Swansea Bay Tidal Lagoon Access Road

Ground Investigation Report

Alun Griffiths Contractors

September 2015

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1. Introduction

1.1. Scope and objective of the report

Atkins Limited (Atkins) has been commissioned to undertake the outline design of the proposed Swansea Bay Tidal Lagoon.

This project comprises an offshore component including construction of breakwaters approximately 9.5km in length to create an artificial lagoon. The onshore component of the project comprises highway improvement works through Swansea Docks in the west and the placement of a new cable between Swansea Docks and the existing power station located in Baglan Burrows to the east. The location of the scheme is shown in Figure 1.1 and Figure 1.2 in Appendix A.

This report has been prepared for the onshore aspects of the project comprising the highway improvements works and new cable connection and presents the following:

- Findings of the desk study;
- Outline the existing available ground investigation reports for the site;
- Outline the ground investigation carried out for the proposed development;
- Provide an interpretation of the ground investigation and outline the ground model for the site and material parameters;
- Land contamination assessment; and
- Present the geotechnical and geoenvironmental risks associated with the site and proposed development.

1.2. Description of project

The Swansea Bay Tidal Lagoon is a proposed tidal energy generation project in Swansea Bay located in the Bristol Channel between the River Tawe in the west and the Baglan Burrows in the east. The Bristol Channel/Severn Estuary holds the second highest tidal range in the world and within this, Swansea Bay benefits from an average tidal range during spring tides of 8.5m. The construction of a tidal lagoon to harness this natural resource would help the UK transition to a low carbon future with greater energy security and lower electricity costs, whilst providing regenerative economic and recreational benefits to the local community.

The project is split into a number of packages and this report covers the onshore works package C133 which covers the access roads through the docks area and associated car parking.

1.3. Geotechnical Category of project

Following completion of the ground investigation works, the Geotechnical Category of this aspect of the project has been reviewed. The review has determined that the project will be classed as Geotechnical Category 1: Projects which only include small and relatively simple structures, earthworks, or geotechnical activities, for which it is possible to ensure that the fundamental requirements will be satisfied based on experience and the qualitative geotechnical investigations.

1.4. Other relevant information

None.

2. Existing Information

The purpose of this section of the report is to summarise the currently available information that is considered directly relevant to the geotechnical elements of the proposed scheme. This information is used in the later sections of this report as background information to determine site conditions, aid the identification and determination of geotechnical constraints and hazards that could impact on the scheme.

Existing information for the site was principally obtained from online sources that are to be referenced accordingly.

2.1. Site Description

For the purposes of the desk study (1) the onshore works area was split into three areas as summarised below:

- Docklands (principally highway improvement works in the west around King's Dock and Queen's Dock;
- Crymlyn Burrows (central area of the service route); and
- Baglan (eastern area of the service route).

For the purpose of this report 'the site' refers to the docklands area in the west of the study area.

The junction of Langdon Road and the A484 Fabian Way constitutes the western extent of the docklands area, which extends eastwards across the northern and eastern boundaries of King's Dock and the eastern and southern boundaries of Queen's Dock to approximately 180m west of Baldwins Crescent.

The site location is shown in Figure 1.1 and Figure 1.2 in Appendix A.

2.2. Historical Development

The historical development of the site has been reviewed using freely available historical maps. Historical maps dating from 1879-1881 to 2015 were available for the site. Significant features and historical changes are summarised in the following table.

Table 2-1 Historical Development

Date	On Site	Surrounding Area
1879-1881 (1:2,500)	The site is undeveloped and exists as tidal sands called Llansamlet Higher. The Crymlyn Burrows exists as marsh land to the eastern part of the site. An arsenic works is shown at the western extent of the site at the current junction of the A484 Fabian Way and Langdon Road.	The city of Swansea lies to approximately 2km to the west of the site and the Great Western Railway (GWR) runs parallel with the coastline east to west around 200m to the north of the site. The Tennant Canal runs parallel, immediately north of the railway. Various works are located adjacent to the canal and railway around 200m to the north of the site in the location of what is now the Ashlands Playing Fields including the Swansea Wagon Works (wagon), the Crown Works (paint and spelter) and a gasworks. The Port Tennant Copper Works are shown between King's Dock and Prince of Wales Dock around 500m west of the western extent of the site. The Burrow Works (chemical) is shown approximately 600m to the northeast of the site on the opposite side of the railway from the present day Gower Chemicals.

1884 (1:10,560)	No significant changes.	No significant changes.
1899 (1:2,500)	No significant changes.	The Rhondda & Swansea Bay Railway has been constructed parallel and to the south of the GWR. Railway sidings have been added to the south of the railway linking the GWR to the Prince of Wales Dock. The Burrow Works have been renamed Crymlyn Chemical Works and new sidings are shown to the south of the railway at this location. The Prince of Wales Dock is shown and the coastline defence to the south of the Port Tennant Copper Works has been developed.
1900 (1:10,560)	No significant changes.	No significant changes.
1917-1919 (1:2,500)	Significant development of Swansea Bay is evident, including the Kings Dock and Queens Dock. To the north east of the site the Great Western Railway has been extensively developed across the site and along the coast. The railway lines have multiplied and widened.	Significant development of the railway infrastructure of the docklands is evident, with tracks connecting the Kings Dock and Queens Dock to the GWR. A timber yard and fish meal factory are shown along the south wall of Queens Dock at the southern extent of the site. Patent fuel works are shown between the Kings Dock and the Queens Dock.
1921 (1:10,560)	No significant changes.	No significant changes.
1948-1949 (1:1,250)	There are at least 11 Oil Storage Tanks interspersed along the south of the site along the southern wall of the Queens Dock. A narrow envelope labelled as Refuse Heap is found along the north side of the Queens Dock and is found to cross into the north east of the site area.	The Port Tennant Works of Aluminium Wire and Cable replaces the English Crown Spelter Works 600 m to the north. The Crymlyn Chemical Works is no longer operational and is replaced by the United Kingdom Chemical Works found 300 m to the north of the site which includes at least 9 storage tanks and a tar distillery. 200m to the east are at least 19 large gas storage depots along the coast and found 100 m south of the Great Western Railway.
1966 (1:1,250)	Large oil depot development on site to the north east with at least 35 storage tanks.	Large oil depot development with at least 8 storage tanks adjacent to the on-site oil depot, found 100 m to the west.
1968-1971 (1:2,500)	Large oil depot now has 37 storage tanks to the north east.	No significant changes.

1979-1980 (1:10,000)	No significant changes.	No significant changes.
1980-1989 (1:10,000)	No significant changes.	No significant changes.
2015 (1:10,000)	No significant changes.	The former industrial plants to the north of King's Dock have been redeveloped for a commercial/industrial estate comprising a hotel, builder's yard and car showrooms. These are located on and adjacent to the site. The depot at Queen's Dock is no longer present and is undergoing academic and residential redevelopment for Swansea University. 200m to the north east two storage tanks associated with a Sewage Works exists.

2.3. Geological maps and memoirs

The geology of the site has been summarised using published information provided on the British Geological Survey (BGS) 1:50,000 scale Solid and Drift geological sheet 247 map of Swansea (2) and the BGS GeoIndex online service (3).

2.3.1. Made Ground

Made Ground is shown to underlie the entire site associated with the construction of the docks and surrounding area.

2.3.2. Superficial Geology

Marine Beach Deposits consisting of shingle, sand, silt and clay are shown to underlie the Made Ground across the entire site.

2.3.3. Bedrock Geology

The underlying bedrock comprises the South Wales Middle Coal Measures, over the South Wales Lower Coal Measures which outcrops at the south of the site along the south of Queens Dock. These strata are described by the BGS as grey, coal-bearing mudstones/siltstones, with seatearths and minor sandstones with reported depths of up to approximately 300m below ground level (bgl) in the Swansea area.

A north-west to south-east trending fault with an easterly downthrow is indicated towards the eastern extent of the site.

2.4. Hydrogeology

Natural Resources Wales (NRW) (4) suggests the bedrock and the Marine Beach Deposits underlying the entire site are classified as a Secondary A Aquifer, defined by the Environment Agency as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

The site is not located on, or within 1 km of a groundwater Source Protection Zone (SPZ).

NRW (4) data indicates that there are no active groundwater abstraction licences on, or within 1 km of, the site.

2.5. Hydrology

A number of hydrological features are present in the area surrounding the site. King's Dock and Queen's Dock are located within 100m of the site. The River Tawe (1.6km west of the site) and River Neath flow into the inter-tidal zone of the Bristol Channel is located to the south of the site.

NRW (4)data indicates that there are no surface water abstractions within 1 km of the site.

2.6. Flood records

Risk of flooding for planning and development purposes have been assessed by Natural Resources Wales (4). The site has generally been classed been Flood Zone 2, with local areas including the port road to the south of Queens Dock and the road to the north of Kings Dock classified as Flood Zone 3.

Flood Zone 2 is land assessed as having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.

Flood Zone 3 is land assessed as having a 1 in 200 of greater annual probability of sea flooding.

2.7. Aerial photographs (old and recent)

No aerial photographs were available for review as part of the study.

2.8. Records of mines and mineral deposits

Review of available historical plans has identified the presence of former collieries approximately 1 km to the northwest of the site from circa 1884 until circa 1964. The site is not located within the zone of likely physical influence of past or present surface or underground coal workings.

2.9. Land use and soil survey information

The earliest historical maps identify that the site did not form part of the existing docklands until the early 1910s. The surrounding area has a long history of significant development, including mixed residential, industrial and infrastructure development. Construction of works and depots were developed coincident with the docklands development in the early 1910s, particularly the United Kingdom Chemical Works and the Port Tennant Works, which are potentially contaminative.

Made Ground is known to be present on the site and the surrounding area associated with development of the current highway and infrastructure. Made Ground may potentially comprise inorganic or organic contaminants. Reflecting the potential contamination risk, laboratory analysis of soil samples was undertaken as part of the recent ground investigation summarised in Section 3 of this report. The results of the analysis are discussed in Section 7.

2.10. Archaeological and historical investigations

No archaeological assessment were available for review as part of this study.

2.11. Existing ground investigations

There are five available historical exploratory hole logs (SS69SE138, SS69SE139, SS69SE140, SS69SE141 and SS69SE142) within the vicinity of the site available from the BGS GeoIndex service (3). The boreholes are located at the eastern extent of the site by the wastewater treatment works.

A summary of the ground profile encountered in the historical exploratory holes is presented in Table 2-2. A copy of the historical borehole records is presented in Appendix B.

Table 2-2 Historical Borehole Records

Strata	Depth to Base of Strata (m bgl)	Description
Made Ground	2.20 to 3.90	Loose to medium dense, dark grey, brown and black, variably clayey, variably silty fine- to coarse-grained sand and gravel of clinker, sandstone, coal, coke, slag, brick and siliceous gravel. Locally (SS69SE139) very soft to soft, dark grey-brown, sandy, silty clay with some subangular to rounded, fine- to coarse-grained gravel including clinker, coal and siliceous gravel.
Marine Beach Deposits	7.50 to 9.20	Medium dense to dense, brown and grey, silty, fine- to medium-grained sand with a little coarse sand and little to some sub-angular to rounded, fine- to coarse grained gravel. Occasionally shell fragments and occasional coaly sand lenses. Locally some cobbles. Locally (SS69139) very dense, grey, silty, fine- to medium-grained sand and some subangular to rounded, fine- to coarse-grained gravel. Occasional shell fragments and pockets of dark grey, organic, slightly clayey, very silty, sand. An oily odour was encountered around 5.40m bgl in SS69SE138. A slight organic odour was encountered around 7.20m bgl in SS69SE140.
Tidal Flat Deposits	30.00*	Interbedded layers of: • soft to firm, brown and grey, silty clay, locally with a little brown and black fibrous peat and other organic material; • medium dense to dense, grey and brown, variably clayey, silty, fine- to medium-grained sand; • medium dense to very dense, brown and grey, variably clayey, slightly sandy silt, locally with occasional organic traces and lenses of peat; and • firm to stiff, brown and grey, laminated, silty to very silty clay. Layers of compact, brown, fibrous peat up to 0.70m in thickness.

*Base not proven

2.12. Consultation with Statutory Bodies and Agencies

None undertaken.

2.13. Potential Land Contamination

Natural Resources Wales (4) data indicates that there are no current or historical landfills or waste transfer sites located on-site. However 650 m to the north of the site Tir John Landfill and Tir John Power Station exists along Fabian Way. The landfill waste includes industrial and commercial waste and the power station contained special waste. The Tir John Power station was active from 1952 with an unknown closure date whereas the Tir John Landfill was reportedly closed from 2005 because of risks of water pollution to an environmentally sensitive location (Crymlyn Bog) bordering it on three sides.

There are no reported pollution incidents on the site.

2.14. Existing services

No Statutory Undertaker's Plans were made available when writing this report.

2.15. Unexploded Ordnance

An Unexploded Ordnance Survey (UXO) threat assessment report was obtained from BACTEC (reference 4122TA) for the site to determine the risk of unexploded ordnance dropped during World War I and II. The report concludes that the risk is high along the majority of the cable route, and low in the areas occupied by buildings that survived the war intact.

A UXO specialist was present during ground investigation to monitor for the presence of UXO.

3. Field and Laboratory Studies

3.1. Ground investigations

Between June 15 and July 9 2015, Apex Drilling Services conducted a ground investigation for the proposed onshore works. The ground investigation comprised:

- 13no. dynamic sample borehole advanced by windowless sampling;
- 116no. machine excavated trial pits including:
  - 41 trial pits along the road route;
  - 62 trial pits in the designated 'arsenic area';
  - 13 trial pits for soakaway testing.
- 3no. road cores.

A location plan of the exploratory hole is presented in the factual report in Appendix C.

Representative bulk and disturbed samples were collected from the exploratory hole for the purposes of selected geotechnical testing, and environmental samples were also collected for the purposes of contamination testing.

Groundwater/gas monitoring installations were installed in ten boreholes (BH1, BH2, BH3, BH4, BH5, BH6A, BH9, BH10A, BHA1 and BHA2) and were monitored during three post fieldwork visits. The results of the groundwater and gas monitoring are discussed in Section 4.2.

3.2. Drainage studies

Soakaways were carried out in thirteen trial pits (TPS1, TPS3, TPS4, TPS5, TPS6, TPS7, TPS8, TPS8A, TPS9, TPS10, TPS11, TPS15 and TPS16).

3.3. Laboratory Analysis

3.3.1. Description of tests

Geotechnical Testing

Geotechnical laboratory tests have been carried out in accordance with BS 1377:1990 **(5)** in order to obtain information on the material properties and derive geotechnical design parameters. Geotechnical testing was not undertaken on samples from the arsenic area trial pits. Tests include the following:

- Moisture content;
- Atterberg limits;
- Particle size distribution (wet sieve);
- Particle size distribution (sedimentation); and
- Organic matter.

Selected soil samples were tested to allow the aggressiveness of the ground to buried concrete to be assessed. Testing was scheduled in accordance with BRE Special Digest 1 (6) and included the following:

- Soluble sulphate 2:1 extract as SO4;
- Chloride 2:1 water/soil extract;
- Nitrate as NO3, 2:1 water soluble;
- Magnesium; and
- pH.

Contamination Testing

Soil samples were taken as part of the GI and contamination laboratory analysis was carried out by Alcontrol Laboratories in accordance with the laboratory's quality control system. Alcontrol Laboratories are a UKAS and MCERTS approved analytical laboratory. 55 soil samples were subject to a suite of analysis comprising the following determinands which were selected based on the historical uses of the site and surrounding area including an oil storage depot:

- Metals – arsenic, antimony, beryllium, boron, cadmium, chromium, hexavalent chromium, copper, lead, mercury, molybdenum, nickel, selenium, vanadium, zinc;
- Total cyanide;
- Total Organic Carbon (TOC);
- Asbestos screen;
- Benzene, Toluene, Ethylbenzene, Xylene (BTEX);
- Speciated polycyclic aromatic hydrocarbons (PAH): US EPA 16; and
- Speciated Total Petroleum Hydrocarbons Criteria Working Group (TPHCWG).

In addition a further 132 soil samples which were obtained from a suspected former arsenic works were subject to a suite of analysis comprising:

- Metals – arsenic, antimony, beryllium, boron, cadmium, chromium, hexavalent chromium, copper, lead, mercury, molybdenum, nickel, selenium, vanadium, zinc;
- TOC; and
- Asbestos screen;

Soil leachate analysis was undertaken on 16 samples comprising the following:

- Metals – arsenic, antimony, beryllium, boron, cadmium, chromium, hexavalent chromium, copper, lead, mercury, molybdenum, nickel, selenium, vanadium, zinc;
- Total cyanide;
- BTEX;
- Speciated PAH: US EPA 16; and
- Speciated TPHCWG.

Water analysis was undertaken on 6 samples comprising the following:

- Metals – arsenic, antimony, beryllium, boron, cadmium, chromium, hexavalent chromium, copper, lead, mercury, molybdenum, nickel, selenium, vanadium, zinc;
- Total cyanide;
- BTEX;
- Speciated PAH: US EPA 16; and
- Speciated TPHCWG.

3.3.2. Copies of test results

Copies of the scheduled geotechnical, chemical and contamination test results, including digital AGS format, is provided in the factual report in Appendix C.

4. Ground Summary

This section summarises the ground profile based on visual observations and results of the ground investigation.

4.1. Ground Model

A summary of the recorded strata underlying the site is presented in Table 4-1, which forms the basis of the ground model for the site.

Table 4-1 Ground Model

Strata	Depth to base (m bgl)	General Description
Made Ground	0.30 to >4.00*	Black and brown, variably silty, variably gravelly, fine- to coarse grained sand and brown, black and grey, variably silty, sandy to very sandy, angular to sub-angular, fine to coarse-grained gravel with local cobbles and boulders. Pockets of clay present, described as very soft to stiff, very low strength to high strength, slightly silty to silty, variably gravelly and friable.
Marine Beach Deposits	>4.00*	Light brown and orange-brown, locally slightly gravelly, fine- to medium-grained, locally fine- to coarse-grained sand.

*base not proven

4.2. Groundwater

Groundwater was encountered in fifteen exploratory holes ranging from 1.90m to 3.80m bgl, equivalent to 2.97m to 5.50m above Ordnance Datum (AOD). The rate of groundwater inflow was described as seepage to medium inflow.

Groundwater monitoring data for boreholes is presented in Table 4-2 below.

Table 4-2 Groundwater Monitoring Data

Hole ID	Depth (m bgl)					
	22/06/2015	02/07/2015	07/07/2015	08/07/2015	09/07/2015	22/07/2015
BH1	3.55 (HT)	3.60 (HT)	3.64 (HT)	3.65 (HT)	3.65 (HT)	3.68 (HT)
BH2	Dry (HT)	Dry (HT)	Dry (HT)	Dry (HT)	Dry (HT)	Dry (HT)
BH3	3.55 (HT)	Dry (HT)	Dry (HT)	Dry (HT)	Dry (HT)	Dry (HT)
BH4	Dry (HT)	Dry (HT)	Dry (HT)	Dry (HT)	Dry (HT)	No reading
BH5	Dry (LT)	Dry (HT)	Dry (HT)	Dry (HT)	Dry (HT)	Dry (LT)
BH6A	Dry (LT)	Dry (LT)	Dry (LT)	Dry (HT)	Dry (HT)	Dry (LT)
BH9	3.44 (LT)	3.54 (LT)	3.54 (LT)	3.54 (HT)	3.50 (HT)	3.51 (LT)

BH10A	Dry (LT)	Dry (LT)	Dry (LT)	Dry (HT)	Dry (HT)	Dry (LT)

*HT indicates that the tide was high when the groundwater level was recorded
LT indicates that the tide was low when the groundwater level was recorded

4.3. Evidence of Contamination

Hydrocarbon odours were recorded in the Made Ground in exploratory holes, BH6A, TP22, TP23, TP32, TP35, TP39 and TPS11 and in the Marine Beach Deposits in BH9.

5. Ground Conditions and Material Properties

5.1. Made Ground

Made Ground was encountered in all exploratory holes to depths ranging from 0.60m to over 4.00m bgl and generally consisted of black and brown, variably silty, variably gravelly, fine- to coarse grained sand and brown, black and grey, variably silty, sandy to very sandy, angular to sub-angular, fine to coarse-grained gravel with local cobbles and boulders.

Gravel is angular to rounded, fine- to coarse-grained of granite, clinker, ash, slag, brick, sandstone, siltstone, limestone, shell fragments, quartz, flint and coal.

Cobbles are angular to rounded brick, concrete and sandstone, limestone, slag, clay (soft) and foundry relics.

Boulders (ranging in size between 300mm to 1m) are angular to sub-rounded slag, clinker, bricks, foundry debris, concrete, mudstone and siltstone, clay (soft to firm medium strength).

Pockets of clay were encountered in TP7, TP10, TP21, TP23, TP42, TP57, TPA7, TPA15, TP22, TPA32, TPA33, TPS5, TPS10 and TPS16. Clay is described as very soft to stiff, very low strength to high strength, slightly silty to silty, variably gravelly and friable.

White, angular, medium, gravel size fragments of asbestos were encountered at 0.60m bgl in BH2, and broken tiles recorded as possibly being asbestos were encountered at 0.30m bgl in TPS11.

Concrete, potentially associated with buried structures was encountered at 0.50m bgl in BH7, at 0.50m bgl in TP19, at 0.20m bgl in TP34, at 0.80m bgl in TP34A.

5.1.1. Classification

Particle size distribution tests were carried out nineteen samples of Made Ground. Results are summarised in Table 5-1. A plot of the test results in presented in Figure 5.1 in Appendix A.

Table 5-1 Particle Size Distribution Test Results – Made Ground

Hole ID	Sample Depth (m bgl)	Percentage by Mass (%)					Description
		Clay	Silt	Sand	Gravel	Cobbles	
BH1	2.50	6		52	42	0	Black, silty, very gravelly SAND
BH3	0.70	9		31	47	13	Brown grey, silty, very sandy GRAVEL with medium cobble content
BH4	2.50	4		51	45	0	Black, slightly silty, very gravelly SAND
TP17	1.00	5		64	31	0	Brown grey, silty, very gravelly SAND
TP23	1.00	1		98	1	0	Light brown, slightly silty, slightly gravelly SAND
TP26	1.00	2		93	5	0	Brown grey, slightly silty, gravelly SAND

TP3	1.00	5	40	55	0	Black, silty, very sandy GRAVEL
TP32	1.00	7	49	44	0	Brown grey, silty, very gravelly SAND
TP42	1.00	5	49	46	0	Brown grey, silty, very gravelly SAND
TP46	2.00	0	99	1	0	Light brown, slightly silty, slightly gravelly SAND
TP49	2.00	1	98	1	0	Light brown, slightly silty, slightly gravelly SAND
TP57	1.00	8	31	58	3	Brown grey, silty, very sandy GRAVEL with low cobble content
TP59	2.00	2	84	11	3	Light brown, slightly silty, gravelly SAND with low cobble content
TP6	1.00	8	57	35	0	Brown grey, silty, very gravelly SAND
TP7	2.00	2	46	52	0	Black, slightly silty, very sandy GRAVEL
TP8	1.00	5	32	63	0	Brown grey, silty, very sandy GRAVEL
BH2	1.20	13	21	66	0	Brown, silty, clayey, sandy GRAVEL (fine-coarse)
BH9	2.00	2	98	0	0	Brown, silty, clayey SAND
BH10A	3.00	4	95	1	0	Brown, gravelly (fine), silty, clayey SAND

Test results indicate the samples to generally be slightly silty to silty, gravelly to very gravelly sand or silty, sandy to very sandy gravel, locally with low to medium cobble content.

Moisture content tests were carried out on thirty samples of Made Ground. The results ranged from 3.9 to 31% with an average moisture content of 10%. Results are summarised in Table 5-2.

Table 5-2 Moisture Content Test Results - Made Ground

Hole ID	Sample Depth (m bgl)	Moisture Content (%)	Description
BH1	1.20	18.0	Black brown, clayey, sandy GRAVEL
BH1	2.50	16.0	Black, silty, very gravelly, SAND
BH2	1.20	6.9	Brown, slightly silty, slightly gravelly, fine to coarse SAND
BH3	0.70	7.6	Brown grey, silty, very sandy GRAVEL with medium cobble content
BH4	0.50	16.0	Black, silty, sandy GRAVEL
BH5	0.30	12.0	Brown grey, slightly silty, sandy GRAVEL
BH9	0.20	5.3	Grey brown, slightly silty, very sandy GRAVEL

Hole ID	Sample Depth (m bgl)	Moisture Content (%)	Description
TP10	2.80	19.0	Yellow brown, locally black, gravelly, fine to medium SAND
TP11	3.00	31.0	Orange, coarse GRAVEL of clinker
TP12	2.00	22.0	Dark brown, slightly silty, sandy, fine to coarse GRAVEL with low boulder content.
TP17	1.00	9.1	Brown grey, silty, very gravelly SAND
TP17A	1.40	9.6	Brown grey, slightly silty, sandy GRAVEL
TP23	1.00	5.3	Light brown, slightly silty, slightly gravelly SAND
TP24	1.00	6.1	Brown grey, slightly silty, sandy GRAVEL
TP26	1.00	4.3	Brown grey, slightly silty, gravelly SAND
TP28	1.00	5.0	Brown grey, slightly silty, gravelly SAND
TP3	1.00	18.0	Black, silty, very sandy GRAVEL
TP32	1.00	7.9	Brown grey, silty, very gravelly SAND
TP34B	1.00	9.2	Brown grey, gravelly SAND
TP37	1.00	5.2	Brown grey, silty, gravelly SAND
TP37	2.00	5.8	Light brown becoming orange brown, slightly gravelly, coarse grained SAND
TP40	1.00	4.0	Brown, silty, gravelly SAND
TP44	1.00	4.7	Light brown, slightly silty, very sandy GRAVEL
TP46	2.00	4.2	Light brown, slightly silty, gravelly SAND
TP49	2.00	3.9	Light brown, slightly silty, slightly gravelly SAND
TP55	1.00	11.0	Brown grey, silty, very sandy GRAVEL
TP59	2.00	5.2	Light brown, slightly silty, gravelly SAND with low cobble content
TP6	1.00	11.0	Brown grey, silty, very gravelly SAND
TP7	2.00	21.0	Black, slightly silty, very sandy GRAVEL
TP8	1.00	15.0	Brown grey, silty, very sandy GRAVEL

5.1.2. Bulk Unit Weight

No tests have been carried out to determine the bulk unit weight, γ of the soil. Using typical values for a medium-dense, well-graded sandy gravel, a value of 20kN/m^3 has been used for design.

Therefore, for the purposes of design, the following parameter is recommended:

- Made Ground γ = 20kN/m^3

5.1.3. Aggressive Environment Classification

Tests were carried out on eight samples of Made Ground to assess the aggressive chemical environment of this strata on buried concrete. Tests to determine the total potential sulphate were not undertaken, so a full assessment in accordance with BRE Special Digest 1 (6) has not been carried out. However a classification has been carried out based on the available data.

One sample taken from TP22 at 3.00m bgl, was described as very soft, friable, dark grey mottled black, slightly gravelly, silty clay and was recorded as having an oily sheen and a strong hydrocarbon odour.

The results indicated the following maximum (or minimum for pH) values:

- Water soluble sulphate (2:1 leachate equivalent) content of 898mg/l;
- Magnesium content of 38mg/l; and
- pH of 6.7

The above results indicate a design sulphate (DS) class of DS-2 and an aggressive chemical environment for concrete classification (ACEC) class of AC-2 can be used for buried concrete within the Made Ground.

5.1.4. Infiltration

Soakaway tests were carried out within the Made Ground in eleven trial pits in accordance with BRE Digest 365 (7). The calculated infiltration rate ranged from 1.984×10^{-5}m/s to 3.685×10^{-4}m/s.

5.1.5. California Bearing Ratio

Five plate load bearing tests were carried out on the Made Ground to determine the California Bearing Ratio (CBR) of this strata. The results varied from 20% to 24%.

Dynamic Cone Penetration Tests (DCPT) were carried out at seven locations (TP13, TP19, TP20, TP25, TP33, TP49 and TP59) with tests carried out in layers ranging from ground surface to 1.15m bgl. Three of the tests (in TP19, TP25 and TP59) were terminated due to obstructions. Test results have been plotted against depth and are presented in Figure 5.2 in Appendix A. A characteristic CBR value of 20% has been used for design.

Therefore, for the purposes of design, the following parameter is recommended:

- Made Ground CBR = 20%

5.2. Marine Beach Deposits

Marine Beach Deposits were encountered underlying the Made Ground in eight exploratory holes (BH5, BH9, BH10A, TP51, TP53, TP55, TP57 and TP59) starting from 0.60m to 1.80m bgl. The base of the Marine Beach Deposits was not encountered in any of the exploratory holes.

The deposits generally consisted of light brown and orange-brown, locally slightly gravelly, fine- to medium-grained, locally fine- to coarse-grained sand.

Gravel is sub-rounded, fine- to coarse-grained of sandstone.

Grey and black, very sandy, sub-angular, fine- to coarse-grained gravel of mudstone was recorded in BH9 from 3.65m bgl.

5.2.1. Classification

Particle size distribution tests were carried out five samples of Marine Beach Deposits. Results are summarised in Table 5-3 .A plot of the test results in presented in Figure 5.3 in Appendix A.

Table 5-3 Particle Size Distribution Test Results – Marine Beach Deposits

Hole ID		Percentage by Mass (%)	Description

	Sample Depth (m bgl)	Clay	Silt	Sand	Gravel	Cobbles	
TP53	1.00	1		94	5	0	Light brown slightly silty gravelly SAND
TP57	1.00	8		31	58	3	Brown grey silty very sandy GRAVEL with low cobble content
TP59	2.00	2		84	11	3	Light brown slightly silty gravelly SAND with low cobble content
BH9	2.00	2		98	0	0	Brown silty clayey SAND
BH10A	3.00	4		95	1	0	Brown gravelly (fine) silty clayey SAND

Test results indicate the samples to generally be slightly silty to silty, locally gravelly, locally clayey sand or silty, very sandy gravel, locally with low cobble content.

Moisture content tests were carried out on two samples of Marine Beach Deposits. The results ranged from 5.5 to 8% with an average moisture content of 7%. Results are summarised in Table 5-4.

Table 5-4 Moisture Content Test Results – Marine Beach Deposits

Hole ID	Sample Depth (m bgl)	Moisture Content (%)	Description
BH10A	3.00	8.0	Light brown, fine to coarse SAND
TP57	1.00	5.5	Brown grey, silty, very sandy GRAVEL with low cobble content

5.2.2. Bulk Unit Weight

No tests have been carried out to determine the bulk unit weight, γ of the soil. Using typical values for a medium-dense, well-graded sandy gravel, a value of 20kN/m^3 has been used for design.

Therefore, for the purposes of design, the following parameter is recommended:

- Made Ground γ = 20kN/m^3

5.2.3. Aggressive Environment Classification

Tests were carried out on one sample of the Marine Beach Deposits to assess the aggressive chemical environment of this strata on buried concrete. Tests to determine the total potential sulphate were not undertaken, so a full assessment in accordance with BRE Special Digest 1 (6) has not been carried out. However a classification has been carried out based on the available data.

The results indicate the following values:

- Water soluble sulphate (2:1 leachate equivalent) content of 63mg/l;
- Magnesium content of <8mg/l; and
- pH of 8.3

The above results indicate a DS class of DS-1 and an ACEC class of AC-1 can be used for buried concrete within the Marine Beach Deposits.

5.3. Groundwater

The groundwater monitoring data presented in Section 4.2 indicates that groundwater levels are not particularly influenced by the tide. The groundwater level is shown to range between 1.90m and 3.80m bgl across the site, with a typical groundwater level of 3.50m bgl.

6. Land Contamination

6.1. Introduction

Land contamination is assessed though development of a conceptual site model (CSM) which describes the relationship between contamination which may be present from past and current activities on a site (including any off-site activities from which contaminants may migrate to a site), receptors to that contamination and pathways between the two.

Sources of contamination and associated contaminants, receptors to that contamination and the pathways between the two are identified and assessed to determine whether all three are present or are likely to be present and, if so, described as a potential contaminant linkage (PCL). These PCLs can then be subjected to the risk assessment process.

The approach adopted by Atkins is in accordance with the Contaminated Land Exposure Assessment (CLEA) model produced by Defra and the Environment Agency and as outlined in Contaminated Land Report (CLR) 11 (8). CLR11 provides a technical framework for identifying and remediating contamination through the application of a risk management process. The question of whether risk is unacceptable in any particular case involves not only scientific and technical assessments, but also appropriate criteria by which to judge the risk and conclude exactly what level of risk would be unacceptable. Decisions regarding a site may be informed by:

- Tier 1 preliminary risk assessment - typically a desk study review to develop the preliminary CSM with an assessment of risk considering the likelihood and severity of the potential consequences associated with the PCL(s);
- Tier 2 GQRA, typically a review of ground investigation and monitoring data, development of a CSM with an assessment of risk using precautionary Generic Assessment Criteria (GAC) relevant to the PCLs that represent minimal or tolerable risk; and
- Tier 3 Detailed Quantitative Risk Assessment (DQRA).

The following Tier 2 GQRA has considered the potential implications of the contaminant concentrations detected, suitability of the material for reuse and the waste classification.

6.2. Potential Sources of Contamination

6.2.1. On-Site

Review of the available historical mapping of the site indicates that the site was historically occupied by marshland which was subsequently reclaimed and developed as dockland and a variety of industrial uses. Historical mapping indicates that the site has been occupied by various commercial and industrial uses.

Therefore, historical potentially contaminative activities on the site which could have given rise to contaminants in, on or under the ground at the site include:

- Made Ground used as fill during land reclamation; and

- Potential contamination in soils and groundwater associated with previous historical site uses including arsenic works, refuse tip, railway land and fuel/oil storage;

Potential contamination associated with the identified sources may comprise a wide range of inorganic and organic contaminants.

6.2.2. Off-Site

Contaminants from off-site sources have to migrate to the site, generally in windblown, soil-derived dust, entrained in surface water run-off, in migrating groundwater and as migrating ground/landfill gas and vapours.

Historical potentially contaminative activities surrounding the site which could have given rise to contaminants in, on or under the ground at the site include:

- Potential contamination in soils and groundwater associated with previous off-site historical site uses including gasworks, copper works, paint works, railway land and fuel / oil storage.

Potential contamination associated with the identified sources may comprise a wide range of inorganic and organic contaminants.

6.3. Potential Receptors and Pathways

6.3.1. Human Receptors

On-site human receptors, comprising future users of the site (pedestrians) and construction/maintenance workers, could be exposed to contamination by the following pathways:

- dermal contact with contaminants in soil, soil-derived dust and entrained in surface water run-off from areas where soil (and contaminant) is exposed and in shallow groundwater if excavation takes place below the groundwater table;
- ingestion of contaminants in soil, soil-derived dust and entrained in surface water run-off from areas where soil (and contaminant) is exposed and in shallow groundwater if excavation takes place below the groundwater table; and
- inhalation of contaminants in soil-derived dust from areas where soil (and contaminant) is exposed.

Off-site human receptors, comprising commercial properties in the north of the site, located off Fabian Way could be exposed to contamination by the following pathways:

- dermal contact with contaminants in windblown, soil-derived dust and entrained in surface water run-off from areas where soil (and contaminant) is exposed and in migrating groundwater if off-site excavation takes place below the groundwater table;
- ingestion of contaminants in windblown, soil-derived dust and entrained in surface water run-off from areas where soil (and contaminant) is exposed and in migrating groundwater if off-site excavation takes place below the groundwater table;
- inhalation of contaminants in windblown, soil-derived dust from areas where soil (and contaminant) is exposed; and
- inhalation of migrating soil-/water-derived vapours and ground gas.

6.3.2. Controlled Water Receptors

Controlled water receptors are considered to comprise the Secondary A Aquifer beneath the site and the surface waters of Swansea Bay to the south of the site. There are no surface water or groundwater abstractions on or within 1 km of the site. Potential pathways associated with these receptors comprise:

- leaching of contaminants from unsaturated soil and migration of contaminants through the unsaturated zone to shallow groundwater followed by vertical migration to deeper groundwater;
- leaching of contaminants from unsaturated soil and migration of contaminants through the unsaturated zone to shallow groundwater followed by migration to surface waters; and
- discharge of contaminants in laterally migrating groundwater, entrained in surface water runoff and via preferential pathways such as drains, pipes and trenches to drains.

6.3.3. Ecological Receptors

Crymlyn Bog SSSI is located approximately 200 m north of the site. Flora and Fauna associated with the SSSI are potential receptors to direct contact with contamination migrating off site via surface water flow or dust migration.

6.3.4. Property Receptors and Pathways

On-site property receptors include proposed roads and associated infrastructure. Pathways to on-site property include direct contact of foundations and below ground infrastructure with contaminants in soil and shallow groundwater.

Off-site property receptors include adjacent existing buildings and infrastructure. Pathways to off-site property include direct contact of foundations in migrating shallow groundwater.

6.4. Preliminary Conceptual Site Model

Based on the information reviewed, potential sources of contamination have been identified and a preliminary CSM developed, together with PCLs or source-receptor-pathway linkages. The preliminary CSM is summarised in Table 6-1 below.

Table 6-1 Preliminary Conceptual Site Model

Source of Contamination	Receptors	Pathways
Made Ground Associated with land reclamation. Potential contamination in soils and groundwater associated with previous on-site historical site uses including arsenic works, refuse tip, railway land and fuel/oil storage. Potential contamination in soils and groundwater associated with previous off-site historical site uses including gas works, copper works, paint works, railway land and fuel / oil storage. A range of inorganic and recalcitrant organic contaminants could be present associated with these sources.	Humans On-site (future site users and construction workers)	Dermal contact with contaminants in soil, soil-derived dust and entrained in surface water run-off from areas where soil (and contaminant) is exposed and in shallow groundwater if excavation takes place below the groundwater table. Ingestion of contaminants in soil, soil-derived dust and entrained in surface water run-off from areas where soil (and contaminant) is exposed and in shallow groundwater if excavation takes place below the groundwater table. Inhalation of contaminants in soil-derived dust from areas where soil (and contaminant) is exposed.
	Humans Off-site (commercial properties adjacent to the site)	Dermal contact with contaminants in windblown, soil-derived dust and entrained in surface water run-off from areas where soil (and contaminant) is exposed and in migrating groundwater if off-site excavation takes place below the groundwater table. Ingestion of contaminants in windblown, soil-derived dust and entrained in surface water run-off from areas where soil (and contaminant) is exposed and in migrating groundwater if off-site excavation takes place below the groundwater table. Inhalation of contaminants in windblown, soil-derived dust from areas where soil (and contaminant) is exposed.
	Groundwater in the Secondary A superficial Aquifer (Marine Beach Deposits)	Leaching of contaminants from the unsaturated soil zone to groundwater and subsequent migration to wider groundwater.
	Surface Water (Swansea Bay)	Discharge of contaminants in surface water run-off and in laterally migrating groundwater.
	Ecological Receptors (Crymlyn Bog SSSI)	Dermal contact with contaminants in windblown, soil-derived dust and entrained in surface water run-off from areas where soil (and contaminant) is exposed.
	Property On-site (buildings/infrastructure)	Direct contact with contaminants in soil/groundwater.
	Property Off-site (buildings/infrastructure)	Direct contact with contaminants in migrating groundwater.

6.5. Generic Quantitative Risk Assessment

A Tier 2 GQRA of identified receptors has been carried out using information from the GI undertaken in July 2015 by Apex Drilling Services.

6.5.1. Human Health Risk Assessment

Detailed guidance on human health risk assessment is available in Science Report SR2 (9), SR3 (10) and the CLEA Model. The GQRA for identified human receptors has compared soil concentration data with GAC which comprised:

- Category 4 Screening Values (C4SLs) have been published for six contaminants (benzo(a)pyrene, benzene, lead, arsenic, cadmium and chromium) by DEFRA (11). C4SLs are low risk levels which are not representative of significant possibility of significant harm (SPoSH) and as such, if the C4SLs are not exceeded, land can be demonstrated as being in Category 4 and cannot be determined as contaminated land;

- Soil Guideline Values: The Environment Agency has published a set of Soil Guideline Values (SGVs) for a limited number of contaminants. SGVs are appropriate for screening out low risk areas of land contamination. They give an indication of representative average concentrations of chemicals in soil below which the long-term health risks are likely to be minimal. The SGVs have been developed for a sandy loam soil with 6% soil organic matter (SOM) content; and

- Atkins' Soil Screening Values: Atkins has derived a set of Soil-Screening Values (SSVs) using the CLEA Model for the CLEA standard residential, allotments and commercial land-uses for a wide range of typical indicator contaminants for a sandy loam soil with 6% SOM. SSVs have also been derived for a sandy soil with 1% SOM and for parks, playing fields and open spaces.

SOM is defined as 'the fraction of the soil composed of organic matter. It consists of plant and animal remains in varying stages of decomposition'. The presence of SOM is important in determining the fate and behaviour of a number of organic contaminants such PAHs and chlorinated solvents. The mobility of these contaminants decreases with increasing SOM. Generally, the greater the SOM content the greater the sorptive capacity of the soil.

Based on soil laboratory results, SOM ranged from 0.34 % to 46.2 % with a mean SOM for the 36 soil samples analysed of 11.84%. Therefore, the Atkins derived SSVs for a 6% SOM have been used as the GAC, together with the SGVs/C4SLs which do not change based on SOM.

Considering the proposed development, which comprises a surfaced roadway and car parking areas, it is considered that the site is most appropriately classified for assessment as an open space end use. There are no occupied buildings currently present or proposed as part of the development. Human site users are likely to have short term exposure during construction or as pedestrians. C4SL and Atkins SSV GACs have been produced for two open space usage scenarios, and the less sensitive public park end use has been used for this assessment which does not consider tracked back dust as a viable pathway.

Construction workers involved with the proposed development and any subsequent maintenance workers cannot be assessed using the GAC because they relate to the long-term (chronic) risk posed by contamination, not short-term exposure (acute risk) which is applicable to construction / maintenance workers. The GAC may therefore be overly conservative and risks to construction workers should be managed with the use of appropriate Personal Protective Equipment (PPE) and working methods. There are also no GAC by which to assess potential risks to off-site receptors.

It should be noted that the GAC may change as new policy and technical guidance, including toxicological data, are published by the Environment Agency and other authoritative sources, but are valid at the time of writing.

6.5.2. Comparison of Soil Concentration Data with Generic Assessment Criteria

Depending on the determinand, between 55 and 182 soil samples have been obtained from the unsaturated zone during the site investigation works. A summary of identified exceedances of the GAC are presented in Table 6-2 below.

Table 6-2 Summary of GAC Exceedances

CoC	GAC (mg/kg)	Concentrations (mg/kg)			No. of Samples	No. of Exceedances	Location of Maximum Concentration
		Min	Max	Mean			
Arsenic	170[b]	0.05	5920	117	182	19	TPA16 0.3 m
Lead	1300 [b]	0.85	46000	2900	182	86	AWS2 1.3 – 2.3 m
Cadmium	880 [b]	0.214	2000	40.33	182	2	TP21 1.0 m
Mercury	25.8 [a]	0.14	107	2.89	182	5	TP008 1.0 m
Notes: a = Atkins SSV; b = DEFRA C4SL							

Data screening has identified widespread exceedances of assessment criteria for lead, and to a lesser extent, arsenic across much of the site. The exceedances were identified predominantly in Made Ground soils containing abundant slag material likely associated with historical site use and land reclamation activities.

6.5.3. Asbestos

A total of 100 soil samples were screened for the presence of asbestos. Positive identification of asbestos fibres was identified in a total of nine soil samples.

A summary of asbestos identification is presented in Table 6-3 below.

Table 6-3 Summary of Asbestos Identification

Sample location	Depth (m)	Total % Asbestos in Sample	Asbestos Type
TP008	0.2	0.001	Chrysotile
TP22	0.2	0.001	Amosite
TP39	0.3	Not Determined	Loose chrysotile fibres in soil
TP40	0.2	0.001	Chrysotile
TP42	1	0.0012	Amosite
AWS2	0 – 0.9	0.001	Chrysotile
TPA2	0.3 – 0.9	0.001	Chrysotile
TPA26	0.3 – 0.9	0.002	Chrysotile
TPA63	0.3 – 0.9	0.004	Chrysotile

6.5.4. Ground Gas

Ground gas measurements were taken from borehole monitoring wells on two occasions. Concentrations of carbon dioxide of between 0% and 13.2% and concentrations of methane between 0% and 89.9% were recorded.

No measurement of gas flow were obtained during the gas monitoring. Therefore no formal assessment of ground gas risks can be undertaken.

However given the nature of the proposed development, (new road and carpark with no buildings) it is considered that the risk to future site users in open air is low.

6.6. Controlled Waters Risk Assessment

6.6.1. Selection of Water Screening Values

The controlled waters GQRA has been designed to assess potential risks posed to identified controlled waters receptors from the migration of potential on-site sources of contamination in accordance with the PCLs defined in Section 6.3.

The site is located above a Secondary A Aquifer and the closest surface water feature is Swansea Bay, located to the south of the site. No groundwater or surface water abstractions have been identified within 1km of the site and considering the proximity of Swansea Bay, saline intrusion to the groundwater is considered likely. Therefore the principal receptor is considered to be the surface waters of Swansea Bay and soil leachate and groundwater data have been screened against the following assessment criteria:

- Environmental Quality Standards (EQS); and
- Where no EQS are available Drinking Water Standards (DWS).

6.6.2. Screening of Soil Leachate Data

Soil-leachate tests give an indication of the concentrations at which contaminants will leach from soil and then migrate to the groundwater. The results indicate the mobility of the contaminants analysed. Soil-leachate analysis was undertaken on 16 soil samples recovered from the unsaturated zone and laboratory analytical data have been screened against the assessment criteria described above.

A summary of the exceedances of assessment criteria are presented in Table 6-4 below. Concentrations less than the laboratory method detection limit (MDL) have not been included in the assessment.

Table 6-4 Summary of Soil Leachate Exceedances

CoC	Units	WQS	Minimum Concentration	Maximum Concentration	No. Samples	No. Exceedances
Hexavalent Chromium	mg/l	0.0006	0.03	0.6	16	1
Mercury	mg/l	0.00005	0.00001	0.000201	16	2
Antimony	mg/l	0.005	0.00042	0.0507	16	8
Arsenic	mg/l	0.025	0.000432	0.563	16	8
Cadmium	mg/l	0.005	0.0001	0.01	16	2
Chromium	mg/l	0.0047	0.000386	0.0125	16	5
Copper	mg/l	0.005	0.00085	0.0181	16	8
Lead	mg/l	0.0072	0.00124	1.07	16	6
Selenium	mg/l	0.01	0.00039	0.039	16	1
Zinc	mg/l	0.04	0.00354	5.03	16	8
Benzene	mg/l	0.008	0.007	0.07	16	2
Xylene	mg/l	0.03	0.011	0.11	16	3
Aliphatics >C5-C6	mg/l	0.01	0.01	0.1	16	1
Aliphatics >C6-C8	mg/l	0.01	0.01	8.36	16	1
Aliphatics >C8-C10	mg/l	0.01	0.01	1.34	16	1
Aliphatics >C10-C12	mg/l	0.01	0.01	24.5	16	1
Aliphatics >C12-C16	mg/l	0.01	0.01	2.12	16	1
Aliphatics >C16-C21	mg/l	0.01	0.01	1.79	16	1
Aliphatics >C21-C35	mg/l	0.01	0.01	16.2	16	1
Aromatics >EC8-EC10	mg/l	0.01	0.01	8.93	16	1
Aromatics >EC10-EC12	mg/l	0.01	0.01	1.64	16	1
Aromatics >EC16-EC21	mg/l	0.01	0.01	2.45	16	1

CoC	Units	WQS	Minimum Concentration	Maximum Concentration	No. Samples	No. Exceedances
Aromatics >EC21-EC35	mg/l	0.01	0.01	5.85	16	1
Fluoranthene	mg/l	0.0001	0.000017	0.00586	16	5
Anthracene	mg/l	0.0001	0.000015	0.00275	16	4
Sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene	mg/l	0.00003	0.00005	0.007044	16	9
Benzo(a)pyrene	mg/l	0.00005	0.000009	0.00313	16	6
Benzo(g,h,i)perylene	mg/l	0.000002	0.000016	0.00341	16	9
Indeno(1,2,3-cd)pyrene	mg/l	0.000002	0.000014	0.000247	16	6

The results of the screening identified widespread exceedances of the relevant assessment criteria for numerous metals, PAH compounds, petroleum hydrocarbons and BTEX compounds in samples taken from across the site. Exceedances were generally associated with Made Ground soils containing abundant slag material.

6.6.3. Screening of Groundwater Data

A total of six groundwater samples, recovered from three borehole monitoring wells on two occasions have been screened against the assessment criteria described above.

A summary of the exceedances of assessment criteria are presented in Table 6-5 below. Concentrations less than the laboratory method detection limit (MDL) have not been included in the assessment.

Table 6-5 Summary of Groundwater Exceedances

CoC	Units	WQS	Minimum Concentration	Maximum Concentration	No. Samples	No. Exceedances
Arsenic	µg/l	25	0.12	46	6	1
Cadmium	µg/l	5	0.1	10.6	6	3
Chromium	µg/l	4.7	1.2	10	6	2
Copper	µg/l	5	0.85	27.9	6	4
Lead	µg/l	7.2	2.54	90.7	6	4
Nickel	µg/l	20	3.14	36.9	6	3
Selenium	µg/l	10	0.39	68.1	6	2
Zinc	µg/l	4	9.17	7090	6	6
Benzene	µg/l	8	7	12	6	1
Aliphatics >C5C6	µg/l	10	10	25	6	1

CoC	Units	WQS	Minimum Concentration	Maximum Concentration	No. Samples	No. Exceedances
Aliphatics >C6C8	µg/l	10	10	2260	6	1
Aliphatics >C8C10	µg/l	10	10	5040	6	3
Aliphatics >C10C12	µg/l	10	10	7800	6	3
Aliphatics >C12C16	µg/l	10	10	19900	6	4
Aliphatics >C16C21	µg/l	10	10	6770	6	4
Aliphatics >C21C35	µg/l	10	10	8290	6	5
Aromatics >EC5EC7	µg/l	10	10	12	6	1
Aromatics >EC8EC10	µg/l	10	10	3360	6	3
Aromatics >EC10EC12	µg/l	10	10	5200	6	3
Aromatics >EC12EC16	µg/l	10	10	1480	6	4
Aromatics >EC16EC21	µg/l	10	10	1410	6	4
Aromatics >EC21EC35	µg/l	10	10	2380	6	4
Naphthalene	µg/l	1.2	0.1	5	6	2
Fluoranthene	µg/l	0.1	0.0672	236	6	4
Anthracene	µg/l	0.1	0.015	29.1	6	4
Sum of Benzo(b)fluoranthene and Benzo(k)fluoranthene	µg/l	0.003	0	283.5	6	5
Benzo(a)pyrene	µg/l	0.05	0.0288	163	6	4
Benzo(g,h,i)perylene	µg/l	0.002	0.0225	117	6	5
Indeno(1,2,3cd)pyrene	µg/l	0.002	0.014	89.1	6	5

The results of the groundwater screening identified widespread exceedances of the relevant assessment criteria for numerous metals, PAH compounds and petroleum hydrocarbons in groundwater samples taken from the boreholes in the north of the site. Groundwater sample were generally noted to have a hydrocarbon odour at the time of sampling, which correlated to hydrocarbon odours identified during drilling works.

6.7. Updated Conceptual Site Model

Based on the findings of the data screening, qualitative environmental risk assessment has been carried out following current best practice and industry guidance. Definitions of probability and consequence have been based on guidance outlined in CIRIA 552 (12) and are summarised in Appendix E. A combination of probability and consequence produces a risk level based on the risk evaluation and likely action required. The land contamination risk, which is a function of the probability and the consequence, can then be defined using the risk matrix in Appendix E.

The updated conceptual model for the site, including identified PCLs, is summarised in Table 6-6 overleaf.

Table 6-6 Updated Conceptual Site Model and Risk Assessment

Source of Contamination	Receptors	Pathways	Associated Hazard	Potential Consequence	Likelihood of consequence and Mitigation	Potential Significance
Made Ground Associated with land reclamation. Potential contamination in soils and groundwater associated with previous on-site historical site uses including arsenic works, refuse tip, railway land and fuel/oil storage. Identified contaminants include a wide range of metals, PAH compounds, BTEX compounds, petroleum hydrocarbons and asbestos.	Humans On-site (construction workers)	Dermal contact Ingestion Inhalation	Health Risk	Medium	Consequence prior to Mitigation Likely Construction workers will undertake excavation of soil, possibly below the water table across the site where exposure pathways are likely to be present. Consequence following to Mitigation Reduced to Unlikely It is assumed that any potential risks to construction workers would be managed through implementation of appropriate risk assessments, use of appropriate Personal Protective Equipment (PPE) and working methods which will be incorporated into the Construction Environmental Management Plan.	Moderate Becoming Low following mitigation
	Humans On-site (future site users)	Dermal contact Ingestion Inhalation	Health Risk	Medium	Consequence prior to Mitigation Likely The data screening has identified widespread exceedances of assessment criteria of lead, arsenic, and to a lesser extent, cadmium, mercury and asbestos along the route of the proposed road and car park. The exceedances were identified predominantly in Made Ground soils containing abundant slag associated with historical site use. Consequence following to Mitigation Reduced to Unlikely The exceedances of assessment criteria are considered to present a theoretical unacceptable risk to future site users. However, the proposed access road/carpark is likely to comprise predominantly hard cover (tarmac / concrete surfacing) and new landscaping which will act as a pathway barrier, limiting exposure pathways to future site users.	Moderate Becoming Low following mitigation
		Inhalation of ground gas	Health Risk	Medium	Unlikely A formal assessment of ground gas risks was not possible. However, as the proposed development	Low Risk

Source of Contamination	Receptors	Pathways	Associated Hazard	Potential Consequence	Likelihood of consequence and Mitigation	Potential Significance
					comprises only of a road/carpark with no buildings the risk to future site users from inhalation of ground gasses is considered to be low.	
	Humans Off-site (commercial properties to the north of the site)	Dermal contact Ingestion Inhalation	Health Risk	Medium	Consequence prior to Mitigation Likely The data screening has identified widespread exceedances of assessment criteria of lead, arsenic, and to a lesser extent, cadmium, mercury and asbestos along the route of the proposed road and car park. The exceedances were identified predominantly in Made Ground soils containing abundant slag associated with historical site use. Consequence following to Mitigation Reduced to Unlikely The exceedances of assessment criteria are considered to present a theoretical risk to off-site users. However, the proposed access road/carpark is likely to comprise predominantly hard cover (tarmac / concrete surfacing) which will act as a pathway barrier, limiting the potential for generation and migration of dusts off site.	Moderate / Low Risk
	Groundwater in the superficial Secondary A aquifer (Marine Beach Deposits)	Leaching	Contamination of Aquifer	Medium	Low The controlled waters risk assessment has identified widespread exceedances of EQS/DWS in soil leachate across the site. The identified exceedances pose a theoretical risk to the Secondary A Aquifer beneath the site. However, the proposed access road/carpark is likely to comprise predominantly hard cover (tarmac / concrete surfacing) and on-site drainage which would reduce the potential for infiltration and subsequent leaching of contaminants from unsaturated soils.	Moderate / Low Risk
	Surface Water (Swansea Bay)	Leaching and migration via surface water flow and migration in groundwater	Contamination of watercourse	Medium	Low The proposed access road/carpark is likely to comprise predominantly hard cover (tarmac / concrete surfacing) and on-site drainage which would reduce the potential for infiltration and subsequent leaching of contaminants from unsaturated soils.	Moderate / Low Risk

Source of Contamination	Receptors	Pathways	Associated Hazard	Potential Consequence	Likelihood of consequence and Mitigation	Potential Significance
	Ecological Receptors (Crymlyn Bog SSSI)	Dermal contact Ingestion Inhalation	Damage to Environment	Medium	Unlikely Given the distance from the site (approximately 200 m) it is considered unlikely that off-site migration of contaminants, via surface water flow or wind blow dust could occur over this distance.	Low Risk
	Property on-site (infrastructure associated with proposed development)	Direct contact with shallow soil/groundwater	Damage to property	Mild	Low Infrastructure associated with the new development is unlikely to be in contact with shallow groundwater at the site.	Low Risk
	Property Off-site (buildings / infrastructure)	Direct contact with shallow migrating groundwater	Damage to property	Mild	Low Shallow groundwater flow is likely to be towards Swansea Bay to the south of the site, away from off-site commercial properties.	Low Risk
Potential contamination in soils and groundwater associated with previous off-site historical site uses including gasworks, copper works, paint works, railway land and fuel / oil storage Potential contaminants include a wide range of metals, PAH compounds, BTEX compounds,	Humans On-site (construction workers)	Dermal contact Ingestion Inhalation	Health Risk	Medium	<u>Consequence prior to Mitigation</u> Likely Construction workers will undertake excavation of soil, possibly below the water table across the site where exposure pathways are likely to be present. <u>Consequence following to Mitigation</u> Reduced to Unlikely It is assumed that any potential risks to construction workers would be managed through implementation of appropriate risk assessments, use of appropriate Personal Protective Equipment (PPE) and working methods which will be incorporated into the Construction Environmental Management Plan.	Moderate Becoming Low following mitigation
	Humans On-site (future site users)	Inhalation of windblown dusts	Health Risk	Medium	Unlikely The data screening has identified widespread exceedances of assessment criteria which may also be present in soil surrounding the site. However much of the surrounding area has been either been developed or is covered in hardstanding / vegetation reducing the potential for dust generation and migration on-site.	Low Risk

Source of Contamination	Receptors	Pathways	Associated Hazard	Potential Consequence	Likelihood of consequence and Mitigation	Potential Significance
petroleum hydrocarbons		Inhalation of ground gas	Health Risk	Medium	Unlikely A formal assessment of ground gas risks was not possible. However, as the proposed development comprises only of a road/carpark with no buildings the risk to future site users from inhalation of ground gasses is considered to be low.	Low Risk
	Groundwater in the superficial Secondary A aquifer (Marine Beach Deposits)	Leaching and migration in groundwater	Contamination of Aquifer	Minor	Likely The controlled waters risk assessment has identified widespread exceedances of EQS/DWS in soil leachate across the site. This is likely to be indicative of poor soil and groundwater quality in the areas surrounding the site. Therefore it is considered that on-site migration of contaminated groundwater is not likely to have further impact groundwater quality beneath the site.	Low Risk
	Property on-site (infrastructure associated with proposed development)	Direct contact with shallow soil/groundwater	Damage to property	Mild	Low Infrastructure associated with the new development is unlikely to be in contact with shallow groundwater at the site.	Low Risk

6.8. Summary

6.8.1. Human Health

With respect to human health, widespread exceedances of assessment criteria for lead, arsenic, and to a lesser extent, cadmium, mercury and asbestos were identified in site soils along the route of the proposed road and car park. A moderate / low risk to future site users and off site receptors in commercial premises from ingestion, inhalation and dermal contact with site soils have been identified.

