

**A417 Missing Link**  
**Geotechnical Ground Investigations:**  
**Phase 1**  
**Archaeological Watching Brief**  
**Excavation Report**  
**PCF Stage 2**

HE551505-MMSJV-HER-000-RP-LH-00014

February 2019

### **Notice**

This document has been prepared on behalf of Highways England by Mott MacDonald Sweco JV for Highways England's Collaborative Delivery Framework (CDF). It is issued for the party which commissioned it and for specific purposes connected with the above-captioned project only. It should not be relied upon by any other party or used for any other purpose. Mott MacDonald Sweco JV accepts no responsibility for the consequences of this document being relied upon by any other party, or being used for any other purpose, or containing any error or omission which is due to an error or omission in data supplied to us by other parties.

This document contains confidential information and proprietary intellectual property. It should not be shown to other parties without consent from Highways England.

Highways England Programme Leader: Andrew Alcorn  
Highways England Project Manager: Michael Goddard  
Mott MacDonald Sweco Joint Venture Project Manager: Mark Casey  
PCF STAGE 2 Supplier: Mott MacDonald Limited - Sweco Limited Joint Venture

## Document control

Client	Highways England
Project	A417 Missing Link
Document title	Geotechnical Ground Investigations: Phase 1 Archaeological Watching Brief Excavation Report
Job no.	HE551505
Document reference	HE551505-MMSJV-HER-000-RP-LH-0014

## Revision history

Job number: HE551505			Document ref: HE551505-MMSJV-HER-000-RP-LH-0014			
Revision	Purpose description	Originator	Checked	Approved	Authorised	Date
1	First draft	E Dennis	J Sugrue	M Hopper		17/04/19

### Prepared for:

Highways England  
Temple Quay House  
2 The Square  
Temple Quay  
Bristol  
BS1 6HA

### Prepared by:

Mott MacDonald Sweco Joint Venture  
Stoneham Place  
Stoneham Lane  
Southampton  
Hampshire  
SO50 9NW

## Table of contents

1.	Introduction	1
1.2.	Archaeological Watching Brief	1
2.	Baseline conditions	3
2.1.	Site location	3
2.2.	Topography and geology	3
2.3.	Archaeological and historic overview	3
3.	Detailed Methodology	4
3.1.	General	4
3.2.	Health and Safety	4
3.3.	Staffing	4
3.4.	Programme	4
3.5.	Procedure	4
3.6.	Recording	4
4.	Results	6
4.1.	Roman Road	6
4.2.	Air Balloon Car Park	7
4.3.	Star College	11
5.	Conclusions	14

## Figures

Figure 1: Location of the boreholes	1
Figure 2: Test Pit 1	6
Figure 3: Test Pit 2	7
Figure 4: Test Pit 3	8
Figure 5: Test Pit 4	9
Figure 6: Test Pit 7	10
Figure 7: Test Pit 8	11
Figure 8: Test Pit 5	12
Figure 9: Test Pit 6	13

# 1. Introduction

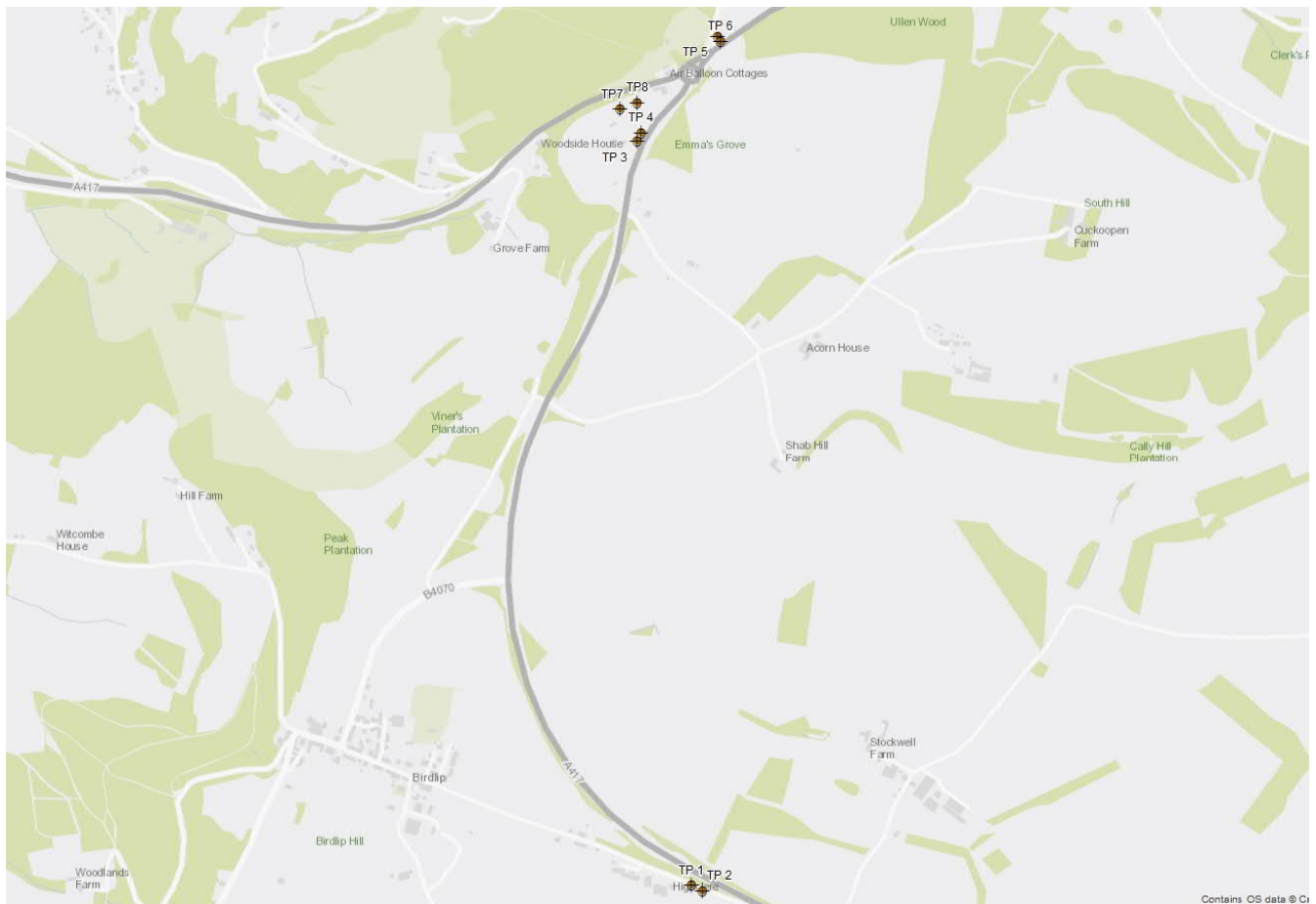
1.1.1. This excavation report sets out results of an archaeological watching brief that was undertaken during ground investigation (GI) works as part of the A417 Missing Link scheme. The GI took place as part of permitted development and was not subject to the requirements of planning policy. The report has been prepared by Mott MacDonald Sweco Joint Venture (MMSJV) on behalf of Highways England (HE).

1.1.2. This document details the method, resources, results and conclusions of the watching brief, to comply with the Chartered Institute of Archaeologists' (CIfA) *Standard guidance for an archaeological watching brief* (2014).

## 1.2. Archaeological Watching Brief

1.2.1. The archaeological watching brief took place during the excavation of two hand excavated inspection pits at four locations, as shown in Figure 1. An additional two test pits were later monitored at one of the previous locations. The GI works were programmed to adequately characterise geo-environmental risks and to

Figure 1: Location of the boreholes





---

inform subsequent design developments for the scheme. The purpose of the archaeological watching brief was to understand and characterise areas of unknown archaeological potential.

- 1.2.2. Two test pits were dug on Roman Road: DS/RC 415 (hereby referred to as Test Pit 1) and OH 416 (hereby referred to as Test Pit 2). Seven test pits were dug in the Air Balloon overflow car park and surrounding land parcel, four of which were monitored: OH 405 (hereby referred to as Test Pit 3), DS/RC 406 (hereby referred to as Test Pit 4), RC508 (hereby referred to as Test Pit 7) and DS/RC 303 (hereby referred to as Test Pit 8). Two test pits were dug in the land to the southwest of Star College: OH 407 (hereby referred to as Test Pit 5) and DS/RC 408 (hereby referred to as Test Pit 6).
- 1.2.3. All elements of the archaeological watching brief were carried out by a suitably qualified MMSJV archaeologist in accordance with the relevant Chartered Institute for Archaeologist's (CIfA) guidance<sup>1</sup>. The MMSJV archaeologist held CIfA Membership to practitioner level, as well as the relevant fieldwork experience. The investigations helped identify areas of archaeological potential around the scheme, which will help manage the archaeological risks associated with these during design stage. The principle contractor for the GI works was responsible for the preparation of Health and Safety documentation, which the MMSJV archaeologist adhered to.

---

<sup>1</sup> CIfA, 2014 *Standard and guidance for an archaeological watching brief* [online] available at: [https://www.archaeologists.net/sites/default/files/CIfAS&GWatchingbrief\\_2.pdf](https://www.archaeologists.net/sites/default/files/CIfAS&GWatchingbrief_2.pdf) (last accessed April 2019)

---

## 2. Baseline conditions

### 2.1. Site location

- 2.1.1. The scheme is located around the Air Balloon roundabout, located along the A417 in Birdlip, Gloucestershire, c. 6km to the west of Gloucester (NGR 393488 216109). The landscape is dominated by the Cotswold escarpment which drops down to the Severn Valley to the west.

### 2.2. Topography and geology

- 2.2.1. According to the British Geological Survey (BGS) mapping, the three locations of the GI are not underlain by superficial deposits. The bedrock of the area is characterised by rocks of the Jurassic period comprising (from oldest to youngest) the Lias Group, the Inferior Oolite Group and the Great Oolite Group. The escarpment is a significant feature on the landscape defined by the Jurassic Limestone Outcrop at the crest. The top of the escarpment is underlain by the Great and Inferior Oolite Groups. All three of the GI locations, along the top of the escarpment, are underlain by the Inferior Oolite Group (the Inferior Oolite is the main scarp-forming rock in this area of the Cotswolds).

### 2.3. Archaeological and historic overview

- 2.3.1. A cultural heritage desk-based assessment was undertaken in 2018 by MMSJV as part of the A417 Missing Link Stage 2 Environmental Assessment Report to understand the potential impact of the two options of the scheme on the historic environment<sup>2</sup>. The assessment details the archaeological and historical background of the area; there is evidence for human activity dating from the Mesolithic through to the modern period across the scheme. The three sites that have been identified for archaeological monitoring are considered to have a high potential for containing deposits of archaeological interest. The location of Test Pits 1 and 2 is considered to be an area of potential associated with Ermin Way, the Roman road that connected Gloucester with Cirencester. The location of Test Pits 3, 4, 7 and 8 are 90m west of the Scheduled Monument Emma's Grove; the scheduled monument comprises three round barrows of potential Bronze Age date. The GI may therefore potentially encounter deposits of archaeological interest associated with the prehistoric monument. The location of Test Pits 5 and 6 is an area of archaeological potential associated with cropmarks recorded in the Gloucestershire Historic Environment Record.

---

<sup>2</sup> MMSJV, 2018 *A417 Missing Link Environmental Assessment Report: PCF Stage 2* (HE551505-MMSJV-EGN-000-RP-LE-00004)

---

## 3. Detailed Methodology

### 3.1. General

- 3.1.1. All work was undertaken to the standards described in the ClfA's (2014) Standard and guidance for an archaeological watching brief. The MMSJV archaeologist followed ClfA's (2014) Code of Conduct.

### 3.2. Health and Safety

- 3.2.1. All relevant health and safety legislation was adhered to. The principal contractor on site retained overall responsibility for Health and Safety. The principal contractor produced a health and safety risk assessment as part of the GI-set up and distributed it to the MMSJV team. The risk assessment confirmed appropriate levels of PPE to be worn on site and other risk avoidance procedures. The MMSJV archaeologist adhered to all the health and safety related documents, as well as reading and signing the MMSJV Health and Safety Site Risk Assessment as part of the initial site induction.

### 3.3. Staffing

- 3.3.1. The archaeological watching brief was undertaken by one MMSJV archaeologist who was present on site each day of excavation, while the test pits were being excavated and prior to their backfilling.

### 3.4. Programme

- 3.4.1. The GI works commenced week beginning 14 January 2019, and then once a week until week beginning 28 January 2019. Additional test pits 7 and 8 were monitored later on 6 March 2019.

### 3.5. Procedure

- 3.5.1. Test Pits 1 and 2 were hand excavated by the principle contractor using a hydraulic breaker. Test Pits 3, 4, 5, 6, 7 and 8 were hand excavated by the principle contractor using insulated hand tools. The MMSJV archaeologist was able to enter the working area to carry out close inspection, record sections or create a photographic record.

### 3.6. Recording

- A photographic record was made throughout the GI works. The primary record was captured in digital images in uncompressed TIFF format using a DSLR

camera. This was done in accordance with Historic England (2015a) Digital Image Capture and Fire Storage guidance.

- A written record was kept of all site drawings and photograph records detailing site name, descriptions, north arrow, scale, orientation, date and compiler.

## 4. Results

### 4.1. Roman Road

#### *Test Pit 1*

- 4.1.1. Test Pit 1 was overlain with c. 0.15m tarmac, which was broken out by the principle contractor. Below the tarmac was a layer of orange sandy gravel, c. 0.15m in thickness, which overlay another layer of tarmac, which was approximately 0.3m thick. This, in turn, overlay c. 0.15m of orange gravelly sand, under which the natural geology was observed. The test pit was dug to a depth of 0.9m.
- 4.1.2. No deposits of archaeological interest were recorded and no finds were recovered from the test pit. The pit showed signs of repeated resurfacing of the road, which has likely compromised the survival of archaeological deposits. The layers of gravel were interpreted to be modern bedding layers that were deposited immediately prior to the tarmac of the road. As the natural geology was observed beneath the modern made ground, it can be concluded that the former Roman road does not survive in this location.

Figure 2: Test Pit 1





## Test Pit 2

- 4.1.3. Test Pit 2 was also overlain with c. 0.15m tarmac, which was also broken out. This overlay c. 0.1m of sandy gravel, under which was another layer of tarmac, which again was approximately 0.3m thick. The tarmac was underlain by 0.2m of an orange sandy-gravelly mix, under which was the natural geology. The test pit was dug to a depth of 0.9m.
- 4.1.4. No deposits of archaeological interest were recorded and no finds were recovered from the test pit. As in Test Pit 1, the pit showed signs of repeated resurfacing of the road, which has likely compromised the survival of archaeological deposits. The layers of gravel were interpreted to be a continuation of the modern bedding layers that were deposited immediately prior to the tarmac of the road. No evidence of Ermin Way was present within either test pit.

Figure 3: Test Pit 2



## 4.2. Air Balloon Car Park

### Test Pit 3

- 4.2.1. Test Pit 3 was overlain by c. 0.06m of topsoil, under which was c. 0.17m of made ground comprising red mudstone gravel. Below this, 0.5m of mid-dark brown silty

sandy clay was recorded. Within this deposit, flecks of charcoal were observed, but no finds were recovered. Below the deposit was a band of large blocks of white limestone, approximately 0.15m in depth, under which was c. 0.06m of a dark-mid brown silty sandy deposit, similar to the deposit prior to the limestone layer, and also contained flecks of charcoal. This overlay a clean deposit of orangey brown clay that contained no inclusions and continued to the limit of excavation; the pit was dug to a depth of 1.2m.

- 4.2.2. The made ground comprising red mudstone was considered to be of modern date and in relation to the construction of the Air Balloon overflow car park in the modern period. The deposit below this resembled pit fill, but with no finds within the deposit it was not possible to date on site. The band of limestone blocks, no doubt quarried from the surrounding landscape, is potentially of interest as it is possibly the result of human activity. The limestone could represent a masonry feature, but produced no dateable finds.

Figure 4: Test Pit 3





## Test Pit 4

- 4.2.3. The first layer observed in Test Pit 4 was the same red mudstone gravel that was observed in Test Pit 3. This was recorded to a depth of c. 0.19m and contained ceramic inclusions of modern date. Below this was a thin band of brown clayey silt, which lay on top of c. 0.52m of brownish white limestone, which in turn overlay orangey brown sandy clay. The latter two deposits contained no inclusions and were considered to be natural geology. The test pit was dug to a depth of 1.2m.
- 4.2.4. No deposits of archaeological interest were recorded and no finds of historic interest were recovered. The red gravel was verified to be of modern date by the modern ceramic fragment that was observed. The thin band of brown silt that was observed likely represented a former topsoil that existed in the field before the gravel was deposited during the construction of the carpark.

Figure 5: Test Pit 4



## Test Pit 7

- 4.2.5. Test pit 7 was overlain with turf and topsoil to a depth of c. 0.15m, which comprised mid brown silt. Below the topsoil was a 0.2m thick layer of mid orangey-brown silty clay, which contained small flecks of charcoal and ceramic



building material (CBM). This overlay clean orangey-white gravel which was considered to be natural and continued to the depth of the test pit, which was 1.2m.

- 4.2.6. The excavation of the test pit was not monitored, so the spoil was retained and examined off site. No finds or inclusions of interest were observed. The flecks of charcoal and CBM in the second layer of the test pit are indicative of human activity. However, with no dateable finds recovered from the test pit, it is not possible to date the deposit.

Figure 6: Test Pit 7



### *Test Pit 8*

- 4.2.7. Test pit 8 was overlain with turf and topsoil to a depth of c. 0.1m, which comprised mid-brown silt and contained fragments of plastic. Below this was a mid-brown clayey silt deposit, which was c. 0.12m thick. This overlay the same orangey white gravel that was observed in Test Pit 7 and considered to be natural, which continued to the depth of the test pit at 1.2m.



- 4.2.8. The excavation of the test pit was monitored, and the excavated spoil was examined on site. A shard of glass was found in deposit overlaying the natural geology, which was considered to be of a late post-medieval/ modern date. No other finds or inclusions of archaeological interest were noted in the test pit.

Figure 7: Test Pit 8



### 4.3. Star College

#### *Test Pit 5*

- 4.3.1. Test pit 5 was overlain with turf and topsoil to a depth of c. 0.15m, which included roots and rocks. Below the topsoil was c. 0.26m of mid-brown clayey, sandy silt, which contained small pockets of orangey sand as well as several, sporadic large chunks of charred mineral. This deposit overlay a pale yellowy orange gravelly sand which contained large pale coloured rocks and was considered to be the natural geology. The pit was dug to a depth of 1.2m.



- 4.3.2. The second layer observed in the test pit, comprising brown silt, resembled pit fill. However, as no finds were recovered from the layer, it was not possible to determine a date. The chunks of charred mineral that were observed were difficult to identify without further analysis; it is possible that they were a byproduct of something resulting from human activity.

Figure 8: Test Pit 5



### *Test Pit 6*

- 4.3.3. Test Pit 6 was also overlain with turf and topsoil to a depth of c. 0.15m, which included rocks and roots. Below this was c. 0.42m of orange gravelly clay, which in turn overlay orangey white sandy gravel to a depth of 0.84, when excavation ceased. The latter two deposits were considered to be natural geology.
- 4.3.4. No deposits of archaeological interest were recorded, and no finds of historic interest were recovered. The test pit did not contain a similar pit fill to Test Pit 5, which was dug a few metres to the north-west.

Figure 9: Test Pit 6





---

## 5. Conclusions

- 5.1.1. The results of the test pits indicate that there is varying potential for deposits of archaeological interest in the locations of the scheme that were monitored.
- 5.1.2. Test Pit 1 and Test Pit 2 suggest that the repeated resurfacing of Roman Road has truncated potential remains of the former Roman road, Ermin Way. The former Roman road may yet remain preserved in other locations, however.
- 5.1.3. The test pits located in the vicinity of the Air Balloon showed varying signs of archaeological potential. Three out of the four test pits monitored exhibited varying levels of made ground, two of which contained charcoal, indicative of human activity. The layer of limestone blocks between two silty fills observed in Test Pit 3 could represent a man-made deposit or structure, but would require further investigation.
- 5.1.4. Test Pit 5 and Test Pit 6 in the land belonging to Star College also showed varying levels of archaeological potential, despite their close proximity. Test Pit 5 revealed c. 0.26m of made ground, whereas Test Pit 6 exhibited no made ground between the topsoil and the natural geology.
- 5.1.5. No remains of significant value were observed in any of the test pits monitored, and no dateable evidence was recovered from the excavated material, which has resulted in a limited understanding of the archaeology. The test pits do, however, provide scope for further investigation, particularly by the Air Balloon. Any future archaeological work would need to be undertaken in accordance with an approved Written Scheme of Investigation (WSI).

## Appendix A

### A417 Missing Link Ground Investigation: Factual Report on Ground Investigation



HE551505 A417 MISSING LINK GROUND  
INVESTIGATION

FACTUAL REPORT ON  
GROUND INVESTIGATION

Prepared for OSBORNE

Report Ref: 34888

**Geotechnical Engineering Ltd**

Centurion House, Olympus Park  
Quedgeley, Gloucester. GL2 4NF

01452 527743

[www.geoeng.co.uk](http://www.geoeng.co.uk)





# HE551505 A417 MISSING LINK GROUND INVESTIGATION

## FACTUAL REPORT ON GROUND INVESTIGATION

Prepared for OSBORNE

Report Ref: 34888

PROJECT: Road realignment

CONSULTANT: Mott MacDonald Sweco JV

VOLUME - VERSION	STATUS	ORIGINATOR	CHECKER	APPROVED	DATE
1 of 1 – A	DRAFT	EL	CT	-	02/04/2019
<b>ORIGINATOR</b>			<b>APPROVER</b>		

The report is not to be used for contractual or engineering purposes unless this sheet is signed and the report designated "Final".

The report has been prepared for the sole use and reliance by Osborne. GEL accepts no liability as a result of the use or reliance of this report by any other parties.





---

## CONTENTS

<b>REPORT</b>	<b>PAGE</b>
1. INTRODUCTION .....	1
2. SITE LOCATION AND GEOLOGY .....	1
3. GROUND INVESTIGATION .....	2
3.1 Fieldwork .....	2
3.2 Logging.....	4
3.3 Chemical Analyses.....	5
4. REFERENCES .....	6

<b>FIGURES</b>	<b>Nos.</b>
EXPLORATORY HOLE LOCATION PLAN	1

## APPENDICES

APPENDIX A	FIELDWORK DATA
APPENDIX B	CHEMICAL ANALYSES



## **1. INTRODUCTION**

It is proposed to realign the A417 carriageway at Birdlip, Gloucestershire. Geotechnical Engineering Limited (GEL) was instructed by Osborne (the Client) to carry out an investigation to determine the ground conditions.

The scope of works and terms and conditions of appointment were specified by the Client and GEL correspondence reference T29042 dated 24<sup>th</sup> October 2018. The investigation was carried out under the direction and supervision of the Client. Mott MacDonald Sweco Joint Venture (the Consultant) provided the specification and technical support to the Client.

This report describes the investigation and presents the findings.

## **2. SITE LOCATION AND GEOLOGY**

The site is situated adjacent to the A417 carriageway between the Air Balloon roundabout in the north and the Cowley roundabout to the south between National Grid co-ordinates SO 935 162 and SO 936 139 respectively.

British Geological Survey (BGS) England and Wales (Sheet No. 234, Gloucester 1:50,000, dated 1975) and the BGS online geology (1:50,000) indicate the site is underlain by the Inferior Oolite Group across much of the site and the Great Oolite Group over the Inferior Oolite Group in the south. Landslip material is shown to the west and multiple faults trending northwest-southeast are shown to dissect the site. Made Ground was anticipated at surface due to existing land use.



### **3. GROUND INVESTIGATION**

#### **3.1 Fieldwork**

The fieldwork was carried out in general accordance with BS5930:2015 during the period 7<sup>th</sup> January to 12<sup>th</sup> February 2019 and comprised eight boreholes.

The exploratory hole locations were selected by the Consultant and set out by this Company and are shown on Figure 1. The ground level and co-ordinates at each exploratory hole were established by this Company using GPS techniques.

The boreholes, referenced DSRC404, DSRC406, DSRC408, DSRC415 and DSRC419 (Appendix A), were formed using a track-mounted Geotechnical Pioneer Rig. Initially, the surface hardstanding at boreholes DSRC404 and DSRC419 was rotary core drilled. An inspection pit was hand excavated at each borehole location to a maximum depth of 1.20m to check for buried services. Disturbed samples were taken and retained in a combination of plastic tubs, bags and glass jars. Heavy duty dynamic sampling techniques were then employed to produce a continuous disturbed sample of 112mm nominal diameter. The samples were recovered in semi-rigid plastic liner.

On refusal to dynamic sampling, the boreholes were continued by Geobor S wireline rotary drilling techniques utilising a water flush. An inner barrel assembly, incorporating a semi-rigid plastic liner, is deployed down the borehole and is latched onto the outer barrel/casing to recover continuous cores of 102mm diameter. The outer barrel acts as the casing ensuring the hole is fully cased at all times. Borehole DSRC404 was rotary core drilled to 36.00m and then continued using rotary open-hole drilling techniques to 100.50m.

The dynamic samples and rotary core were extracted horizontally from the sampler and core barrel respectively, the semi-rigid liner was cut to length and caps placed at each end to retain



moisture content. All samples and core were retained in sequence in labelled, wooden coreboxes.

Clean drilling techniques were required in DSRC415 to protect the underlying formation. Initially, 200mm diameter casing was installed and a 2.20m thick bentonite seal placed within the casing. The bentonite was allowed to cure for an hour prior to sampling through the bentonite with a 168mm diameter casing string and advancing the borehole.

Standard penetration tests (SPT) were carried out within the superficial deposits in general accordance with BS EN ISO 22476-3:2005+A1:2011. A split barrel was used and the split barrel samples retained in airtight jars. The SPT N value was taken as the number of blows to penetrate the 300mm test drive following a 150mm seating drive. Where low penetration was recorded the seating drive was terminated at 25 blows and the test drive completed after a further 50 blows. Detailed SPT results, together with the energy ratio ( $E_r$ ), are presented in Appendix A and summarised as uncorrected N values on the borehole logs.

The boreholes, referenced OH405, OH407 and OH416 (Appendix A), were formed using a track-mounted Geotechnical Pioneer Rig. Initially, the surface hardstanding at OH416 was rotary core drilled. An inspection pit was then hand excavated at each borehole location to a maximum depth of 1.20m to check for buried services. Disturbed samples were taken and retained in a combination of plastic tubs, bags and glass jars. The boreholes were then continued by rotary open hole drilling techniques utilising a water flush.

All boreholes were monitored for groundwater ingress as the boreholes were advanced. Upon encountering water in DSRC415 and DSRC419, drilling was temporarily stopped to allow the level to stabilise. Water levels were also recorded at the start and finish of each day's work and on completion of the borehole and are presented on the relevant log.



On completion, each borehole was flushed with clean water and a slotted standpipe installed. Each standpipe consisted of a 50mm ID HDPE slotted tube set in a granular filter medium and sealed above and below with a cement:bentonite plug (OH416 was sealed above only). The installations were protected at the surface by a lockable stopcock cover set in concrete. Installation details are given on the relevant borehole log. Subsequent water level readings are tabulated in Appendix A.

Prior to water sampling, the water monitoring standpipes were purged until at least three well volumes of water had been removed. Temperature, dissolved oxygen levels, pH, resistivity, conductivity, dissolved solids, salinity and redox potential readings were also taken at various levels during well development and the readings are presented in Appendix A.

Diver type data loggers were installed within the monitoring wells of each borehole. The data logger is designed to measure pressure and temperature at regular intervals for extended periods. The measurements are subsequently stored within the internal memory of the data logger. Readings downloaded from the instrument are summarised in Appendix A.

Samples for chemical analyses were dispatched daily to i2 Analytical Limited under a Chain of Custody. The remaining samples were brought to this Company's laboratory for storage.

### **3.2 Logging**

The logging of soils and rocks was carried out by an Engineering Geologist in general accordance with BS5930:2015. A key to the exploratory hole logs is presented in Appendix A.

Detailed descriptions of the core and samples are given in the borehole logs, Appendix A, along with details of sampling, in situ testing, groundwater ingress, installations and relevant comments on drilling techniques.



---

Suitable core subsamples were selected by the logging engineer. The core was carefully logged and prepared prior to preserving the subsample by wrapping in clingfilm and tinfoil and coating with at least three layers of wax. The sample was further protected by a covering of waxed cheesecloth, labelled and transported horizontally in padded, wooden coreboxes.

