mc=8.2%				
1.30	ES			From 1.60m, Low slate cobble content.			
				From 2.00m, Becoming slightly silty.			
					2.50		50.85
2.50	B			End of Excavation			
2.60	D						

Excavation

Plant	14 Tonne Excavator	Width (B)	0.60
Date	20/07/2020	Length (C)	3.60
Shoring	None.	Orientation	090 deg
		Date Backfilled	20/07/2020
Stability	Pit walls becoming unstable at 2.00m depth.		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks: Trial Pit terminated at 2.50m depth due to pit walls collapsing.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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TRIAL PIT RECORD — Trial Pit

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit	TPL104
				Project No	PE201646
Client	DORTON GROUP	National Grid Coordinates	259520.911 E 55397.912 N	Ground Level	51.18 m OD

Scale 1:30

Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		51.18
0.10- 0.25	D			Grass over light brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular fine to coarse slate and subangular quartz. Frequent rootlets.		1	
0.10- 0.25	ES				0.25		50.93
0.60	B			Weathered SLATE recovered as: Brown sandy slightly silty GRAVEL with a low slate cobble content. Sand is fine to coarse. Gravel is angular fine to coarse very weak to weak slate. Relict steeply dipping cleavage visible in walls of pit. [WEATHERED SLATE]		2	
0.60	D		mc=7.9%				
					1.00		50.18
1.50	B			Weathered SLATE recovered as: Brown sandy very silty GRAVEL. Sand is fine to coarse. Gravel is angular fine to coarse very weak slate. [WEATHERED SLATE]		3	
1.50	D		mc=8.7%				
				From 2.00m, Becoming slightly silty.			
					2.20		48.98
2.20	B			End of Excavation			
2.20	D						
2.20	ES						

Excavation

Plant	14 Tonne Excavator	Width (B)	0.60
Date	20/07/2020	Length (C)	3.70
Shoring	None.	Orientation	090 deg
		Date Backfilled	20/07/2020
Stability	Poor. Collapsing from 1.00 - 2.20m.		

Groundwater

Depth Observed	Depth of Pit	Details
		Damp from 1.50m.

Remarks: Trial Pit terminated at 2.20m depth due to pit walls collapsing.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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TRIAL PIT RECORD — Trial Pit

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit / Project No	TPL105 / PE201646
Client	DORTON GROUP	National Grid Coordinates	259548.965 E, 55464.288 N	Ground Level	53.37 m OD

Scale 1:30

Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		53.37
				Grass over firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse slate and quartz. Frequent rootlets.	0.20	1	53.17
0.60	B			Greyish brown sandy silty GRAVEL with a low slate cobble content. Sand is fine to coarse. Gravel is angular fine to coarse very weak to weak slate.			
0.60	D		mc=13%	[RESIDUAL SOIL]			
0.60	ES						
						2	
				From 1.40m, Grey with brown silt on gravel surfaces.			
1.80	B				1.80		51.57
1.80	D			End of Excavation			
1.80	ES						

Excavation

Plant	14 Tonne Excavator	Width (B)	0.60
Date	21/07/2020	Length (C)	3.50
Shoring	None.	Orientation	270 deg
Stability	Poor. Spalling from 0.50m.	Date Backfilled	21/07/2020

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks: Trial Pit terminated at 1.80m depth due to pit walls collapsing.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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TRIAL PIT RECORD — Trial Pit

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit	TPL106
				Project No	PE201646
Client	DORTON GROUP	National Grid Coordinates	259656.510 E 55503.672 N	Ground Level	50.38 m OD

Scale 1:30

Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		50.38
0.10- 0.25	D			Grass over firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse slate and quartz. Frequent rootlets.		1	
0.10- 0.25	ES				0.25		50.13
0.40	HV		Av=53kPa	Firm to stiff brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is angular fine to coarse very weak to extremely weak slate and quartz. [RESIDUAL SOIL]		2	
0.50	B						
0.50	D						
0.50	ES						
					0.80		49.58
1.00	B			Brown very sandy silty GRAVEL. Sand is fine to coarse. Gravel is angular fine to coarse extremely to very weak slate, rarely quartz. [RESIDUAL SOIL]		3	
1.00	D		mc=19%				
					1.70		48.68
2.20	B			Weathered SLATE recovered as: Brown sandy slightly silty GRAVEL with a medium slate cobble content. Relict steeply dipping cleavage visible in pit walls. [WEATHERED SLATE]		4	
2.20	D						
				End of Excavation	3.00		47.38

Excavation

Plant	14 Tonne Excavator	Width (B)	0.60
Date	21/07/2020	Length (C)	3.50
Shoring	None.	Orientation	090 deg
		Date Backfilled	21/07/2020
Stability	Some spalling below 1.70m.		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks: Trial Pit terminated at 3.00m at scheduled depth.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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TRIAL PIT RECORD — Trial Pit