The proposed access road/carpark is likely to comprise predominantly hard cover (tarmac / concrete surfacing) which will limit exposure pathways to future site users. Therefore further mitigation measures in hard cover areas are not likely to be required. Should soft cover / landscaped areas form part of the proposed access road/carpark, then further mitigation measures are likely to be required to prevent exposure to site soils. This would likely comprise placement of a break layer and at least 800 mm, of 'clean' imported soil.

As previously discussed, risks to construction workers cannot be assessed through the risk assessment process described in section 6.5. However, risks to workers during construction works can be mitigated through appropriate risk assessment, good working practices and use of appropriate PPE.

6.8.2. Controlled Waters

With respect to controlled waters, widespread exceedances of EQS/DWS assessment criteria were identified in soil leachate across the site. However the proposed access road/carpark is likely to comprise predominantly hard cover (tarmac / concrete surfacing) and on-site drainage which would reduce the potential for infiltration and subsequent leaching of contaminants from unsaturated soils, therefore additional mitigation measures are not considered to be required.

Elevated concentration of contaminants in groundwater are likely to be indicative of poor groundwater quality in the wider area surrounding the site as a result of historical land use and therefore mitigation measures with respect to groundwater quality are not likely to be effective in improving groundwater quality are not considered to be required.

6.9. Suitability for Re-use

Material can be re-used if, among other parameters, it can be demonstrated that it does not pose a potential risk to human health or the environment. The risk assessment process has identified numerous exceedances of GAC for human health and numerous exceedances of EQS/DWS in soil leachate samples.

Based on the available information, it is considered that soils arising from excavations during the construction of the proposed road/carpark are not suitable for re-use with the proposed development. Waste material should be appropriately stockpiled, sampled and classified for off-site disposal at a licensed waste treatment / disposal facility.

6.10. Waste Classification

Material that is surplus to requirements and/or unsuitable for re-use on-site is classified as waste and should be disposed of in accordance with the Duty of Care as specified in the Landfill Regulations. If the scheme does not require all excavated material to be retained on-site it is a waste.

Waste is classified into three categories comprising inert, non-hazardous and hazardous. A preliminary waste assessment has been undertaken based on analysed concentrations of contaminants in 182 soil samples obtained during the site investigation using Atkins' on-line waste classification tool (CAT-WASTE^{SOIL}). The assessment was undertaken with TPH inputted as petrol on the basis that this represents the most conservative approach.

The results of the CAT-WASTE^{SOIL} assessment indicates that 132 (74%) of the samples analysed would be classified as hazardous waste for off-site disposal purposes, based on the identified chemical concentrations. This is due to the concentrations of lead and zinc with associated hazard properties HP10 (human toxicity) and HP14 (eco-toxicity)

The presence of asbestos has also been identified within soil samples which may characterise the waste as hazardous, depending on the quantity present, and if removal is required this would need to be handled by a licensed Contractor and disposed appropriately. Advice should be sought from a specialist Contractor regarding disposal.

This classification is based on a limited number of samples and the actual material to be removed off-site for disposal must be appropriately classified and agreed with the chosen landfill operator. It is the responsibility of the waste producer to classify, treat, manage and dispose of waste appropriately and to ensure the chosen landfill is licensed to accept such material.

6.11. Limitations

It should be noted that, as with any physical site investigation involving discrete sampling, test results will only be representative of the point sampled and further investigation and analysis may be required should ground conditions differ from those reported. If, during any excavation/construction works, visibly contaminated material is encountered in excavations, advice should be sought from an Environmental Scientist and the requirement for additional testing and assessment of the risks agreed.

7. Preliminary Engineering Assessment

7.1. Pavement Design

In situ tests carried out during the ground investigation suggest a CBR value of 20% for the Made Ground is used for design as discussed in Section 5.1.5. Interim Advice Note (IAN) 73/06 (13) recommends a CBR values ranging for 20% to 60% based on the formation material ranging from a poorly graded sand to a well graded sandy gravel.

It is recommended that the lower bound CBR value of 20% is used for design to allow for the variable characteristics of the Made Ground.

7.2. Drainage

Soakaway tests were carried out within the Made Ground in eleven trial pits as discussed in Section 5.1.4. The calculated infiltration rate ranged from $1.984x10^{-5}$m/s to $3.685x10^{-4}$m/s, which indicates that this strata has suitable drainage characteristics for soakaway design.

However, there remains the risk that contaminants from the Made Ground may leach into the groundwater and NRW should be consulted regarding the use of soakaways in this environment.

7.3. Protection of Buried Concrete

The following classifications have been recommended for buried concrete, as discussed in Sections 5.1.3 and 5.2.3:

- For Made Ground, a DS class of DS-2 and an ACEC class of AC-2 is recommended.
- For the Marine Beach Deposits, a DS class of DS-1 and an ACEC class of AC-1 is recommended.

7.4. Unexploded Ordnance

The UXO threat assessment report for the site (reference 4122TA), concludes that the risk of UXO being present is high along the majority of the cable route, and low in the areas occupied by buildings that survived the war intact as discussed in Section 2.15. It is recommended that the high risk rating is used for the entire site.

The UXO threat assessment report in Appendix D outlines recommended mitigation measures which should be taken into account during the construction of the road and associated drainage.

8. Geotechnical Risk Register

Table 8-1 Geotechnical Risk Register

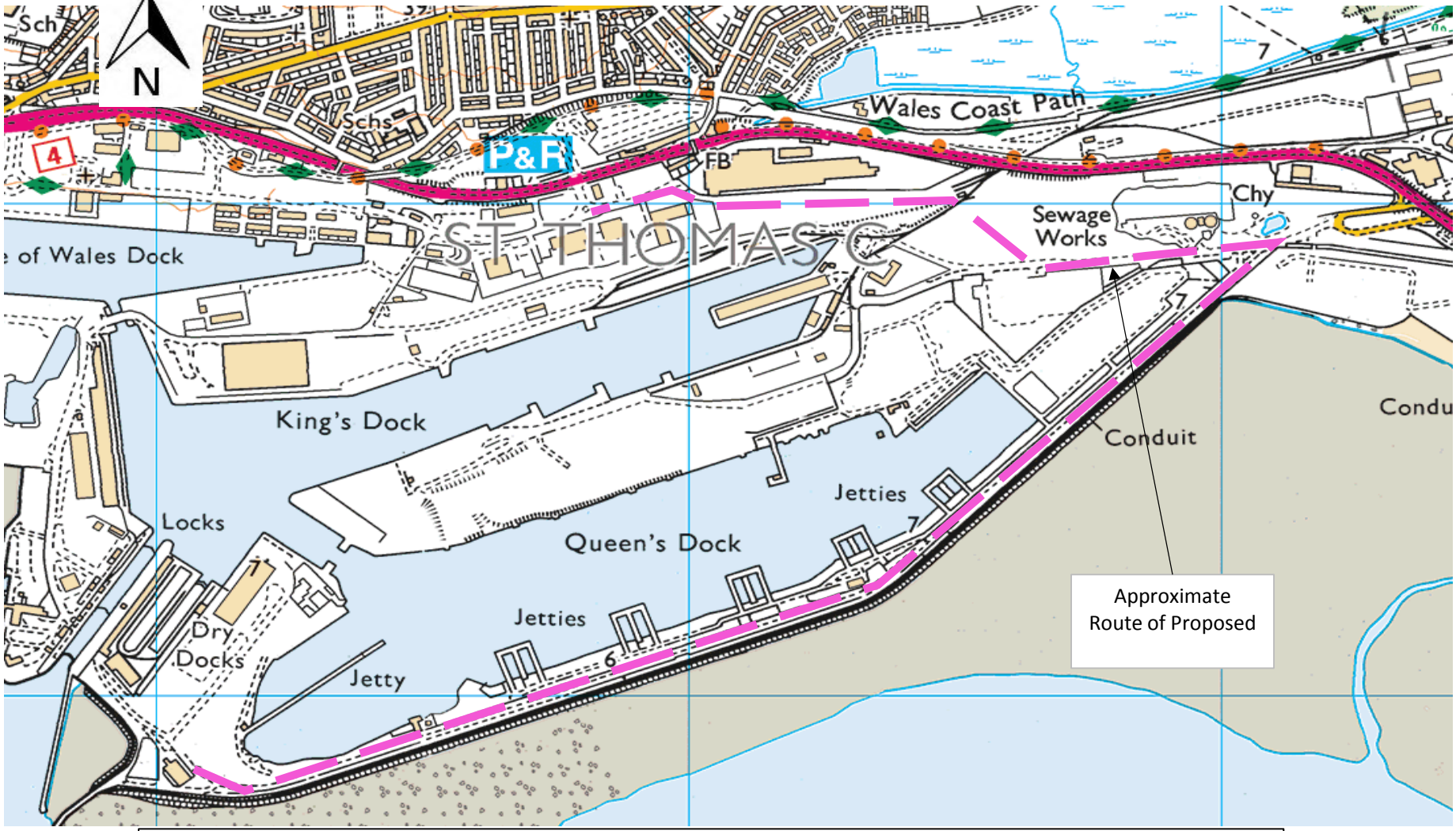
Probability (P)		Impact/ Consequence (I)		Risk Rating	RISK (P x I = R)
Very likely	5	Very high	5	Intolerable	17 to 25
Probable	4	High	4	Intolerable	13 to 16
Likely	3	Medium	3	Substantial	9 to 12
Unlikely	2	Low	2	Tolerable	5 to 8
Negligible	1	Very low	1	Trivial	1 to 4

Ground Hazard	Risk / Consequence to project	Initial Risk Rating			Mitigation Measures	Hazard Rating after Mitigation Measures		
		Probability of Hazard	Impact of Hazard	Risk Rating		Probability of Hazard	Impact of Hazard	Risk Rating
Groundwater	Instability of excavations leading to redesign, delay and extra cost.	2	3	6	Contractor to assess stability of excavations based on factual information and to design temporary works accordingly.	1	3	3
Loose Made Ground	Instability of excavations leading to redesign, delay and extra cost.	2	3	6	Contractor to assess stability of excavations based on factual information and to design temporary works accordingly	1	3	3

Ground Hazard	Risk / Consequence to project	Initial Risk Rating			Mitigation Measures	Hazard Rating after Mitigation Measures		
		Probability of Hazard	Impact of Hazard	Risk Rating		Probability of Hazard	Impact of Hazard	Risk Rating
Potential for contamination to be present in soil / groundwater	Delays whilst contamination issues are resolved. Re-design of scheme to address contamination. Waste disposal / remediation costs.	3	4	12	The results and conclusions presented in the GIR should be provided to the Contractor for use in the CEMP and materials management plant for the site. Contractor to implement appropriate measures in the event that contamination is encountered to ensure protection of workforce, public and identified environmental receptors during the works.	2	4	8
High sulphate content in soils and groundwater	Deterioration of concrete due to chemical attack requiring mitigation.	3	3	9	Designer to select appropriate concrete class for foundation design.	1	3	3
Unknown buried services	Damage to buried services resulting in risk to health & safety of workforce and damage to property, increased costs and delay to programme.	3	5	15	Contractor to ensure appropriate procedure for dealing with services risk including obtaining and up-to-date buried services information.	2	5	10
Unexploded Ordnance	UXO being encountered during construction works, resulting in delay and extra cost. Potential for serious injury/casualties if UXO is accidentally detonated.	3	5	15	Contractor to ensure appropriate mitigation measures are practiced as recommended by the BACTEC threat assessment report in Appendix D.	2	5	10

Appendices

Appendix A. Figures



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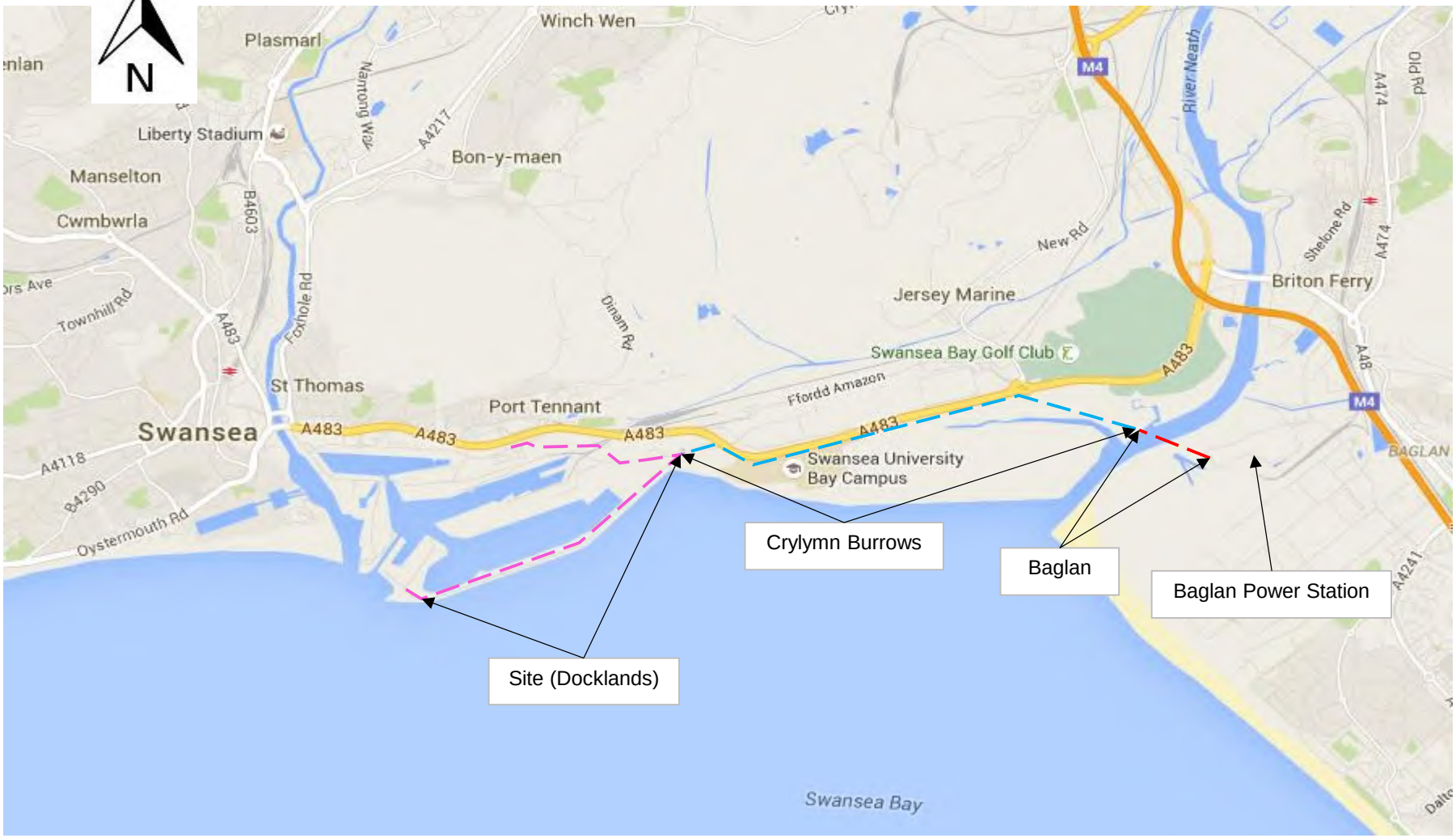
Project: **Swansea Bay Tidal Lagoon Onshore Works**	Compiled	T.S	Checked	AKG
	Date	15/09/2015	Date	16/09/2015
Title: **Figure 1.1: Site Location Plan**	Job No. 5143160			Figure 1.1

ATKINS



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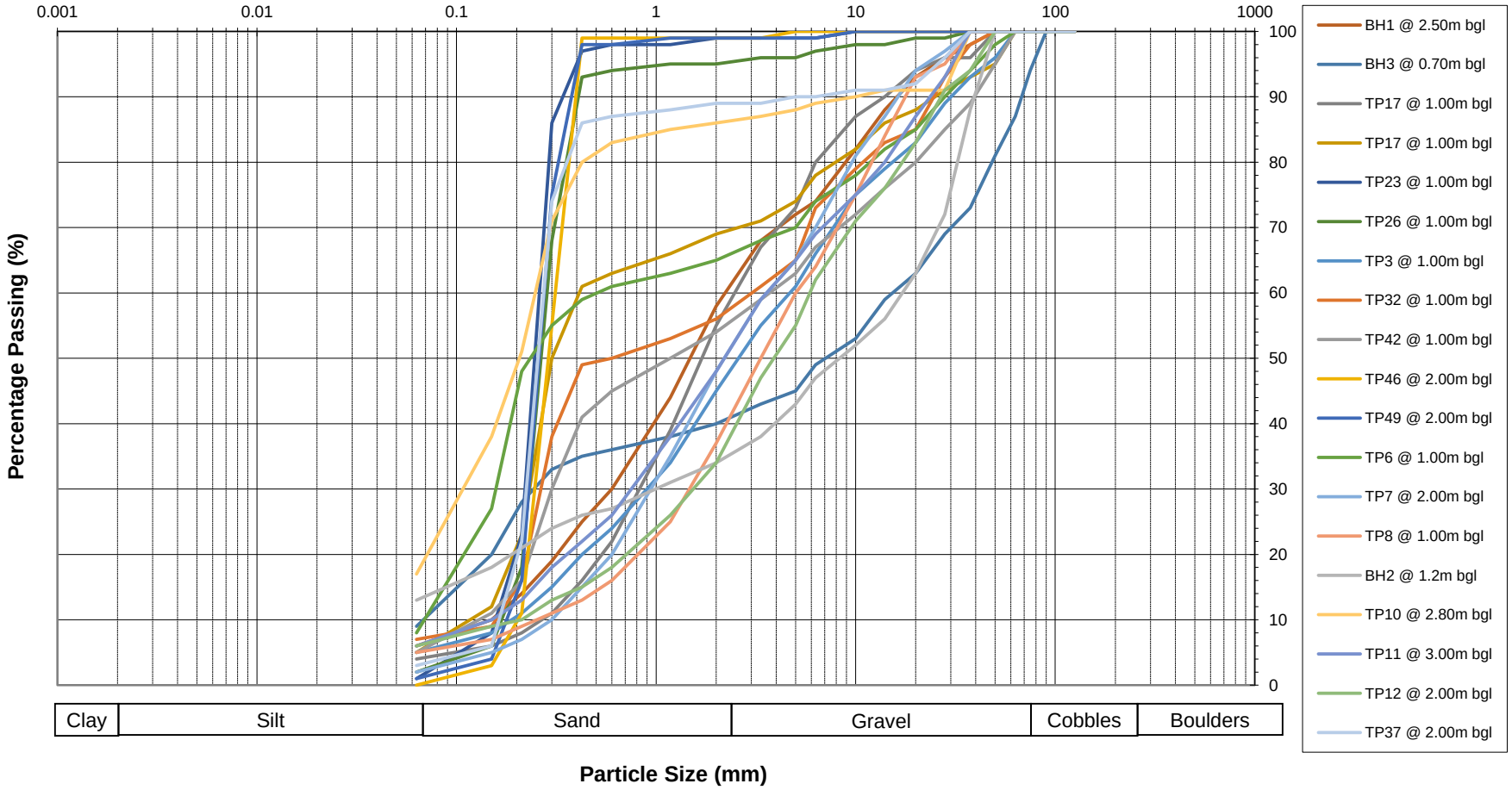
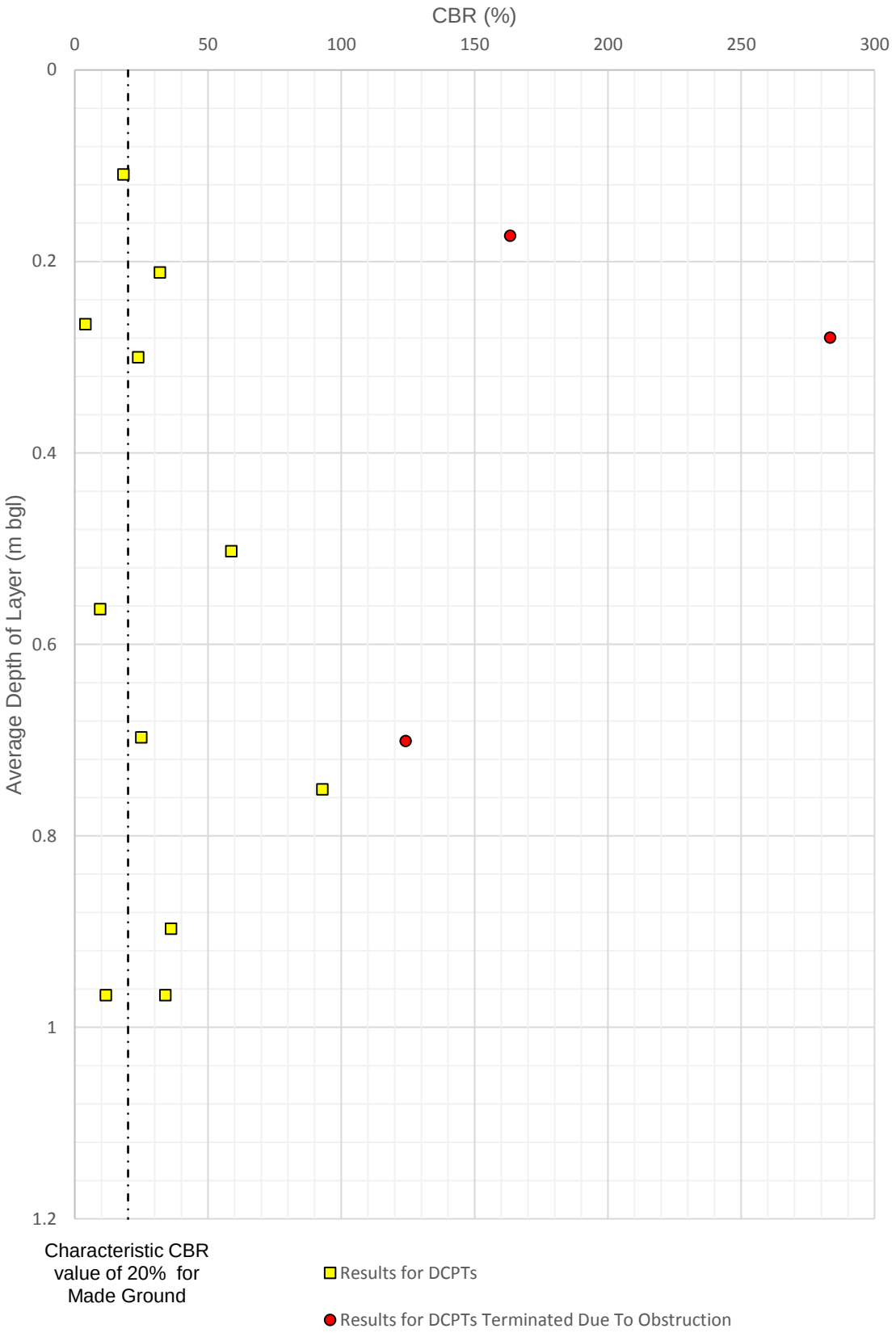
Project: **Swansea Bay Tidal Lagoon Onshore Works**	Compiled	T.S	Checked	AKG
	Date	15/09/2015	Date	16/09/2015
Title: **Figure 1.2: Site Location Plan - Wider Site Area**	Job No.	5143160		Figure 1.2

ATKINS

Particle Size Distribution Test Results
Made Ground



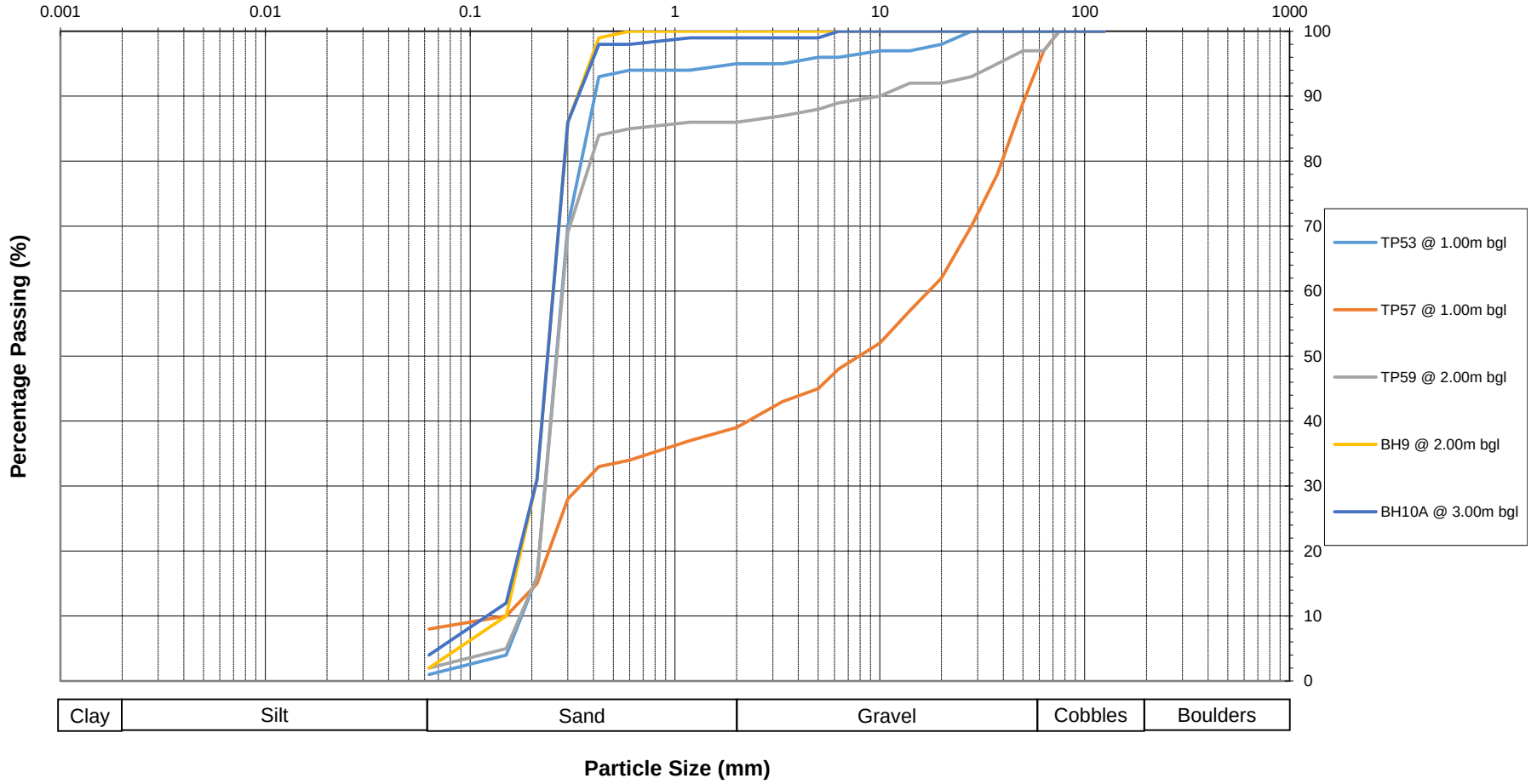
Project: **Swansea Bay Tidal Lagoon Onshore Works**	Compiled	T.S	Checked	AKG
	Date	15/09/2015	Date	16/09/2015
Title: **Figure 5.1: Particle Size Distribution Test Results - Made Ground**	Job No. 5143160		Figure 5.1	



Project:	Compiled	T.S	Checked	AKG
Swansea Bay Tidal Lagoon Onshore Works	Date	16/09/2015	Date	16/09/2015
Title: **Figure 5.2: Dynamic Cone Penetration Test Results**	Job No. 5143160			Figure 5.2

ATKINS

Particle Size Distribution Test Results
Marine Beach Deposits



Project: **Swansea Bay Tidal Lagoon Onshore Works**		Compiled	T.S	Checked	AKG
		Date	15/09/2015	Date	16/09/2015
Title: **Figure 5.3: Particle Size Distribution Test Results - Marine Beach Deposits**		Job No.	5143160	Figure	5.3

Appendix B. Historical Borehole Records

Geology of Britain viewer

mapapps.bgs.ac.uk/geologyofbritain/home.html

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

Geology of Britain viewer

More BGS map viewers

Surface Geology | 3D Models | Borehole Scans | Earthquake Timeline

Go to Location

Switch Basemap

100% 0%

Geology Transparency

Grid Ref: 268454, 193112

Borehole Scans

Click on a borehole to view scan.

Borehole depth

- 0 - 10m
- 10 - 30m
- 30m+
- Unknown
- Confidential or Restricted

More on boreholes

SS69SE403
SS69SE46
SS69SE19
SS69SE18
SS69SE405
SS69SE142
SS69SE141
SS69SE140
SS69SE139
SS69SE138
SS69SE423

0 30 60m

POWERED BY esri

SS 68805 92895

SS 69 SE 138

RECORD OF BOREHOLE No: 155

SHEET 1 OF 3

START DATE: 05/10/93

DRILLING METHOD: CABLE PERCUSSION

EQUIPMENT: BANDO 175

CASING DETAILS 200 mm to 18.00 m
150 mm to 29.30 m

BORE HOLE DIA 200 mm to 18.00 m
150 mm to 30.00 m

CO-ORDINATES: E 268885 N 192995

GROUND LEVEL 6.82 —0.0

Date & Time	Casing Depth (m)	Depth to Water (m)	SAMPLE Depth (m) At/From	To	Type	No.	U100 Blows Test Length (mm)	U100 Rec (m) SPT Blows /N	DESCRIPTION OF STRATA	Depth (Thickness) (m)	Level (m O.D.)	Strata Symbol
05/10			0.00	0.40	B	1			MADE GROUND: Dark grey/black, slightly clayey, slightly silty, fine to coarse sand and gravel of clinker, sandstone, coal, coke, brick and siliceous gravel.	(0.40)		
		DRY	0.40	2.00	B	2		C 8		0.40	6.42	
									MADE GROUND: Loose, becoming medium dense, dark grey/black, clayey, silty, fine to coarse sand and fine gravel of clinker with some medium and coarse gravel of clinker, brick, coal, coke, slag and siliceous gravel.	(2.00)		
	14th	March 94						C 20				
	2.10	DRY	2.40	3.90	B	3				2.40	4.42	
									MADE GROUND: Medium dense, subangular to rounded fine to coarse gravel and cobbles, with some fragments of brick and clinker. With some grey and brown slightly clayey silty fine to coarse sand.	(1.50)		
	3.60	0.00	3.70		D	4		S 28				
			4.20	5.40	B	5				3.90	2.92	
									Medium dense, brown, silty, fine and medium SAND, with a little coarse sand and a little subangular to rounded, fine to coarse gravel. Occasional shell fragments.			
									(UPPER ALLUVIUM)			
16 05												
	5.30	0.00	5.40		D	6		S 24	Above 5.40m slightly grey brown and with a slight oily odour.	(3.00)		
			5.90	6.90	B	7						
	6.90	0.00	6.90	7.50	B	8		C 28	Medium dense, grey, silty, fine and medium SAND and subangular to rounded fine to coarse GRAVEL. Some cobbles and a little coarse sand. Occasional shells. (UPPER ALLUVIUM)	6.90 (0.60)	-0.08	
	7.50	0.00	7.50		B	9				7.50	-0.68	
			7.60	8.05	U	10	(30)	0.30	Soft to firm, grey, silty CLAY with a little brown fibrous peat. Interlaminated with grey, clayey, sandy (fine) silt and silty, fine and medium sand. (LOWER ALLUVIUM)	(0.80)		
			8.50		D	11				8.30	-1.48	
			8.30		D	12						
	8.40	0.00	8.60		D	13		S 28	Medium dense, grey, silty, fine and medium SAND with occasional brown and black peaty fibres.	(0.80)		
									(LOWER ALLUVIUM)	9.10	-2.28	
			9.10	10.20	B	14			Dense, grey, slightly clayey, slightly sandy (fine) SILT. With laminae/very thin bands of grey silty clay. (LOWER ALLUVIUM)			
									(Continued...)			
05/10	8.40	0.00										

REMARKS:
1. Prior to boring, a Cable Avoidance Tool survey (CAT) was carried out.
2. Water was added to assist boring from 2.40m to 30.00m depth.
3. The addition of water may have masked the level at which groundwater entered the borehole.

Logged by JS — Date 07/10
Checked by PR
Approved by

SCALE 1:50

FOUNDATION & EXPLORATION SERVICES

SWANSEA BAY BVI SCHEME
ABP SITE

CONTRACT No. 2475

FIGURE: 43

SS 66805 92895

SS69SE 138

RECORD OF BOREHOLE No: 15S

SHEET 2 OF 3

START DATE: 05/10/93

DRILLING METHOD: CABLE PERCUSSION

EQUIPMENT: BANDO 175

CASING DETAILS: 200 mm to 10.00 m; 150 mm to 29.30 m

BOREHOLE DIA: 200 mm to 10.00 m; 150 mm to 30.00 m

CO-ORDINATES E 266805 N 192895

GROUND LEVEL: 6.82 m.O.D.

Date & Time	Casing Depth (m)	Depth to Water (m)	SAMPLE Depth (m) A/From	To	Type	No.	U100 Blows Test Length (mm)	U100 Rec.(m) Spt Blows /N	DESCRIPTION OF STRATA	Depth (Thickness) (m)	Level (m.O.D.)	Strata Symbol
05/10	10.00	0.00	10.20		D	15		S 35	(...cont.)	(2.30)		
									Dense, clayey, sandy, SILT, as Sheet 1.			
									(LOWER ALLUVIUM)			
										11.40	-4.58	
			11.40		D	16				(0.40)		
	11.40	0.00	11.60		U	17	(35)		Soft to firm, grey silty CLAY, mottled dark grey and slightly organic in parts. (LOWER ALLUVIUM)	11.80	-4.98	
									Probably medium dense to dense, grey, clayey/very clayey SILT.	(0.90)		
			12.20		D	18						
	12.40	0.00	12.50	12.95	U	19	(80)	0.30	(LOWER ALLUVIUM)	12.70	-5.88	
									Dense, grey, clayey, slightly sandy (fine and medium) SILT.			
	12.40	0.00	13.10		D	20		S 34				
			13.10		D	21			Locally very clayey.	(1.60)		
			13.60	14.30	B	22			(LOWER ALLUVIUM)			
										14.30	-7.48	
			14.30		D	23						
									Soft to firm, slightly brown-grey, silty CLAY, flecked dark grey in parts and with a little brown and black peat.			
	14.50	1.20	14.70		U	24	(32)					
									(LOWER ALLUVIUM)	(1.60)		
			15.30	15.90	B	26						
			15.30		D	25						
										15.90	-9.08	
			15.90		D	27						
	16.00	2.70	16.20	16.65	U	28	(30)	0.30	Medium dense, grey, slightly sandy (fine) clayey SILT with occasional black organic traces.			
									(LOWER ALLUVIUM)			
			16.80		D	29						
										(2.50)		
			17.20		D	30						
	17.10	0.00	17.40		D	31		S 22				
			18.40		D	32				18.40	-11.58	
	18.40	2.40	18.80		U	33	(55)		Probably medium dense, grey, slightly sandy (fine), clayey SILT.			
									Locally very clayey.			
			19.40		D	34			(LOWER ALLUVIUM)			
05/10	20.00	2.00	20.00	20.60	B	35			(Continued...)			

REMARKS:

Logged by JS

Checked by PR

Approved by

Date 07/10

SCALE 1:50

FOUNDATION & EXPLORATION SERVICES

SWANSEA BAY BWI SCHEME
ABP SITE

CONTRACT No. 2475

FIGURE: 44

SS 68805 92895

SS 69 SE 138

RECORD OF BOREHOLE No: 15S

START DATE: 05/10/93
DRILLING METHOD: CABLE PERCUSSION
EQUIPMENT: BANDO 175

CASING DETAILS: 200 mm to 10.00 m
150 mm to 29.30m
BOREHOLE DIA: 200 mm to 10.00 m
150 mm to 30.00 m

SHEET 3 OF 3
CO-ORDINATES: E 268805 N 192895
GROUND LEVEL 6.82 m.O.D.

Date & Time	Casing Depth (m)	Depth to Water (m)	SAMPLE Depth (m) At/From	To	Type	No.	U100 Blows Test Length (mm)	U100 Rec (m) SPT Blows /M	DESCRIPTION OF STRATA	Depth (Thickness) (m)	Level (m.O.D.)	Strata Symbol
06/10	20.00	2.80	20.00	20.60	B	35			(...cont.)			
	20.40	0.00	20.60		U	36	(60)		Sandy, clayey SILT, as Sheet 2.			
									(LOWER ALLUVIUM)	(5.00)		
			21.20		D	37						
			21.70		D	38						
	22.00	0.00	22.20	22.65	U	39	(100)	0.40	At 21.70m, very silty clay.			
	22.00	0.00	22.80		D	40		S 32				
			22.90		D	41						
			23.40	24.30	B	42			Probably medium dense grey, clayey/very clayey SILT, with a little subangular to rounded, fine gravel and occasional peaty fragments. (LOWER ALLUVIUM)	23.40 (0.90)	-16.58	
			24.30		D	43				24.30	-17.48	
	24.30	0.00	24.40	24.65	U	44	(180)	0.25	Compact, brown, fibrous PEAT. (LOWER ALLUVIUM)	(0.60)		
			24.80		D	45				24.90	-18.08	
			24.90		D	46						
	24.80	0.00	25.10		U	47	(80)		Firm, becoming soft, grey, organic, silty CLAY with a little brown fibrous peat. Slight organic odour. (LOWER ALLUVIUM)			
			25.70	26.80	B	49						
			25.70		D	48						
	26.50	0.00	26.80	27.25	U	50	(40)	0.40		(3.70)		
			27.40		D	51						
			27.80		D	52			At 27.80m slightly brown-grey.			
	28.00	0.00	28.30		U	53	(30)					
									Firm, slightly brown-grey, laminated silty CLAY with laminae of brown and grey silty fine and medium sand and clayey/very clayey silt. (LOWER ALLUVIUM)	28.60 (0.60)	-21.78	
			28.90		D	54						
			29.20		D	55				29.20	-22.38	
	29.30	0.00	29.30	30.00	B	57		S 25	Medium dense, grey-brown, slightly clayey, silty fine and medium SAND.			
			29.50		D	56			Below 29.50m grades to slightly sandy/sandy silt. (LOWER ALLUVIUM)	(0.80)		
06/10	29.30	0.00							END OF BOREHOLE	30.00	-23.18	

REMARKS: 4. On completion of boring two Casagrande type standpipe piezometers were installed with their tips at 8.80m and 4.40m depth and the following details: From 30.00m to 18.80m, cement/bentonite grout; from 18.80m to 9.30m, bentonite seal; from 9.30m to 7.80m, sand filter response zone; from 7.80m to 6.80m, bentonite seal; from 6.80m to 5.90m, cement/bentonite grout; from 5.90m to 4.90m, bentonite seal from 4.90m to 2.40m, sand filter response zone; from 2.40m to 1.90m, bentonite seal; from 1.90m to 1.00m, cement/bentonite grout and from 1.00m to ground level, concrete and a projecting lockable cover.

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FOUNDATION & EXPLORATION SERVICES

SWANSEA BAY BWI SCHEME
ABP SITE

CONTRACT No. 2475

FIGURE: 45

SS 66805 72705

SS 69 SE 139

RECORD OF BOREHOLE No: 16S

START DATE: 03/10/9
DRILLING METHOD: CABLE PERCUSSION
EQUIPMENT: DANSO 175

CASING DETAILS: 200 mm to 9.00 m
150 mm to 29.40m
BOREHOLE DIA: 200 mm to 9.00 m
150 mm to 30.00 m

SHEET 1 OF 3
CO-ORDINATES E 268805 N 192905
GROUND LEVEL 6.60 m.O.D.

Date & Time	Casing Depth (m)	Depth to Water (m)	SAMPLE Depth (m) At/From	To	Type	No.	U100 Blows Test Length (mm)	U100 Rec.(m) SPT Blows /N	DESCRIPTION OF STRATA	Depth (Thickness) (m)	Level (m.O.D.)	Strata Symbol
03/10			0.00	0.50	B	1			MADE GROUND: Black fine to coarse sand and gravel of clinker, coal, coke, brick, slag, concrete and sandstone.	(0.50)		
	NIL	DRY	0.50	1.40	B	2		C 6		0.50	6.10	
	NIL	DRY							MADE GROUND: Loose, black, slightly clayey/clayey, fine to coarse sand and gravel of clinker, coal, coke and siliceous gravel.	(0.90)		
			1.40		B	3				1.40	5.20	
	1.50	DRY	1.50	2.20	SPT	4		S 4				
			1.50		SPT				MADE GROUND: Very soft to soft, dark grey-brown, sandy (fine to coarse), silty clay with some, subangular to rounded fine to coarse gravel including clinker, coal and siliceous gravel.	(0.80)		
			2.20		B	7				2.20	4.40	
			2.20	2.60	SPT	5			MADE GROUND: Brown, silty, fine to coarse sand and subangular to rounded, fine to coarse gravel.	(0.40)		
	2.50	0.00	2.60		D	6		S 23		2.60	4.00	
									Medium dense, brown, silty, fine and medium SAND with a little coarse sand and a little subangular to rounded, fine to coarse gravel.			
									Occasional shell fragments.			
									Occasional cobbles.			
	4.00	0.00	4.20		D	9		S 21				
									(UPPER ALLUVIUM)	(2.60)		
			4.70	5.70	B	10						
	5.60	0.00	5.70		D	11	250	S 50				
			6.20		D	12				6.20	0.40	
									Very dense, grey, silty, fine and medium SAND, with a little coarse sand and some subangular to rounded, fine to coarse gravel. Occasional shell fragments and pockets of dark grey, organic slightly clayey, very silty, fine sand.			
	6.60	0.00	6.60	7.70	B	13	225	C 50		(1.50)		
									(UPPER ALLUVIUM)			
			7.70		D	14				7.70	-1.10	
	7.70	1.10	7.90		U	15	(30)		Soft, becoming firm, grey, mottled brown in parts, silty CLAY with a little brown and black fibrous and amorphous peat.			
									Slight organic odour.			
			8.50	9.50	B	17						
			8.50		D	16				(2.10)		
									(LOWER ALLUVIUM)			
	9.10	1.80	9.50	9.95	U	18	(80)	0.35				
									(Continued...)	9.80	-3.20	
03/10	9.10											

REMARKS:
1. Prior to boring, a Cable Avoidance Tool survey (CAT) was carried out.
2. Water was added to assist boring from 2.20m to 30.00m depth.
3. The addition of water may have masked the level at which groundwater entered the borehole.

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FOUNDATION & EXPLORATION SERVICES

SWANSEA BAY BWI SCHEME
ABP SITE

CONTRACT No. 2475
FIGURE: 46

SS 68885 12905

SS 69SE 139

RECORD OF BOREHOLE No: 16S

START DATE: 03/10/9

DRILLING METHOD: CABLE PERCUSSION

EQUIPMENT: DANDO 175

CASING DETAILS: 200 mm to 9.00 m; 150 mm to 29.40 m

BOREHOLE DIA: 200 mm to 9.00 m; 150 mm to 30.00 m

SHEET 2 OF 3

CO-ORDINATES: E 268885 N 192905

GROUND LEVEL 6.60 m.O.D.

Date & Time	Casing Depth (m)	Depth to Water (m)	SAMPLE Depth (m) At/From	To	Type	No.	U100 Blows Test Length (mm)	U100 Rec (m) SPT Blows /N	DESCRIPTION OF STRATA	Depth (Thickness) (m)	Level (m.O.D.)	Strata Symbol
03/10	9.10	0.00	10.10		D	19		S 31	(...cont.)			
			10.10		D	20			Dense, grey, slightly clayey, slightly sandy (fine), SILT with occasional black peaty fragments.			
			10.60	11.70	B	21			Locally clayey/very clayey.			
									(LOWER ALLUVIUM)			
	11.60	0.00	11.70		D	22		S 37	10.60m to 11.70m slightly sandy (fine to coarse).	(4.10)		
			12.20	13.30	B	23						
	13.00	0.00	13.30		D	24		S 34	Below 13.30m sandy (fine).			
			13.90		D	25				13.90	-7.30	
	14.20	1.10	14.40		U	26	(30)		Soft to firm, slightly brown-grey, mottled grey in parts, silty CLAY with a little black organic and peaty material.			
									Below 16.50m with lenses and laminae of dark grey/black organic clayey silt and silty clay.			
			15.00	15.90	B	26						
			15.00		D	27			Locally grades to very silty clay.			
									(LOWER ALLUVIUM)			
	15.10	2.10	15.90		U	29	(25)			(3.90)		
			16.50		D	30						
	16.10	1.70	16.80		U	31	(30)					
			17.40		D	32						
			17.80	19.70	B	33				17.80	-11.20	
	18.00	0.00	18.10		D	34		S 41	Dense, grey, generally slightly clayey, slightly sandy (fine) SILT.			
									Locally clayey and locally sandy.			
									(LOWER ALLUVIUM)			
	19.70	0.00	19.70		D	35		S 37	(Continued....)			
03/10	20.00	2.10										

REMARKS:

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SWANSEA BAY BVI SCHEME
ABP SITE

CONTRACT No. 2475

FIGURE: 47

SS 68885 92705

SS 69 SE 139

RECORD OF BOREHOLE No: 16S

START DATE: 03/10/9

DRILLING METHOD: CABLE PERCUSSION

EQUIPMENT: DANBO 175

CASING DETAILS: 200 mm to 9.00 m; 150 mm to 29.40 m

BOREHOLE DIA: 200 mm to 9.00 m; 150 mm to 30.00 m

SHEET 3 OF 3

CO-ORDINATES: E 268885 N 192905

GROUND LEVEL 6.60 m.O.D.

Date & Time	Casing Depth (m)	Depth to Water (m)	SAMPLE Depth (m) At/From	To	Type	No.	U100 Blows Test Length (mm)	U100 Rec (m) SPT Blows /N	DESCRIPTION OF STRATA	Depth (Thickness) (m)	Level (m.O.D.)	Strata Symbol
04/10	20.00	2.90	20.20	21.40	B	36			(...cont.)			
									Dense, clayey, sandy SILT, as Sheet 2.			
									(LOWER ALLUVIUM)			
	21.00	0.00	21.40		D	37		S 40				
			21.90	22.40	B	38				(7.90)		
	22.50	0.00	22.90		D	39		S 43				
		0.00	23.40	24.50	B	40						
	24.40	0.00	24.50		D	41		S 48				
			25.00	25.70	B	42			Below 25.00m, occasional lenses of soft grey silty clay.			
			25.70		D	43				25.70	-19.10	
	25.80	0.00	25.90	26.70	U#B	44	(80)		Firm to stiff, grey, silty/very silty CLAY with thin bands of compact, dark brown, fibrous peat.	(1.20)		
	26.50	0.00	26.70	27.15	U	45	(100)	0.35	(LOWER ALLUVIUM)	26.90	-20.30	
			27.30		D	46			Very dense, slightly brown-grey, slightly clayey, slightly sandy (fine, occasionally medium) SILT.			
	27.40	0.00	27.60		D	47	225	S 50	Possibly slightly organic.			
			28.00	29.20	B	48			(LOWER ALLUVIUM)	(2.30)		
			29.20		D	49				29.20	-22.60	
	29.40	0.00	29.40		U	50	(100)		Firm, slightly brown-grey, silty CLAY, with laminae of brown-grey, slightly clayey silt. (LOWER ALLUVIUM)	(0.80)		
04/10	29.40	0.00	30.00		B	51			END OF BOREHOLE	30.00	-23.40	

REMARKS: 4. On completion of boring a Casagrande type standpipe piezometer was installed with the tip at 9.00m, and a slotted standpipe was installed with the slotted section from 5.60m to 4.30m and the following detail: From 30.00m to 11.00m, cement/bentonite grouts from 11.00m to 9.50m, bentonite seals from 9.50m to 8.00m, sand filter response zone: from 8.00m to 7.00m, bentonite seal from 7.00m to 6.70m, cement/bentonite grouts from 6.70m to 5.70m bentonite seal from 5.70m to 4.20m, sand filter response zone; from 4.30m to 2.70m, bentonite seal from 2.70m to 1.00m, cement/bentonite grout and from 1.00m to ground level, concrete and a projecting lockable cover.

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FOUNDATION & EXPLORATION SERVICES

SWANSEA BAY BWI SCHEME
ABP SITE

CONTRACT No. 2475

FIGURE: 48

SS 68975 22910 SS 69 SE 140

RECORD OF BOREHOLE No: 17S

START DATE: 30/09/93
DRILLING METHOD: CABLE PERCUSSION
EQUIPMENT: DANDO 175

CASING DETAILS: 200 mm to 10.00 m; 150 mm to 29.50m
BOREHOLE DIA: 150 mm to 30.00 m; 150 mm to 30.00 m

SHEET 1 OF 3
CO-ORDINATES E 268975 N 192910
GROUND LEVEL 6.71 m.O.D.

Date & Time	Casing Depth (m)	Depth to Water (m)	SAMPLE Depth (m) At/From	To	Type	No.	U100 Blows Test Length (mm)	U100 Rec (m) SPT Blows /%	DESCRIPTION OF STRATA	Depth (Thickness) (m)	Level (m.O.D.)	Strata Symbol
30/09			0.00	1.10	B	1			MADE GROUND: Loose, dark brown/black, silty fine to coarse sand of clinker, with much fine to coarse gravel of clinker, brick, coal and coke.			
	NIL	DRY	0.60		D	2		S 4	Occasional siliceous gravel.	(1.70)		
			1.10	1.70	B	3						
			1.70	2.30	B	4				1.70	5.01	
			1.70		D	4			MADE GROUND: Medium dense, dark brown and grey-brown, slightly clayey silty, fine to coarse sand with some subangular to rounded, fine to coarse siliceous gravel and clinker.	(0.60)		
	1.60	DRY	2.00		D	5		S 17		2.30	4.41	
			2.50	3.70	B	6						
	2.46	0.00	2.60		D	7		S 24	Medium dense, brown, silty fine and medium SAND with a little coarse sand and a little subangular to rounded gravel. Occasional shell fragments and occasional cooly sand lenses.	(1.40)		
									(Possible Made Ground)			
			3.70		D	9				3.70	3.01	
	4.00	0.00	4.20	5.80	B	11		S 42	Dense, brown, silty, fine and medium SAND with a little coarse sand and a little subangular to rounded, fine to coarse gravel. Occasional shell fragments.			
			4.20		D	10						
									(UPPER ALLUVIUM)			
									4.20m to 5.80m much fine to coarse gravel and occasional cobbles.	(3.20)		
	5.60	0.00	5.80		D	12	280	C 50				
			6.30	6.90	B	13			Below 6.30m golden-brown.			
			6.90		D	14				6.90	-0.19	
	7.10	0.00	7.20		D	15		S 27	Medium dense, becoming dense, grey, silty, fine and medium SAND, with a little coarse sand and a little subangular to rounded, fine and medium gravel. Occasional shell fragments.			
			7.70	8.70	B	16						
									(UPPER ALLUVIUM)	(2.30)		
									At 7.20m slight organic odour.			
	8.40	0.00	8.70		D	17		S 36	At 8.70m mottled grey-brown.			
			9.20		D	18				9.20	-2.49	
	8.40	0.00	9.40	9.85	U	19	(24)	0.35	Probably medium dense, grey, clayey/very clayey SILT. Slight organic odour. (LOWER ALLUVIUM)	(1.20)		
30/09	10.00	3.00	10.00		D	20			(Continued....)			

REMARKS:
1. Prior to boring, a Cable Avoidance Tool survey (CAT) was carried out.
2. Groundwater was encountered at 2.30m during the subsequent 20 minute monitoring period the level did not rise.
3. Water was added to assist boring from 2.30m to 9.20m depth.

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FOUNDATION & EXPLORATION SERVICES

SWANSEA BAY BWI SCHEME
ABP SITE

CONTRACT No. 2475
FIGURE: 49

British Geological Survey

SS 69SE 140

RECORD OF BOREHOLE No: 175

START DATE: 30/09/93 SS 68975 92910

DRILLING METHOD: CABLE PERCUSSION

EQUIPMENT: DANDO 175

CASING DETAILS: 200 mm to 10.00 m; 150 mm to 29.50 m

BOREHOLE DIA: 150 mm to 30.00 m; 150 mm to 30.00 m

SHEET 2 OF 3

CO-ORDINATES E 268975 N 192910

GROUND LEVEL 6.71 m.O.D

Date & Time	Casing Depth (m)	Depth to Water (m)	SAMPLE Depth (m) At/From	To	Type	No.	U100 Blows Test Length (mm)	U100 Rec.(m) SPT Blows /N	DESCRIPTION OF STRATA	Depth (Thickness) (m)	Level (m O.D.)	Strata Symbol
01/10	10.00	2.20	10.00		D	20			(...cont.) Clayey SILT, as Sheet 1. (LOWER ALLUVIUM)	10.40	-3.69	
			10.40	11.20	B	22			Dense, grey, locally brown-grey, slightly clayey, silty, fine, occasionally medium SAND.			
	10.50	0.00	10.70		D	23		S 37				
			11.20	12.30	B	24			Locally very silty and clayey.			
									(LOWER ALLUVIUM)			
									At 10.70m with laminae of grey silty clay and with a little black organic matter.	(3.60)		
	12.10	0.00	12.30		D	25		S 39				
			12.80	14.00	B	26						
	13.70	0.00	14.00		D	27		S 28		14.00	-7.29	
			14.50	15.50	B	28			Firm, grey silty CLAY, locally very silty. Thinly interbedded with grey clayey silt and occasional fine and medium sand lenses.	(1.50)		
									(LOWER ALLUVIUM)			
	15.20	0.00	15.50		D	29		S 27		15.50	-8.79	
			16.00	17.60	B	30			Medium dense, grey, slightly clayey/clayey SILT with occasional shell fragments and black peaty fibres. (LOWER ALLUVIUM)	(0.50) 16.00	-9.29	
									Probably firm, grey, slightly sandy (fine) silty CLAY, with occasional shell fragments.	(1.40)		
									(LOWER ALLUVIUM)			
	17.00	0.00	17.20		D	31		S 21	At 17.20m slightly brown-grey and very silty.	17.40	-10.69	
									Medium dense, grey, clayey SILT, locally slightly sandy (fine).	(1.10)		
	17.80	1.20	17.90		U	32	(40)		(LOWER ALLUVIUM)			
			18.40	19.50	B	34				18.50	-11.79	
			18.50		D	33			Firm, brown-grey, slightly sandy (fine), silty/very silty CLAY.			
									(LOWER ALLUVIUM)	(1.30)		
	19.20	1.80	19.50	19.90	U	35	(65)	0.30				
									(Continued...)	19.80	-13.09	
01/10	19.20	1.80										

REMARKS: 4. Water was added to assist boring from 10.00m to 25.60m depth.
5. The addition of water may have masked the level at which groundwater entered the borehole.