Prior to logging, photographs of the core were taken and are presented separately.

### **3.3 Chemical Analyses**

Selected soil and water samples were despatched to i2 Analytical Limited, where chemical analyses were carried out to in-house methods for a suite of contaminants. The results are presented in Appendix B.

## **GEOTECHNICAL ENGINEERING LIMITED**



---

#### **4. REFERENCES**

British Standards Institution (2015): Code of practice for ground investigations. BS 5930:2015.

British Standards Institution (2016): Methods of test for soils for civil engineering purposes – Part 1: General requirements and sample preparation. BS1377-1:2016.

British Standards Institution (2012): Geotechnical investigation and testing. Field testing. Standard penetration test. BS EN ISO 22476-3:2005+A1:2011.

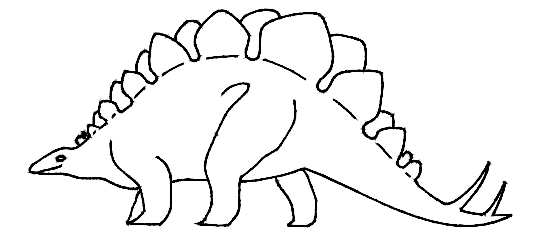


Key.



Notes:

Drawing supplied by the Consultant



**geotechnical**  
Geotechnical Engineering Ltd

Centurion House, Olympus Park, Quedgeley,  
Gloucester GL2 4NF  
Telephone: (01452) 527743 Facsimile: (01452) 729314  
E-mail: [geotech@geoeng.co.uk](mailto:geotech@geoeng.co.uk) Web: [www.geoeng.co.uk](http://www.geoeng.co.uk)

Client:

OSBORNE

Consultant:

MOTT MACDONALD SWECO JV

Site:

HE551505 A417 MISSING LINK GROUND INVESTIGATION

Title:

EXPLORATORY HOLE LOCATION PLAN

Drawn By:

ELe

Checked By:

EC

Paper Size:

A3

Scale:

1:10,000

Date:

Feb 2019

Contract:

34888

Figure:

01





---

# **APPENDIX A**

## **FIELDWORK DATA**



### Sample type

D Small disturbed	U Undisturbed	L Dynamic	ES Environmental - soil	Cs Core subsample (prepared)
B Bulk disturbed	UT Undisturbed thin wall	C Core	EW Environmental - water	Ls Dynamic subsample (prepared)
LB Large bulk disturbed	P Piston	W Water		

### Test type

- S SPT - Split spoon sampler followed by uncorrected SPT 'N' Value
- C SPT - Solid cone followed by uncorrected SPT 'N' Value
- (\*250 - Where full test drive not completed, linearly extrapolated 'N' value reported, \*\* - Denotes no effective penetration)
- H Hand vane - direct reading in kPa - not corrected for BS1377 (1990). Re\* denotes refusal
- M Mackintosh probe - number of blows to achieve 100mm penetration
- Mx Mexe cone - average reading of equivalent CBR value in %
- PP Pocket penetrometer - direct reading in kg/sq.cm
- Vo Headspace vapour reading, uncorrected peak values in ppm, using a PID (calibrated with Isobutylene, using a 10.6eV bulb)

### Sample/core range/l<sub>i</sub>

| Dynamic sample

|

█ Undisturbed sample - open drive including thin wall. Symbol length reflects recovery

x x = Total Core Recovery (TCR) as percentage of core run

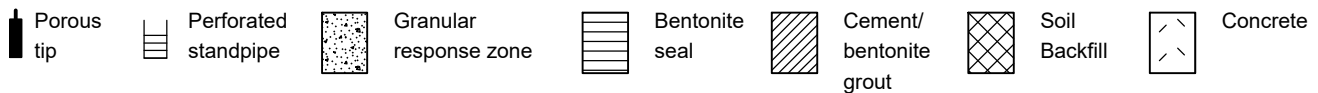
y y = Solid Core Recovery (SCR) as percentage of core run. Assessment of core is based on full diameter.

z z = Rock Quality Designation (RQD). The amount of solid core greater than 100mm expressed as percentage of core run.

Where SPT has been carried out at beginning of core run, disturbed section of core excluded from SCR and RQD assessment.

l<sub>i</sub> - fracture spacing - the modal fracture spacing (mm) over the indicated length of core. Where spacing varies significantly, the minimum, mode and maximum values are given. NI = non-intact core NA = not applicable

### Instrumentation



### Stratum boundaries



### Logging

The logging of soils and rocks has been carried out in general accordance with BS 5930:2015.

Chalk is logged in general accordance with Lord et al (2002) CIRIA C574. Where possible, dynamic samples in chalk have been logged in accordance with CIRIA C574; descriptions and gradings (if presented) should be treated with caution given the potential for sample disturbance.

For rocks the term fracture has been used to identify a mechanical break within the core. Where possible incipient and drilling induced fractures have been excluded from the assessment of fracture state. Where doubt exists, a note has been made in the descriptions. All fractures are considered to be continuous unless otherwise reported.

Made Ground is readily identifiable when, within the material make up, man made constituents are evident. Where Made Ground appears to be reworked natural material the differentiation between in situ natural deposits and Made Ground is much more difficult to ascertain. The interpretation of Made Ground within the logs should therefore be treated with caution.

The descriptors "topsoil" and "tarmacadam" are used as generic terms and do not imply conformation to any particular standard or composition.

Rootlets are defined as being less than 2mm in diameter, roots are defined as in excess of 2mm diameter.

### General Comments

The process of drilling and sampling will inevitably lead to disturbance, mixing or loss of material in some soil and rocks.

Indicated water levels are those recorded during the process of drilling or excavating exploratory holes and may not represent standing water levels.

All depths are measured along the axis of the borehole and are related to ground level at the point of entry. All inclinations are measured normal to the axis of the core.

Where provided, the stratigraphic names/geological rock units are for guidance only and may not be wholly accurate.

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC404**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 1 of 21

Start Date 7 January 2019 Easting 393207.0

Scale 1 : 25

End Date 17 January 2019 Northing 215566.0 Ground level 269.00mOD

Depth 100.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
07/01/19 1605hrs	1C	0.00 - 0.17			100			MADE GROUND comprising black TARMACADAM.	0.17	268.83	[Cross-hatched pattern]
	1ES	0.17 - 0.30									
	2B	0.17 - 0.30						Yellowish brown sandy subangular and subrounded fine to coarse limestone and sandstone GRAVEL. (MADE GROUND)	0.30	268.70	[Cross-hatched pattern]
07/01/19 1700hrs Dry	3D	0.17 - 0.30			100				0.40	268.60	[Cross-hatched pattern]
	4C	0.30 - 0.40							0.45	268.55	[Cross-hatched pattern]
	2ES	0.45 - 0.50						MADE GROUND comprising black TARMACADAM.			
08/01/19 0800hrs Dry	5B	0.45 - 0.50						Dark grey sandy angular and subangular fine to coarse tarmacadam and crystalline GRAVEL. (MADE GROUND)			[Stippled pattern]
	6D	0.45 - 0.50						Yellowish brown very sandy subangular fine to coarse limestone GRAVEL.			[Stippled pattern]
	7L	0.50 - 1.00						0.50 - 0.70m: Orangish brown.			[Stippled pattern]
	3ES	0.90 - 1.00	1.00	S 18				1.00m: Medium dense.			[Stippled pattern]
	8D	1.00 - 1.45			96			1.00 - 1.50m: Fines probably washed away.			[Stippled pattern]
08/01/19 1240hrs 1.00m									1.50	267.50	[Stippled pattern]
09/01/19 0825hrs Dry	10C	1.50 - 3.00	1.50		83 79 49	30 100 130		Medium strong light yellowish brown oolitic LIMESTONE. Fractures are subhorizontal to 20° very closely and closely spaced undulating rough and planar smooth infilled (up to 1mm) with white calcite. (BLPL)			[Brick pattern]
								1.80 - 1.90m: 80° planar rough fracture.			[Brick pattern]
	11C	3.00 - 4.50	3.00		100 100 95						[Brick pattern]
					80 280 400			Medium strong light yellowish brown medium and coarse grained oolitic LIMESTONE. Fractures are subhorizontal to 30° closely and medium spaced planar rough locally stained orangish brown and frequently infilled (up to 1mm) with white calcite. (BLPL)	3.45	265.55	[Brick pattern]
								Continued Next Page	{4.00}		[Brick pattern]

EQUIPMENT: Geotechnical Pioneer rig.  
 METHOD: Rotary core drilled (300mm) 0.00-0.17m and 0.30-0.40m. Hand dug inspection pit 0.17-0.30m and 0.40-0.50m. Dynamic sampled (128mm) 0.50-1.00m. Waterflush rotary core drilled (146mm wireline) 1.50-36.00m. Waterflush rotary open hole drilled (146mm wireline) 36.00-100.50m  
 CASING: 168mm diam to 1.50m and 140mm diam to 100.50m.  
 BACKFILL: On completion, downhole geophysical survey carried out 0.00-69.00m. Borehole backfilled with bentonite pellets 100.50-44.00m, cement:bentonite pellets 44.00-34.00m. A slotted standpipe (50mm) with geosock was installed to 33.50m, granular response zone 34.00-23.00m, bentonite seal 23.00-22.00m, cement:bentonite grout 22.00-18.00m, cement:bentonite pellets 18.00-16.00m, gravel 16.00-7.00m, bentonite pellets 7.00-5.00m, cement:bentonite grout 5.00-3.00m, cement:bentonite pellets 3.00-0.50m, concrete and stopcock cover 0.50-0.00m. Installation completed on 28/01/2019.  
 REMARKS: Driller notes loss of flush returns 1.50-75.00m.  
 EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks		<b>CONTRACT</b> <b>34888</b>	<b>CHECKED</b>
				Groundwater not encountered prior to use of water flush.			

Geotechnical Engineering Ltd, Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:17 JC EL

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC404**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 2 of 21

Start Date 7 January 2019 Easting 393207.0

Scale 1 : 25

End Date 17 January 2019 Northing 215566.0 Ground level 269.00mOD

Depth 100.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	12C	4.50 - 6.00	4.50		100 100 100						
	13Cs	5.60 - 6.00						5.40 - 5.90m: Frequent shell fragments (up to 30mm).			
	14C	6.00 - 7.50	6.00		100 91 91	40 230 420		Weak to medium strong thinly laminated to very thinly bedded light yellowish brown medium and coarse oolitic LIMESTONE with frequent thin and thick laminae of light grey limestone. Fractures are subhorizontal to 10° very closely to medium spaced planar smooth and rough frequently stained dark orangish brown. (BLPL) 6.00 - 6.10m: Subvertical planar rough fracture stained dark orangish brown.	5.90	263.10	
	15C	7.50 - 9.00	7.50		85 68 63			6.70 - 6.80m: 50° planar rough fracture.  7.30 - 7.40m: 60° planar rough fracture.  7.50 - 8.10m: Subvertical to 80° undulating rough fracture stained dark orangish brown.			
	16Cs	8.40 - 8.80						8.30 - 8.40m: 60° planar rough fracture stained dark orangish brown.			
Continued Next Page									{9.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:17 JC EL

water strike (m) casing (m) rose to (m) time to rise (m) remarks  
Groundwater not encountered prior to use of water flush.



CONTRACT  
**34888**

CHECKED

# BOREHOLE LOG



**DSRC404**

CLIENT OSBORNE

Sheet 3 of 21

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Scale 1 : 25

Start Date 7 January 2019 Easting 393207.0

End Date 17 January 2019 Northing 215566.0 Ground level 269.00mOD Depth 100.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	17C	9.00 - 10.50	9.00		93 57 25		NI 120 270	Medium strong light yellowish brown frequently mottled light greyish white LIMESTONE with frequent shell fragments (up to 30mm) and rare burrows (up to 30mm) infilled with sparitic calcite. Fractures are subhorizontal to 20° very closely to medium spaced undulating rough locally stained dark orangish brown and locally infilled with yellowish brown clay. (BLPL) 9.05 - 9.20m: 60° planar rough fracture. 9.05 - 9.40m: Fractures are randomly orientated extremely closely to very closely spaced planar rough. 9.50 - 9.60m: Frequent veins and pockets of dark orangish brown ironstone (up to 30mm).	9.05	259.95	
	18C	10.50 - 12.00	10.50		100 100 76			10.45 - 10.50m: 40° planar smooth fracture. 10.60 - 10.75m: Subvertical undulating rough fracture.			
	19Cs	10.90 - 11.15									
	20C	12.00 - 13.50	12.00		69 40 23			11.45 - 11.50m: 45° planar rough fracture. 12.00 - 12.15m: 80° planar rough fracture. 12.20 - 12.30m: Subvertical planar rough fracture. 12.55 - 12.65m: 80° planar rough fracture.			
	21C 22Cs	13.50 - 15.00 13.60 - 13.95	13.50		96 80 75			12.70 - 12.90m: Stained orangish brown. Rare angular dark orangish brown ironstone. Fractures are randomly orientated extremely closely to closely spaced undulating rough infilled with dark orangish brown cement. 12.90 - 13.50m: Assessed zone of core loss. 13.50 - 13.65m: 70° planar rough fracture. 13.60 - 13.70m: Rare thin laminae of dark orangish brown limestone. 13.60 - 14.60m: Burrow mottled grey.			
Continued Next Page									{14.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888 GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:17 JC EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC404**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 4 of 21

Start Date 7 January 2019 Easting 393207.0

Scale 1 : 25

End Date 17 January 2019 Northing 215566.0 Ground level 269.00mOD

Depth 100.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
								14.10 - 14.15m: 30° undulating rough fracture. 14.15 - 14.35m: 80° planar rough fracture.			
								14.40 - 14.60m: 80° planar rough fracture.			
								14.55 - 14.60m: Frequent veins and pockets of dark orangish brown ironstone (up to 30mm). 14.55 - 14.80m: Locally weak stained dark orangish brown.	14.70	254.30	
	23C	15.00 - 16.50	15.00		38 9 9	NI NI 140		Weak to medium strong dark orangish brown medium and coarse grained LIMESTONE with abundant shell fragments (up to 5mm). Fractures are subhorizontal to subvertical very closely and closely spaced planar rough. (BLPL)	15.00	254.00	
								Weak to medium strong light yellowish brown medium and coarse grained bioclastic LIMESTONE recovered non intact. (BLPL)			
								NO RECOVERY. Assessed zone of core loss (assumed core scrubbed).	15.60	253.40	
	24C	16.50 - 18.00	16.50		43 43 43	130 130 360		Weak to medium strong light yellowish brown medium and coarse grained bioclastic LIMESTONE with rare greyish brown limestone intraclasts (up to 40mm). Bioclasts are whole and fragmented shells, corals and peloids. Bedding fractures are subhorizontal to 20° closely to medium spaced undulating rough. (BLPL) 16.50 - 17.35m: Subvertical to 80° undulating rough fracture.	16.50	252.50	
								NO RECOVERY. Assessed zone of core loss (assumed core scrubbed).	17.35	251.65	
	25C	18.00 - 19.50	18.00		32 19 19	NI NI 350		Medium strong light greyish brown fine and medium grained oolitic LIMESTONE. (BLPL) 18.00 - 18.15m: Recovered non intact (assumed drilling disturbed). 18.25 - 18.35m: 70° planar rough fracture.	18.00	251.00	
								NO RECOVERY. Assessed zone of core loss (assumed core scrubbed).	18.50	250.50	
								Continued Next Page	{19.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:18 JC EL

water strike (m) casing (m) rose to (m) time to rise (m) remarks  
Groundwater not encountered prior to use of water flush.



CONTRACT  
**34888**

CHECKED

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC404**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 5 of 21

Start Date 7 January 2019 Easting 393207.0

Scale 1 : 25

End Date 17 January 2019 Northing 215566.0 Ground level 269.00mOD

Depth 100.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	26C	19.50 - 21.00	19.50		97 83 0	NI NI 130		Weak to medium strong light yellowish brown medium grained LIMESTONE locally disintegrated to firm dark yellowish brown gravelly clay. Gravel is subangular to rounded fine to coarse limestone lithorelicts. Abundant shell fragments (up to 20mm), subrounded peloids (up to 15mm) and subrounded ooids (up to 10mm). Fractures are subhorizontal to 20° and 80° to subvertical extremely closely to closely spaced planar and undulating rough. (BLPL)	19.50	249.50	
	27C	21.00 - 22.50	21.00		81 65 35			20.45 - 20.70m: 80° very closely spaced planar rough fractures.			
						NI 70 340		Medium strong thinly to medium bedded light yellowish brown medium and coarse LIMESTONE with frequent shell fragments (up to 5mm), frequent rounded peloids (up to 5mm) and frequent burrows (up to 40mm) infilled with dark orangish brown clay. Locally disintegrated to dark yellowish brown gravelly clay. Gravel is subrounded fine and medium limestone. Fractures are subhorizontal to 20° very closely to medium spaced planar and undulating rough locally weakened (up to 30mm). (BLPL)	21.85	247.15	
09/01/19 1620hrs Dry	28C	22.50 - 24.00	22.50		100 95 78			22.05 - 22.10m: 80° planar rough fracture.			
10/01/19 0800hrs Dry	29Cs	23.65 - 24.00				70 280 510		Strong thickly laminated to thinly bedded light orangish brown and yellowish brown medium and coarse shelly LIMESTONE with rare burrows (up to 20mm). Shells are whole and fragmented (up to 5mm). Fractures are	23.65	245.35	
								Continued Next Page	{24.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:18 JC EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC404**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 6 of 21

Start Date 7 January 2019 Easting 393207.0

Scale 1 : 25

End Date 17 January 2019 Northing 215566.0 Ground level 269.00mOD

Depth 100.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	30C	24.00 - 25.50	24.00		97 97 93			subhorizontal to 20° closely to widely spaced planar rough and undulating rough locally weakened (up to 10mm) and stained dark orangish brown. (BLPL) 23.65 - 24.00m: Dark orangish brown with frequent elongated voids (up to 10mm).			
	31C	25.50 - 27.00	25.50		100 97 87			24.75m: Subhorizontal undulating rough incipient fracture.  25.90 - 26.30m: 80° intersecting incipient fractures.			
	32C 33Cs	27.00 - 28.50 27.00 - 27.50	27.00		99 91 87			26.30 - 26.50m: Subvertical planar rough fracture. 26.55 - 26.70m: Frequent subrounded and elongated voids infilled with dark orangish brown clay cement. 26.90 - 26.95m: Coarse grained with abundant shells (up to 5mm).			
	34C	28.50 - 30.00	28.50		85 82 69			26.90 - 26.95m: Coarse grained with abundant shells (up to 5mm).  Medium strong light yellowish brown medium grained oolitic LIMESTONE locally with subrounded burrows (up to 30mm) infilled with dark orangish brown cemented clay. Fractures are subhorizontal to 10° very closely to medium spaced planar rough locally stained dark orangish brown. (BLPL) 27.55 - 27.90m: 80° to subvertical undulating rough fracture stained dark orangish brown. 27.90 - 28.00m: Locally disintegrated to dark orangish brown clay.  28.40 - 29.30m: 80° to subvertical undulating rough fracture stained dark orangish brown.	27.50	241.50	
Continued Next Page									{29.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:18 JC EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks
				Groundwater not encountered prior to use of water flush.



CONTRACT  
**34888**

CHECKED



# BOREHOLE LOG



CLIENT OSBORNE

**DSRC404**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 7 of 21

Start Date 7 January 2019 Easting 393207.0

Scale 1 : 25

End Date 17 January 2019 Northing 215566.0 Ground level 269.00mOD

Depth 100.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	35C	30.00 - 31.50	30.00		99 97 91			29.75 - 29.80m: Subvertical planar rough fracture.  Medium strong to strong light yellowish brown fine and medium shelly LIMESTONE with abundant interconnected burrows (up to 40mm) infilled with dark orangish brown clay cement. Shells are whole and fragmented (up to 60mm). Fractures are subhorizontal to 10° closely to medium spaced undulating rough locally infilled with dark orangish brown clay. (BLPL)	29.80	239.20	
	36Cs	30.95 - 31.50				750		Strong light yellowish brown medium and coarse oolitic LIMESTONE (BLPL) 30.95 - 31.05m: Frequent spherical voids (up to 30mm) infilled with dark orangish brown clay.	30.95	238.05	
	37C	31.50 - 33.00	31.50		100 96 96			31.60 - 31.70m: Rare spherical voids (up to 20mm) infilled with dark orangish brown cement.  Medium strong light yellowish brown fine and medium locally shelly LIMESTONE with abundant locally interconnected burrows (up to 50mm) infilled with dark orangish brown slightly sandy clay. Fractures are subhorizontal to 20° closely to widely spaced stepped rough locally stained dark orangish brown. (BLPL)	31.70	237.30	
								32.60 - 32.80m: Extremely weak to weak dark orangish brown calcareous fine sandstone.			
	38C	33.00 - 34.50	33.00		94 94 81			32.90 - 33.10m: Extremely weak to weak dark orangish brown calcareous fine sandstone.			
	39Cs	33.65 - 34.10									
Continued Next Page									{34.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:19 JC EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks
				Groundwater not encountered prior to use of water flush.

	<b>CONTRACT</b> <b>34888</b>	<b>CHECKED</b>
--	---------------------------------	----------------

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC404**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 8 of 21

Start Date 7 January 2019 Easting 393207.0

Scale 1 : 25

End Date 17 January 2019 Northing 215566.0 Ground level 269.00mOD

Depth 100.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	40C 41Cs	34.50 - 36.00 34.50 - 34.80	34.50		91 75 37				34.90	234.10	
	42C	36.00 - 37.50	36.00		99 69 41			Extremely weak thinly and thickly laminated dark grey, light grey and dark yellowish brown MUDSTONE with closely spaced thin laminae and pockets (up to 20mm) of reddish brown and orangish brown ironstone. Locally tending to very stiff clay. Incipient bedding fractures are subhorizontal to 10° extremely closely and very closely spaced planar smooth. Fractures are subhorizontal to 10° very closely to closely spaced planar smooth. (BDS) 34.90 - 35.30m: Thinly and thickly laminated with yellowish brown fine sand and ironstone. 35.50 - 35.60m: 80° to subvertical extremely closely spaced undulating smooth fractures. 35.75m: Thin lamination of fragmented ironstone. 36.05m: 30° planar smooth fracture with dark orangish brown penetrative staining (20mm from fracture surface). Extremely weak and weak thinly bedded dark orangish brown and orangish brown fine SANDSTONE locally disintegrated to dark orangish brown and orangish brown sand. Bedding fractures are subhorizontal to 10° closely spaced planar rough. (BDS) 36.65 - 36.85m: Stiff orangish brown very sandy clay. 36.85 - 36.95m: Thinly cross laminated. 36.85 - 37.30m: 80° to subvertical very closely spaced planar smooth fractures locally stained dark orangish brown infilled with ironstone. 37.00m: Very thin bed of orangish brown clayey fine sand. 37.30 - 37.40m: Subvertical planar smooth fracture recovered non intact. 37.45m: Thin lamination of dark reddish brown ironstone.	36.15	232.85	
10/01/19 1610hrs Dry											
11/01/19 0800hrs Dry	C	37.50 - 39.00	37.50		0			OPEN HOLE DRILLED. Driller notes clay with mudstone bands.	37.50	231.50	
Continued Next Page									{39.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:19 JC EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC404**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 9 of 21

Start Date 7 January 2019 Easting 393207.0

Scale 1 : 25

End Date 17 January 2019 Northing 215566.0 Ground level 269.00mOD

Depth 100.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	C	39.00 - 40.50	39.00		0						
	C	40.50 - 42.00	40.50		0						
	C	42.00 - 43.50	42.00		0						
	C	43.50 - 45.00	43.50		0						

DRAFT

Continued Next Page

{44.00}

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:19 JC EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC404**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 10 of 21

Start Date 7 January 2019 Easting 393207.0

Scale 1 : 25

End Date 17 January 2019 Northing 215566.0 Ground level 269.00mOD

Depth 100.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	C	45.00 - 46.50	45.00		0						
	C	46.50 - 48.00	46.50		0						
	C	48.00 - 49.50	48.00		0						
Continued Next Page									{49.00}		

Geotechnical Engineering Ltd, Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:20 JC EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC404**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 11 of 21

Start Date 7 January 2019 Easting 393207.0

Scale 1 : 25

End Date 17 January 2019 Northing 215566.0 Ground level 269.00mOD

Depth 100.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	C	49.50 - 51.00	49.50		0						
	C	51.00 - 52.50	51.00		0						
	C	52.50 - 54.00	52.50		0						
Continued Next Page									{54.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:20 JC EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC404**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 12 of 21

Start Date 7 January 2019 Easting 393207.0

Scale 1 : 25

End Date 17 January 2019 Northing 215566.0 Ground level 269.00mOD

Depth 100.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
11/01/19 1620hrs 40.11m  14/01/19 0800hrs 43.81m	C	54.00 - 55.50	54.00		0						
	C	55.50 - 57.00	55.50		0						
	C	57.00 - 58.50	57.00		0						
	C	58.50 - 60.00	58.50		0						
Continued Next Page									{59.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:20 JC EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC404**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 13 of 21

Start Date 7 January 2019 Easting 393207.0

Scale 1 : 25

End Date 17 January 2019 Northing 215566.0 Ground level 269.00mOD

Depth 100.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
14/01/19 1500hrs 41.00m											
15/01/19 0830hrs 42.60m	C	60.00 - 61.50	60.00		0						
	C	61.50 - 63.00	61.50		0						
15/01/19 1520hrs 39.00m											
16/01/19 0800hrs 38.63m	C	63.00 - 64.50	63.00		0						
Continued Next Page									{64.00}		

DRAFT

Geotechnical Engineering Ltd, Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:20 JC EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC404**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 14 of 21

Start Date 7 January 2019 Easting 393207.0

Scale 1 : 25

End Date 17 January 2019 Northing 215566.0 Ground level 269.00mOD

Depth 100.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	C	64.50 - 66.00	64.50		0						
	C	66.00 - 67.50	66.00		0						
	C	67.50 - 69.00	67.50		0						
Continued Next Page									{69.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:21 JC EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			



# BOREHOLE LOG



CLIENT OSBORNE

**DSRC404**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 15 of 21

Start Date 7 January 2019 Easting 393207.0

Scale 1 : 25

End Date 17 January 2019 Northing 215566.0 Ground level 269.00mOD

Depth 100.50 m


progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	C	69.00 - 70.50	69.00		0						
	C	70.50 - 72.00	70.50		0						
	C	72.00 - 73.50	72.00		0						
	C	73.50 - 75.00	73.50		0						

DRAFT

Continued Next Page

{74.00}

Geotechnical Engineering Ltd, Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:21 JC EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		<b>CONTRACT</b> <b>34888</b>	<b>CHECKED</b>
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC404**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 16 of 21

Start Date 7 January 2019 Easting 393207.0

Scale 1 : 25

End Date 17 January 2019 Northing 215566.0 Ground level 269.00mOD

Depth 100.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
16/01/19 1630hrs 16.85m											
17/01/19 0820hrs 22.10m	C	75.00 - 76.50	75.00		0						
	C	76.50 - 78.00	76.50		0						
	C	78.00 - 79.50	78.00		0						
Continued Next Page									{79.00}		

DRAFT

Geotechnical Engineering Ltd, Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:21 JC EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		<b>CONTRACT</b> <b>34888</b>	<b>CHECKED</b>
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC404**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 17 of 21

Start Date 7 January 2019 Easting 393207.0

Scale 1 : 25

End Date 17 January 2019 Northing 215566.0 Ground level 269.00mOD

Depth 100.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	C	79.50 - 81.00	79.50		0						
	C	81.00 - 82.50	81.00		0						
	C	82.50 - 84.00	82.50		0						
Continued Next Page									{84.00}		

DRAFT

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:22 JC EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC404**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 18 of 21

Start Date 7 January 2019 Easting 393207.0

Scale 1 : 25

End Date 17 January 2019 Northing 215566.0 Ground level 269.00mOD

Depth 100.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	C	84.00 - 85.50	84.00		0						
	C	85.50 - 87.00	85.50		0						
	C	87.00 - 88.50	87.00		0						
	C	88.50 - 90.00	88.50		0						

DRAFT

Continued Next Page

{89.00}

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:22 JC EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		<b>CONTRACT</b> <b>34888</b>	<b>CHECKED</b>
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC404**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 19 of 21

Start Date 7 January 2019 Easting 393207.0

Scale 1 : 25

End Date 17 January 2019 Northing 215566.0 Ground level 269.00mOD

Depth 100.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	C	90.00 - 91.50	90.00		0						
	C	91.50 - 93.00	91.50		0						
	C	93.00 - 94.50	93.00		0						
Continued Next Page									{94.00}		