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit	TPL107
				Project No	PE201646
Client	DORTON GROUP	National Grid Coordinates	259626.894 E 55477.107 N	Ground Level	50.65 m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.80	B		
0.80	D		mc=14%
0.80	ES		
1.80	B		
1.80	D		
1.80	ES		
3.00	B		
3.00	D		

Strata

Scale 1:30

Description	Depth	Legend	Level m OD
	G.L.		50.65
Grass over firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse slate and quartz. Frequent rootlets.	0.20	1	50.45
Greyish brown sandy silty GRAVEL with a low quartz cobble content. Sand is fine to coarse. Gravel is angular fine to coarse extremely weak to very weak slate. [RESIDUAL SOIL]		2	
Weathered SLATE recovered as: Greyish brown sandy silty GRAVEL with a medium quartz cobble content and rare quartz boulders. Sand is fine to coarse. Gravel is angular fine to coarse slate and quartz. Relict steeply dipping cleavage visible in pit walls. [WEATHERED SLATE]	1.50	3	49.15
End of Excavation	3.00		47.65

Excavation

Plant	14 Tonne Excavator	Width (B)	0.60
Date	21/07/2020	Length (C)	3.60
Shoring	None.	Orientation	180 deg
		Date Backfilled	21/07/2020
Stability	Minor spalling below 1.30m.		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks: Trial Pit terminated at 3.00m at scheduled depth.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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TRIAL PIT RECORD — Trial Pit

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit	TPL108
				Project No	PE201646
Client	DORTON GROUP	National Grid Coordinates	259669.347 E 55455.622 N	Ground Level	48.42 m OD

Scale 1:30

Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		48.42
0.15	D			Grass over firm brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse slate and quartz. Frequent rootlets.		1	
0.15	ES				0.25		48.17
0.40	HV		Av=36kPa	Soft to firm orangish brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular fine to coarse slate. [RESIDUAL SOIL]		2	
					0.60		47.82
0.80	B		mc=19%	Brown sandy slightly silty GRAVEL. Sand is fine to coarse. Gravel is angular fine to coarse very weak slate. [RESIDUAL SOIL]			
0.80	D		mc=13%				
				Between 1.20 and 1.50m, Very silty.		3	
2.00	B			From 2.00m, Low slate cobble content.			
2.00	D		mc=12%				
2.90	B			End of Excavation	2.90		45.52
2.90	D						
2.90	ES						

Excavation

Plant	14 Tonne Excavator	Width (B)	0.60
Date	20/07/2020	Length (C)	3.60
Shoring	None.	Orientation	090 deg
		Date Backfilled	20/07/2020
Stability	Some spalling below 1.40m, poor below 2.00m.		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks: Trial Pit terminated at 2.90m depth due to pit walls collapsing.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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TRIAL PIT RECORD — Trial Pit

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit / Project No	TPL109 / PE201646
Client	DORTON GROUP	National Grid Coordinates	259716.670 E, 55401.384 N	Ground Level	44.36 m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.40- 0.50	B		
0.40- 0.50	D		
0.40- 0.50	ES		
0.40	HV		Av=26kPa
0.90	B		
0.90	D		mc=11%
2.50	B		
2.50	D		mc=8.3%
2.50	ES		

Strata

Scale 1:30

Description	Depth	Legend	Level m OD
	G.L.		44.36
Grass over soft brown slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular to subangular fine to coarse slate and quartz. Frequent rootlets.	0.30	1	44.06
Soft to firm brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is angular fine to coarse slate and subangular fine to coarse quartz. [RESIDUAL SOIL]	0.60	2	43.76
Greyish brown sandy very silty GRAVEL. Sand is fine to coarse. Gravel is angular fine to coarse very weak slate. [RESIDUAL SOIL] From 1.00m, Silty, low slate cobble content.	1.10	3	43.26
Weathered SLATE recovered as: Greyish brown sandy slightly silty GRAVEL. Sand is medium to coarse. Gravel is angular fine to coarse very weak slate. Relict steeply dipping cleavage visible in walls of pit. [WEATHERED SLATE] From 1.75m, Slightly silty.		4	
End of Excavation	2.50		41.86

Excavation

Plant	14 Tonne Excavator	Width (B)	0.60
Date	20/07/2020	Length (C)	3.50
Shoring	None.	Date Backfilled	20/07/2020
Stability	Poor below 1.10m depth.		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks: Trial Pit terminated at 2.50m depth due to pit walls collapsing.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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TRIAL PIT RECORD — Trial Pit

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit / Project No	TPL110 / PE201646
Client	DORTON GROUP	National Grid Coordinates	259629.209 E, 55369.889 N	Ground Level	45.37 m OD