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FOUNDATION & EXPLORATION SERVICES

SWANSEA BAY BWI SCHEME
ABP SITE

CONTRACT No. 2475

FIGURE: 50

SS 69 SE 140

RECORD OF BOREHOLE No: 17S

SS 68975 92910

START DATE: 30/09/93
DRILLING METHOD: CABLE PERCUSSION
EQUIPMENT: DANDO 175

CASING DETAILS: 200 mm to 10.00 m; 150 mm to 29.50 m
BOREHOLE DIA: 150 mm to 30.00 m; 150 mm to 30.00 m

SHEET 3 OF 3
CO-ORDINATES: E 268975 N 192955
GROUND LEVEL 6.71 m.O.D.

Date & Time	Casing Depth (m)	Depth to Water (m)	SAMPLE Depth (m) A/From	To	Type	No.	U100 Shows Inc Length (mm)	U100 Rec (m) UP Shows /N	DESCRIPTION OF STRATA	Depth (Thickness) (m)	Level (m.O.D.)	Strata Symbol
01/10	19.20	1.80	20.10		B	36		S 40	(...cont.)			
			20.10		D	37			Dense, grey, generally clayey, sandy (fine) SILT. Locally very clayey.			
			20.60	21.80	B	38			(LOWER ALLUVIUM)			
	21.60	0.00	21.80		D	39		S 38	At 21.80m grades to very silty fine sand, with occasional brown woody and peaty fragments.	(3.60)		
			22.30	23.40	B	40			Below 22.30m with occasional gravel sized pockets of brown fibrous and amorphous peat.			
			23.40		D	41				23.40	-16.69	
	23.50	4.20	23.60	24.05	U	42	(120)	0.35	Firm, brown-grey, friable silty CLAY with occasional lenses of black organic silt and brown peaty fibres. (LOWER ALLUVIUM)	(0.50)		
										23.90	-17.19	
			24.20		D	43			Compact, brown, fibrous PEAT.	(0.70)		
									(LOWER ALLUVIUM)			
			24.60	25.60	B	47				24.60	-17.89	
	24.60	5.70	24.60		U	44						
			24.80		U	45	(65)		Firm, grey, silty CLAY, with occasional lenses of grey and brown, silty fine and medium sand and sandy (fine) silt.	(1.00)		
									(LOWER ALLUVIUM)			
01/10	25.00	3.80	25.40		D	46						
02/10	25.00	4.10	25.60	26.10	B	48				25.60	-18.89	
									Dense, becoming medium dense, slightly grey-brown, silty, fine and medium SAND, with a little coarse sand.			
	26.00	8.00	26.20		D	49		S 45	Locally slightly clayey.			
			26.70	28.10	B	50			(LOWER ALLUVIUM)			
										(3.30)		
	27.80	8.00	28.10		D	51		S 29				
			28.90	30.00	B	52				28.90	-22.19	
									Medium dense, grey, slightly clayey/clayey, slightly sandy (fine, occasionally medium and coarse), SILT, with occasional black peat fragments. (LOWER ALLUVIUM)	(1.10)		
	29.50	8.00	29.60		D	53		S 23	END OF BOREHOLE	30.00	-23.29	
02/10	29.50	1.10										

REMARKS: 6. On completion of boring, a slotted standpipe was installed with the slotted section from 12.90m to 11.60m and a Casagrande type piezometer was installed with the tip at 8.20m and the following details: from 30.00m to 14.50m, cement/bentonite grout; from 14.50m to 13.00m, bentonite seal; from 13.00m to 11.50m, gravel filter response zone; from 11.50m to 8.70m, bentonite seal; from 8.70m to 7.20m gravel filter response zone; from 7.20m to 5.70m, bentonite seal; from 5.70m to 1.80m, cement/bentonite grout and from 1.80m to ground level, concrete and a projecting lockable cover.

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FOUNDATION & EXPLORATION SERVICES

SWANSEA BAY BWI SCHEME
ABP SITE

CONTRACT No. 2475
FIGURE: 51

SS 69SE 141

SS 69055 92926

RECORD OF BOREHOLE No: 18S

START DATE: 01/10/93
DRILLING METHOD: CABLE PERCUSSION
EQUIPMENT: PILCON WAYFARER

CASING DETAILS: 200 mm to 9.00 m; 150 mm to 27.00 m
BOREHOLE DIA: 200 mm to 10.00 m; 150 mm to 30.00 m

SHEET 1 OF 3
CO-ORDINATES: E 269055 N 192920
GROUND LEVEL 6.92 m.O.D.

Date & Time	Casing Depth (m)	Depth to Water (m)	SAMPLE Depth (m) From	To	Type	No.	U100 Blows Tot Length (mm)	U100 Rec (m) SPT Blows /N	DESCRIPTION OF STRATA	Depth (Thickness) (m)	Level (m.O.D.)	Strata Symbol
01/10			0.00	0.80	B	1			MADE GROUND: Dark brown, clayey, silty fine to coarse sand and subangular to rounded fine to coarse gravel of ash, clinker, coal and slag. With occasional fragments of brick and concrete. Below 0.80m with pockets of black, cooly silt and silty clay.	(1.40)		
			0.80	1.50	B	2				1.40	5.52	
	1.50	DRY	1.50		D	3		S 16	Medium dense, locally dense, brown, silty fine and medium SAND with a little coarse sand and a little subangular to rounded fine to coarse gravel. Occasional shell fragments.			
			2.20	2.80	B	4			(UPPER ALLUVIUM)			
	2.50	2.00	3.00		D	5		S 28	(Possible Made Ground above about 3.00mT)			
			3.80	4.20	B	6				(6.10)		
	4.50	3.00	4.50		D	7		S 23				
			5.20	5.80	B	8						
	6.00	3.20	6.00		D	9		S 31				
			6.80	7.20	B	10						
	7.50	2.80	7.50		D	11		S 15	Soft to firm, grey, silty CLAY, laminated/very thinly interbedded with grey, silty, fine and medium sand. (LOWER ALLUVIUM)	7.50 (0.70)	-0.58	
			8.20	8.80	B	12			Grey, slightly clayey, sandy (fine, occasionally medium and coarse) SILT. (LOWER ALLUVIUM)	8.20 (0.60)	-1.28	
	9.00	3.00	9.00		D	13		S 7	Soft, grey, silty CLAY with occasional black peaty fibres. (LOWER ALLUVIUM)	8.80	-1.88	
									(Continued....)			
01/10	9.00	3.00										

REMARKS:
1. Prior to boring, a Cable Avoidance Tool survey (CAT) was carried out.
2. Water was added to assist boring from ground level to 30.00m depth.
3. The addition of water may have masked the level at which groundwater entered the borehole.
4. A Falling Head Permeability Test was carried out in the borehole at 6.00m depth.

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FOUNDATION & EXPLORATION SERVICES

SWANSEA BAY BWI SCHEME
ABP SITE

CONTRACT No. 2475
FIGURE: 52

SS69SE 141

RECORD OF BOREHOLE No: 18S

SS 69055 92926

START DATE: 01/10/93
DRILLING METHOD: CABLE PERCUSSION
EQUIPMENT: PILCON WAYFARER

CASING DETAILS: 200 mm to 9.80 m; 150 mm to 27.60 m
BOREHOLE DIA: 200 mm to 10.00 m; 150 mm to 30.00 m

SHEET 2 OF 3
CO-ORDINATES: E 269055 N 192920
GROUND LEVEL 6.92 m.O.D.

Date & Time	Casing Depth (m)	Depth to Water (m)	SAMPLE Depth (m) At/From	To	Type	No.	U100 Blows Test Length (mm)	U100 Rec.(m) SPT Blows /N	DESCRIPTION OF STRATA	Depth (Thickness) (m)	Level (m.O.D.)	Strata Symbol
02/10	9.00	2.00							(...cont.)	(2.60)		
			10.50		U	14	(293)		Soft, grey, silty CLAY with occasional black peaty fibres.			
	9.00	2.00							Changing in U100 (Sample 14) to			
			10.95		D	15			Grey, clayey SILT, mottled dark grey in parts and possibly slightly organic.			
			11.40		D	16			(LOWER ALLUVIUM)	11.40	-4.48	
									Firm, grey, very silty CLAY.	(0.90)		
	12.00	3.10	12.00		U	17	(423)		(LOWER ALLUVIUM)	12.30	-5.38	
			12.45		D	18			Medium dense, grey, silty, fine and medium SAND, with a little coarse sand. Occasional black peaty fibres.			
			13.00		D	19			Grading with depth to become clayey.	(1.90)		
	13.50	5.20	13.50		D	20		S 11	(LOWER ALLUVIUM)			
			14.20	14.80	B	21				14.20	-7.28	
									Soft, grey and slightly brown-grey, silty CLAY, flecked dark grey in parts and with a little black peat.			
	15.00	5.70	15.00		U	22	(293)		(LOWER ALLUVIUM)			
			15.45		D	23						
			16.00		D	24			At 16.00m laminated with dark grey organic silty clay.			
	16.50	5.70	16.50		U	25	(21)					
			16.95		D	26			At 16.95m grey, clayey, slightly sandy (fine) silt band.	(5.40)		
			17.50		D	27			17.50m to 19.00m very silty.			
	18.00	6.30	18.00		U	28	(22)					
			18.45		D	29						
			19.00		D	30			Below 19.00m slightly sandy (fine).			
	19.50	6.40	19.50		U	31	(54)			19.60	-12.68	
02/10	19.50		19.95		D	32			Medium dense to dense, grey, generally (Continued...)			

REMARKS:

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SWANSEA BAY BWI SCHEME
ABP SITE

CONTRACT No. 2475
FIGURE: 53

SS 69 SE 141

RECORD OF BOREHOLE No: 18S

SS 69055 92920

START DATE: 01/10/93

DRILLING METHOD: CABLE PERCUSSION

EQUIPMENT: PILCON WAYFARER

CASING DETAILS: 200 mm to 9.00 m; 150 mm to 27.00 m

BOREHOLE DIA: 200 mm to 10.00 m; 150 mm to 30.00 m

SHEET 3 OF 3

CO-ORDINATES: E 269055 N 192920

GROUND LEVEL 6.92 m.O.D.

Date & Time	Casing Depth (m)	Depth to Water (m)	SAMPLE Depth (m) At/From	To	Type	No.	U100 Blows Test Length (mm)	U100 Rec (m) SPT Blows /N	DESCRIPTION OF STRATA	Depth (Thickness) (m)	Level (m.O.D.)	Strata Symbol
02/10	19.50		20.20	20.80	B	33			(...cont.) slightly clayey, sandy (fine) SILT, with occasional black and brown peaty fragments.			
	21.00	6.40	21.00		D	34		S 25	(LOWER ALLUVIUM)			
			21.20	22.40	B	35			20.20m to 20.80m very clayey.			
02/10	21.00											
03/10	21.00	3.40	22.50		D	36		S 32		(5.90)		
			23.20	23.80	B	37			23.20m to 23.80m with a little subangular to rounded fine gravel.			
	24.00	4.80	24.00		D	38		S 23				
			24.80	25.40	B	39						
	25.50	5.60	25.50		D	40		S 38	Firm, grey, silty CLAY, with a little subangular to rounded, fine and medium gravel. Occasional brown and black peaty fibres.	25.50	-18.58	
			26.20	26.80	B	41			(LOWER ALLUVIUM)			
	27.00	6.00	27.00		U	42	(43)					
			27.45		D	43				(4.50)		
			28.00		D	44						
	27.00	6.20	28.50		U	45	(46)		Below 28.50m mottled dark grey/black in parts (organic silty clay).			
			28.95		D	46						
			29.50		D	47						
									END OF BOREHOLE	30.00	-23.08	
03/10	27.00	6.20										

REMARKS: 3. On completion of boring, two Casagrande type standpipe piezometers were installed with the tips at 13.50m and 6.50m and the following detail: From 30.00m to 13.50m, cement/bentonite grout; from 13.50m to 14.00m, bentonite seal; from 14.00m to 12.50m, sand filter response zone; from 12.50m to 11.00m, bentonite seal; from 11.00m to 8.50m, cement/bentonite grout; from 8.50m to 7.00m, bentonite seal; from 7.00m to 5.50m, sand filter response zone; from 5.50m to 4.00m, bentonite seal; from 4.00m to 1.00m, cement/bentonite grout and from 1.00m to ground level, concrete and projecting lockable cover.

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FOUNDATION & EXPLORATION SERVICES

SWANSEA BAY BWI SCHEME
ABP SITE

CONTRACT No. 2475

FIGURE: 54

SS 69 SE 142

SS 69140 92945

RECORD OF BOREHOLE No: 19S

START DATE: 30/09/93
DRILLING METHOD: CABLE PERCUSSION
EQUIPMENT: PILCON WAYFARER

CASING DETAILS: 200 mm to 11.50 m
150 mm to 27.50 m
BOREHOLE DIA: 200 mm to 11.50 m
150 mm to 30.00 m

SHEET 1 OF 3
CO-ORDINATES: E 269140 N 192945
GROUND LEVEL 8.22 m.O.D.

Date & Time	Casing Depth (m)	Depth to Water (m)	SAMPLE Depth (m) From	To	Type	No.	U100 Blows Loss Length (mm)	U100 Rec.(m) SPT Blows /N	DESCRIPTION OF STRATA	Depth (Thickness) (m)	Level (m.O.D.)	Strata Symbol
30/09												
	NIL	DRY	0.50	1.00	B	1		C 10	MADE GROUND: Loose to medium dense, dark brown and brown, silty fine and medium sand and subangular to rounded, fine to coarse gravel and cobbles, including coal, brick and slag concrete and pieces of wire. With pockets of dark brown pesty sandy topsoil.			
			1.00		D	2				(2.20)		
			1.50		D	3						
	1.85	DRY	2.00	2.50	B	4	145	C 50	Note: SPT at 2.00m high "N" value due to presence of concrete cobbles.			
			2.50		D	5			Loose, becoming medium dense then dense, golden brown, silty, fine and medium SAND with a little coarse sand and a little subangular to rounded, fine to coarse gravel. Occasional shell fragments.	2.20	6.02	
			3.00		D	6			(UPPER ALLUVIUM)			
	3.50	3.15	3.50		D	7		S 8	(Possible Made Ground above 4.00m?)			
			4.00	4.50	B	8			4.00m to 4.50m with occasional cobbles.			
			4.50		D	9						
	5.00	3.55	5.00		D	10		S 28				
			5.50	6.00	B	11				(6.60)		
			6.00		D	12						
	6.50	3.20	6.50		D	13	230	S 50				
30/09	6.70	3.40	7.00	7.50	B	15						
01/10	6.70	4.28	7.00		C	14			7.00m to 7.50m with occasional cobbles.			
			7.50		D	16						
	8.00	4.90	8.00		D	17		S 39				
			8.50	9.00	B	18						
			9.00		D	19			Medium dense, grey, silty, fine and medium SAND with occasional shell fragments.	8.80	-0.58	
	9.50	3.60	9.50		D	20		S 26	(LOWER ALLUVIUM)			
									At 9.00m with pockets of grey silty clay.			
01/10	9.50		10.00	10.50	B	21			(Continued....)			

REMARKS:
1. Prior to boring, a Cable Avoidance Tool survey (CAT) was carried out.
2. The borehole was advanced by chiselling from 1.60m to 2.45m (1.00 hour).
3. Water was added to assist boring from 3.50m to 7.00m and from 8.50m to 30.00m depth.
4. The addition of water may have masked the level at which groundwater entered the borehole.

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SWANSEA BAY BWI SCHEME
ABP SITE

CONTRACT No. 2475

FIGURE: 55

SS 69 SE 142

SS 69140 92945 **RECORD OF BOREHOLE No: 19S**

START DATE: 30/09/93 — SHEET 2 OF 3

DRILLING METHOD: CABLE PERCUSSION — CASING DETAILS: 200 mm to 11.50 m, 150 mm to 27.50 m — CO-ORDINATES: E 269140 N 192945

EQUIPMENT: PILCON WAYFARER — BOREHOLE DIA: 200 mm to 11.50 m, 150 mm to 30.00 m — GROUND LEVEL: 8.22 m.O.D.

Date & Time	Casing Depth (m)	Depth to Water (m)	SAMPLE Depth (m) At/From	To	Type	No.	U100 Blows Test Length (mm)	U100 Rec.(m) SPT Blows /N	DESCRIPTION OF STRATA	Depth Thickness (m)	Level (m.O.D.)	Strata Symbol
01/10	9.50		10.00	10.50	B	21			(...cont.)			
			10.50		D	22			Medium dense, silty SAND, as Sheet 1.			
									(LOWER ALLUVIUM)	(4.20)		
	11.00	3.90	11.00		D	23		S 29	From 10.00m to 10.50m, grades to sandy silt.			
			11.50	12.00	B	24						
			12.00		D	25						
	12.50	4.10	12.50		D	26		S 22				
			13.00	13.50	B	27						
									Grey, clayey, slightly sandy (fine, occasionally medium) SILT.	13.00	-4.78	
									(LOWER ALLUVIUM)	(0.50)		
			13.50		D	28				13.50	-5.28	
	14.00	8.70	14.00		U	29	(25)		Soft, grey, slightly sandy (fine and medium) silty CLAY. (LOWER ALLUVIUM)	(0.90)		
										14.40	-6.18	
			14.50		D	30			Medium dense, grey, slightly clayey, sandy (fine, occasionally medium) SILT, with occasional shell fragments.			
			15.00	15.50	B	31						
									(LOWER ALLUVIUM)	(1.80)		
	15.40	4.35	15.50		D	32		S 19				
			16.00	16.50	B	33						
										16.20	-7.98	
			16.50		D	34			Soft, grey and brown-grey, mottled and laminated, silty CLAY, with occasional flecks of dark grey organic silty clay.			
	17.00	5.40	17.00		U	35	(26)		Slightly sandy (fine and medium) above 16.50m.	(1.80)		
			17.50		D	36			(LOWER ALLUVIUM)			
01/10 04/10	17.00 17.00	6.40 6.30	18.00		D	37				18.00	-9.78	
	17.00	6.30	18.50		U	38	(20)		Medium dense, grey, clayey, locally very clayey SILT, with occasional black peaty fragments. Slight organic odour.			
			19.00		D	39			(LOWER ALLUVIUM)			
			19.50		D	40						
04/10	20.00	8.75	20.00		D	41		S 18	(Continued....)			

REMARKS:

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SWANSEA BAY BWI SCHEME
ABP SITE

CONTRACT No. 2475

FIGURE: 56

SS 69 SE 142

RECORD OF BOREHOLE No: 19S

START DATE: 30/09/93 — SS 69140 92945 — CASING DETAILS: 200 mm to 11.50 m; 150 mm to 27.50 m — SHEET 3 OF 3

DRILLING METHOD: CABLE PERCUSSION — BOREHOLE DIA: 200 mm to 11.50 m; 150 mm to 30.00 m — CO-ORDINATES: E 269140 N 192945

EQUIPMENT: PILCON WAYFARER — GROUND LEVEL 8.22 m.O.D.

Date & Time	Casing Depth (m)	Depth to Water (m)	SAMPLE Depth (m) At/From	SAMPLE Depth (m) To	Type	No.	U100 Blows Test Length (mm)	U100 Rec.(m) Blows /m	DESCRIPTION OF STRATA	Depth (Thickness) (m)	Level (m.O.D.)	Strata Symbol
04/10	20.00	8.75	20.00		D	41		S 18	(...cont.)			
			20.50	21.00	B	42			Medium dense, clayey SILT, as Sheet 2.			
			21.00		D	43			(LOWER ALLUVIUM)			
	21.50	7.15	21.50		D	44		S 19	At 21.50m, slightly sandy (fine).			
			22.00	22.50	B	45						
			22.50		D	46				(8.50)		
	22.90	6.20	23.00		D	47		S 22	At 23.00m, slightly clayey.			
			23.50	24.00	B	48						
			24.00		D	49			From 24.00m to 24.50m, slightly sandy to sandy (fine).			
	24.50	7.70	24.50		D	50		S 24				
			25.00	25.50	B	51			Below 25.00m, very clayey, locally grading to silty clay.			
			25.50		D	52						
	26.00	7.95	26.00		D	53		S 14				
			26.50	27.00	B	54			Soft, grey, slightly organic, very silty CLAY.	26.50	-18.28	
			27.00		D	55			(LOWER ALLUVIUM)	(0.50) 27.00	-18.78	
	27.50	8.40	27.50		U	56	(40)		Compact, brown, fibrous PEAT with laminae of grey-brown, peaty, silty clay and clayey silt. (LOWER ALLUVIUM)	(0.45) 27.45	-19.23	
			28.00		D	57			Firm, grey, silty CLAY with a little brown peaty matter. Slight organic odour.			
	27.50	8.90	28.50		U	58	(41)		(LOWER ALLUVIUM)	(2.55)		
			29.00		D	59						
	27.50	9.90	29.50		U	60	(40)					
04/10	27.50		30.00		D	61			END OF BOREHOLE	30.00	-21.78	

REMARKS: 3. On completion of boring, a Casagrande type standpipe piezometer was installed with the tip at 15.50m depth and slotted standpipe was installed with the slotted section from 8.40m to 7.10m and the following detail: From 30.00m to 17.50m, cement/bentonite grout; from 17.50m to 16.00m, bentonite seal; from 16.00m to 14.50m, sand filter response zone; from 14.50m to 13.00m, bentonite seal; from 13.00m to 10.00m, cement/bentonite grout; from 10.00m to 8.50m, bentonite seal; from 8.50m to 7.00m, gravel filter response zone; from 7.00m to 5.50m, bentonite seal; from 5.50m to 1.00m, cement/bentonite grout and from 1.00m to ground level, concrete and a projecting lockable cover.

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FOUNDATION & EXPLORATION SERVICES

SWANSEA BAY BWI SCHEME
ABP SITE

CONTRACT No. 2475

FIGURE: 57

Appendix C. Factual Report on Ground Investigation

Report No 10318

Swansea Bay Tidal Lagoon
C133 Onshore Ground Investigation

FACTUAL REPORT

Employer:
Alun Griffiths (Contractors) Ltd.

Client:
Tidal Lagoon Swansea Bay Plc.

Engineer:
Atkins

August 2015

Apex Drilling Services Ltd.
Sturmi Way, Village Farm Industrial Estate,
Pyle, Bridgend, Mid Glamorgan, CF33 6BZ, UK
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SWANSEA BAY TIDAL LAGOON

C133 ONSHORE GROUND INVESTIGATION

FACTUAL REPORT

Report No: **10318**

Date: **August 2015**

Employer:

Alun Griffiths (Contractors) Ltd.
Waterways House
Merthyr Road
Llanfoist
Abergavenny
Monmouthshire
NP7 9PE

Engineer:

Atkins
Longcross Court
47 Newport Road
Cardiff
CF24 0AD

Issue No	Date	Details
1	August 2015	Factual Report as submitted

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2	**THE SITE AND GEOLOGY**	**2**
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3.3	In Situ Testing	
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ENCLOSURES

A	EXPLORATORY HOLE RECORDS
B	INSTRUMENTATION AND MONITORING
C	IN SITU TESTING
D	GEOTECHNICAL LABORATORY TEST RESULTS
E	GEOENVIRONMENTAL LABORATORY TEST RESULTS
F	DRAWINGS

1 INTRODUCTION

In May 2015 Apex Drilling Services (APEX) were commissioned by Alun Griffiths (Contractors) Ltd. (AG) on behalf of Tidal Lagoon Swansea Bay Plc. (TLSB) to carry out a ground investigation at Swansea Docks. The investigation was required to obtain geotechnical and geo-environmental information for highways improvement, routing of a 113Kv electrical cable and other infrastructure improvements in relation to the proposed Swansea Bay tidal lagoon.

The scope of the investigation, which was specified by Atkins, comprised of windowless sampling boreholes, trial pitting, road cores, in situ testing in the form of standard penetration tests, soakaway testing, plate load CBR tests, dynamic cone penetration tests, gas and groundwater monitoring and laboratory testing. The investigation was carried out in accordance with the contract specification, Eurocode 7 and relevant related standards identified below (see also References). The fieldwork was carried out between 15th June and 9th July 2015.

This report presents the factual records of the fieldwork and laboratory testing. The data is also presented separately in digital format.

2 THE SITE AND GEOLOGY

2.1 The Site

The site is located within Swansea Docks, approximately 3km east of Swansea city centre, as shown in Figure 1, Site Location Plam, Enclosure F. The main areas of investigation include land between the A483 Fabian Way to the north and Port Road to the south, and land adjacent to and including the Breakwater Road running alongside Queens Dock.

The site is bound to the north by the A483, to the east by Baldwin Crescent Road and the Swansea University Bay Campus development, and to the south and west by Breakwater Road, Kings Dock and Queens Dock.

The approximate centre of the site is at National Grid reference SS 686 928.

Historically the site has had several rail lines serving the docks as well as a former power station, arsenic works and oil storage area.

2.2 Published Geology

The published geological map of the area, BGS Sheet 247, show superficial deposits in the vicinity to comprise of Made Ground in the form of colliery and mineral smelting spoil, also some road and railway embankments. Also indicated is Beach and Tidal Flat Deposits in the form of sand, silt and clay and also Blown Sand deposits on the eastern portion of the site.

The solid geology is shown to comprise of Carboniferous aged mudstone, coal seams, seat earths and thin sandstones of the South Wales Middle Coal Measures.

A north-west to south-east trending fault with an easterly downthrow is indicated near the centre of the site.

3 FIELDWORK

3.1 General

The fieldwork which was specified by Atkins was carried out in general accordance with BS 5930 +A2 (2010), BS EN 1997-2 (2007), BS EN ISO 22475-1 (2006) and BS 10175 (2011) + A1 (2013).

Standard penetration testing was undertaken in the boreholes, the results are presented within the logs.

Whilst undertaking geo-environmental sampling a best practice policy was observed which included ensuring appropriate sample containers were used, cleaning tools to prevent cross contamination, keeping samples in cool boxes and dispatching samples at the earliest opportunity, complete with chain of custody, to the testing laboratory.

The exploratory hole locations were selected by Atkins. The locations of the exploratory holes were surveyed by AG before the exploratory hole was stared.

The positions of the exploratory holes are shown on the Exploratory Hole Location Plan in Enclosure F.

3.2 Exploratory Holes

The exploratory holes are listed in the following table.

SUMMARY OF EXPLORATORY HOLES

TYPE	QUANTITY	MAXIMUM DEPTH (m)	REMARKS
Windowless Sample Borehole	13	4.00	Designated BH1 to 6, 6A, 7, 9, 10, 10A & A1 to A2
Trial Pits (Machine Excavated)	41	3.70	Designated TP3, 3B, 3C, 5 to 8, 10 to 12, 16 to 17, 17A, 19 to 24, 26, 28, 30, 32 34, 34A, 34B, 35, 37, 39, 40, 42, 42A, 44, 46, 48 to 49, 51, 53, 55, 57 & 59
Trial Pits (Machine Excavated) – Arsenic Area	62	0.90	Designated TPA1 to A7, A9 to A63
Trial Pits (Machine Excavated) – Soakaway	13	2.00	Designated TPS1, S3 to S8, S8A, S9 to S11, S15 to S16
Road Core	3	0.40	Designated CC1 to 3

The exploratory hole records are presented in Enclosure A and should be read in conjunction with the Key which is included in that enclosure. The records provide descriptions of the materials encountered in accordance with BS EN ISO 14688-1 (2002) + A1 (2013) and 14689-1 (2003), for soils and rocks respectively, as amplified by BS 5930+A2 (2010).

The records also give details of the samples taken together with observations made during operations. Photographs of the recovered windowless samples and trial pits re presented in a seperate Photographic Volume.

3.3 In Situ Testing

In situ testing was carried out in accordance with the relevant standards as tabulated below. The testing is summarised in the following table and the results are presented in Enclosure C unless noted otherwise.

SUMMARY OF IN SITU TESTING

TYPE	QUANTITY	MAXIMUM DEPTH (m)	REMARKS
Plate Load Bearing CBR	5	G.L.	Designated Test 1 to 5, Report No. D5232-15/1
Trial Pit Soakaway Test	12	2.00	Designated TPS1, S3 to S7, S8A, S9 to S11, and S15 to S16.

TYPE	QUANTITY	MAXIMUM DEPTH (m)	REMARKS
Dynamic Cone Penetration Test	7	1.04	Designated DCPTP13, TP19, TP20, TP25, TP33, TP49 and TP59

3.4 Instrumentation and Monitoring

The instruments installed in the exploratory holes are shown on the logs and detailed in Enclosure B. Records of groundwater and ground gas monitoring carried out by Apex during the fieldwork period are presented in Enclosure B. Records of groundwater and gas monitoring carried out by Apex after the fieldwork period are also presented in Enclosure B.

4 LABORATORY TESTING

4.1 Geotechnical Testing

The testing was scheduled by Atkins and was carried out in accordance with BS 1377-2 (1990) unless otherwise stated. The testing was undertaken by Apex Testing Solutions at their Bridgend laboratory unless otherwise stated. The testing is summarised below and the results are presented in Enclosure D.

SUMMARY OF GEOTECHNICAL LABORATORY TESTING

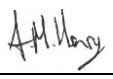
TYPE	REMARKS
Moisture Content	34no.
Atterberg Limit	2no.
Particle Size Distribution (Sieve)	25no.
Particle Size Distribution (Sedimentation)	2no.
Organic Matter Content	28no.
Suite C	11no.

4.2 Geoenvironmental Testing

The testing was scheduled by Atkins and was carried out using MCERTS accredited testing methods unless otherwise stated. The testing was undertaken by ALcontrol Laboratories at their Deeside laboratory. The testing is summarised below and the results are presented in Enclosure E.

SUMMARY OF GEOENVIRONMENTAL LABORATORY TESTING

TYPE - SOIL	REMARKS
Soil Testing – 15no. Reports	Report No.319918, 319919, 320562, 320563, 320598, 320695, 320715, 320813, 320875, 321039, 321065, 321164, 321665, 321875, 321895, 323543

Prepared By	**Aled Henry BSc. (Hons) FGS**	
Reviewed By	**Robert Brewer BSc.**	
Approved for Issue By	**Roger Martin**	

REFERENCES

AGS : 2005 : Electronic transfer of geotechnical and geoenvironmental data (Edition 3.1 including addendum May 2005). Association of Geotechnical and Geoenvironmental Specialists.

BGS England and Wales Sheet 247 : Swansea 2011. 1:50000 geological map (solid & drift). British Geological Survey

BRE Special Digest 1 : 2005 : Concrete in aggressive ground. Building Research Establishment.

BRE Digest 365 : 2003 : Soakaway Design. Building Research Establishment.

BS 1377-2: 1990: Methods of test for soils for civil engineering purposes. Classification tests. British Standards Institution.

BS 5930+A2 : 2010 : Code of practice for site investigations (Amendment 2). British Standards Institution.

BS 10175 : 2011 + A1 2013 : Code of practice for investigation of potentially contaminated sites. British Standards Institution.

BS 22475-3 : 2011: Geotechnical investigation and testing. Sampling methods and groundwater measurements. British Standards Institution.

BS EN 1997-2 : 2007 : Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing. British Standards Institution.

BS EN ISO 14688-1 : 2002 + A1 2013 : Geotechnical investigation and testing - Identification and classification of soil - Part 1 Identification and description. British Standards Institution.

BS EN ISO 14689-1 : 2003 : Geotechnical investigation and testing - Identification and classification of rock - Part 1 Identification and description. British Standards Institution.

UK Specification for Ground investigation 2nd Edition 2

ENCLOSURE A

EXPLORATORY HOLE RECORDS

Exploratory Hole Log Key	
Windowless Borehole	BH1 to 6, 6A, 7, 9, 10,10A & A1 to A2
Trial Pit	TP3, 3B, 3C, 5 to 8, 10 to 12, 16 to 17, 17A, 19 to 24, 26, 28, 30, 32 34, 34A, 34B, 35, 37, 39, 40, 42, 42A, 44, 46, 48 to 49, 51, 53, 55, 57 & 59
Tral Pit - Arsenic Area	TPA1 to A7, A9 to A63
Tral Pit - Soakaway	TPS1, S3 to S8, S8A, S9 to S11, S15 to S16
Road Core	CC1 to CC3

Key to Exploratory Hole Records

APEX DRILLING SERVICES

SAMPLES

Undisturbed

U	Driven tube sample
UT	Driven thin wall tube sample
TW	Pushed thin wall tube sample
P	Pushed piston sample

} nominally 100 mm diameter and full recovery unless otherwise stated

WLS	Liner sample (from Windowless or similar sampler), full recovery unless otherwise stated
CBR	CBR mould sample
BLK	Block sample
C	Core sample (from rotary core) taken for laboratory testing
AMAL	Amalgamated sample

Disturbed

D	Small sample
B	Bulk sample

Other

W	Water sample
G	Gas sample
	Environmental chemistry samples (in more than one container where appropriate)
ES	Soil sample
EW	Water sample

Comments Sample reference numbers are assigned to every sample taken. A sample reference of 'NR' indicates that attempt was made to take a tube sample, however, there was no recovery.

Monitoring samples taken after completion of hole construction are not shown on the exploratory hole logs.

TESTS

SPT S or SPT C — Standard Penetration Test, open shoe (S) or solid cone (C)

The Standard Penetration Test is defined in BS EN ISO 22476-3 (2005). The incremental blow counts are given in the Field Records column; each increment is 75 mm unless stated otherwise and any penetration under self weight in mm (SW) is noted. Where the full 300 mm test drive is achieved the total number of blows for the test drive is presented as N = ** in the Test column. Where the test drive blows reach 50 the total blow count beyond the seating drive is given (without the N = prefix).

IV	*in situ* Vane shear strength, peak (p) and remoulded (r)
HV	Hand vane shear strength, peak (p) and remoulded (r)
PP	Pocket penetrometer test, converted to shear strength
KFH, KRH, KPI	Permeability tests (KFH = falling head, KRH = rising head; KPI = packer inflow); results provided in Field Records column (one value per stage for packer tests)

DRILLING RECORDS

The mechanical indices (TCR/SCR/RQD & If) are defined in BS 5930+A2 (2010)

TCR	Total Core Recovery, %
SCR	Solid Core Recovery, %
RQD	Rock Quality Designation, %
If	Fracture spacing, mm. Minimum, typical and maximum spacings are presented. The term non-intact (NI) is used where the core is fragmented.

Flush returns, estimated percentage with colour where relevant, are given in the Records column

CRF	Core recovered (length in m) in the following run
AZCL	Assessed zone of core loss
NR	Not recovered

GROUNDWATER

▼	Groundwater strike
▽	Groundwater level after standing period

Key to Exploratory Hole Records

APEX DRILLING SERVICES

INSTALLATION

Standpipe/ piezometer

Details of standpipe/piezometer installations are given on the Record. Legend column shows installed instrument depths including slotted pipe section or tip depth, response zone filter material type and layers of backfill.

The type of instrument installed is indicated by a code in the Legend column at the depth of the response zone:

SP Standpipe
SPIE Standpipe piezometer
PPIE Pneumatic piezometer
EPIE Electronic piezometer

Inclinometer or Slip Indicator

The installation of vertical profiling instruments is indicated on the Record. The base of tubing is shown in the Legend column.

The type of instrument installed is indicated by a code in the Legend column at the base of the tubing:

ICE Biaxial inclinometer
ICM Inclinometer tubing for use with probe
SLIP Slip indicator

Settlement Points or Pressure Cells

The installation of single point instruments is indicated on the Record. The location of the measuring device is shown in the Legend column.

The type of instrument installed is indicated by a code in the Legend column:

ESET Electronic settlement cell/gauge
ETM Magnetic extensometer settlement point
EPCE Electronic embedment pressure cell
PPCE Electronic push in pressure cell

INSTALLATION LEGENDS

A legend describing the installation is shown in the rightmost column. Legends additional to BS5930 are used to describe the backfill materials as indicated below.

NOTES

1 Soils and rocks are described in accordance with BS EN ISO 14688-1 (2002) and 14689-1 (2003) respectively as amplified by BS 5930+A2 (2010).

2 For fine soils consistency determined in the field by the logger is reported for those strata where undisturbed samples are available. The consistency is qualified and given (in brackets) when, in the opinion of the logger, the sample is disturbed but the assessed consistency is reasonably representative of the in situ conditions; in these circumstances it will normally underestimate consistency in situ. No consistency is given where the samples available are too disturbed to allow a reasonable assessment.

3 Evidence of the occurrence of very coarse particles (cobbles and boulders) is presented on the logs, however, because of their size in relation to the exploratory hole these records may not be fully representative of their size and frequency in the ground mass.

4 The declination of bedding and joints is given with respect to the normal to the core axis. Thus in a vertical borehole this will be the dip.

5 The assessment of SCR, RQD and Fracture Spacing excludes artificial fractures

6 Strata legends are in accordance with BS 5930+A2 (2010).

7 Water level observations of discernible entries during the advancing of the exploratory hole are given at the foot of the log and in the Legend column. The term "none observed" is used where no discrete entries are identified although this does not necessarily indicate that the hole has not been advanced below groundwater level. Under certain conditions groundwater cannot be observed, for instance, drilling with water flush or overwater, or boring at a rate much faster than water can make its way into the borehole (ref BS5930+A2:2010, Clause 47.2.7). In addition, where appropriate, water levels in the hole at the time of recovering individual samples or carrying out in situ tests and at shift changes are given in the Records column.

8 The borehole logs present the results of Standard Penetration Tests recorded in the field without correction or interpretation. However, in certain ground conditions (e.g. high hydraulic head or where very coarse particles are present) some judgment may be necessary in considering whether the results are representative of in situ mass conditions.

Borehole Log

APEX DRILLING SERVICES

Drilled	AR	**Start**	**Equipment, Methods and Remarks**	**Depth From**	**Diameter**	**Casing Depth**	**Ground Level** 8.940
Logged	DM	17/06/2015	Dando Terrier Hand excavated pit G.L. - 1.20m. Windowless sampling 1.20 - 4.00m.	3.00m 4.00m	100mm 90mm		**Coordinates** 268158E 193007N
Checked	RB	**End** 17/06/2015	Terminated due to collapsing strata. UXO clearance 1hr.				**National Grid** 268158E - 193007N
							Chainage

Samples and Tests

Strata

Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.10	ES 1		17/06/2015	0930	MADE GROUND: Grey and red brown sandy angular to sub-angular fine to coarse GRAVEL of granite.	(0.25)		
0.00-0.25	B 2							
0.25-0.50	ES 3				MADE GROUND: Dark brown and black slightly silty sandy to very sandy angular to sub-rounded fine to coarse GRAVEL of clinker, slag, brick and sandstone with low to medium cobble content. Cobbles are angular to sub-angular of brick, concrete and sandstone.	0.25 *8.69*		
0.25-1.00	B 4				0.50m: PID reading, 0ppm.			
0.80-1.00	ES 5							
1.20-1.50	ES 6							
1.20-2.00	B 7				1.50m: PID reading, 0ppm.			
2.00-2.50	ES 8					(3.40)		
2.50-3.00	B 9				2.50m: PID reading, 0ppm.			
3.00-3.65	B 10							
3.40-3.65	ES 11				3.50m: PID reading, 0ppm.			
3.70-3.90	ES 12				3.60m - 4.00m: Collapsing strata.	3.65 *5.29*	(0.05)	
3.90-4.00	D 13				MADE GROUND: Brown and black medium to coarse SAND. (insufficient material to sample).	3.70 *5.24*	(0.20)	
			17/06/2015	1230	MADE GROUND: Soft brown sandy slightly gravelly clayey SILT. Gravel is angular to sub-rounded fine to coarse of sandstone, siltstone and clinker.	3.90 *5.04*	(0.10)	
					MADE GROUND: Brown slightly gravelly fine to coarse SAND. Gravel is angular to sub-rounded fine to coarse of sandstone, siltstone and clinker.	4.00 *4.94*		
					End of Borehole at 4.00 m			

Depth	TCR SCR RQD	If	Records/Samples	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour	Depth Sealed (m)
-	3.60	Seepage	-

Depth Related Marks *

From	To (m)

Chiselling

Depths (m)	Time	Tools Used

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

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Project Swansea Bay Tidal Lagoon C133 Onshore G.I.

Project No. 10318

Carried out for Tidal Lagoon Swansea Bay Plc.

Borehole **BH1**

Sheet 1 of 1

Borehole Log

APEX DRILLING SERVICES

Drilled	AR	**Start**	**Equipment, Methods and Remarks**	**Depth From**	**Diameter**	**Casing Depth**	**Ground Level** 8.960
Logged	DM	17/06/2015	Dando Terrier	3.00m	100mm		**Coordinates** 268206E 193010N
Checked	RB	**End** 17/06/2015	Hand excavated pit G.L. - 4.00m. Terminated due to collapsing strata. UXO clearance 1hr.	4.00m	90mm		**National Grid** 268206E - 193010N
							Chainage

Samples and Tests

Strata

Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.11	ES 1		17/06/2015	1230	MADE GROUND: Grey and red brown sandy angular to sub-angular fine to coarse GRAVEL of granite.	(0.20)		
0.00-0.20	B 2				0.10m: PID reading, 0ppm.	0.20 *8.76*		
0.20-0.50	ES 3				MADE GROUND: Dark brown and black slightly silty sandy to very sandy angular to sub-rounded fine to coarse GRAVEL of clinker, slag, brick and sandstone with low to medium cobble content. Cobbles are angular to sub-angular of brick, concrete and sandstone.			
0.50-0.80	B 4					(0.60)		
0.60	ES 5		~~17/06/2015~~	~~1300~~	0.50m: PID reading, 0ppm.			
			18/06/2015	0800	0.60m: White angular medium gravel size fragments of ASBESTOS.			
0.80-1.20	ES 6					0.80 *8.16*		
	D 7				MADE GROUND: Brown slightly silty slightly gravelly fine to coarse SAND. Gravel is sub-angular to rounded fine to coarse of sandstone.			
1.20-1.55	B 8					(0.75)		
					1.30m - 1.55m: Becoming slightly clayey.			
1.55-2.00	ES 9					1.55 *7.41*		
	B 10				MADE GROUND: Brown, black and orange fine to coarse SAND and angular fine to coarse GRAVEL of clinker, ash, slag and brick with low cobble content. Cobbles are angular to subangular of brick and clinker.			
2.00-2.50	ES 11				2.00m: PID reading, 0ppm.			
2.50-3.00	B 12					(2.45)		
3.00-3.50	ES 13				3.00m: PID reading, 0.2ppm.			
3.50-4.00	B 14							
					3.60m - 4.00m: Collapsing strata.			
			~~18/06/2015~~	~~1100~~		4.00 *4.96*		
					End of Borehole at 4.00 m			

Depth	TCR SCR ROD	If	Records/Samples	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour	Depth Sealed (m)
-	3.55		-

Depth Related Marks *

From	To (m)

Chiselling

Depths (m)	Time	Tools Used

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

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Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Borehole **BH2**

Sheet 1 of 1

Borehole Log

APEX DRILLING SERVICES

Drilled	AR	**Start**	**Equipment, Methods and Remarks**	**Depth From**	**Diameter**	**Casing Depth**	**Ground Level** 8.880
Logged	DM	17/06/2015	Dando Terrier	3.00m	100mm		**Coordinates** 268298E 193011N
Checked	RB	**End** 17/06/2015	Hand excavated pit G.L. - 1.20m. Windowless sampling 1.20 - 4.00m. Terminated due to collapsing strata. UXO clearance 1hr.	4.00m	90mm		**National Grid** 268298E - 193011N
							Chainage

Samples and Tests

Strata

Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.10	ES 1		17/06/2015	1500	MADE GROUND: Grey and red brown sandy angular to sub-angular fine to coarse GRAVEL of granite.	(0.20)		
0.20-0.50	ES 2					0.20		
0.20-0.70	B 3				MADE GROUND: Dark brown and black slightly silty sandy to very sandy angular to sub-rounded fine to coarse GRAVEL of clinker, slag, sandstone, siltstone and ash.	*8.68*		
						(0.50)		
0.70-1.00	ES 4					0.70		
0.70-1.20	B 5				MADE GROUND: Brown fine to coarse SAND and sub-angular to rounded fine to coarse GRAVEL of sandstone with low cobble content. Cobbles are sub-angular to rounded of sandstone.	*8.18*		
						(0.60)		
1.30-1.80	ES 6					1.30		
1.30-2.00	B 7				Black and dark brown fine to coarse SAND and angular to sub-rounded fine to coarse GRAVEL of clinker, slag and ash.	*7.58*		
					1.50m: PID reading, 0.4ppm.			
2.00-2.50	ES 8							
						(1.60)		
2.50-2.90	B 9				2.50m: PID reading, 0.2ppm.			
2.90-3.20	ES 10					2.90		
					MADE GROUND: Brown slightly gravelly medium to coarse SAND. Gravel is angular fine to coarse of clinker and ash.	*5.98*		
					3.00m: PID reading, 0.4ppm.	(0.30)		
3.20-3.50	ES 11					3.20		
					Black and dark brown fine to coarse SAND and angular to sub-rounded fine to coarse GRAVEL of clinker, slag and ash.	*5.68*		
3.50-4.00	B 12							
						(0.80)		
					3.65m - 4.00m: Collapsing strata.			
					3.90m - 4.00m: PID reading, 3.8ppm.			
			17/06/2015	1700		4.00		
					End of Borehole at 4.00 m	*4.88*		

Depth	TCR SCR RQD	If	Records/Samples	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour	Depth Sealed (m)
-	3.55		-

Depth Related Marks *

From	To (m)

Chiselling

Depths (m)	Time	Tools Used

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

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Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Borehole **BH3**

Sheet 1 of 1

Borehole Log

APEX DRILLING SERVICES

Drilled	AR	**Start**	**Equipment, Methods and Remarks**	**Depth From**	**Diameter**	**Casing Depth**	**Ground Level** 8.790
Logged	DM	18/06/2015	Dando Terrier Hand excavated pit G.L. - 1.20m. Windowless sampling 1.20 - 4.00m.	3.00m 4.00m	100mm 90mm		**Coordinates** 268402E 193008N
Checked	RB	**End** 18/06/2015	Terminated due to collapsing strata. UXO clearance 1hr.				**National Grid** 268402E - 193008N **Chainage**

Samples and Tests

Strata

Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.10 0.00-0.20	ES 1 B 2		18/06/2015	1100	MADE GROUND: Grey and red brown slightly silty sandy angular fine to coarse GRAVEL of pinkish grey granite, sandstone and siltstone.	(0.20)		
0.20-0.50	ES 3				MADE GROND: Black and dark brown fine to coarse SAND and angular to subrounded fine to coarse GRAVEL of clinker, slag and ash.	0.20 *8.59*		
0.50-1.00	B 4				0.50m: PID reading, 0.2ppm.			
1.20-1.50	ES 5							
1.50-2.00	ES 6				1.50m: PID reading, 0.3ppm.			
						(3.25)		
2.00-2.50	ES 7							
2.50-3.00	B 8				2.50m: PID reading, 0.2ppm.			
					3.30m - 4.00m: Collapsing strata.			
3.45-4.00 3.50-4.00	ES 9 B 10				MADE GROND: Brown slightly gravelly fine to coarse SAND. Gravel is angular fine to coarse of clinker and slag.	3.45 *5.34*		
					3.60m: PID reading, 0.5ppm.	(0.55)		
			18/06/2015	1400	End of Borehole at 4.00 m	4.00 *4.79*		
Depth	TCR SCR RQD	If	Records/Samples	Date Casing	Time Water			

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour	Depth Sealed (m)
-	3.45	Damp	-

Depth Related Marks *

From	To (m)

Chiselling

Depths (m)	Time	Tools Used

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

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Project Swansea Bay Tidal Lagoon C133 Onshore G.I.

Project No. 10318

Carried out for Tidal Lagoon Swansea Bay Plc.

Borehole

BH4

Sheet 1 of 1

Borehole Log

APEX DRILLING SERVICES

Drilled	AR	**Start** 18/06/2015	**Equipment, Methods and Remarks** Dando Terrier Hand excavated pit G.L. - 1.20m. Windowless sampling 1.20 - 3.00m. Terminated due to collapsing strata. UXO clearance 1hr.	**Depth From** 3.00m	**Diameter** 100mm	**Casing Depth**	**Ground Level** 8.000
Logged	DM	**End** 18/06/2015					**Coordinates** 268663E 192891N
Checked	RB						**National Grid** 268663E - 192891N
							Chainage

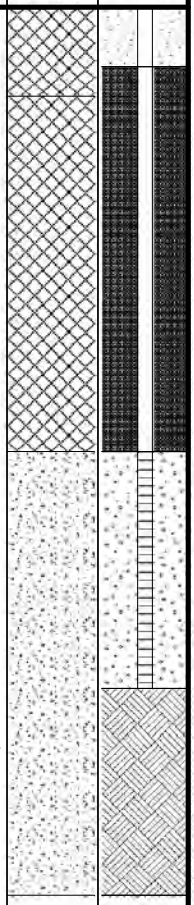
Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
0.00-0.30	ES 1 D 2		18/06/2015	1400
0.30-0.80 0.30-1.00	ES 3 B 4			
1.50-2.00	ES 5 B 6			
2.00-3.00	ES 7 B 8			
			~~18/06/2015~~	~~1700~~

Strata

Description	Depth, Level (Thickness)
MADE GROUND: Grey and red brown sandy angular to sub-angular fine to coarse GRAVEL of granite.	(0.30)
MADE GROUND: Dark brown and black fine to coarse SAND and angular to rounded fine to coarse GRAVEL of clinker, slag, ash and sandstone with low cobble content. Cobbles are angular to rounded of brick, clinker and sandstone. 0.50m: PID reading, 0ppm.	0.30 *7.70* (1.20)
Grey brown slightly gravelly to gravelly fine to coarse SAND (predominantly fine to medium grained). Gravel is sub-angular to rounded fine to coarse of sandstone and siltstone with occasional shell fragments. 2.00m: PID reading, 0ppm. 2.50m - 3.00m: Collapsing strata.	1.50 *6.50* (1.50)
End of Borehole at 3.00 m	3.00 *5.00*

Legend



Backfill/ Instruments

Depth	TCR SCR RQD	If	Records/Samples	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour	Depth Sealed (m)
-	2.50	Damp	-

Depth Related Marks *

From	To (m)

Chiselling

Depths (m)	Time	Tools Used

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

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Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Borehole **BH5**

Sheet 1 of 1

Borehole Log

APEX DRILLING SERVICES

Drilled	AR	**Start** 19/06/2015	**Equipment, Methods and Remarks** Dando Terrier Hand excavated pit G.L. - 0.50m. Pit terminated due to presence of service.	**Depth From**	**Diameter**	**Casing Depth**	**Ground Level** 6.580
Logged	DM	**End** 19/06/2015					**Coordinates** 268712E 192876N
Checked	RB						**National Grid** 268712E - 192876N
							Chainage

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
			19/06/2015	0800
			19/06/2015	0830

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
MADE GROUND: Grass over brown slightly silty slightly gravelly fine to medium SAND. Gravel is angular to sub-angular of sandstone and siltstone.	(0.10) 0.10 *6.48*		
MADE GROUND: Black slightly gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse of sandstone and clinker.	(0.40)		
0.49m - 0.50m: Light grey plastic pipe encountered (redundant service). Small hole made in top of pipe with scissor shovels (approx. 30mm across). Orientation 90°/270°, approximately 100mm diameter. Moved to BH006A.	0.50 *6.08*		
End of Borehole at 0.50 m			

Depth	TCR SCR RQD	If	Records/Samples	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour	Depth Sealed (m)
No Groundwater Encountered			

Depth Related Marks *

From	To (m)

Chiselling

Depths (m)	Time	Tools Used

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

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Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Borehole **BH6**

Sheet 1 of 1

Borehole Log

APEX DRILLING SERVICES

Drilled	AR	**Start** 19/06/2015	**Equipment, Methods and Remarks** Dando Terrier Hand excavated pit G.L. - 1.20m. Windowless sampling 1.20 - 3.00m. Terminated due to collapsing strata. UXO clearance 1hr.	**Depth From**	**Diameter**	**Casing Depth**	**Ground Level** 6.580
Logged	DM	**End** 19/06/2015		3.00m	100mm		**Coordinates** 268712E 192876N
Checked	RB						**National Grid** 268712E - 192876N
							Chainage

Samples and Tests

Strata

Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.10 0.10-0.60 0.10-1.00	ES 1 ES 2 B 3		19/06/2015	1000	MADE GROUND: Grass over brown slightly silty slightly gravelly fine to medium SAND. Gravel is angular to sub-angular of sandstone and siltstone.	(0.10) 0.10 *6.48*		
					MADE GROUND: Black slightly gravelly fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse of sandstone and clinker.	(1.10)		
1.20-1.50 1.20-2.00	ES 4 B 5				MADE GROUND: Brown, black and grey fine to coarse SAND and angular to sub-angular fine to coarse GRAVEL of clinker, slag and ash with low cobble content. Cobbles are angular of clinker. Slight hydrocarbon odour.	1.20 *5.38*		
					1.50m: PID reading, 5.2ppm.			
2.00-2.30 2.00-2.70	ES 6 B 7					(1.80)		
					2.20m: Gravel size wood fragments.			
					2.50m: PID reading, 19.2ppm.			
					2.70m - 3.00m: No recovery (AZCL).			
			19/06/2015	1100	End of Borehole at 3.00 m	3.00 *3.58*		

Depth	TCR SCR RQD	If	Records/Samples	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour	Depth Sealed (m)
-	1.90	Damp	-

Depth Related Marks *

From	To (m)

Chiselling

Depths (m)	Time	Tools Used

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale: 1:26 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Borehole **BH6A**

Sheet 1 of 1

Borehole Log

APEX DRILLING SERVICES

Drilled	AR	**Start** 19/06/2015	**Equipment, Methods and Remarks** Dando Terrier Hand excavated pit G.L. - 0.50m. Pit terminated due to presence of concrete. UXO clearance 1hr.	**Depth From**	**Diameter**	**Casing Depth**	**Ground Level** 6.790
Logged	DM	**End** 19/06/2015					**Coordinates** 268858E 192876N
Checked	RB						**National Grid** 268858E - 192876N
							Chainage

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
0.00-0.10	ES 1		19/06/2015	1200
0.10-0.50	ES 2			
	B 3			
			19/06/2015	1300

Depth | TCR SCR ROD | If | Records/Samples | Date Casing | Time Water

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
MADE GROUND: Grass over dark grey brown slightly silty sandy angular fine to coarse GRAVEL of sandstone and siltstone.	(0.10) 0.10 *6.69*		
MADE GROUND: Dark grey brown sandy to very sandy angular to sub-angular fine to coarse GRAVEL of sandstone, siltstone, clinker and ash.	(0.40)		
0.49m - 0.50m: Concrete.	0.50 *6.29*		
End of Borehole at 0.50 m			

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour	Depth Sealed (m)

No Groundwater Encountered

Depth Related Marks *

From	To (m)

Chiselling

Depths (m)	Time	Tools Used

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale: 1:26 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Borehole **BH7**

Sheet 1 of 1

Borehole Log

APEX DRILLING SERVICES

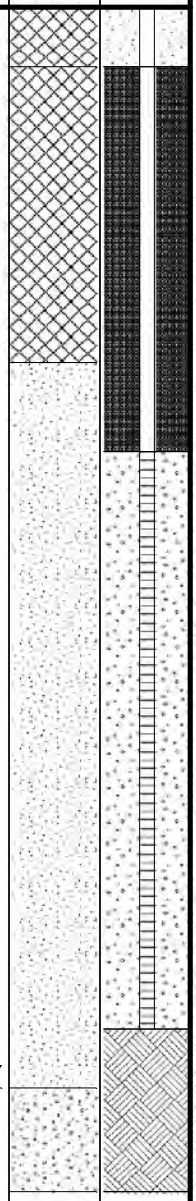
Drilled	AR	**Start** 19/06/2015	**Equipment, Methods and Remarks** Dando Terrier Hand excavated pit G.L. - 1.20m. Windowless sampling 1.20 - 4.00m. Terminated due to collapsing strata. UXO clearance 1hr.	**Depth From**	**Diameter**	**Casing Depth**	**Ground Level** 6.740
Logged	DM	**End** 19/06/2015		4.00m	100mm		**Coordinates** 268921E 192761N
Checked	RB						**National Grid** 268921E - 192761N
							Chainage

Samples and Tests

Strata

Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)
0.00-0.10	ES 1		19/06/2015	1400	MADE GROUND: Grey over grey brown very sandy angular fine to coarse GRAVEL of limestone and sandstone. 0.10m: PID reading, 0ppm.	(0.20)
0.20-0.50	ES 2					0.20
0.20-1.00	B 3				MADE GROUND: Brown gravelly fine to coarse SAND with low cobble content. Gravel is angular to rounded fine to coarse of sandstone. Cobbles are angular of concrete and sandstone. 0.50m: PID reading, 0ppm.	*6.54* (1.00)
1.20-1.50	ES 4					1.20
1.20-2.00	B 5				Orange brown fine to coarse SAND. 1.50m: PID reading, 0ppm.	*5.54*
2.00-2.50	ES 6					
2.00-3.00	B 7				2.50m: PID reading, 0ppm.	(2.45)
3.00-3.50	B 8				3.20m: PID reading, 3ppm.	
3.65-4.00	ES 9					3.65
	B 10				Dark grey black very sandy sub-angular fine to coarse GRAVEL of mudstone. Very strong hydrocarbon odour. 3.80m: PID reading, 570ppm.	*3.09* (0.35)
			19/06/2015	1500	End of Borehole at 4.00 m	4.00 *2.74*
Depth	TCR SCR RQD / If	Records/Samples	Date Casing	Time Water		

Legend / **Backfill/ Instruments**



Groundwater Entries

No.	Struck (m)	Post Strike Behaviour	Depth Sealed (m)
-	3.65	Damp	-

Depth Related Marks *

From	To (m)

Chiselling

Depths (m)	Time	Tools Used

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale: 1:26 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.