Geotechnical Engineering Ltd, Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:22 JC EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC404**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 20 of 21

Start Date 7 January 2019 Easting 393207.0

Scale 1 : 25

End Date 17 January 2019 Northing 215566.0 Ground level 269.00mOD

Depth 100.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	C	94.50 - 96.00	94.50		0						
	C	96.00 - 97.50	96.00		0						
	C	97.50 - 99.00	97.50		0						
Continued Next Page									{99.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:22 JC EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC404**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 21 of 21

Start Date 7 January 2019 Easting 393207.0

Scale 1 : 25

End Date 17 January 2019 Northing 215566.0 Ground level 269.00mOD

Depth 100.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend	
17/01/19 1220hrs 40.90m	C	99.00 - 100.50	99.00		0				100.50	168.50		
								Borehole completed at 100.50m.				
<p>water strike (m) casing (m) rose to (m) time to rise (m) remarks</p> <p>Groundwater not encountered prior to use of water flush.</p>											<p>CONTRACT</p> <p><b>34888</b></p>	<p>CHECKED</p>

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:23 JC EL

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC406**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 1 of 13

Start Date 22 January 2019 Easting 393384.0

Scale 1 : 25

End Date 28 January 2019 Northing 216009.0 Ground level 238.65mOD

Depth 60.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend				
22/01/19 1300hrs	1B	0.10 - 0.20						Stiff red and brown slightly sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse mudstone, siltstone, crystalline and limestone. (MADE GROUND)	0.20	238.45					
	1ES	0.10 - 0.20													
	2D	0.10 - 0.20													
	3B	0.30 - 0.40													
	2ES	0.30 - 0.40													
	4D	0.30 - 0.40													
	5B	0.50 - 0.60													
	3ES	0.50 - 0.60													
	6D	0.50 - 0.60													
	7B	1.00 - 1.20													
22/01/19 1650hrs 1.97m	4ES	1.00 - 1.20					Firm orange slightly gravelly CLAY. Gravel is subangular and subrounded fine and medium limestone and mudstone.	0.90	237.75						
	8D	1.00 - 1.20													
	9D	1.20 - 1.65	Nil	S 15											
	10L	1.20 - 2.00													
	11D	1.60 - 1.70													
	23/01/19 0810hrs 2.00m	12D	2.00 - 2.45	2.00	S 30							Firm dark orangish brown slightly sandy gravelly CLAY with a low oolitic limestone cobble content. Gravel is angular and subangular fine to coarse oolitic limestone.	1.20	237.45	
		13L	2.00 - 3.00												
		14D	2.80 - 2.90												
	23/01/19 0810hrs 2.00m	15D	2.90 - 3.38									Medium dense to dense light yellowish brown and orangish brown slightly sandy clayey angular and subangular medium and coarse oolitic limestone GRAVEL with a medium subangular oolitic limestone cobble content.	1.90	236.75	
		16C	3.00 - 4.50												
14D		2.80 - 2.90													
15D		2.90 - 3.38	3.00	S*67											
23/01/19 0810hrs 2.00m	16C	3.00 - 4.50			97 37 29	NI	Medium strong light yellowish brown fine and medium LIMESTONE recovered non intact. Fractures are probably subhorizontal and subvertical very closely spaced planar rough infilled (up to 20mm) with dark orangish brown sandy clay. (BLPL)	3.10	235.55						
	14D	2.80 - 2.90													
	15D	2.90 - 3.38	3.00	S*67											
23/01/19 0810hrs 2.00m	16C	3.00 - 4.50			140 300	NI	Strong thickly laminated to medium bedded light yellowish brown oolitic LIMESTONE. Fractures are subhorizontal to 20° closely and medium spaced planar rough and locally infilled (up to 30mm) with dark orangish brown sandy clay. (BLPL)	3.60	235.05						
	16C	3.00 - 4.50													
Continued Next Page									{4.00}						

EQUIPMENT: Geotechnical Pioneer rig.  
 METHOD: Hand dug inspection pit 0.00-1.20m. Dynamic sampled (128mm) 1.20-3.00m. Rotary core drilled utilising a water flush (146mm wireline) 3.00-60.00m.  
 CASING: 168mm diam to 3.00m and 140mm diam to 60.00m.  
 BACKFILL: On completion, borehole backfilled with cement-bentonite pellets 60.00-50.00m, gravel 50.00-45.00m and cement-bentonite pellets 45.00-35.00m.  
 A slotted standpipe (50mm) was installed to 34.00m, granular response zone 35.00-20.50m, bentonite seal 20.50-19.00m, cement-bentonite grout 19.00-9.00m, gravel 9.00-5.00m, cement-bentonite grout 5.00-0.50m, concrete and stopcock cover at 0.50-0.00m.  
 REMARKS: Driller notes flush returns reduced between 3.00-4.50m (approx. 10% returned) and loss of flush returns between 4.50-60.00m. Polymer added to waterflush 57.50-60.00m.  
 EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:35 JC EL



# BOREHOLE LOG



**DSRC406**

CLIENT OSBORNE

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 2 of 13

Start Date 22 January 2019 Easting 393384.0

Scale 1 : 25

End Date 28 January 2019 Northing 216009.0 Ground level 238.65mOD

Depth 60.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
								3.70 - 4.10m: 70° undulating rough fracture.			
	17C	4.50 - 6.00	4.50		100 55 40			4.40 - 4.65m: 70° planar rough fracture infilled with orangish brown calcite cement (up to 1mm).			
								5.25 - 5.90m: 70° to subvertical undulating rough fracture locally infilled (up to 20mm) with dark orangish brown sandy clay.			
								5.60 - 5.90m: 70° to subvertical undulating rough fracture.			
	18C	6.00 - 7.50	6.00		100 67 55			5.90 - 6.00m: Orangish brown. 6.00 - 6.15m Coarse grained.			
								6.25 - 6.35m: 70° planar rough fracture.			
								6.45 - 6.85m: 80° to subvertical planar rough fracture locally infilled (up to 10mm) with light orangish brown sandy clay.			
	19Cs	6.95 - 7.25						6.85 - 6.90m: Recovered non intact as subangular fine and medium limestone gravel.			
	20C	7.50 - 9.00	7.50		97 55 55			7.50 - 7.90m: 80° to subvertical undulating rough fracture stained dark orangish brown.			
								8.35 - 8.40m: 80° planar rough fracture.			
	21Cs	8.45 - 8.75						8.60 - 8.75m: Frequent elongated burrows (up to 10mm).	8.75	229.90	
								Strong thinly laminated to thinly bedded light orangish brown oolitic LIMESTONE. Fractures are subhorizontal to 20° very closely to medium spaced planar rough and			
								Continued Next Page	{9.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:36 JC EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC406**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 3 of 13

Start Date 22 January 2019

Easting 393384.0

Scale 1 : 25

End Date 28 January 2019

Northing 216009.0 Ground level 238.65mOD

Depth 60.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	22C	9.00 - 10.50	9.00		97 76 58			locally infilled (up to 30mm) with orangish brown sandy clay. (BLPL) 8.75 - 9.25m: Subvertical planar rough fracture infilled (30mm) with dark orangish brown sandy clay.			
	23Cs	9.35 - 9.65						9.50 - 9.65m: Frequent elongated burrows (up to 40mm). 9.65 - 9.70m: Subvertical planar rough fracture.			
	24C	10.50 - 12.00	10.50		100 55 48			10.10 - 10.15m: 80° planar rough incipient fracture. 10.15 - 10.35m: Frequent 70° to subvertical white calcite veins (up to 5mm thick). 10.65 - 10.70m: 80° planar rough fracture. 10.85 - 10.95m: Disintegrated to firm orangish brown slightly gravelly sandy clay. Gravel is subangular fine and medium limestone. 10.95 - 11.30m: Locally recovered non intact.	11.30	227.35	
	25C	12.00 - 13.50	12.00		97 17 17			Medium strong and strong light greyish brown LIMESTONE with frequent shell fragments (up to 10mm). Fractures are subhorizontal to 20° closely and medium spaced planar rough. (BLPL) 11.30 - 11.50m: 60° planar rough fracture. 11.45 - 11.55m: Recovered non intact (assumed drilling disturbed). 11.65 - 11.90m: 70° planar rough fracture. 12.15 - 12.25m: Recovered non intact (assumed drilling disturbed). 12.25 - 12.55m: 70° to subvertical undulating rough fracture.	12.55	226.10	
	26C	13.50 - 15.00	13.50		93 61 37			Weak and medium strong light brown fine and medium LIMESTONE with frequent shells and shell fragments (up to 20mm) including bivalves. Locally disintegrated to orangish brown clayey angular to subrounded fine to coarse limestone gravel. Fractures are subhorizontal to 10° extremely closely to closely spaced planar rough and 70° to subvertical planar rough. (BLPL) 12.75 - 13.35m: Frequent elongated burrows (up to 20mm) infilled with orangish brown sandy clay.			
Continued Next Page									{14.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:36 JC EL

water strike (m) casing (m) rose to (m) time to rise (m) remarks  
Groundwater not encountered prior to use of water flush.



CONTRACT  
**34888**

CHECKED

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC406**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 4 of 13

Start Date 22 January 2019 Easting 393384.0

Scale 1 : 25

End Date 28 January 2019 Northing 216009.0 Ground level 238.65mOD

Depth 60.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	27Cs	14.35 - 14.60					550	14.20 - 14.25m: Firm orangish brown slightly sandy clay.	14.25	224.40	[Brick pattern]
								Strong light yellowish brown medium and coarse shelly LIMESTONE with frequent burrows (up to 15mm) locally infilled with orangish brown sandy clay. (BLPL)			
	28C	15.00 - 16.50	15.00		87 34 25		NI 110 190	14.80 - 15.40m: Fractures are subhorizontal to 20° extremely closely to closely spaced planar rough.			[Brick pattern]
								15.15 - 15.25m: Disintegrated to dark orangish brown clayey subangular fine to coarse limestone gravel.	15.40	223.25	
	29C	16.50 - 18.00	16.50		83 43 27		NI NI 250	Medium strong light yellowish brown and orangish brown LIMESTONE with abundant burrows (up to 40mm) frequently infilled with dark orangish brown sandy clay and frequently disintegrated to dark orangish brown clayey angular and subangular fine to coarse limestone gravel. Fractures are subhorizontal to 20° very closely to medium spaced planar rough. (BLPL)			[Brick pattern]
								16.25 - 16.85m: Recovered non intact (assumed drilling disturbed).			
	30C	18.00 - 19.50	18.00		91 94 59		NR  NI 120 200	17.75 - 18.10m: Assessed zone of core loss.			[Brick pattern]
								Medium strong yellowish brown shelly ooidal and peloidal LIMESTONE. Shells are whole and fragmented (up to 30mm) and peloids are locally stained dark orangish brown. Fractures are subhorizontal to 20° very closely and closely spaced planar and undulating rough. (BLPL) 18.10 - 18.35m: 70° to subvertical undulating rough fracture with a veneer of dark orangish brown sandy clay. 18.80 - 18.90m: 50° planar rough fracture.	18.10	220.55	
								Continued Next Page	{19.00}		[Brick pattern]

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:36 JC EL

water strike (m) casing (m) rose to (m) time to rise (m) remarks  
Groundwater not encountered prior to use of water flush.

	<b>CONTRACT</b> <b>34888</b>	<b>CHECKED</b>
--	---------------------------------	----------------

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC406**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 5 of 13

Start Date 22 January 2019 Easting 393384.0

Scale 1 : 25

End Date 28 January 2019 Northing 216009.0 Ground level 238.65mOD

Depth 60.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	31Cs	19.25 - 19.45						19.15 - 19.25m: Abundant shells (up to 30mm).			
	32C	19.50 - 21.00	19.50		95 49 24			19.70 - 20.00m: Recovered non intact. Fractures are randomly orientated extremely closely to closely spaced planar rough. 20.10 - 22.10m: Frequently disintegrated to light brown and orangish brown clayey subrounded fine and medium peloids and subangular fine to coarse limestone gravel. 20.40 - 20.55m: 80° planar rough fracture stained dark orangish brown.	19.70	218.95	
	33C	21.00 - 22.50	21.00		82 31 26			20.90 - 21.30m: Assessed zone of core loss.			
	34Cs	22.10 - 22.50			400			21.30 - 21.80m: Recovered non intact (assumed drilling disturbed). 22.10 - 24.00m: Abundant burrows (up to 30mm) infilled with orangish brown sandy clay.			
	35C	22.50 - 24.00	22.50		88 45 35			22.50 - 24.00m: Fractures are subhorizontal to 20° very closely to medium spaced planar rough and locally stained dark orangish brown. 22.60 - 22.95m: 80° to subvertical undulating rough fracture.	24.00	214.65	
Continued Next Page									{24.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:37 JC EL

water strike (m) casing (m) rose to (m) time to rise (m) remarks  
Groundwater not encountered prior to use of water flush.



CONTRACT  
**34888**

CHECKED

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC406**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 6 of 13

Start Date 22 January 2019 Easting 393384.0

Scale 1 : 25

End Date 28 January 2019 Northing 216009.0 Ground level 238.65mOD

Depth 60.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend	
	36C	24.00 - 25.50	24.00		100 100 100		NI 420 570	Strong light greyish brown and light yellowish brown oolitic and peloidal LIMESTONE with abundant whole and fragmented shells (up to 40mm) and local burrows (up to 10mm) infilled with dark orangish brown sandy clay. Fractures are subhorizontal to 20° closely to medium spaced planar rough and stepped rough. (BLPL)				
	37Cs	24.65 - 25.10										
	38C	25.50 - 27.00	25.50		95 72 61			25.60 - 25.65m: Recovered non intact. Fractures are probably randomly orientated very closely spaced planar rough. 25.75 - 25.80m: Greenish grey.				
								26.25m: Fracture infilled with orangish brown sandy clay (40mm).				
	39C	27.00 - 28.50	27.00		99 99 75		40 110 270	26.80m: Fracture infilled with orangish brown sandy clay (30mm). Medium strong light yellowish brown shelly LIMESTONE with frequent ooids, peloids and burrows infilled with orangish brown sandy clay. Shells are whole and fragmented (up to 50mm) including bivalves. Fractures are subhorizontal to 20° very closely to medium spaced planar and undulating rough locally infilled (up to 3mm) with orangish brown sandy clay. (BLPL)	26.85	211.80		
	40Cs	28.15 - 28.50					500	Strong bluish grey fine to coarse shelly LIMESTONE. (BLPL)	28.15	210.50		
23/01/19 1700hrs 25.00m	41C	28.50 - 30.00	28.50		100 94 87		NI 200 200	Strong yellowish brown and dark yellowish brown shelly LIMESTONE with abundant burrows (up to 30mm) infilled with dark orangish brown sandy clay. Fractures are subhorizontal to 10° closely spaced planar rough. (BLPL)	28.65	210.00		
24/01/19 0820hrs 26.81m								Continued Next Page	{29.00}			
water strike (m) casing (m) rose to (m) time to rise (m) remarks Groundwater not encountered prior to use of water flush.											CONTRACT <b>34888</b>	CHECKED

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:37 JC EL

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC406**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 7 of 13

Start Date 22 January 2019 Easting 393384.0

Scale 1 : 25

End Date 28 January 2019 Northing 216009.0 Ground level 238.65mOD

Depth 60.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
								28.85 - 28.95m: Disintegrated to dark orangish brown sandy gravelly clay. Gravel is subrounded fine to coarse limestone lithorelicts. 29.15m: 10° planar rough fracture with a veneer of dark orangish brown sandy clay.	29.35	209.30	
						200		Strong bluish grey shelly Limestone. (BLPL)			
						800		29.55m: Subhorizontal undulating rough fracture with a veneer of dark orangish brown sandy clay and orangish brown penetrative staining (up to 80mm).			
	42C	30.00 - 31.50	30.00		100 78 71						
								30.35m: Subhorizontal planar rough bedding fracture infilled with brown sandy clay (up to 40mm).	30.35	208.30	
							NI 250 650	Medium strong light yellowish brown shelly Limestone with frequent burrows (up to 30mm) frequently infilled with dark orangish brown sandy clay. Fractures are subhorizontal to 20° medium and widely spaced planar rough. (BLPL)			
								31.00m: Subhorizontal undulating rough fracture infilled (40mm) with dark orangish brown sandy gravelly clay. Gravel is subangular fine to coarse limestone. 31.05 - 31.30m: Abundant burrows with frequent shells (up to 50mm). 31.25 - 31.40m: Recovered non intact.	31.40	207.25	
	43C	31.50 - 33.00	31.50		100 91 89			Medium strong dark grey locally shelly Limestone. (BLPL)			
	44Cs	31.50 - 31.90						31.70m: Flame structures (up to 30mm).	31.90	206.75	
							NI 50 100	Medium strong orangish brown Limestone with frequent shells and shell fragments (up to 20mm) and frequent burrows (up to 10mm) infilled with dark orangish brown sandy clay. Fractures are subhorizontal to 30° extremely closely to closely spaced undulating rough infilled (up to 10mm) with dark orangish brown sandy clay. (BLPL)			
								Strong light grey and dark bluish grey locally shelly Limestone. (BLPL)	32.20	206.45	
	45C	33.00 - 34.50	33.00		100 60 60						
								33.15m: Subhorizontal to 20° undulating rough fracture with a veneer of dark grey clay.			
								33.55m: Subhorizontal stepped rough fracture. 33.55 - 33.80m: Abundant shells and shell fragments (up to 60mm).	33.80	204.85	
	46D	33.90 - 34.00					NA	Very stiff fissured thinly and thickly laminated dark grey CLAY locally tending to extremely weak mudstone with			
								Continued Next Page	{34.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:37 JC EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		<b>CONTRACT</b> <b>34888</b>	<b>CHECKED</b>
				Groundwater not encountered prior to use of water flush.			



# BOREHOLE LOG



CLIENT OSBORNE

**DSRC406**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 8 of 13

Start Date 22 January 2019 Easting 393384.0

Scale 1 : 25

End Date 28 January 2019 Northing 216009.0 Ground level 238.65mOD

Depth 60.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	47C	34.50 - 36.00	34.50		100 43 43			frequent partings of light grey silt. Fissures are subhorizontal extremely closely to very closely spaced planar smooth. (WHM) 34.05m: Very thin bed of cross laminated grey fine sand.			
	48D	34.90 - 35.00						34.80 - 34.95m: Frequent very weak subrounded and tabular light brown phosphatic nodules (up to 30mm). 35.05m: Very thin bed of dark grey silt.	35.20	203.45	
	49Cs	35.30 - 35.70				600		Very weak to weak dark greenish grey sandy SILTSTONE with rare shells (up to 20mm). (WHM)			
	50C	36.00 - 37.50	36.00		100 23 23		NA	Bluish grey SILT. (WHM) 35.85 - 35.90m: Medium strong light grey siltstone cobble. 35.95 - 36.00m: Clayey.	35.85	202.80	
								Very stiff dark grey clayey SILT. (WHM)	36.35	202.30	
							NI 200 200	Very weak to weak dark grey SILTSTONE with rare partings of grey silt and local wisps of white gypsum. No natural fractures observed. (WHM) 36.95 - 37.05m: Disintegrated to dark grey silty subangular fine to coarse siltstone lithorelicts. 37.10m: Frequent phosphatic nodules (up to 60mm).	36.75	201.90	
	51C	37.50 - 39.00	37.50				NA	Dark grey locally sandy SILT with rare thin laminae and pockets (up to 20mm) of light grey silt. (WHM) 37.50 - 37.70m: Very stiff dark grey silty clay.	37.35	201.30	
	52D	37.55 - 37.65				93					
	53D	38.50 - 38.60									
Continued Next Page									{39.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:37 JC EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC406**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 9 of 13

Start Date 22 January 2019 Easting 393384.0

Scale 1 : 25

End Date 28 January 2019 Northing 216009.0 Ground level 238.65mOD

Depth 60.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	54C	39.00 - 40.50	39.00		100 23 23			39.00m: Very thin bed of weak grey siltstone.			x x x
						150		39.15m: Very thin bed of weak grey siltstone.			x x x
						NA		39.20 - 39.35m: Medium strong thickly laminated light grey siltstone.			x x x
	55D	39.70 - 39.80									x x x
	56C	40.50 - 42.00	40.50		100						x x x
	57D	41.40 - 41.50									x x x
	58C	42.00 - 43.50	42.00		99			42.20 - 43.50m: Fissured. Fissures are subhorizontal to 10° very closely to closely spaced planar smooth.			x x x
	59D	42.50 - 42.60						42.75 - 42.80m: Very stiff dark grey clayey silt.			x x x
	60C	43.50 - 45.00	43.50		100 20 20	150 150		Extremely weak to weak dark grey SILTSTONE with frequent weak tabular and rounded dark greyish brown phosphate nodules. Fractures are subhorizontal to 10° closely spaced planar smooth. (WHM)	43.50	195.15	x x x
						NA		43.75m: Flame structures (up to 50mm).	43.80	194.85	x x x
								Continued Next Page	{44.00}		x x x

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:38 JC EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			



# BOREHOLE LOG



**DSRC406**

CLIENT OSBORNE

Sheet 11 of 13

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Scale 1 : 25

Start Date 22 January 2019 Easting 393384.0

End Date 28 January 2019 Northing 216009.0 Ground level 238.65mOD Depth 60.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	68C	49.50 - 51.00	49.50		100			49.50m: Very thin bed of dark grey cross bedded fine sand. 49.60m: Very thin bed of dark grey clayey silt.			x x x
	69D	50.20 - 50.30						50.50m: Thin bed of dark grey silty fine sand.			x x x
	70C	51.00 - 52.50	51.00		100			51.10m: Very thin bed of dark grey clayey silt. 51.20 - 51.60m: Frequent weak light grey subrounded and tabular calcareous siltstone nodules (up to 40mm). 51.25m: Thin lamination of weak light grey calcareous siltstone.			x x x
	71D	51.70 - 51.80									x x x
	72C	52.50 - 54.00	52.50		100			52.80 - 53.30m: Abundant pockets (up to 20mm) of white silt.			x x x
	73D	53.20 - 53.30									x x x
Continued Next Page									{54.00}		x x x

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:38 JC EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC406**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 12 of 13

Start Date 22 January 2019 Easting 393384.0

Scale 1 : 25

End Date 28 January 2019 Northing 216009.0 Ground level 238.65mOD

Depth 60.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	74C	54.00 - 55.50	54.00		100						x x x
	75D	54.50 - 54.60									x x x
								54.75m: 20° undulating rough fissure.			x x x
								55.10m: Very thin bed of dark grey clayey silt.			x x x
								55.30m: Thick lamination of light grey fine silty sand.			x x x
	76C	55.50 - 57.00	55.50		97			55.50 - 55.60m: Very stiff dark grey clay.			x x x
								55.70m: Very thin bed of grey silty fine sand.			x x x
								55.85m: Thin bed of grey silty fine sand.			x x x
	77D	56.10 - 56.20									x x x
								56.55m: Very thin bed of very stiff dark grey clay.	56.60	182.05	x x x
								Dark grey locally slightly sandy SILT locally tending to extremely weak siltstone and locally with partings and pockets (up to 10mm) of white silt. (WHM)			x x x
	78C	57.00 - 57.50	57.00		98						x x x
	79D	57.10 - 57.20						57.20m: Very thin bed of stiff dark grey clay.			x x x
25/01/19 1630hrs 32.00m									57.50	181.15	x x x
28/01/19 0730hrs 32.09m	80C	57.50 - 59.00	57.50		81 10 0			Very stiff dark grey silty CLAY. (WHM)			x x x
	81D	57.70 - 57.80						Dark grey SILT with frequent pockets (up to 20mm) of light grey silt. (WHM)	57.85	180.80	x x x
	82D	58.20 - 58.30									x x x
								58.50m: Very thin bed of medium strong light grey siltstone.			x x x
								58.60m: Thin bed of medium strong light grey siltstone.			x x x
								Continued Next Page	{59.00}		x x x

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:39 JC EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC406**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 13 of 13

Start Date 22 January 2019 Easting 393384.0

Scale 1 : 25

End Date 28 January 2019 Northing 216009.0 Ground level 238.65mOD Depth 60.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
28/01/19 1705hrs 31.83m	83C	59.00 - 60.00	59.00		71 40 35			Very stiff dark grey locally gravelly silty CLAY. Gravel is subangular fine and medium siltstone. (WHM) 59.10m: Weak light grey siltstone cobble.	59.05	179.60	x x
	84D	59.10 - 59.20							59.25	179.40	x x
						NI 200 200		Extremely weak to very weak dark grey SILTSTONE with frequent weak light grey subangular siltstone clasts and locally tending to dark grey silt. Fractures are subhorizontal to 10° closely spaced planar smooth. (WHM)			x x
						NR		59.70 - 60.00m: Assessed zone of core loss.			x x x x x x x x x x x x x x x x
								Borehole completed at 60.00m.	60.00	178.65	x x x x x x x x
									{64.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:39 JC EL

water strike (m) casing (m) rose to (m) time to rise (m) remarks Groundwater not encountered prior to use of water flush.		<b>CONTRACT</b> <b>34888</b>	<b>CHECKED</b>
--	--	---------------------------------	----------------



# BOREHOLE LOG



CLIENT OSBORNE

**DSRC408**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 1 of 16

Start Date 30 January 2019 Easting 393605.0

Scale 1 : 25

End Date 12 February 2019 Northing 216240.0 Ground level 232.50mOD

Depth 75.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
30/01/19 1215hrs	1B	0.10 - 0.20						Grass over soft dark brown silty CLAY with frequent rootlets. (MADE GROUND)	0.10	232.40	
	1ES	0.10 - 0.20						Stiff orangish brown very gravelly CLAY with frequent pockets (up to 10mm) of dark brown fine sand. Gravel is subangular fine to coarse limestone and calcite. (MADE GROUND)			
30/01/19 1330hrs Dry	2B	0.30 - 0.40						0.50 - 0.60m: High subangular limestone cobble content.	0.65	231.85	
	2ES	0.30 - 0.40						Very weak yellowish grey LIMESTONE recovered non intact as clayey subangular fine to coarse gravel.			
04/02/19 1300hrs Dry	3B	0.60 - 0.70									
	3ES	0.60 - 0.70									
	4L	0.85 - 1.20									
	5D	1.20 - 1.65	1.20	S 28							
	6L	1.20 - 2.20									
	7D	1.70 - 1.80						Firm yellowish brown and orangish brown slightly sandy gravelly CLAY. Gravel is subangular and subrounded fine to coarse limestone.	1.55	230.95	
	8D	2.20 - 2.55	2.20	S*75				Yellowish brown slightly sandy subangular and subrounded fine to coarse limestone GRAVEL.	1.90	230.60	
	9C	2.20 - 3.20			80 18 0	NI NI 90		Weak yellowish brown oolitic LIMESTONE. Fractures are vertical, 45° and 80° extremely closely to closely spaced stepped undulating rough stained orangish brown. (BLPL)	2.15	230.35	
	10C	3.20 - 4.70	3.20		67 15 15			2.70 - 4.90m: Limited recovery. Probable washout of weathered material. Recovered as gravel and cobble sized fragments.			
Continued Next Page									{4.00}		

EQUIPMENT: Geotechnical Pioneer rig.  
 METHOD: Hand dug inspection pit 0.00-0.85m. Dynamic sampled (128mm) 0.85-2.20m. Waterflush rotary core drilled (146mm wireline) 2.20-75.20m.  
 CASING: 168mm diam to 2.20m and 140mm to 75.20m.  
 BACKFILL: On completion, downhole geophysical survey carried out. Borehole backfilled with gravel 75.20-34.00m and cement-bentonite pellets 34.00-24.00m. A slotted standpipe (50mm) was installed to 23.50m, granular response zone 24.00-20.00m, bentonite seal 20.00-19.00m, cement:bentonite grout 19.00-9.00m, gravel 9.00-5.00m, cement:bentonite grout 5.00-0.50m, concrete and stopcock cover 0.50-0.00m.  
 REMARKS: Driller notes loss of flush returns 4.70-75.20m.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks		<b>CONTRACT</b> <b>34888</b>	<b>CHECKED</b>
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



**DSRC408**

CLIENT OSBORNE

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 2 of 16

Start Date 30 January 2019 Easting 393605.0

Scale 1 : 25

End Date 12 February 2019 Northing 216240.0 Ground level 232.50mOD Depth 75.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	11C	4.70 - 6.20	4.70		93 49 49				4.90	227.60	
	12Cs	5.47 - 6.00				NI NI 150		Medium strong light grey and yellowish brown oolitic LIMESTONE with frequent fine and medium gravel sized voids and frequent fine and medium gravel sized shell fossils. Fractures are horizontal and 45° rarely randomly orientated and intersecting stained orangish brown and locally weathered to orangish brown fine to coarse sand and subangular fine to coarse gravel sized fragments up to 50mm either side of fracture. (BLPL) 5.20 - 5.50m: Probable washout of weathered material. Recovered as gravel and cobble sized fragments.			
	13C	6.20 - 7.70	6.70		100 71 53	NI 120 220					
	14C	7.70 - 9.20	7.70		100 63 55	NI 210 400		7.60 - 8.60m: Subvertical undulating rough fracture stained orangish brown.			
Continued Next Page									{9.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:50 ED/JC JH

water strike (m) casing (m) rose to (m) time to rise (m) remarks  
Groundwater not encountered prior to use of water flush.