Scale 1:30

Samples and Tests				Strata			
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		45.37
0.20- 0.50	B			Grass over firm brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse quartz. Frequent rootlets.		1	
0.20- 0.50	D		mc=27%		0.20		45.17
0.20- 0.50	ES						
0.50			69	Firm brown slightly gravelly CLAY. Gravel is subangular to subrounded fine to coarse quartz. [RESIDUAL SOIL]		2	
0.90	B				0.80		44.57
0.90	D			Brownish grey sandy very silty GRAVEL. Sand is fine to coarse. Gravel is angular fine to coarse extremely to very weak slate. [RESIDUAL SOIL]		3	
2.00	B						
2.00	D						
2.00	ES						
3.10	D			End of Excavation	3.10		42.27

Excavation

Plant	14 Tonne Excavator	Width (B)	0.60
Date	20/07/2020	Length (C)	3.60
Shoring	None.	Orientation	180 deg
Stability	Stable during excavation.	Date Backfilled	20/07/2020

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks: Trial Pit terminated at 3.10m at scheduled depth.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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TRIAL PIT RECORD — Trial Pit

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit	TPL111
				Project No	PE201646
Client	DORTON GROUP	National Grid Coordinates	259698.248 E 55361.453 N	Ground Level	43.38 m OD

Scale 1:30

Samples and Tests				Strata			
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		43.38
				Soft light orangish brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is angular to subangular fine to coarse quartz and slate. Between 0.00 and 0.10m, Abundant rootlets.		1	
0.50	B		mc=25%		0.50		42.88
0.50	D			Soft light grey and brown mottled orange slightly sandy slightly gravelly SILT. Sand is fine to medium. Gravel is very angular to angular fine to coarse slate. [RESIDUAL SOIL]			
0.50	ES						
1.00	B			At 0.50m, Band of angular to subangular cobbles and gravels of quartz.		2	
1.00	D		mc=21%				
					2.00		41.38
2.10	B			Light grey mottled orange slightly sandy silty GRAVEL with a medium slate cobble content. Gravel is very angular to angular fine to medium weak slate. [RESIDUAL SOIL]		3	
2.10	D						
2.10	ES			Between 2.00 and 2.90m, Collapse.			
3.00	B				3.00		40.38
3.00	D			End of Excavation			

Excavation

Plant	14 Tonne Excavator	Width (B)	0.65
Date	21/07/2020	Length (C)	3.50
Shoring	None.	Orientation	090 deg
		Date Backfilled	21/07/2020
Stability	Collapsing below 2.00m.		

Groundwater

Depth Observed	Depth of Pit	Details
2.90		Slow seepage.

Remarks: Trial Pit terminated at 3.00m at scheduled depth.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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TRIAL PIT RECORD — Trial Pit

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit / Project No	TPL112 / PE201646
Client	DORTON GROUP	National Grid Coordinates	259646.332 E, 55304.118 N	Ground Level	45.47 m OD

Scale 1:30

Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		45.47
0.10	B			Stiff light orangish brown slightly sandy slightly gravelly CLAY/SILT. Sand is fine to coarse. Gravel is very angular to subangular fine to coarse quartz and slate. [RESIDUAL SOIL]			
0.10	D						
0.10	ES						
0.40	HV		Av=105kPa				
				Between 0.00 and 0.18m, Abundant rootlets.			
0.60	HV		Av=100kPa			1	
0.80	HV		Av=67kPa	From 0.80m, Firm.			
1.20	B				1.20		44.27
1.20	D			Soft mottled orange, light grey and brown slightly sandy slightly gravelly CLAY/SILT. Sand is fine to medium. Gravel is very angular to subangular fine to coarse slate. [RESIDUAL SOIL]			
2.00	B					2	
2.00	D						
2.00	ES						
					2.90	3	42.57
3.00	B			Light grey and brown mottled orange slightly sandy silty GRAVEL with medium cobble content. Sand is fine to coarse. Gravel is very angular to subangular fine to coarse weak slate. Cobbles are very angular to subangular weak slate. [RESIDUAL SOIL]	3.00		42.47
3.00	D						
				End of Excavation			

Excavation

Plant	14 Tonne Excavator	Width (B)	0.60
Date	21/07/2020	Length (C)	3.50
Shoring	None.	Orientation	180 deg
		Date Backfilled	21/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details

Remarks: Trial Pit terminated at 3.00m at scheduled depth.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

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TRIAL PIT RECORD *Trial Pit*

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit / Project No	TPL113 / PE201646
Client	DORTON GROUP	National Grid Coordinates	259586.795 E, 55331.749 N	Ground Level	45.94 m OD