Project No. 10318

Carried out for Tidal Lagoon Swansea Bay Plc.

Borehole **BH9**

Sheet 1 of 1

Borehole Log

APEX DRILLING SERVICES

Drilled	AR	**Start** 19/06/2015	**Equipment, Methods and Remarks** Dando Terrier Hand excavated pit G.L. - 0.05m. Pit terminated due to presence of services.	**Depth From**	**Diameter**	**Casing Depth**	**Ground Level** 6.770
Logged	DM	**End** 19/06/2015					**Coordinates** 268843E 192689N
Checked	RB						**National Grid** 268843E - 192689N
							Chainage

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
			19/06/2015	1500
			19/06/2015	1530

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
MADE GROUND: Grey over grey brown very sandy angular fine to coarse GRAVEL of limestone and sandstone. 0.04m - 0.05m: Bundle of 6No. Orientation 40°/220°, approximately 12mm diameter. Moved to BH010.	0.05 (0.05) *6.72*		
End of Borehole at 0.05 m			

Depth	TCR SCR RQD	If	Records/Samples	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour	Depth Sealed (m)
No Groundwater Encountered			

Depth Related Marks *

From	To (m)

Chiselling

Depths (m)	Time	Tools Used

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale: 1:26 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.

Project No. 10318

Carried out for Tidal Lagoon Swansea Bay Plc.

Borehole **BH10**

Borehole Log

APEX DRILLING SERVICES

Drilled	AR	**Start** 19/06/2015	**Equipment, Methods and Remarks** Dando Terrier Hand excavated pit G.L. - 1.20m. Windowless sampling 1.20 - 4.00m. Terminated due to collapsing strata.	**Depth From**	**Diameter**	**Casing Depth**	**Ground Level** 6.770
Logged	DM	**End** 19/06/2015		4.00m	100mm		**Coordinates** 268843E 192689N
Checked	RB						**National Grid** 268843E - 192689N
							Chainage

Samples and Tests

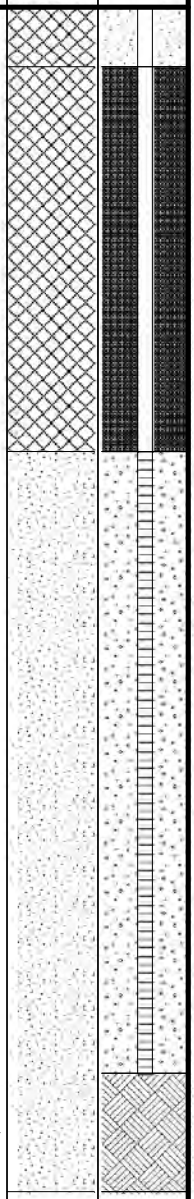
Depth	Type & No	Records	Date Casing	Time Water
0.00-0.10	ES 1		19/06/2015	1600
0.20-1.00	ES 2 B 3			
1.20-1.60	ES 4 B 5			
1.60-1.70	ES 6			
2.00-2.50 2.00-3.00	ES 7 B 8			
3.00-3.80	B 9 ES 10			

Depth	TCR SCR ROD	If	Records/Samples	Date Casing	Time Water

Strata

Description	Depth, Level (Thickness)
MADE GROUND: Grey over grey brown very sandy angular fine to coarse GRAVEL of limestone and sandstone. 0.10m: PID reading, 0ppm. 0.15m - 0.20m: Light brown fine to coarse SAND.	(0.20) 0.20 *6.57*
MADE GROUND: Brown, orange and grey slightly silty fine to coarse SAND and sub-angular to rounded fine to coarse GRAVEL of sandstone. 0.50m: PID reading, 0ppm.	(1.30)
Light brown fine to coarse SAND. 1.65m: PID reading, 0ppm.	1.50 *5.27*
2.50m: PID reading, 0ppm.	(2.50)
3.80m - 4.00m: No recovery (AZCL).	
19/06/2015 1700 End of Borehole at 4.00 m	4.00 *2.77*

Legend / Backfill/ Instruments



Groundwater Entries

No.	Struck (m)	Post Strike Behaviour	Depth Sealed (m)
-	3.80		-

Depth Related Marks *

From	To (m)

Chiselling

Depths (m)	Time	Tools Used

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale: 1:26 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.

Project No. 10318

Carried out for Tidal Lagoon Swansea Bay Plc.

Borehole **BH10A**

Sheet 1 of 1

Borehole Log

APEX DRILLING SERVICES

Drilled	AR	**Start** 26/06/2015	**Equipment, Methods and Remarks** Dando Terrier Hand excavated pit G.L. - 1.20m. Windowless sampling 1.20 - 4.00m. Terminated due to collapsing strata.	**Depth From**	**Diameter**	**Casing Depth**	**Ground Level** 7.400
Logged	AB	**End** 26/06/2015		4.00m	100mm		**Coordinates** 268552E 192945N
Checked	RB						**National Grid** 268552E - 192945N
							Chainage

Samples and Tests

Strata

Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.20	ES 1 D 2		26/06/2015	0900	MADE GROUND: Grass over brown slightly silty slightly gravelly fine to medium grained SAND. Gravel is sub-angular of sandstone and siltstone.	(0.20)		
0.20-1.30	B 3 ES 4 D 5				MADE GROUND: Black slightly gravelly fine to coarse grained SAND. Gravel is sub-angular to sub-rounded fine to coarse of sandstone and clinker.	0.20 *7.20*		
						(1.10)		
1.30-2.30	B 6 ES 7 D 8				MADE GROUND: Black and dark brown fine to coarse grained SAND and angular to sub-rounded fine to coarse ashy GRAVEL of slag and clinker with low cobble content. Cobbles are angular of slag,	1.30 *6.10*		
						(2.70)		
			26/06/2015	1100	End of Borehole at 4.00 m	4.00 *3.40*		

Depth	TCR SCR RQD	If	Records/Samples	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour	Depth Sealed (m)
-	2.50		-

Depth Related Marks *

From	To (m)

Chiselling

Depths (m)	Time	Tools Used

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale: 1:26 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Borehole **BHA1**

Sheet 1 of 1

Borehole Log

APEX DRILLING SERVICES

Drilled	AR	**Start** 26/06/2015	**Equipment, Methods and Remarks** Dando Terrier Hand excavated pit G.L. - 1.20m. Windowless sampling 1.20 - 3.00m. Terminated due to collapsing strata.	**Depth From** 3.00m	**Diameter** 100mm	**Casing Depth**	**Ground Level** 7.360
Logged	AB	**End** 26/06/2015					**Coordinates** 268590E 192909N
Checked	RB						**National Grid** 268590E - 192909N
							Chainage

Samples and Tests

Strata

Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.90	B 1 D 2 ES 3		26/06/2015	1100	MADE GROUND: Black slightly gravelly fine to coarse grained SAND. Gravel is sub-angular to sub-rounded fine to coarse of sandstone and clinker.	(0.90)		
0.90-1.30	B 4 D 5 ES 6				MADE GROUND: Greyish brown slightly gravelly to gravelly fine to coarse grained SAND. Gravel is sub-angular to rounded fine to medium of sandstone and siltstone.	0.90 *6.46* (0.40)		
1.30-2.30	B 7 D 8 ES 9				MADE GROUND: Black and dark brown fine to coarse grained SAND and angular to sub-rounded fine to coarse ashy GRAVEL of clinker and slag with low cobble content. Cobbles are angular of slag.	1.30 *6.06* (1.70)		
			26/06/2015	1300	End of Borehole at 3.00 m	3.00 *4.36*		

Depth	TCR SCR RQD	If	Records/Samples	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour	Depth Sealed (m)
-	2.45		-

Depth Related Marks *

From	To (m)

Chiselling

Depths (m)	Time	Tools Used

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale: 1:26 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.

Project No. 10318

Carried out for Tidal Lagoon Swansea Bay Plc.

Borehole **BHA2**

Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 17/06/2015 **End** 17/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 1.80m. Pit terminated due to presence of service. UXO clearance 1hr.	**Dimensions and Orientation** Width 0.50m Length 3.20m A / D / B / C 88(Deg)	**Ground Level** 9.240 **Coordinates** 268005E 193018N **National Grid** 268005E - 193018N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		17/06/2015 1000	MADE GROUND: Brown slightly sandy angular to sub-rounded coarse GRAVEL of slag, clinker and limestone with high cobble content. Cobbles are angular to sub-angular of slag.	(0.30)		
0.20	D 1 ES 2		MADE GROUND: Dark brown slightly silty sandy angular to sub-angular fine to coarse ashy GRAVEL of clinker and slag with high cobble content. Cobbles are angular to sub-angular tabular of slag.	0.30 *8.94* (0.20)		
			MADE GROUND: Dark brown silty gravelly fine to coarse grained SAND with low cobble content. Gravel is sub-angular to sub-rounded fine to coarse of slag and limestone. Cobbles are angular to sub-angular of limestone and slag. 0.50m: High boulder content, sub-angular to sub-rounded (300-400mm) of slag, clinker and bricks.	0.50 *8.74*		
1.00	B 3 D 4 ES 5			(1.00)		
			1.40m: Steel railway peg and whole bricks.			
			MADE GROUND: Light grey slightly sandy angular to sub-rounded medium to coarse GRAVEL of limestone and siltstone (possible sub-base). Suspected sewage pipe encountered on south face at 1.80m. 1.50m: PID reading, 0.2ppm.	1.50 *7.74* (0.30)		
		17/06/2015 1200	Exploratory Hole Ends at 1.80 m	1.80 *7.44*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)	
0.50	0.50	Slow progress, 0.5hr.

Stability	Collapsing from 1.50m
Shoring	None
Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit
TP3
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 17/06/2015 **End** 17/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 1.90m. Pit terminated due to presence of service.	**Dimensions and Orientation** Width 0.50m Length 3.20m A / D / B / C 88(Deg)	**Ground Level** 9.240 **Coordinates** 268005E 193018N **National Grid** 268005E - 193018N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
			MADE GROUND: Brown slightly sandy angular to sub-rounded coarse GRAVEL of slag, clinker and limestone with high cobble content. Cobbles are angular to sub-angular of slag.	(0.30)		
			MADE GROUND: Dark brown slightly silty sandy angular to sub-angular fine to coarse ashy GRAVEL of clinker and slag with high cobble content. Cobbles are angular to sub-angular tabular of slag.	0.30 *8.94* (0.20)		
			MADE GROUND: Dark brown silty gravelly fine to coarse grained SAND with low cobble content. Gravel is sub-angular to sub-rounded fine to coarse of slag and limestone. Cobbles are angular to sub-angular of limestone and slag.	0.50 *8.74* (1.00)		
			MADE GROUND: Light grey slightly sandy angular to sub-rounded medium to coarse GRAVEL of limestone and siltstone (possible sub-base). Suspected sewage pipe encountered on north face at 1.90m, east-west orientation. Approximately 750mm diameter.	1.50 *7.74* (0.40)		
			Exploratory Hole Ends at 1.90 m	1.90 *7.34*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Collapsing from 1.60m
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP3B**
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 17/06/2015 **End** 17/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 1.70m. Pit terminated due to presence of service.	**Dimensions and Orientation** Width 0.50m Length 3.20m A / D / B / C 88(Deg)	**Ground Level** 9.210 **Coordinates** 268001E 193019N **National Grid** 268001E - 193019N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
			MADE GROUND: Brown slightly sandy angular to sub-rounded coarse GRAVEL of slag, clinker and limestone with high cobble content. Cobbles are angular to sub-angular of slag.	(0.30)		
			MADE GROUND: Dark brown slightly silty sandy angular to sub-angular fine to coarse ashy GRAVEL of clinker and slag with high cobble content. Cobbles are angular to sub-angular tabular of slag.	0.30 *8.91* (0.20)		
			MADE GROUND: Dark brown silty gravelly fine to coarse grained SAND with low cobble content. Gravel is sub-angular to sub-rounded fine to coarse of slag and limestone. Cobbles are angular to sub-angular of limestone and slag.	0.50 *8.71* (1.00)		
			MADE GROUND: Light grey slightly sandy angular to sub-rounded medium to coarse GRAVEL of limestone and siltstone (possible sub-base). Suspected sewage pipe with rubber / bitumen covering encountered on south face at 1.70m, east-west orientation. 1.50m: Railway sleeper.	1.50 *7.71* (0.20)		
			Exploratory Hole Ends at 1.70 m	1.70 *7.51*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Collapsing from 1.60m
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP3C**
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 17/06/2015 **End** 17/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 3.50m. Pit terminated due to collapsing strata. UXO clearance 1hr.	**Dimensions and Orientation** Width 0.50m Length 3.80m A / D / B / C 86(Deg)	**Ground Level** 8.850 **Coordinates** 268111E 193003N **National Grid** 268111E - 193003N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		17/06/2015 1400	MADE GROUND: Brown slightly sandy angular to sub-rounded coarse GRAVEL of granite, slag and clinker with high cobble content. Cobbles are angular to sub-angular of slag, brick and granite.	(0.20)		
0.20	D 1 ES 2		MADE GROUND: Dark brown slightly sandy angular to sub-angular fine to coarse ashy GRAVEL of clinker, slag and brick.	0.20 *8.65*		
				(0.70)		
1.00	B 3 D 4 ES 5		MADE GROUND: Light brown gravelly coarse SAND with high cobble content. Gravel is angular to sub-angular fine to coarse of slag and brick. Cobbles are sub-angular of slag and brick. 1.00m: PID reading, 0ppm. 1.00m - 1.10m: Metal pole.	0.90 *7.95*		
				(0.50)		
			MADE GROUND: Black angular to sub-angular mainly fine, locally coarse ashy GRAVEL of slag, clinker and brick with low boulder content. Boulders are angular to sub-angular of slag and fused clinker.	1.40 *7.45*		
2.00	B 6 D 7 ES 8		2.00m: PID reading, 0ppm.			
				(2.10)		
3.00	B 9 D 10 ES 11		3.00m: PID reading, 0ppm.			
		17/06/2015 1606	Exploratory Hole Ends at 3.50 m	3.50 *5.35*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)	
0.90	1.40	Slow progress, 0.5hr.

Stability Collapsing from 3.00m
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP5**
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 18/06/2015 **End** 18/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 3.50m. Pit terminated due to collapsing strata. UXO clearance 1hr.	**Dimensions and Orientation** Width 0.50m Length 3.20m A / D / B / C, 90(Deg)	**Ground Level** 8.870 **Coordinates** 268262E 193011N **National Grid** 268262E - 193011N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		18/06/2015 1815	MADE GROUND: Reddish grey gravelly sub-angular COBBLES of granite. Gravel is sub-angular fine to coarse of granite, slag and clinker.	(0.40)		
0.40	D 1 ES 2		MADE GROUND: Brown slightly sandy angular to sub-rounded coarse GRAVEL of granite, slag, clinker and brick with high cobble content. Cobbles are angular of brick and slag. Numerous rootlets.	0.40 *8.47*		
			0.80m: Black angular BOULDERS (300-500mm) of slag.	(0.50)		
1.00	B 3 D 4 ES 5		MADE GROUND: Light brown slightly silty gravelly coarse grained SAND with high cobble content. Gravel is sub-angular fine to coarse of slag and clinker. Cobbles are angular to sub-angular of foundry relics. 1.00m: PID reading, 0ppm.	0.90 *7.97*		
				(0.70)		
			MADE GROUND: Orange to brown slightly sandy sub-angular generally fine locally coarse ashy GRAVEL of clinker and slag with low cobble content. Cobbles are angular of slag.	1.60 *7.27*		
2.00	B 6 D 7 ES 8		2.00m: PID reading, 0ppm.			
				(1.90)		
			2.90m - 3.00m: Damp			
3.00	B 9 D 10 ES 11		3.00m: PID reading, 0ppm.			
3.50	B 12	~~18/06/2015 1906~~	Exploratory Hole Ends at 3.50 m	3.50 *5.37*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)	
0.00	0.40	Slow progress, 0.5hr.
0.80	0.90	Slow progress, 0.5hr.

Stability	Collapsing from 3.00m
Shoring	None
Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit

TP6

Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 18/06/2015 **End** 18/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 3.70m. Pit terminated at maximum reach of the excavator. UXO clearance 1hr.	**Dimensions and Orientation** Width 0.50m Length 3.00m A / D / B / C 90(Deg)	**Ground Level** 9.000 **Coordinates** 268353E 193009N **National Grid** 268353E - 193009N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		18/06/2015 1000	MADE GROUND: Reddish grey gravelly sub-angular to sub-rounded COBBLES of granite. Gravel is sub-angular fine to coarse of granite, clinker and slag.			
0.20	D 1 ES 2			(0.40)		
			MADE GROUND: Brown slightly sandy angular to sub-rounded fine to coarse GRAVEL of granite, slag and clinker. Numerous rootlets.	0.40 *8.60*		
				(0.50)		
			0.80m - 0.90m: Black angular BOULDERS of slag and clinker.	0.90		
1.00	B 3 D 4 ES 5		MADE GROUND: Light brown gravelly coarse grained SAND. Gravel is sub-angular fine to coarse of slag, brick and clinker. 1.00m: PID reading, 0ppm. Pockets of soft to firm brownish grey CLAY.	*8.10* (0.50)		
			MADE GROUND: Black sub-angular to angular generally fine locally coarse ashy GRAVEL of slag, clinker and brick with low to medium boulder content. Boulders are angular to sub-angular of foundry debris.	1.40 *7.60*		
2.00	B 6 D 7 ES 8		2.00m: PID reading, 0ppm.			
				(2.30)		
3.00	B 9 D 10 ES 11		3.00m: PID reading, 0ppm.			
3.70	B 12 D 13 ES 14	~~18/06/2015 1400~~	Exploratory Hole Ends at 3.70 m	3.70 *5.30*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
-	3.70	Very slow inflow

Depth Related Marks *

From	To (m)	
0.00	0.40	Slow progress, 0.5hr.
0.80	0.90	Slow progress, 0.5hr.

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP7**
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 18/06/2015 **End** 18/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 3.60m. Pit terminated due to collapsing strata. UXO clearance 1hr.	**Dimensions and Orientation** Width 0.50m Length 3.20m A / D / B / C 90(Deg)	**Ground Level** 8.820 **Coordinates** 268456E 193010N **National Grid** 268456E - 193010N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		18/06/2015 1400	MADE GROUND: Reddish grey gravelly sub-angular to sub-rounded COBBLES of granite. Gravel is angular to sub-angular fine to coarse of granite, slag and clinker.	(0.20)		
0.20	D 1 ES 2		MADE GROUND: Brown slightly sandy angular to sub-rounded coarse GRAVEL of granite, slag, clinker and brick with high cobble content. Cobbles are angular of brick and slag. Numerous rootlets.	0.20 *8.62*		
			0.50m: Angular BOULDERS of slag (up to 1m long).	(0.60)		
			MADE GROUND: Orange to brown slightly sandy sub-angular generally fine locally coarse ashy GRAVEL of clinker, slag and brick.	0.80 *8.02*		
1.00	B 3 D 4 ES 5		1.00m: PID reading, 0.1ppm.			
				(2.20)		
2.00	B 6 D 7 ES 8		2.00m: PID reading, 0.2ppm.			
3.00	B 9 D 10 ES 11		MADE GROUND: Orange to reddish brown angular to sub-angular coarse GRAVEL of slag and clinker with high cobble content. Cobbles are angular of foundry relics. 3.00m: PID reading, 0.1ppm.	3.00 *5.82*		
				(0.60)		
3.60	B 12 D 13 ES 14	18/06/2015 1806	Exploratory Hole Ends at 3.60 m	3.60 *5.22*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
-	3.60	Slow inflow

Depth Related Marks *

From	To (m)	
0.00	0.20	Slow progress, 0.5hr.
0.50	0.50	Slow progress, 0.5hr.

Stability Collapsing from 0.50m
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP8**
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 19/06/2015 **End** 19/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 2.80m. Pit terminated due to collapsing strata. UXO clearance 1hr.	**Dimensions and Orientation** Width 0.50m Length 3.50m A / D / B / C 88(Deg)	**Ground Level** 7.330 **Coordinates** 268540E 192961N **National Grid** 268540E - 192961N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		19/06/2015 0800	MADE GROUND: Light brown silty sandy angular to sub-angular fine to coarse GRAVEL of brick, slag and siltstone with high cobble content. Cobbles are angular to sub-angular of various lithologies. Abumdant rootlets, wood fragments and organic matter.	(0.40)		
0.40	D 1 ES 2		MADE GROUND: Dark brown slightly silty sandy angular to sub-angular fine to coarse ashy GRAVEL of clinker, slag and brick with low boulder content. Boulders (500mm) are angular of reinforced concrete.	0.40 *6.93* (0.50)		
1.00	B 3 D 4 ES 5		MADE GROUND: Light brown very gravelly coarse grained SAND with low boulder content. Gravel is sub-angular fine to coarse of slag and siltstone. Boulders (up to 400mm) are angular of various lithologies. 1.00m: PID reading, 0.2ppm. 1.30m - 1.40m: Soft to firm brownish grey silty CLAY with thinly laminated fine grained sand.	0.90 *6.43* (0.50)		
			MADE GROUND: Dark brown slightly silty sandy angular to sub-angular fine to coarse ashy GRAVEL of clinker, slag, brick and various other lithologies.	1.40 *5.93* (0.30)		
2.00	B 6 D 7 ES 8		MADE GROUND: Soft grading to stiff brownish grey silty CLAY with extremely closely spaced thin laminae of orange yellow fine sand and grey ash in upper bed. Mottled orange yellow with fine black angular fragments (suspected flint) in lower bed. 2.00m: PID reading, 0.2ppm.	1.70 *5.63* (1.00)		
2.80	B 9 D 10 ES 11	~~19/06/2015 1106~~	MADE GROUND: Yellow, brown, locally black gravelly fine to medium grained SAND. Gravel is angular to sub-rounded fine to coarse of shell fragments, flint and quartz.	2.70 *4.63* (0.10) 2.80 *4.53*		
			Exploratory Hole Ends at 2.80 m			

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
1	2.40	Slow to medium inflow

Depth Related Marks *

From	To (m)	
0.40	0.90	Slow progress, 0.5hr.
0.90	1.40	Slow progress, 0.5hr.

Stability Collapsing from 2.40m
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP10**
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 19/06/2015 **End** 19/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 3.00m. Pit terminated due to collapsing strata. UXO clearance 1hr.	**Dimensions and Orientation** Width 0.50m Length 3.50m A / D / B / C 88(Deg)	**Ground Level** 7.300 **Coordinates** 268572E 192922N **National Grid** 268572E - 192922N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		19/06/2015 1100	MADE GROUND: Dark brown slightly silty sandy angular to sub-angular fine to coarse ashy GRAVEL of clinker, slag, glass and various lithologies with high cobble content and high boulder content. Cobbles are angular to sub-rounded of clinker, slag and sandstone. Boulders are angular of slag, bricks and sandstone. Numerous metal bars.			
0.20	D 1 ES 2					
				(1.80)		
1.00	B 3 D 4 ES 5		1.00m: PID reading, 1.1ppm.			
			MADE GROUND: Blackish brown angular tabular BOULDERS of slag and clinker.	1.80 *5.50* (0.20)		
2.00	B 6 D 7 ES 8		MADE GROUND: Black angular coarse ashy GRAVEL of clinker and slag. 2.00m: PID reading, 0.4ppm.	2.00 *5.30* (0.20)		
			MADE GROUND: Orange angular coarse GRAVEL of clinker.	2.20 *5.10*		
			2.40m: Orange brown coloured groundwater.			
				(0.80)		
3.00	B 9 D 10 ES 11	19/06/2015 1406	2.95m - 3.00m: PID reading, 0.7ppm.	3.00 *4.30*		
			Exploratory Hole Ends at 3.00 m			

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
1	2.40	Medium inflow

Depth Related Marks *

From	To (m)	
0.00	1.80	Slow progress, 0.5hr.
1.80	2.00	Slow progress, 0.5hr.

Stability Collapsing from 2.40m
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit TP11
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 19/06/2015 **End** 19/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 3.00m. Pit terminated due to collapsing strata. UXO clearance 1hr.	**Dimensions and Orientation** Width 0.50m Length 4.00m A / D / B / C 88(Deg)	**Ground Level** 7.270 **Coordinates** 268613E 192894N **National Grid** 268613E - 192894N **Chainage**	

Samples and Tests

Depth	Type & No	Date Records
0.20	D 1 ES 2	19/06/2015 1400
1.00	B 3 D 4 ES 5	
2.00	B 6 D 7 ES 8	
3.00	B 9 D 10 ES 11	19/06/2015 1700

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
MADE GROUND: Light brown silty sandy angular to sub-angular fine to coarse GRAVEL of brick, slag and siltstone with high cobble content. Cobbles are angular to sub-angular of various lithologies. Abundant rootlets, wood fragments and organic matter.	(0.40)		
MADE GROUND: Dark brown slightly silty sandy angular to sub-angular fine to coarse GRAVEL of clinker, slag and brick with low boulder content. Boulders are angular of relic foundry materials.	0.40 *6.87* (0.70)		
1.00m: PID reading, 0.5ppm.			
MADE GROUND: Blackish brown angular tabular BOULDERS of slag and clinker.	1.10 *6.17* (0.20)		
MADE GROUND: Dark brown slightly silty sandy angular to sub-angular fine to coarse ashy GRAVEL of clinker, slag and brick with low boulder content. Boulders are angular relic foundry materials.	1.30 *5.97* (1.70)		
Exploratory Hole Ends at 3.00 m	3.00 *4.27*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
1	2.50	Slow inflow

Depth Related Marks *

From	To (m)	
1.10	1.30	Slow progress, 0.5hr.

Stability Collapsing from 2.50m
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit TP12
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 22/06/2015 **End** 22/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 1.50m. Pit terminated due to collapsing strata. UXO clearance 0.5hr.	**Dimensions and Orientation** Width 0.50m Length 3.70m A / D / B / C 90(Deg)	**Ground Level** 7.020 **Coordinates** 269011E 192888N **National Grid** 269011E - 192888N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		22/06/2015 0900	MADE GROUND: Light brown gravelly coarse grained SAND with high cobble content and low to medium boulder content. Gravel is angular to sub-angular fine to coarse of slag, clinker and shell fragments. Cobbles are sub-angular of slag and clinker. Boulders are angular to sub-rounded of slag and clinker. Abundant rootlets.			
0.20	D 1 ES 2					
				(1.50)		
1.00	B 3 D 4 ES 5		1.10m - 1.50m: Pockets of black angular to sub-angular fine to coarse lustrous ashy GRAVEL.			
		22/06/2015 1030	1.49m - 1.50m: PID reading, 0ppm.	1.50		
			Exploratory Hole Ends at 1.50 m	*5.52*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability	Collapsing at 1.50m
Shoring	None
Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP16**

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Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 22/06/2015 **End** 22/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 1.10m. Pit terminated due to collapsing strata and presence of services. UXO clearance 0.25hr.	**Dimensions and Orientation** Width 0.70m Length 3.80m A / D / B / C 54(Deg)	**Ground Level** 6.900 **Coordinates** 269068E 192895N **National Grid** 269068E - 192895N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		22/06/2015 1040	MADE GROUND: Brown very sandy silty angular to sub-angular fine to coarse GRAVEL of slag and siltstone with high cobble content and low cobble content. Cobbles are angular of slag. Boulders (700mm) are angular of slag.	(0.20)		
0.20	D 1 ES 2		MADE GROUND: Light brown gravelly coarse SAND with high cobble content. Gravel is angular to sub-angular fine to coarse of slag. Cobbles are sub-angular of cobbles.	0.20 *6.70*		
				(0.90)		
1.00	B 3 D 4 ES 5	22/06/2015 1200	Exploratory Hole Ends at 1.10 m	1.10 *5.80*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)	
0.00	0.20	Slow progress, 0.5hr.

Stability Collapsing from 1.00m
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP17**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 22/06/2015 **End** 22/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 1.40m. Pit terminated due to collapsing strata.	**Dimensions and Orientation** Width 0.70m Length 3.80m A / D / B / C 54(Deg)	**Ground Level** 6.900 **Coordinates** 269068E 192895N **National Grid** 269068E - 192895N **Chainage**	

Samples and Tests			Strata			
Depth	**Type & No**	**Date Records**	**Description**	**Depth, Level (Thickness)**	**Legend**	**Backfill/ Instruments**
		22/06/2015 1040	MADE GROUND: Brown very sandy silty angular to sub-angular fine to coarse GRAVEL of slag and siltstone with high cobble content and low cobble content. Cobbles are angular of slag. Boulders (700mm) are angular of slag.	(0.20) 0.20 *6.70*		
			MADE GROUND: Light brown gravelly coarse SAND with high cobble content. Gravel is angular to sub-angular fine to coarse of slag. Cobbles are sub-angular of cobbles.	(1.00)		
			MADE GROUND: Light grey slightly sandy angular to sub-angular medium to coarse GRAVEL of limestone and siltstone.	1.20 *5.70* (0.20)		
1.40	ES 1 D 2 B 3	22/06/2015 1200	Exploratory Hole Ends at 1.40 m	1.40 *5.50*		

Groundwater Entries			Depth Related Marks *		Stability	Collapsing from 1.00m
No.	**Struck (m)**	**Post Strike Behaviour**	**From**	**To (m)**	**Shoring**	None
No Groundwater Encountered					**Weather**	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column. Scale: 1:25 www.apexdrilling.co.uk	**Project**	Swansea Bay Tidal Lagoon C133 Onshore G.I.	**Trial Pit** **TP17A**
	Project No.	10318	Sheet 1 of 1
	Carried out for	Tidal Lagoon Swansea Bay Plc.	

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 22/06/2015 **End** 22/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.50m. Pit terminated due to hard excavation. UXO clearance 0.33hr.	**Dimensions and Orientation** Width 0.50m Length 3.70m A / D / B / C 70(Deg)	**Ground Level** 7.550 **Coordinates** 269141E 192932N **National Grid** 269141E - 192932N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		22/06/2015 1240	MADE GROUND: Brown very sandy silty angular to sub-angular fine to coarse GRAVEL of slag and siltstone with high cobble content and low boulder content. Cobbles are sub-angular to sub-rounded of slag, brick and limestone. Boulders are angular of slag, clinker and tarmac. Pit terminated due to tarmac / concrete layer.	(0.50)		
		22/06/2015 1340	Exploratory Hole Ends at 0.50 m	0.50 *7.05*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP19**
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 22/06/2015 **End** 22/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 2.10m. Pit terminated due to collapsing strata. UXO clearance 0.25hr.	**Dimensions and Orientation** Width 0.50m Length 3.80m A / D / B / C 30(Deg)	**Ground Level** 6.670 **Coordinates** 269034E 192863N **National Grid** 269034E - 192863N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		22/06/2015 1345	MADE GROUND: Light brown gravelly coarse grained SAND with high cobble content. Gravel is black angular to sub-angular fine to coarse lustrous slag and clinker. Cobbles are sub-angular to sub-rounded of slag, brick and siltstone.			
0.20	D 1 ES 2					
1.00	B 3 D 4 ES 5		1.00m: PID reading, 1.2ppm.	(2.10)		
2.00	B 6 D 7 ES 8	22/06/2015 1445	2.00m: PID reading, 1.3ppm.			
			Exploratory Hole Ends at 2.10 m	2.10 *4.57*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Collapsing at 2.10m
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP20**
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 22/06/2015 **End** 22/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 2.50m. Pit terminated due to probable service. UXO clearance 0.25hr.	**Dimensions and Orientation** Width 0.50m Length 3.70m A / D / B / C, 45(Deg)	**Ground Level** 6.820 **Coordinates** 268988E 192819N **National Grid** 268988E - 192819N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		22/06/2015 1450	MADE GROUND: Light brown gravelly coarse grained ashy SAND with high cobble content and medium boulder content. Gravel is sub-angular fine to coarse of lustrous clinker and slag. Cobbles are angular to sub-rounded of slag. Boulders are angular of slag. Abundant shell fragments and rootlets.			
0.20	D 1 ES 2					
1.00	B 3 D 4 ES 5		1.00m: PID reading, 0.5ppm.	(2.20)		
			1.70m - 1.80m: MADE GROUND: Soft to firm brownish red mottled orange slightly gravelly silty CLAY.			
2.00	B 6 D 7 ES 8		2.00m: PID reading, 2.4ppm.			
			MADE GROUND: Light grey slightly sandy medium to coarse 'clean' GRAVEL of siltstone and limestone with green plastic mesh tape at the base (service marker gravel).	2.20 *4.62* (0.30)		
		22/06/2015 1545	Exploratory Hole Ends at 2.50 m	2.50 *4.32*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit TP21
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Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 23/06/2015 **End** 23/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 3.20m. Pit terminated due to collapsing strata. UXO clearance 0.5hr.	**Dimensions and Orientation** Width 0.50m Length 3.80m A / D / B / C 40(Deg)	**Ground Level** 6.590 **Coordinates** 268953E 192788N **National Grid** 268953E - 192788N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		23/06/2015 0830	MADE GROUND: Light brown gravelly coarse grained SAND with high cobble content. Gravel is angular to sub-angular fine to coarse of slag, siltstone, mudstone and brick fragments. Cobbles are angular to sub-rounded of slag, siltsone and brick.			
0.20	D 1 ES 2					
1.00	B 3 D 4 ES 5		1.00m: PID reading, 2.5ppm.	(2.10)		
2.00	B 6 D 7 ES 8		2.00m: PID reading, 1.5ppm.			
			MADE GROUND: Brownish orange medium to coarse grained SAND with fine black angular fragments (possible flint or coal).	2.10 *4.49* (0.10)		
			Very soft friable dark grey mottled black slightly gravelly silty CLAY. Gravel is sub-angular fine of coal.	2.20 *4.39*		
			2.20m - 3.20m: Oily sheen and strong hydrocarbon odour. 2.50m: PID reading, 45ppm.	(1.00)		
3.00	B 9 D 10 ES 11		3.00m: PID reading, 300ppm.			
		23/06/2015 1030	Exploratory Hole Ends at 3.20 m	3.20 *3.39*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Collapsing from 1.00m
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP22**
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 23/06/2015 **End** 23/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 2.80m. Pit terminated due to collapsing strata. UXO clearance 0.25hr.	**Dimensions and Orientation** Width 0.50m Length 3.90m A / D / B / C 42(Deg)	**Ground Level** 6.740 **Coordinates** 268906E 192736N **National Grid** 268906E - 192736N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		23/06/2015 1030	MADE GROUND: Light brown slightly gravelly coarse grained SAND with low boulder content. Gravel is angular to sub-angular of slag. Boulders are angular of slag.			
0.30	D 1 ES 2					
1.00	B 3 D 4 ES 5		1.00m: PID reading, 0ppm.	(2.50)		
			1.60m - 2.00m: MADE GROUND: Pockets of very soft dark grey slightly silty slightly gravelly CLAY. Gravel is sub-angular of coal. Slight hydrocarbon odour.			
2.00	B 6 D 7 ES 8					
			MADE GROUND: Dark reddish grey angular to sub-angular coarse GRAVEL of mudstone with closely spaced laminations.	2.50 *4.24* (0.20)		
			MADE GROUND: Soft orange brown silty CLAY.	2.70 *4.04* (0.10)		
		23/06/2015 1145	Exploratory Hole Ends at 2.80 m	2.80 *3.94*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Collapsing from 1.00m
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP23**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 23/06/2015 **End** 23/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 2.00m. Pit terminated due to collapsing strata. UXO clearance 0.25hr.	**Dimensions and Orientation** Width 0.50m Length 3.80m A / D / B / C 43(Deg)	**Ground Level** 6.660 **Coordinates** 268802E 192648N **National Grid** 268802E - 192648N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.20	D 1 ES 2		MADE GROUND: Light brown slightly gravelly coarse grained SAND with medium cobble content. Gravel is angular to sub-angular fine to coarse of slag. Cobbles are sub-angular of slag.	(1.10)		
1.00	B 3 D 4 ES 5		1.00m: PID reading, 0.5ppm.	1.10 *5.56*		
			MADE GROUND: Brownish orange medium grained SAND.	(0.90)		
2.00	B 6 D 7 ES 8		1.99m - 2.00m: PID reading, 1.3ppm.	2.00 *4.66*		
			Exploratory Hole Ends at 2.00 m			

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Collapsing from 1.10m
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP24**
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 23/06/2015 **End** 23/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 2.00m. Pit terminated due to collapsing strata. UXO clearance 0.25hr.	**Dimensions and Orientation** Width 0.50m Length 3.80m A / D / B / C 45(Deg)	**Ground Level** 6.450 **Coordinates** 268687E 192537N **National Grid** 268687E - 192537N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		23/06/2015 1245	MADE GROUND: Grey slightly gravelly fine grained SAND with high cobble content and low boulder content. Gravel is angular to sub-angular fine to coarse of limestone, slag and siltstone. Cobbles are angular of slag, limestone and siltstone. Boulders are angular of siltstone and slag.			
0.20	D 1 ES 2			(1.00)		
1.00	B 3 D 4 ES 5		MADE GROUND: Light brown coarse grained SAND. 1.00m: PID reading, 0.7ppm.	1.00 *5.45*		
				(1.00)		
2.00	B 6 D 7 ES 8	23/06/2015 1325	1.99m - 2.00m: PID reading, 0.6ppm. Exploratory Hole Ends at 2.00 m	2.00 *4.45*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Collapsing from 1.00m
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP26**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 23/06/2015 **End** 23/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 1.50m. Pit terminated due to collapsing strata. UXO clearance 0.25hr.	**Dimensions and Orientation** Width 0.50m Length 4.50m A / D / B / C 42(Deg)	**Ground Level** 6.280 **Coordinates** 268599E 192458N **National Grid** 268599E - 192458N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.20	D 1 ES 2		MADE GROUND: Grey slightly gravelly fine grained SAND with high cobble content and low boulder content. Gravel is angular to sub-angular of limestone, slag and siltstone. Cobbles are angular of limestone, slag and siltstone. Boulders are angular of siltstone and slag.	(0.80)		
1.00	B 3 D 4 ES 5		MADE GROUND: Light brown coarse grained SAND. 1.00m: PID reading, 0ppm.	0.80 *5.48* (0.70)		
1.50	B 6 D 7 ES 8		Exploratory Hole Ends at 1.50 m	1.50 *4.78*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Collapsing from 0.80m
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP28**
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 23/06/2015 **End** 23/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 1.80m. Pit terminated due to collapsing strata. UXO clearance 0.25hr.	**Dimensions and Orientation** Width 0.50m Length 3.80m A / D / B / C 40(Deg)	**Ground Level** 6.180 **Coordinates** 268529E 192386N **National Grid** 268529E - 192386N **Chainage**	

Samples and Tests / Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		23/06/2015 1500	MADE GROUND: Grey slightly gravelly fine grained SAND with high cobble content. Gravel is angular to sub-angular fine to coarse of limestone, slag, brick and siltstone. Cobbles are angular of brick, limestone and slag (decreasing with depth).			
0.30	D 1 ES 2			(0.70)		
			MADE GROUND: Light brown coarse grained SAND.	0.70 *5.48*		
1.00	B 3 D 4 ES 5		1.00m: PID reading, 1ppm.	(1.10)		
1.80	B 6 D 7 ES 8	23/06/2015 1600	1.79m - 1.80m: PID reading, 3.8ppm. Exploratory Hole Ends at 1.80 m	1.80 *4.38*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Collapsing from 0.70m
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP30**
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 24/06/2015 **End** 24/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 2.50m. Pit terminated due to collapsing strata UXO clearance 0.25hr.	**Dimensions and Orientation** Width 0.50m Length 4.00m A / D / B / C 41(Deg)	**Ground Level** 6.250 **Coordinates** 268466E 192327N **National Grid** 268466E - 192327N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		24/06/2015 0825	MADE GROUND: Brown slightly silty slightly sandy angular to sub-rounded fine to coarse GRAVEL of siltstone and slag with medium cobble content. Cobbles are sub-angular of slag and siltstone. Cobble and sand content increasing with depth.			
0.20	D 1 ES 2			(0.80)		
			MADE GROUND: Light brown becoming orange brown with depth gravelly coarse grained SAND with high cobble content and low boulder content. Gravel is sub-angular fine to coarse of mudstone and siltstone. Cobbles are angular to sub-angular of mudstone and siltstone. Boulders are angular of mudstone.	0.80 *5.45*		
1.00	B 3 D 4 ES 5		1.00m: PID reading, 1.0ppm.			
				(1.60)		
			2.00m: PID reading, 4.7ppm.			
			MADE GROUND: Grey fine to medium grained SAND with oily sheen (strong hydrocarbon odour).	2.40 *3.85* (0.10)		
2.50	B 6 D 7 ES 8	24/06/2015 0926	2.40m: PID reading, 480ppm.	2.50 *3.75*		
			Exploratory Hole Ends at 2.50 m			

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability	Collapsing from 1.00m
Shoring	None
Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit

TP32

Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 24/06/2015 **End** 24/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.20m. Pit terminated due to concrete slab. UXO clearance 0.25hr.	**Dimensions and Orientation** Width 0.50m Length 3.40m A / D / B / C 60(Deg)	**Ground Level** 6.570 **Coordinates** 268363E 192230N **National Grid** 268363E - 192230N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		24/06/2015 0925 ~~24/06/2015 1035~~	MADE GROUND: Brown slightly silty slightly sandy angular to sub-rounded fine to coarse GRAVEL of siltstone and slag with low cobble content. Cobbles are sub-angular of slag and sitstone. Concrete slab encountered at 0.20m. Exploratory Hole Ends at 0.20 m	(0.20) 0.20 *6.37*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP34**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 24/06/2015 **End** 24/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.80m. Pit terminated due to concrete slab.	**Dimensions and Orientation** Width 0.50m Length 3.40m A / D / B / C 60(Deg)	**Ground Level** 6.570 **Coordinates** 268363E 192230N **National Grid** 268363E - 192230N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		24/06/2015 0925	MADE GROUND: Brown slightly silty slightly sandy angular to sub-rounded fine to coarse GRAVEL of siltstone and slag with low cobble content. Cobbles are sub-angular of slag and sitstone. Concrete slab encountered at 0.80m.	(0.80)		
		24/06/2015 1035	Exploratory Hole Ends at 0.80 m	0.80 *5.77*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
No Groundwater Encountered		

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP34A**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 22/06/2015 **End** 22/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 1.50m. Pit terminated due to presence of service.	**Dimensions and Orientation** Width 0.50m Length 3.40m A / D / B / C 60(Deg)	**Ground Level** 6.570 **Coordinates** 268363E 192230N **National Grid** 268363E - 192230N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		22/06/2015 0925	MADE GROUND: Brown slightly silty slightly sandy angular to sub-rounded fine to coarse GRAVEL of siltstone and slag with low cobble content. Cobbles are sub-angular of slag and sitstone. Pipe (unknown diameter) encountered at 1.50m parallel to Face A.			
0.30	D 1 ES 2			(1.50)		
1.00	B 3 D 4 ES 5		1.00m: PID reading, 0.3ppm.			
1.50	B 6 D 7 ES 8	22/06/2015 1035	1.49m - 1.50m: PID reading, 0.5ppm. Exploratory Hole Ends at 1.50 m	1.50 *5.07*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit
TP34B
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Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 25/06/2015 **End** 25/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 2.50m. Pit terminated due to collapsing strata. UXO clearance 0.5hr.	**Dimensions and Orientation** Width 0.50m Length 3.40m A / D / B / C 60(Deg)	**Ground Level** 6.630 **Coordinates** 268316E 192217N **National Grid** 268316E - 192217N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		25/06/2015 0815	MADE GROUND: Dark brown slightly silty slightly sandy angular to sub-rounded fine to coarse GRAVEL of slag, siltstone, brick and clinker.	(0.30)		
0.20	D 1 ES 2		MADE GROUND: Black slightly sandy angular fine occasionally coarse GRAVEL of clinker.	0.30 *6.33* (0.30)		
			MADE GROUND:Light brown slightly gravelly coarse grained SAND with high cobble content and low bouldr content. Gravel is angular to sub-angular fine to coarse ashy of slag and clinker. Cobbles are angular to sub-rounded of clinker, slag, siltstone and sandstone. Boulders are angular of slag. Coarser material decreases with depth.	0.60 *6.03*		
1.00	B 3 D 4 ES 5		1.00m: PID reading, 0.4ppm.			
				(1.80)		
2.00	B 6 D 7 ES 8		2.00m: PID reading, 0.1ppm.			
			MADE GROUND: Grey fine grained SAND with strong hydrocarbon odour.	2.40 *4.23* (0.10)		
2.50	B 9 D 10 ES 11	25/06/2015 0945	2.49m - 2.50m: PID reading, 212ppm.	2.50 *4.13*		
			Exploratory Hole Ends at 2.50 m			

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)	
0.60	2.40	Slow progress, 0.5hr.

Stability Collapsing from 2.00m
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP35**
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 24/06/2015 **End** 24/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 2.00m. Pit terminated due to collapsing strata. UXO clearance 1hr.	**Dimensions and Orientation** Width 0.50m Length 3.80m A / D / B / C	**Ground Level** 6.450 **Coordinates** 268229E 192185N **National Grid** 268229E - 192185N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		24/06/2015 1045	MADE GROUND: Brown slightly silty slightly sandy angular to sub-rounded fine to coarse GRAVEL of sandstone, mudstone and slag with high cobble content. Cobbles are angular of to sub-rounded of mudstone and sandstone.			
0.20	D 1 ES 2		0.30m: Sub-angular boulder of slag.	(1.20)		
1.00	B 3 D 4 ES 5		1.00m: PID reading, 0.4ppm.			
			MADE GROUND: Light brown becoming orange brown with depth slightly gravelly coarse grained SAND. Gravel is sub-angular to subrounded fine to coarse of sandstone.	1.20 *5.25* (0.80)		
2.00	B 6 D 7 ES 8	24/06/2015 1145	1.99m - 2.00m: PID reading, 0.6ppm.	2.00 *4.45*		
			Exploratory Hole Ends at 2.00 m			

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Collapsing from 1.00m
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP37**
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 24/06/2015 **End** 24/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 2.00m. Pit terminated due to collapsing strata. UXO clearance 0.25hr.	**Dimensions and Orientation** Width 0.50m Length 3.70m A / D / B / C 68(Deg)	**Ground Level** 6.400 **Coordinates** 268099E 192142N **National Grid** 268099E - 192142N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		24/06/2015 1150	MADE GROUND: Brown slightly silty slightly sandy angular to sub-rounded fine to coarse GRAVEL of slag, siltstone, brick and clinker.	(0.30)		
0.30	D 1 ES 2		MADE GROUND: Black angular coarse ashy GRAVEL of clinker. Slight hydrocarbon odour.	0.30 *6.10* (0.20)		
			MADE GROUND: Black slightly sandy angular fine occasionally coarse GRAVEL of clinker and possible coal and flint. 0.50m: PID reading, 205ppm.	0.50 *5.90* (0.10)		
			MADE GROUND: Grey fine to medium grained SAND with oliy sheen. Strong hydrocarbon odour.	0.60 *5.80* (0.20) 0.80 *5.60*		
1.00	B 3 D 4 ES 5		MADE GROUND: Light greyish brown fine grained SAND. Strong hydrocarbon odour. 1.00m: PID reading, 730ppm.	(1.20)		
2.00	B 6 D 7 ES 8	24/06/2015 1245	1.99m - 2.00m: PID reading, 532ppm. Exploratory Hole Ends at 2.00 m	2.00 *4.40*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability	Collapsing from 1.00m
Shoring	None
Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit

TP39

Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 24/06/2015 **End** 24/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 1.80m. Pit terminated due to collapsing strata. UXO clearance 0.25hr.	**Dimensions and Orientation** Width 0.50m Length 4.00m A / D / B / C 78(Deg)	**Ground Level** 6.110 **Coordinates** 268036E 192104N **National Grid** 268036E - 192104N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		24/06/2015 1345	MADE GROUND: Brown slightly silty slightly sandy angular to sub-rounded fine to coarse GRAVEL of slag, siltstone, brick and clinker with medium cobble content. Cobbles are sub-angular of slag and siltstone.	(0.60)		
0.20	D 1 ES 2			0.60 *5.51*		
			MADE GROUND: Light brown slightly gravelly coarse grained SAND with medium cobble content. Gravel is angular to sub-angular fine to coarse of mudstone, sandstone and limestone. Cobbles are angular of limestone, siltstone and sandstone.			
1.00	B 3 D 4 ES 5		1.00m: PID reading, 0.4ppm.	(1.20)		
1.80	B 6 D 7 ES 8	24/06/2015 1446	1.79m - 1.80m: PID reading, 0.4ppm.	1.80 *4.31*		
			Exploratory Hole Ends at 1.80 m			

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Collapsing from 1.50m
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP40**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 24/06/2015 **End** 24/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 1.10m. Pit terminated due presence of service. UXO clearance 0.5hr.	**Dimensions and Orientation** Width 0.50m Length 3.20m A / D / B / C 68(Deg)	**Ground Level** 6.450 **Coordinates** 267934E 192080N **National Grid** 267934E - 192080N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		24/06/2015 1500	MADE GROUND: Brown slightly silty slightly sandy angular to sub-rounded fine to coarse GRAVEL of slag, siltstone, brick and clinker with medium cobble content and low boulder content. Cobbles are sub-angular of slag and siltstone. Boulders are angular of slag.	(0.30)		
0.30	D 1 ES 2		MADE GROUND: Light brown slightly gravelly coarse grained SAND with high cobble content. Gravel is angular to sub-rounded fine to coarse of mudstone, limestone and slag. Cobbles are angular to sub-rounded of slag, limestone and mudstone. Cobble content decreases with depth.	0.30 *6.15*		
			0.80m: Pockets of firm high strength grey mottled orange slightly silty CLAY.	(0.80)		
1.00	B 3 D 4 ES 5	24/06/2015 1706	1.00m: PID reading, 0.4ppm. 1.00m - 1.10m: Grey plastic pipe approximately 200mm diamater, at 68 degrees, 1.50m from road.	1.10 *5.35*		
			Exploratory Hole Ends at 1.10 m			

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)	
0.00	0.30	Slow progress, 1hr.

Stability	Stable
Shoring	None
Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP42**

Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 24/06/2015 **End** 24/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 2.00m. Pit terminated due to collapsing strata.	**Dimensions and Orientation** Width 0.50m Length 3.20m A / D / B / C 68(Deg)	**Ground Level** 6.450 **Coordinates** 267934E 192080N **National Grid** 267934E - 192080N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		24/06/2015 1500	MADE GROUND: Brown slightly silty slightly sandy angular to sub-rounded fine to coarse GRAVEL of slag, siltstone, brick and clinker with medium cobble content and low boulder content. Cobbles are sub-angular of slag and siltstone. Boulders are angular of slag.	(0.30)		
			MADE GROUND: Light brown slightly gravelly coarse grained SAND with high cobble content. Gravel is angular to sub-rounded fine to coarse of mudstone, limestone and slag. Cobbles are angular to sub-rounded of slag, limestone and mudstone. Cobble content decreases with depth.	0.30 *6.15* (1.70)		
2.00	B 1 D 2 ES 3	24/06/2015 1700	1.99m - 2.00m: PID reading, 0.6ppm.	2.00 *4.45*		
			Exploratory Hole Ends at 2.00 m			

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Collapsing from 1.00m
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
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Trial Pit **TP42A**
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Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 25/06/2015 **End** 25/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 2.00m. Pit terminated due to collapsing strata. UXO clearance 0.5hr.	**Dimensions and Orientation** Width 0.50m Length 3.40m A / D / B / C 64(Deg)	**Ground Level** 6.600 **Coordinates** 267836E 192047N **National Grid** 267836E - 192047N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		25/06/2015 0800	MADE GROUND: Dark brown slightly silty slightly sandy angular to sub-rounded fine to coarse GRAVEL of slag, siltstone, brick and clinker.	(0.20)		
0.20	D 1 ES 2		MADE GROUND: Black slightly sandy angular fine occasionally coarse GRAVEL of clinker.	0.20 *6.40*		
				(0.40)		
			MADE GROUND: Light brown slightly gravelly coarse grained SAND with high cobble content. Gravel is angular to sub-rounded fine to coarse of slag, clinker and siltstone. Cobbles are angular to sub-rounded of slag, clinker and siltstone.	0.60 *6.00*		
1.00	B 3 D 4 ES 5		1.00m: PID reading, 0.4ppm.			
				(1.40)		
2.00	B 6 D 7 ES 8	25/06/2015 0926	1.99m - 2.00m: PID reading, 0.4ppm.	2.00 *4.60*		
			Exploratory Hole Ends at 2.00 m			

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)	
0.60	2.00	Slow progress, 0.66hr.

Stability Collapsing at 2.00m
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
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Trial Pit **TP44**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 25/06/2015 **End** 25/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 2.00m. Pit terminated due to collapsing strata. UXO clearance 0.5hr.	**Dimensions and Orientation** Width 0.50m Length 3.70m A / D / B / C 68(Deg)	**Ground Level** 6.440 **Coordinates** 267750E 192018N **National Grid** 267750E - 192018N **Chainage**	

Samples and Tests / Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		25/06/2015 0920	MADE GROUND: Dark brown and black slightly silty slightly sandy angular to sub-rounded fine to coarse GRAVEL of slag, siltstone, brick and clinker.			
0.20	D 1 ES 2			(0.50)		
			MADE GROUND: Light brown slightly gravelly coarse grained SAND with high cobble content. Gravel is angular to sub-rounded of slag, clinker, silstone and sandstone. Cobbles are angular to sub-rounded of clinker, slag, siltstone and sandstone. Cobbles content decreases with depth.	0.50 *5.94*		
1.00	B 3 D 4 ES 5		1.00m: PID reading, 0.5ppm.	(1.50)		
2.00	B 6 D 7 ES 8	~~25/06/2015 1106~~	1.99m - 2.00m: PID reading, 0.6ppm.	2.00 *4.44*		
			Exploratory Hole Ends at 2.00 m			

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)	
0.30	1.00	Slow progress, 0.5hr.

Stability	Collapsing at 2.00m
Shoring	None
Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP46**

Trial Pit Log

Logged AB **Checked** RB	**Start** 25/06/2015 **End** 25/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 2.00m. Pit terminated due to collapsing strata and presence of service. UXO clearance 0.5hr.	**Dimensions and Orientation** Width 0.50m Length 3.40m A / D / B / C 70(Deg)	**Ground Level** 6.380 **Coordinates** 267649E 191981N **National Grid** 267649E - 191981N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		25/06/2015 1100	MADE GROUND: Dark brown and black slightly silty, slightly sandy angular to sub-rounded fine to coarse GRAVEL of slag, siltstone, brick and clinker. Occasional railway sleeper.			
0.20	D 1 ES 2			(0.50)		
			MADE GROUND: Light brown slightly gravelly coarse grained SAND with high cobble content and low boulder content. Gravel is angular to sub-angular fine to coarse of slag, clinker and sandstone. Cobbles are angular to rounded of clinker, slag, siltstone and sandstone. Cobble content decreasing with depth. Boulders are angular of concrete and bricks.	0.50 *5.88*		
1.00	B 3 D 4 ES 5		1.00m: PID reading, 0.8ppm.			
				(1.50)		
			1.50m: Plastic grey pipe at south face with 70 degree orientation, 2.80m from the road.			
2.00	B 6 D 7 ES 8	~~25/06/2015 1230~~	1.99m - 2.00m: PID reading, 0.1ppm.	2.00 *4.38*		
			Exploratory Hole Ends at 2.00 m			

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability None Collapsing from ..
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TP48**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 25/06/2015 **End** 25/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 2.00m. Pit terminated due to collapsing strata. UXO clearance 0.50hr.	**Dimensions and Orientation** Width 0.50m Length 3.70m A / D / B / C	**Ground Level** 6.370 **Coordinates** 267609E 191965N **National Grid** 267609E - 191965N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		25/06/2015 1300	MADE GROUND: Dark brown and black slightly silty slightly sandy angular to sub-rounded fine to coarse ashy GRAVEL of slag, siltstone, mudstone, brick and clinker.	(0.30)		
0.20	D 1 ES 2		MADE GROUND: Light brown slightly gravelly coarse grained SAND with high cobble content and low boulder content. Gravel is angular to sub-rounded fine to coarse of mudstone, siltstone and clinker. Cobbles are angular of clinker and mudstone. Boulders are angular of mudstone and siltstone. Cobble and boulder content decreasing with depth.	0.30 *6.07*		
1.00	B 3 D 4 ES 5		1.00m: PID reading, 0.3ppm.	(1.70)		
2.00	B 6 D 7 ES 8	25/06/2015 1430	1.99m - 2.00m: PID reading, 0.4ppm.	2.00 *4.37*		
			Exploratory Hole Ends at 2.00 m			

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)	
0.30	1.00	Slow progress, 0.5hr.