CONTRACT  
**34888**

CHECKED

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC408**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 3 of 16

Start Date 30 January 2019 Easting 393605.0

Scale 1 : 25

End Date 12 February 2019 Northing 216240.0 Ground level 232.50mOD

Depth 75.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	15Cs	9.00 - 9.20									
	16C	9.20 - 10.70	9.20		100 53 38						
	17Cs	10.30 - 10.50									
04/02/19 1620hrs Dry											
05/02/19 0820hrs 10.64m	18C	10.70 - 12.20	10.70		93 63 49						
	19C	12.20 - 13.70	12.20		100 59 59				12.30	220.20	
	20Cs	12.48 - 12.70			40 170 390			Strong light grey LIMESTONE with frequent fine to coarse gravel sized shell fragments and frequent burrows (up to 10x60mm) stained orangish brown and locally infilled with calcite. Fractures are subhorizontal rarely 45° very closely to medium spaced stepped undulating rough stained orangish brown. (BLPL)			
								12.90 - 12.95m: Fracture infilled with orangish brown slightly clayey sandy subangular fine to coarse gravel.			
								13.30 - 13.45m: Orangish brown sandy silt tending to extremely weak siltstone.			
								13.45 - 13.70m: Subvertical curved stepped rough fracture.			
	21C	13.70 - 15.20	13.70		80 80 63	40 170 390					
								Continued Next Page	{14.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888 GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:50 ED/JC JH

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks	AGS	CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC408**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 4 of 16

Start Date 30 January 2019 Easting 393605.0

Scale 1 : 25

End Date 12 February 2019 Northing 216240.0 Ground level 232.50mOD

Depth 75.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	22Cs	15.02 - 15.20									
	23C	15.20 - 16.70	15.20		43 90						
									15.85	216.65	
	24C	16.70 - 18.20	16.70		43			Limited recovery. Recovered as orangish brown sandy gravelly clay with a low subangular limestone cobble content. Gravel is subangular and subrounded fine to coarse limestone. (BDS) 15.85 - 16.70m: Assessed zone of core loss.			
								17.35 - 18.20m: Assessed zone of core loss.			
	25C	18.20 - 19.70	18.20		100			Stiff thinly laminated brownish grey silty CLAY. (WHM)	18.30	214.20	
								Stiff fissured grey micaceous silty CLAY with frequent partings of light grey fine sand (up to 1mm). Fissures are randomly orientated intersecting extremely closely spaced undulating and smooth. (WHM)	18.50	214.00	
		18.80		H 104							
								Continued Next Page	{19.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:50 ED/JC JH

water strike (m) casing (m) rose to (m) time to rise (m) remarks  
Groundwater not encountered prior to use of water flush.



CONTRACT  
**34888**

CHECKED

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC408**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 5 of 16

Start Date 30 January 2019 Easting 393605.0

Scale 1 : 25

End Date 12 February 2019 Northing 216240.0 Ground level 232.50mOD Depth 75.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	26Cs	19.45 - 19.60						19.10 - 19.25m: Thinly laminated. Laminae are fine grey sand orientated at 45° (up to 1mm). Fissures are smooth and polished. 19.25 - 19.85m: Rare laminae. Laminae are fine grey sand orientated at 45° (up to 1mm)			X
	27C	19.70 - 21.20	19.70		100 35 35			19.60 - 19.85m: Fissures are subhorizontal.			X
								19.85 - 20.00m: Very stiff brownish grey silty clay with frequent orangish brown silt partings (up to 1mm)	20.00	212.50	X
								Very stiff orangish brown sandy micaceous SILT locally tending to extremely weak siltstone. (MRB)	20.10	212.40	X
								Medium strong orangish brown and bluish grey fine SANDSTONE. Fractures are subhorizontal medium spaced undulating smooth. (MRB)			•
	28Cs	20.88 - 21.20									•
	29C	21.20 - 22.70	21.20		78 47 47	NA		Extremely weak orangish brown fine SANDSTONE. Drilling disturbed, recovered as slightly sandy clayey subangular and subrounded fine to coarse sandstone gravel. (MRB) 21.20 - 21.55m: Assessed zone of core loss.	21.20	211.30	•
									22.00	210.50	•
								Extremely weak orangish brown and bluish grey fine SANDSTONE with frequent 20-30° undulating yellowish brown and reddish brown thick laminae. Fractures are 20-30° closely and medium spaced undulating rough. (MRB)			•
									22.55	209.95	•
	30C	22.70 - 24.20	22.70		93 28 15	NI NI 160		Extremely weak greenish brown fine micaceous SANDSTONE locally disintegrated to a subangular fine and medium gravel. Fractures are horizontal and 80° undulating rough stained reddish brown. (DYS)			•
								23.25 - 24.10m: Bluish grey locally mottled orangish brown with frequent grey greenish grey horizontal laminae (up to 1mm).			•
								Continued Next Page	{24.00}		•

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:51 ED/JC JH

water strike (m) casing (m) rose to (m) time to rise (m) remarks  
Groundwater not encountered prior to use of water flush.



CONTRACT  
**34888**

CHECKED

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC408**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

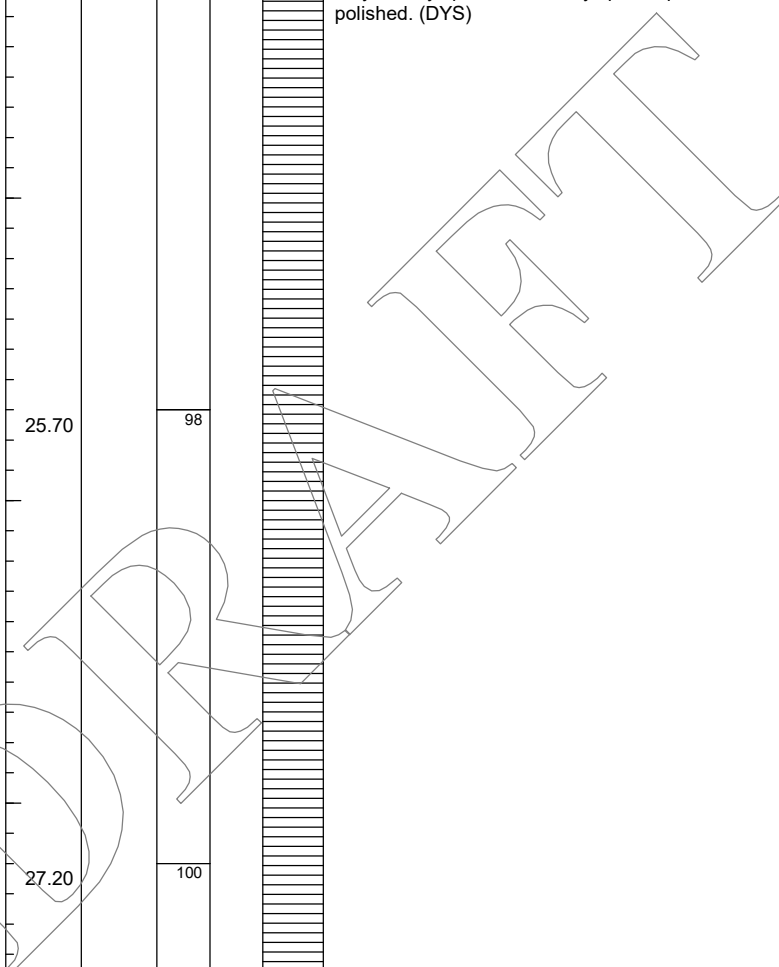
Sheet 6 of 16

Start Date 30 January 2019 Easting 393605.0

Scale 1 : 25

End Date 12 February 2019 Northing 216240.0 Ground level 232.50mOD Depth 75.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	31C	24.20 - 25.70	24.20		100		NA	Very stiff fissured grey clayey SILT with frequent light grey sand lenses (up to 2mm). Fissures are horizontal and 80° very closely spaced to closely spaced planar smooth and polished. (DYS)	24.10	208.40	
	32C	25.70 - 27.20	25.70		98						
	33Cs	25.90 - 26.05									
	34C	27.20 - 28.70	27.20		100						
	35C	28.70 - 29.00	28.70		100						
05/02/19 1630hrs 15.14m											



Continued Next Page

{29.00}

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:51 ED/JC JH

water strike (m) casing (m) rose to (m) time to rise (m) remarks	AGS	CONTRACT <b>34888</b>	CHECKED
Groundwater not encountered prior to use of water flush.			





# BOREHOLE LOG



CLIENT OSBORNE

**DSRC408**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 8 of 16

Start Date 30 January 2019 Easting 393605.0

Scale 1 : 25

End Date 12 February 2019 Northing 216240.0 Ground level 232.50mOD

Depth 75.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	42Cs	34.16 - 34.40									XXXXXX
	43C	34.70 - 36.20	34.70		87 67 57						XXXXXX
	44C	36.20 - 37.70	36.20		98 43 20	NA		35.60 - 35.65m: Very weak and light brown.	36.20	196.30	XXXXXX
	45C	37.70 - 39.20	37.70		100						XXXXXX
	46Cs	38.62 - 38.96						38.35 - 37.00m: Slightly gravelly. Gravel is subangular fine to coarse sandstone with iron pyrite mineralisation.			XXXXXX
Continued Next Page									{39.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:51 ED/JC JH

water strike (m) casing (m) rose to (m) time to rise (m) remarks

Groundwater not encountered prior to use of water flush.



CONTRACT

**34888**

CHECKED

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC408**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 9 of 16

Start Date 30 January 2019 Easting 393605.0

Scale 1 : 25

End Date 12 February 2019 Northing 216240.0 Ground level 232.50mOD

Depth 75.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	47C	39.20 - 40.70	39.20		100						
	48C	40.70 - 42.20	40.70		100						
	49C	42.20 - 43.70	42.20		100 87 70						
	50C	43.70 - 45.20	43.70		100 100 91						
						40 210 310		Extremely weak dark grey SILTSTONE with frequent partings of light grey calcitic material. Fractures are subhorizontal closely to medium spaced undulating rough. (CHAM)	42.40	190.10	
								43.30 - 44.85m: Frequent lenses (up to 5mm) of light grey calcitic fine sandstone.			
								43.90 - 44.90m: Very weak.			
								Continued Next Page	{44.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:52 ED/JC JH

water strike (m) casing (m) rose to (m) time to rise (m) remarks  
 Groundwater not encountered prior to use of water flush.



CONTRACT  
**34888**

CHECKED

# BOREHOLE LOG



**DSRC408**

CLIENT OSBORNE

Sheet 10 of 16

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Scale 1 : 25

Start Date 30 January 2019 Easting 393605.0

End Date 12 February 2019 Northing 216240.0 Ground level 232.50mOD Depth 75.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	51C	45.20 - 46.70	45.20		100 53 45			45.35 - 45.45m: Stiff grey clay with frequent white fine sand partings (up to 1mm).			xxxxx
	52Cs	45.75 - 45.93						45.90 - 46.05m: Frequent lenses (up to 5mm) of light grey calcitic fine sandstone.			xxxxx
	53C	46.70 - 48.20	46.70		100		NA	Very stiff fissured dark grey silty CLAY locally tending to extremely weak siltstone with rare fine to coarse gravel sized shell fragments and rare brown trace fossils (up to 2x10mm) possible burrows. Fissures are 45-60° closely and medium spaced planar smooth. (CHAM)	46.40	186.10	xxxxx
	54C	48.20 - 49.70	48.20		100						xxxxx
Continued Next Page									{49.00}		xxxxx

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:52 ED/JC JH

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC408**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 11 of 16

Start Date 30 January 2019 Easting 393605.0

Scale 1 : 25

End Date 12 February 2019 Northing 216240.0 Ground level 232.50mOD

Depth 75.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	55C	49.70 - 51.20	49.70		100 100 0						
	56Cs	49.70 - 49.90									
06/02/19 1600hrs 23.48m	57C	51.20 - 51.55	51.20		100						
07/02/19 0840hrs 21.63m	58C	51.55 - 52.70	51.55		100						
	59C	52.70 - 54.20	52.70		93						

Continued Next Page

{54.00}

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:52 ED/JJC JH

water strike (m) casing (m) rose to (m) time to rise (m) remarks  
 Groundwater not encountered prior to use of water flush.



CONTRACT  
**34888**

CHECKED

# BOREHOLE LOG



**DSRC408**

CLIENT OSBORNE

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 12 of 16

Start Date 30 January 2019

Easting 393605.0

Scale 1 : 25

End Date 12 February 2019

Northing 216240.0 Ground level 232.50mOD

Depth 75.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	60Cs	53.98 - 54.20									
	61C	54.20 - 55.70	54.20		100						
	62C	55.70 - 57.20	55.70		100			55.30 - 55.40m: Very strong grey limestone with frequent reddish brown and white mineral veins (up to 4mm).			
	63Cs	56.97 - 57.20						56.85m: Two coarse gravel sized shell fragments infilled with white calcite.			
	64C	57.20 - 58.50	57.20		100			57.80m: Rare fine to coarse gravel sized ammonite shell fragments.			
	65C	58.50 - 58.70	58.50		100						
	66C	58.70 - 60.20	58.70		100						

Continued Next Page

{59.00}

Geotechnical Engineering Ltd, Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:53 ED/JC JH

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks
				Groundwater not encountered prior to use of water flush.



CONTRACT  
**34888**

CHECKED

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC408**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 13 of 16

Start Date 30 January 2019 Easting 393605.0

Scale 1 : 25

End Date 12 February 2019 Northing 216240.0 Ground level 232.50mOD


Depth 75.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
07/02/19 1630hrs 21.06m	67Cs	59.02 - 59.40									
08/02/19 0815hrs 21.76m	68C	60.20 - 61.70	60.20		100						
	69C	61.70 - 63.20	61.70		93			61.50m: Subangular grey limestone cobble with frequent reddish brown and white mineral veins (up to 10mm).			
	70Cs	62.30 - 62.70									
08/02/19 1120hrs 20.04m	71C	63.20 - 63.40	63.20		100			Very stiff fissured dark brownish grey CLAY locally tending to extremely weak mudstone locally with frequent shell fragments (up to 1mm). Fissures are subhorizontal to 20° very closely and closely spaced planar rough and smooth. (CHAM)	63.20	169.30	
11/02/19 1010hrs 21.76m	72C	63.40 - 64.70	63.40		93		63.75 - 64.00m: Subvertical planar smooth fissure.				
Continued Next Page									{64.00}		

DRAFT

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:53 ED/JC JH

water strike (m) casing (m) rose to (m) time to rise (m) remarks  
Groundwater not encountered prior to use of water flush.

 <b>CONTRACT</b> <b>34888</b>	<b>CHECKED</b>
--	----------------



# BOREHOLE LOG



**DSRC408**

CLIENT OSBORNE

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 14 of 16

Start Date 30 January 2019 Easting 393605.0

Scale 1 : 25

End Date 12 February 2019 Northing 216240.0 Ground level 232.50mOD Depth 75.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	73C	64.70 - 66.20	64.70		100			65.00m: Medium strong light grey subangular limestone cobble.			
								65.20 - 65.30m: Frequent nodules of fine grained pyrite (up to 10mm).			
								65.25 - 66.45m: 80° to subvertical planar smooth fissure.			
	74D	65.70 - 65.80						65.60 - 65.70m: 50° planar smooth fissure.	65.75	166.75	
								65.70m: Frequent weak light brown subrounded phosphatic nodules (up to 50mm).			
	75C	66.20 - 67.70	66.20		100		Very stiff fissured dark grey locally slightly sandy CLAY locally tending to extremely weak mudstone. Fissures are subhorizontal to 30° very closely to medium spaced planar rough and smooth. (CHAM)				
							66.15 - 66.25m: 50° planar smooth fissure.				
							66.50m: Medium strong light bluish grey subrounded limestone cobble.				
							66.70 - 66.85m: 80° to subvertical planar smooth fissure.				
							66.85m: 20mm band of fine and medium subangular pyrite gravel.				
	76C	67.70 - 69.20	67.70		100		67.70 - 67.75m: Frequent fine to coarse pyrite sand.				
							67.75 - 67.85m: Frequent subrounded pyrite nodules (up to 15mm).				
							68.00 - 68.10m: 80° to subvertical planar smooth fissure.				
							68.15 - 68.35m: Frequent subrounded pyrite nodules (up to 30mm).				
							68.35 - 68.40m: 40° planar smooth fissure.				
							68.45m: Thin lamination of abundant white shells (up to 10mm).				
	77Cs	68.75 - 69.10									
Continued Next Page									{69.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:53 ED/JC JH

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT	CHECKED
				Groundwater not encountered prior to use of water flush.		34888	

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC408**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 15 of 16

Start Date 30 January 2019 Easting 393605.0

Scale 1 : 25

End Date 12 February 2019 Northing 216240.0 Ground level 232.50mOD

Depth 75.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
11/02/19 1615hrs 20.25m	78C	69.20 - 70.70	69.20		100		[Stippled pattern]	68.85 - 68.90m: Frequent weak light brown subrounded phosphate nodules (up to 30mm). 69.00 - 69.20m: 50° planar smooth fissure.			[Stippled pattern]
								69.50 - 69.60m: Frequent pyrite nodules (up to 10mm).			
12/02/19 1000hrs 21.78m	79D	70.20 - 70.30					[Stippled pattern]	70.10m: Weak light brownish grey subrounded limestone cobble.			[Stippled pattern]
								70.50m: Thin band (20mm) of abundant pyrite nodules (up to 30mm).			
	80C	70.70 - 72.20	70.70			99			71.10 - 71.15m: Subvertical planar smooth fissure.		
	81C	72.20 - 73.70	72.20		100		[Stippled pattern]	72.15 - 72.25m: Frequent medium strong light bluish brown subrounded limestone coarse gravel and cobbles. 72.25 - 72.35m: 60° planar smooth fissure.			[Stippled pattern]
								72.55m: Thick lamination of greyish green sandy clay.			
								72.80m: Thin lamination of extremely weak light grey siltstone.			
	82D	73.20 - 73.30					[Stippled pattern]	73.20 - 73.30m: Frequent medium and coarse subrounded gravel of medium strong light grey limestone.			[Stippled pattern]
	83C	73.70 - 75.20	73.70		100						
Continued Next Page									{74.00}		

Geotechnical Engineering Ltd, Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:53 ED/JC JH

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC408**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 16 of 16

Start Date 30 January 2019 Easting 393605.0

Scale 1 : 25

End Date 12 February 2019 Northing 216240.0 Ground level 232.50mOD Depth 75.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
12/02/19 1150hrs 21.02m	84Cs	74.10 - 74.55						74.50 - 75.20m: Frequent shell fragments (up to 10mm) and local partings of white silt.	75.20	157.30	
								Borehole completed at 75.20m.			

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 08:59:54 ED/JC JH

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC415**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 1 of 11

Start Date 15 January 2019 Easting 393527.0

Scale 1 : 25

End Date 28 January 2019 Northing 213994.0 Ground level 287.20mOD

Depth 51.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
15/01/19 0900hrs	1B	0.20 - 0.30						MADE GROUND comprising dark grey TARMACADAM.	0.15	287.05	[Cross-hatched pattern]
	1ES	0.20 - 0.30						Dark yellowish brown slightly sandy subrounded and rounded fine to coarse limestone GRAVEL. (MADE GROUND)	0.30	286.90	
15/01/19 1100hrs Dry	2B	0.60 - 0.70						MADE GROUND comprising dark grey TARMACADAM.	0.60	286.60	[Cross-hatched pattern]
	2ES	0.60 - 0.70						Dark yellowish grey gravelly fine to coarse SAND. Gravel is angular to subrounded fine to coarse limestone. (MADE GROUND)	0.75	286.45	
15/01/19 1425hrs Dry	3L	0.90 - 2.20	0.90					Firm light yellowish brown frequently greenish brown slightly gravelly CLAY. Gravel is angular tabular fine to coarse mudstone. (FE)	0.90	286.30	[Horizontal line pattern]
								Stiff light brown calcareous CLAY. (FE)	1.30	285.90	
	4D	1.50 - 1.60						Stiff locally very stiff orangish brown mottled bluish grey calcareous CLAY. (FE)	1.75	285.45	
21/01/19 1550hrs 1.38m	5D	2.20 - 2.65	0.90	S 24				Stiff light brown locally orangish brown and greyish brown gravelly calcareous CLAY. Gravel is angular and subangular fine to coarse weak dark reddish grey calcareous mudstone lithorelicts. (FE)			[Horizontal line pattern]
22/01/19 1425hrs Dry	6L	2.20 - 3.20	2.20						2.45	284.75	
	7D	2.80 - 2.90									
	8D	3.20 - 3.65	2.20	S*51							
	9C	3.20 - 4.70	3.20		100	NA		3.20m: Thick lamination of bluish grey mudstone.			
									Continued Next Page		{4.00}

EQUIPMENT: Geotechnical Pioneer rig.  
 METHOD: Hand held hydraulic breaker 0.00-0.60m. Hand dug inspection pit 0.60-0.90m. Dynamic sampled (128mm) 0.90-3.20m. Rotary core drilled utilising a water flush (146mm wireline) 3.20-51.00m.  
 CASING: 200mm diam to 1.70m, 168mm diam to 2.20m and 140mm diam to 51.00m.  
 BACKFILL: On completion, downhole geophysical survey carried out. Borehole backfilled with bentonite-cement pellets 51.00-50.00m. A slotted standpipe (50mm) was installed to 49.00m, granular response zone 50.00-25.50m, bentonite seal 25.50-24.00m, cement-bentonite grout 24.00-14.00m, gravel 14.00-5.00m, cement-bentonite grout 5.00-0.50m, concrete and stopcock cover 0.50-0.00m. REMARKS: Driller notes reduced flush returns between 6.20-15.00m (80% returned) and 19.50-22.50m (60% returned). Driller notes loss of flush returns between 22.50-51.00m. Bentonite seal for aquifer protection installed 0.00-2.20m. Seal cured for 15hr prior to progressing hole through seal at reduced casing diameter.  
 EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks		CONTRACT <b>34888</b>	CHECKED

# BOREHOLE LOG



**DSRC415**

CLIENT OSBORNE

Sheet 2 of 11

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Scale 1 : 25

Start Date 15 January 2019 Easting 393527.0

Depth 51.00 m

End Date 28 January 2019 Northing 213994.0 Ground level 287.20mOD

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
							NA	Very stiff thinly laminated to very thinly bedded dark bluish grey calcareous silty CLAY locally tending to extremely weak mudstone. (FE)	4.05	283.15	Horizontal dashes with 'x' marks
	10C	4.70 - 6.20	4.70		93			4.45m: Very thin bed of grey calcareous mudstone. 4.60m: Very thin bed of grey calcareous mudstone. 4.70 - 4.85m: Thin bed of weak calcareous mudstone.			
	11D	5.50 - 5.60									
	12C	6.20 - 7.70	6.20		100 53 48						
							NI 220 300	Very weak grey calcareous SILTSTONE. Fractures are subhorizontal to 20° mainly medium spaced planar rough. (FE)	6.75	280.45	Vertical 'x' marks
	13C	7.70 - 9.20	7.70		100 99 97			7.30 - 7.60m: 70° to subvertical stepped rough fracture stained reddish brown and brownish orange with brownish yellow penetrative staining (up to 60mm). 7.30 - 7.65m: Weak light grey limestone.  7.75 - 7.90m: Weak light grey limestone.  8.00m: Subhorizontal planar rough fracture with orangish brown penetrative staining (up to 70mm) and infilled (2mm) with orangish brown clay. 8.25 - 8.50m: Frequent coarse gravel sized limestone clasts.			
									9.00	278.20	
								Continued Next Page	{9.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 09:00:07 JW EL

water strike (m) casing (m) rose to (m) time to rise (m) remarks



CONTRACT  
**34888**

CHECKED

# BOREHOLE LOG



## DSRC415

CLIENT OSBORNE  
 SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION  
 Start Date 15 January 2019 Easting 393527.0  
 End Date 28 January 2019 Northing 213994.0 Ground level 287.20mOD

Sheet 3 of 11  
 Scale 1 : 25  
 Depth 51.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	14C	9.20 - 10.50	9.20		100 81 62		NI 130 240	Extremely weak grey SILTSTONE locally tending to silt with frequent partings of light grey silt. Fractures are subhorizontal to 20° closely and medium spaced undulating smooth. (FE)			x x x x
	15C	10.50 - 12.00	10.50		100 73 40			9.90 - 10.00m: Very closely spaced subhorizontal planar rough fractures infilled (up to 2mm) with grey clay.			x x x x
	16C	12.00 - 13.50	12.00		100 95 75			12.15 - 12.20m: Subhorizontal planar rough fractures infilled (2mm) with grey clay. 12.20 - 12.30m: Weak light grey calcareous mudstone.			x x x x
	17C	13.50 - 15.00	13.50		100 81 74			13.60 - 13.75m: 70° fracture undulating smooth infilled (2mm) with grey clay.			x x x x
								Continued Next Page	{14.00}		x x x x

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 09:00:07 JW EL

water strike (m) casing (m) rose to (m) time to rise (m) remarks



CONTRACT  
**34888**

CHECKED



# BOREHOLE LOG



**DSRC415**

CLIENT OSBORNE

Sheet 5 of 11

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Scale 1 : 25

Start Date 15 January 2019 Easting 393527.0

End Date 28 January 2019 Northing 213994.0 Ground level 287.20mOD Depth 51.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
								19.25m: Subhorizontal to 10° planar rough fracture.			
	22C	19.50 - 21.00	19.50		100 100 100				19.70	267.50	
	23Cs	20.60 - 20.90			160 240 1270			Weak thinly bedded brownish yellow bioclastic LIMESTONE locally tending to very stiff sandy clay. Abundant shell fragments (up to 20mm) infilled with white calcite. Fractures are subhorizontal medium to widely spaced undulating smooth. (SALS)			
23/01/19 1650hrs 1.88m											
24/01/19 0900hrs 2.03m	24C	21.00 - 22.50	21.00		100 99 98						
								21.70 - 21.80m: Abundant shell fragments (up to 10mm). 21.85 - 21.90m: Abundant shell fragments (up to 10mm).			
									22.05	265.15	
	25C	22.50 - 24.00	22.50		99 88 53			Weak and medium strong brownish yellow peloidal LIMESTONE locally with abundant shell fragments (up to 80mm). Fractures are subhorizontal to 30° closely and medium spaced undulating smooth infilled (2mm) with orangish brown sandy clay. (ASLS)			
								22.70m: Shell fragment (20mm) replaced with light grey calcite.			
								23.20 - 24.10m: Subvertical very closely spaced undulating rough fractures.			
								Continued Next Page	{24.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 09:00:08 JW EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
------------------	------------	-------------	------------------	---------	--	--------------------------	---------