Scale 1:30

Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		45.94
0.10- 0.20	B			Grass over firm to stiff brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is angular fine to coarse extremely to very weak slate and quartz. [RESIDUAL SOIL]			
0.10- 0.20	D		mc=34%				
0.10- 0.20	ES						
				Between 0.00 and 0.20m, Frequent rootlets.			
0.60	HV		Av=82kPa	From 0.60m, Stiff.			
				Between 0.80m and 1.50m, Gravelly, low quartz cobble content.		1	
1.20	B						
1.20	D						
					1.70		44.24
1.80	B			Brownish grey sandy very silty GRAVEL. Sand is fine to coarse. Gravel is angular fine to coarse extremely to very weak slate, rare quartz gravel. [RESIDUAL SOIL]			
1.80	D					2	
1.80	ES			From 2.50m, Silty, low slate cobble content.			
3.00	B				3.00		42.94
3.00	D			End of Excavation			

Excavation

Plant	14 Tonne Excavator	Width (B)	0.60
Date	21/07/2020	Length (C)	3.60
Shoring	None.	Orientation	270 deg
		Date Backfilled	21/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks: Trial Pit terminated at 3.00m at scheduled depth.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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TRIAL PIT RECORD *Trial Pit*

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit	TPL114
				Project No	PE201646
Client	DORTON GROUP	National Grid Coordinates	259527.310 E 55325.079 N	Ground Level	46.96 m OD

Scale 1:30

Samples and Tests				Strata			
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		46.96
0.20	B		mc=50%	Soft brown slightly sandy slightly gravelly SILT with a low cobble content. Sand is fine to coarse. Gravel (and cobbles) are very angular to subangular fine to coarse quartz and slate. [RESIDUAL SOIL]			
0.20	D		mc=41%				
0.20	ES			Between 0.00 and 0.20m, Abundant rootlets.			
				At 0.50m, Band of quartz.		1	
0.80	B						
0.80	D						
				Brown gravelly silty fine to coarse SAND with a high cobble content. Gravel is very angular to subangular fine to coarse slate and quartz. Cobbles are angular to subangular quartz. [RESIDUAL SOIL]	1.50	2	45.46
1.80	B				1.80		45.16
1.80	D			Light grey and brown mottled orange slightly sandy gravelly SILT. Sand is fine to coarse. Gravel is very angular to subangular fine to coarse slate and quartz. [RESIDUAL SOIL]		3	
				At 1.80m, Band of quartz.			
2.60	B			Between 1.80 and 3.00m, Slate is extremely weak and decomposes to silt.			
2.60	D						
2.60	ES						
				End of Excavation	3.00		43.96

Excavation

Plant	14 Tonne Excavator	Width (B)	0.65
Date	22/07/2020	Length (C)	4.40
Shoring	None.	Orientation	090 deg
		Date Backfilled	22/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks AGS Trial Pit terminated at 3.00m at scheduled depth.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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TRIAL PIT RECORD *Trial Pit*

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit	TPL115
				Project No	PE201646
Client	DORTON GROUP	National Grid Coordinates	259468.877 E 55306.054 N	Ground Level	48.38 m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.30	HV		Av=37kPa
0.50	HV		Av=74kPa
0.60	B		mc=29%
0.60	D		mc=26%
0.60	ES		
1.00	B		
1.00	D		
2.00	B		
2.00	D		
2.00	ES		
3.00	B		
3.00	D		

Strata

Scale 1:30

Description	Depth	Legend	Level m OD
Soft to firm brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is very angular to subangular fine to coarse quartz and slate. [RESIDUAL SOIL] Between 0.00 and 0.20m, Abundant rootlets.	G.L.	1	48.38
Light grey and brown mottled orange slightly sandy silty GRAVEL with a medium cobble content. Sand is fine to coarse. Gravel is very angular to angular fine to coarse slate. Cobbles are very angular to angular slate. [RESIDUAL SOIL] Between 1.80 and 3.00m, Gravel and cobbles are extremely weak and decompose to silt.	1.80	2	46.58
End of Excavation	3.00		45.38

Excavation

Plant	14 Tonne Excavator	Width (B)	0.65
Date	22/07/2020	Length (C)	4.30
Shoring	None.	Orientation	180 deg
		Date Backfilled	22/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks Trial Pit terminated at 3.00m at scheduled depth.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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TRIAL PIT RECORD *Trial Pit*

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit / Project No	TPL116 / PE201646
Client	DORTON GROUP	National Grid Coordinates	259515.470 E, 55270.632 N	Ground Level	47.86 m OD

Scale 1:30

Samples and Tests				Strata			
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		47.86
0.70	B			Soft to firm brown slightly sandy slightly gravelly CLAY/SILT. Sand is fine to coarse. Gravel is very angular to subangular fine to coarse slate and quartz. [RESIDUAL SOIL]			
0.70	D						
0.70	ES			Between 0.00 and 0.20m, Abundant rootlets.		1	
1.50	B				1.50		46.36
1.50	D			Orange, light grey and brown slightly sandy silty GRAVEL with a high cobble content. Sand is fine to coarse. Gravel is very angular to subangular fine to coarse slate. Cobbles are very angular to subangular slate. [RESIDUAL SOIL]			
1.50	ES						
				From 1.50 to 3.00m, Gravel and cobbles strengthen with depth becoming extremely weak to weak.		2	
3.00	B				3.00		44.86
3.00	D			End of Excavation			