Stability	Collapsing from 1.00m
Shoring	None
Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

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Trial Pit

TP49

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Trial Pit Log

Logged AB **Checked** RB	**Start** 16/06/2015 **End** 16/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 1.20m. Pit terminated due to collapsing strata and proximity of buried service. UXO clearance 1hr.	**Dimensions and Orientation** Width 0.41m Length 3.20m A / D / B / C	**Ground Level** 6.220 **Coordinates** 267529E 191939N **National Grid** 267529E - 191939N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		16/06/2015 1515	MADE GROUND: Dark brown silty gravelly fine to coarse grained SAND. Gravel is sub-angular to sub-rounded fine to medium of slag, brick and plastic.			
0.20	D 1 ES 2		0.20m: PID reading, 0ppm.			
			0.30m: Pockets of light brown slightly gravelly fine to medium grained sand.	(1.00)		
			0.83m: Pockets of light brown slightly gravelly fine to medium grained sand.			
1.00	B 3 D 4 ES 5		Light brown fine to medium grained SAND.	1.00 *5.22*		
			1.00m: PID reading, 0ppm.	(0.20)		
		16/06/2015 1615	1.10m: Plastic pipe with metal collar at North face of TP, 4m from road, possible water pipe.	1.20 *5.02*		
			Exploratory Hole Ends at 1.20 m			

Groundwater Entries			Depth Related Marks *		Stability	Collapsing from 1.10m
No.	Struck (m)	Post Strike Behaviour	From	To (m)	Shoring	None
No Groundwater Encountered					Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
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Trial Pit **TP51**

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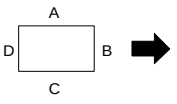
Trial Pit Log

Logged AB **Checked** RB	**Start** 16/06/2015 **End** 16/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 2.00m. Pit terminated due to collapsing strata. UXO clearance 1hr.	**Dimensions and Orientation** Width 0.41m Length 3.70m 	**Ground Level** 6.250 **Coordinates** 267422E 191905N **National Grid** 267422E - 191905N **Chainage**	

Samples and Tests			Strata			
Depth	**Type & No**	**Date Records**	**Description**	**Depth, Level (Thickness)**	**Legend**	**Backfill/ Instruments**
		16/06/2015 1400	MADE GROUND: Dark brown silty gravelly fine to coarse grained ashy SAND with low cobble content. Gravel is sub-rounded fine to coarse of brick and slag. Cobbles are sub-rounded of slag.			
0.20	ES 1 D 2		0.20m: PID reading, 0ppm.	(0.60)		
			Light brown slightly gravelly fine to medium grained SAND. Gravel is sub-rounded fine to coarse of sandstone.	0.60 *5.65*		
1.00	B 3 ES 4 D 5		1.00m: PID reading, 0ppm.	(1.40)		
2.00	B 6 ES 7 D 8	16/06/2015 1515	Exploratory Hole Ends at 2.00 m	2.00 *4.25*		

Groundwater Entries			Depth Related Marks *			
No.	**Struck (m)**	**Post Strike Behaviour**	**From**	**To (m)**	**Stability**	Collapsing from 1.70m
No Groundwater Encountered					**Shoring**	None
					Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
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Trial Pit
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Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 16/06/2015 **End** 16/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 2.20m. Pit terminated due to collapsing strata and proximity of buried service. UXO clearance 1hr.	**Dimensions and Orientation** Width 0.40m Length 3.20m A / D / B / C	**Ground Level** 6.700 **Coordinates** 267325E 191873N **National Grid** 267325E - 191873N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		16/06/2015 1300	MADE GROUND: Dark brown slightly silty sandy sub-rounded fine to coarse ashy GRAVEL of clinker, slag, brick and occasional coal fragment with low cobble content. Cobbles are sub-rounded of slag.			
0.20	D 1 ES 2		0.20m: PID reading, 0ppm. 0.21m: Scrap iron.			
				(1.20)		
1.00	B 3 D 4 ES 5		1.00m: PID reading, 0ppm.			
			Light brown fine to medium grained SAND.	1.20 *5.50*		
			1.30m: Plastic pipe with metal collar at North face of TP, 9m from road, possible water pipe.			
				(1.00)		
2.00	B 6 D 7 ES 8		2.00m: PID reading, 0ppm.			
		16/06/2015 1406	Exploratory Hole Ends at 2.20 m	2.20 *4.50*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Collapsing from 1.30m
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
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Trial Pit
TP55
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Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 16/06/2015 **End** 16/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 2.30m. Pit terminated due to collapsing strata. UXO clearance 1hr.	**Dimensions and Orientation** Width 0.41m Length 3.00m A / D / B / C	**Ground Level** 6.570 **Coordinates** 267231E 191853N **National Grid** 267231E - 191853N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		16/06/2015 0800	Dark brown slightly silty sandy sub-angular fine to coarse ashy GRAVEL of clinker, slag, brick and occasional coal fragment with low cobble content. Cobbles are sub-rounded of slag.	(0.20)		
0.20	D 1 ES 2		MADE GROUND: Dark grey to black sandy sub-angular fine to coarse GRAVEL of slag.	0.20 *6.37* (0.10)		
			MADE GROUND: Stiff brown slightly gravelly silty CLAY. Gravel is sub-rounded fine to coarse of slag.	0.30 *6.27*		
				(0.70)		
1.00	B 3 D 4 ES 5		Light brown slightly gravelly fine to medium grained SAND. Gravel is sub-rounded fine to coarse of sandstone. 1.00m: PID reading, 0ppm.	1.00 *5.57*		
				(1.30)		
2.00	B 6 D 7 ES 8		2.00m: PID reading, 0ppm.			
2.30	B 9 D 10 ES 11	~~16/06/2015 1000~~	Exploratory Hole Ends at 2.30 m	2.30 *4.27*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
No Groundwater Encountered		

Depth Related Marks *

From	To (m)

Stability Collapsing from1.70m
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
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Trial Pit **TP57**
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Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 15/06/2015 **End** 15/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 3.50m. Pit terminated due to collapsing strata. UXO clearance 1hr.	**Dimensions and Orientation** Width 0.41m Length 3.00m A / D / B / C	**Ground Level** 7.620 **Coordinates** 267128E 191839N **National Grid** 267128E - 191839N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		15/06/2015 1200	MADE GROUND: Dark brown slightly silty sandy sub-angular fine to coarse ashy GRAVEL of clinker, slag, brick and occasional fragments of coal, with low cobble content. Cobbles are sub-rounded of slag.			
0.20	D 1 ES 2					
			0.90m: PID reading, 0ppm	(1.80)		
1.00	B 3 D 4 ES 5					
			1.20m: Wood fragments.			
			1.30m - 1.40m: Pockets of light brown coarse sand and occasional sub-rounded gravel.			
			Light brown slightly gravelly fine to medium grained SAND. Gravel is sub-rounded fine to coarse of sandstone.	1.80 *5.82*		
2.00	B 6 D 7 ES 8					
				(1.70)		
3.00	D 9 ES 10					
3.50	B 11 D 12 ES 13	15/06/2015 1406	Exploratory Hole Ends at 3.50 m	3.50 *4.12*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Collapsing from 3.00m
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
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Trial Pit **TP59**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 25/06/2015 **End** 25/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 124(Deg)	**Ground Level** 8.070 **Coordinates** 268700E 193018N **National Grid** 268700E - 193018N **Chainage**	

Samples and Tests / Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	25/06/2015 0800	MADE GROUND: Dark brown to black slightly sandy angular fine to coarse GRAVEL of slag, clinker and siltstone with high cobble content and low boulder content. Cobbles are angular of brick, slag and clinker. Boulders are angular of bricks and slag. Increased sand content with depth. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		25/06/2015 0845	Exploratory Hole Ends at 0.90 m	0.90 *7.17*		

Groundwater Entries			Depth Related Marks *			
No.	Struck (m)	Post Strike Behaviour	From	To (m)	**Stability**	Stable
No Groundwater Encountered					**Shoring**	None
					Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA1**

Trial Pit Log

Logged AB **Checked** RB	**Start** 29/06/2015 **End** 29/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 86(Deg)	**Ground Level** 7.440 **Coordinates** 268700E 192992N **National Grid** 268700E - 192992N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	29/06/2015 0800	MADE GROUND: Dark brown slightly silty angular to sub-rounded ashy GRAVEL of slag, clinker, siltstone and sandstone with medium cobble and boulder content. Cobbles are angular to sub-rounded of brick, slag, clinker and sandstone. Boulders are angular of slag. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		29/06/2015 0830	Exploratory Hole Ends at 0.90 m	0.90 *6.54*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA2**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 29/06/2015 **End** 29/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 74(Deg)	**Ground Level** 7.320 **Coordinates** 268702E 192969N **National Grid** 268702E - 192969N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	29/06/2015 0830	MADE GROUND: Dark brown slightly silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of slag, clinker, siltstone and sandstone with medium cobble and boulder content. Cobbles are angular to sub-rounded of brick, clinker and sandstone. Boulders are angular of clinker. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		29/06/2015 0900	Exploratory Hole Ends at 0.90 m	0.90 *6.42*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
No Groundwater Encountered		

Depth Related Marks *

From	To (m)

Stability	Stable
Shoring	None
Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA3**

Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.30m A / D / B / C 88(Deg)	**Ground Level** 7.340 **Coordinates** 268703E 192943N **National Grid** 268703E - 192943N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	30/06/2015 1130	MADE GROUND: Dark brown to black silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of slag, clinker, sandstone and siltstone with high cobble content and low boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are sub-rounded of sandstone. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		30/06/2015 1200	Exploratory Hole Ends at 0.90 m	0.90 *6.44*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA4**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 88(Deg)	**Ground Level** 7.510 **Coordinates** 268706E 192920N **National Grid** 268706E - 192920N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	30/06/2015 1200	MADE GROUND: Dark brown to black silty sandy angular to sub-rounded fine to coarse GRAVEL of slag, clinker, sandstone and siltstone with high cobble content and low boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are sub-rounded of sandstone. Sand content increases with depth. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		30/06/2015 1230	Exploratory Hole Ends at 0.90 m	0.90 *6.61*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability	Stable
Shoring	None
Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA5**

Trial Pit Log

Logged AB **Checked** RB	**Start** 01/07/2015 **End** 01/07/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.90m Length 1.40m A / D / B / C 83(Deg)	**Ground Level** 7.480 **Coordinates** 268707E 192893N **National Grid** 268707E - 192893N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	01/07/2015 0800	MADE GROUND: Dark brown to black silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of slag, clinker and siltstone with high cobble content and low boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are angular of slag. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		01/07/2015 0830	Exploratory Hole Ends at 0.90 m	0.90 *6.58*		

Groundwater Entries			Depth Related Marks *			
No.	Struck (m)	Post Strike Behaviour	From	To (m)		
No Groundwater Encountered						

Stability	Good	
Shoring	None	
Weather	Dry	

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA6**

Trial Pit Log

Logged AB **Checked** RB	**Start** 01/07/2015 **End** 01/07/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.30m A / D / B / C 86(Deg)	**Ground Level** 7.460 **Coordinates** 268686E 192893N **National Grid** 268686E - 192893N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	01/07/2015 0830	MADE GROUND: Dark brown to black silty sandy angular to sub-rounded fine to coarse GRAVEL of slag, clinker and siltstone with high cobble content and medium boulder. Cobbles are angular of slag and clinker. Boulders size clay deposits, soft to firm medium strength grey mottled reddish brown slightly gravelly. Gravel is sub-angular fine of ash. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		01/07/2015 0900	Exploratory Hole Ends at 0.90 m	0.90 *6.56*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA7**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 88(Deg)	**Ground Level** 7.360 **Coordinates** 268683E 192915N **National Grid** 268683E - 192915N **Chainage**	

Samples and Tests			Strata			
Depth	**Type & No**	**Date Records**	**Description**	**Depth, Level (Thickness)**	**Legend**	**Backfill/ Instruments**
0.00-0.30	ES 1	30/06/2015 1230	MADE GROUND: Dark brown to black silty sandy angular to sub-rounded fine to coarse GRAVEL of slag, clinker, sandstone and siltstone with high cobble content and low boulder content. Cobbles are angular to sub-rounded of slag, mudstone and sandstone. Boulders are sub-rounded of sandstone. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		30/06/2015 1300	Exploratory Hole Ends at 0.90 m	0.90 *6.46*		

Groundwater Entries			Depth Related Marks *			
No.	**Struck (m)**	**Post Strike Behaviour**	**From**	**To (m)**	**Stability**	Stable
		No Groundwater Encountered			**Shoring**	None
					Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA9**

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.30m A / D / B / C 80(Deg)	**Ground Level** 7.360 **Coordinates** 268681E 192943N **National Grid** 268681E - 192943N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	30/06/2015 1300	MADE GROUND: Dark brown to black silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of slag, clinker, sandstone and siltstone with high cobble content and low boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are angular of slag. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		30/06/2015 1330	Exploratory Hole Ends at 0.90 m	0.90 *6.46*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA10**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 29/06/2015 **End** 29/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 80(Deg)	**Ground Level** 7.430 **Coordinates** 268679E 192967N **National Grid** 268679E - 192967N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	29/06/2015 0900	MADE GROUND: Dark brown slightly silty very sandy angular to sub-rounded ashy GRAVEL of slag, clinker, siltstone and sandstone with occasional bitumen with high cobble and boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are angular of slag. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		29/06/2015 0930	Exploratory Hole Ends at 0.90 m	0.90 *6.53*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
No Groundwater Encountered		

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA11**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 29/06/2015 **End** 29/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 86(Deg)	**Ground Level** 7.420 **Coordinates** 268680E 192990N **National Grid** 268680E - 192990N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	29/06/2015 0930	MADE GROUND: Dark brown slightly silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of slag, clinker, siltstone and sandstone with high cobble and boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are angular of slag and bricks. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		29/06/2015 1000	Exploratory Hole Ends at 0.90 m	0.90 *6.52*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA12**
Sheet 1 of 1

Trial Pit Log

Logged AH **Checked** RB	**Start** 25/06/2015 **End** 25/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.70m A / D / B / C 78(Deg)	**Ground Level** 7.410 **Coordinates** 268678E 193015N **National Grid** 268678E - 193015N **Chainage**	

Samples and Tests / Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	25/06/2015 0845	MADE GROUND: Dark brown to black angular fine to coarse GRAVEL of slag, clinker and siltstone with high cobble content and low boulder content. Cobbles are angular of slag, brick and clinker. Boulders are angular of slag and bricks. Increased sand content with depth. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		25/06/2015 0945	Exploratory Hole Ends at 0.90 m	0.90 *6.51*		

Groundwater Entries			Depth Related Marks *			
No.	Struck (m)	Post Strike Behaviour	From	To (m)	**Stability**	Stable
No Groundwater Encountered					**Shoring**	None
					Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA13**

Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 25/06/2015 **End** 25/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.70m A / D / B / C 78(Deg)	**Ground Level** 7.410 **Coordinates** 268654E 193014N **National Grid** 268654E - 193014N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	25/06/2015 0945	MADE GROUND: Dark brown to black slightly sandy angular fine to coarse GRAVEL of slag, clinker and siltstone with high cobble content and low boulder content. Cobbles are angular of brick, slag and clinker. Boulders are angular of slag and bricks. Increased sand content with depth. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		25/06/2015 1045	Exploratory Hole Ends at 0.90 m	0.90 *6.51*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
No Groundwater Encountered		

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA14**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 26/06/2015 **End** 26/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 98(Deg)	**Ground Level** 7.430 **Coordinates** 268656E 192988N **National Grid** 268656E - 192988N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	26/06/2015 1645	MADE GROUND: Dark brown to black sandy angular fine to coarse GRAVEL of slag, clinker and siltstone with high cobble content and medium boulder content. Cobbles are angular of slag, brick and clinker. Boulders are angular of slag.	(0.80)		
0.30-0.90	ES 2					
		26/06/2015 1715	MADE GROUND: Firm medium strength reddish brown slightly silty slightly sandy CLAY.	0.80 *6.63* (0.10)		
			Exploratory Hole Ends at 0.90 m	0.90 *6.53*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
No Groundwater Encountered		

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Rain

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA15**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 29/06/2015 **End** 29/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 90(Deg)	**Ground Level** 7.380 **Coordinates** 268654E 192965N **National Grid** 268654E - 192965N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	29/06/2015 1000	MADE GROUND: Dark brown slightly silty very sandy angular to sub-rounded fine to coarse ashy GRAVEL of slag, clinker, siltstone and sandstone with medium cobble and boulder content. Cobbles are angular to sub-rounded of slag, brick and sandstone. Boulders are angular of slag. Abundant rootlets and wood fragments.	(0.90)		
0.30-0.90	ES 2					
		29/06/2015 1030	Exploratory Hole Ends at 0.90 m	0.90 *6.48*		

Groundwater Entries			Depth Related Marks *			
No.	Struck (m)	Post Strike Behaviour	From	To (m)	**Stability**	Stable
No Groundwater Encountered					**Shoring**	None
					Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA16**

Trial Pit Log

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 126(Deg)	**Ground Level** 7.380 **Coordinates** 268657E 192937N **National Grid** 268657E - 192937N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	30/06/2015 1330	MADE GROUND: Dark brown to black silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of slag, clinker, sandstone and siltstone with high cobble content and low boulder content. Cobbles are angular to sub-rounded of slag, clinker, coal and sandstone. Boulders are angular of slag. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		30/06/2015 1350	Exploratory Hole Ends at 0.90 m	0.90 *6.48*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA17**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 84(Deg)	**Ground Level** 7.530 **Coordinates** 268662E 192917N **National Grid** 268662E - 192917N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	30/06/2015 1350	MADE GROUND: Dark brown to black silty sandy angular to sub-rounded fine to coarse GRAVEL of slag, clinker, brick and siltstone with high cobble content and low boulder content. Cobbles are angular to sub-rounded of slag, clinker, brick and sandstone. Boulders are sub-rounded of sandstone. Sand content increasing with depth. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		30/06/2015 1410	Exploratory Hole Ends at 0.90 m	0.90 *6.63*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA18**
Sheet 1 of 1

Trial Pit Log

Logged AH **Checked** RB	**Start** 01/07/2015 **End** 01/07/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 86(Deg)	**Ground Level** 7.410 **Coordinates** 268661E 192892N **National Grid** 268661E - 192892N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	01/07/2015 0900	MADE GROUND: Dark brown to black silty sandy angular to sub-rounded fine to coarse GRAVEL of slag, clinker and siltstone with high cobble content and low boulder content. Cobbles are are angular to sub-rounded of slag, clinker and sandstone. Boulders are angular of slag. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		01/07/2015 0930	Exploratory Hole Ends at 0.90 m	0.90 *6.51*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
No Groundwater Encountered		

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA19**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 01/07/2015 **End** 01/07/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 86(Deg)	**Ground Level** 7.430 **Coordinates** 268635E 192890N **National Grid** 268635E - 192890N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	01/07/2015 0930	MADE GROUND: Dark brown to black silty sandy angular to sub-rounded fine to coarse GRAVEL of slag, clinker and siltstone with high cobble content and low boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are angular of concrete and slag. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		01/07/2015 1000	Exploratory Hole Ends at 0.90 m	0.90 *6.53*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA20**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 84(Deg)	**Ground Level** 7.420 **Coordinates** 268634E 192911N **National Grid** 268634E - 192911N **Chainage**	

Samples and Tests			Strata			
Depth	**Type & No**	**Date Records**	**Description**	**Depth, Level (Thickness)**	**Legend**	**Backfill/ Instruments**
0.00-0.30	ES 1	30/06/2015 1410	MADE GROUND: Dark brown to black silty sandy angular to sub-rounded fine to coarse GRAVEL of slag, clinker, brick and siltstone with high cobble content and low boulder content. Cobbles are angular to sub-rounded of slag, clinker, brick and sandstone. Boulders are sub-rounded of sandstone. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		30/06/2015 1430	Exploratory Hole Ends at 0.90 m	0.90 *6.52*		

Groundwater Entries			Depth Related Marks *			
No.	**Struck (m)**	**Post Strike Behaviour**	**From**	**To (m)**	**Stability**	Stable
		No Groundwater Encountered			**Shoring**	None
					Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA21**

Trial Pit Log

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 80(Deg)	**Ground Level** 7.360 **Coordinates** 268633E 192935N **National Grid** 268633E - 192935N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	30/06/2015 1430	MADE GROUND: Dark brown to black silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of slag, clinker, sandstone and siltsone with high cobble content and low boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are angular of slag. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		30/06/2015 1450	Exploratory Hole Ends at 0.90 m	0.90 *6.46*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA22**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 29/06/2015 **End** 29/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 120(Deg)	**Ground Level** 7.390 **Coordinates** 268633E 192964N **National Grid** 268633E - 192964N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	29/06/2015 1030	MADE GROUND: Dark brown slightly silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of slag, clinker, siltstone and sandstone with medium cobble and boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are angular of slag. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		29/06/2015 1100	Exploratory Hole Ends at 0.90 m	0.90 *6.49*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA23**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 26/06/2015 **End** 26/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.70m A / D / B / C 98(Deg)	**Ground Level** 7.400 **Coordinates** 268631E 192987N **National Grid** 268631E - 192987N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	26/06/2015 1730	MADE GROUND: Dark brown to black sandy angular fine to coarse GRAVEL of slag, clinker and siltstone with high cobble content and medium boulder content. Cobbles are angular of slag, clinker and brick. Boulders are angular of slag. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		26/06/2015 1800	Exploratory Hole Ends at 0.90 m	0.90 *6.50*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Rain

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA24**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 25/06/2015 **End** 25/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.70m A / D / B / C 78(Deg)	**Ground Level** 7.450 **Coordinates** 268630E 193012N **National Grid** 268630E - 193012N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	25/06/2015 1045	MADE GROUND: Brown ashy gravelly coarse grained SAND with high cobble content and low boulder content. Gravel is angular to sub-angular fine to coarse of slag, clinker and brick. Cobbles are angular to sub-rounded of brick, slag, clinker and siltstone. Boulders are angular of slag. Abundant wood fragments and rootlets.	(0.90)		
0.30-0.90	ES 2					
		25/06/2015 1145	Exploratory Hole Ends at 0.90 m	0.90 *6.55*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA25**
Sheet 1 of 1

Trial Pit Log

Logged AH **Checked** RB	**Start** 25/06/2015 **End** 25/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 78(Deg)	**Ground Level** 7.320 **Coordinates** 268605E 193010N **National Grid** 268605E - 193010N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	25/06/2015 1145	MADE GROUND: Brown ashy gravelly coarse grained SAND with high cobble content and low boulder content. Gravel is angular to sub-angular fine to coarse of slag, clinker and brick. Cobbles are angular to sub-rounded of brick, slag, clinker and siltstone. Boulders are angular of slag. Abundant wood fragments and rootlets.	(0.90)		
0.30-0.90	ES 2					
		25/06/2015 1245	Exploratory Hole Ends at 0.90 m	0.90 *6.42*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA26**
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 26/06/2015 **End** 26/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 62(Deg)	**Ground Level** 7.360 **Coordinates** 268607E 192985N **National Grid** 268607E - 192985N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1		MADE GROUND: Dark brown to black sandy angular fine to coarse GRAVEL of slag, clinker and siltstone with high cobble content and medium boulder content. Cobbles are angular of slag, clinker and brick. Boulders are angular of slag. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
			Exploratory Hole Ends at 0.90 m	0.90 *6.46*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Rain

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA27**
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 29/06/2015 **End** 29/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 62(Deg)	**Ground Level** 7.360 **Coordinates** 268607E 192963N **National Grid** 268607E - 192963N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	29/06/2015 1200	MADE GROUND: Light brown silty sandy angular to sub-rounded fine to coarse GRAVEL of slag, sandstone and siltstone. Abundant rootlets, wood fragments and shell fragments.	(0.90)		
0.30-0.90	ES 2					
		29/06/2015 1220	Exploratory Hole Ends at 0.90 m	0.90 *6.46*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
No Groundwater Encountered		

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA28**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 80(Deg)	**Ground Level** 7.380 **Coordinates** 268610E 192934N **National Grid** 268610E - 192934N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	30/06/2015 1450	MADE GROUND: Dark brown to black silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of slag, clinker, sandstone and siltstone with high cobble content and low boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are angular of slag. Occasional rebar. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		30/06/2015 1520	Exploratory Hole Ends at 0.90 m	0.90 *6.48*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA29**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 82(Deg)	**Ground Level** 7.330 **Coordinates** 268610E 192909N **National Grid** 268610E - 192909N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	30/06/2015 0800	MADE GROUND: Dark brown to black silty sandy angular to sub-angular fine to coarse GRAVEL of slag, clinker, brick and siltstone with high cobble content and low boulder content. Cobbles are angular to sub-rounded of slag, clinker, brick and sandstone. Boulders are sub-rounded of sandstone. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		30/06/2015 0830	Exploratory Hole Ends at 0.90 m	0.90 *6.43*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA30**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 01/07/2015 **End** 01/07/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 80(Deg)	**Ground Level** 7.330 **Coordinates** 268612E 192888N **National Grid** 268612E - 192888N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	01/07/2015 1000	MADE GROUND: Dark brown to black silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of slag, clinker and siltstone with high cobble content and low boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are angular of concrete and slag. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		01/07/2015 1030	Exploratory Hole Ends at 0.90 m	0.90 *6.43*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA31**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 01/07/2015 **End** 01/07/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C, 87(Deg)	**Ground Level** 7.300 **Coordinates** 268586E 192885N **National Grid** 268586E - 192885N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	01/07/2015 1030	MADE GROUND: Brown silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of slag, clinker and siltstone with high cobble content and medium boulder content. Cobbles are angular of slag and clinker. Boulders are deposits of clay, firm high strength grey mottled reddish brown slightly silty slightly gravelly. Gravel is sub-angular fine of ash. Abundant rootlets and occasional rebar.	(0.90)		
0.30-0.90	ES 2					
		01/07/2015 1100	Exploratory Hole Ends at 0.90 m	0.90 *6.40*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA32**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 82(Deg)	**Ground Level** 7.340 **Coordinates** 268584E 192907N **National Grid** 268584E - 192907N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	30/06/2015 0830	MADE GROUND: Dark brown to black silty sandy angular to sub-angular fine to coarse GRAVEL of slag, clinker, brick and siltstone with high cobble content and low boulder content. Cobbles are angular to sub-rounded of slag, clinker, brick and sandstone. Boulders are sub-rounded of sandstone. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2		0.70m - 0.90m: Pocket of soft to firm very low strength grey mottled black sandy CLAY.			
		30/06/2015 0900	Exploratory Hole Ends at 0.90 m	0.90 *6.44*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA33**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 90(Deg)	**Ground Level** 7.380 **Coordinates** 268586E 192932N **National Grid** 268586E - 192932N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	30/06/2015 1520	MADE GROUND: Dark brown to black silty very sandy angular to sub-rounded fine to coarse GRAVEL of slag, clinker, sandstone and siltstone with high cobble content and medium boulder content. Cobbles are angular to sub-rounded of slag and sandstone. Boulders are angular of slag. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		30/06/2015 1550	Exploratory Hole Ends at 0.90 m	0.90 *6.48*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA34**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 29/06/2015 **End** 29/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 68(Deg)	**Ground Level** 7.380 **Coordinates** 268580E 192960N **National Grid** 268580E - 192960N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	29/06/2015 1100	MADE GROUND: Light brown silty sandy angular to sub-rounded fine to coarse GRAVEL of slag, sandstone and siltstone. Abundant rootlets, wood and shell fragments.	(0.20)		
0.30-0.90	ES 2		MADE GROUND: Dark brown to black slightly silty sandy angular fine to coarse ashy GRAVEL of slag, clinker and siltsone with high cobble content and low boulder content. Cobbles are angular of slag, clinker and brick. Boulders are angular of slag. Occasional metal railway pins.	0.20 *7.18* (0.70)		
		29/06/2015 1130	Exploratory Hole Ends at 0.90 m	0.90 *6.48*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
No Groundwater Encountered		

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA35**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 26/06/2015 **End** 26/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.70m A / D / B / C 92(Deg)	**Ground Level** 7.420 **Coordinates** 268582E 192983N **National Grid** 268582E - 192983N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1		MADE GROUND: Dark brown to black sandy angular fine to coarse GRAVEL of slag, clinker and siltstone with high cobble content and mdium boulder content. Cobbles are angular of slag, clinker and brick. Boulders are angular of slag. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
			Exploratory Hole Ends at 0.90 m	0.90 *6.52*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Rain

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA36**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 25/06/2015 **End** 25/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 78(Deg)	**Ground Level** 7.360 **Coordinates** 268579E 193008N **National Grid** 268579E - 193008N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	25/06/2015 1245	MADE GROUND: Brown ashy gravelly coarse grained SAND with high cobble content and low boulder content. Gravel is angular to sub-angular fine to coarse of slag, clinker and brick. Cobbles are angular to sub-rounded of brick, slag, clinker and siltstone. Boulders are angular of slag. Abundant wood fragments and rootlets.	(0.90)		
0.30-0.90	ES 2					
		25/06/2015 1345	Exploratory Hole Ends at 0.90 m	0.90 *6.46*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
No Groundwater Encountered		

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA37**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 25/06/2015 **End** 25/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 79(Deg)	**Ground Level** 7.410 **Coordinates** 268554E 193007N **National Grid** 268554E - 193007N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	25/06/2015 1345	MADE GROUND: Brown ashy gravelly coarse grained SAND with high cobble content and low boulder content. Gravel is angular to sub-angular fine to coarse of slag, clinker and brick. Cobbles are angular to sub-rounded of brick, slag, clinker and siltstone. Boulders are angular of slag. Abundant wood fragments and rootlets.	(0.90)		
0.30-0.90	ES 2					
		25/06/2015 1415	Exploratory Hole Ends at 0.90 m	0.90 *6.51*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA38**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 26/06/2015 **End** 26/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.30m Length 1.30m A / D / B / C 92(Deg)	**Ground Level** 7.420 **Coordinates** 268557E 192981N **National Grid** 268557E - 192981N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	26/06/2015 1415	MADE GROUND: Dark brown to black sandy angular fine to coarse GRAVEL of slag, clinker and siltstone with high cobble content and medium boulder content. Cobbles are angular of slag, brick and clinker. Boulders are angular of slag. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		26/06/2015 1445	Exploratory Hole Ends at 0.90 m	0.90 *6.52*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
No Groundwater Encountered		

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA39**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 29/06/2015 **End** 29/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 74(Deg)	**Ground Level** 7.350 **Coordinates** 268557E 192959N **National Grid** 268557E - 192959N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	29/06/2015 1130	MADE GROUND: Brown slightly silty sandy angular to sub-rounded fine to coarse GRAVEL of slag, clinker, sandstone and siltstone with medium cobble and boulder content. Cobbles are angular to sub-rounded of slag, clinker, brick and sandstone. Boulders are angular of slag. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		29/06/2015 1200	Exploratory Hole Ends at 0.90 m	0.90 *6.45*		

Groundwater Entries			Depth Related Marks *			
No.	Struck (m)	Post Strike Behaviour	From	To (m)	**Stability**	Stable
No Groundwater Encountered					**Shoring**	None
					Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA40**

Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 100(Deg)	**Ground Level** 7.350 **Coordinates** 268561E 192934N **National Grid** 268561E - 192934N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	30/06/2015 1550	MADE GROUND: Dark brown to black silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of slag, clinker, sandstone and siltstone with high cobble content and medium boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are angular of slag. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		30/06/2015 1620	Exploratory Hole Ends at 0.90 m	0.90 *6.45*		

Groundwater Entries			Depth Related Marks *			
No.	Struck (m)	Post Strike Behaviour	From	To (m)		
		No Groundwater Encountered				

Stability	Stable
Shoring	None
Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA41**

Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 82(Deg)	**Ground Level** 7.330 **Coordinates** 268561E 192905N **National Grid** 268561E - 192905N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	30/06/2015 0900	MADE GROUND: Dark brown to black silty very sandy angular to sub-rounded fine to coarse GRAVEL of slag, clinker, brick and siltstone with high cobble content and low boulder content. Cobbles are angular to sub-rounded of brick, slag, clinker and sandstone. Boulders are sub-angular of sandstone. Sand content increasing with depth. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		30/06/2015 0930	Exploratory Hole Ends at 0.90 m	0.90 *6.43*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA42**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 01/07/2015 **End** 01/07/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 90(Deg)	**Ground Level** 7.400 **Coordinates** 268561E 192883N **National Grid** 268561E - 192883N **Chainage**	

Samples and Tests / Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	01/07/2015 1100	MADE GROUND: Brown silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of slag, clinker and siltstone with high cobble content and low boulder content. Cobbles are angular to sub-angular of slag, clinker and clay (soft friable, grey mottled brown slightly gravelly silty). Boulders are angular of slag. Abundant rootlets and occasional plastic sheeting.	(0.90)		
0.30-0.90	ES 2					
		01/07/2015 1130	Exploratory Hole Ends at 0.90 m	0.90 *6.50*		

Groundwater Entries			Depth Related Marks *			
No.	Struck (m)	Post Strike Behaviour	From	To (m)	**Stability**	Stable
No Groundwater Encountered					**Shoring**	None
					Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA43**

Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 01/07/2015 **End** 01/07/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C, 90(Deg)	**Ground Level** 7.320 **Coordinates** 268538E 192882N **National Grid** 268538E - 192882N **Chainage**	

Samples and Tests			Strata			
Depth	**Type & No**	**Date Records**	**Description**	**Depth, Level (Thickness)**	**Legend**	**Backfill/ Instruments**
0.00-0.30	ES 1	01/07/2015 1130	MADE GROUND: Brown silty sandy angular to sub-rounded fine to coarse GRAVEL of slag, clinker, sandstone and siltstone with high cobble content and low boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are sub-rounded of sandstone. Abundant rootlets and occasional rebar.	(0.90)		
0.30-0.90	ES 2					
		01/07/2015 1200	Exploratory Hole Ends at 0.90 m	0.90 *6.42*		

Groundwater Entries			Depth Related Marks *		
No.	**Struck (m)**	**Post Strike Behaviour**	**From**	**To (m)**	
No Groundwater Encountered					

Stability	Stable
Shoring	None
Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA44**

Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.30m A / D / B / C 82(Deg)	**Ground Level** 7.230 **Coordinates** 268536E 192904N **National Grid** 268536E - 192904N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	30/06/2015 0930	MADE GROUND: Dark brown to black silty sandy angular to sub-rounded fine to coarse GRAVEL of slag, clinker, brick and siltstone with high cobble content and medium boulder content. Cobbles are angular of brick, slag, clinker and mudstone. Boulders are angular of mudstone. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		30/06/2015 1000	Exploratory Hole Ends at 0.90 m	0.90 *6.33*		

Groundwater Entries			Depth Related Marks *			
No.	Struck (m)	Post Strike Behaviour	From	To (m)	**Stability**	Stable
No Groundwater Encountered					**Shoring**	None
					Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA45**

Trial Pit Log

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 94(Deg)	**Ground Level** 7.360 **Coordinates** 268534E 192928N **National Grid** 268534E - 192928N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	30/06/2015 1620	MADE GROUND: Dark brown to black silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of slag, clinker, sandstone and siltstone with high cobble content and medium boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are angular of slag. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		30/06/2015 1650	Exploratory Hole Ends at 0.90 m	0.90 *6.46*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA46**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 29/06/2015 **End** 29/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.60m A / D / B / C 74(Deg)	**Ground Level** 7.310 **Coordinates** 268530E 192957N **National Grid** 268530E - 192957N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	29/06/2015 1220	MADE GROUND: Brown slightly silty sandy angular to sub-rounded fine to coarse GRAVEL of slag, clinker, sandstone and siltstone with high cobble content and high boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are angular of concrete (0.20-1.30m in length), difficult to excavate. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		29/06/2015 1240	Exploratory Hole Ends at 0.90 m	0.90 *6.41*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA47**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 26/06/2015 **End** 26/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.60m A / D / B / C 88(Deg)	**Ground Level** 7.280 **Coordinates** 268531E 192979N **National Grid** 268531E - 192979N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	26/06/2015 1445	MADE GROUND: Dark brown to black sandy angular fine to coarse GRAVEL of slag, clinker and siltstone with high cobble content and low boulder content. Cobbles are sub-rounded of siltstone and sandstone. Boulders are rounded of sandstone. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		26/06/2015 1515	Exploratory Hole Ends at 0.90 m	0.90 *6.38*		

Groundwater Entries			Depth Related Marks *			
No.	Struck (m)	Post Strike Behaviour	From	To (m)	**Stability**	Stable
No Groundwater Encountered					**Shoring**	None
					Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA48**

Trial Pit Log

Logged AB **Checked** RB	**Start** 25/06/2015 **End** 25/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 79(Deg)	**Ground Level** 7.310 **Coordinates** 268529E 193004N **National Grid** 268529E - 193004N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	25/06/2015 1515	MADE GROUND: Light brown coarse grained SAND. Occasional rootlets.	(0.90)		
0.30-0.90	ES 2					
		25/06/2015 1545	Exploratory Hole Ends at 0.90 m	0.90 *6.41*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
No Groundwater Encountered		

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA49**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 26/06/2015 **End** 26/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 88(Deg)	**Ground Level** 7.340 **Coordinates** 268507E 192978N **National Grid** 268507E - 192978N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	26/06/2015 1545	MADE GROUND: Dark brown to black sandy angular fine to coarse GRAVEL of slag, clinker and siltstone with high cobble content and low boulder content. Cobbles are angular of slag, clinker and brick. Boulders are angular of slag and clinker. Occasional wood and metal fragments, abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		26/06/2015 1615	Exploratory Hole Ends at 0.90 m	0.90 *6.44*		

Groundwater Entries			Depth Related Marks *			
No.	Struck (m)	Post Strike Behaviour	From	To (m)		
		No Groundwater Encountered				

Stability	Stable
Shoring	None
Weather	Raining

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA50**

Trial Pit Log

Logged AB **Checked** RB	**Start** 29/06/2015 **End** 29/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 74(Deg)	**Ground Level** 7.410 **Coordinates** 268505E 192955N **National Grid** 268505E - 192955N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	29/06/2015 1240	MADE GROUND: Brown slightly silty sandy angular to sub-rounded fine to coarse GRAVEL of slag, clinker, sandstone and siltstone with high cobble content and high boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are angular of slag and foundry relics. Occasional rebar and wood fragments.	(0.90)		
0.30-0.90	ES 2					
		29/06/2015 1300	Exploratory Hole Ends at 0.90 m	0.90 *6.51*		

Groundwater Entries			Depth Related Marks *			
No.	Struck (m)	Post Strike Behaviour	From	To (m)	**Stability**	Stable
No Groundwater Encountered					**Shoring**	None
					Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA51**

Trial Pit Log

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 94(Deg)	**Ground Level** 7.310 **Coordinates** 268509E 192926N **National Grid** 268509E - 192926N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	30/06/2015 1650	MADE GROUND: Dark brown to black silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of slag, clinker, sandstone and siltstone with high cobble content and medium boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are angular of slag. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		30/06/2015 1710	Exploratory Hole Ends at 0.90 m	0.90 *6.41*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA52**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 82(Deg)	**Ground Level** 7.290 **Coordinates** 268512E 192905N **National Grid** 268512E - 192905N **Chainage**	

Samples and Tests			Strata			
Depth	**Type & No**	**Date Records**	**Description**	**Depth, Level (Thickness)**	**Legend**	**Backfill/ Instruments**
0.00-0.30	ES 1	30/06/2015 1000	MADE GROUND: Dark brown to black silty very sandy angular to sub-rounded fine to coarse GRAVEL of slag, clinker, sandstone and siltstone with high cobble content and low boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are sub-rounded of sandstone. Sand content increasing with depth. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		30/06/2015 1030	Exploratory Hole Ends at 0.90 m	0.90 *6.39*		

Groundwater Entries			Depth Related Marks *			
No.	**Struck (m)**	**Post Strike Behaviour**	**From**	**To (m)**	**Stability**	Stable
No Groundwater Encountered					**Shoring**	None
					Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA53**

Trial Pit Log

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 82(Deg)	**Ground Level** 7.470 **Coordinates** 268484E 192900N **National Grid** 268484E - 192900N **Chainage**	

Samples and Tests			Strata			
Depth	**Type & No**	**Date Records**	**Description**	**Depth, Level (Thickness)**	**Legend**	**Backfill/ Instruments**
0.00-0.30	ES 1	30/06/2015 1030	MADE GROUND: Dark brown to black silty very sandy angular to sub-rounded fine to coarse GRAVEL of slag, clinker, sandstone and siltstone with high cobble content and low boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are sub-rounded of sandstone. Abundant rootlets, occasional rebar.	(0.90)		
0.30-0.90	ES 2					
		30/06/2015 1100	Exploratory Hole Ends at 0.90 m	0.90 *6.57*		

Groundwater Entries			Depth Related Marks *		
No.	**Struck (m)**	**Post Strike Behaviour**	**From**	**To (m)**	
No Groundwater Encountered					

Stability	Stable
Shoring	None
Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA54**

Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 94(Deg)	**Ground Level** 7.430 **Coordinates** 268484E 192924N **National Grid** 268484E - 192924N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	30/06/2015 1710	MADE GROUND: Dark brown to black silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of slag, clinker, sandstone and siltstone with high cobble content and medium boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are angular of slag. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		30/06/2015 1730	Exploratory Hole Ends at 0.90 m	0.90 *6.53*		

Groundwater Entries			Depth Related Marks *			
No.	Struck (m)	Post Strike Behaviour	From	To (m)	**Stability**	Stable
No Groundwater Encountered					**Shoring**	None
					Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA55**

Trial Pit Log

Logged AB **Checked** RB	**Start** 29/06/2015 **End** 29/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 74(Deg)	**Ground Level** 7.380 **Coordinates** 268480E 192951N **National Grid** 268480E - 192951N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	29/06/2015 1300	MADE GROUND: Brown slightly silty sandy angular to sub-rounded fine to coarse GRAVEL of slag, clinker and siltstone with high cobble content and high boulder content. Cobbles are angular of slag, clinker and brick. Boulders are angular of slag. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		29/06/2015 1320	Exploratory Hole Ends at 0.90 m	0.90 *6.48*		

Groundwater Entries			Depth Related Marks *			
No.	Struck (m)	Post Strike Behaviour	From	To (m)	**Stability**	Stable
No Groundwater Encountered					**Shoring**	None
					Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA56**

Trial Pit Log

Logged AB **Checked** RB	**Start** 26/06/2015 **End** 26/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 80(Deg)	**Ground Level** 7.220 **Coordinates** 268483E 192976N **National Grid** 268483E - 192976N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	26/06/2015 1615	MADE GROUND: Light brown coarse grained SAND. Occasional rootlets.	(0.90)		
0.30-0.90	ES 2					
		26/06/2015 1645	Exploratory Hole Ends at 0.90 m	0.90 *6.32*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
No Groundwater Encountered		

Depth Related Marks *

From	To (m)

Stability	Stable
Shoring	None
Weather	Rain

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit

TPA57

Trial Pit Log

Logged AB **Checked** RB	**Start** 29/06/2015 **End** 29/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 94(Deg)	**Ground Level** 7.290 **Coordinates** 268457E 192951N **National Grid** 268457E - 192951N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	29/06/2015 1320	MADE GROUND: Dark brown to black slightly silty sandy angular fine to coarse GRAVEL of slag, clinker and siltstone with high cobble content and high boulder content. Cobbles are angular of slag, clinker and brick. Boulders are angular of concrete (0.50m). Occasional plastic. Hard to excavate.	(0.90)		
0.30-0.90	ES 2					
		29/06/2015 1340	Exploratory Hole Ends at 0.90 m	0.90 *6.39*		

Groundwater Entries			Depth Related Marks *			
No.	Struck (m)	Post Strike Behaviour	From	To (m)	**Stability**	Stable
No Groundwater Encountered					**Shoring**	None
					Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA58**

Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 94(Deg)	**Ground Level** 7.330 **Coordinates** 268459E 192923N **National Grid** 268459E - 192923N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	30/06/2015 1730	MADE GROUND: Dark brown to black silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of slag, clinker, sandstone and siltstone with high cobble content and medium boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are angular of slag. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		30/06/2015 1750	Exploratory Hole Ends at 0.90 m	0.90 *6.43*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA59**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 82(Deg)	**Ground Level** 7.360 **Coordinates** 268463E 192901N **National Grid** 268463E - 192901N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	30/06/2015 1100	MADE GROUND: Dark brown to black silty very sandy angular to sub-rounded fine to coarse GRAVEL of slag, clinker, sandstone and siltstone with high cobble content and low boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are sub-rounded of sandstone. Abundant rootlets, occasional rebar.	(0.90)		
0.30-0.90	ES 2					
		30/06/2015 1130	Exploratory Hole Ends at 0.90 m	0.90 *6.46*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability	Stable
Shoring	None
Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit
TPA60
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 94(Deg)	**Ground Level** 7.360 **Coordinates** 268434E 192921N **National Grid** 268434E - 192921N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	30/06/2015 1750	MADE GROUND: Dark brown to black very silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of slag, clinker, sandstone and siltstone with high cobble content and medium boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are sub-rounded of sandstone. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		30/06/2015 1810	Exploratory Hole Ends at 0.90 m	0.90 *6.46*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA61**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 29/06/2015 **End** 29/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.40m A / D / B / C 68(Deg)	**Ground Level** 7.290 **Coordinates** 268433E 192947N **National Grid** 268433E - 192947N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	29/06/2015 1340	MADE GROUND: Dark brown to black slightly silty sandy angular fine to coarse GRAVEL of slag, clinker and siltstone with high cobble content and high boulder content. Cobbles are angular of slag, clinker and brick. Boulders are angular of slag. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		29/06/2015 1400	Exploratory Hole Ends at 0.90 m	0.90 *6.39*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA62**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 30/06/2015 **End** 30/06/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.90m. Pit terminated at required depth.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 94(Deg)	**Ground Level** 7.310 **Coordinates** 268411E 192923N **National Grid** 268411E - 192923N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
0.00-0.30	ES 1	30/06/2015 1810	MADE GROUND: Dark brown to black slightly silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of slag, clinker, sandstone and siltstone with high cobble content and medium boulder content. Cobbles are angular to sub-rounded of slag, clinker and sandstone. Boulders are sub-rounded of sandstone. Abundant rootlets.	(0.90)		
0.30-0.90	ES 2					
		30/06/2015 1830	Exploratory Hole Ends at 0.90 m	0.90 *6.41*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPA63**
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 03/07/2015 **End** 03/07/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 1.50m. Soakaway undertaken.	**Dimensions and Orientation** Width 0.30m Length 1.50m A / D / B / C 102(Deg)	**Ground Level** 9.060 **Coordinates** 268079E 193006N **National Grid** 268079E - 193006N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		03/07/2015 0800	MADE GROUND: Grey and red brown sandy angular to sub-angular fine to coarse GRAVEL of granite.	(0.10) 0.10 *8.96*		
			MADE GROUND: Light brown slightly silty sandy angular to sub-angular fine to coarse GRAVEL of granite, siltstone and slag. Occasional rootlets.	(0.80)		
			MADE GROUND: Dark brown to black slightly silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of clinker, slag, brick and sandstone with medium cobble content. Cobbles are sub-angular of slag.	0.90 *8.16* (0.30)		
			MADE GROUND: Brown slightly gravelly fine to coarse grained SAND. Gravel is angular to sub-rounded fine to coarse of sandstone, siltstone and clinker.	1.20 *7.86* (0.30)		
		03/07/2015 0830	Exploratory Hole Ends at 1.50 m	1.50 *7.56*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPS1**
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 03/07/2015 **End** 03/07/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 1.50m. Soakaway undertaken.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 72(Deg)	**Ground Level** 9.090 **Coordinates** 268160E 193012N **National Grid** 268160E - 193012N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		03/07/2015 0830	MADE GROUND: Grey and reddish brown sandy angular to sub-angular fine to coarse GRAVEL of granite.	(0.10) 0.10 *8.99*		
			MADE GROUND: Light brown slightly silty sandy angular to sub-angular fine to coarse GRAVEL of granite, siltstone and slag. Occasional rootlets.	(0.20) 0.30 *8.79*		
			MADE GROUND: Dark brown to black slightly silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of clinker, slag, brick and sandstone with medium cobble and boulder content. Cobbles are sub-angular of slag. Boulders are angular of slag.	(1.20)		
		03/07/2015 0900	Exploratory Hole Ends at 1.50 m	1.50 *7.59*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPS3**
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 03/07/2015 **End** 03/07/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 1.50m. Soakaway undertaken.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 80(Deg)	**Ground Level** 9.120 **Coordinates** 268235E 193013N **National Grid** 268235E - 193013N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		03/07/2015 0900	MADE GROUND: Grey and reddish brown sandy angular to sub-angular fine to coarse GRAVEL of granite.	(0.10) 0.10 *9.02*		
			MADE GROUND: Light brown slightly silty sandy angular to sub-angular fine to coarse GRAVEL of granite, siltstone and slag. Occasional rootlets.	(0.20) 0.30 *8.82*		
			MADE GROUND: Dark brown to black slightly silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of clinker, slag, brick and sandstone with medium cobble content. Cobbles are sub-angular of slag.	(0.50)		
			MADE GROUND: Brown slightly gravelly fine to coarse SAND. Gravel is angular to sub-rounded fine to coarse of sandstone, siltstone and clinker.	0.80 *8.32* (0.70)		
		03/07/2015 0930	Exploratory Hole Ends at 1.50 m	1.50 *7.62*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit TPS4
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 03/07/2015 **End** 03/07/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 1.50m. Soakaway undertaken.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 88(Deg)	**Ground Level** 8.990 **Coordinates** 268305E 193014N **National Grid** 268305E - 193014N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		03/07/2015 0930	MADE GROUND: Grey and reddish brown sandy angular to sub-angular fine to coarse GRAVEL of granite.	(0.20)		
			MADE GROUND: Dark brown to black slightly silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of clinker, slag, brick and sandstone with medium cobble and boulder content. Cobbles are sub-angular of slag. Boulders are sub-angular of slag.	0.20 *8.79* (0.30)		
			MADE GROUND: Orange to brown angular fine to coarse GRAVEL of clinker.	0.50 *8.49* (0.30)		
			MADE GROUND: Brown slightly gravelly fine to coarse grained SAND. Gravel is angular to sub-rounded fine to coarse of sandstone, siltstone and clinker.	0.80 *8.19* (0.60)		
		03/07/2015 1000	MADE GROUND: Soft to firm medium strength grey mottled reddish brown silty slightly gravelly CLAY. Gravel is angular to sub-rounded fine to medium of siltstone.	1.40 *7.59* (0.10)		
			Exploratory Hole Ends at 1.50 m	1.50 *7.49*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPS5**
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 03/07/2015 **End** 03/07/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 1.50m. Soakaway undertaken.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 82(Deg)	**Ground Level** 9.020 **Coordinates** 268375E 193015N **National Grid** 268375E - 193015N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		03/07/2015 0930	MADE GROUND: Grey and reddish brown sandy angular to sub-angular fine to coarse GRAVEL of granite.	(0.20)		
			MADE GROUND: Dark brown to black slightly silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of clinker, slag, brick and sandstone with medium cobble and boulder content. Cobbles are sub-angular of slag. Boulders are sub-angular of slag.	0.20 *8.82* (0.60)		
			MADE GROUND: Brown slightly gravelly fine to coarse SAND. Gravel is angular to sub-rounded fine to coarse of sandstone, siltstone and clinker.	0.80 *8.22* (0.70)		
		03/07/2015 1000	Exploratory Hole Ends at 1.50 m	1.50 *7.52*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
No Groundwater Encountered		

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPS6**
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 03/07/2015 **End** 03/07/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 1.50m. Soakaway undertaken.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 130(Deg)	**Ground Level** 8.860 **Coordinates** 268463E 193016N **National Grid** 268463E - 193016N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		03/07/2015 1000	MADE GROUND: Grey and reddish brown sandy angular to sub-angular fine to coarse GRAVEL of granite.	(0.20)		
			MADE GROUND: Dark brown to black slightly silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of clinker, slag, brick and sandstone with medium cobble content and high boulder content. Cobbles are sub-angular of slag. Boulders are sub-angular of slag.	0.20 *8.66* (0.60)		
			MADE GROUND: Brown fine to coarse SAND.	0.80 *8.06* (0.70)		
		03/07/2015 1030	Exploratory Hole Ends at 1.50 m	1.50 *7.36*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPS7**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 03/07/2015 **End** 03/07/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 0.60m. Pit terminated due to presence of service.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 150(Deg)	**Ground Level** 7.370 **Coordinates** 268503E 192987N **National Grid** 268503E - 192987N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		03/07/2015 1030	MADE GROUND: Brown silty sandy angular to sub-rounded fine to coarse GRAVEL of clinker, slag, brick, siltstone and sandstone with medium cobble and boulder content. Cobbles are angular to sub-rounded of slag and sandstone. Boulders are angular of slag. Abundant rootlets.	(0.60)		
		03/07/2015 1100	0.59m - 0.60m: Top of grey ducting, approximately 100m diameter, 62 degrees. Move TP to the SE.	0.60 *6.77*		
			Exploratory Hole Ends at 0.60 m			

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
No Groundwater Encountered		

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPS8**
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 03/07/2015 **End** 03/07/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 2.00m. Soakaway undertaken.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 124(Deg)	**Ground Level** 7.380 **Coordinates** 268507E 192983N **National Grid** 268507E - 192983N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		03/07/2015 1030	MADE GROUND: Brown silty sandy angular to sub-rounded fine to coarse GRAVEL of clinker, slag, brick, siltstone and sandstone with medium cobble and boulder content. Cobbles are angular to sub-rounded of slag and sandstone. Boulders are angular of slag. Abundant rootlets.	(0.80)		
			MADE GROUND: Brown slightly gravelly fine to coarse SAND. Gravel is angular to sub-rounded fine to coarse of sandstone, siltstone and clinker.	0.80 *6.58* (1.20)		
		03/07/2015 1100	Exploratory Hole Ends at 2.00 m	2.00 *5.38*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPS8A**
Sheet 1 of 1

Trial Pit Log

Logged AB **Checked** RB	**Start** 08/07/2015 **End** 08/07/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 1.50m. Soakaway undertaken.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 38(Deg)	**Ground Level** 7.310 **Coordinates** 268548E 192944N **National Grid** 268548E - 192944N **Chainage**	

Samples and Tests / Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		08/07/2015 0800	MADE GROUND: Dark brown to black slightly silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of clinker, slag, brick and sandstone with medium cobble and boulder content. Cobbles are sub-angular of slag and clinker. Boulders are angular of slag. Abundant wood fragments and rootlets.	(1.50)		
		08/07/2015 0830	Exploratory Hole Ends at 1.50 m	1.50 *5.81*		

Groundwater Entries			Depth Related Marks *			
No.	Struck (m)	Post Strike Behaviour	From	To (m)	**Stability**	Stable
No Groundwater Encountered					**Shoring**	None
					Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPS9**

Trial Pit Log

Logged AB **Checked** RB	**Start** 08/07/2015 **End** 08/07/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 2.00m. Soakaway undertaken.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 72(Deg)	**Ground Level** 7.400 **Coordinates** 268592E 192898N **National Grid** 268592E - 192898N **Chainage**	

Samples and Tests

Strata

Depth	Type & No	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
		08/07/2015 0830	MADE GROUND: Dark brown to black slightly silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of clinker, slag, brick and sandstone with medium cobble and boulder content. Cobbles are angular to sub-rounded of slag, mudstone and sandstone. Boulders are sub-angular of slag. Abundant rootlets.	(1.50)		
			MADE GROUND: Stiff friable brown mottled orange slightly gravelly silty CLAY. Gravel is angular fine to medium of mudstone (Possible re-worked natural deposit).	1.50 *5.90* (0.50)		
		08/07/2015 0900	Exploratory Hole Ends at 2.00 m	2.00 *5.40*		

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
		No Groundwater Encountered

Depth Related Marks *

From	To (m)

Stability Stable
Shoring None
Weather Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No. 10318
Carried out for Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPS10**
Sheet 1 of 1

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 08/07/2015 **End** 08/07/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 2.00m. Soakaway undertaken.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 80(Deg)	**Ground Level** 6.610 **Coordinates** 268668E 192873N **National Grid** 268668E - 192873N **Chainage**	

Samples and Tests			Strata			
Depth	**Type & No**	**Date Records**	**Description**	**Depth, Level (Thickness)**	**Legend**	**Backfill/ Instruments**
		08/07/2015 0900	MADE GROUND: Light brown slightly silty sandy angular to sub-angular fine to coarse GRAVEL of sandstone, siltstone and slag.	(0.30)		
			MADE GROUND: Black sandy angular to sub-angular fine to coarse ashy GRAVEL of clinker, slag, brick and sandstone with medium cobble content. Cobbles are angular to sub-angular of slag and clinker. Abundant broken tiles (possibly asbestos) 0.05-0.20m in length. Strong hydrocarbon odour.	0.30 *6.31* (1.30)		
			MADE GROUND: Black, silver and white angular fine to medium GRAVEL of shell gragments. Oily sheen.	1.60 *5.01* (0.40)		
		08/07/2015 0930	Exploratory Hole Ends at 2.00 m	2.00 *4.61*		

Groundwater Entries			Depth Related Marks *		Stability	Stable
No.	**Struck (m)**	**Post Strike Behaviour**	**From**	**To (m)**	**Shoring**	None
		No Groundwater Encountered			**Weather**	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.

Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPS11**

Trial Pit Log

Logged AB **Checked** RB	**Start** 09/07/2015 **End** 09/07/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 1.50m. Soakaway undertaken.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 60(Deg)	**Ground Level** 6.810 **Coordinates** 269023E 192889N **National Grid** 269023E - 192889N **Chainage**	

Samples and Tests			Strata			
Depth	**Type & No**	**Date Records**	**Description**	**Depth, Level (Thickness)**	**Legend**	**Backfill/ Instruments**
		09/07/2015 0930	MADE GROUND: Light brown gravelly fine to coarse grained SAND. Gravel is sub-angular to sub-rounded fine to coarse of sandstone and slag with low cobble content. Cobbles are sub-rounded of sandstone. frequent shell fragments and abundant rootlets.	(1.50)		
		09/07/2015 1000	MADE GROUND: Light grey slightly sandy angular to sub-angular medium to coarse GRAVEL of limestone and siltstone (possible service marker gravel).	1.50 (0.00) *5.31* *5.31*		
			Exploratory Hole Ends at 1.50 m			

Groundwater Entries			Depth Related Marks *		Stability	Stable
No.	**Struck (m)**	**Post Strike Behaviour**	**From**	**To (m)**	**Shoring**	None
		No Groundwater Encountered			**Weather**	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column. Scale: 1:25 www.apexdrilling.co.uk	**Project**	Swansea Bay Tidal Lagoon C133 Onshore G.I.	**Trial Pit** **TPS15**
	Project No.	10318	Sheet 1 of 1
	Carried out for	Tidal Lagoon Swansea Bay Plc.	

Trial Pit Log

APEX DRILLING SERVICES

Logged AB **Checked** RB	**Start** 09/07/2015 **End** 09/07/2015	**Equipment, Methods and Remarks** JCB 3cx Machine excavated pit G.L - 1.50m. Soakaway undertaken.	**Dimensions and Orientation** Width 0.50m Length 1.50m A / D / B / C 63(Deg)	**Ground Level** 6.970 **Coordinates** 269017E 192873N **National Grid** 269017E - 192873N **Chainage**	

Samples and Tests			Strata			
Depth	**Type & No**	**Date Records**	**Description**	**Depth, Level (Thickness)**	**Legend**	**Backfill/ Instruments**
		09/07/2015 1000	MADE GROUND: Light brown gravelly fine to coarse SAND with low cobble content. Gravel is sub-angular to sub-rounded of slag and sandstone. Cobbles are sub-rounded of sandstone.	(0.30)		
			MADE GROUND: Bitumen wearing course.	0.30 *6.67* (0.10)		
			MADE GROUND: Orange angular COBBLES of brick.	0.40 *6.57* (0.30)		
			MADE GROUND: Dark brown to black slightly silty sandy angular to sub-rounded fine to coarse ashy GRAVEL of clinker, slag, brick and sandstone with high cobble and boulder content. Cobbles are angular to sub-rounded of mudstone, clinker and sandstone. Boulders are sub-angular of slag and mudstone.	0.70 *6.27*		
			1.00m - 1.50m: Soft friable brown mottled orange gravelly silty CLAY. Gravel is angular fine to medium of mudstone.	(0.80)		
		09/07/2015 1100	Exploratory Hole Ends at 1.50 m	1.50 *5.47*		

Groundwater Entries			Depth Related Marks *			
No.	**Struck (m)**	**Post Strike Behaviour**	**From**	**To (m)**	**Stability**	Stable
No Groundwater Encountered					**Shoring**	None
					Weather	Dry

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale: 1:25 www.apexdrilling.co.uk

Project	Swansea Bay Tidal Lagoon C133 Onshore G.I.
Project No.	10318
Carried out for	Tidal Lagoon Swansea Bay Plc.

Trial Pit **TPS16**

SWANSEA BAY TIDAL
LAGOON 133KV PHASE 1

APEX DRILLING SERVICES

CORE LOG REPORT

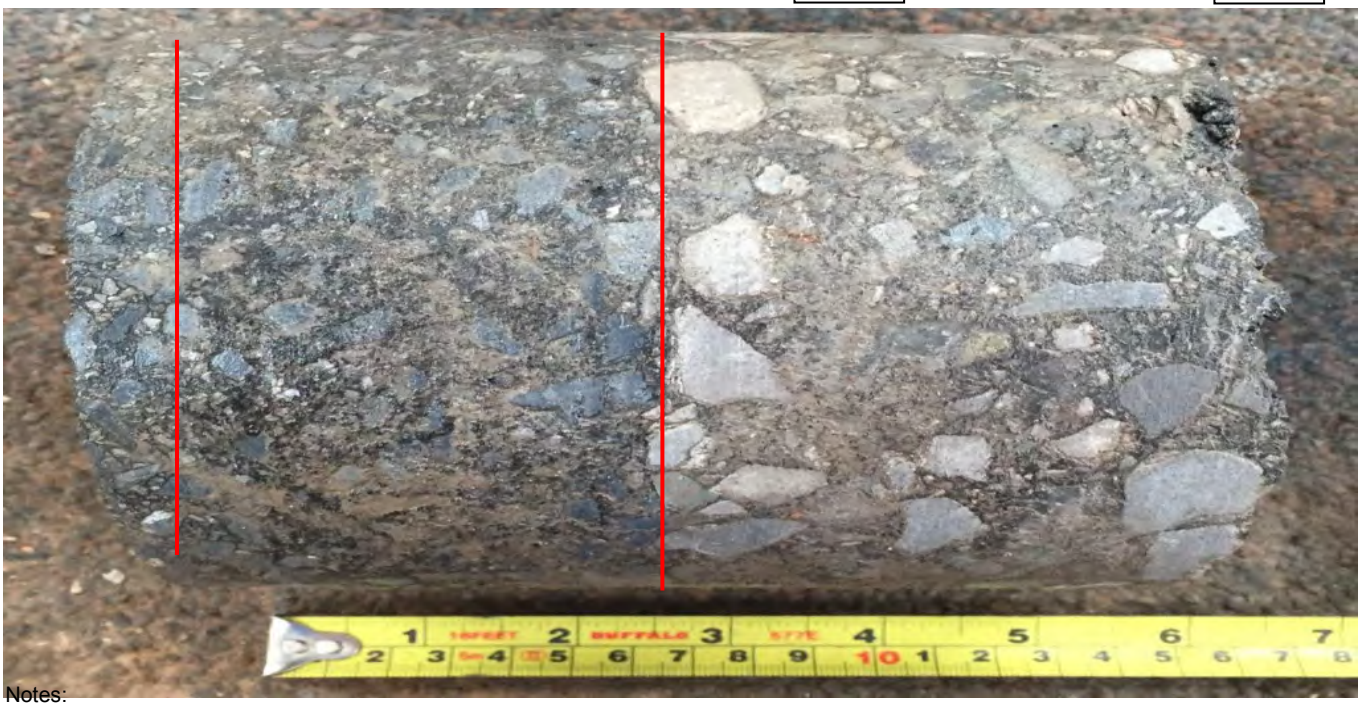
Design Manual for Roads and Bridges: Volume 7, Section 3, Part 2, HD 29/08

CORE RECORD SHEET - THICKNESS AND LAYER DESCRIPTION

Project Name	Swansea Bay Tidal Lagoon 133Kv Phase 1			Road Type (See note 1)	Not Supplied	
Road Name	Main Access Road, Swansea Dock			Lane Direction (See note 2)	Not Supplied	
Coring Date	08/07/2015	Logged Date	14/07/2015	Lane Number (See note 3)	Not Supplied	
Core Reference	CC1	Coordinates E:268510.16 N:192868.88	Not Supplied	Position of Core (See note 4)	Not Supplied	

Layer No.	Layers					Aggregate		Comments (see note 5 below)
	Top (mm)	Bottom (mm)	Thickness (mm)	Material Description (see note 7)	Debonded at Lower Interface (Yes / No)	Max Size (mm)	Type	
1	0	15	15	Asphalt Surface Layer	No	10	C/R	
2	15	60	45	Asphalt Binder Layer	No	10	C/R	
3	60	140	80	Asphalt Base Layer	Yes	20	C/R	
4	140	200	60	Angular Fine to Coarse Gravel of Limestone	N/A	N/A	N/A	Sub-Base

Top | Layer 1 | Layer 2 | Layer 3 | Base



Notes:

1 Insert as appropriate i.e. D2AP, S2 etc.
2 Insert eastbound, westbound, northbound, southbound as appropriate.
3 Insert appropriate descriptor e.g. lane 1 (nearside), lane 2 (offside), hard shoulder.
4 Insert appropriate location e.g. NSWP (nearside wheel path), OSWP (offside wheel path), Centre, etc.
5 Insert material condition (e.g. sound, cracked, friable), presence of tar, interface bonding, voiding & segregation, binder stripping, crack depth and severity, nature of material at the bottom of the hole and any peculiarities.
6 For information only; without composition analysis, descriptions cannot be taken as definitive.
7 AC - Asphalt Concrete, HRA - Hot Rolled Asphalt

SWANSEA BAY TIDAL
LAGOON 133KV PHASE 1

APEX DRILLING SERVICES

CORE LOG REPORT

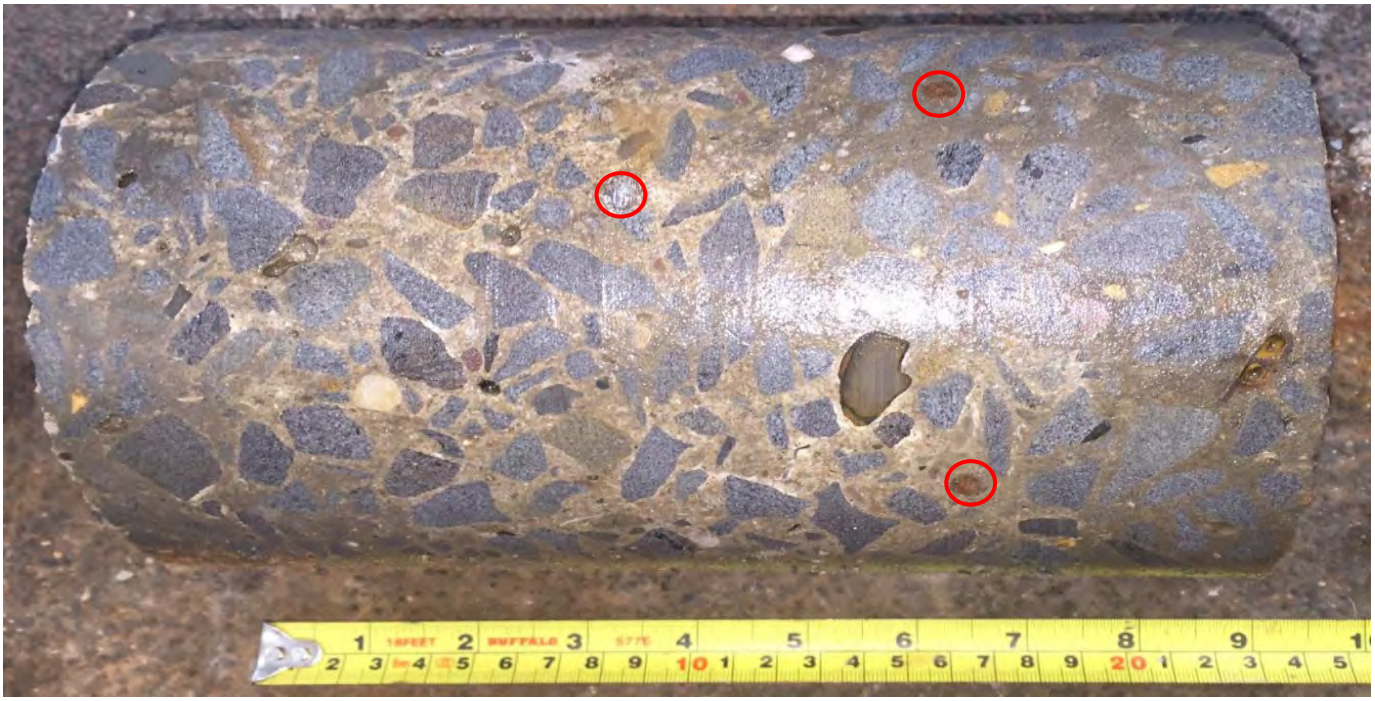
Design Manual for Roads and Bridges: Volume 7, Section 3, Part 2, HD 29/08

CORE RECORD SHEET - THICKNESS AND LAYER DESCRIPTION

Project Name	Swansea Bay Tidal Lagoon 133Kv Phase 1				Road Type (See note 1)		Not Supplied
Road Name	Main Access Road, Swansea Dock				Lane Direction (See note 2)		Not Supplied
Coring Date	08/07/2015	Logged Date		14/07/2015	Lane Number (See note 3)		Not Supplied
Core Reference	CC2	Coordinates E:268793.12 N:192884.11		Not Supplied	Position of Core (See note 4)		Not Supplied

Layer No.	Layers					Aggregate		Comments (see note 5 below)
	Top (mm)	Bottom (mm)	Thickness (mm)	Material Description (see note 7)	Debonded at Lower Interface (Yes / No)	Max Size (mm)	Type	
1	0	220	220	Concrete	Yes	20	Gritstone	Aggregate evenly distributed with no segregation. Approximately 0.5% voiding. Reinforcing bar (5mm thick) 100mm & 150mm from surface.
2	220	280	60	Angular Fine to Coarse Gravel of Sandstone	N/A	N/A	N/A	Sub-Base

Top | Layer 1 | Reinforcing Bar | Base



Notes:

1 Insert as appropriate i.e. D2AP, S2 etc.
2 Insert eastbound, westbound, northbound, southbound as appropriate.
3 Insert appropriate descriptor e.g. lane 1 (nearside), lane 2 (offside), hard shoulder.
4 Insert appropriate location e.g. NSWP (nearside wheel path), OSWP (offside wheel path), Centre, etc.
5 Insert material condition (e.g. sound, cracked, friable), presence of tar, interface bonding, voiding & segregation, binder stripping, crack depth and severity, nature of material at the bottom of the hole and any perculiarities.
6 For information only; without composition analysis, descriptions cannot be taken as definitive.
7 AC - Asphalt Concrete, HRA - Hot Rolled Asphalt

SWANSEA BAY TIDAL
LAGOON 133KV PHASE 1

APEX DRILLING SERVICES

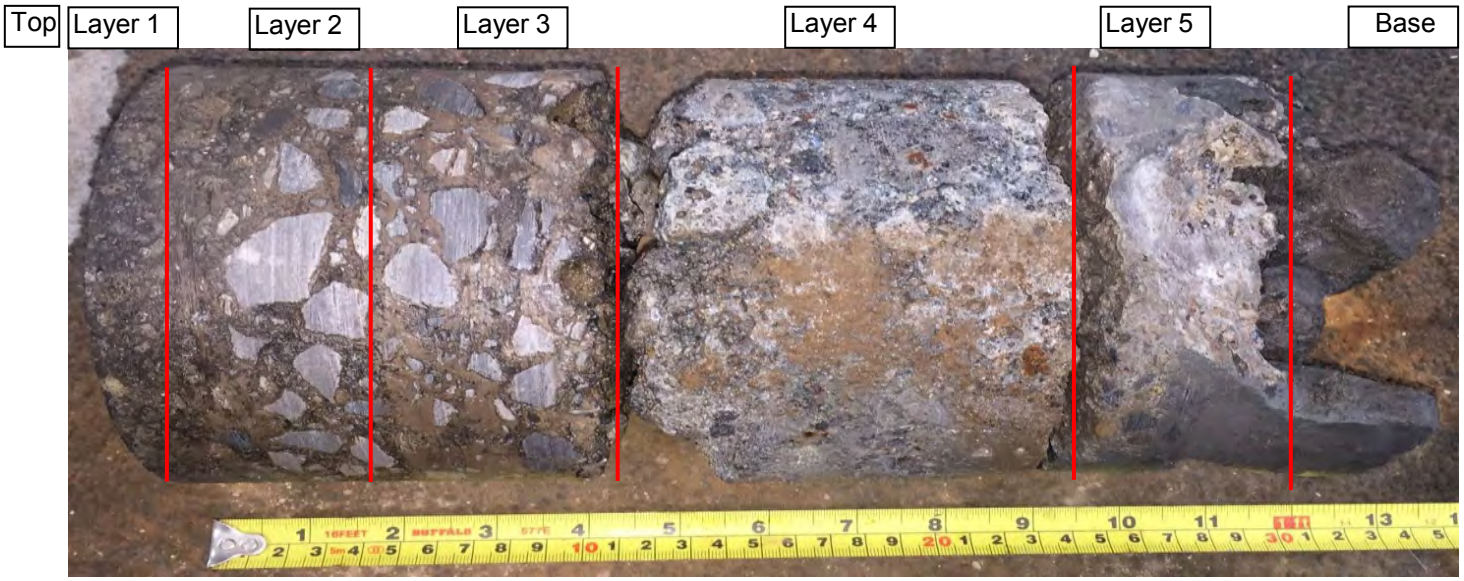
CORE LOG REPORT

Design Manual for Roads and Bridges: Volume 7, Section 3, Part 2, HD 29/08

CORE RECORD SHEET - THICKNESS AND LAYER DESCRIPTION

Project Name	Swansea Bay Tidal Lagoon 133Kv Phase 1			Road Type (See note 1)	Not Supplied	
Road Name	Main Access Road, Swansea Dock			Lane Direction (See note 2)	Not Supplied	
Coring Date	08/07/2015	Logged Date	14/07/2015	Lane Number (See note 3)	Not Supplied	
Core Reference	CC3	Coordinates E:269047.48 N:192902.29	Not Supplied	Position of Core (See note 4)	Not Supplied	

Layer No.	Layers					Aggregate		Comments (see note 5 below)
	Top (mm)	Bottom (mm)	Thickness (mm)	Material Description (see note 7)	Debonded at Lower Interface (Yes / No)	Max Size (mm)	Type	
1	0	25	25	Asphalt Surface Layer	No	10	C/R	
2	25	60	35	Asphalt Binder Layer	No	20	C/R	
3	60	100	40	Asphalt Base Layer	Yes	20	C/R	
4	100	220	145	Cement Bound Slag	Yes	40	C/R	>3.0% voiding
5	220	320	100	Cement Bound Slag	Yes	40	C/R	Approximately 1.5 – 3.0% voiding
6	320	400	80	Angular Fine to Coarse Gravel of Slag	N/A	N/A	N/A	Sub-Base



Notes:

1 Insert as appropriate i.e. D2AP, S2 etc.
2 Insert eastbound, westbound, northbound, southbound as appropriate.
3 Insert appropriate descriptor e.g. lane 1 (nearside), lane 2 (offside), hard shoulder.
4 Insert appropriate location e.g. NSWP (nearside wheel path), OSWP (offside wheel path), Centre, etc.
5 Insert material condition (e.g. sound, cracked, friable), presence of tar, interface bonding, voiding & segregation, binder stripping, crack depth and severity, nature of material at the bottom of the hole and any perculiarities.
6 For information only; without composition analysis, descriptions cannot be taken as definitive.
7 AC - Asphalt Concrete, HRA - Hot Rolled Asphalt

ENCLOSURE B

INSTRUMENTATION AND MONITORING

Installation Details	B1
Gas & Groundwater Monitoring –	B2 to B8

Installation Details

Hole ID	Instrument ID	Instrument Type	Date of Installation	Pipework Diameter ID (mm)	Base of Pipework (mBGL)	Top of response zone (mBGL)	Base of response zone (mBGL)	Headworks	Remarks
BH1	1	SP	17/06/2015	50.00	3.60	1.00	3.60	Raised Cover	
BH2	1	SP	17/06/2015	50.00	3.60	1.00	3.60	Raised Cover	
BH3	1	SP	17/06/2015	50.00	3.60	1.00	3.60	Raised Cover	
BH4	1	SP	18/06/2015	50.00	3.30	1.00	3.30	Raised Cover	
BH5	1	SP	18/06/2015	50.00	2.30	1.50	2.30	Raised Cover	
BH6A	1	SP	19/06/2015	50.00	1.90	1.00	1.90	Raised Cover	
BH9	1	SP	19/06/2015	50.00	3.45	1.50	3.45	Raised Cover	
BH10A	1	SP	19/06/2015	50.00	3.60	1.50	3.60	Flush Cover	
BHA1	1	SPIE	26/06/2015	19.00	4.20	3.90	4.20	Raised Cover	
BHA2	1	SPIE	26/06/2015	19.00	4.00	3.70	4.00	Raised Cover	

SP - Standpipe
SPIE - Standpipe Piezometer

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH1 22/06/2015; 11:00; HT of 8.2m @ 10:50, LT of 2.1m @16:35						BH2 22/06/2015; 11:30; HT of 8.2m @ 10:50, LT of 2.1m @16:35						BH3 22/06/2015; 12:00; HT of 8.2m @ 10:50, LT of 2.1m @16:35					
Weather conditions	Cloudy						Cloudy						Cloudy					
Recent weather conditions	Intermittent rain and sun						Intermittent rain and sun						Intermittent rain and sun					
Atmospheric pressure	1011mb						1011mb						1011mb					
Pressure rising falling or stable, *ref.metcheck before visiting site*	Ref: Met Office. Steady rise in pressure.						Ref: Met Office. Steady rise in pressure.						Ref: Met Office. Steady rise in pressure.					
Ambient temperature	15°c						15°c						15°c					
BH refernce number	BH 1						BH 2	Readings at following pump interval					BH3	Readings at following pump interval				
Gas concentratation	pre pump	Reading					pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %	0	0.3					0	0					0	0				
Co2 %	0	2.8					0	3.2					0	2.3				
O2 %	20.8	14.1					20.8	13.7					20.8	18.6				
H2s ppm																		
CO ppm																		
VOC ppm																		
LEL CH4 %																		
Rel Pressure of gas in hole																		
Gas flow																		
Water level in well	3.55m						Dry well						3.55m					
Diameter well pipe	50mm						50mm						50mm					
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	3.7m						3.53m						3.7m					
Condition of the monitoring point. *(damage broken etc)*	Good condition						Good condition						Good condition					
Ground conditions. *(frost , flooded etc)*	Dry ground						Dry ground						Dry ground					
migration. *(bubbling or smell of gas etc)*	No visible signs						No visible signs						No visible signs					
Oil level	No detectable oil level						No detectable oil level						No detectable oil level					

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH4 22/06/2015; 12:30; HT of 8.2m @ 10:50, LT of 2.1m @16:35						BH5 22/06/2015; 14:00; HT of 8.2m @ 10:50, LT of 2.1m @16:35						BH6a 22/06/2015; 14:30; HT of 8.2m @ 10:50, LT of 2.1m @16:35					
Weather conditions	Cloudy						Cloudy						Cloudy					
Recent weather conditions	Intermittent rain and sun						Intermittent rain and sun						Intermittent rain and sun					
Atmospheric pressure	1011mb						1011mb						1011mb					
Pressure rising falling or stable, *ref.metcheck before visiting site*	Ref: Met Office. Steady rise in pressure.						Ref: Met Office. Steady rise in pressure.						Ref: Met Office. Steady rise in pressure.					
Ambient temperature	15°c						15°c						15°c					
BH refernce number	BH 4						BH 5	Readings at following pump interval					BH6a	Readings at following pump interval				
Gas concentratation	pre pump	Reading					pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %	0	0					0	0					0	0				
Co2 %	0	10					0	1.2					0	0				
O2 %	20.8	5.8					20.8	18.3					20.8	20.9				
H2s ppm																		
CO ppm																		
VOC ppm																		
LEL CH4 %																		
Rel Pressure of gas in hole																		
Gas flow																		
Water level in well	Dry well						Dry well						Dry well					
Diameter well pipe	50mm						50mm						50mm					
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	3.14m						2.35m						1.9m					
Condition of the monitoring point.	Good condition						Good condition						Good condition					
Ground conditions. *(frost , flooded etc)*	Dry ground						Dry ground						Dry ground					
Visible signs of gas migration. *(bubbling or smell of gas etc)*	No visible signs						No visible signs						No visible signs					
Oil level	No detectable oil level						No detectable oil level						No detectable oil level					

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH9 22/06/2015; 15:00; HT of 8.2m @ 10:50, LT of 2.1m @16:35						BH10a 22/06/2015; 15:30; HT of 8.2m @ 10:50, LT of 2.1m @16:35											
Weather conditions	Cloudy						Cloudy											
Recent weather conditions	Intermittent rain and sun						Intermittent rain and sun											
Atmospheric pressure	1011mb						1011mb											
Pressure rising falling or stable, *ref.metcheck before visiting site*	Ref: Met Office. Steady rise in pressure.						Ref: Met Office. Steady rise in pressure.											
Ambient temperature	15°c						15°c											
BH refernce number	BH 9						BH 10a	Readings at following pump interval					BH6a	Readings at following pump interval				
Gas concentratation	pre pump	Reading					pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %	0	0					0	>100										
Co2 %	0	0.2					0	0.7										
O2 %	20.8	20.9					20.8	13										
H2s ppm																		
CO ppm																		
VOC ppm																		
LEL CH4 %																		
Rel Pressure of gas in hole																		
Gas flow																		
Water level in well	3.44m						Dry well											
Diameter well pipe	50mm						50mm											
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	3.6m						3.55m											
Condition of the monitoring point.	Good condition						Good condition											
Ground conditions. *(frost , flooded etc)*	Dry ground						Dry ground											
Visible signs of gas migration. *(bubbling or smell of gas etc)*	No visible signs						No visible signs											
Oil level	No detectable oil level						No detectable oil level											

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH1 02/07/2015; 08:00; HT of 9.1m @ 07:10, LT of 1.2m @13:12						BH2 02/07/2015; 08:30; HT of 9.1m @ 07:10, LT of 1.2m @ 13:12						BH3 02/07/2015; 09:00; HT of 9.1m @ 07:10, LT of 1.2m @ 13:12					
Weather conditions	Dry, Partial sun						Dry, Partial sun						Dry, Partial sun					
Recent weather conditions	Hot, sunny, occassional thunder storms.						Hot, sunny, occassional thunder storms.						Hot, sunny, occassional thunder storms.					
Atmospheric pressure	1018mb						1018mb						1018mb					
Pressure rising falling or stable, *ref.metcheck before visiting site*	Ref: Met Office. Steady rise in pressure from 1014 on 01/07						Ref: Met Office. Steady rise in pressure from 1014 on 01/07						Ref: Met Office. Steady rise in pressure from 1014 on 01/07					
Ambient temperature	18°c						18°c											
BH refernce number	BH 1	Readings at following pump interval					BH 2	Readings at following pump interval					BH3	Readings at following pump interval				
Gas concentratation	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %	0	0.2	0.2	0.1	0.2	0.2	0	0.1	0.1	0.1	0.1	0.1	0	0.1	0.1	0.1	0.1	0.1
Co2 %	3.4	3.9	3.9	4	4.7	4.7	2.4	2.7	0.7	2.4	2.1	2.1	0.9	1.2	1.5	2.1	3	3.3
O2 %	14.5	12.3	12.3	11.9	10.8	10.6	16.8	13.6	13.5	14.7	16.1	16.6	19	18.2	18	17.5	16.7	16.4
H2s ppm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO ppm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VOC ppm																		
LEL CH4 %																		
Rel Pressure of gas in hole																		
Gas flow																		
Water level in well	3.6m Approx 800ml						Dry well						Dry well					
Diameter well pipe	ID 50mm						ID 50mm						ID 50mm					
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	3.7m						3.53m						3.7m					
Condition of the monitoring point.	Good condition						Good condition						Good condition					
Ground conditions. *(frost , flooded etc)*	Dry ground						Dry ground						Dry ground					
Visible signs of gas migration. *(bubbling or smell of gas etc)*	No visible signs						No visible signs						No visible signs					
Oil Level	No detectable oil level						No detectable oil level						No detectable oil level					

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH4 02/07/2015; 09:30; HT of 9.1m @ 07:10, LT of 1.2m @13:12						BH5 02/07/2015; 10:00; HT of 9.1m @ 07:10, LT of 1.2m @ 13:12						BH6a 02/07/2015; 10:30; HT of 9.1m @ 07:10, LT of 1.2m @ 13:12					
Weather conditions	Dry, Partial sun						Dry, Partial sun						Dry, Partial sun					
Recent weather conditions	Hot, sunny, occassional thunder storms.						Hot, sunny, occassional thunder storms.						Hot, sunny, occassional thunder storms.					
Atmospheric pressure	1018mb						1018mb						1018mb					
Pressure rising falling or stable, *ref.metcheck before visiting site*	Ref: Met Office. Steady rise in pressure from 1014 on 01/07						Ref: Met Office. Steady rise in pressure from 1014 on 01/07						Ref: Met Office. Steady rise in pressure from 1014 on 01/07					
Ambient temperature	18°c						18°c											
BH refernce number	BH 4	Readings at following pump interval					BH 5	Readings at following pump interval					BH6a	Readings at following pump interval				
Gas concentratation	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0	0.1	0.1	0.1	0.1	0.1
Co2 %	1.9	3.3	3.7	3.5	3.4	4	0.7	1.9	1.9	1.8	1.8	1.9	1.5	7.2	7.1	7	7.1	7.5
O2 %	18.1	13.8	13.4	13.9	14.4	13.4	18.4	16.2	16.3	16.4	16.5	16.8	16.8	10.9	11.1	11.4	11	10.6
H2s ppm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO ppm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VOC ppm																		
LEL CH4 %																		
Rel Pressure of gas in hole																		
Gas flow																		
Water level in well	Dry well						Dry well						Dry well					
Diameter well pipe	ID 50mm						ID 50mm						ID 50mm					
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	3.3m						2.35m						1.9m					
Condition of the monitoring point.	Good condition						Good condition						Good condition					
Ground conditions. *(frost , flooded etc)*	Dry ground						Dry ground						Dry ground					
Visible signs of gas migration. *(bubbling or smell of gas etc)*	No visible signs						No visible signs						No visible signs					
Oil Level	No detectable oil level						No detectable oil level						No detectable oil level					

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	AWS1 02/07/2015; 11:00; HT of 9.1m @ 07:10, LT of 1.2m @13:12						AWS2 02/07/2015; 12:00; HT of 9.1m @ 07:10, LT of 1.2m @ 13:12						BH9 02/07/2015; 12:45; HT of 9.1m @ 07:10, LT of 1.2m @ 13:12					
Weather conditions	Cloudy, raining						Cloudy, raining						Cloudy					
Recent weather conditions	Hot, sunny, occassional thunder storms.						Hot, sunny, occassional thunder storms.						Hot, sunny, occassional thunder storms.					
Atmospheric pressure	1020mb						1020mb						1020mb					
Pressure rising falling or stable, *ref.metcheck before visiting site*	Ref: Met Office. Steady rise in pressure from 1014 on 01/07						Ref: Met Office. Steady rise in pressure from 1014 on 01/07						Ref: Met Office. Steady rise in pressure from 1014 on 01/07					
Ambient temperature	18°c						18°c						18°c					
BH refernce number	AWS1	Readings at following pump interval					AWS2	Readings at following pump interval					BH9	Readings at following pump interval				
Gas concentratation	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Co2 %	0	0	0	0	0	0	0.1	0.3	0.3	0.3	0.4	0.3	1.8	2.2	2.2	2.3	2.4	2.4
O2 %	19.8	19.8	19.9	19.9	19.9	19.7	18.9	15.2	14.8	14.8	16.1	15.8	18.5	17.7	17.6	17.5	17.5	17.4
H2s ppm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO ppm	0	0	0	0	0	1	0	0	7	1	2	0	0	0	0	0	0	0
VOC ppm																		
LEL CH4 %																		
Rel Pressure of gas in hole																		
Gas flow																		
Water level in well	2.3m. Full sample set. After 30 mins of pumping water level @ 2.35m.						2.43m Approx 250ml						3.46m Approx 500ml					
Diameter well pipe	ID 19mm						ID 19mm						ID 50mm					
Depth of response zone.																		
Total depth well. *(from drillers log / client)*	4.3m						3.2m						3.6m					
Condition of the monitoring point.	Good condition						Good condition						Good condition					
Ground conditions. *(frost , flooded etc)*	Dry ground						Damp ground						Damp ground					
Visible signs of gas migration. *(bubbling or smell of gas etc)*	No visible signs						Oily sheen on water surface						Hydrocarbon odour					
Oil Level	No detectable oil level						No detectable oil level						No detectable oil level					

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH10a 02/07/2015; 13:45; HT of 9.1m @ 07:10, LT of 1.2m @13:12																	
Weather conditions	Cloudy, raining																	
Recent weather conditions	Hot, sunny, occassional thunder storms.																	
Atmospheric pressure	1021mb																	
Pressure rising falling or stable, *ref.metcheck before visiting site*	Ref: Met Office. Steady rise in pressure from 1014 on 01/07																	
Ambient temperature	18°c																	
BH refernce number	BH10a	Readings at following pump interval					BH 2	Readings at following pump interval					BHA	Readings at following pump interval					
Gas concentratation	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %	0.1	3	53.8	86.2	100	100												
Co2 %	0.8	6.4	7.9	9.7	11.2	12.8												
O2 %	19.4	9.8	6.9	4.2	2	0												
H2s ppm	0	0	0	0	0	0												
CO ppm	0	2	5	6	9	12												
VOC ppm																		
LEL CH4 %																		
Rel Pressure of gas in hole																		
Gas flow																		
Water level in well	Dry well																	
Diameter well pipe	ID 50mm																	
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	3.55m																	
Condition of the monitoring point.	Good condition																	
Ground conditions. (*frost , flooded etc)*	Damp ground																	
Visible signs of gas migration. *(bubbling or smell of gas etc)*	Hydrocarbon odour. Please note: High CH4 readings may correspond to high levels of other hydrocarbon gases in well (e.g. ethane, propane, buatne, etc).																	
Oil Level	No detectable oil level																	

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH1 07/07/2015; 08:50; HT of 9.0m @ 09:58, LT of 1.4m @15:54						BH2 07/07/2015; 09:15; HT of 9.0m @ 09:58, LT of 1.4m @15:54						BH3 07/07/2015; 09:15; HT of 9.0m @ 09:30, LT of 1.4m @15:54					
Weather conditions	Raining						Raining						Raining					
Recent weather conditions	Intermittent rain and sun.						Intermittent rain and sun.						Intermittent rain and sun					
Atmospheric pressure	1010						1010						1010					
Pressure rising falling or stable, *ref.metcheck before visiting site*	Met Office: Pressure stable						Met Office: Pressure stable						Met Office: Pressure stable					
Ambient temperature	16°c						16°c						16°c					
BH refernce number	BH 1	Readings at following pump interval					BH 2	Readings at following pump interval					BH3	Readings at following pump interval				
Gas concentratation	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %	0.1	0.2	0.2	4	0.3	0	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2
Co2 %	0	3.4	6.4	6.4	6.5	6.4	0.1	8.2	8.2	8.2	8.3	8.4	0	3.5	3.6	3.6	3.7	3.7
O2 %	19.1	13.6	6.9	6.9	6.4	6.6	16	1.2	1	0.8	0.6	0.5	18	16.1	16	16	16	16
H2s ppm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO ppm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VOC ppm	2.9	2.8	1	0.5	0.2	0.2	3.2	3.1	1.7	2.3	1.9	2.6	2.3	1.9	2.3	1.3	2.2	2.2
LEL CH4 %																		
Rel Pressure of gas in hole																		
Gas flow																		
Water level in well	3.64m						Dry well						Dry well					
Diameter well pipe	ID 50mm						ID 50mm						ID 50mm					
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	3.7m						3.53m						3.7m					
Condition of the monitoring point.	Good condition						Good condition						Good condition					
Ground conditions. *(frost , flooded etc)*	Damp ground						Damp ground						Damp ground					
Visible signs of gas migration. *(bubbling or smell of gas etc)*	No visible signs						No visible signs						No visible signs					
Oil Level	No detectable oil level						No detectable oil level						No detectable oil level					

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH5 07/07/2015; 10:00; HT of 9.0m @ 09:58, LT of 1.4m @15:54						BH6a 07/07/2015; 14:20; HT of 9.0m @ 09:58, LT of 1.4m @15:54						BH9 07/07/2015; 15:10; HT of 9.0m @ 09:58, LT of 1.4m @15:54					
Weather conditions	Raining						Raining						Cloudy					
Recent weather conditions	Intermittent rain and sun.						Intermittent rain and sun.						Intermittent rain and sun					
Atmospheric pressure	1010						1010						1010					
Pressure rising falling or stable, *ref.metcheck before visiting site*	Met Office: Pressure stable						Met Office: Pressure stable						Met Office: Pressure stable					
Ambient temperature	16°c						16°c						16°c					
BH refernce number	BH 5	Readings at following pump interval					BH 6a	Readings at following pump interval					BH 9	Readings at following pump interval				
Gas concentratation	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %	0.4	0.3	0.3	0.3	0	0	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Co2 %	0.9	1.7	1.7	1.7	1.6	1.6	0.2	7.8	7.8	7.9	7.9	8	0	2.3	2.3	2.3	2.4	2.4
O2 %	18.2	16.6	16.6	16.6	16.6	16.5	16.9	11.1	11	10.8	10.9	10.7	19.7	17.3	17.3	17.3	17.2	17.2
H2s ppm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO ppm	0	0	0	0	0	0	13	0	0	3	1	2	1	0	2	1	0	2
VOC ppm	2.6	2	1.4	0.9	1.2	1.9	0.6	0.3	1.2	1.11	0.8	0.2	2.5	2	1.7	1.7	1.3	1.3
LEL CH4 %																		
Rel Pressure of gas in hole																		
Gas flow																		
Water level in well	Dry well						Dry well						3.54m					
Diameter well pipe	ID 50mm						ID 50mm						ID 50mm					
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	2.35m						1.9m						3.6m					
Condition of the monitoring point.	Good condition						Good condition						Good condition					
Ground conditions. *(frost , flooded etc)*	Damp ground						Damp ground						Damp ground					
Visible signs of gas migration. *(bubbling or smell of gas etc)*	No visible signs						No visible signs						No visible signs					
Oil Level	No detectable oil level						No detectable oil level						No detectable oil level					

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH4 07/07/2015; 10:00; HT of 9.0m @ 09:58, LT of 1.4m @15:54						AWS1 07/07/2015; 12:15; HT of 9.0m @ 09:58, LT of 1.4m @15:54						AWS2 07/07/2015; 13:15; HT of 9.0m @ 09:58, LT of 1.4m @15:54					
Weather conditions	Raining						Raining						Raining					
Recent weather conditions	Intermittent rain and sun.						Intermittent rain and sun.						Intermittent rain and sun					
Atmospheric pressure	1010						1010						1010					
Pressure rising falling or stable, *ref.metcheck before visiting site*	Met Office: Pressure stable						Met Office: Pressure stable						Met Office: Pressure stable					
Ambient temperature	16°c						16°c						16°c					
BH refernce number	BH 4	Readings at following pump interval					AWS1	Readings at following pump interval					AWS2	Readings at following pump interval				
Gas concentratation	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %	0.2	0.2	0.2	0.2	0.2	0.2	0	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3
Co2 %	0	8.1	8.3	8.9	9.6	10.1	0	0	0	0	0	0	0	0	0	0.5	0.5	0.5
O2 %	19.4	7.5	6.8	6.2	5.5	5	19.6	20	20	20	20	20.1	20.2	18.2	18	11.4	13.8	14.1
H2s ppm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO ppm	3.6	0	0	0	0	0	0	0	1	1	1	2	0	364	403	122	35	19
VOC ppm	2.9	0.5	0.3	0.3	0.3	0.2	1.3	0.7	0.5	0.5	0.5	0.5	0.4	0.5	0.6	0.7	0.7	0.9
LEL CH4 %																		
Rel Pressure of gas in hole																		
Gas flow																		
Water level in well	Dry well						2.3m						2.38					
Diameter well pipe	50mm						19mm						19mm					
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	3.3m						4.3m						3.2m					
Condition of the monitoring point.	Good condition						Good condition						Good condition					
Ground conditions. *(frost , flooded etc)*	Damp ground						Damp ground						Damp ground					
Visible signs of gas migration. *(bubbling or smell of gas etc)*	No visible signs						No visible signs						No visible signs					
Oil Level	No detectable oil level						No detectable oil level						No detectable oil level					

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH10a 07/07/2015; 15:40; HT of 9.0m @ 09:58, LT of 1.4m @15:54																	
Weather conditions	Raining																	
Recent weather conditions	Intermittent rain and sun.																	
Atmospheric pressure	1010																	
Pressure rising falling or stable, *ref.metcheck before visiting site*	Met Office: Pressure stable																	
Ambient temperature	16°c																	
BH refernce number	BH10a	Readings at following pump interval																
Gas concentratation	pre pump	1min	2min	3min	4min	5min												
Ch4 %	0.2	40.5	58.1	75.8	88.5	76.6												
Co2 %	0.5	7.2	8.1	9.1	10	10.6												
O2 %	19.8	9.4	7.8	5.9	4.8	3.9												
H2s ppm	0	0	0	0	0	0												
CO ppm	3	7	9	7	11	1.2												
VOC ppm	1.8	2.5	3.6	15.4	2.2	1.7												
LEL CH4 %																		
Rel Pressure of gas in hole																		
Gas flow																		
Water level in well	Dry well																	
Diameter well pipe	ID 50mm																	
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	3.55m																	
Condition of the monitoring point.	Good condition																	
Ground conditions. *(frost , flooded etc)*	Damp ground																	
Visible signs of gas migration. *(bubbling or smell of gas etc)*	Hydrocarbon odour																	

Oil Level No detectabke oil level

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH1 22/07/2015; 11.00; HT of 8.2m @ 10:52, LT of 2.1m @16:37						BH2 22/07/2015; 11:40; HT of 8.2m @ 10:52, LT of 2.1m @16:37						BH3 22/07/2015; 12:00; HT of 8.2m @ 10:52, LT of 2.1m @16:37					
Weather conditions	Cloudy, dry						Cloudy, dry						Cloudy, dry					
Recent weather conditions	Intermittent rain and sun.						Intermittent rain and sun.						Intermittent rain and sun					
Atmospheric pressure	1015mb						1015mb						1015mb					
Pressure rising falling or stable, *ref.metcheck before visiting site*	Met Office: Small rise in pressure from 1014 on 21/07						Met Office: Small rise in pressure from 1014 on 21/07						Met Office: Small rise in pressure from 1014 on 21/07					
Ambient temperature	15°c						15°c						15°c					
BH refernce number	BH 1	Readings at following pump interval					BH 2	Readings at following pump interval					BH3	Readings at following pump interval				
Gas concentratation	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %	0	0.1	0.1	0.1	0.1	0.1	0	0.1	0.1	0.1	0.1	0.1	0	0.1	0.1	0.1	0.1	0.1
Co2 %	0	6.2	6.2	6.1	5.9	5.7	0	8.2	8.3	8.4	8.5	8.6	0	1.7	1.9	2.4	2.9	3.5
O2 %	19.7	6.2	6.2	6.7	7.6	8.1	19.1	0.8	0.6	0.3	0	0	18.8	17.3	17	16.6	16.1	15.7
H2s ppm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO ppm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VOC ppm	0.9	1.4	1.5	1.1	1.2	1.1	0	2	1.9	1.4	1.3	0.9	0.1	0.5	1	1.2	1.4	1.5
LEL CH4 %	0	2	1	2	2	1	1	2	2	1	1	1	1	2	2	1	1	1
Rel Pressure of gas in hole																		
Gas flow																		
Water level in well	3.68m						Dry well						1cm of damp silt					
Diameter well pipe	ID 50mm						ID 50mm						ID 50mm					
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	3.7m						3.53m						3.7m					
Condition of the monitoring point	Good condition						Good condition						Good condition					
Ground conditions. *(frost , flooded etc)*	Dry ground						Dry ground						Dry ground					
Visible signs of gas migration. *(bubbling or smell of gas etc)*	No visible signs						No visible signs						No visible signs					
Oil Level	No detectable oil level						No detectable oil level						No detectable oil level					

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH4 07/07/2015; 12:25; HT of 8.2m @ 10:52, LT of 2.1m @16:37						AWS1 07/07/2015; 13:00; HT of 9.0m @ 09:58, LT of 1.4m @15:54						AWS2 07/07/2015; 13:30; HT of 9.0m @ 09:58, LT of 1.4m @15:54					
Weather conditions	Cloudy, dry						Cloudy, dry						Cloudy, dry					
Recent weather conditions	Intermittent rain and sun.						Intermittent rain and sun.						Intermittent rain and sun					
Atmospheric pressure	1015						1015						1015					
Pressure rising falling or stable, *ref.metcheck before visiting site*	Met Office: Small rise in pressure from 1014 on 21/07						Met Office: Small rise in pressure from 1014 on 21/07						Met Office: Small rise in pressure from 1014 on 21/07					
Ambient temperature	15°c						15°c						15°c					
BH refernce number	BH 4	Readings at following pump interval					AWS1	Readings at following pump interval					AWS2	Readings at following pump interval				
Gas concentratation	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %	0	0.1	0.1	0.1	0	0.1	0.1	0.1	0.1	0.3	0.2	0	0	0.1	0.1	0.1	0.1	0.1
Co2 %	0	9.6	9.8	10.2	10.4	10.8	0.1	0	0	0	0	0	0	0	0.1	0.1	0.1	0.1
O2 %	19.5	5.7	4.9	4.4	3.9	3.6	18.8	19.8	19.8	19.9	19.8	19.8	19.5	18.4	18.2	18	17.6	17.7
H2s ppm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO ppm	1	2	0	0	0	0	0	1	1	1	0	0	0	28	29	39	45	47
VOC ppm	1	2.5	3.2	3.8	3.9	4	0.5	0.6	0.5	0.4	0.4	0.3	0.3	0.6	0.7	0.7	0.7	0.7
LEL CH4 %	0	1	1	1	0	1	1	1	2	4	2	0	0	1	2	1	1	1
Rel Pressure of gas in hole																		
Gas flow																		
Water level in well	Dry well						2.37m						2.33					
Diameter well pipe	50mm						19mm						19mm					
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	3.3m						4.3m						3.2m					
Condition of the monitoring point.	Good condition						Good condition						Good condition					
Ground conditions. *(frost , flooded etc)*	Dry ground						Dry ground						Dry ground					
Visible signs of gas migration. *(bubbling or smell of gas etc)*	No visible signs						No visible signs						No visible signs					
Oil Level	No detectable oil level						No detectable oil level						No detectable oil level					

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH5 22/07/2015; 13:50; HT of 8.2m @ 10:52, LT of 2.1m @16:37						BH6a 22/07/2015; 14:25; HT of 8.2m @ 10:52, LT of 2.1m @16:37						BH9 22/07/2015; 14:45; HT of 8.2m @ 10:52, LT of 2.1m @15:54					
Weather conditions	Cloudy, dry						Sunny, dry						Sunny, dry					
Recent weather conditions	Intermittent rain and sun.						Intermittent rain and sun.						Intermittent rain and sun					
Atmospheric pressure	1015mb						1015mb						1015mb					
Pressure rising falling or stable, *ref.metcheck before visiting site*	Met Office: Small rise in pressure from 1014 on 21/07						Met Office: Small rise in pressure from 1014 on 21/07						Met Office: Small rise in pressure from 1014 on 21/07					
Ambient temperature	15°c						15°c						15°c					
BH refernce number	BH 5	Readings at following pump interval					BH 6a	Readings at following pump interval					BH9	Readings at following pump interval				
Gas concentratation	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Co2 %	0	2.7	2.8	2.8	2.9	3	0	6.3	6.3	6.3	6.3	6.4	0	2	2.1	2.2	2.3	2.3
O2 %	19.5	13.4	13.2	13.2	13.1	13.2	19.6	12.5	12.5	12.5	12.5	12.2	19.3	16.8	16.7	16.6	16.5	16.4
H2s ppm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO ppm	0	0	1	1	1	0	1	0	1	2	1	0	0	1	1	0	0	2
VOC ppm	0.2	3.7	4	4.1	4.1	4.1	0.7	2.8	3	3.4	3.6	3.7	3.5	5.1	5.4	5.8	5.9	5
LEL CH4 %	0	1	2	2	3	1	1	2	1	1	1	2	0	1	1	1	1	1
Rel Pressure of gas in hole																		
Gas flow																		
Water level in well	Dry well						Dry well						3.51m					
Diameter well pipe	ID 50mm						ID 50mm						ID 50mm					
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	2.35m						1.9m						3.6m					
Condition of the monitoring point.	Good condition						Good condition						Good condition					
Ground conditions. *(frost , flooded etc)*	Dry ground						Dry ground						Dry ground					
Visible signs of gas migration. *(bubbling or smell of gas etc)*	No visible signs						No visible signs						No visible signs					
Oil Level	No detectable oil level						No detectable oil level						No detectable oil level					

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH10a 22/07/2015; 15:15; HT of 8.2m @ 10:52, LT of 2.1m @ 16:37																	
Weather conditions	Sunny																	
Recent weather conditions	Intermittent rain and sun.																	
Atmospheric pressure	1015																	
Pressure rising falling or stable, *ref.metcheck before visiting site*	Met Office: Small rise in pressure from 1014 on 21/07																	
Ambient temperature	15°c																	
BH refernce number	BH10a	Readings at following pump interval																
Gas concentratation	pre pump	1min	2min	3min	4min	5min												
Ch4 %	0.1	68.8	75.1	84.8	87.6	96												
Co2 %	0	11.6	11.7	12.2	12.3	12.6												
O2 %	19.3	2.5	2	1.4	1.2	0.7												
H2s ppm	0	0	0	0	0	0												
CO ppm	0	1	4	5	6	7												
VOC ppm	209	209	211	213	217	220												
LEL CH4 %	0	>>>	>>>	>>>	>>>	>>>												
Rel Pressure of gas in hole																		
Gas flow																		
Water level in well	Dry well																	
Diameter well pipe	ID 50mm																	
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	3.55m																	
Condition of the monitoring point.	Good condition																	
Ground conditions. *(frost , flooded etc)*	Dry ground																	
Visible signs of gas migration. *(bubbling or smell of gas etc)*	Slight hydrocarbon odour																	
Oil level	No detectable oil level																	

Please Note: Higher PID readings obtained due to an improved valve to meter connection.