# BOREHOLE LOG



CLIENT OSBORNE

**DSRC415**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 6 of 11

Start Date 15 January 2019

Easting 393527.0

Scale 1 : 25

End Date 28 January 2019

Northing 213994.0 Ground level 287.20mOD

Depth 51.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	26C	24.00 - 25.50	24.00		100 57 37			24.00 - 24.45m: Recovered non intact as fine to coarse gravel sized fragments with abundant brachiopods and bivalves.			
	27C	25.50 - 27.00	25.50		100 93 85			24.75 - 25.10m: Frequent shell fragments (up to 10mm).			
	28C	27.00 - 28.50	27.00		95 78 39		NI 270 310	Strong light brownish yellow bioclastic LIMESTONE with frequent shell fragments (up to 20mm) infilled with white calcite. Fractures are subhorizontal to 20° medium spaced undulating rough infilled (2mm) with brownish orange sandy clay. (BLPL) 26.30 - 26.40m: Abundant shell fragments (up to 20mm) infilled with micrite cement or replaced by white calcite.	26.30	260.90	
	29C	28.50 - 30.00	28.50		99 78 54		NI 110 290	27.00 - 27.25m: 40° to subvertical stepped incipient fracture. 27.20 - 27.25m: Abundant shell fragments (up to 35mm) replaced with white calcite.  Strong light yellowish grey bioclastic LIMESTONE with abundant shell fragments (up to 20mm) replaced by white calcite and abundant burrows (up to 20mm) stained brownish orange. Fractures are subhorizontal to 30° closely and medium spaced undulating rough stained brownish orange. (BLPL)  28.20m: Burrow (110mm) infilled with grey calcite.	27.65	259.55	
Continued Next Page									{29.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 09:00:08 JW EL

water strike (m) casing (m) rose to (m) time to rise (m) remarks



CONTRACT  
**34888**

CHECKED

# BOREHOLE LOG



**DSRC415**

CLIENT OSBORNE

Sheet 7 of 11

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Scale 1 : 25

Start Date 15 January 2019 Easting 393527.0

End Date 28 January 2019 Northing 213994.0 Ground level 287.20mOD Depth 51.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	30C	30.00 - 31.50	30.00		100 71 45			29.20m: 40° undulating rough fracture stained brownish orange. 29.30 - 29.50m: Subhorizontal incipient fractures.  29.75m: Subhorizontal to 20° stepped fracture infilled (3mm) with brownish orange sandy clay.	30.45	256.75	
	31Cs	31.20 - 31.50			NI 200 590			Strong light brownish yellow bioclastic LIMESTONE locally oolitic with abundant shell fragments (up to 30mm). Fractures are subhorizontal to 20° mainly medium spaced undulating rough stained dark brownish orange. (BLPL) 30.50 - 30.90m: 40° to subvertical undulating incipient fracture. 30.80 - 30.90m: Frequent shell fragments (up to 70mm) replaced by white calcite. 31.10 - 31.15m: Yellowish brown.			
	32C	31.50 - 33.00	31.50		100 91 91			31.50 - 31.65m: 70° to subvertical undulating incipient fracture.  32.20 - 32.30m: Yellow brown with abundant shell fragments (up to 10mm).  32.65 - 33.70m: 50° to subvertical undulating rough fracture stained dark brownish orange locally infilled (up to 3mm) with white calcite.			
	33C	33.00 - 34.50	33.00		100 86 54						

Continued Next Page

{34.00}

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 09:00:08 JW EL

water strike (m) casing (m) rose to (m) time to rise (m) remarks



CONTRACT  
**34888**

CHECKED

Geotechnical Engineering Limited  
**BOREHOLE LOG**



**DSRC415**

CLIENT OSBORNE

Sheet 8 of 11

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Scale 1 : 25

Start Date 15 January 2019 Easting 393527.0

Depth 51.00 m

End Date 28 January 2019 Northing 213994.0 Ground level 287.20mOD

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
24/01/19 1630hrs 35.09m	34C	34.50 - 35.25	34.50		100 96 96			34.70 - 34.90m: 80° to subvertical incipient undulating fracture.			
	35Cs	34.90 - 35.25									
25/01/19 0800hrs Dry	36C	35.25 - 36.00	35.25		100 96 84			36.10m: Shell fragment (20mm) infilled with white calcite. 36.40 - 36.95m: Locally grey.			
	37C	36.00 - 37.50	36.00		100 97 91						
	38Cs	36.40 - 36.80						36.95m: Subhorizontal vein of grey and white calcite (up to 10mm). 36.97 - 37.06m: Grey. 37.05m: Brachiopod with lower valve infilled with micrite cement and upper valve replaced by white calcite. 37.40m: Subvertical vein of grey to white calcite (up to 10mm). 37.55 - 38.10m: Grey.			
	39C	37.50 - 39.00	37.50		100 99 93						
								Medium strong light brown bioclastic LIMESTONE with abundant shell fragments (up to 40mm) and ooids. Fractures are subhorizontal to 30° closely and medium spaced stepped rough infilled with white calcite and brown slightly sandy clay. (BLPL)	38.10	249.10	
								Strong light brownish yellow LIMESTONE locally with abundant shell fragments (up to 20mm) locally replaced by calcite. Fractures are subhorizontal medium and widely spaced undulating smooth stained brownish orange. (BLPL)	38.50	248.70	
								Continued Next Page	{39.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 09:00:09 JW EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks
------------------	------------	-------------	------------------	---------

	CONTRACT <b>34888</b>	CHECKED
--	--------------------------	---------

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC415**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 9 of 11

Start Date 15 January 2019 Easting 393527.0

Scale 1 : 25

End Date 28 January 2019 Northing 213994.0 Ground level 287.20mOD

Depth 51.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	40C	39.00 - 40.50	39.00		100 100 100			38.50 - 39.25m: 80° to subvertical undulating incipient fracture.			
	41C	40.50 - 42.00	40.50		100 100 100						
	42Cs	41.50 - 41.90									
	43C	42.00 - 43.50	42.00		100 100 100						
	44Cs 45C	43.50 - 43.90 43.50 - 45.00	43.50		100 99 87						
Continued Next Page									{44.00}		

DRAFT

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 09:00:09 JW EL

water strike (m) casing (m) rose to (m) time to rise (m) remarks  
 40.50 40.50 35.73 20



CONTRACT  
**34888**

CHECKED

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC415**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 10 of 11

Start Date 15 January 2019 Easting 393527.0

Scale 1 : 25

End Date 28 January 2019 Northing 213994.0 Ground level 287.20mOD

Depth 51.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
25/01/19 1610hrs 35.89m							44.25 - 44.60m: Abundant shell fragments (up to 10mm).			
28/01/19 0915hrs 44.17m	46C	45.00 - 46.50	45.00		97 97 97					
	47C	46.50 - 48.00	46.50		100 100 100					
	48Cs	46.70 - 47.00								
	49C	48.00 - 49.50	48.00		100 100 96					

Continued Next Page

{49.00}

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 09:00:09 JW EL

water strike (m) casing (m) rose to (m) time to rise (m) remarks



CONTRACT  
**34888**

CHECKED

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC415**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 11 of 11

Start Date 15 January 2019 Easting 393527.0

Scale 1 : 25

End Date 28 January 2019 Northing 213994.0 Ground level 287.20mOD

Depth 51.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
	50C	49.50 - 51.00	49.50		100 100 98					
28/01/19 1220hrs 48.24m	51Cs	50.60 - 51.00					50.65m: 25° very closely spaced planar rough fractures stained yellowish orange.	51.00	236.20	
							Borehole completed at 51.00m.	{54.00}		
water strike (m) casing (m) rose to (m) time to rise (m) remarks							AGS	CONTRACT <b>34888</b>	CHECKED	

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 09:00:10 JW EL

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC419**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 1 of 13

Start Date 7 January 2019 Easting 393213.0

Scale 1 : 25

End Date 15 January 2019 Northing 215564.0 Ground level 268.90mOD Depth 60.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
07/01/19 1515hrs	1C	0.00 - 0.15			100			MADE GROUND comprising black TARMACADAM.	0.15	268.75	
	2B	0.10 - 0.30					Yellowish brown gravelly fine to coarse SAND. Gravel is subangular and subrounded fine and medium limestone and sandstone. (MADE GROUND)				
	1ES	0.10 - 0.30									
	3B	0.30 - 0.50									
	2ES	0.30 - 0.50									
	4B	0.50 - 0.70									
	3ES	0.50 - 0.70									
07/01/19 1810hrs Dry	5B	1.00 - 1.20						0.95	267.95		
	4ES	1.00 - 1.20					Firm yellowish grey and brown gravelly calcareous CLAY. Gravel is subrounded and rounded fine and medium limestone.	1.20	267.70		
08/01/19 0830hrs Dry	6D	1.20 - 1.65	Nil	S 3				Firm greenish brown slightly sandy CLAY.	1.60	267.30	
	7L	1.20 - 2.20						1.75	267.15		
	8D	9L	2.20 - 2.64	Nil	S*52			Stiff greyish brown slightly sandy gravelly CLAY. Gravel is subangular and subrounded fine to coarse limestone.	2.10	266.80	
			2.20 - 3.20	3.20	S*600			Stiff orangish-brown sandy gravelly CLAY. Gravel is subangular and subrounded fine to coarse limestone.			
								Very weak light yellowish brown medium and coarse grained oolitic LIMESTONE recovered non intact. Fractures are probably subhorizontal to 20° very closely spaced planar rough locally stained orangish brown. (BLPL)			
10C	3.20 - 3.26 3.20 - 4.60	3.20	S*600		85 78 78	NI 220 330	Medium strong and strong light brownish yellow medium grained oolitic LIMESTONE. Fractures are subhorizontal to 30° very closely to medium spaced undulating smooth frequently stained dark orange locally infilled (up to 2mm) with white calcite. (BLPL)	3.20	265.70		
Continued Next Page									{4.00}		

EQUIPMENT: Geotechnical Pioneer rig.  
 METHOD: Rotary core drilled (300mm) 0.00-0.15m. Hand dug inspection pit 0.15-1.20m. Dynamic sampled (128mm) 1.20-3.20m. Waterflush rotary core drilled (146mm wireline) 3.20-60.20m. CASING: 168mm diam to 3.20m and 140mm diam to 60.20m.  
 BACKFILL: On completion, borehole sidewalls collapsed 60.20-56.50m whilst withdrawing casing for downhole geophysical survey. Survey carried out 3.20-40.20m. Borehole backfilled with cement:bentonite pellets 56.50-42.00m. A slotted standpipe (50mm) with geosock was installed to 41.50m, granular response zone 42.00-36.00m, bentonite seal 36.00-34.50m, cement:bentonite grout 34.50-31.00m, cement:bentonite pellets 31.00-29.00m, gravel 29.00-7.00m, bentonite pellets 7.00-5.00m, cement:bentonite grout 5.00-4.00m, cement:bentonite pellets 4.00-0.50m, concrete and stopcock cover 0.50-0.00m. Installation completed on 28/01/2019. REMARKS: Driller notes loss of flush returns 3.20-60.20m.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks		<b>CONTRACT</b> <b>34888</b>	<b>CHECKED</b>

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC419**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 2 of 13

Start Date 7 January 2019 Easting 393213.0

Scale 1 : 25

End Date 15 January 2019 Northing 215564.0 Ground level 268.90mOD

Depth 60.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	11Cs	3.98 - 4.28									
	12C	4.60 - 6.10	4.60		100 87 78			4.60 - 4.70m: 60° planar smooth fracture.			
								5.20 - 5.40m: Subvertical undulating rough fracture stained orangish brown			
	13C	6.10 - 7.60	6.10		100 96 81		Ni 150 490	Medium strong thinly laminated to very thinly bedded light brownish yellow medium and coarse oolitic LIMESTONE with closely spaced thin beds of light grey limestone. Fractures are subhorizontal to 20° closely and medium spaced undulating rough frequently stained dark orangish brown. (BLPL)	5.90	263.00	
	14C	7.60 - 9.10	7.60		95 78 70			7.50 - 7.60m: 40° planar smooth fracture stained orangish brown.			
	15Cs	8.02 - 8.30						7.90 - 8.00m: Frequent elongated voids (up to 10mm) stained orangish brown.			
								8.50 - 9.10m: 80° to subvertical undulating rough fracture stained orangish brown.			
									9.00	259.90	
								Continued Next Page	{9.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 09:00:19 JW EL

water strike (m) casing (m) rose to (m) time to rise (m) remarks



CONTRACT  
**34888**

CHECKED



# BOREHOLE LOG



CLIENT OSBORNE

**DSRC419**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 3 of 13

Start Date 7 January 2019 Easting 393213.0

Scale 1 : 25

End Date 15 January 2019 Northing 215564.0 Ground level 268.90mOD

Depth 60.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	16C	9.10 - 10.60	9.10		91 35 14	NI 40 130		Medium strong and strong light yellowish brown LIMESTONE with frequent shell fragments (up to 30mm) and burrows (up to 80mm) infilled with calcite. Fractures are subhorizontal to 20° very closely and closely spaced undulating rough stained orangish brown locally infilled (up to 5mm) with orangish brown clay. (BLPL)  9.60 - 9.75m: Frequent elongate voids (up to 30mm) stained dark brownish orange.			
	17C	10.60 - 12.10	10.60		100 47 8						
08/01/19 1630hrs Dry						NI 40 100		Weak to medium strong brownish orange medium and coarse grained LIMESTONE with closely spaced zones of extremely weak highly fractured limestone recovered as claybound gravel. Abundant shell fragments (up to 20mm) and frequent white calcite crystals (up to 20mm). Fractures are subhorizontal to 20° very closely spaced undulating rough infilled (up to 2mm) with orangish brown clay. (BLPL)	11.45	257.45	
10/01/19 0850hrs Dry	18C	12.10 - 13.60	12.10		17 7 0			12.40 - 13.60m: Assessed zone of core loss (assumed core scrubbed).			
	19C	13.60 - 15.10	13.60		83 49 29	NI 60 110		Strong light yellowish brown medium and coarse grained bioclastic LIMESTONE with frequent ooids and burrows (up to 20mm) infilled with orangish brown clay. Fractures are subhorizontal to 20° closely spaced undulating smooth and rough stained orangish brown. (BLPL)	13.60	255.30	
Continued Next Page									{14.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 09:00:19 JW EL

water strike (m) casing (m) rose to (m) time to rise (m) remarks



CONTRACT  
**34888**

CHECKED

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC419**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 4 of 13

Start Date 7 January 2019 Easting 393213.0

Scale 1 : 25

End Date 15 January 2019 Northing 215564.0 Ground level 268.90mOD Depth 60.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	20C	15.10 - 16.60	15.10		81 79 48			Strong light brownish yellow medium and coarse grained bioclastic LIMESTONE with frequent ooids and peloids. Fractures are subhorizontal to 20° mainly closely spaced undulating smooth and rough stained light orangish brown. (BLPL)	14.65	254.25	
	21C	16.60 - 18.10	16.60		97 97 97						
	22Cs	17.17 - 17.50			80 230 230			Strong light yellowish brown fine to coarse grained bioclastic LIMESTONE with frequent ooids and peloids. Fractures are subhorizontal to 20° closely and medium spaced planar smooth and rough stained orangish brown. (BLPL)	17.00	251.90	
	23C	18.10 - 19.60	18.10		95 88 63						
								Strong light yellowish brown fine and medium grained bioclastic LIMESTONE with frequent ooids. Fractures are subhorizontal to 20° closely spaced undulating rough infilled (up to 3mm) with brownish orange clay. (BLPL)	18.45	250.45	
Continued Next Page									{19.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 09:00:19 JW EL

water strike (m) casing (m) rose to (m) time to rise (m) remarks



CONTRACT  
**34888**

CHECKED

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC419**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 5 of 13

Start Date 7 January 2019 Easting 393213.0

Scale 1 : 25

End Date 15 January 2019 Northing 215564.0 Ground level 268.90mOD Depth 60.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	24C	19.60 - 21.10	19.60		91 61 51			Strong light yellowish brown medium and coarse grained bioclastic LIMESTONE locally disintegrated to orangish brown clayey angular to rounded fine to coarse limestone gravel sized fragments. Frequent shell fragments (up to 30mm), peloids and ooids and frequent burrows (up to 60mm) infilled with light orangish brown clay. Fractures are subhorizontal to 20° mainly medium spaced undulating rough infilled (up to 5mm) with orangish brown sandy clay. (BLPL)	19.35	249.55	
	25C	21.10 - 22.60	21.10		71 37 23						
	26C	22.60 - 24.10	22.60		53 33 27			Medium strong thinly to medium bedded light brownish grey fine to coarse grained LIMESTONE with frequent shell fragments (up to 10mm), ooids and peloids and frequent burrows (up to 60mm) stained orangish brown. Fractures are subhorizontal to 20° closely spaced undulating rough stained brownish orange and infilled (up to 5mm) with brownish orange sandy clay. (BLPL)	21.80	247.10	
								23.30 - 24.10m: Assessed zone of core loss.			
								Continued Next Page	{24.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 09:00:20 JW EL

water strike (m) casing (m) rose to (m) time to rise (m) remarks		<b>CONTRACT</b> <b>34888</b>	<b>CHECKED</b>
--	--	---------------------------------	----------------

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC419**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 6 of 13

Start Date 7 January 2019 Easting 393213.0

Scale 1 : 25

End Date 15 January 2019 Northing 215564.0 Ground level 268.90mOD

Depth 60.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	27C	24.10 - 25.60	24.10		87 82 76			24.20 - 24.40m: Subvertical undulating rough fracture stained orangish brown.  24.55 - 24.95m: Subvertical undulating rough fracture stained orangish brown.			
	28C	25.60 - 27.10	25.60		93 80 49						
10/01/19 1630hrs 26.47m											
11/01/19 0815hrs Dry	29C	27.10 - 28.60	27.10		95 61 46			27.10 - 27.50m: Subvertical fracture planar and undulating rough stained orangish brown.	27.50	241.40	
								Medium strong thinly to medium bedded light brownish grey fine to coarse grained LIMESTONE with frequent shell fragments (up to 10mm), ooids and peloids. Abundant burrows (up to 100mm) stained orangish brown locally infilled with orangish brown sandy clay. Fractures are subhorizontal to 20° mainly medium spaced undulating rough stained brownish orange and infilled (up to 5mm) with brownish orange sandy clay locally weakened up to 20mm from fracture surface. (BLPL) 27.50 - 27.90m: Subvertical conjugate fractures planar and undulating rough stained orangish brown. 27.90 - 28.00m: Extremely weak highly fractured limestone recovered as claybound subangular fine and medium gravel.			
	30C	28.60 - 30.10	28.60		100 99 80						
								Continued Next Page	{29.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 09:00:20 JW EL

water strike (m) casing (m) rose to (m) time to rise (m) remarks



CONTRACT  
**34888**

CHECKED

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC419**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 7 of 13

Start Date 7 January 2019 Easting 393213.0

Scale 1 : 25

End Date 15 January 2019 Northing 215564.0 Ground level 268.90mOD

Depth 60.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	31Cs	29.20 - 29.60									
	32C	30.10 - 31.60	30.10		97 85 67						
	33Cs	31.20 - 31.60							30.90	238.00	
	34C	31.60 - 33.10	31.60		99 94 83			Medium strong and strong light grey and light brownish grey fine and medium grained oolitic LIMESTONE locally disintegrated to clayey sandy angular to subrounded fine to coarse gravel sized fragments. Frequent shell fragments (up to 25mm) and peloids. Rare burrows (up to 50mm) infilled with orangish brown slightly sandy clay. Fractures are subhorizontal to 30° closely and medium spaced undulating rough infilled (up to 5mm) with orangish brown sandy clay. (BLPL)			
	35C	33.10 - 34.60	33.10					32.60 - 32.75m: Abundant voids (up to 40mm) infilled with orangish brown sandy clay.	32.75	236.15	
	36Cs	33.20 - 33.60						Weak greenish brown fine grained LIMESTONE. (BLPL)			
								Medium strong light yellowish brown fine and medium locally shelly LIMESTONE with abundant locally interconnected burrows (up to 50mm) infilled with dark orangish brown slightly sandy clay. Fractures are subhorizontal to 20° medium and widely spaced stepped rough locally stained dark orangish brown. (BLPL)	33.15	235.75	
								Continued Next Page	{34.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 09:00:20 JW EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks
29.06	29.06	29.06	20	

	<b>CONTRACT</b> <b>34888</b>	<b>CHECKED</b>
--	---------------------------------	----------------

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC419**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 8 of 13

Start Date 7 January 2019 Easting 393213.0

Scale 1 : 25

End Date 15 January 2019 Northing 215564.0 Ground level 268.90mOD

Depth 60.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
								34.20 - 34.60m: Extremely weak orangish brown calcareous fine sandstone.			
	37C	34.60 - 36.10	34.60		95 81 61						
									35.10	233.80	
								Extremely weak thinly and thickly laminated dark grey, light grey and dark yellowish brown MUDSTONE with closely spaced thin laminae and pockets (up to 20mm) of reddish brown and orangish brown ironstone. Locally tending to very stiff clay. Incipient bedding fractures are subhorizontal to 10° extremely closely to very closely spaced planar smooth. Fractures are subhorizontal to 10° very closely to closely spaced planar smooth. (BDS)			
	38C	36.10 - 37.60	36.10		77 26 16						
								Extremely weak and weak thinly bedded dark orangish brown and orangish brown fine SANDSTONE locally disintegrated to dark orangish brown and orangish brown sand. Bedding fractures are subhorizontal to 10° closely spaced planar rough. (BDS)	36.05	232.85	
	39C	37.60 - 39.10	37.60		43 31 7						
								Very stiff thinly and thickly laminated light grey locally orangish brown sandy clayey SILT. (WHM)	38.25	230.65	
								38.25 - 39.10m: Assessed zone of core loss (assumed core scrubbed).			
Continued Next Page									{39.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 09:00:21 JW EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
------------------	------------	-------------	------------------	---------	--	--------------------------	---------

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC419**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 9 of 13

Start Date 7 January 2019 Easting 393213.0

Scale 1 : 25

End Date 15 January 2019 Northing 215564.0 Ground level 268.90mOD

Depth 60.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	40C	39.10 - 40.60	39.10		80	NA					
	41C	40.60 - 42.10	40.60		81			41.10 - 41.50m: Relict subvertical fracture stained orangish brown.			
	42C	42.10 - 43.60	42.10		90			Very stiff fissured thinly and thickly laminated brown CLAY. Fissures are 40° planar and undulating smooth. (WHM)	42.00	226.90	
	43C	43.60 - 45.10	43.60		100				43.85	225.05	
									{44.00}		

Continued Next Page

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 09:00:21 JW EL

water strike (m) casing (m) rose to (m) time to rise (m) remarks		<b>CONTRACT</b> <b>34888</b>	<b>CHECKED</b>
--	--	---------------------------------	----------------

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC419**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 10 of 13

Start Date 7 January 2019 Easting 393213.0

Scale 1 : 25

End Date 15 January 2019 Northing 215564.0 Ground level 268.90mOD

Depth 60.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
11/01/19 1610hrs 35.60m							Very stiff thickly laminated and very thinly bedded grey clayey SILT with very closely spaced thick laminae and very thin beds of dark grey clayey silt. (WHM)			
14/01/19 0830hrs 39.21m	44C	45.10 - 46.60	45.10		60		44.50 - 44.70m: Frequent subangular to rounded fine to coarse gravel sized clasts of light grey siltstone.	45.20	223.70	
	45C	46.60 - 48.10	46.60		100		Very stiff fissured thickly laminated and very thinly bedded grey clayey SILT with very closely spaced thick laminae and very thin beds of dark grey clayey silt. Fissures are 50-80° planar and undulating smooth. (WHM)			
	46C	48.10 - 49.60	48.10		81					

Continued Next Page

{49.00}

water strike (m) casing (m) rose to (m) time to rise (m) remarks



CONTRACT  
**34888**

CHECKED



# BOREHOLE LOG



CLIENT OSBORNE

**DSRC419**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 11 of 13

Start Date 7 January 2019 Easting 393213.0

Scale 1 : 25

End Date 15 January 2019 Northing 215564.0 Ground level 268.90mOD

Depth 60.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
	47C	49.60 - 51.10	49.60		97						
	48C	51.10 - 52.60	51.10		100			50.80m: Very thin bed of weak grey siltstone.			
	49C	52.60 - 54.10	52.60		100			52.80m: Very thin bed of weak grey siltstone.			
Continued Next Page									{54.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 09:00:21 JW EL

water strike (m) casing (m) rose to (m) time to rise (m) remarks



**CONTRACT**  
**34888**

**CHECKED**

# BOREHOLE LOG



CLIENT OSBORNE

**DSRC419**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 12 of 13

Start Date 7 January 2019 Easting 393213.0

Scale 1 : 25

End Date 15 January 2019 Northing 215564.0 Ground level 268.90mOD

Depth 60.20 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	lf	instru -ment	description	depth (m)	reduced level (m)	legend
14/01/19 1450hrs 41.52m	50C	54.10 - 54.67	54.10		44				55.20	213.70	
	51C	54.67 - 55.20	54.67		80						
15/01/19 0830hrs 39.11m	52C	55.20 - 55.70	55.20		100			Fissured grey SILT with very closely spaced thin and thick laminae of light grey and dark grey silt. Fissures are 60° to subvertical locally subhorizontal planar rough stained orangish brown. (WHM)			
	53C	55.70 - 57.20	55.70		88						
	54C	57.20 - 58.70	57.20		100						
	55C	58.70 - 60.20	58.70		100						

Continued Next Page

{59.00}

Geotechnical Engineering Ltd, Tel. 01452 527743 34888.GPJ PROJECT\_MASTER.GPJ GEOTECH2.GLB 03/04/2019 09:00:22 JW EL

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		<b>CONTRACT</b> <b>34888</b>	<b>CHECKED</b>
------------------	------------	-------------	------------------	---------	--	---------------------------------	----------------



# STANDARD PENETRATION TEST



CLIENT OSBORNE

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

borehole no.	borehole depth (m)	s.w.p (m)	bottom depth (m)	casing depth (m)	water level (m)	seating drive		test drive				test type	N	energy ratio (%)
						blows	pen (mm)	blows		pen (mm)				
DSRC404	1.00		1.45	1.00	0.60	1 4	75 75	4 4 4 6	75 75 75 75	S	18	74		
DSRC406	1.20		1.65	Nil	Dry	4 4	75 75	3 3 4 5	75 75 75 75	S	15	74		
DSRC406	2.00		2.45	2.00	1.97	5 6	75 75	6 6 9 9	75 75 75 75	S	30	74		
DSRC406	3.00		3.38	3.00	2.29	6 11	75 75	13 16 19 2	75 75 75 0	S	67	74		
DSRC408	1.20		1.65	1.20	Dry	8 7	75 75	12 6 5 5	75 75 75 75	S	28	73		
DSRC408	2.20		2.55	2.20	1.18	10 10	75 75	18 23 9	75 75 50	S	75	73		
DSRC415	2.20		2.65	0.90	1.38	2 2	75 75	6 6 6 6	75 75 75 75	S	24	58		
DSRC415	3.20		3.65	2.20	2.79	5 6	75 75	9 9 13 19	75 75 75 70	S	51	58		
DSRC419	1.20		1.65	Nil	Dry	1 0	75 75	1 0 0 2	75 75 75 75	S	3	58		
DSRC419	2.20		2.64	Nil	Dry	2 2	75 75	12 31 5 2	75 75 75 65	S	52	58		
DSRC419	3.20		3.26	3.20	0.72	25	30	50	25	S	600	58		

notes:

1. Test carried out in general accordance with BS EN ISO 22476-3:2005 + A1:2011
2. s.w.p = self weight penetration.
3. N values have not been subjected to any correction.
4. Test carried out using split spoon S, solid cone C.
5. Where full test drive not completed, linearly extrapolated N value reported.
6. \*\* Denotes no effective penetration.