Excavation

Plant	14 Tonne Excavator	Width (B)	0.65
Date	22/07/2020	Length (C)	4.35
Shoring	None.	Orientation	180 deg
Stability	Stable during excavation.	Date Backfilled	22/07/2020

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks: Trial Pit terminated at 3.00m at scheduled depth.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

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TRIAL PIT RECORD — Trial Pit

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit / Project No	TPL117 / PE201646
Client	DORTON GROUP	National Grid Coordinates	259522.296 E, 55238.942 N	Ground Level	50.23 m OD

Samples and Tests

Depth	Type	Stratum No	Results
0.15	ES		
0.80	B		
0.80	D		mc=11%
1.60	B		
1.60	D		
1.60	ES		
3.00	B		
3.00	D		

Strata

Scale 1:30

Description	Depth	Legend	Level m OD
Soft brown slightly sandy slightly gravelly CLAY/ SILT. Sand is fine to coarse. Gravel is very angular to subangular fine to coarse slate and quartz.	G.L.	1	50.23
Between 0.00 and 0.20m, Abundant rootlets.	0.40		49.83
Orange, light grey and brown slightly sandy to sandy silty GRAVEL. Sand is fine to coarse. Gravel is very angular to subangular fine to coarse slate and quartz. [RESIDUAL SOIL]		2	
Orange, light grey and brown slightly sandy silty GRAVEL with a high cobble content. Sand is fine to coarse. Gravel is very angular to subangular fine to coarse slate and quartz. Cobbles are very angular to angular slate. [RESIDUAL SOIL]	1.10		49.13
From 1.10 to 3.00m, Gravel and cobbles becoming very weak to weak.		3	
End of Excavation	3.00		47.23

Excavation

Plant	14 Tonne Excavator	Width (B)	0.65
Date	22/07/2020	Length (C)	4.50
Shoring	None.	Orientation	180 deg
		Date Backfilled	22/07/2020
Stability	Slight collapse.		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks: Trial Pit terminated at 3.00m at scheduled depth.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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TRIAL PIT RECORD *Trial Pit*

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit	TPL118
				Project No	PE201646
Client	DORTON GROUP	National Grid Coordinates	259574.443 E 55242.304 N	Ground Level	49.48 m OD

Scale 1:30

Samples and Tests				Strata			
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		49.48
0.10	ES			Brown sandy very silty GRAVEL. Sand is fine to coarse. Gravel is very angular to subangular fine to coarse slate and quartz. [RESIDUAL SOIL]			
0.30	B		mc=14%				
0.30	D		mc=13%				
0.30	ES			Between 0.00 and 0.40m, Abundant rootlets.		1	
					0.90		48.58
				Orange, light grey and brown silty sandy GRAVEL with a high cobble and boulder content. Sand is fine to coarse. Gravel is very angular to subangular fine to coarse slate and quartz. Cobbles and boulders are very angular to angular slate. [RESIDUAL SOIL]			
				From 0.90 to 2.00m, Gravel, cobbles and boulders becoming very weak to weak.		2	
1.70	B						
1.70	D						
					2.00		47.48
				End of Excavation			

Excavation

Plant	14 Tonne Excavator	Width (B)	0.65
Date	22/07/2020	Length (C)	4.10
Shoring	None.	Orientation	090 deg
		Date Backfilled	22/07/2020
Stability	Collapse below 1.00m.		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks Trial Pit terminated at 2.00m depth due to pit walls collapsing.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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TRIAL PIT RECORD — Trial Pit

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit	TPL119
				Project No	PE201646
Client	DORTON GROUP	National Grid Coordinates	259663.191 E 55256.803 N	Ground Level	47.37 m OD

Scale 1:30

Samples and Tests				Strata			
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		47.37
0.30	B		mc=23%	Soft to firm brown slightly sandy slightly gravelly SILT. Sand is fine to coarse. Gravel is very angular to angular fine to coarse slate and quartz. [RESIDUAL SOIL]			
0.30	D		mc=24%				
0.30	ES			Between 0.00 and 0.25m, Abundant rootlets.			
0.30	HV		Av=64kPa				
0.40	HV		Av=111kPa	From 0.40m, Stiff.			
0.60	HV		Av=94kPa				
						1	
					1.60		45.77
1.70	B			Orange, light grey and brown slightly sandy silty GRAVEL with a high cobble content. Sand is fine to coarse. Gravel is very angular to subangular fine to coarse slate. Cobbles are very angular to subangular slate. [RESIDUAL SOIL]			
1.70	D						
1.70	ES			From 1.60 to 3.00m, Gravel and cobbles becoming extremely weak to weak.			
						2	
3.00	B				3.00		44.37
3.00	D			End of Excavation			