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH1 08/07/2015; 08:15; HT of 8.6m @ 10:49, LT of 1.8m @16:48						BH2 08/07/2015; 08:30; HT of 8.6m @ 10:49, LT of 1.8m @ 16:48						BH3 02/07/2015; 08:45; HT of 8.6m @ 10:49, LT of 1.8m @ 16:48					
Weather conditions	Raining						Raining						Raining					
Recent weather conditions	Intermittent rain and sun.						Intermittent rain and sun.						Intermittent rain and sun.					
Atmospheric pressure	1011mb						1011mb						1011mb					
Pressure rising falling or stable, *ref.metcheck before visiting site*	Ref: Met Office. Steady rise in pressure from 1008 at midnight on 07/07						Ref: Met Office. Steady rise in pressure from 1008 at midnight on 07/07						Ref: Met Office. Steady rise in pressure from 1008 at midnight on 07/07					
Ambient temperature	16°c						16°c						16°c					
BH refernce number	BH 1	Readings at following pump interval					BH 2	Readings at following pump interval					BH3	Readings at following pump interval				
Gas concentratation	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %																		
Co2 %																		
O2 %																		
H2s ppm																		
16°c+B12:S16																		
VOC ppm																		
LEL CH4 %																		
Rel Pressure of gas in hole																		
Gas flow																		
Water level in well	3.65m						Dry well						Dry well					
Diameter well pipe	ID 50mm						ID 50mm						ID 50mm					
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	3.7m						3.53m						3.7m					
Condition of the monitoring point.	Good condition						Good condition						Good condition					
Ground conditions. *(frost , flooded etc)*	Damp ground						Damp ground						Damp ground					
Visible signs of gas migration. *(bubbling or smell of gas etc)*	No visible signs						No visible signs						No visible signs					
Oil Level	No detectable oil level						No detectable oil level						No detectable oil level					

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH4 08/07/2015; 09:00; HT of 8.6m @ 10:49, LT of 1.8m @16:48						AWS1 08/07/2015; 09:10; HT of 8.6m @ 10:49, LT of 1.8m @ 16:48						AWS2 02/07/2015; 09:20; HT of 8.6m @ 10:49, LT of 1.8m @ 16:48					
Weather conditions	Raining						Raining						Raining					
Recent weather conditions	Intermittent rain and sun.						Intermittent rain and sun.						Intermittent rain and sun.					
Atmospheric pressure	1011mb						1011mb						1011mb					
Pressure rising falling or stable, *ref.metcheck before visiting site*	Ref: Met Office. Steady rise in pressure from 1008 at midnight on 07/07						Ref: Met Office. Steady rise in pressure from 1008 at midnight on 07/07						Ref: Met Office. Steady rise in pressure from 1008 at midnight on 07/07					
Ambient temperature	16°c						16°c						16°c					
BH refernce number	BH 4	Readings at following pump interval					AWS1	Readings at following pump interval					AWS2	Readings at following pump interval				
Gas concentratation	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %																		
Co2 %																		
O2 %																		
H2s ppm																		
16°c+B12:S16																		
VOC ppm																		
LEL CH4 %																		
Rel Pressure of gas in hole																		
Gas flow																		
Water level in well	Dry well						2.3m						2.4m					
Diameter well pipe	ID 50mm						ID 19mm						ID 19mm					
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	3.3m						4.3m						3.2m					
Condition of the monitoring point.	Good condition						Good condition						Good condition					
Ground conditions. *(frost , flooded etc)*	Damp ground						Damp ground						Damp ground					
Visible signs of gas migration. *(bubbling or smell of gas etc)*	No visible signs						No visible signs						No visible signs					
Oil Level	No detectable oil level						No detectable oil level						No detectable oil level					

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH5 08/07/2015; 09:30; HT of 8.6m @ 10:49, LT of 1.8m @16:48						BH6a 08/07/2015; 09:40; HT of 8.6m @ 10:49, LT of 1.8m @ 16:48						BH9 02/07/2015; 09:55; HT of 8.6m @ 10:49, LT of 1.8m @ 16:48					
Weather conditions	Raining						Raining						Raining					
Recent weather conditions	Intermittent rain and sun.						Intermittent rain and sun.						Intermittent rain and sun.					
Atmospheric pressure	1011mb						1011mb						1011mb					
Pressure rising falling or stable, *ref.metcheck before visiting site*	Ref: Met Office. Steady rise in pressure from 1008 at midnight on 07/07						Ref: Met Office. Steady rise in pressure from 1008 at midnight on 07/07						Ref: Met Office. Steady rise in pressure from 1008 at midnight on 07/07					
Ambient temperature	16°c						16°c						16°c					
BH refernce number	BH 5	Readings at following pump interval					BH 6a	Readings at following pump interval					BH9	Readings at following pump interval				
Gas concentratation	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %																		
Co2 %																		
O2 %																		
H2s ppm																		
16°c+B12:S16																		
VOC ppm																		
LEL CH4 %																		
Rel Pressure of gas in hole																		
Gas flow																		
Water level in well	Dry well						Dry well						3.54m					
Diameter well pipe	ID 50mm						ID 50mm						ID 50mm					
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	2.35m						1.9m						3.6m					
Condition of the monitoring point.	Good condition						Good condition						Good condition					
Ground conditions. *(frost , flooded etc)*	Damp ground						Damp ground						Damp ground					
Visible signs of gas migration. *(bubbling or smell of gas etc)*	No visible signs						No visible signs						No visible signs					
Oil Level	No detectable oil level						No detectable oil level						No detectable oil level					

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH10a 08/07/2015; 10:10; HT of 8.6m @ 10:49, LT of 1.8m @16:48																	
Weather conditions	Raining																	
Recent weather conditions	Intermittent rain and sun.																	
Atmospheric pressure	1011mb																	
Pressure rising falling or stable, *ref.metcheck before visiting site*	Ref: Met Office. Steady rise in pressure from 1008 at midnight on 07/07																	
Ambient temperature	16°c																	
BH refernce number	BH 10a	Readings at following pump interval						BH 2	Readings at following pump interval					BHA	Readings at following pump interval				
Gas concentratation	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %																		
Co2 %																		
O2 %																		
H2s ppm																		
16°c+B12:S16																		
VOC ppm																		
LEL CH4 %																		
Rel Pressure of gas in hole																		
Gas flow																		
Water level in well	Dry well																	
Diameter well pipe	ID 50mm																	
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	3.55m																	
Condition of the monitoring point.	Good condition																	
Ground conditions. *(frost , flooded etc)*	Damp ground																	
Visible signs of gas migration. *(bubbling or smell of gas etc)*	No visible signs																	

Oil Level No detectable oil level

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH1 09/07/2015; 08:20; HT of 8.2m @ 11:45, LT of 2.2m @17:52						BH2 09/07/2015; 08:30; HT of 8.2m @ 11:45, LT of 2.2m @17:52						BH1 09/07/2015; 08:40; HT of 8.2m @ 11:45, LT of 2.2m @17:52					
Weather conditions	Sunny						Sunny						Sunny					
Recent weather conditions	Intermittent rain and sun						Intermittent rain and sun						Intermittent rain and sun					
Atmospheric pressure	1025mb						1025mb						1025mb					
Pressure rising falling or stable, *ref.metcheck before visiting site*	Ref: Met Office. Steady rise in pressure.						Ref: Met Office. Steady rise in pressure.						Ref: Met Office. Steady rise in pressure.					
Ambient temperature	18°c						18°c						18°c					
BH refernce number	BH 1	Readings at following pump interval					BH 2	Readings at following pump interval					BH3	Readings at following pump interval				
Gas concentratation	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %																		
Co2 %																		
O2 %																		
H2s ppm																		
CO ppm																		
VOC ppm																		
LEL CH4 %																		
Rel Pressure of gas in hole																		
Gas flow																		
Water level in well	3.65m						Dry well						Dry well					
Diameter well pipe	50mm																	
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	3.7m						3.53m						3.7m					
Condition of the monitoring point.	Good condition						Good condition						Good condition					
Ground conditions. *(frost , flooded etc)*	Damp ground						Damp ground						Damp ground					
Visible signs of gas migration. *(bubbling or smell of gas etc)*	No visible signs						No visible signs						No visible signs					
Oil Level	No detectable oil level						No detectable oil level						No detectable oil level					

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH4 09/07/2015; 08:50; HT of 8.2m @ 11:45, LT of 2.2m @17:52						AWS1 09/07/2015; 09:00; HT of 8.2m @ 11:45, LT of 2.2m @17:52						AWS2 09/07/2015; 09:10; HT of 8.2m @ 11:45, LT of 2.2m @17:52					
Weather conditions	Sunny						Sunny						Sunny					
Recent weather conditions	Intermittent rain and sun						Intermittent rain and sun						Intermittent rain and sun					
Atmospheric pressure	1025mb						1025mb						1025mb					
Pressure rising falling or stable, *ref.metcheck before visiting site*	Ref: Met Office. Steady rise in pressure.						Ref: Met Office. Steady rise in pressure.						Ref: Met Office. Steady rise in pressure.					
Ambient temperature	18°c						18°c						18°c					
BH refernce number	BH 4	Readings at following pump interval					AWS1	Readings at following pump interval					AWS2	Readings at following pump interval				
Gas concentratation	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %																		
Co2 %																		
O2 %																		
H2s ppm																		
CO ppm																		
VOC ppm																		
LEL CH4 %																		
Rel Pressure of gas in hole																		
Gas flow																		
Water level in well	Dry well						2.41m						2.4m					
Diameter well pipe	50mm						19mm						19mm					
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	3.3m						4.3m						3.2m					
Condition of the monitoring point.	Good condition						Good condition						Good condition					
Ground conditions. *(frost , flooded etc)*	Damp ground						Damp ground						Damp ground					
Visible signs of gas migration. *(bubbling or smell of gas etc)*	No visible signs						No visible signs						No visible signs					
Oil Level	No detectable oil level						No detectable oil level						No detectable oil level					

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH5 09/07/2015; 09:15; HT of 8.2m @ 11:45, LT of 2.2m @17:52						BH6a 09/07/2015; 09:40; HT of 8.2m @ 11:45, LT of 2.2m @17:52						BH9 09/07/2015; 10:00; HT of 8.2m @ 11:45, LT of 2.2m @17:52					
Weather conditions	Sunny						Sunny						Sunny					
Recent weather conditions	Intermittent rain and sun						Intermittent rain and sun						Intermittent rain and sun					
Atmospheric pressure	1025mb						1025mb						1025mb					
Pressure rising falling or stable, *ref.metcheck before visiting site*	Ref: Met Office. Steady rise in pressure.						Ref: Met Office. Steady rise in pressure.						Ref: Met Office. Steady rise in pressure.					
Ambient temperature	18°c						18°c						18°c					
BH refernce number	BH 5	Readings at following pump interval					BH 6a	Readings at following pump interval					BH9	Readings at following pump interval				
Gas concentratation	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %																		
Co2 %																		
O2 %																		
H2s ppm																		
CO ppm																		
VOC ppm																		
LEL CH4 %																		
Rel Pressure of gas in hole																		
Gas flow																		
Water level in well	Dry well						Dry well						3.5m					
Diameter well pipe	50mm						19mm						19mm					
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	2.35m						1.9m						3.6m					
Condition of the monitoring point.	Good condition						Good condition						Good condition					
Ground conditions. *(frost , flooded etc)*	Damp ground						Damp ground						Damp ground					
Visible signs of gas migration. *(bubbling or smell of gas etc)*	No visible signs						No visible signs						No visible signs					
Oil Level	No detectable oil level						No detectable oil level						No detectable oil level					

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH10a 09/07/2015; 10:10; HT of 8.2m @ 11:45, LT of 2.2m @17:52																	
Weather conditions	Sunny																	
Recent weather conditions	Intermittent rain and sun																	
Atmospheric pressure	1025mb																	
Pressure rising falling or stable, *ref.metcheck before visiting site*	Ref: Met Office. Steady rise in pressure.																	
Ambient temperature	18°c																	
BH refernce number	BH 10a	Readings at following pump interval					BH 2	Readings at following pump interval					BHA	Readings at following pump interval					
Gas concentratation	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %																		
Co2 %																		
O2 %																		
H2s ppm																		
CO ppm																		
VOC ppm																		
LEL CH4 %																		
Rel Pressure of gas in hole																		
Gas flow																		
Water level in well	Dry well																	
Diameter well pipe	50mm																	
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	3.55m																	
Condition of the monitoring point.	Good condition																	
Ground conditions. *(frost , flooded etc)*	Damp ground																	
Visible signs of gas migration. *(bubbling or smell of gas etc)*	No visible signs																	
Oil Level	No detectable oil level																	

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH1 07/08/2015; 09:00; HT of 11.31m @ 12:25, LT of 4.86m @06:07						BH2 07/08/2015; 09:45; HT of 11.31m @ 12:25, LT of 4.86m @06:07						BH3 07/08/2015; 09:15; HT of 11.31m @ 12:25, LT of 4.86m @06:07					
Weather conditions	Sunny, Dry						Sunny, Dry						Sunny, Dry					
Recent weather conditions	Intermittent rain and sun.						Intermittent rain and sun.						Intermittent rain and sun					
Atmospheric pressure	1018mb						1018mb						1018mb					
Pressure rising falling or stable, *ref.metcheck before visiting site*	Met Office: Steady rise in pressure						Met Office: Steady rise in pressure						Met Office: Steady rise in pressure					
Ambient temperature	19°c						19°c						19°c					
BH refernce number	BH 1	Readings at following pump interval					BH 2	Readings at following pump interval					BH3	Readings at following pump interval				
Gas concentratation	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %	0	0.1	0.1	0	0	0	0.2	0	0	0	0	0	0	0.8	4.2	7	2.8	0.3
Co2 %	0	5.7	5.7	5.5	5	4.7	0.6	8.1	7.7	7.2	7.1	7.5	0.2	3.9	5.1	5.5	5.4	4.6
O2 %	18.4	7.4	7.3	7.4	8	8.3	15.7	0.8	0.4	0.2	0	0	17.7	15.5	15.4	15.4	15.2	15
H2s ppm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO ppm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VOC ppm	0	1.5	2.3	1.7	1.4	1.4	0	5.3	6.8	6	4.8	2.6	0	2.3	3.1	5.1	9.4	6.3
LEL CH4 %	0	2	3	0	0	0	3	0	0	0	0	0	0	16	92	>>>	43	5
Rel Pressure of gas in hole (mb)	0.19	0.19	0.19	0.19	0.19	0.19	0.1	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
Gas flow																		
Water level in well	3.68m						Dry well						Dry well					
Diameter well pipe	ID 50mm						ID 50mm						ID 50mm					
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	3.7m						3.53m						3.7m					
Condition of the monitoring point.	Good condition, raised cover						Good condition, raised cover						Good condition, raised cover					
Ground conditions. *(frost , flooded etc)*	Dry ground						Dry ground						Dry ground					
Visible signs of gas migration. *(bubbling or smell of gas etc)*	No visible signs						No visible signs						No visible signs					
Oil Level	No detectable oil level						No detectable oil level						No detectable oil level					

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH4 07/08/2015; 10:40; HT of 11.31m @ 12:25, LT of 4.86m @06:07						AWS1 07/08/2015; 11:00; HT of 11.31m @ 12:25, LT of 4.86m @06:07						AWS2 07/08/2015; 11:30; HT of 11.31m @ 12:25, LT of 4.86m @06:07					
Weather conditions	Sunny, Dry						Sunny, Dry						Sunny, Dry					
Recent weather conditions	Intermittent rain and sun.						Intermittent rain and sun.						Intermittent rain and sun					
Atmospheric pressure	1018mb						1018mb						1018mb					
Pressure rising falling or stable, *ref.metcheck before visiting site*	Met Office: Steady rise in pressure						Met Office: Steady rise in pressure						Met Office: Steady rise in pressure					
Ambient temperature	19°c						19°c						19°c					
BH refernce number	BH 4	Readings at following pump interval					AWS1	Readings at following pump interval					AWS2	Readings at following pump interval				
Gas concentratation	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %	0	0.1	0.1	0.1	0.1	0.1	0	0.1	0.1	0.1	0.2	0	0	0.1	0.1	0.1	0.1	0.1
Co2 %	0	10.3	10.4	10.5	10.6	10.7	0	0	0	0	0	0	0	0	0	0.5	0.5	0.5
O2 %	18.1	4.4	4.2	4.1	4	3.8	18.8	19.2	19.3	19.3	19.3	19.3	19.5	19.5	19.1	16	16.2	16.4
H2s ppm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO ppm	0	0	0	0	0	0	0	0	0	1	2	0	0	13	93	52	46	48
VOC ppm	0	7	12.9	13.6	12.6	14.3	0	0	0.2	0.2	0.1	0.1	0	0.6	1.2	1.6	1.7	2
LEL CH4 %	0	2	2	2	2	2	0	1	1	1	3	0	0	2	1	1	1	1
Rel Pressure of gas in hole (mb)	0.19	0.19	0.19	0.19	0.19	0.19	-0.05	-0.04	-0.04	-0.04	-0.04	-0.04	0.1	0.11	0.11	0.11	0.11	0.11
Gas flow																		
Water level in well	Dry well						2.3m						2.35m					
Diameter well pipe	ID 50mm						ID 19mm						ID 19mm					
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	3.3m						4.3m						3.2m					
Condition of the monitoring point.	Good condition, raised cover						Good condition, raised cover						Good condition					
Ground conditions. *(frost , flooded etc)*	Dry ground						Dry ground						Dry ground					
Visible signs of gas migration. *(bubbling or smell of gas etc)*	No visible signs						No visible signs						No visible signs					
Oil Level	No detectable oil level						No detectable oil level						No detectable oil level					

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH5 07/08/2015; 12:25; HT of 11.31m @ 12:25, LT of 4.86m @06:07						BH6a 07/08/2015; 12:45; HT of 11.31m @ 12:25, LT of 4.86m @06:08						BH9 07/08/2015; 13:05; HT of 11.31m @ 12:25, LT of 4.86m @06:09					
Weather conditions	Sunny, Dry						Sunny, Dry						Sunny, Dry					
Recent weather conditions	Intermittent rain and sun.						Intermittent rain and sun.						Intermittent rain and sun					
Atmospheric pressure	1018mb						1018mb						1018mb					
Pressure rising falling or stable, *ref.metcheck before visiting site*	Met Office: Steady rise in pressure						Met Office: Steady rise in pressure						Met Office: Steady rise in pressure					
Ambient temperature	19°c						19°c						19°c					
BH refernce number	BH 5	Readings at following pump interval					BH 6a	Readings at following pump interval					BH 9	Readings at following pump interval				
Gas concentratation	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min	pre pump	1min	2min	3min	4min	5min
Ch4 %	0	0.1	0.1	0.1	0.1	0.1	0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Co2 %	0	1.9	1.9	1.9	1.9	1.9	0	7.2	7.3	7.4	7.4	7.7	0.1	2.2	2.3	2.4	2.5	2.5
O2 %	19.4	15.7	15.7	15.6	15.5	15.6	19.1	11.1	10.9	10.7	10.4	10.2	18.8	16.4	16.3	16.3	16.2	16.1
H2s ppm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CO ppm	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
VOC ppm	0	8	8.6	9	8.1	8.4	0	3.6	3.7	3.1	2.9	3.1	0	7.2	11.2	11.4	9.5	8
LEL CH4 %	0	2	2	1	1	1	0	2	2	1	1	1	1.000	1	1	1	2	1
Rel Pressure of gas in hole (mb)	0.1	0.11	0.11	0.11	0.11	0.11	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.6	-0.61	-0.61	-0.61	-0.61	-0.61
Gas flow																		
Water level in well	Dry well						Dry well						3.55m					
Diameter well pipe	ID 50mm						ID 50mm						ID 50mm					
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	2.35m						1.9m						3.6m					
Condition of the monitoring point.	Good condition, raised cover						Good condition, raised cover						Good condition, raised cover					
Ground conditions. *(frost , flooded etc)*	Dry ground						Dry ground						Dry ground					
Visible signs of gas migration. *(bubbling or smell of gas etc)*	No visible signs						No visible signs						No visible signs					
Oil Level	No detectable oil level						No detectable oil level						No detectable oil level					

Site name	**Swansea Bay Tide Lagoon 113KV GI**																	
Engineer contact for access	**Atkins**						Site owner notify prior to visit ABP						Apex Job Ref 10318					
Date time and site details etc	BH10a 07/08/2015; 13:35 HT of 11.31m @ 12:25, LT of 4.86m @06:07																	
Weather conditions	Sunny, Dry																	
Recent weather conditions	Intermittent rain and sun.																	
Atmospheric pressure	1018mb																	
Pressure rising falling or stable, *ref.metcheck before visiting site*	Met Office: Steady rise in pressure																	
Ambient temperature	19°c																	
BH refernce number	BH10a	Readings at following pump interval																
Gas concentratation	pre pump	1min	2min	3min	4min	5min												
Ch4 %	0	16.2	57.8	72.3	84.7	99.9												
Co2 %	0	9.6	10.3	11.3	12.1	12.9												
O2 %	19	5.3	4.2	3	1.9	0.8												
H2s ppm	0	0	0	0	0	0												
CO ppm	0	0	5	4	5	7												
VOC ppm	0	8.5	2	3.6	4	4.1												
LEL CH4 %	0	>>>	>>>	>>>	>>>	>>>												
Rel Pressure of gas in hole (mb)	-0.6	-0.61	-0.61	-0.61	-0.61	-0.61												
Gas flow																		
Water level in well	Dry well																	
Diameter well pipe	ID 50mm																	
Depth of response zone. *(from driller logs / client)*																		
Total depth well. *(from drillers log / client)*	3.55m																	
Condition of the monitoring point.	Good condition																	
Ground conditions. *(frost , flooded etc)*	Damp ground																	
Visible signs of gas migration. *(bubbling or smell of gas etc)*	Hydrocarbon odour																	

Oil Level No detectable oil level

ENCLOSURE C

IN SITU TESTING

Plate Load Bearing CBR	Report No. D5232-15/1
Trial Pit Soakaway	S1, S3 to S7, S8A, S9 to S11, S15 to S16
Dynamic Cone Penetration Test	DCPTP13, DCPTP19, DCPTP20, DCPTP25, DCPTP33, DCPDCPTP49 & DCPTP59

Apex Testing Solutions
Sturmi Way
Village Farm Industrial Estate
Pyle
Bridgend
CF33 6BZ
Telephone :01656 746762
Facsimile :01656 749096
Email : richard.anstee@apex-drilling.com

REPORT No.	:	D5232-15 / 1
CLIENT	:	Apex Drilling Services
SITE	:	Swansea Bay Tidal Lagoon
MATERIAL DESCRIPTION	:	See Individual Tests Results
DATE TESTED	:	01 July 2015
TESTING REQUIRED	:	5 No. Plate Load Bearing Tests
RELEVANT SPECIFICATION	:	BS 1377 : Part 9 : 1990 In House Method / Clients Specification IAN 73/06 (supercedes HD 25/94)
TEST METHOD	:	Clause 4.1.6.4.2
TEST RESULTS	:	See Pages 3 – 7

Apex Testing Solutions
Sturmi Way
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CF33 6BZ
Telephone :01656 746762
Facsimile :01656 749096
Email : richard.anstee@apex-drilling.com

REPORT No.	:	D5232-15 / 1
CLIENT	:	Apex Drilling Services
SITE	:	Swansea Bay Tidal Lagoon
TEST LOCATION	:	5 No. Locations as instructed by Client
DEPTH (m)	:	See Individual Test Results
Reaction Load	:	7 Tonne Machine
Plate Diameter	:	300mm
Seating Pressure	:	10kN/m2

TEST RESULTS

kN/m^2	Settlement mm				
Test No.	1	2	3	4	5
10.0	0.00	0.00	0.00	0.00	0.00
138.6	-	-	-	0.69	-
208.0	0.89	1.06	0.97	-	0.94
277.3	1.40	1.63	1.85	1.44	1.49
CBR%	24	20	20	22	22

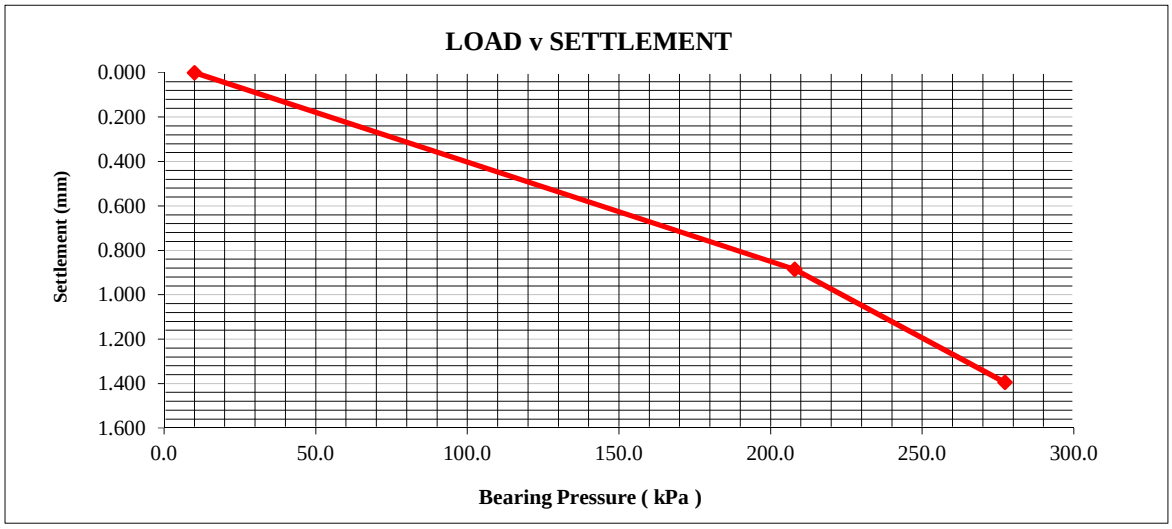
COMMENTS
Weather - Bright and sunny

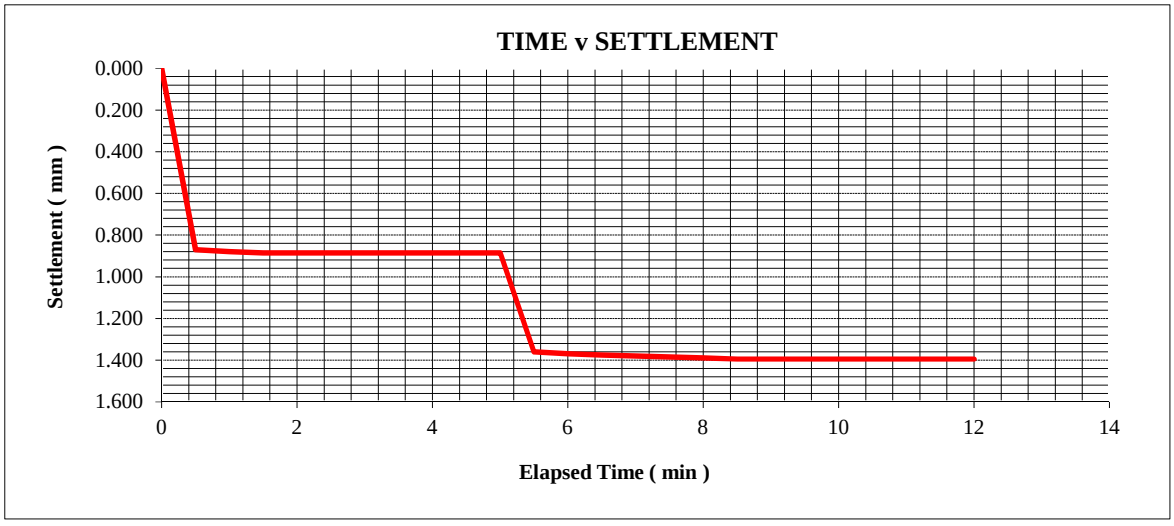
CHECKED BY: Richard Anstee DATE: 05/07/2015

REPORT No : D5232-15 / 1
CLIENT : Apex Drilling Services
SITE : Swansea Bay Tidal Lagoon

TEST RESULTS

TEST No.	: 1		
DATE TESTED	: 01 July 2015		
SAMPLE TYPE	: Re-compacted		
DEPTH (m)	: EGL		
SAMPLE DESCRIPTION	: Brown silty sandy GRAVEL		
LOCATION	: CBR 1		
Plate Size	: 300 mm		
LOAD TO ACHIEVE 1.25mm SETTLEMENT >		:	257.60 kN/m^2
MODULUS OF SUBGRADE REACTION (k_{762}) >		:	91024 kN/m2/m
~CBR VALUE >		:	24 %

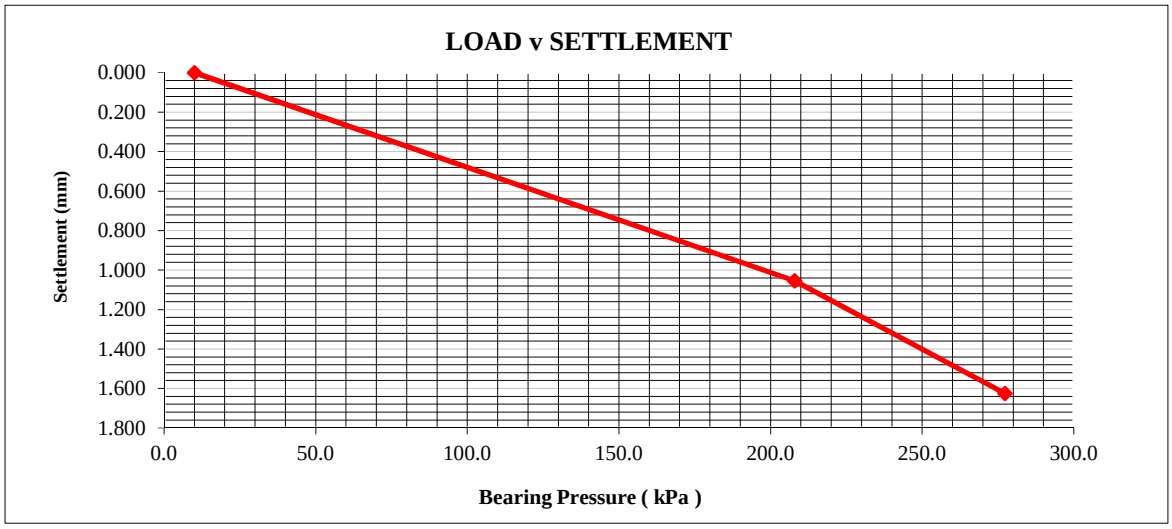


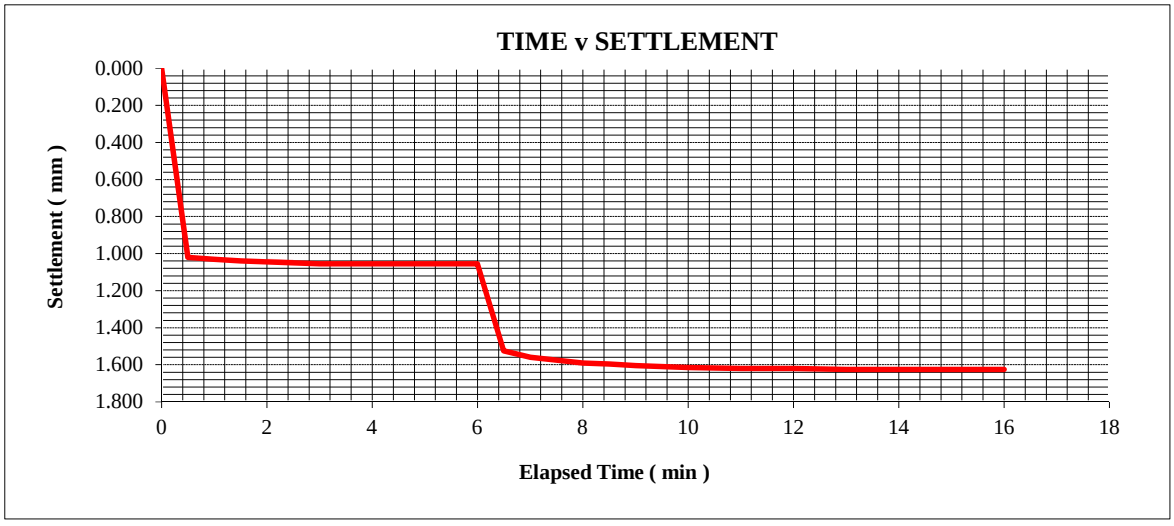


REPORT No : D5232-15 / 1
CLIENT : Apex Drilling Services
SITE : Swansea Bay Tidal Lagoon

TEST RESULTS

TEST No.	: 2		
DATE TESTED	: 01 July 2015		
SAMPLE TYPE	: Re-compacted		
DEPTH (m)	: EGL		
SAMPLE DESCRIPTION	: Brown silty sandy GRAVEL		
LOCATION	: CBR 2		
Plate Size	: 300 mm		
LOAD TO ACHIEVE 1.25mm SETTLEMENT >		:	231.71 kN/m^2
MODULUS OF SUBGRADE REACTION (k_{762}) >		:	81876 kN/m2/m
~CBR VALUE >		:	20 %

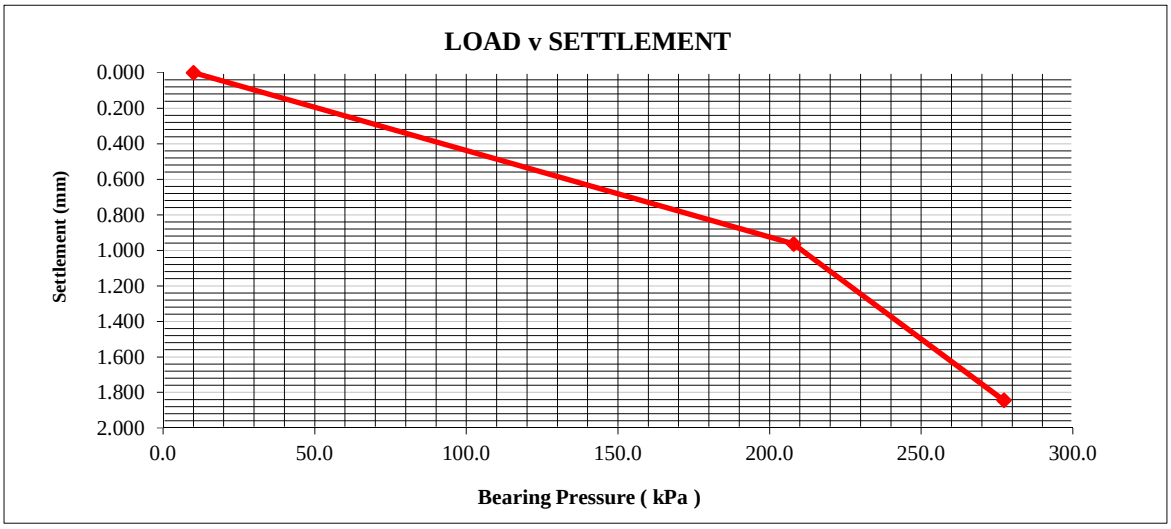


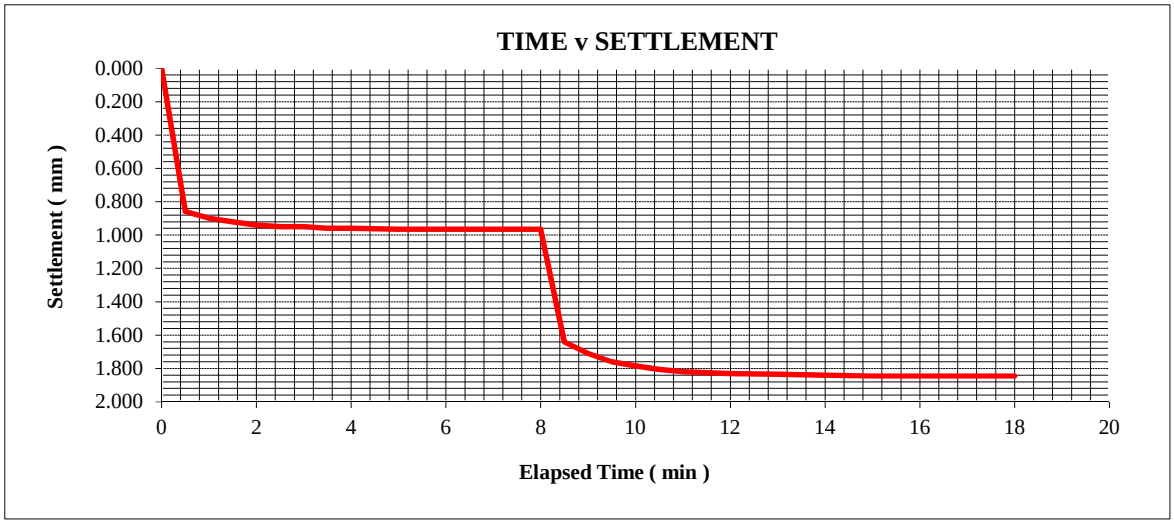


REPORT No : D5232-15 / 1
CLIENT : Apex Drilling Services
SITE : Swansea Bay Tidal Lagoon

TEST RESULTS

TEST No.	: 3		
DATE TESTED	: 01 July 2015		
SAMPLE TYPE	: Re-compacted		
DEPTH (m)	: EGL		
SAMPLE DESCRIPTION	: Brown silty sandy GRAVEL		
LOCATION	: CBR 3		
Plate Size	: 300 mm		
LOAD TO ACHIEVE 1.25mm SETTLEMENT >		:	230.44 kN/m^2
MODULUS OF SUBGRADE REACTION (k_{762}) >		:	81430 kN/m2/m
~CBR VALUE >		:	20 %

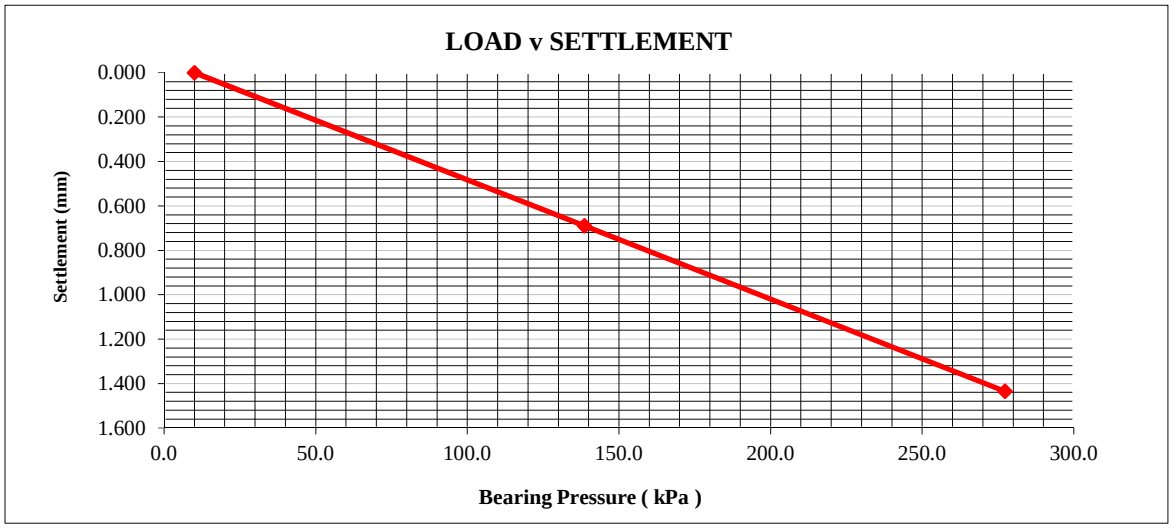


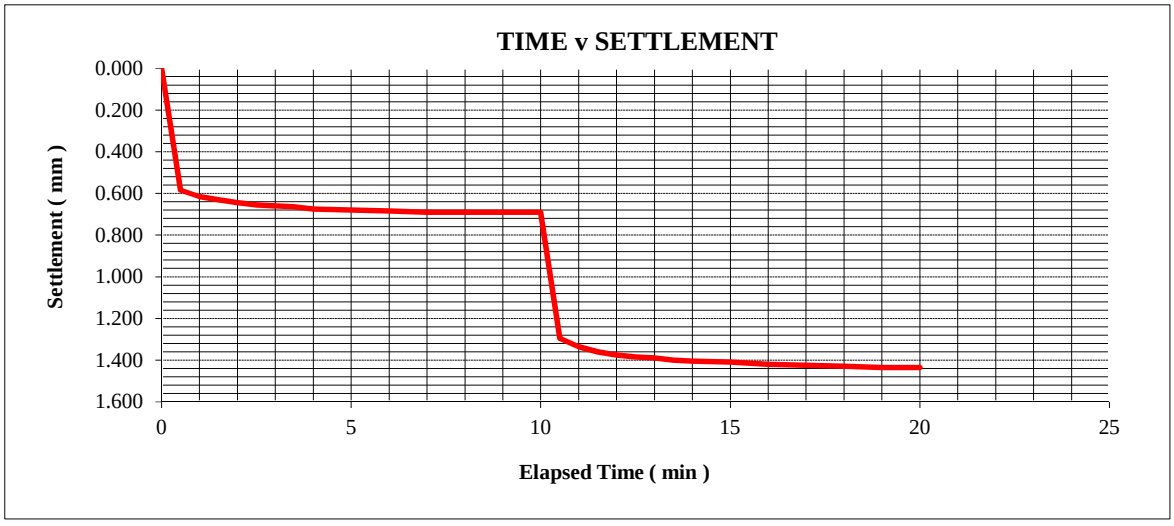


REPORT No : D5232-15 / 1
CLIENT : Apex Drilling Services
SITE : Swansea Bay Tidal Lagoon

TEST RESULTS

TEST No.	: 4		
DATE TESTED	: 01 July 2015		
SAMPLE TYPE	: Re-compacted		
DEPTH (m)	: EGL		
SAMPLE DESCRIPTION	: Brown silty sandy GRAVEL		
LOCATION	: CBR 4		
Plate Size	: 300 mm		
LOAD TO ACHIEVE 1.25mm SETTLEMENT >		:	242.86 kN/m^2
MODULUS OF SUBGRADE REACTION (k_{762}) >		:	85816 kN/m2/m
~CBR VALUE >		:	22 %

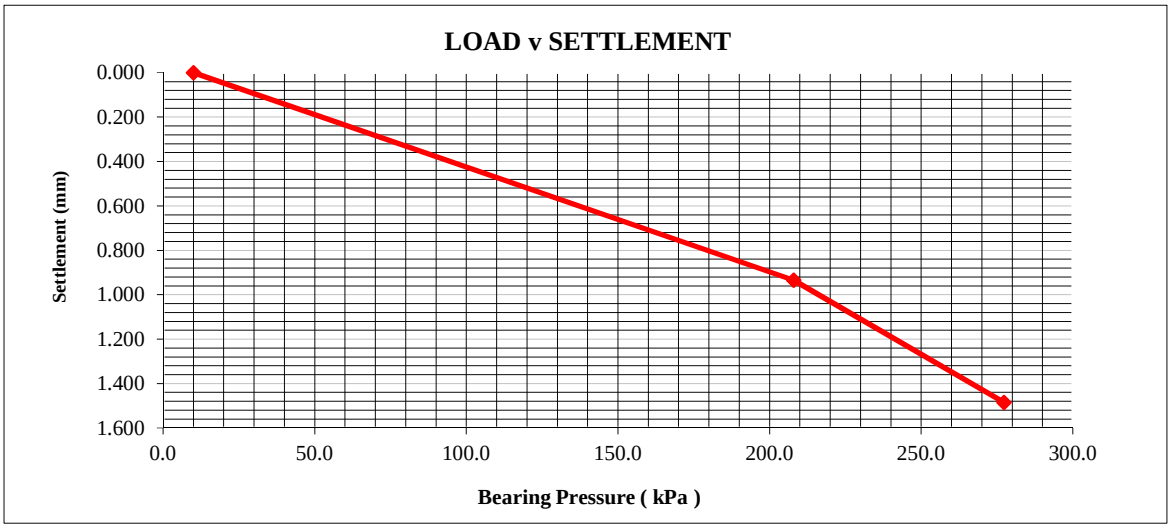


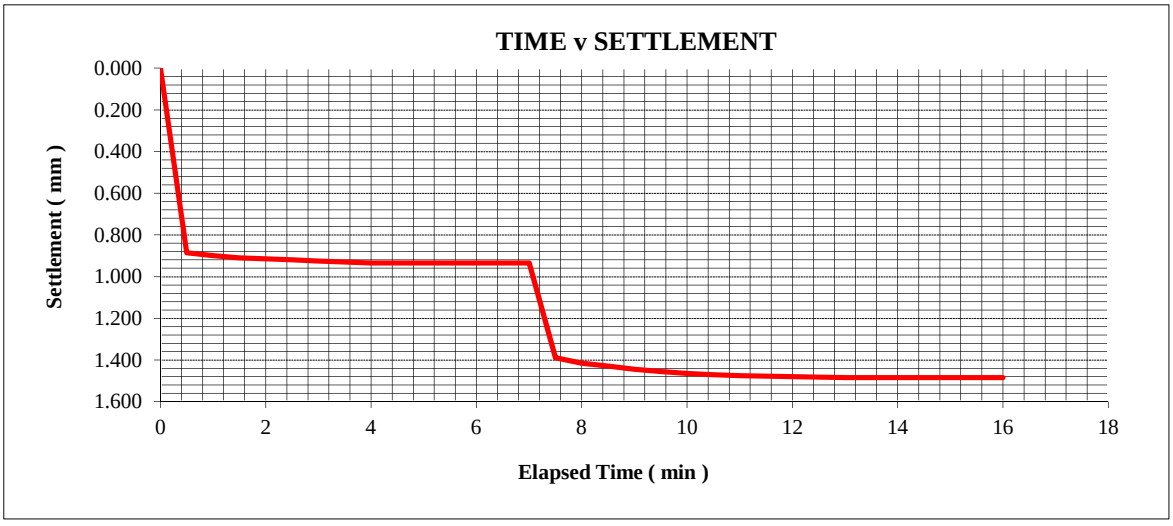


REPORT No : D5232-15 / 1
CLIENT : Apex Drilling Services
SITE : Swansea Bay Tidal Lagoon

TEST RESULTS

TEST No.	: 5		
DATE TESTED	: 01 July 2015		
SAMPLE TYPE	: Re-compacted		
DEPTH (m)	: EGL		
SAMPLE DESCRIPTION	: Brown silty sandy GRAVEL		
LOCATION	: CBR 5		
Plate Size	: 300 mm		
LOAD TO ACHIEVE 1.25mm SETTLEMENT >		:	247.69 kN/m^2
MODULUS OF SUBGRADE REACTION (k_{762}) >		:	87524 kN/m2/m
~CBR VALUE >		:	22 %





SOAKAWAY TEST

	Job Name :	**SBTL**	**Test:**	**TPS1.1**
	Date :	**03/07/2015**	**Time:**	**09:23:00**
	Technician :	**AB**	**High Tide:**	**06.54 9.3m**
1	**Depth of Pit, d(m)**	1.50		**complete green only**
2	**Length of Pit,L(m)**	1.50		
3	**Width of Pit,W(m)**	0.50		
4	**Volume of water pumped into pit from bowser**			
5	**duration of filling (mins)**	13.00	PIT	
6	**EFFECTIVE DEPTH WATER (Initial depth m)**	1.20	effect dpth	Invert of pipe = lowest level of drainage pipe = effective depth
7	**MAXIMUM DEPTH WATER DRAINED (m)**	1.45		
8	Effective storage volume water,Vp_{75-25}	0.09		
9	Effective area of loss,ap50(m2)	1.25	max depth	
10	Time for head drop 75% to 25% from graph,tp_{75-25}(sec)	1020.00		max depth = to final water level

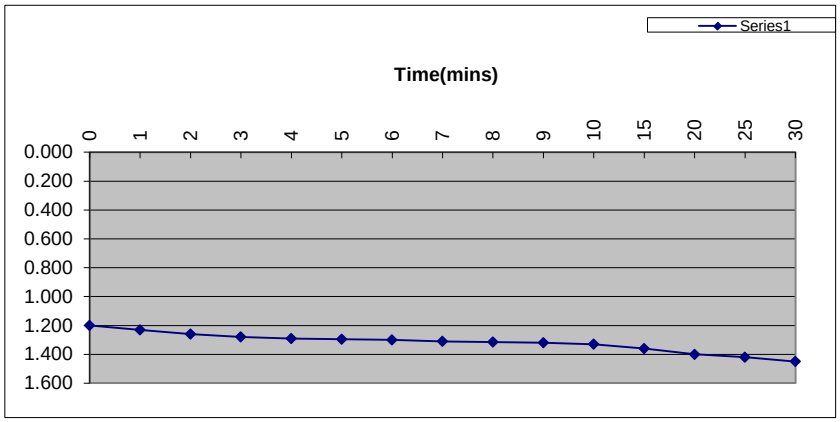
Time (Mins)	Depth to induced water (m)
0	1.200
1	1.230
2	1.260
3	1.280
4	1.290
5	1.295
6	1.300
7	1.310
8	1.315
9	1.320
10	1.330
15	1.360
20	1.400
25	1.420
30	1.450

PUMP NOT AVAILBALE THEREFORE HEAD COULD NOT BE DEVELOPED

2 high tide 06.54 9.3m

19

11	75% effective depth(m)	1.26	m	NBT for instances where the full depth soakaway has not been possible. The soakage is calculated from the actual max water depth achieved
12	25% effective depth(m)	1.39	m	
13	Soil infiltration rate,f(m/s)	**7.353E-05**		



SOAKAWAY TEST

	Job Name :	**SBTL**	**Test:**	**TPS1.2**
	Date :	**03/07/2015**	**Time:**	**10:02:00**
	Technician :	**AB**	**High Tide:**	**06.54 9.3m**
1	**Depth of Pit, d(m)**	1.50		**complete green only**
2	**Length of Pit,L(m)**	1.50		
3	**Width of Pit,W(m)**	0.50		
4	**Volume of water pumped into pit from bowser**			
5	**duration of filling (mins)**	24.00		
6	**EFFECTIVE DEPTH WATER (Initial depth m)**	1.20		
7	**MAXIMUM DEPTH WATER DRAINED (m)**	1.43		
8	Effective storage volume water,Vp_{75-25}	0.09		
9	Effective area of loss,ap50(m2)	1.21		
10	Time for head drop 75% to 25% from graph,tp_{75-25}(sec)	780.00		

PIT

effect dpth

max depth

Invert of pipe = lowest level of drainage pipe = effective depth

max depth = to final water level

Time (Mins)	Depth to induced water (m)
0	1.200
1	1.230
2	1.260
3	1.280
4	1.290
5	1.300
6	1.315
7	1.320
8	1.320
9	1.335
10	1.340
15	1.370
20	1.390
25	1.410
30	1.430
40	1.430

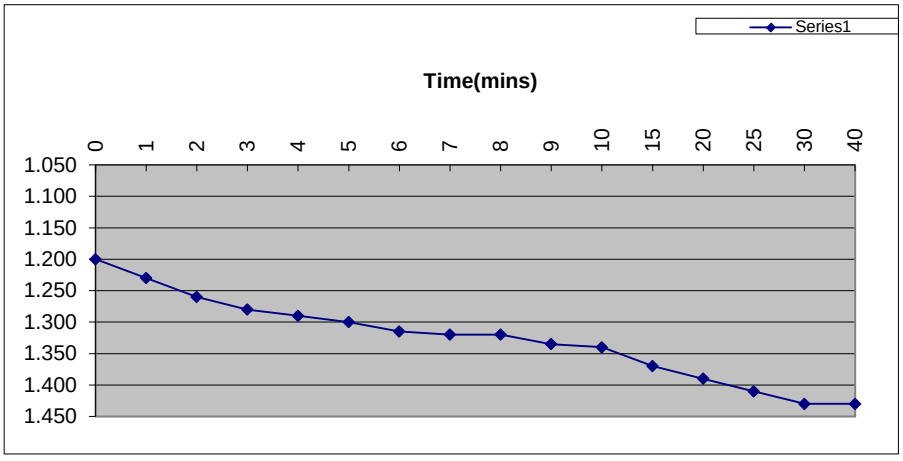
COMMENT ONLY SAND BED TESTED
COULD NOT RAISE HEAD
high tide 06.54 9.3m

2

15

11	75% effective depth(m)	1.26	m
12	25% effective depth(m)	1.37	m
13	Soil infiltration rate,f(m/s)	**9.139E-05**	

NBT for instances where the full depth soakaway has not been possible. The soakage is calculated from the actual max water depth achieved



SOAKAWAY TEST

	Job Name :	**SBTL**	**Test:**	**TPS1.3**
	Date :	**03/07/2015**	**Time:**	**10:46:00**
	Technician :	**AB**	**High Tide:**	**06.54 9.3m**
1	**Depth of Pit, d(m)**	1.50		**complete green only**
2	**Length of Pit,L(m)**	1.50		
3	**Width of Pit,W(m)**	0.50		
4	**Volume of water pumped into pit from bowser**			
5	**duration of filling (mins)**	3.00	PIT	
6	**EFFECTIVE DEPTH WATER (Initial depth m)**	1.20	effect dpth	Invert of pipe = lowest level of drainage pipe = effective depth
7	**MAXIMUM DEPTH WATER DRAINED (m)**	1.43		
8	Effective storage volume water,Vp_{75-25}	0.08		
9	Effective area of loss,ap50(m2)	1.20	max depth	
10	Time for head drop 75% to 25% from graph,tp_{75-25}(sec)	930.00		max depth = to final water level

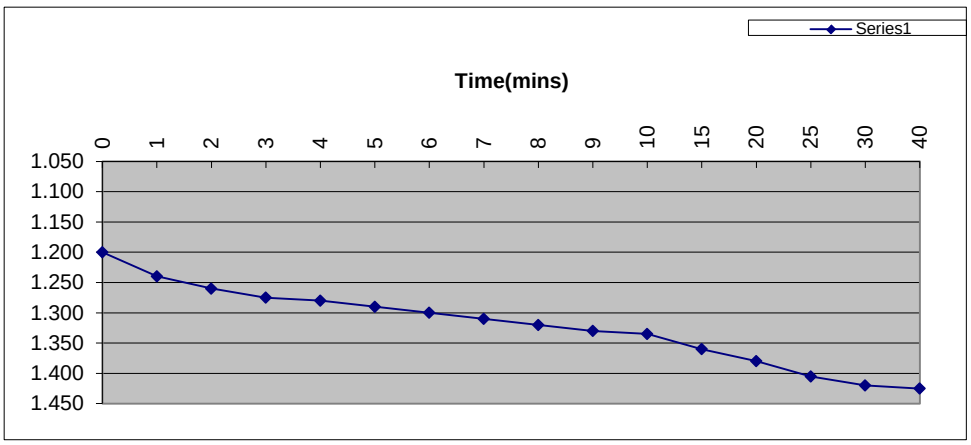
Time (Mins)	Depth to induced water (m)
0	1.200
1	1.240
2	1.260
3	1.275
4	1.280
5	1.290
6	1.300
7	1.310
8	1.320
9	1.330
10	1.335
15	1.360
20	1.380
25	1.405
30	1.420
40	1.425
50	
60	

LIMITED HEAD DEVELOPED
SAND BED ONLY TESTED
high tide 06.54 9.3m

2

17.5

11	75% effective depth(m)	1.26	m	NBT for instances where the full depth soakaway has not been possible. The soakage is calculated from the actual max water depth achieved
12	25% effective depth(m)	1.37	m	
13	Soil infiltration rate,f(m/s)	**7.560E-05**		

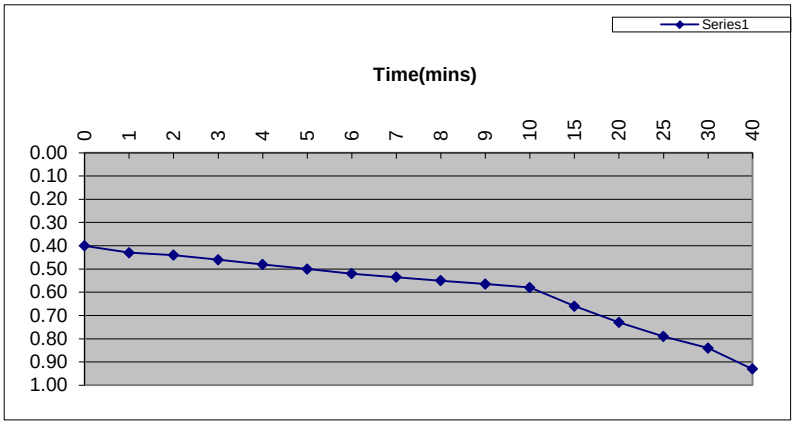


SOAKAWAY TEST

	Job Name :	**SBTL**	**Test:**	**TPS3.1**
	Date :	**03/07/2015**	**Time:**	**12:16:00**
	Technician:	**AB**	**High Tide:**	**06.54 9.3m**
1	**Depth of Pit, d(m)**	1.50		complete green only
2	**Length of Pit,L(m)**	1.50		
3	**Width of Pit,W(m)**	0.50		
4	**Volume of water pumped into pit from bowser**			
5	**duration of filling (mins)**	4.00	PIT	
6	**EFFECTIVE DEPTH WATER (Initial depth m)**	0.40	effect dpth	Invert of pipe = lowest level of drainage pipe = effective depth
7	**MAXIMUM DEPTH WATER DRAINED (m)**	0.93		
8	Effective storage volume water,Vp_{75-25}	0.20		
9	Effective area of loss,ap50(m2)	1.81	max depth	
10	Time for head drop 75% to 25% from graph,tp_{75-25}(sec)	1170.00		max depth = to final water level

Time (Mins)	Depth to induced water (m)		
0	0.40		COMMENTS
1	0.43		WATER PUMPED INTO PIT
2	0.44		
3	0.46		
4	0.48		
5	0.50		
6	0.52	6.5	
7	0.54		
8	0.55		
9	0.57		
10	0.58		
15	0.66		
20	0.73		
25	0.79	26	
30	0.84		
40	0.93		
50			
60			

11	75% effective depth(m)	0.53	m	NBT for instances where the full depth soakaway has not been possible. The soakage is calculated from the actual max water depth achieved
12	25% effective depth(m)	0.80	m	
13	Soil infiltration rate,f(m/s)	**9.385E-05**		

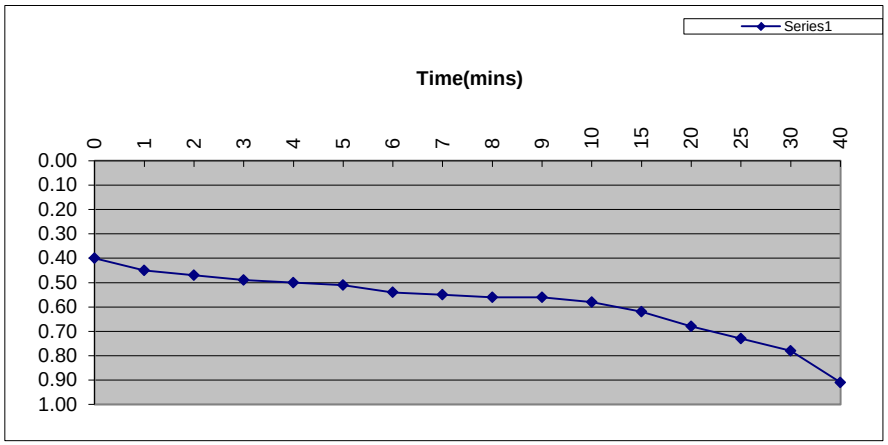


SOAKAWAY TEST

	Job Name :	**SBTL**	**Test:**	**TPS3.2**
	Date :	**03/07/2015**	**Time:**	**13:03:00**
	Technician:	**AB**	**High Tide:**	**06.54 9.3m**
1	**Depth of Pit, d(m)**	1.50		complete green only
2	**Length of Pit,L(m)**	1.50		
3	**Width of Pit,W(m)**	0.50		
4	**Volume of water pumped into pit from bowser**			
5	**duration of filling (mins)**	3.00		
6	**EFFECTIVE DEPTH WATER (Initial depth m)**	0.40	PIT / effect dpth	Invert of pipe = lowest level of drainage pipe = effective depth
7	**MAXIMUM DEPTH WATER DRAINED (m)**	0.91		
8	Effective storage volume water,Vp_{75-25}	0.19		
9	Effective area of loss,ap50(m2)	1.77	max depth	
10	Time for head drop 75% to 25% from graph,tp_{75-25}(sec)	1460.00		max depth = to final water level

Time (Mins)	Depth to induced water (m)		COMMENTS
0	0.40		
1	0.45		
2	0.47		
3	0.49		
4	0.50		
5	0.51	5.66	
6	0.54		
7	0.55		
8	0.56		
9	0.56		
10	0.58		
15	0.62		
20	0.68		
25	0.73		
30	0.78	30	
40	0.91		
50			
60			

11	75% effective depth(m)	0.53	m	NBT for instances where the full depth soakaway has not been possible. The soakage is calculated from the actual max water depth achieved
12	25% effective depth(m)	0.78	m	
13	Soil infiltration rate,f(m/s)	**7.401E-05**		

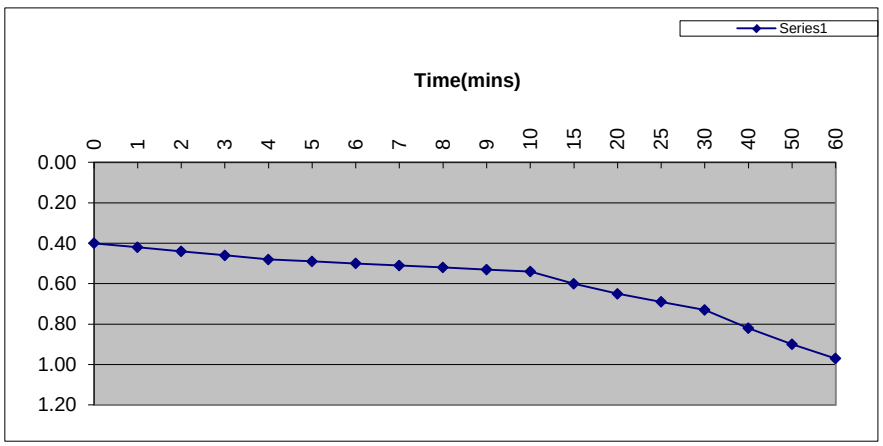


SOAKAWAY TEST

	Job Name :	**SBTL**	**Test:**	**TPS3.3**
	Date :	**03/07/2015**	**Time:**	**13:50:00**
	Technician:	**AB**	**High Tide:**	**06.54 9.3m**
1	**Depth of Pit, d(m)**	1.50		**complete green only**
2	**Length of Pit,L(m)**	1.50		
3	**Width of Pit,W(m)**	0.50		
4	**Volume of water pumped into pit from bowser**			
5	**duration of filling (mins)**	3.00	PIT	
6	**EFFECTIVE DEPTH WATER (Initial depth m)**	0.40	effect dpth	Invert of pipe = lowest level of drainage pipe = effective depth
7	**MAXIMUM DEPTH WATER DRAINED (m)**	0.97		
8	Effective storage volume water,Vp_{75-25}	0.21		
9	Effective area of loss,ap50(m2)	1.89	max depth	
10	Time for head drop 75% to 25% from graph,tp_{75-25}(sec)	1860.00		max depth = to final water level