CONTRACT	CHECKED
<b>34888</b>	

# BOREHOLE LOG



**OH405**

CLIENT OSBORNE

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 1 of 5

Start Date 30 January 2019

Easting 393388.0

Scale 1 : 50

End Date 4 February 2019

Northing 215997.0 Ground level 239.50mOD

Depth 40.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru-ment	description	depth (m)	reduced level (m)	legend
30/01/19 1500hrs	1ES	0.00 - 0.10					Stiff red and reddish brown slightly sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse limestone, mudstone, siltstone and crystalline. (MADE GROUND)	0.15	239.35	
	2B	0.30 - 0.40					Firm brown slightly gravelly silty CLAY. Gravel is subangular and subrounded fine to coarse sandstone, limestone and brick. (MADE GROUND)	0.90	238.60	
	3B	0.30 - 0.40								
	2ES	0.50 - 0.60					Firm orange slightly gravelly CLAY with rare pockets (up to 10mm) of dark orange silt. Gravel is subangular to rounded fine and medium mudstone and limestone.	1.20	238.30	
	4B	0.50 - 0.60								
	3ES	1.00 - 1.20					NO RECOVERY. Rotary open hole drilled. Sandy brown CLAY (Driller's description).			
	5B	1.00 - 1.20								
4ES	1.20 - 2.00		1.20		0					
	C	2.00 - 3.50	2.00		0		NO RECOVERY. Rotary open hole drilled. Grey/white LIMESTONE (Driller's description).	2.20	237.30	
	C	3.50 - 5.00	3.50		0					
	C	5.00 - 6.50	5.00		0					
30/01/19 1610hrs Dry										
31/01/19 0830hrs Dry	C	6.50 - 8.00	6.50		0					

Continued Next Page

{8.00}

EQUIPMENT: Geotechnical Pioneer rig.  
 METHOD: Hand dug inspection pit 0.00-1.20m. Waterflush rotary open hole drilled (146mm wireline) 1.20-40.00m.  
 CASING: 168mm diam to 3.00m and 140mm diam to 40.00m.  
 BACKFILL: On completion, borehole backfilled with cement:bentonite pellets 40.00-35.00m, gravel 35.00-28.00m, cement:bentonite pellets 28.00-18.00m, gravel 18.00-17.00m. A slotted standpipe (50mm) with geosock was installed to 17.00m, granular response zone 18.00-11.00m, bentonite seal 11.00-10.00m, cement:bentonite grout 10.00-0.50m, concrete and stopcock cover 0.50-0.00m. Installation completed on 05/02/2019.  
 REMARKS: Driller notes loss of flush returns 1.20-40.00m.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



**OH405**

CLIENT OSBORNE

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 2 of 5

Start Date 30 January 2019

Easting 393388.0

Scale 1 : 50

End Date 4 February 2019

Northing 215997.0 Ground level 239.50mOD

Depth 40.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
	C	8.00 - 9.50	8.00		0					
	C	9.50 - 11.00	9.50		0					
	C	11.00 - 12.50	11.00		0					
	C	12.50 - 14.00	12.50		0					
	C	14.00 - 15.50	14.00		0					
	C	15.50 - 17.00	15.50		0					
	C	17.00 - 18.50	17.00		0					

Continued Next Page

{18.00}

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ TRIAL.JH.GPJ GEOTECH2.GLB 03/04/2019 09:01:11 CT

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		<b>CONTRACT</b> <b>34888</b>	<b>CHECKED</b>
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



**OH405**

CLIENT OSBORNE

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 3 of 5

Start Date 30 January 2019

Easting 393388.0

Scale 1 : 50

End Date 4 February 2019

Northing 215997.0 Ground level 239.50mOD

Depth 40.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru-ment	description	depth (m)	reduced level (m)	legend
	C	18.50 - 20.00	18.50		0					
	C	20.00 - 21.50	20.00		0					
	C	21.50 - 23.00	21.50		0					
	C	23.00 - 24.50	23.00		0					
	C	24.50 - 26.00	24.50		0					
	C	26.00 - 27.50	26.00		0					
	C	27.50 - 29.00	27.50		0					

Continued Next Page

{28.00}

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ TRIAL.JH.GPJ GEOTECH2.GLB 03/04/2019 09:01:11 CT

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



**OH405**

CLIENT OSBORNE

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 4 of 5

Start Date 30 January 2019

Easting 393388.0

Scale 1 : 50

End Date 4 February 2019

Northing 215997.0 Ground level 239.50mOD

Depth 40.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru-ment	description	depth (m)	reduced level (m)	legend
	C	29.00 - 30.50	29.00		0					
	C	30.50 - 32.00	30.50		0					
	C	32.00 - 33.50	32.00		0					
	C	33.50 - 34.50	33.50		0					
31/01/19 1640hrs Dry	C	34.50 - 36.00	34.50		0					
04/02/19 0815hrs Dry	C	36.00 - 37.50	36.00		0					
	C	37.50 - 39.00	37.50		0					

Continued Next Page

{38.00}

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ TRIAL.JH.GPJ GEOTECH2.GLB 03/04/2019 09:01:11 CT

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT	CHECKED
				Groundwater not encountered prior to use of water flush.		<b>34888</b>	



# BOREHOLE LOG



**OH405**

CLIENT OSBORNE

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 5 of 5

Start Date 30 January 2019

Easting 393388.0

Scale 1 : 50

End Date 4 February 2019

Northing 215997.0 Ground level 239.50mOD

Depth 40.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru-ment	description	depth (m)	reduced level (m)	legend	
04/02/19 0940hrs Dry	C	39.00 - 40.00	39.00		0			40.00	199.50		
							Borehole completed at 40.00m.				
								{48.00}			
water strike (m) casing (m) rose to (m) time to rise (m) remarks							AGS	CONTRACT	CHECKED		
Groundwater not encountered prior to use of water flush.								34888			

# BOREHOLE LOG



CLIENT OSBORNE

**OH407**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 1 of 6

Start Date 5 February 2019 Easting 393596.0

Scale 1 : 50

End Date 11 February 2019 Northing 216246.0 Ground level 231.75mOD Depth 55.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru-ment	description	depth (m)	reduced level (m)	legend
06/02/19 0900hrs	1B	0.10 - 0.20					Grass over dark brown sandy SILT. Frequent rootlets. (MADE GROUND)	0.10	231.65	
	1ES	0.10 - 0.20								
	2B	0.30 - 0.40					Brown and light brown slightly gravelly clayey fine and medium SAND with frequent pockets (up to 30mm) of brown silty clay. Gravel is subangular and subrounded fine and medium limestone and rare crystalline. (MADE GROUND)	0.80	230.95	
	2ES	0.30 - 0.40								
	3B	0.50 - 0.60								
	3ES	0.50 - 0.60								
	4B	1.00 - 1.20					Yellowish brown clayey gravelly fine to coarse SAND. Gravel is subangular and subrounded fine to coarse limestone.	1.20	230.55	
	4ES	1.00 - 1.20								
	C	1.20 - 2.00	1.20			0	NO RECOVERY. Rotary open hole drilled. Grey LIMESTONE (Driller's description).			
	C	2.00 - 3.50	2.00			0				
C	3.50 - 5.00	3.50			0					
C	5.00 - 6.50	5.00			0					
C	6.50 - 8.00	6.50			0					

Continued Next Page

{8.00}

EQUIPMENT: Geotechnical Pioneer rig.  
 METHOD: Hand dug inspection pit 0.00-1.20m. Waterflush rotary open hole drilled (146mm wireline) 1.20-21.50m. Wireline system withdrawn to unblock bit. Waterflush rotary open hole drilled (146mm conventional) 21.50-55.00m.  
 CASING: 168mm diam to 3.00m and 140mm diam to 21.50m (withdrawn and then reamed to 19.50m).  
 BACKFILL: On completion, downhole geophysical survey carried out 0.50-50.00m. Borehole backfilled with gravel 55.50-25.50m, cement:bentonite pellets 25.50-15.50m, gravel 15.50-15.00m. A slotted standpipe (50mm) with geosock was installed to 15.00m, granular response zone 15.50-6.00m, bentonite seal 6.00-5.00m, cement:bentonite grout 5.00-0.50m, concrete and stopcock cover 0.50-0.00m. Installation completed on 13/02/2019.  
 REMARKS: Driller notes reduced flush returns 1.20-45.00m (approx 50% returned) and loss of flush returns 45.00-55.00m.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m) casing (m) rose to (m) time to rise (min) remarks  
 Groundwater not encountered prior to use of water flush.



CONTRACT  
**34888**

CHECKED

# BOREHOLE LOG



**OH407**

CLIENT OSBORNE

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 2 of 6

Start Date 5 February 2019

Easting 393596.0

Scale 1 : 50

End Date 11 February 2019

Northing 216246.0 Ground level 231.75mOD

Depth 55.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
	C	8.00 - 9.50	8.00		0					
	C	9.50 - 11.00	9.50		0					
	C	11.00 - 12.50	11.00		0					
	C	12.50 - 14.00	12.50		0					
	C	14.00 - 15.50	14.00		0					
	C	15.50 - 17.00	15.50		0		NO RECOVERY. Rotary open hole drilled. Grey LIMESTONE with clay bands (Driller's description).	15.50	216.25	
	C	17.00 - 18.50	17.00		0					
Continued Next Page								{18.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ TRIAL.JH.GPJ GEOTECH2.GLB 03/04/2019 09:01:15 CT

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



**OH407**

CLIENT OSBORNE

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 3 of 6

Start Date 5 February 2019 Easting 393596.0

Scale 1 : 50

End Date 11 February 2019 Northing 216246.0 Ground level 231.75mOD Depth 55.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
	C	18.50 - 20.00	18.50		0		NO RECOVERY. Rotary open hole drilled. Grey CLAY (Driller's description).	18.50	213.25	
	C	20.00 - 21.50	20.00		0					
	C	21.50 - 23.00	21.50		0					
	C	23.00 - 24.50	23.00		0					
	C	24.50 - 26.00	24.50		0					
	C	26.00 - 27.50	26.00		0					
	C	27.50 - 29.00	27.50		0					

Continued Next Page

{28.00}

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ TRIAL.JH.GPJ GEOTECH2.GLB 03/04/2019 09:01:16 CT

water strike (m) casing (m) rose to (m) time to rise (m) remarks  
Groundwater not encountered prior to use of water flush.



**CONTRACT**  
**34888**

**CHECKED**

# BOREHOLE LOG



CLIENT OSBORNE

**OH407**

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 4 of 6

Start Date 5 February 2019 Easting 393596.0

Scale 1 : 50

End Date 11 February 2019 Northing 216246.0 Ground level 231.75mOD Depth 55.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru-ment	description	depth (m)	reduced level (m)	legend
	C	29.00 - 30.50	29.00		0					
	C	30.50 - 32.00	30.50		0					
	C	32.00 - 33.50	32.00		0					
	C	33.50 - 35.00	33.50		0					
	C	35.00 - 36.50	35.00		0					
	C	36.50 - 38.00	36.50		0					
Continued Next Page								{38.00}		

Geotechnical Engineering Ltd, Tel. 01452 527743 34888.GPJ TRIAL.JH.GPJ GEOTECH2.GLB 03/04/2019 09:01:16 CT

water strike (m) casing (m) rose to (m) time to rise (m) remarks  
 Groundwater not encountered prior to use of water flush.



CONTRACT  
**34888**

CHECKED

# BOREHOLE LOG



## OH407

CLIENT OSBORNE

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 5 of 6

Start Date 5 February 2019 Easting 393596.0

Scale 1 : 50

End Date 11 February 2019 Northing 216246.0 Ground level 231.75mOD Depth 55.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru -ment	description	depth (m)	reduced level (m)	legend
	C	38.00 - 39.50	38.00		0					
	C	39.50 - 41.00	39.50		0					
	C	41.00 - 42.50	41.00		0					
	C	42.50 - 44.00	42.50		0					
	C	44.00 - 45.50	44.00		0					
06/02/19 1550hrs Dry	C	45.50 - 47.00	45.50		0					
07/02/19 0805hrs Dry	C	47.00 - 48.50	47.00		0					

Continued Next Page

{48.00}

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ TRIAL.JH.GPJ GEOTECH2.GLB 03/04/2019 09:01:16 CT

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT	CHECKED
				Groundwater not encountered prior to use of water flush.		34888	

# BOREHOLE LOG



**OH407**

CLIENT OSBORNE

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 6 of 6

Start Date 5 February 2019 Easting 393596.0

Scale 1 : 50

End Date 11 February 2019 Northing 216246.0 Ground level 231.75mOD Depth 55.50 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru-ment	description	depth (m)	reduced level (m)	legend
	C	48.50 - 50.00	48.50		0					
	C	50.00 - 51.50	50.00		0					
	C	51.50 - 53.00	51.50		0					
	C	53.00 - 54.50	53.00		0					
	C	54.50 - 55.50	54.50		0					
07/02/19 1530hrs 24.65m								55.50	176.25	
							Borehole completed at 55.50m.			
								{58.00}		

Geotechnical Engineering Ltd. Tel. 01452 527743 34888.GPJ TRIAL.JH.GPJ GEOTECH2.GLB 03/04/2019 09:01:17 CT

water strike (m)	casing (m)	rose to (m)	time to rise (m)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

# BOREHOLE LOG



**OH416**

CLIENT OSBORNE

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

Sheet 1 of 1

Start Date 31 January 2019 Easting 393538.0

Scale 1 : 50

End Date 31 January 2019 Northing 213990.0 Ground level 286.85mOD Depth 5.00 m

progress date/time water depth	sample no & type	depth (m) from to	casing depth (m)	test type & value	samp. /core range	instru-ment	description	depth (m)	reduced level (m)	legend	
15/01/19 1230hrs	1B	0.15 - 0.25	0.90				MADE GROUND compromising TARMACADAM.	0.15	286.70		
	1ES	0.15 - 0.25					0.25	286.60			
15/01/19 1400hrs Dry	2B	0.55 - 0.75	0.90				Yellowish brown sandy GRAVEL. Gravel is subrounded and rounded fine to coarse limestone. (MADE GROUND)	0.55	286.30		
	3B	0.75 - 0.90					0.75	286.10			
	3ES	0.75 - 0.90					0.90	285.95			
31/01/19 1025hrs Dry	C	0.90 - 2.40	0.90		0		Light brownish grey very gravelly SAND with frequent lumps of firm clay. Gravel is subangular and subrounded fine to coarse limestone. (MADE GROUND)	1.50	285.35		
											Yellowish brown sandy GRAVEL with frequent pockets of firm clay (up to 30mm). Gravel is angular to subrounded fine to coarse mudstone.
											NO RECOVERY. Rotary open hole drilled. Grey LIMESTONE (Driller's description).
	C	2.40 - 3.90	0.90		0		NO RECOVERY. Rotary open hole drilled. Brownish yellow silty gravelly CLAY (Driller's description).	3.25	283.60		
							NO RECOVERY. Rotary open hole drilled. Grey CLAY (Driller's description).				
	C	3.90 - 5.00	0.90		0			5.00	281.85		
31/01/19 2100hrs Dry											

EQUIPMENT: Geotechnical Pioneer rig.  
 METHOD: Hand dug inspection pit 0.00-0.90m. Waterflush rotary core drilled (146mm) 0.90-5.00m.  
 CASING: 168mm diam to 0.90m.  
 BACKFILL: On completion, borehole backfilled with gravel 5.00-4.50m. A slotted standpipe (50mm) with geosock was installed to 4.50m, granular response zone 5.00-2.50m, bentonite seal 2.50-2.00m, cement:bentonite grout 2.00-0.50m, concrete and stopcock cover 0.50- 0.00m.  
 REMARKS: Flush returns maintained throughout borehole.

EXPLORATORY HOLE LOGS SHOULD BE READ IN CONJUNCTION WITH KEY SHEETS

water strike (m)	casing (m)	rose to (m)	time to rise (min)	remarks		CONTRACT <b>34888</b>	CHECKED
				Groundwater not encountered prior to use of water flush.			

Geotechnical Engineering Ltd. Tel. 01452 527743 34888 GPJ TRIALJH.GPJ GEOTECH2.GLB 03/04/2019 09:01:20 CT



Geotechnical Engineering Limited  
**GROUNDWATER LEVELS**



CLIENT OSBORNE

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

borehole /trial pit no.	installation depth (m)	response zone (m)	date	time	water level (m - bgl)	reduced water level (m)	remarks	
DSRC404	33.50	23.00 - 34.00	31/01/2019	15:45	Dry.		Water level below 235.50mOD.	
DSRC404	33.50	23.00 - 34.00	04/02/2019	14:00	Dry.			
DSRC404	33.50	23.00 - 34.00	05/02/2019	09:15	Dry.			
DSRC404	33.50	23.00 - 34.00	06/02/2019	09:21	Dry.			
DSRC404	33.50	23.00 - 34.00	07/02/2019	08:08	Dry.			
DSRC404	33.50	23.00 - 34.00	08/02/2019	14:10	Dry.			
DSRC404	33.50	23.00 - 34.00	11/02/2019	10:05	Dry.			
DSRC404	33.50	23.00 - 34.00	12/02/2019	08:47	Dry.			
DSRC404	33.50	23.00 - 34.00	14/02/2019	10:20	Dry.			
DSRC404	33.50	23.00 - 34.00	28/02/2019	14:20	Dry.			
DSRC404	33.50	23.00 - 34.00	19/03/2019	12:00	Dry.			Diver installed at 33.00m. Serial number BP319.
DSRC404	33.50	23.00 - 34.00	21/03/2019	09:15	Dry.			
DSRC406	34.00	20.50 - 35.00	04/02/2019	15:00	31.94	206.71		
DSRC406	34.00	20.50 - 35.00	05/02/2019	10:02	31.95	206.70		
DSRC406	34.00	20.50 - 35.00	06/02/2019	10:02	31.94	206.71		
DSRC406	34.00	20.50 - 35.00	07/02/2019	08:38	31.94	206.71		
DSRC406	34.00	20.50 - 35.00	08/02/2019	14:34	31.95	206.70		
DSRC406	34.00	20.50 - 35.00	11/02/2019	09:08	31.96	206.69		

general remarks:

CONTRACT	CHECKED
<b>34888</b>	

Geotechnical Engineering Limited  
**GROUNDWATER LEVELS**



CLIENT OSBORNE

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

borehole /trial pit no.	installation depth (m)	response zone (m)	date	time	water level (m - bgl)	reduced water level (m)	remarks
DSRC406	34.00	20.50 - 35.00	12/02/2019	09:17	31.96	206.69	
DSRC406	34.00	20.50 - 35.00	14/02/2019	08:25	31.98	206.67	
DSRC406	34.00	20.50 - 35.00	28/02/2019	13:30	31.96	206.69	
DSRC408	23.50	20.00 - 24.00	14/02/2019	16:35	Dry.		Water level below 209.00mOD.
DSRC408	23.50	20.00 - 24.00	28/02/2019	13:50	Dry.		
DSRC408	23.50	20.00 - 24.00	19/03/2019	12:30	22.12	210.38	Diver installed at 23.00m. Serial number AN815
DSRC408	23.50	20.00 - 24.00	21/03/2019	10:00	22.10	210.40	
DSRC415	49.00	25.50 - 50.00	05/02/2019	09:30	Dry.		Water level below 238.20mOD.
DSRC415	49.00	25.50 - 50.00	06/02/2019	09:50	Dry.		
DSRC415	49.00	25.50 - 50.00	07/02/2019	08:58	Dry.		
DSRC415	49.00	25.50 - 50.00	08/02/2019	14:20	Dry.		
DSRC415	49.00	25.50 - 50.00	11/02/2019	09:43	Dry.		
DSRC415	49.00	25.50 - 50.00	12/02/2019	09:01	Dry.		
DSRC415	49.00	25.50 - 50.00	28/02/2019	14:05	Dry.		
DSRC415	49.00	25.50 - 50.00	19/03/2019	13:35	Dry.		Diver installed at 48.50m. Serial number AN817.
DSRC415	49.00	25.50 - 50.00	21/03/2019	09:30	Dry.		
DSRC419	41.50	36.00 - 42.00	31/01/2019	15:40	39.09	229.81	
DSRC419	41.50	36.00 - 42.00	04/02/2019	14:10	39.24	229.66	

general remarks:

CONTRACT	CHECKED
<b>34888</b>	

Geotechnical Engineering Limited  
**GROUNDWATER LEVELS**



CLIENT OSBORNE

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

borehole /trial pit no.	installation depth (m)	response zone (m)	date	time	water level (m - bgl)	reduced water level (m)	remarks
DSRC419	41.50	36.00 - 42.00	05/02/2019	09:08	39.17	229.73	
DSRC419	41.50	36.00 - 42.00	06/02/2019	09:26	39.12	229.78	
DSRC419	41.50	36.00 - 42.00	07/02/2019	08:10	38.95	229.95	
DSRC419	41.50	36.00 - 42.00	08/02/2019	14:12	38.70	230.20	
DSRC419	41.50	36.00 - 42.00	11/02/2019	10:09	38.12	230.78	
DSRC419	41.50	36.00 - 42.00	12/02/2019	08:52	38.07	230.83	
DSRC419	41.50	36.00 - 42.00	14/02/2019	09:44	38.00	230.90	
DSRC419	41.50	36.00 - 42.00	28/02/2019	14:30	38.69	230.21	
DSRC419	41.50	36.00 - 42.00	19/03/2019	12:05	37.37	231.53	Diver installed at 40.00m. Serial number AN824.
DSRC419	41.50	36.00 - 42.00	21/03/2019	09:00	37.38	231.52	
OH405	17.00	11.00 - 18.00	06/02/2019	10:05	Dry.		Water level below 222.50mOD.
OH405	17.00	11.00 - 18.00	07/02/2019	08:42	Dry.		
OH405	17.00	11.00 - 18.00	08/02/2019	14:38	Dry.		
OH405	17.00	11.00 - 18.00	11/02/2019	09:13	Dry.		
OH405	17.00	11.00 - 18.00	12/02/2019	09:20	Dry.		
OH405	17.00	11.00 - 18.00	28/02/2019	13:35	Dry.		
OH405	17.00	11.00 - 18.00	19/03/2019	12:56	Dry.		Diver installed at 16.50m. Serial number AN794.
OH405	17.00	11.00 - 18.00	21/03/2019	09:45	Dry.		

general remarks:

CONTRACT	CHECKED
<b>34888</b>	

Geotechnical Engineering Limited  
**GROUNDWATER LEVELS**



CLIENT OSBORNE

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION

borehole /trial pit no.	installation depth (m)	response zone (m)	date	time	water level (m - bgl)	reduced water level (m)	remarks
OH407	15.00	6.00 - 15.50	14/02/2019	16:30	Dry.		Water level below 216.75mOD.
OH407	15.00	6.00 - 15.50	28/02/2019	13:45	Dry.		
OH407	15.00	6.00 - 15.50	19/03/2019	12:20	Dry.		Diver installed at 14.50m. Serial number BP219.
OH407	15.00	6.00 - 15.50	21/03/2019	10:00	Dry.		
OH416	4.50	2.50 - 5.00	04/02/2019	14:25	2.44	284.41	
OH416	4.50	2.50 - 5.00	05/02/2019	09:35	2.24	284.61	
OH416	4.50	2.50 - 5.00	06/02/2019	09:54	2.24	284.61	
OH416	4.50	2.50 - 5.00	07/02/2019	09:02	2.23	284.62	
OH416	4.50	2.50 - 5.00	08/02/2019	14:22	2.20	284.65	
OH416	4.50	2.50 - 5.00	11/02/2019	09:38	2.04	284.81	
OH416	4.50	2.50 - 5.00	12/02/2019	09:05	2.04	284.81	
OH416	4.50	2.50 - 5.00	14/02/2019	09:12	2.07	284.78	
OH416	4.50	2.50 - 5.00	28/02/2019	14:00	2.39	284.46	
OH416	4.50	2.50 - 5.00	19/03/2019	13:40	2.18	284.67	Diver installed at 4.00m. Serial number BP305.
OH416	4.50	2.50 - 5.00	21/03/2019	09:30	2.20	284.65	

general remarks:

CONTRACT	CHECKED
<b>34888</b>	

# GROUNDWATER TESTING DATA



CLIENT: OSBORNE

SITE: HE551505 A417 MISSING LINK GROUND INVESTIGATION

borehole /trial pit no.	date and time	sample depth (m)	water temperature (°C)	dissolved oxygen concentration (mg/l)	pH	resistivity (ohmcm)	conductivity (uS/cm)	total dissolved solids (ppm)	salinity (PSU)	redox (mV)	remarks	
DSRC406	14/02/19 08:38:00	31.98	3.76	12.26	8.70	43189.8	23.15367	25.32697	0.0	175.7	Slightly cloudy, light brown. No visual or olfactory contamination.	
DSRC406	14/02/19 08:39:00	31.98	4.26	5.69	7.99	4208.0	357.4659	384.588	0.3	246.6		
DSRC406	14/02/19 08:40:00	31.98	5.57	0.67	7.95	2642.2	378.4795	391.1866	0.3	252.0		
DSRC406	14/02/19 08:41:00	31.98	6.45	0.43	7.90	2598.7	384.8085	387.4156	0.3	259.4		
DSRC406	14/02/19 08:42:00	31.98	7.08	0.39	7.87	2571.3	388.9116	384.3262	0.3	263.1		
DSRC406	14/02/19 08:43:00	31.98	8.17	0.22	7.78	2491.4	401.3852	384.5051	0.3	264.7		
DSRC406	14/02/19 08:44:00	31.98	9.32	0.13	7.80	2466.0	405.5086	376.22	0.3	252.4		
DSRC406	14/02/19 08:45:00	31.98	10.21	0.13	7.79	2358.2	424.0535	384.1254	0.3	239.2		
DSRC406	14/02/19 08:46:00	31.98	12.02	0.13	7.73	2256.9	443.085	382.9671	0.3	227.3		
DSRC406	14/02/19 08:47:00	31.98	12.46	0.15	7.72	2285.8	437.4769	373.902	0.3	216.7		
DSRC406	14/02/19 08:48:00	31.98	12.20	0.20	7.72	2325.7	429.9734	369.8907	0.3	205.1		
DSRC419	14/02/19 09:48:00	38.00	6.35	11.45	7.99	42551.2	23.54411	23.77346	0.0	284.9		Translucent, clear. No visual or olfactory contamination.
DSRC419	14/02/19 09:49:00	38.00	6.87	1.15	7.85	2611.1	382.9784	380.8437	0.3	313.4		
DSRC419	14/02/19 09:50:00	38.00	7.65	0.65	7.83	2531.5	395.0268	384.0286	0.3	314.1		
DSRC419	14/02/19 09:51:00	38.00	8.27	0.48	7.83	2492.9	401.1436	383.1387	0.3	312.6		
DSRC419	14/02/19 09:52:00	38.00	8.66	0.39	7.83	2476.8	403.7505	381.4786	0.3	311.7		
DSRC419	14/02/19 09:53:00	38.00	8.96	0.36	7.82	2457.0	406.993	381.4285	0.3	310.4		
DSRC419	14/02/19 09:54:00	38.00	9.45	0.32	7.82	2421.8	412.9087	381.7338	0.3	308.3		

remarks  
# denotes result exceeding capacity of testing equipment

CONTRACT <b>34888</b>	CHECKED
--------------------------	---------

# GROUNDWATER TESTING DATA



CLIENT: OSBORNE

SITE: HE551505 A417 MISSING LINK GROUND INVESTIGATION

borehole /trial pit no.	date and time	sample depth (m)	water temperature (°C)	dissolved oxygen concentration (mg/l)	pH	resistivity (ohmcm)	conductivity (uS/cm)	total dissolved solids (ppm)	salinity (PSU)	redox (mV)	remarks
DSRC419	14/02/19 09:55:00	38.00	10.13	0.30	7.82	2377.9	420.5458	381.8338	0.3	306.6	
DSRC419	14/02/19 09:56:00	38.00	10.92	0.28	7.82	2328.8	429.4132	381.8425	0.3	305.4	
DSRC419	14/02/19 09:57:00	38.00	11.50	0.26	7.82	2302.6	434.289	380.3208	0.3	305.9	
DSRC419	14/02/19 09:58:00	38.00	11.80	0.25	7.81	2287.0	437.248	380.0408	0.3	306.7	
OH416	14/02/19 09:25:00	N/A	6.32	11.47	8.60	42916.0	23.30137	23.54828	0.0	265.9	
OH416	14/02/19 09:26:00	N/A	7.44	0.87	7.44	1919.9	520.8611	509.3914	0.4	292.8	Unable to obtain water sample. Purged dry after 1 minute. No recharge after 30 minutes.