Excavation

Plant	14 Tonne Excavator	Width (B)	0.65
Date	22/07/2020	Length (C)	4.40
Shoring	None.	Orientation	090 deg
		Date Backfilled	22/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks AGS Trial Pit terminated at 3.00m at scheduled depth.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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TRIAL PIT RECORD *Trial Pit*

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit	TPL120
				Project No	PE201646
Client	DORTON GROUP	National Grid Coordinates	259545.356 E 55172.043 N	Ground Level	58.48 m OD

Scale 1:30

Samples and Tests				Strata			
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		58.48
0.40	B			MADE GROUND: Soft brown slightly sandy slightly gravelly silt. Sand is fine to coarse. Gravel is very angular to subrounded fine to coarse slate, flint, brick, concrete and quartz.		1	
0.40	D		mc=22%	Between 0.00 and 0.15m, Abundant rootlets.			
0.40	ES				0.60		57.88
0.90	B			MADE GROUND: Dark grey mottled orange, light grey and brown sandy clayey gravel with a high cobble and boulder content. Sand is fine to coarse. Gravel is very angular to subrounded fine to coarse slate, flint, brick, concrete, quartz, asphalt and limestone. Cobbles are very angular to subangular slate, concrete, brick, marble and asphalt. Boulders are angular to subangular concrete.			
0.90	D						
0.90	ES			Between 1.20 and 1.40m, Layer of reworked slate.			
1.50	B					2	
1.50	D			At 1.80m, 300 x 500mm steel sheet visible.			
				Between 2.00 and 2.80m, Rebar.			
					2.80		55.68
				End of Excavation			

Excavation

Plant	14 Tonne Excavator	Width (B)	0.65
Date	23/07/2020	Length (C)	4.00
Shoring	None.	Orientation	090 deg
		Date Backfilled	23/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks AGS Trial Pit terminated at 2.80m depth due to concrete obstruction.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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TRIAL PIT RECORD *Trial Pit*

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit	TPL121
				Project No	PE201646
Client	DORTON GROUP	National Grid Coordinates	259576.420 E 55168.931 N	Ground Level	58.31 m OD

Scale 1:30

Samples and Tests				Strata			
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		58.31
				MADE GROUND: Soft brown very sandy silty gravel. Sand is fine to coarse. Gravel is very angular to subrounded fine to coarse flint, slate, quartz and brick. Between 0.00 and 0.15m, Abundant rootlets. Between 0.75 and 0.80m, Layer of brick.		1	
1.00	B						
1.00	D						
1.00	ES				1.10		57.21
1.20	B			MADE GROUND: Dark grey mottled orange, light grey and brown sandy clayey gravel with a high cobble content. Gravel is very angular to subangular fine to coarse brick, concrete, slate, quartz and plastics. Cobbles are very angular to subangular brick, concrete and slate. Between 1.30 and 1.40m, Layer of concrete. Between 2.00 and 2.20m, Layer of reworked slate.		2	
1.20	D						
1.20	ES						
3.00	B				3.00		55.31
3.00	D			End of Excavation			

Excavation

Plant	14 Tonne Excavator	Width (B)	0.65
Date	23/07/2020	Length (C)	4.05
Shoring	None.	Orientation	090 deg
		Date Backfilled	23/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks AGS Trial Pit terminated at 3.00m at scheduled depth.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

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TRIAL PIT RECORD *Trial Pit*

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit / Project No	TPL122 / PE201646
Client	DORTON GROUP	National Grid Coordinates	259647.911 E, 55171.557 N	Ground Level	56.82 m OD

Scale 1:30

Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		56.82
				MADE GROUND: Brown sandy silty gravel Sand is fine to coarse. Gravel is very angular to subangular fine to coarse slate, flint and quartz. **Between 0.00 and 0.15m, Abundant rootlets.**		1	
1.00	B						
1.00	D		mc=9.6%				
1.00	ES						
2.00	B				2.00		54.82
2.00	D			**MADE GROUND: Orange, light grey and brown slightly sandy silty gravel. Sand is fine to coarse. Gravel is very angular to subangular fine to coarse slate and quartz.**		2	
2.00	ES						
					2.90	3	53.92
				MADE GROUND: Very soft to stiff multicoloured slightly sandy gravelly clay. Sand is fine to coarse. Gravel is very angular to subrounded fine to coarse slate, quartz, concrete, brick, sandstone and lignite. Cobbles are very angular to subrounded concrete, brick and slate. **Between 2.90 and 3.00m, Black vertical bands of organic material.**	3.00		53.82
				End of Excavation			

Excavation

Plant	14 Tonne Excavator	Width (B)	0.65
Date	23/07/2020	Length (C)	4.00
Shoring	None.	Orientation	090 deg
Stability	Stable during excavation.	Date Backfilled	23/07/2020

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks: Trial Pit terminated at 3.00m at scheduled depth.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

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TRIAL PIT RECORD *Trial Pit*

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit	TPL123
				Project No	PE201646
Client	DORTON GROUP	National Grid Coordinates	259726.565 E 55126.426 N	Ground Level	64.00 m OD

Samples and Tests

Depth	Type	Stratum No	Results
1.00	B		
1.00	D		mc=8.0%
1.00	ES		
2.00	B		
2.00	D		
2.00	ES		
3.00	B		
3.00	D		

Strata

Scale 1:30

Description	Depth	Legend	Level m OD
	G.L.		64.00
MADE GROUND: Multicoloured sandy silty gravel with a high cobble content. Sand is fine to coarse. Gravel is very angular to subrounded fine to coarse slate, quartz, brick, asphalt, wood and plastic. Cobbles are very angular to subangular slate, brick and concrete. Between 0.00 and 0.10m, Abundant rootlets. Between 0.50 and 0.60m, Brick layer (cobbles). Between 1.70 and 1.90m, Concrete layer (cobbles).		1	
End of Excavation	3.00		61.00

Excavation

Plant	14 Tonne Excavator	Width (B)	0.65
Date	24/07/2020	Length (C)	4.20
Shoring	None.	Orientation	090 deg
Stability	Stable during excavation.	Date Backfilled	24/07/2020

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks AGS Trial Pit terminated at 3.00m at scheduled depth.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

Logged by PR
Checked by MAK
Figure 1 of 1
06/01/2021

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TRIAL PIT RECORD *Trial Pit*

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit	TPL124
				Project No	PE201646
Client	DORTON GROUP	National Grid Coordinates	259704.335 E 55136.178 N	Ground Level	64.15 m OD

Scale 1:30

Samples and Tests				Strata			
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		64.15
				MADE GROUND: Multicoloured very sandy silty gravel with a high cobble content. Gravel are very angular to subrounded fine to coarse slate, quartz, brick, asphalt, wood and plastic. Cobbles are very angular to subangular slate, brick, concrete and asphalt.			
0.50	B			**Between 0.00 and 0.05m, Abundant rootlets.**			
0.50	D						
0.50	ES			**Between 0.50 and 1.50m, Band of black asphalt (gravel and cobbles). Hydrocarbon odour.**			
1.00	B					1	
1.00	D						
1.00	ES						
2.00	B						
2.00	D				2.10		62.05
				End of Excavation			

Excavation

Plant	14 Tonne Excavator	Width (B)	0.65
Date	24/07/2020	Length (C)	4.35
Shoring	None.	Orientation	180 deg
		Date Backfilled	24/07/2020
Stability	Stable during excavation.		

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks AGS **Trial Pit terminated at 2.10m due to concrete obstruction.**

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

Logged by PR
Checked by MAK
Figure 1 of 1
06/01/2021

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TRIAL PIT RECORD *Trial Pit*

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit / Project No	TPL125 / PE201646
Client	DORTON GROUP	National Grid Coordinates	259686.404 E, 55118.624 N	Ground Level	63.88 m OD

Scale 1:30

Samples and Tests				Strata			
Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		63.88
				MADE GROUND: Multicoloured gravelly silty fine to coarse sand with a high cobble content. Gravel is very angular to subrounded fine to coarse slate, quartz, concrete, brick, asphalt, glass, wood, plastic and sandstone. Cobbles are very angular to subangular slate, concrete, brick and asphalt.			
0.50	B						
0.50	D			Between 0.00 and 0.05m, Abundant rootlets.			
0.50	ES						
				Occasional rebar throughout.			
				Hydrocarbon odour present.			
				At 1.00m, Rubber hydraulic hosing.			
1.50	B					1	
1.50	D			Between 1.50 and 2.20m, Layer of asphalt (cobbles and gravels).			
1.50	ES						
2.00	B						
2.00	D						
				Between 2.80 and 3.00m, Concrete at east end of pit.			
				End of Excavation	3.00		60.88

Excavation

Plant	14 Tonne Excavator	Width (B)	0.65
Date	24/07/2020	Length (C)	4.30
Shoring	None.	Orientation	090 deg
Stability	Stable during excavation.	Date Backfilled	24/07/2020

Groundwater

Depth Observed	Depth of Pit	Details
		Groundwater was not encountered during pitting.