remarks  
# denotes result exceeding capacity of testing equipment

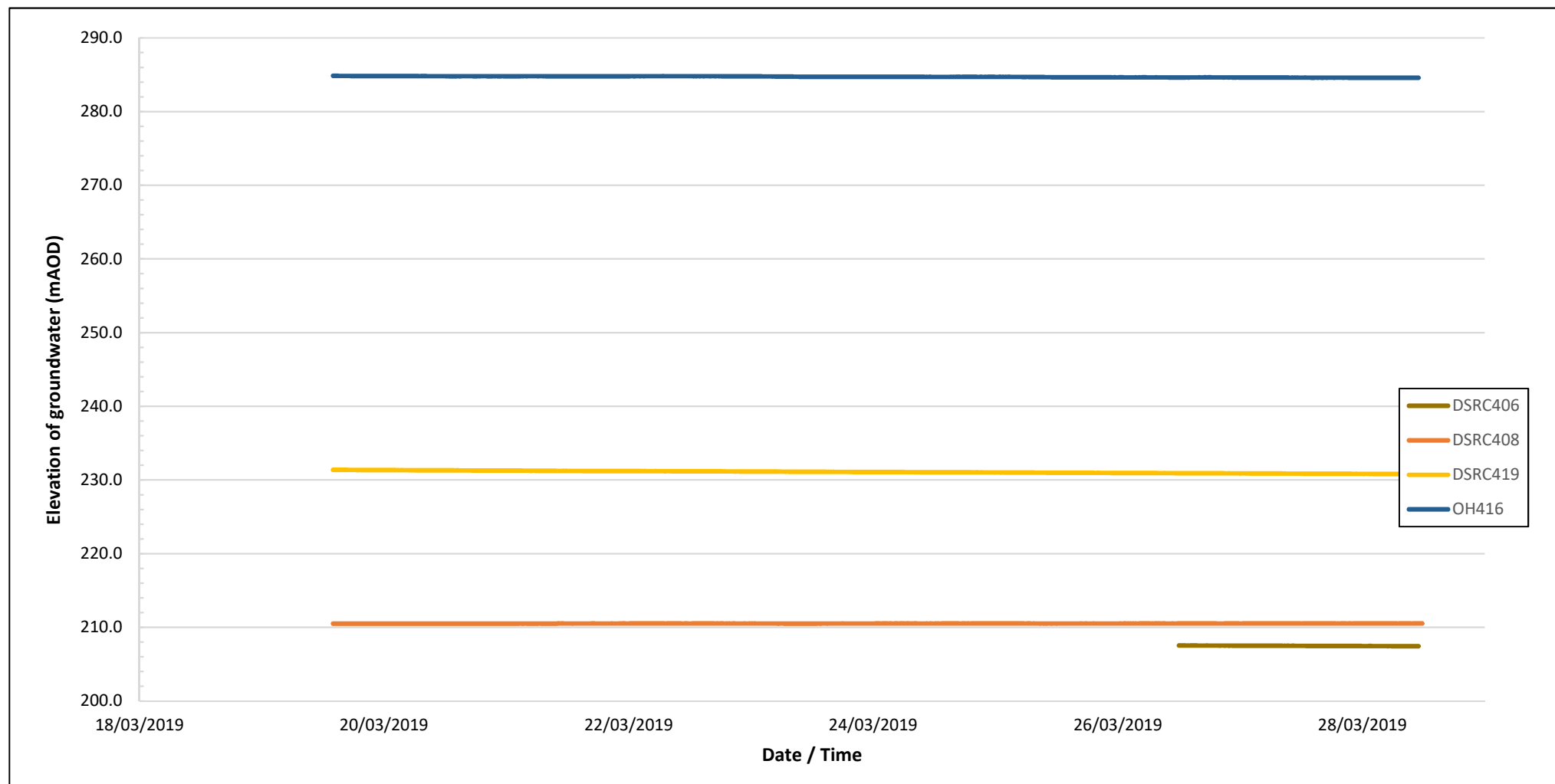
CONTRACT <b>34888</b>	CHECKED
--------------------------	---------

# DIVER DATA - COMBINED



CLIENT OSBORNE

SITE HE551505 A417 MISSING LINK GROUND INVESTIGATION



## REMARKS

CONTRACT	CHECKED
<b>34888</b>	



---

# **APPENDIX B**

## **CHEMICAL ANALYSES**





**Emma Leivers**

Geotechnical Engineering Ltd  
Centurion House  
Olympus Park  
Quedgeley  
Gloucester  
GL2 4NF

t: 01452 527 743  
f: 01452 729 314  
e: emma.leivers@geoeng.co.uk

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

t: 01923 225404  
f: 01923 237404  
e: reception@i2analytical.com

## **Analytical Report Number : 19-24098**

<b>Project / Site name:</b>	HE551505 A417 Missing link Ground Investigation	<b>Samples received on:</b>	08/01/2019
<b>Your job number:</b>	34888-DO	<b>Samples instructed on:</b>	08/01/2019
<b>Your order number:</b>		<b>Analysis completed by:</b>	15/01/2019
<b>Report Issue Number:</b>	1	<b>Report issued on:</b>	15/01/2019
<b>Samples Analysed:</b>	1 leachate sample - 1 soil sample		

**Signed** 

Jordan Hill  
Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

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

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

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

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

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

Analytical Report Number: 19-24098

Project / Site name: HE551505 A417 Missing link Ground Investigation

<b>Lab Sample Number</b>				1126641				
<b>Sample Reference</b>				DSRC419				
<b>Sample Number</b>				2				
<b>Depth (m)</b>				0.30-0.50				
<b>Date Sampled</b>				07/01/2019				
<b>Time Taken</b>				None Supplied				
<b>Analytical Parameter (Soil Analysis)</b>	<b>Units</b>	<b>Limit of detection</b>	<b>Accreditation Status</b>					
Stone Content	%	0.1	NONE	< 0.1				
Moisture Content	%	N/A	NONE	4.6				
Total mass of sample received	kg	0.001	NONE	2.0				

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

**General Inorganics**

pH - Automated	pH Units	N/A	MCERTS	8.8				
Free Cyanide	mg/kg	1	MCERTS	< 1				
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.019				
Total Sulphur	mg/kg	50	MCERTS	410				
Fraction Organic Carbon (FOC)	N/A	0.001	NONE	0.0075				

**Phenols by HPLC**

Catechol	mg/kg	0.1	ISO 17025	< 0.10				
Resorcinol	mg/kg	0.1	ISO 17025	< 0.10				
Cresols (o-, m-, p-)	mg/kg	0.3	ISO 17025	< 0.30				
Total Naphthols (sum of 1- and 2- Naphthol)	mg/kg	0.2	ISO 17025	< 0.20				
2-Isopropylphenol	mg/kg	0.1	ISO 17025	< 0.10				
Phenol	mg/kg	0.1	ISO 17025	< 0.10				
Trimethylphenol (2,3,5-)	mg/kg	0.1	ISO 17025	< 0.10				
Total Xylenols and Ethylphenols	mg/kg	0.3	ISO 17025	< 0.30				

**Total Phenols**

Total Phenols (HPLC)	mg/kg	1.3	ISO 17025	< 1.3				
----------------------	-------	-----	-----------	-------	--	--	--	--

**Speciated PAHs**

Naphthalene	mg/kg	0.05	MCERTS	< 0.05				
Acenaphthylene	mg/kg	0.05	MCERTS	0.26				
Acenaphthene	mg/kg	0.05	MCERTS	0.64				
Fluorene	mg/kg	0.05	MCERTS	0.62				
Phenanthrene	mg/kg	0.05	MCERTS	4.9				
Anthracene	mg/kg	0.05	MCERTS	1.4				
Fluoranthene	mg/kg	0.05	MCERTS	11				
Pyrene	mg/kg	0.05	MCERTS	9.1				
Benzo(a)anthracene	mg/kg	0.05	MCERTS	3.8				
Chrysene	mg/kg	0.05	MCERTS	3.2				
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	4.2				
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	3.0				
Benzo(a)pyrene	mg/kg	0.05	MCERTS	4.7				
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	2.5				
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.73				
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	3.3				

**Total PAH**

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	53.0				
-----------------------------	-------	-----	--------	------	--	--	--	--

Analytical Report Number: 19-24098

Project / Site name: HE551505 A417 Missing link Ground Investigation

<b>Lab Sample Number</b>				1126641				
<b>Sample Reference</b>				DSRC419				
<b>Sample Number</b>				2				
<b>Depth (m)</b>				0.30-0.50				
<b>Date Sampled</b>				07/01/2019				
<b>Time Taken</b>				None Supplied				
<b>Analytical Parameter (Soil Analysis)</b>	<b>Units</b>	<b>Limit of detection</b>	<b>Accreditation Status</b>					

**Heavy Metals / Metalloids**

Antimony (aqua regia extractable)	mg/kg	1	ISO 17025	< 1.0				
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	13				
Barium (aqua regia extractable)	mg/kg	1	MCERTS	42				
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.30				
Boron (water soluble)	mg/kg	0.2	MCERTS	0.3				
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2				
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0				
Chromium (III)	mg/kg	1	NONE	11				
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	11				
Copper (aqua regia extractable)	mg/kg	1	MCERTS	14				
Iron (aqua regia extractable)	mg/kg	40	MCERTS	25000				
Lead (aqua regia extractable)	mg/kg	1	MCERTS	33				
Manganese (aqua regia extractable)	mg/kg	1	MCERTS	450				
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3				
Molybdenum (aqua regia extractable)	mg/kg	0.25	MCERTS	< 0.25				
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	11				
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0				
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	37				
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	170				

**Monoaromatics**

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

**Petroleum Hydrocarbons**

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0				
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	2.6				
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	8.5				
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	82				
<b>TPH-CWG - Aliphatic (EC5 - EC35)</b>	mg/kg	10	MCERTS	93				

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0				
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	17				
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	130				
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	430				
<b>TPH-CWG - Aromatic (EC5 - EC35)</b>	mg/kg	10	MCERTS	580				

Analytical Report Number: 19-24098

Project / Site name: HE551505 A417 Missing link Ground Investigation

<b>Lab Sample Number</b>				1126641			
<b>Sample Reference</b>				DSRC419			
<b>Sample Number</b>				2			
<b>Depth (m)</b>				0.30-0.50			
<b>Date Sampled</b>				07/01/2019			
<b>Time Taken</b>				None Supplied			
<b>Analytical Parameter (Soil Analysis)</b>	<b>Units</b>	<b>Limit of detection</b>	<b>Accreditation Status</b>				

**VOCs**

Chloromethane	µg/kg	1	ISO 17025	< 1.0			
Chloroethane	µg/kg	1	NONE	< 1.0			
Bromomethane	µg/kg	1	ISO 17025	< 1.0			
Vinyl Chloride	µg/kg	1	NONE	< 1.0			
Trichlorofluoromethane	µg/kg	1	NONE	< 1.0			
1,1-Dichloroethene	µg/kg	1	NONE	< 1.0			
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	< 1.0			
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	< 1.0			
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0			
1,1-Dichloroethane	µg/kg	1	MCERTS	< 1.0			
2,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0			
Trichloromethane	µg/kg	1	MCERTS	< 1.0			
1,1,1-Trichloroethane	µg/kg	1	MCERTS	< 1.0			
1,2-Dichloroethane	µg/kg	1	MCERTS	< 1.0			
1,1-Dichloropropene	µg/kg	1	MCERTS	< 1.0			
Trans-1,2-dichloroethene	µg/kg	1	NONE	< 1.0			
Benzene	µg/kg	1	MCERTS	< 1.0			
Tetrachloromethane	µg/kg	1	MCERTS	< 1.0			
1,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0			
Trichloroethene	µg/kg	1	MCERTS	< 1.0			
Dibromomethane	µg/kg	1	MCERTS	< 1.0			
Bromodichloromethane	µg/kg	1	MCERTS	< 1.0			
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0			
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0			
Toluene	µg/kg	1	MCERTS	< 1.0			
1,1,2-Trichloroethane	µg/kg	1	MCERTS	< 1.0			
1,3-Dichloropropane	µg/kg	1	ISO 17025	< 1.0			
Dibromochloromethane	µg/kg	1	ISO 17025	< 1.0			
Tetrachloroethene	µg/kg	1	NONE	< 1.0			
1,2-Dibromoethane	µg/kg	1	ISO 17025	< 1.0			
Chlorobenzene	µg/kg	1	MCERTS	< 1.0			
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0			
Ethylbenzene	µg/kg	1	MCERTS	< 1.0			
p & m-Xylene	µg/kg	1	MCERTS	< 1.0			
Styrene	µg/kg	1	MCERTS	< 1.0			
Tribromomethane	µg/kg	1	NONE	< 1.0			
o-Xylene	µg/kg	1	MCERTS	< 1.0			
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0			
Isopropylbenzene	µg/kg	1	MCERTS	< 1.0			
Bromobenzene	µg/kg	1	MCERTS	< 1.0			
n-Propylbenzene	µg/kg	1	ISO 17025	< 1.0			
2-Chlorotoluene	µg/kg	1	MCERTS	< 1.0			
4-Chlorotoluene	µg/kg	1	MCERTS	< 1.0			
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0			
tert-Butylbenzene	µg/kg	1	MCERTS	< 1.0			
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0			
sec-Butylbenzene	µg/kg	1	MCERTS	< 1.0			
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	< 1.0			
p-Isopropyltoluene	µg/kg	1	ISO 17025	< 1.0			
1,2-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0			
1,4-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0			
Butylbenzene	µg/kg	1	MCERTS	< 1.0			
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	< 1.0			
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	< 1.0			
Hexachlorobutadiene	µg/kg	1	MCERTS	< 1.0			
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	< 1.0			



Analytical Report Number: 19-24098

Project / Site name: HE551505 A417 Missing link Ground Investigation

<b>Lab Sample Number</b>				1126642				
<b>Sample Reference</b>				DSRC419				
<b>Sample Number</b>				2				
<b>Depth (m)</b>				0.30-0.50				
<b>Date Sampled</b>				07/01/2019				
<b>Time Taken</b>				None Supplied				
<b>Analytical Parameter (Leachate Analysis)</b>	<b>Units</b>	<b>Limit of detection</b>	<b>Accreditation Status</b>					

**General Inorganics**

pH	pH Units	N/A	ISO 17025	8.5				
Total Cyanide	µg/l	10	ISO 17025	< 10				
Complex Cyanide	µg/l	10	ISO 17025	< 10				
Free Cyanide	µg/l	10	ISO 17025	< 10				
Sulphate as SO <sub>4</sub>	mg/l	0.1	ISO 17025	1.9				
Chloride	mg/l	0.15	ISO 17025	1.5				
Fluoride	µg/l	50	ISO 17025	400				
Ammoniacal Nitrogen as N	µg/l	15	NONE	33				

**Phenols by HPLC**

Catechol	µg/l	0.5	NONE	< 0.5				
Resorcinol	µg/l	0.5	NONE	< 0.5				
Ethylphenol & Dimethylphenol	µg/l	0.5	NONE	< 0.5				
Cresols	µg/l	0.5	NONE	< 0.5				
Naphthols	µg/l	0.5	NONE	< 0.5				
Isopropylphenol	µg/l	0.5	NONE	< 0.5				
Phenol	µg/l	0.5	NONE	< 0.5				
Trimethylphenol	µg/l	0.5	NONE	< 0.5				

**Total Phenols**

Total Phenols (HPLC)	µg/l	3.5	NONE	< 3.5				
----------------------	------	-----	------	-------	--	--	--	--

**Heavy Metals / Metalloids**

Antimony (dissolved)	µg/l	1.7	ISO 17025	< 1.7				
Arsenic (dissolved)	µg/l	1.1	ISO 17025	< 1.1				
Barium (dissolved)	µg/l	0.05	ISO 17025	8.9				
Beryllium (dissolved)	µg/l	0.2	ISO 17025	< 0.2				
Boron (dissolved)	µg/l	10	ISO 17025	< 10				
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08				
Chromium (hexavalent)	µg/l	5	NONE	< 5.0				
Chromium (III)	µg/l	1	NONE	< 1.0				
Chromium (dissolved)	µg/l	0.4	ISO 17025	< 0.4				
Copper (dissolved)	µg/l	0.7	ISO 17025	5.9				
Iron (dissolved)	mg/l	0.004	ISO 17025	0.32				
Lead (dissolved)	µg/l	1	ISO 17025	1.1				
Manganese (dissolved)	µg/l	0.06	ISO 17025	7.3				
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5				
Molybdenum (dissolved)	µg/l	0.4	ISO 17025	3.1				
Nickel (dissolved)	µg/l	0.3	ISO 17025	0.5				
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0				
Vanadium (dissolved)	µg/l	1.7	ISO 17025	< 1.7				
Zinc (dissolved)	µg/l	0.4	ISO 17025	2.7				

Calcium (dissolved)	mg/l	0.012	ISO 17025	13				
Magnesium (dissolved)	mg/l	0.005	ISO 17025	0.52				



**Analytical Report Number : 19-24098**

**Project / Site name: HE551505 A417 Missing link Ground Investigation**

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1126641	DSRC419	2	0.30-0.50	Light brown loam and sand with gravel and vegetation.

**Analytical Report Number : 19-24098**

**Project / Site name: HE551505 A417 Missing link Ground Investigation**

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Ammoniacal Nitrogen as N in leachate	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the discrete analyser (colorimetric) salicylate/nitroprusside method.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	NONE
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron in leachate	Determination of boron in leachate. Sample acidified and followed by ICP-OES.	In-house method based on MEWAM	L039-PL	W	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BS EN 12457-1 (2:1) Leachate Prep	2:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-1.	L043-PL	W	NONE
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Cations in soil by ICP-OES	Determination of cations in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Chloride in leachate	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Complex cyanide in leachate	Determination of complex cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L040-PL	W	ISO 17025
Cr (III) in soil	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
Fluoride in leachate	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033B-PL	W	ISO 17025
Fraction of Organic Carbon in soil	Determination of fraction of organic carbon in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L009-PL	D	NONE
Free cyanide in leachate	Determination of free cyanide by distillation followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	NONE
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025

Iss No 19-24098-1 HE551505 A417 Missing link Ground Investigation 34888-DO

This certificate should not be reproduced, except in full, without the express permission of the laboratory.

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

Page 7 of 8

**Analytical Report Number : 19-24098**

**Project / Site name: HE551505 A417 Missing link Ground Investigation**

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
pH at 20oC in leachate	Determination of pH in leachate by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	ISO 17025
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Phenols, speciated, in leachate, by HPLC	Determination of speciated phenols by HPLC.	In house method based on Blue Book Method.	L030-PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate in leachates	Determination of sulphate in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil"	L039-PL	W	ISO 17025
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Total cyanide in leachate	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038-PL	D	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS
Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS

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

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

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





**Emma Leivers**

Geotechnical Engineering Ltd  
Centurion House  
Olympus Park  
Quedgeley  
Gloucester  
GL2 4NF

t: 01452 527 743  
f: 01452 729 314  
e: emma.leivers@geoeng.co.uk

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

t: 01923 225404  
f: 01923 237404  
e: reception@i2analytical.com

## **Analytical Report Number : 19-26062**

<b>Project / Site name:</b>	HE551505 A417 MISSING LINK GROUND INVESTIGATION	<b>Samples received on:</b>	23/01/2019
<b>Your job number:</b>	34888-DO	<b>Samples instructed on:</b>	23/01/2019
<b>Your order number:</b>		<b>Analysis completed by:</b>	30/01/2019
<b>Report Issue Number:</b>	1	<b>Report issued on:</b>	30/01/2019
<b>Samples Analysed:</b>	1 leachate sample - 1 soil sample		

**Signed:**

Jordan Hill  
Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

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

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

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

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

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

Analytical Report Number: 19-26062

Project / Site name: HE551505 A417 MISSING LINK GROUND INVESTIGATION

<b>Lab Sample Number</b>				1138925			
<b>Sample Reference</b>				OH405			
<b>Sample Number</b>				2			
<b>Depth (m)</b>				0.30-0.40			
<b>Date Sampled</b>				22/01/2019			
<b>Time Taken</b>				None Supplied			
<b>Analytical Parameter (Soil Analysis)</b>	<b>Units</b>	<b>Limit of detection</b>	<b>Accreditation Status</b>				
Stone Content	%	0.1	NONE	< 0.1			
Moisture Content	%	N/A	NONE	26			
Total mass of sample received	kg	0.001	NONE	1.8			

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

#### General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.9			
Free Cyanide	mg/kg	1	MCERTS	< 1			
Water Soluble SO <sub>4</sub> 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.027			
Total Sulphur	mg/kg	50	MCERTS	630			
Fraction Organic Carbon (FOC)	N/A	0.001	NONE	0.037			

#### Phenols by HPLC

Catechol	mg/kg	0.1	ISO 17025	< 0.10			
Resorcinol	mg/kg	0.1	ISO 17025	< 0.10			
Cresols (o-, m-, p-)	mg/kg	0.3	ISO 17025	< 0.30			
Total Naphthols (sum of 1- and 2- Naphthol)	mg/kg	0.2	ISO 17025	< 0.20			
2-Isopropylphenol	mg/kg	0.1	ISO 17025	< 0.10			
Phenol	mg/kg	0.1	ISO 17025	< 0.10			
Trimethylphenol (2,3,5-)	mg/kg	0.1	ISO 17025	< 0.10			
Total Xylenols and Ethylphenols	mg/kg	0.3	ISO 17025	< 0.30			

#### Total Phenols

Total Phenols (HPLC)	mg/kg	1.3	ISO 17025	< 1.3			
----------------------	-------	-----	-----------	-------	--	--	--

#### Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05			
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05			
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05			
Fluorene	mg/kg	0.05	MCERTS	< 0.05			
Phenanthrene	mg/kg	0.05	MCERTS	0.37			
Anthracene	mg/kg	0.05	MCERTS	< 0.05			
Fluoranthene	mg/kg	0.05	MCERTS	2.0			
Pyrene	mg/kg	0.05	MCERTS	2.0			
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.81			
Chrysene	mg/kg	0.05	MCERTS	1.2			
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	1.8			
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	1.1			
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.9			
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.5			
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.34			
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	2.2			

#### Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	15.2			
-----------------------------	-------	-----	--------	------	--	--	--

Analytical Report Number: 19-26062

Project / Site name: HE551505 A417 MISSING LINK GROUND INVESTIGATION

<b>Lab Sample Number</b>				1138925				
<b>Sample Reference</b>				OH405				
<b>Sample Number</b>				2				
<b>Depth (m)</b>				0.30-0.40				
<b>Date Sampled</b>				22/01/2019				
<b>Time Taken</b>				None Supplied				
<b>Analytical Parameter (Soil Analysis)</b>	<b>Units</b>	<b>Limit of detection</b>	<b>Accreditation Status</b>					

**Heavy Metals / Metalloids**

Antimony (aqua regia extractable)	mg/kg	1	ISO 17025	< 1.0				
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	33				
Barium (aqua regia extractable)	mg/kg	1	MCERTS	56				
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.82				
Boron (water soluble)	mg/kg	0.2	MCERTS	3.8				
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.5				
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0				
Chromium (III)	mg/kg	1	NONE	38				
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	39				
Copper (aqua regia extractable)	mg/kg	1	MCERTS	13				
Iron (aqua regia extractable)	mg/kg	40	MCERTS	38000				
Lead (aqua regia extractable)	mg/kg	1	MCERTS	40				
Manganese (aqua regia extractable)	mg/kg	1	MCERTS	720				
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3				
Molybdenum (aqua regia extractable)	mg/kg	0.25	MCERTS	< 0.25				
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	15				
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0				
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	50				
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	98				

**Monoaromatics**

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

**Petroleum Hydrocarbons**

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0				
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0				
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0				
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	21				
<b>TPH-CWG - Aliphatic (EC5 - EC35)</b>	mg/kg	10	MCERTS	21				

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0				
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0				
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	17				
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	95				
<b>TPH-CWG - Aromatic (EC5 - EC35)</b>	mg/kg	10	MCERTS	110				

Analytical Report Number: 19-26062

Project / Site name: HE551505 A417 MISSING LINK GROUND INVESTIGATION

<b>Lab Sample Number</b>				1138925			
<b>Sample Reference</b>				OH405			
<b>Sample Number</b>				2			
<b>Depth (m)</b>				0.30-0.40			
<b>Date Sampled</b>				22/01/2019			
<b>Time Taken</b>				None Supplied			
<b>Analytical Parameter (Soil Analysis)</b>	<b>Units</b>	<b>Limit of detection</b>	<b>Accreditation Status</b>				

**VOCs**

Chloromethane	µg/kg	1	ISO 17025	< 1.0			
Chloroethane	µg/kg	1	NONE	< 1.0			
Bromomethane	µg/kg	1	ISO 17025	< 1.0			
Vinyl Chloride	µg/kg	1	NONE	< 1.0			
Trichlorofluoromethane	µg/kg	1	NONE	< 1.0			
1,1-Dichloroethene	µg/kg	1	NONE	< 1.0			
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	< 1.0			
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	< 1.0			
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0			
1,1-Dichloroethane	µg/kg	1	MCERTS	< 1.0			
2,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0			
Trichloromethane	µg/kg	1	MCERTS	< 1.0			
1,1,1-Trichloroethane	µg/kg	1	MCERTS	< 1.0			
1,2-Dichloroethane	µg/kg	1	MCERTS	< 1.0			
1,1-Dichloropropene	µg/kg	1	MCERTS	< 1.0			
Trans-1,2-dichloroethene	µg/kg	1	NONE	< 1.0			
Benzene	µg/kg	1	MCERTS	< 1.0			
Tetrachloromethane	µg/kg	1	MCERTS	< 1.0			
1,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0			
Trichloroethene	µg/kg	1	MCERTS	< 1.0			
Dibromomethane	µg/kg	1	MCERTS	< 1.0			
Bromodichloromethane	µg/kg	1	MCERTS	< 1.0			
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0			
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0			
Toluene	µg/kg	1	MCERTS	< 1.0			
1,1,2-Trichloroethane	µg/kg	1	MCERTS	< 1.0			
1,3-Dichloropropane	µg/kg	1	ISO 17025	< 1.0			
Dibromochloromethane	µg/kg	1	ISO 17025	< 1.0			
Tetrachloroethene	µg/kg	1	NONE	< 1.0			
1,2-Dibromoethane	µg/kg	1	ISO 17025	< 1.0			
Chlorobenzene	µg/kg	1	MCERTS	< 1.0			
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0			
Ethylbenzene	µg/kg	1	MCERTS	< 1.0			
p & m-Xylene	µg/kg	1	MCERTS	< 1.0			
Styrene	µg/kg	1	MCERTS	< 1.0			
Tribromomethane	µg/kg	1	NONE	< 1.0			
o-Xylene	µg/kg	1	MCERTS	< 1.0			
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0			
Isopropylbenzene	µg/kg	1	MCERTS	< 1.0			
Bromobenzene	µg/kg	1	MCERTS	< 1.0			
n-Propylbenzene	µg/kg	1	ISO 17025	< 1.0			
2-Chlorotoluene	µg/kg	1	MCERTS	< 1.0			
4-Chlorotoluene	µg/kg	1	MCERTS	< 1.0			
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0			
tert-Butylbenzene	µg/kg	1	MCERTS	< 1.0			
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0			
sec-Butylbenzene	µg/kg	1	MCERTS	< 1.0			
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	< 1.0			
p-Isopropyltoluene	µg/kg	1	ISO 17025	< 1.0			
1,2-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0			
1,4-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0			
Butylbenzene	µg/kg	1	MCERTS	< 1.0			
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	< 1.0			
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	< 1.0			
Hexachlorobutadiene	µg/kg	1	MCERTS	< 1.0			
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	< 1.0			



Analytical Report Number: 19-26062

Project / Site name: HE551505 A417 MISSING LINK GROUND INVESTIGATION

<b>Lab Sample Number</b>				1138926				
<b>Sample Reference</b>				OH405				
<b>Sample Number</b>				2				
<b>Depth (m)</b>				0.30-0.40				
<b>Date Sampled</b>				22/01/2019				
<b>Time Taken</b>				None Supplied				
<b>Analytical Parameter (Leachate Analysis)</b>	<b>Units</b>	<b>Limit of detection</b>	<b>Accreditation Status</b>					

**General Inorganics**

pH	pH Units	N/A	ISO 17025	8.1				
Total Cyanide	µg/l	10	ISO 17025	< 10				
Complex Cyanide	µg/l	10	ISO 17025	< 10				
Free Cyanide	µg/l	10	ISO 17025	< 10				
Sulphate as SO <sub>4</sub>	µg/l	100	ISO 17025	8830				
Chloride	mg/l	0.15	ISO 17025	4.0				
Fluoride	µg/l	50	ISO 17025	250				
Ammoniacal Nitrogen as N	µg/l	15	NONE	17				

**Phenols by HPLC**

Catechol	µg/l	0.5	NONE	< 0.5				
Resorcinol	µg/l	0.5	NONE	< 0.5				
Ethylphenol & Dimethylphenol	µg/l	0.5	NONE	< 0.5				
Cresols	µg/l	0.5	NONE	< 0.5				
Naphthols	µg/l	0.5	NONE	< 0.5				
Isopropylphenol	µg/l	0.5	NONE	< 0.5				
Phenol	µg/l	0.5	NONE	< 0.5				
Trimethylphenol	µg/l	0.5	NONE	< 0.5				

**Total Phenols**

Total Phenols (HPLC)	µg/l	3.5	NONE	< 3.5				
----------------------	------	-----	------	-------	--	--	--	--

**Heavy Metals / Metalloids**

Antimony (dissolved)	µg/l	1.7	ISO 17025	< 1.7				
Arsenic (dissolved)	µg/l	1.1	ISO 17025	3.5				
Barium (dissolved)	µg/l	0.05	ISO 17025	9.5				
Beryllium (dissolved)	µg/l	0.2	ISO 17025	< 0.2				
Boron (dissolved)	µg/l	10	ISO 17025	47				
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08				
Chromium (hexavalent)	µg/l	5	NONE	< 5.0				
Chromium (III)	µg/l	1	NONE	1.6				
Chromium (dissolved)	µg/l	0.4	ISO 17025	1.6				
Copper (dissolved)	µg/l	0.7	ISO 17025	20				
Iron (dissolved)	mg/l	0.004	ISO 17025	0.33				
Lead (dissolved)	µg/l	1	ISO 17025	< 1.0				
Manganese (dissolved)	µg/l	0.06	ISO 17025	7.1				
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5				
Molybdenum (dissolved)	µg/l	0.4	ISO 17025	< 0.4				
Nickel (dissolved)	µg/l	0.3	ISO 17025	0.8				
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0				
Vanadium (dissolved)	µg/l	1.7	ISO 17025	4.3				
Zinc (dissolved)	µg/l	0.4	ISO 17025	4.3				

Calcium (dissolved)	mg/l	0.012	ISO 17025	45				
Magnesium (dissolved)	mg/l	0.005	ISO 17025	3.5				



**Analytical Report Number : 19-26062**

**Project / Site name: HE551505 A417 MISSING LINK GROUND INVESTIGATION**

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1138925	OH405	2	0.30-0.40	Brown clay and sand with gravel and brick.

Analytical Report Number : 19-26062

Project / Site name: HE551505 A417 MISSING LINK GROUND INVESTIGATION

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Ammoniacal Nitrogen as N in leachate	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the discrete analyser (colorimetric) salicylate/nitroprusside method.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	NONE
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron in leachate	Determination of boron in leachate. Sample acidified and followed by ICP-OES.	In-house method based on MEWAM	L039-PL	W	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BS EN 12457-1 (2:1) Leachate Prep	2:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-1.	L043-PL	W	NONE
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Cations in soil by ICP-OES	Determination of cations in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Chloride in leachate	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Complex cyanide in leachate	Determination of complex cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L040-PL	W	ISO 17025
Cr (III) in soil	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
Fluoride in leachate	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033B-PL	W	ISO 17025
Fraction of Organic Carbon in soil	Determination of fraction of organic carbon in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L009-PL	D	NONE
Free cyanide in leachate	Determination of free cyanide by distillation followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS

**Analytical Report Number : 19-26062**

**Project / Site name: HE551505 A417 MISSING LINK GROUND INVESTIGATION**

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	NONE
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
pH at 20oC in leachate	Determination of pH in leachate by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	ISO 17025
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Phenols, speciated, in leachate, by HPLC	Determination of speciated phenols by HPLC.	In house method based on Blue Book Method.	L030-PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate in leachates	Determination of sulphate in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Total cyanide in leachate	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038-PL	D	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS
Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS

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

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

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

Iss No 19-26062-1 HE551505 A417 MISSING LINK GROUND INVESTIGATION 34888-DO

This certificate should not be reproduced, except in full, without the express permission of the laboratory.

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





**Emma Leivers**

Geotechnical Engineering Ltd  
Centurion House  
Olympus Park  
Quedgeley  
Gloucester  
GL2 4NF

t: 01452 527 743  
f: 01452 729 314  
e: emma.leivers@geoeng.co.uk

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

t: 01923 225404  
f: 01923 237404  
e: reception@i2analytical.com

## **Analytical Report Number : 19-26145**

<b>Project / Site name:</b>	HE551505 A417 MISSING LINK GROUND INVESTIGATION	<b>Samples received on:</b>	24/01/2019
<b>Your job number:</b>	34888	<b>Samples instructed on:</b>	24/01/2019
<b>Your order number:</b>		<b>Analysis completed by:</b>	31/01/2019
<b>Report Issue Number:</b>	1	<b>Report issued on:</b>	31/01/2019
<b>Samples Analysed:</b>	1 leachate sample - 1 soil sample		

**Signed:** \_\_\_\_\_

Jordan Hill  
Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

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

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

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

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

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

Analytical Report Number: 19-26145

Project / Site name: HE551505 A417 MISSING LINK GROUND INVESTIGATION

<b>Lab Sample Number</b>				1139455				
<b>Sample Reference</b>				DSRC415				
<b>Sample Number</b>				2				
<b>Depth (m)</b>				0.60-0.70				
<b>Date Sampled</b>				16/01/2019				
<b>Time Taken</b>				None Supplied				
<b>Analytical Parameter (Soil Analysis)</b>	<b>Units</b>	<b>Limit of detection</b>	<b>Accreditation Status</b>					
Stone Content	%	0.1	NONE	< 0.1				
Moisture Content	%	N/A	NONE	7.6				
Total mass of sample received	kg	0.001	NONE	2.0				

<b>Asbestos in Soil</b>	Type	N/A	ISO 17025	Not-detected				
-------------------------	------	-----	-----------	--------------	--	--	--	--

#### General Inorganics

pH - Automated	pH Units	N/A	MCERTS	9.1				
Free Cyanide	mg/kg	1	MCERTS	< 1				
Water Soluble SO <sub>4</sub> 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.024				
Total Sulphur	mg/kg	50	MCERTS	360				
Fraction Organic Carbon (FOC)	N/A	0.001	NONE	0.0074				

#### Phenols by HPLC

Catechol	mg/kg	0.1	ISO 17025	< 0.10				
Resorcinol	mg/kg	0.1	ISO 17025	< 0.10				
Cresols (o-, m-, p-)	mg/kg	0.3	ISO 17025	< 0.30				
Total Naphthols (sum of 1- and 2- Naphthol)	mg/kg	0.2	ISO 17025	< 0.20				
2-Isopropylphenol	mg/kg	0.1	ISO 17025	< 0.10				
Phenol	mg/kg	0.1	ISO 17025	< 0.10				
Trimethylphenol (2,3,5-)	mg/kg	0.1	ISO 17025	< 0.10				
Total Xylenols and Ethylphenols	mg/kg	0.3	ISO 17025	< 0.30				

#### Total Phenols

Total Phenols (HPLC)	mg/kg	1.3	ISO 17025	< 1.3				
----------------------	-------	-----	-----------	-------	--	--	--	--

#### Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	21				
Acenaphthylene	mg/kg	0.05	MCERTS	2.5				
Acenaphthene	mg/kg	0.05	MCERTS	21				
Fluorene	mg/kg	0.05	MCERTS	29				
Phenanthrene	mg/kg	0.05	MCERTS	120				
Anthracene	mg/kg	0.05	MCERTS	37				
Fluoranthene	mg/kg	0.05	MCERTS	100				
Pyrene	mg/kg	0.05	MCERTS	84				
Benzo(a)anthracene	mg/kg	0.05	MCERTS	39				
Chrysene	mg/kg	0.05	MCERTS	35				
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	41				
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	15				
Benzo(a)pyrene	mg/kg	0.05	MCERTS	34				
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	15				
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	3.8				
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	16				

#### Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	617				
-----------------------------	-------	-----	--------	-----	--	--	--	--



Analytical Report Number: 19-26145

Project / Site name: HE551505 A417 MISSING LINK GROUND INVESTIGATION

<b>Lab Sample Number</b>				1139455				
<b>Sample Reference</b>				DSRC415				
<b>Sample Number</b>				2				
<b>Depth (m)</b>				0.60-0.70				
<b>Date Sampled</b>				16/01/2019				
<b>Time Taken</b>				None Supplied				
<b>Analytical Parameter (Soil Analysis)</b>	<b>Units</b>	<b>Limit of detection</b>	<b>Accreditation Status</b>					

**Heavy Metals / Metalloids**

Antimony (aqua regia extractable)	mg/kg	1	ISO 17025	< 1.0				
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	1.8				
Barium (aqua regia extractable)	mg/kg	1	MCERTS	35				
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.20				
Boron (water soluble)	mg/kg	0.2	MCERTS	0.4				
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2				
Chromium (hexavalent)	mg/kg	4	MCERTS	< 4.0				
Chromium (III)	mg/kg	1	NONE	7.4				
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	7.4				
Copper (aqua regia extractable)	mg/kg	1	MCERTS	14				
Iron (aqua regia extractable)	mg/kg	40	MCERTS	9900				
Lead (aqua regia extractable)	mg/kg	1	MCERTS	4.5				
Manganese (aqua regia extractable)	mg/kg	1	MCERTS	500				
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3				
Molybdenum (aqua regia extractable)	mg/kg	0.25	MCERTS	< 0.25				
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	4.2				
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0				
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	19				
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	17				

**Monoaromatics & Oxygenates**

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

**Petroleum Hydrocarbons**

TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	2.0				
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	39				
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	80				
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	240				
<b>TPH-CWG - Aliphatic (EC5 - EC35)</b>	mg/kg	10	MCERTS	360				

TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.001	MCERTS	< 0.001				
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	35				
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	300				
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	980				
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	1200				
<b>TPH-CWG - Aromatic (EC5 - EC35)</b>	mg/kg	10	MCERTS	2500				

Analytical Report Number: 19-26145

Project / Site name: HE551505 A417 MISSING LINK GROUND INVESTIGATION

<b>Lab Sample Number</b>				1139455			
<b>Sample Reference</b>				DSRC415			
<b>Sample Number</b>				2			
<b>Depth (m)</b>				0.60-0.70			
<b>Date Sampled</b>				16/01/2019			
<b>Time Taken</b>				None Supplied			
<b>Analytical Parameter (Soil Analysis)</b>	<b>Units</b>	<b>Limit of detection</b>	<b>Accreditation Status</b>				

**VOCs**

Chloromethane	µg/kg	1	ISO 17025	< 1.0			
Chloroethane	µg/kg	1	NONE	< 1.0			
Bromomethane	µg/kg	1	ISO 17025	< 1.0			
Vinyl Chloride	µg/kg	1	NONE	< 1.0			
Trichlorofluoromethane	µg/kg	1	NONE	< 1.0			
1,1-Dichloroethene	µg/kg	1	NONE	< 1.0			
1,1,2-Trichloro 1,2,2-Trifluoroethane	µg/kg	1	ISO 17025	< 1.0			
Cis-1,2-dichloroethene	µg/kg	1	MCERTS	< 1.0			
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0			
1,1-Dichloroethane	µg/kg	1	MCERTS	< 1.0			
2,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0			
Trichloromethane	µg/kg	1	MCERTS	< 1.0			
1,1,1-Trichloroethane	µg/kg	1	MCERTS	< 1.0			
1,2-Dichloroethane	µg/kg	1	MCERTS	< 1.0			
1,1-Dichloropropene	µg/kg	1	MCERTS	< 1.0			
Trans-1,2-dichloroethene	µg/kg	1	NONE	< 1.0			
Benzene	µg/kg	1	MCERTS	< 1.0			
Tetrachloromethane	µg/kg	1	MCERTS	< 1.0			
1,2-Dichloropropane	µg/kg	1	MCERTS	< 1.0			
Trichloroethene	µg/kg	1	MCERTS	< 1.0			
Dibromomethane	µg/kg	1	MCERTS	< 1.0			
Bromodichloromethane	µg/kg	1	MCERTS	< 1.0			
Cis-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0			
Trans-1,3-dichloropropene	µg/kg	1	ISO 17025	< 1.0			
Toluene	µg/kg	1	MCERTS	< 1.0			
1,1,2-Trichloroethane	µg/kg	1	MCERTS	< 1.0			
1,3-Dichloropropane	µg/kg	1	ISO 17025	< 1.0			
Dibromochloromethane	µg/kg	1	ISO 17025	< 1.0			
Tetrachloroethene	µg/kg	1	NONE	< 1.0			
1,2-Dibromoethane	µg/kg	1	ISO 17025	< 1.0			
Chlorobenzene	µg/kg	1	MCERTS	< 1.0			
1,1,1,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0			
Ethylbenzene	µg/kg	1	MCERTS	< 1.0			
p & m-Xylene	µg/kg	1	MCERTS	< 1.0			
Styrene	µg/kg	1	MCERTS	< 1.0			
Tribromomethane	µg/kg	1	NONE	< 1.0			
o-Xylene	µg/kg	1	MCERTS	< 1.0			
1,1,2,2-Tetrachloroethane	µg/kg	1	MCERTS	< 1.0			
Isopropylbenzene	µg/kg	1	MCERTS	< 1.0			
Bromobenzene	µg/kg	1	MCERTS	< 1.0			
n-Propylbenzene	µg/kg	1	ISO 17025	< 1.0			
2-Chlorotoluene	µg/kg	1	MCERTS	< 1.0			
4-Chlorotoluene	µg/kg	1	MCERTS	< 1.0			
1,3,5-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0			
tert-Butylbenzene	µg/kg	1	MCERTS	< 1.0			
1,2,4-Trimethylbenzene	µg/kg	1	ISO 17025	< 1.0			
sec-Butylbenzene	µg/kg	1	MCERTS	< 1.0			
1,3-Dichlorobenzene	µg/kg	1	ISO 17025	< 1.0			
p-Isopropyltoluene	µg/kg	1	ISO 17025	< 1.0			
1,2-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0			
1,4-Dichlorobenzene	µg/kg	1	MCERTS	< 1.0			
Butylbenzene	µg/kg	1	MCERTS	< 1.0			
1,2-Dibromo-3-chloropropane	µg/kg	1	ISO 17025	< 1.0			
1,2,4-Trichlorobenzene	µg/kg	1	MCERTS	< 1.0			
Hexachlorobutadiene	µg/kg	1	MCERTS	< 1.0			
1,2,3-Trichlorobenzene	µg/kg	1	ISO 17025	< 1.0			



Analytical Report Number: 19-26145

Project / Site name: HE551505 A417 MISSING LINK GROUND INVESTIGATION

<b>Lab Sample Number</b>				1139456				
<b>Sample Reference</b>				DSRC415				
<b>Sample Number</b>				2				
<b>Depth (m)</b>				0.60-0.70				
<b>Date Sampled</b>				16/01/2019				
<b>Time Taken</b>				None Supplied				
<b>Analytical Parameter (Leachate Analysis)</b>	<b>Units</b>	<b>Limit of detection</b>	<b>Accreditation Status</b>					

**General Inorganics**

pH	pH Units	N/A	ISO 17025	8.5				
Total Cyanide	µg/l	10	ISO 17025	< 10				
Complex Cyanide	µg/l	10	ISO 17025	< 10				
Free Cyanide	µg/l	10	ISO 17025	< 10				
Sulphate as SO <sub>4</sub>	µg/l	100	ISO 17025	5770				
Chloride	mg/l	0.15	ISO 17025	7.8				
Fluoride	µg/l	50	ISO 17025	350				
Ammoniacal Nitrogen as N	µg/l	15	NONE	310				
Hardness - Total	mgCaCO <sub>3</sub> /l	1	NONE	30.8				

**Phenols by HPLC**

Catechol	µg/l	0.5	NONE	< 0.5				
Resorcinol	µg/l	0.5	NONE	< 0.5				
Ethylphenol & Dimethylphenol	µg/l	0.5	NONE	< 0.5				
Cresols	µg/l	0.5	NONE	< 0.5				
Naphthols	µg/l	0.5	NONE	< 0.5				
Isopropylphenol	µg/l	0.5	NONE	< 0.5				
Phenol	µg/l	0.5	NONE	< 0.5				
Trimethylphenol	µg/l	0.5	NONE	< 0.5				

**Total Phenols**

Total Phenols (HPLC)	µg/l	3.5	NONE	< 3.5				
----------------------	------	-----	------	-------	--	--	--	--

**Heavy Metals / Metalloids**

Antimony (dissolved)	µg/l	1.7	ISO 17025	< 1.7				
Arsenic (dissolved)	µg/l	1.1	ISO 17025	< 1.1				
Barium (dissolved)	µg/l	0.05	ISO 17025	18				
Beryllium (dissolved)	µg/l	0.2	ISO 17025	< 0.2				
Boron (dissolved)	µg/l	10	ISO 17025	13				
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08				
Chromium (hexavalent)	µg/l	5	NONE	< 5.0				
Chromium (III)	µg/l	1	NONE	< 1.0				
Chromium (dissolved)	µg/l	0.4	ISO 17025	< 0.4				
Copper (dissolved)	µg/l	0.7	ISO 17025	2.5				
Iron (dissolved)	mg/l	0.004	ISO 17025	0.29				
Lead (dissolved)	µg/l	1	ISO 17025	2.6				
Manganese (dissolved)	µg/l	0.06	ISO 17025	150				
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5				
Molybdenum (dissolved)	µg/l	0.4	ISO 17025	1.9				
Nickel (dissolved)	µg/l	0.3	ISO 17025	0.7				
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0				
Vanadium (dissolved)	µg/l	1.7	ISO 17025	< 1.7				
Zinc (dissolved)	µg/l	0.4	ISO 17025	1.3				
Calcium (dissolved)	mg/l	0.012	ISO 17025	11				
Magnesium (dissolved)	mg/l	0.005	ISO 17025	1.1				



**Analytical Report Number : 19-26145**

**Project / Site name: HE551505 A417 MISSING LINK GROUND INVESTIGATION**

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1139455	DSRC415	2	0.60-0.70	Brown loam and sand with gravel.

Analytical Report Number : 19-26145

Project / Site name: HE551505 A417 MISSING LINK GROUND INVESTIGATION

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Ammoniacal Nitrogen as N in leachate	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the discrete analyser (colorimetric) salicylate/nitroprusside method.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	NONE
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron in leachate	Determination of boron in leachate. Sample acidified and followed by ICP-OES.	In-house method based on MEWAM	L039-PL	W	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BS EN 12457-1 (2:1) Leachate Prep	2:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-1.	L043-PL	W	NONE
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Cations in soil by ICP-OES	Determination of cations in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Chloride in leachate	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Complex cyanide in leachate	Determination of complex cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L040-PL	W	ISO 17025
Cr (III) in soil	In-house method by calculation from total Cr and Cr VI.	In-house method by calculation	L080-PL	W	NONE
Fluoride in leachate	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033B-PL	W	ISO 17025
Fraction of Organic Carbon in soil	Determination of fraction of organic carbon in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L009-PL	D	NONE
Free cyanide in leachate	Determination of free cyanide by distillation followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	NONE
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazine followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025

Iss No 19-26145-1 HE551505 A417 MISSING LINK GROUND INVESTIGATION 34888

This certificate should not be reproduced, except in full, without the express permission of the laboratory.

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

Page 7 of 9

**Analytical Report Number : 19-26145**

**Project / Site name: HE551505 A417 MISSING LINK GROUND INVESTIGATION**

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 2, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
pH at 20oC in leachate	Determination of pH in leachate by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	ISO 17025
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	D	MCERTS
Phenols, speciated, in leachate, by HPLC	Determination of speciated phenols by HPLC.	In house method based on Blue Book Method.	L030-PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate in leachates	Determination of sulphate in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests, 2:1 water:soil extraction, analysis by ICP-OES.	L038-PL	D	MCERTS
Total cyanide in leachate	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
Total Hardness of leachates	Determination of hardness in leachates by calculation from calcium and magnesium.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L045-PL	W	NONE
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038-PL	D	MCERTS
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L088/76-PL	W	MCERTS
Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS

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

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

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



Sample Deviation Report



Sample ID	Other ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
DSRC415	2	S	19-26145	1139455	c	Free cyanide in soil	L080-PL	c

**Emma Leivers**

Geotechnical Engineering Ltd  
Centurion House  
Olympus Park  
Quedgeley  
Gloucester  
GL2 4NF

t: 01452 527 743  
f: 01452 729 314  
e: emma.leivers@geoeng.co.uk

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

t: 01923 225404  
f: 01923 237404  
e: reception@i2analytical.com

## **Analytical Report Number : 19-29777**

<b>Project / Site name:</b>	HE551502 A417 Missing Link Ground Investigation	<b>Samples received on:</b>	15/02/2019
<b>Your job number:</b>	34888-DO	<b>Samples instructed on:</b>	20/02/2019
<b>Your order number:</b>		<b>Analysis completed by:</b>	26/02/2019
<b>Report Issue Number:</b>	1	<b>Report issued on:</b>	26/02/2019
<b>Samples Analysed:</b>	2 water samples		

**Signed:** \_\_\_\_\_

Jordan Hill  
Reporting Manager  
**For & on behalf of i2 Analytical Ltd.**

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

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

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

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

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



Analytical Report Number: 19-29777

Project / Site name: HE551502 A417 Missing Link Ground Investigation

<b>Lab Sample Number</b>				1160464	1160465			
<b>Sample Reference</b>				DSRC406	DSRC419			
<b>Sample Number</b>				1	1			
<b>Depth (m)</b>				31.98	38.00			
<b>Date Sampled</b>				14/02/2019	14/02/2019			
<b>Time Taken</b>				None Supplied	None Supplied			
<b>Analytical Parameter (Water Analysis)</b>	<b>Units</b>	<b>Limit of detection</b>	<b>Accreditation Status</b>					

**General Inorganics**

pH	pH Units	N/A	ISO 17025	7.7	7.5			
Temperature on Receipt	oC	0.1	NONE	5.60	5.60			
Electrical Conductivity at 20 °C	µS/cm	10	ISO 17025	470	470			
Sulphate as SO <sub>4</sub>	µg/l	45	ISO 17025	112000	33800			
Sulphate as SO <sub>4</sub>	mg/l	0.045	ISO 17025	112	33.8			
Chloride	mg/l	0.15	ISO 17025	10	56			
Ammoniacal Nitrogen as N	µg/l	15	ISO 17025	< 15	< 15			
Ammonium as NH <sub>4</sub>	µg/l	15	ISO 17025	< 15	< 15			
Nitrate as N	mg/l	0.01	ISO 17025	0.58	0.22			
Nitrate as NO <sub>3</sub>	mg/l	0.05	ISO 17025	2.55	0.98			
Nitrite as N	µg/l	1	ISO 17025	12	2.3			
Nitrite as NO <sub>2</sub>	µg/l	5	ISO 17025	41	7.5			
Alkalinity	mgCaCO <sub>3</sub> /l	3	ISO 17025	150	160			
Total Oxidised Nitrogen (TON)	mg/l	0.3	NONE	0.6	< 0.3			
Total Suspended Solids	mg/l	2	ISO 17025	2600	55			
Hardness - Total	mgCaCO <sub>3</sub> /l	1	ISO 17025	269	218			
Bicarbonate	mgHCO <sub>3</sub> /l	10	NONE	< 10	< 10			
Dissolved Oxygen	mg/l	1	NONE	8.0	6.6			

**Heavy Metals / Metalloids**

Aluminium (dissolved)	mg/l	0.012	ISO 17025	< 0.012	0.013			
Arsenic (dissolved)	µg/l	1	ISO 17025	3.8	2.0			
Boron (dissolved)	µg/l	10	ISO 17025	95	160			
Calcium (dissolved)	mg/l	0.012	ISO 17025	76	80			
Iron (dissolved)	mg/l	0.004	ISO 17025	0.59	0.051			
Magnesium (dissolved)	mg/l	0.005	ISO 17025	20	4.6			
Manganese (dissolved)	µg/l	0.06	ISO 17025	210	83			
Potassium (dissolved)	mg/l	0.025	ISO 17025	2.8	2.4			
Sodium (dissolved)	mg/l	0.01	ISO 17025	21	50			

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



**Analytical Report Number : 19-29777**

**Project / Site name: HE551502 A417 Missing Link Ground Investigation**

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Alkalinity in Water (by discreet analyser)	Determination of Alkalinity by discreet analyser (colorimetry). Accredited matrices: SW, PW, GW.	In house method based on MEWAM & USEPA Method 310.2.	L082-PL	W	ISO 17025
Alkalinity in Water (by titration)	Determination of Alkalinity by titration (colorimetry). Accredited matrices: SW, PW, GW.	In house method based on MEWAM & USEPA Method 310.2.	L025-PL	W	ISO 17025
Ammoniacal Nitrogen as N in water	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the discrete analyser (colorimetric) salicylate/nitroprusside method. Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	ISO 17025
Ammonium as NH <sub>4</sub> in water	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the colorimetric salicylate/nitroprusside method. Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	ISO 17025
Boron in water	Determination of boron in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW	In-house method based on MEWAM	L039-PL	W	ISO 17025
Chloride in water	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260. Accredited matrices: SW, PW, GW.	L082-PL	W	ISO 17025
Dissolved Oxygen in water	Determination of dissolved oxygen.	In-house method	L086-PL	W	NONE
Electrical conductivity at 20oC of water	Determination of electrical conductivity in water by electrometric measurement. Accredited Matrices SW, GW, PW	In-house method	L031-PL	W	ISO 17025
Metals in water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited Matrices: SW, GW, PW except B=SW,GW, Hg=SW,PW, Al=SW,PW.	In-house method based on USEPA Method 6020 & 200.8 "for the determination of trace elements in water by ICP-MS.	L012-PL	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited Matrices SW, GW, PW, PrW.(Al, Cu,Fe,Zn).	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Nitrate as N in water	Determination of nitrate by reaction with sodium salicylate and colorimetry. Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08,	L078-PL	W	ISO 17025
Nitrate in water	Determination of nitrate by reaction with sodium salicylate and colorimetry. Accredited matrices SW, GW, PW	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08,	L078-PL	W	ISO 17025
Nitrite as N in water	Determination of nitrite in water by addition of sulphanilamide and NED followed by discrete analyser (colorimetry). Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	ISO 17025
Nitrite in water	Determination of nitrite in water by addition of sulphanilamide and NED followed by discrete analyser (colorimetry). Accredited matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	ISO 17025
pH at 20oC in water (automated)	Determination of pH in water by electrometric measurement. Accredited matrices: SW PW GW	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L099-PL	W	ISO 17025
Sulphate in water	Determination of sulphate in water by acidification followed by ICP-OES. Accredited matrices: SW PW GW, PrW.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Suspended solids in water	Determined gravimetrically with GFC filtration papers.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L004-PL	W	ISO 17025

Iss No 19-29777-1 HE551502 A417 Missing Link Ground Investigation 34888-DO

This certificate should not be reproduced, except in full, without the express permission of the laboratory.

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



Analytical Report Number : 19-29777

Project / Site name: HE551502 A417 Missing Link Ground Investigation

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Temperature on Receipt (water)	Temperature of water upon receipt.	In-house method	L019-UK	W	NONE
Total Hardness of water	Determination of hardness in waters by calculation from calcium and magnesium. Accredited Matrices SW, GW, PW.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L045-PL	W	ISO 17025
Total oxidised nitrogen in water	Calculation from nitrate and nitrite.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton & Polish Standard Method PN-82/C-04579.08	L078-PL	W	NONE

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

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

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

## Sample Deviation Report



Sample ID	Other ID	Sample Type	Job	Sample Number	Sample Deviation Code	test_name	test_ref	Test Deviation code
DSRC406	1	W	19-29777	1160464	c	Ammoniacal Nitrogen as N in water	L082-PL	c
DSRC406	1	W	19-29777	1160464	c	Ammonium as NH4 in water	L082-PL	c
DSRC406	1	W	19-29777	1160464	c	Dissolved Oxygen in water	L086-PL	c
DSRC406	1	W	19-29777	1160464	c	Electrical conductivity at 20oC of water	L031-PL	c
DSRC406	1	W	19-29777	1160464	c	Nitrate as N in water	L078-PL	c
DSRC406	1	W	19-29777	1160464	c	Nitrate in water	L078-PL	c
DSRC406	1	W	19-29777	1160464	c	Nitrite as N in water	L082-PL	c
DSRC406	1	W	19-29777	1160464	c	Nitrite in water	L082-PL	c
DSRC406	1	W	19-29777	1160464	c	Settleable Solids in water	L004-PL	c
DSRC406	1	W	19-29777	1160464	c	Suspended solids in water	L004-PL	c
DSRC406	1	W	19-29777	1160464	c	Total oxidised nitrogen in water	L078-PL	c
DSRC406	1	W	19-29777	1160464	c	pH at 20oC in water (automated)	L099-PL	c
DSRC419	1	W	19-29777	1160465	c	Ammoniacal Nitrogen as N in water	L082-PL	c
DSRC419	1	W	19-29777	1160465	c	Ammonium as NH4 in water	L082-PL	c
DSRC419	1	W	19-29777	1160465	c	Dissolved Oxygen in water	L086-PL	c
DSRC419	1	W	19-29777	1160465	c	Electrical conductivity at 20oC of water	L031-PL	c
DSRC419	1	W	19-29777	1160465	c	Nitrate as N in water	L078-PL	c
DSRC419	1	W	19-29777	1160465	c	Nitrate in water	L078-PL	c
DSRC419	1	W	19-29777	1160465	c	Nitrite as N in water	L082-PL	c
DSRC419	1	W	19-29777	1160465	c	Nitrite in water	L082-PL	c
DSRC419	1	W	19-29777	1160465	c	Settleable Solids in water	L004-PL	c
DSRC419	1	W	19-29777	1160465	c	Suspended solids in water	L004-PL	c
DSRC419	1	W	19-29777	1160465	c	Total oxidised nitrogen in water	L078-PL	c
DSRC419	1	W	19-29777	1160465	c	pH at 20oC in water (automated)	L099-PL	c