Remarks: Trial Pit terminated at 3.00m at scheduled depth.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

Logged by PR
Checked by MAK
Figure 1 of 1
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TRIAL PIT RECORD — Trial Pit

Project	GROUND INVESTIGATION FOR AN INERT LANDFILL AT CHALLONSLEIGH FARM	Engineer	ATKINS GLOBAL	Trial Pit / Project No	TPW101 / PE201646
Client	DORTON GROUP	National Grid Coordinates	259565.845 E, 54996.649 N	Ground Level	55.35 m OD

Scale 1:30

Depth	Type	Stratum No	Results	Description	Depth	Legend	Level m OD
					G.L.		55.35
0.20	ES			MADE GROUND: Multicoloured sandy clayey gravel with a high cobble content and a medium boulder content. Sand is fine to coarse. Gravel and cobbles are very angular to subrounded fine to coarse of brick, limestone, asphalt, concrete with metals, plastics and rubber tubing. Boulders are angular to subangular.			
				From 0.40m, Darkens with depth from grey to blackish grey, becoming very clayey.			
1.30	B						
1.30	D						
1.30	ES						
1.80	B						
1.80	D						
				From 2.00m, Light grey. Boulders becoming more frequent.			
3.00	B				3.00		52.35
3.00	D			End of Excavation			

Excavation

Plant	14 Tonne Excavator	Width (B)	1.35
Date	24/07/2020	Length (C)	3.35
Shoring	None.	Orientation	180 deg
Stability	Some spalling.	Date Backfilled	24/07/2020

Groundwater

Depth Observed	Depth of Pit	Details
0.40		Seepage from side of pit.

Remarks: Trial Pit terminated at 3.00m at scheduled depth.
A Soakaway Test was carried at 3.00m depth - results are presented separately.

Symbols and abbreviations are explained on the accompanying key sheet.

All dimensions are in metres.

Logged in accordance with BS5930:2015

Logged by PR
Checked by MAK
Figure 1 of 1
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APPENDIX 9

Trial Pit Photos

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



TPL101 Pit



TPL101 Spoil

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



TPL102 Pit



TPL102 Spoil

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



TPL103 Pit



TPL103 Spoil

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Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



TPL104 Pit



TPL104 Spoil

PHOTOGRAPHS

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



TPL105 Pit



TPL105 Spoil

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



TPL106 Pit



TPL106 Spoil

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



TPL107 Pit



TPL107 Spoil

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



TPL108 Pit



TPL108 Spoil

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



TPL109 Pit



TPL109 Spoil

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



TPL110 Pit



TPL110 Spoil

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



TPL111 Pit



TPL111 Spoil

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



TPL112 Pit



TPL112 Spoil

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



TPL113 Pit



TPL113 Spoil

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



TPL114 Pit



TPL114 Spoil

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



TPL115 Pit



TPL115 Spoil

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



TPL116 Pit



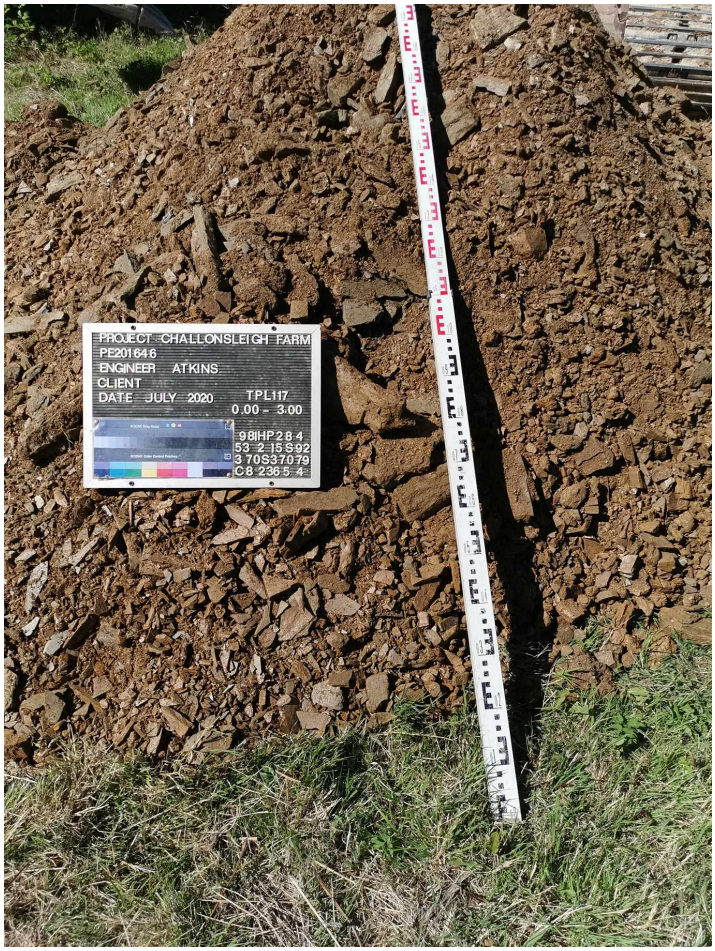
TPL116 Spoil

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



TPL117 Pit



TPL117 Spoil

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Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



TPL118 Pit



TPL118 Spoil

Project Number : PE201646

Project : Ground Investigation for an Inert Landfill at Challonsleigh Farm



TPL119 Pit



TPL119 Spoil