Time (Mins)	Depth to induced water (m)	
0	0.40	
1	0.42	
2	0.44	
3	0.46	
4	0.48	
5	0.49	
6	0.50	
7	0.51	
8	0.52	
9	0.53	
10	0.54	10
15	0.60	
20	0.65	
25	0.69	
30	0.73	
40	0.82	41
50	0.90	
60	0.97	

11	75% effective depth(m)	0.54	m	NBT for instances where the full depth soakaway has not been possible. The soakage is calculated from the actual max water depth achieved
12	25% effective depth(m)	0.83	m	
13	Soil infiltration rate,f(m/s)	**6.080E-05**		



	Job Name :	**Swansea Bay Tide Lagoon**	**Test:**	**TPS4.1**
	Date :	**06/07/2015**	**Time:**	**09:00:00**
	Technician:	**AB**	**High tide:**	**09.10 9.2m**

1	Depth of Pit (m)	1.50	
2	Length of Pit (m)	1.50	**calculated cells**
3	Width of Pit (m)	0.50	
4	Volume of water pumped into pit from bowser	1422.00	**recorded pump delivery from testing 3.95ltr / second or 237 ltr / min**
5	Duration of filling (mins)	6.00	
6	EFFECTIVE HEAD of WATER ACHIEVED (Initial depth m)	0.20	PIT — ground level
7	MAXIMUM DEPTH WATER DRAINED (m)	1.05	effect dpth — Invert of pipe = lowest level of drainage pipe = effective depth
8	Effective storage volume water, **Vp_{75-25}**	0.32	
9	Effective area of loss, **ap50(m2)**	2.45	max depth — max depth = to final water level
10	Time for head drop 75% to 25% from graph, **tp_{75-25}(sec)**	2046.00	

Time (Mins)	Depth to induced water (m)
0	0.20
1	0.23
2	0.27
3	0.30
4	0.33
5	0.39
6	0.38
7	0.40
8	0.42
9	0.44
10	0.45
15	0.55
20	0.62
25	0.68
30	0.73
40	0.81
50	0.87
60	0.92
70	0.98
80	1.00
90	1.03
100	1.05

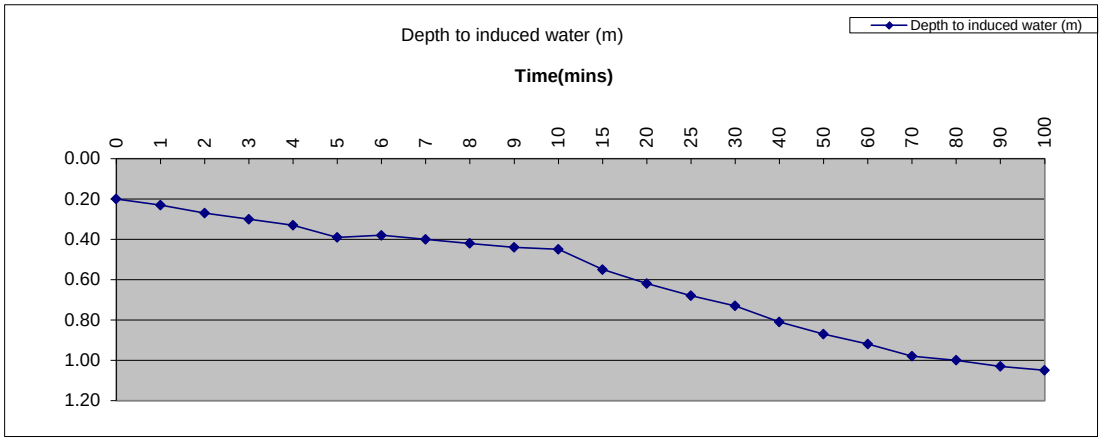
7.5

41.5

Comments. Nbt the pit was filled by pumping 1422 ltrs into the pit (at a rate of 3.95ltr/s) for 6 mins. A head was achieved at 0.2mbgl. 447 ltrs was lost during the filling over 6 mins

11	75% effective depth(m)	0.41	m
12	25% effective depth(m)	0.84	m
13	Soil infiltration rate,f(m/s)	**6.359E-05**	

NBT for instances where soakaway throughout the full depth of the pit has not been possible. The soakage is calculated from the final water depth achieved



Job Name :	**Swansea Bay Tide Lagoon**		**Test:**	**TPS4.2**
Date :	**06/07/2015**		**Time:**	**11.09**
Technician:	**AB**		**High tide:**	**09.10 9.2m**

1	Depth of Pit (m)	1.50	
2	Length of Pit (m)	1.50	
3	Width of Pit (m)	0.50	
4	Volume of water pumped into pit from bowser	900.00	
5	Duration of filling (mins)		
6	EFFECTIVE HEAD of WATER ACHIEVED (Initial depth m)	0.20	
7	MAXIMUM DEPTH WATER DRAINED (m)	0.87	
8	Effective storage volume water, **Vp_{75-25}**	0.25	
9	Effective area of loss, **ap50(m2)**	2.09	
10	Time for head drop 75% to 25% from graph, **tp_{75-25}(sec)**	1569.00	

calculated cells

900 ltr delivered to pit. Water standing at 1.1m use 1.1m as saturation zone for test end depth

PIT

ground level

effect dpth

Invert of pipe = lowest level of drainage pipe = effective depth

max depth

max depth = to final water level

Time (Mins)	Depth to induced water (m)
0	0.200
1	0.230
2	0.240
3	0.250
4	0.260
5	0.280
6	0.290
7	0.300
8	0.315
9	0.325
10	0.330
15	0.400
20	0.450
25	0.480
30	0.510
40	0.590
50	0.640
60	0.700
70	0.750
80	0.790
90	0.830
100	0.870

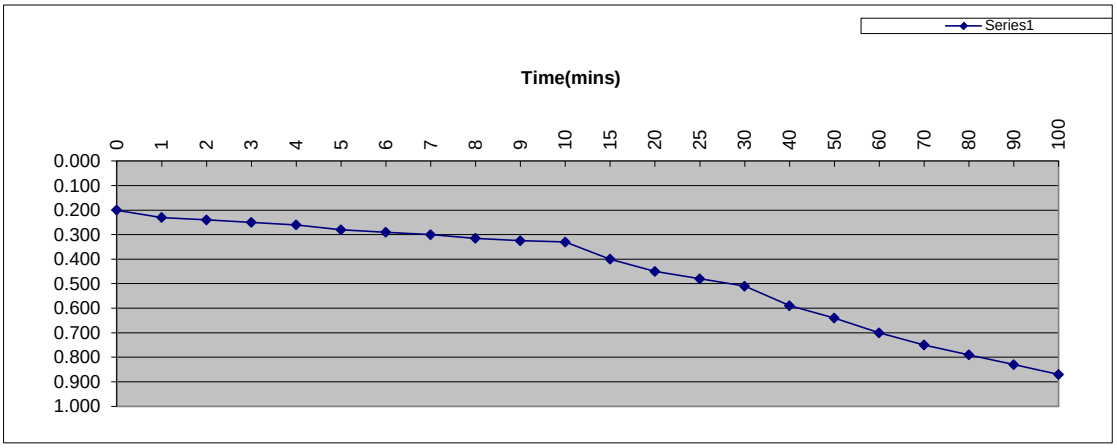
12.85

60

Comments. Pit was saturated with water standing in bottom. Site conditions heavy rain showers. If we calc f based upon pit end depth 1.1 (the saturated zone) f = 7.66x10-5

11	75% effective depth(m)	0.37	m
12	25% effective depth(m)	0.70	m
13	Soil infiltration rate, f(m/s)	**7.662E-05**	

NBT for instances where soakaway throughout the full depth of the pit has not been possible. The soakage is calculated from the final water depth achieved

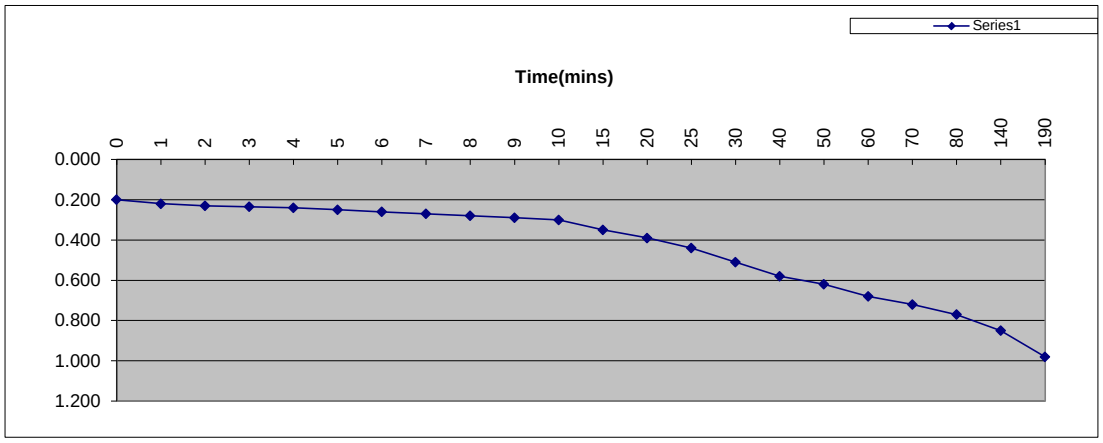


	Job Name :	**Swansea Bay Tide Lagoon**		**Test:**	**TPS4.3**
	Date :	**06/07/2015 - 7/7/15**		**Time:**	**13:00:00**
	Technician:	**AB**		**High tide:**	**09.10 9.2m**

1	Depth of Pit (m)	1.50			
2	Length of Pit (m)	1.50			**calculated cells**
3	Width of Pit (m)	0.50		**comments**	
4	Volume of water pumped into pit from bowser	1185.00			
5	Duration of filling (mins)	5.00			
6	EFFECTIVE HEAD of WATER ACHIEVED (Initial depth m)	0.20		PIT	ground level
7	MAXIMUM DEPTH WATER DRAINED (m)	0.98		effect dpth	Invert of pipe = lowest level of drainage pipe = effective depth
8	Effective storage volume water,**Vp_{75-25}**	0.29			
9	Effective area of loss,**ap50(m2)**	2.31		max depth	max depth = to final water level
10	Time for head drop 75% to 25% from graph, **tp_{75-25}(sec)**	3690.00			

Time (Mins)	Depth to induced water (m)	
0	0.200	
1	0.220	
2	0.230	
3	0.235	
4	0.240	
5	0.250	
6	0.260	
7	0.270	
8	0.280	
9	0.290	
10	0.300	
15	0.350	
20	0.390	21
25	0.440	
30	0.510	
40	0.580	
50	0.620	
60	0.680	
70	0.720	
80	0.770	82.5
140	0.850	
190	0.980	
	1.400	

11	75% effective depth(m)	0.40	m	NBT for instances where soakaway throughout the full depth of the pit has not been possible. The soakage is calculated from the final water depth achieved
12	25% effective depth(m)	0.79	m	
13	Soil infiltration rate, f(m/s)	**3.432E-05**		



Job Name :	**Swansea Bay Tide Lagoon**		**Test:**	**TPS5.1**
Date :	**06/07/2015**		**Time:**	**11.30**
Technician:	**AB**		**High tide:**	**09.10 9.2m**

1	Depth of Pit (m)	1.50			calculated cells
2	Length of Pit (m)	1.50			
3	Width of Pit (m)	0.50			
4	Volume of water pumped into pit from bowser	1054.65			
5	Duration of filling (mins)	4.45			
6	EFFECTIVE HEAD of WATER ACHIEVED (Initial depth m)	0.20		PIT	ground level
7	MAXIMUM DEPTH WATER DRAINED (m)	1.50		effect dpth	Invert of pipe = lowest level of drainage pipe = effective depth
8	Effective storage volume water, **Vp_{75-25}**	0.49			
9	Effective area of loss, **ap50(m2)**	3.35		max depth	max depth = to final water level
10	Time for head drop 75% to 25% from graph, **tp_{75-25}(sec)**	3642.00			

Time (Mins)	Depth to induced water (m)
0	0.20
1	0.36
2	0.45
3	0.51
4	0.57
5	0.60
6	0.64
7	0.66
8	0.69
9	0.71
10	0.72
15	0.79
20	0.84
25	0.88
30	0.94
40	1.03
50	1.10
60	1.16
70	1.21
80	1.26

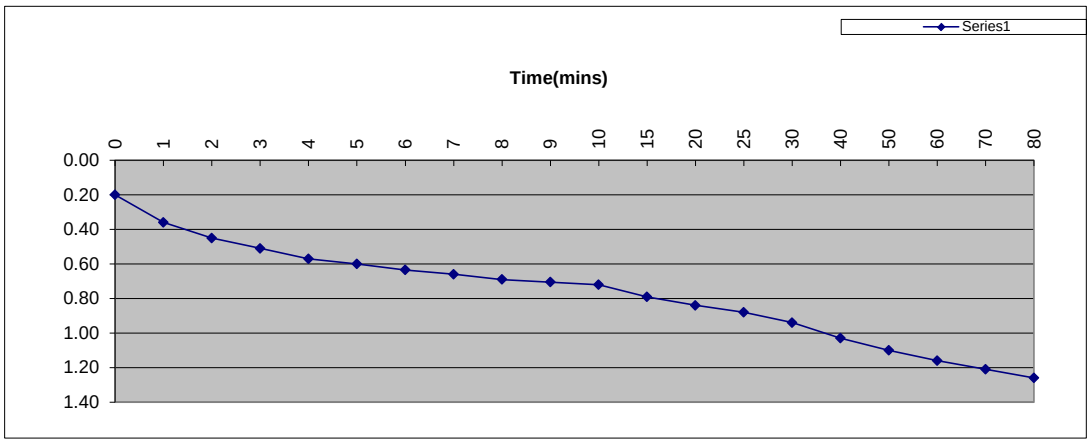
3.3

64

Pit collapsed during filling. F based on effective end depth 7.059x10-5. f based upon end depth 1.5m 3.996x10-5

11	75% effective depth(m)	0.53	m
12	25% effective depth(m)	1.18	m
13	Soil infiltration rate,f(m/s)	**3.996E-05**	

NBT for instances where soakaway throughout the full depth of the pit has not been possible. The soakage is calculated from the final water depth achieved



	Job Name :	**Swansea Bay Tide Lagoon**	**Test:**	**TPS5.2**	
	Date :	**06/07/2015**	**Time:**	**13.00**	
	Technician:	**AB**	**High tide:**	**09.10 9.2m**	

1	Depth of Pit (m)	1.50			
2	Length of Pit (m)	1.50			**calculated cells**
3	Width of Pit (m)	0.50			
4	Volume of water pumped into pit from bowser	948.00			
5	Duration of filling (mins)	4.00			
6	EFFECTIVE HEAD of WATER ACHIEVED (Initial depth m)	0.40	PIT	ground level	
7	MAXIMUM DEPTH WATER DRAINED (m)	1.15	effect dpth	Invert of pipe = lowest level of drainage pipe = effective depth	
8	Effective storage volume water, **Vp_{75-25}**	0.28			
9	Effective area of loss, **ap50(m2)**	2.25	max depth	max depth = to final water level	
10	Time for head drop 75% to 25% from graph, **tp_{75-25}(sec)**	2550.00			

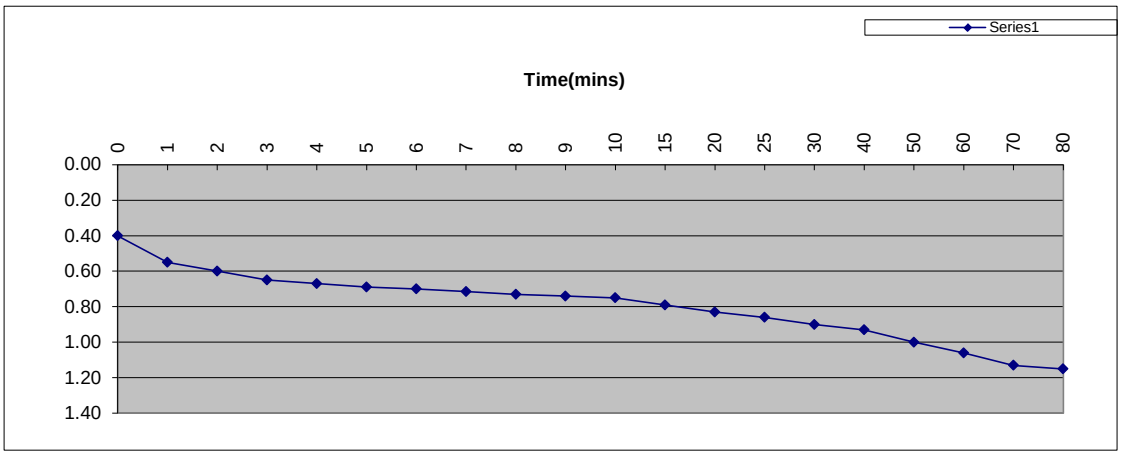
Time (Mins)	Depth to induced water (m)
0	0.40
1	0.55
2	0.60
3	0.65
4	0.67
5	0.69
6	0.70
7	0.72
8	0.73
9	0.74
10	0.75
15	0.79
20	0.83
25	0.86
30	0.90
40	0.93
50	1.00
60	1.06
70	1.13
80	1.15

1.8

44.3

11	75% effective depth(m)	0.59	m
12	25% effective depth(m)	0.96	m
13	Soil infiltration rate,f(m/s)	**4.902E-05**	

NBT for instances where soakaway throughout the full depth of the pit has not been possible. The soakage is calculated from the final water depth achieved



Job Name :	**Swansea Bay Tide Lagoon**		**Test:**	**TPS5.3**
Date :	**06/07/2015**		**Time:**	**14.30**
Technician:	**AB**		**High tide:**	**09.10 9.2m**

1	Depth of Pit (m)	1.50			
2	Length of Pit (m)	1.50			calculated cells
3	Width of Pit (m)	0.50			
4	Volume of water pumped into pit from bowser	720.48			
5	Duration of filling (mins)	3.04			
6	EFFECTIVE HEAD of WATER ACHIEVED (Initial depth m)	0.20		PIT	ground level
7	MAXIMUM DEPTH WATER DRAINED (m)	1.13		effect dpth	Invert of pipe = lowest level of drainage pipe = effective depth
8	Effective storage volume water, **Vp_{75-25}**	0.35			
9	Effective area of loss, **ap50(m2)**	2.61		max depth	max depth = to final water level
10	Time for head drop 75% to 25% from graph, **tp_{75-25}(sec)**	2112.00			

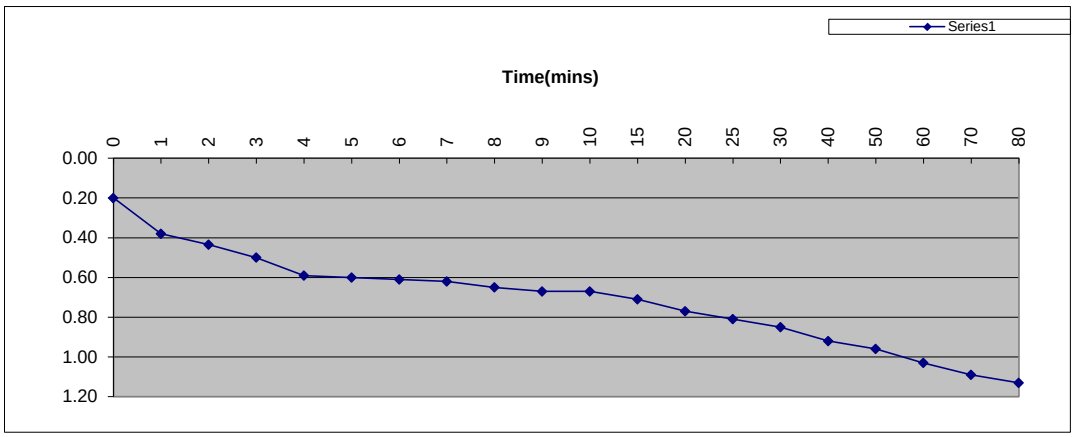
Time (Mins)	Depth to induced water (m)
0	0.20
1	0.38
2	0.44
3	0.50
4	0.59
5	0.60
6	0.61
7	0.62
8	0.65
9	0.67
10	0.67
15	0.71
20	0.77
25	0.81
30	0.85
40	0.92
50	0.96
60	1.03
70	1.09
80	1.13

1.8

37

11	75% effective depth(m)	0.43	m
12	25% effective depth(m)	0.90	m
13	Soil infiltration rate,f(m/s)	**6.327E-05**	

NBT for instances where soakaway throughout the full depth of the pit has not been possible. The soakage is calculated from the final water depth achieved



Job Name :	**Swansea Bay Tide Lagoon**		**Test:**	**TPS6.1**
Date :	**06/07/2015**		**Time:**	**14:30:00**
Technician:	**AB**		**High tide:**	**09.10 9.2m**

1	Depth of Pit (m)	1.50	
2	Length of Pit (m)	1.50	calculated cells
3	Width of Pit (m)	0.50	
4	Volume of water pumped into pit from bowser	1185.00	
5	Duration of filling (mins)	5.00	
6	EFFECTIVE HEAD of WATER ACHIEVED (Initial depth m)	0.24	PIT
7	MAXIMUM DEPTH WATER DRAINED (m)	1.13	effect dpth
8	Effective storage volume water, Vp_{75-25}	0.33	
9	Effective area of loss, **ap50(m2)**	2.53	max depth
10	Time for head drop 75% to 25% from graph, tp_{75-25} **(sec)**	3240.00	

ground level

Invert of pipe = lowest level of drainage pipe = effective depth

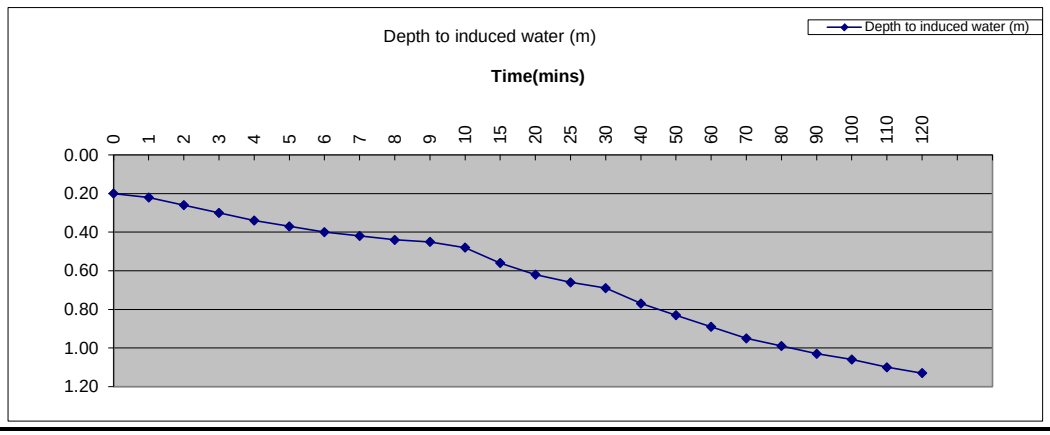
max depth = to final water level

Rain showers

Time (Mins)	Depth to induced water (m)	
0	0.20	
1	0.22	
2	0.26	
3	0.30	
4	0.34	
5	0.37	
6	0.40	
7	0.42	
8	0.44	
9	0.45	9.33
10	0.48	
15	0.56	
20	0.62	
25	0.66	
30	0.69	
40	0.77	
50	0.83	
60	0.89	63.33
70	0.95	
80	0.99	
90	1.03	
100	1.06	
110	1.10	
120	1.13	

11	75% effective depth(m)	0.46	m
12	25% effective depth(m)	0.91	m
13	Soil infiltration rate,f(m/s)	**4.072E-05**	

NBT for instances where soakaway throughout the full depth of the pit has not been possible. The soakage is calculated from the final water depth achieved



	Job Name :	**Swansea Bay Tide Lagoon**		**Test:**	**TPS6.2**
	Date :	**07/07/2015**		**Time:**	**08:36:00**
	Technician:	**AB**		**High tide:**	**09.58 9m**

1	Depth of Pit (m)	1.50			**calculated cells**
2	Length of Pit (m)	1.50			
3	Width of Pit (m)	0.50			
4	Volume of water pumped into pit from bowser	1185.00			
5	Duration of filling (mins)	5.00			
6	EFFECTIVE HEAD of WATER ACHIEVED (Initial depth m)	0.24		PIT	ground level
7	MAXIMUM DEPTH WATER DRAINED (m)	1.13		effect dpth	Invert of pipe = lowest level of drainage pipe = effective depth
8	Effective storage volume water,**Vp_{75-25}**	0.33			
9	Effective area of loss,**ap50(m2)**	2.53		max depth	max depth = to final water level
10	Time for head drop 75% to 25% from graph,**tp_{75-25}(sec)**	3120.00			

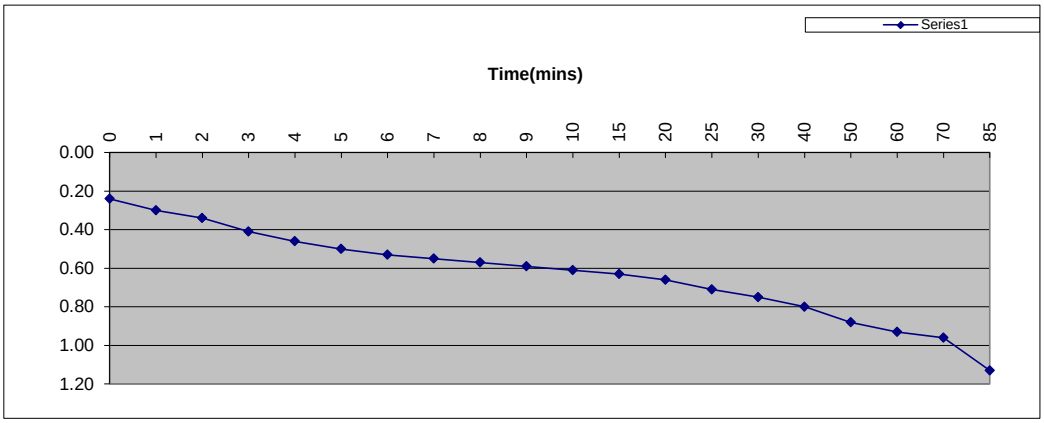
Time (Mins)	Depth to induced water (m)
0	0.24
1	0.30
2	0.34
3	0.41
4	0.46
5	0.50
6	0.53
7	0.55
8	0.57
9	0.59
10	0.61
15	0.63
20	0.66
25	0.71
30	0.75
40	0.80
50	0.88
60	0.93
70	0.96
85	1.13

Rain showers

4

56

11	75% effective depth(m)	0.46	m	NBT for instances where soakaway throughout the full depth of the pit has not been possible. The soakage is calculated from the final water depth achieved
12	25% effective depth(m)	0.91	m	
13	Soil infiltration rate,f(m/s)	**4.228E-05**		



	Job Name :	**Swansea Bay Tide Lagoon**		**Test:**	**TPS6.3**
	Date :	**07/07/2015**		**Time:**	**11:15:00**
	Technician:	**AB**		**High tide:**	**09.58 9m**

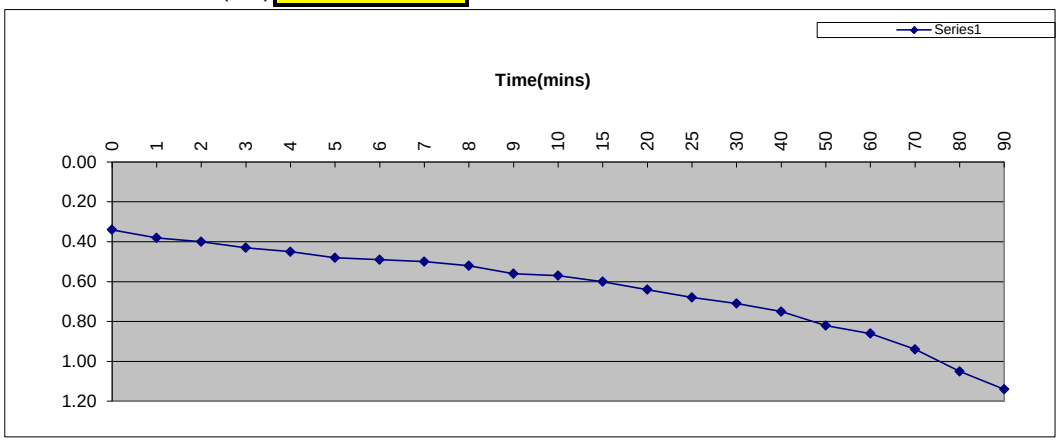
1	Depth of Pit (m)	1.50			calculated cells
2	Length of Pit (m)	1.50			
3	Width of Pit (m)	0.50			
4	Volume of water pumped into pit from bowser	0.00			
5	Duration of filling (mins)				
6	EFFECTIVE HEAD of WATER ACHIEVED (Initial depth m)	0.34		PIT	ground level
7	MAXIMUM DEPTH WATER DRAINED (m)	1.14		effect dpth	Invert of pipe = lowest level of drainage pipe = effective depth
8	Effective storage volume water, Vp_{75-25}	0.30			
9	Effective area of loss, **ap50(m2)**	2.35		max depth	max depth = to final water level
10	Time for head drop 75% to 25% from graph, tp_{75-25} **(sec)**	3690.00			

Time (Mins)	Depth to induced water (m)
0	0.34
1	0.38
2	0.40
3	0.43
4	0.45
5	0.48
6	0.49
7	0.50
8	0.52
9	0.56
10	0.57
15	0.60
20	0.64
25	0.68
30	0.71
40	0.75
50	0.82
60	0.86
70	0.94
80	1.05
90	1.14

8.5

70

11	75% effective depth(m)	0.54	m	NBT for instances where soakaway throughout the full depth of the pit has not been possible. The soakage is calculated from the final water depth achieved
12	25% effective depth(m)	0.94	m	
13	Soil infiltration rate,f(m/s)	**3.460E-05**		



	Job Name :	**Swansea Bay Tide Lagoon**		**Test:**	**TPS7.1**
	Date :	**07/07/2015**		**Time:**	**09:40:00**
	Technician:	**AB**		**High tide:**	**09.58 9.0m**

1	Depth of Pit (m)	1.50	
2	Length of Pit (m)	1.50	calculated cells
3	Width of Pit (m)	0.50	
4	Volume of water pumped into pit from bowser	1896.00	
5	Duration of filling (mins)	8.00	
6	EFFECTIVE HEAD of WATER ACHIEVED (Initial depth m)	0.50	PIT
7	MAXIMUM DEPTH WATER DRAINED (m)	1.15	effect dpth
8	Effective storage volume water, **Vp_{75-25}**	0.24	
9	Effective area of loss, **ap50(m2)**	2.05	max depth
10	Time for head drop 75% to 25% from graph, **tp_{75-25}(secs)**	1076.00	

ground level

Invert of pipe = lowest level of drainage pipe = effective depth

max depth = to final water level

Time (Mins)	Depth to induced water (m)
0	0.50
1	0.64
2	0.68
3	0.71
4	0.72
5	0.75
6	0.78
7	0.80
8	0.81
9	0.82
10	0.84
15	0.91
20	1.00
25	1.15

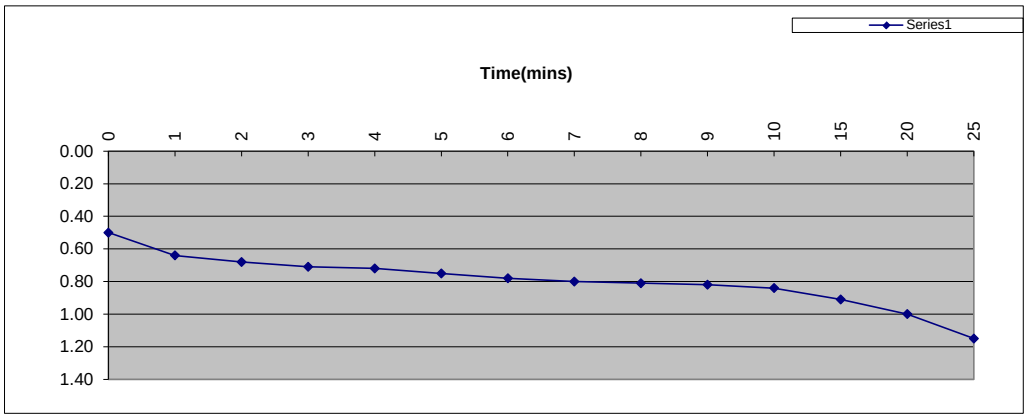
90

1166

Total collapse in sand after test 1. Sides very unstable, pit abandoned after Test 1.

11	75% effective depth(m)	0.66	m
12	25% effective depth(m)	0.99	m
13	Soil infiltration rate,f(m/s)	**1.105E-04**	

NBT for instances where soakaway throughout the full depth of the pit has not been possible. The soakage is calculated from the final water depth achieved



Job Name :	**Swansea Bay Tide Lagoon**		**Test:**	**TPS8A.1**
Date :	**07/07/2015**		**Time:**	**12:25:00**
Technician:	**AB**		**High tide:**	**09.58 9.0m**

1	Depth of Pit (m)	2.00
2	Length of Pit (m)	1.50
3	Width of Pit (m)	0.50
4	Volume of water pumped into pit from bowser	1540.50
5	Duration of filling (mins)	6.50
6	EFFECTIVE HEAD of WATER ACHIEVED (Initial depth m)	0.30
7	MAXIMUM DEPTH WATER DRAINED (m)	1.52
8	Effective storage volume water, **Vp_{75-25}**	0.46
9	Effective area of loss, **ap50(m2)**	3.19
10	Time for head drop 75% to 25% from graph, **tp_{75-25}(secs)**	1394.00

calculated cells

PIT — ground level

effect dpth — Invert of pipe = lowest level of drainage pipe = effective depth

max depth — max depth = to final water level

Heavy rain showers.

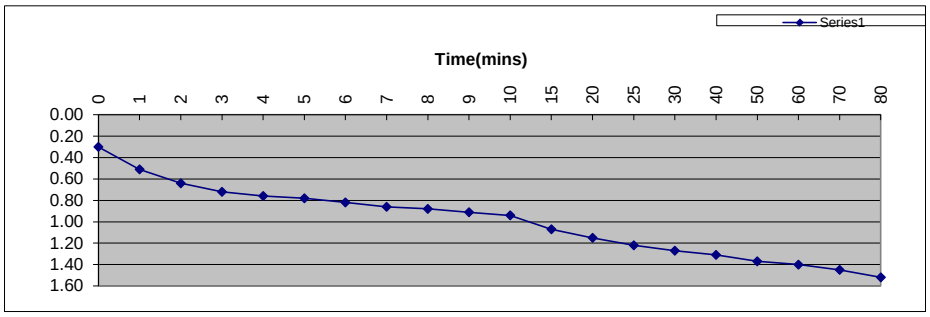
Time (Mins)	Depth to induced water (m)
0	0.30
1	0.51
2	0.64
3	0.72
4	0.76
5	0.78
6	0.82
7	0.86
8	0.88
9	0.91
10	0.94
15	1.07
20	1.15
25	1.22
30	1.27
40	1.31
50	1.37
60	1.40
70	1.45
80	1.52

106

1500

11	75% effective depth(m)	0.61	m
12	25% effective depth(m)	1.22	m
13	Soil infiltration rate,f(m/s)	**1.029E-04**	

NBT for instances where soakaway throughout the full depth of the pit has not been possible. The soakage is calculated from the final water depth achieved



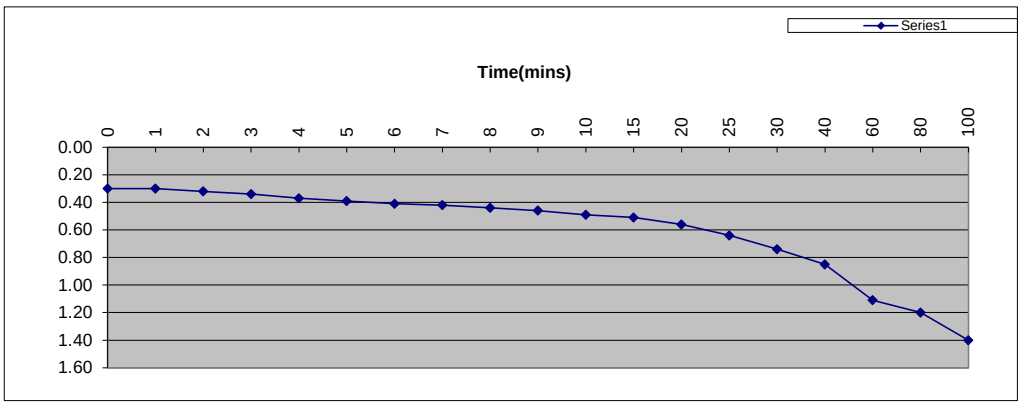
	Job Name :	**Swansea Bay Tide Lagoon**		**Test:**	**TPS8A.2**
	Date :	**07/07/2015**		**Time:**	**13:55:00**
	Technician:	**AB**		**High tide:**	**09.58 9m**

1	Depth of Pit (m)	2.00			
2	Length of Pit (m)	1.50			calculated cells
3	Width of Pit (m)	0.50			
4	Volume of water pumped into pit from bowser	1185.00			
5	Duration of filling (mins)	5.00			
6	EFFECTIVE HEAD of WATER ACHIEVED (Initial depth m)	0.30		PIT	ground level
7	MAXIMUM DEPTH WATER DRAINED (m)	1.40		effect dpth	Invert of pipe = lowest level of drainage pipe = effective depth
8	Effective storage volume water, **Vp_{75-25}**	0.41			
9	Effective area of loss, **ap50(m2)**	2.95		max depth	max depth = to final water level
10	Time for head drop 75% to 25% from graph, **tp_{75-25}(secs)**	2590.00			

Heavy rain showers.

Time (Mins)	Depth to induced water (m)	
0	0.30	
1	0.30	
2	0.32	
3	0.34	
4	0.37	
5	0.39	
6	0.41	
7	0.42	
8	0.44	
9	0.46	
10	0.49	
15	0.51	
20	0.56	1276
25	0.64	
30	0.74	
40	0.85	
60	1.11	3866
80	1.20	
100	1.40	

11	75% effective depth(m)	0.58	m	NBT for instances where soakaway throughout the full depth of the pit has not been possible. The soakage is calculated from the final water depth achieved
12	25% effective depth(m)	1.13	m	
13	Soil infiltration rate,f(m/s)	**5.399E-05**		

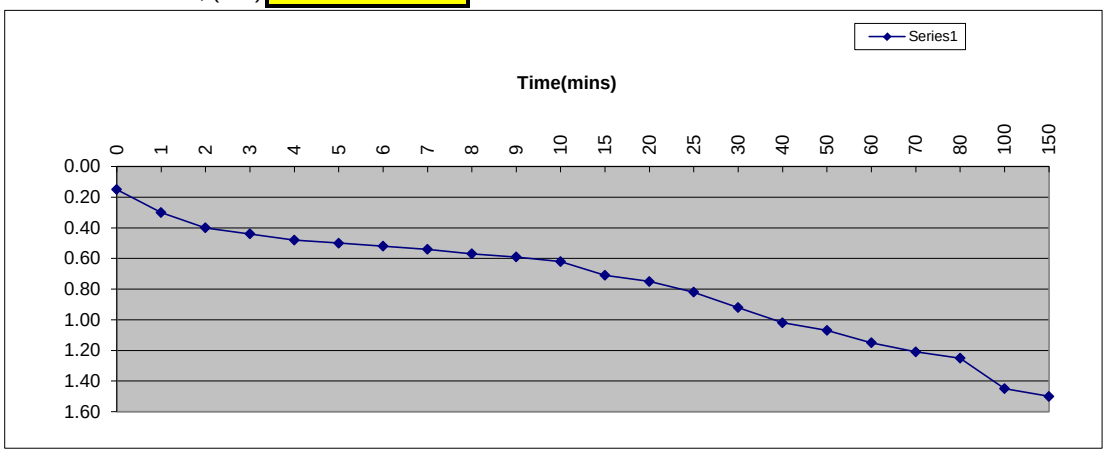


	Job Name :	**Swansea Bay Tide Lagoon**		**Test:**	**TPS8A.3**
	Date :	**08/07/2015**		**Time:**	**08:18:00**
	Technician:	**AB**		**High tide:**	**10.49 8.6m**

1	Depth of Pit (m)	2.00			
2	Length of Pit (m)	1.50			calculated cells
3	Width of Pit (m)	0.50			
4	Volume of water pumped into pit from bowser	2133.00			
5	Duration of filling (mins)	9.00			
6	EFFECTIVE HEAD of WATER ACHIEVED (Initial depth m)	0.15		PIT	ground level
7	MAXIMUM DEPTH WATER DRAINED (m)	1.50		effect dpth	Invert of pipe = lowest level of drainage pipe = effective depth
8	Effective storage volume water, **Vp_{75-25}**	0.51			
9	Effective area of loss, **ap50(m2)**	3.45		max depth	max depth = to final water level
10	Time for head drop 75% to 25% from graph, **tp_{75-25}(secs)**	3430.00			

Time (Mins)	Depth to induced water (m)	
0	0.15	
1	0.30	
2	0.40	
3	0.44	
4	0.48	270
5	0.50	
6	0.52	
7	0.54	
8	0.57	
9	0.59	
10	0.62	
15	0.71	
20	0.75	
25	0.82	
30	0.92	
40	1.02	
50	1.07	
60	1.15	3700
70	1.21	
80	1.25	
100	1.45	
150	1.50	

11	75% effective depth(m)	0.49	m	NBT for instances where soakaway throughout the full depth of the pit has not been possible. The soakage is calculated from the final water depth achieved
12	25% effective depth(m)	1.16	m	
13	Soil infiltration rate,f(m/s)	**4.278E-05**		



	Job Name :	**Swansea Bay Tide Lagoon**	**Test:**	**TPS10.1**	
	Date :	**08/07/2015**	**Time:**	**12:00:00**	
	Technician:	**AB**	**High tide:**	**10.49 8.6m**	
1	Depth of Pit (m)	2.00			
2	Length of Pit (m)	1.50			calculated cells
3	Width of Pit (m)	0.50			
4	Volume of water pumped into pit from bowser	1066.50			
5	Duration of filling (mins)	4.50			
6	EFFECTIVE HEAD of WATER ACHIEVED (Initial depth m)	0.00	PIT	ground level	
7	MAXIMUM DEPTH WATER DRAINED (m)	0.75	effect dpth	Invert of pipe = lowest level of drainage pipe = effective depth	
8	Effective storage volume water,**Vp_{75-25}**	0.28			
9	Effective area of loss,**ap50(m2)**	2.25	max depth	max depth = to final water level	
10	Time for head drop 75% to 25% from graph,**tp_{75-25}(secs)**	6300.00			

Time (Mins)	Depth to induced water (m)
0	0
1	0.05
2	0.1
3	0.12
4	0.12
5	0.15
6	0.18
7	0.18
8	0.18
9	0.18
10	0.19
15	0.2
20	0.22
25	0.25
30	0.25
40	0.29
50	0.34
60	0.37
70	0.41
80	0.43
90	0.45
100	0.49
110	0.55
120	0.57
130	0.58
140	0.59
150	0.6
160	0.615
180	0.64
190	0.66
200	0.68
210	0.69
220	0.7
230	0.72
240	0.75

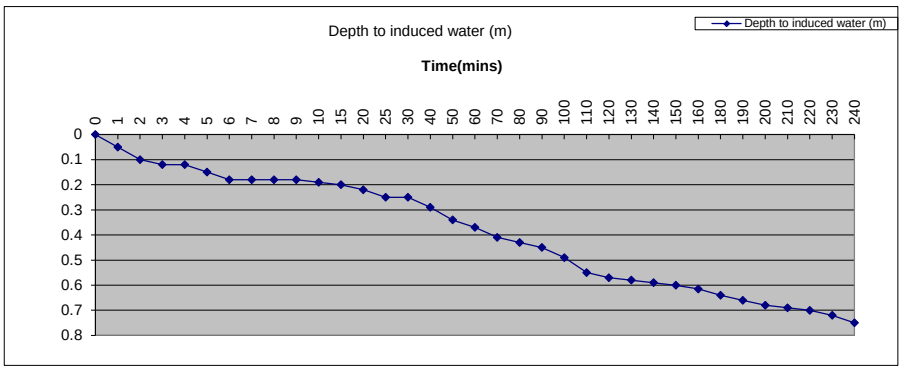
600

6900

Rain showers. 1 test unertaken due to long soakage period. Dry at 0800 the following day

11	75% effective depth(m)	0.19	m
12	25% effective depth(m)	0.56	m
13	Soil infiltration rate,f(m/s)	**1.984E-05**	

NBT for instances where soakaway throughout the full depth of the pit has not been possible. The soakage is calculated from the final water depth achieved



	Job Name :	**Swansea Bay Tide Lagoon**		**Test:**	**TPS11.1**
	Date :	**08/07/2015**		**Time:**	**12:48:00**
	Technician:	**AB**		**High tide:**	**10.49 8.6m**

1	Depth of Pit (m)	2.00			
2	Length of Pit (m)	1.50			**calculated cells**
3	Width of Pit (m)	0.50			
4	Volume of water pumped into pit from bowser	1422.00			
5	Duration of filling (mins)	6.00			
6	EFFECTIVE HEAD of WATER ACHIEVED (Initial depth m)	1.47		PIT	ground level
7	MAXIMUM DEPTH WATER DRAINED (m)	2.00		effect dpth	Invert of pipe = lowest level of drainage pipe = effective depth
8	Effective storage volume water, **Vp_{75-25}**	0.20			
9	Effective area of loss, **ap50(m2)**	1.81		max depth	max depth = to final water level
10	Time for head drop 75% to 25% from graph, **tp_{75-25}(secs)**	298.00			

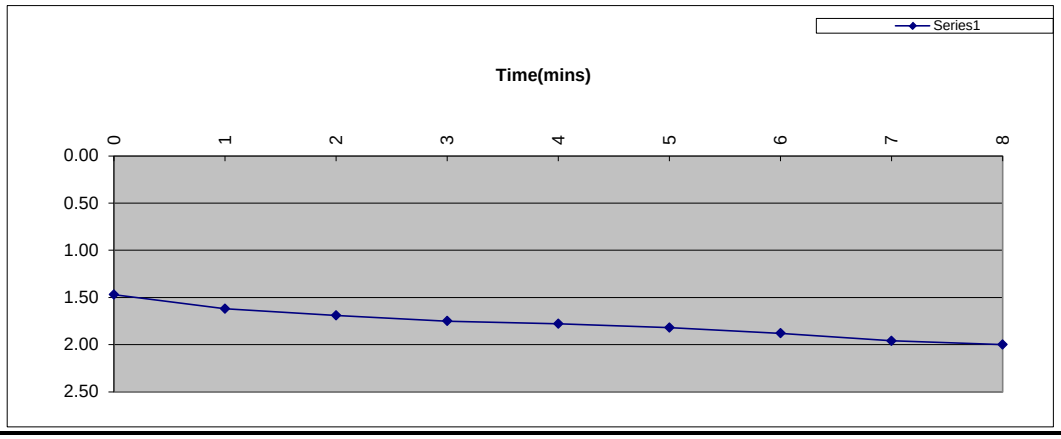
Time (Mins)	Depth to induced water (m)
0	1.47
1	1.62
2	1.69
3	1.75
4	1.78
5	1.82
6	1.88
7	1.96
8	2.00

Rain showers

52

350

11	75% effective depth(m)	1.60	m	NBT for instances where soakaway throughout the full depth of the pit has not been possible. The soakage is calculated from the final water depth achieved
12	25% effective depth(m)	1.87	m	
13	Soil infiltration rate,f(m/s)	**3.685E-04**		



	Job Name :	**Swansea Bay Tide Lagoon**	**Test:**	**TPR11.2**	
	Date :	**08/07/2015**	**Time:**	**14:17:00**	
	Technician:	**AB**	**High tide:**	**10.49 8.6m**	

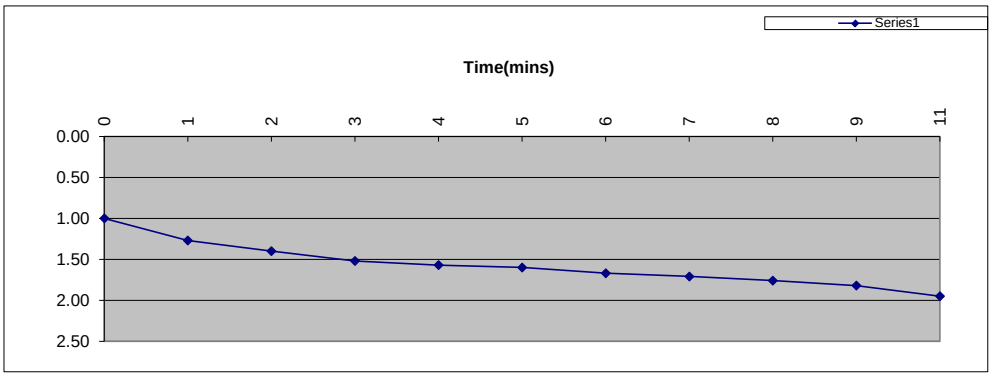
1	Depth of Pit (m)	2.00			
2	Length of Pit (m)	1.50			**calculated cells**
3	Width of Pit (m)	0.50			
4	Volume of water pumped into pit from bowser	1303.50			
5	Duration of filling (mins)	5.50			
6	EFFECTIVE HEAD of WATER ACHIEVED (Initial depth m)	1.00		PIT	ground level
7	MAXIMUM DEPTH WATER DRAINED (m)	1.95		effect dpth	Invert of pipe = lowest level of drainage pipe = effective depth
8	Effective storage volume water, **Vp_{75-25}**	0.36			
9	Effective area of loss, **ap50(m2)**	2.65		max depth	max depth = to final water level
10	Time for head drop 75% to 25% from graph, **tp_{75-25}(secs)**	366.70			

Time (Mins)	Depth to induced water (m)
0	1.00
1	1.27
2	1.40
3	1.52
4	1.57
5	1.60
6	1.67
7	1.71
8	1.76
9	1.82
11	1.95

53.3

420

11	75% effective depth(m)	1.24	m	NBT for instances where soakaway throughout the full depth of the pit has not been possible. The soakage is calculated from the final water depth achieved
12	25% effective depth(m)	1.71	m	
13	Soil infiltration rate,f(m/s)	**3.666E-04**		



Job Name :	**Swansea Bay Tide Lagoon**	**Test:**	**TPS11.1**
Date :	**08/07/2015**	**Time:**	**14:35:00**
Technician:	**AB**	**High tide:**	**10.49 8.6m**

1	Depth of Pit (m)	2.00	
2	Length of Pit (m)	1.50	**calculated cells**
3	Width of Pit (m)	0.50	
4	Volume of water pumped into pit from bowser	1244.25	
5	Duration of filling (mins)	5.25	
6	EFFECTIVE HEAD of WATER ACHIEVED (Initial depth m)	0.55	PIT — ground level
7	MAXIMUM DEPTH WATER DRAINED (m)	1.93	effect dpth — Invert of pipe = lowest level of drainage pipe = effective depth
8	Effective storage volume water, **Vp_{75-25}**	0.52	
9	Effective area of loss, **ap50(m2)**	3.51	max depth — max depth = to final water level
10	Time for head drop 75% to 25% from graph, **tp_{75-25}(secs)**	427.00	

Time (Mins)	Depth to induced water (m)
0	0.55
1	0.87
2	1.10
3	1.26
4	1.38
5	1.43
6	1.49
7	1.54
8	1.58
9	1.62
10	1.65
15	1.76
20	1.93

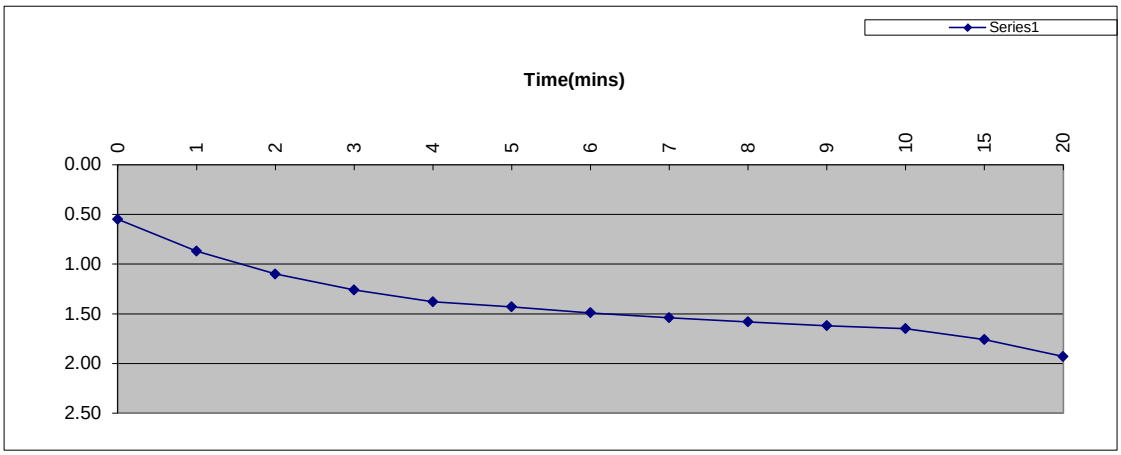
68

495

Rain showers. Strong hydrocarbon odour. Oily sheen on water.

11	75% effective depth(m)	0.90	m
12	25% effective depth(m)	1.59	m
13	Soil infiltration rate,f(m/s)	**3.453E-04**	

NBT for instances where soakaway throughout the full depth of the pit has not been possible. The soakage is calculated from the final water depth achieved



Job Name :	**Swansea Bay Tide Lagoon**		**Test:**	**TPS15.1**
Date :	**09/07/2015**		**Time:**	**08:35:00**
Technician:	**AB**		**High tide:**	**11.45 8.2m**

1	Depth of Pit (m)	1.50
2	Length of Pit (m)	1.50
3	Width of Pit (m)	0.50
4	Volume of water pumped into pit from bowser	2196.00
5	Duration of filling (mins)	6.00
6	EFFECTIVE HEAD of WATER ACHIEVED (Initial depth m)	1.50
7	MAXIMUM DEPTH WATER DRAINED (m)	1.50
8	Effective storage volume water, **Vp_{75-25}**	0.00
9	Effective area of loss, **ap50(m2)**	0.75
10	Time for head drop 75% to 25% from graph, **tp_{75-25}(min)**	0.00

calculated cells

Increased pump delivery >366l/m. One large bowser emptied without achieving a head

PIT

ground level

effect dpth — Invert of pipe = lowest level of drainage pipe = effective depth

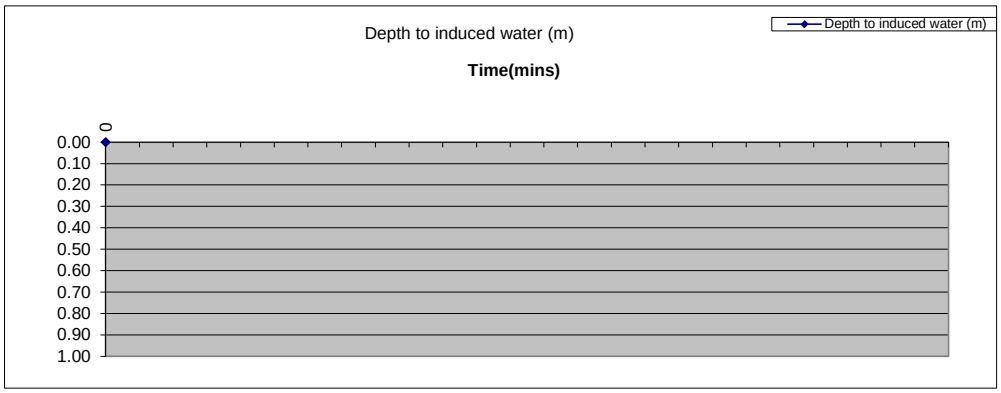
max depth — max depth = to final water level

Time (Mins)	Depth to induced water (m)
0	0.00

Marker gravel at base of soak away pit, could not achieve an effective head. Pumped 2200 gallons into pit and over area 0.75m2 F= >3.4x10-4

11	75% effective depth(m)	1.50	m
12	25% effective depth(m)	1.50	m
13	Soil infiltration rate,f(m/s)	**N/A**	

NBT for instances where soakaway throughout the full depth of the pit has not been possible. The soakage is calculated from the final water depth achieved



Job Name :	**Swansea Bay Tide Lagoon**		**Test:**	**TPS15.2**
Date :	**09/07/2015**		**Time:**	**09:10:00**
Technician:	**AB**		**High tide:**	**11.45 8.2m**

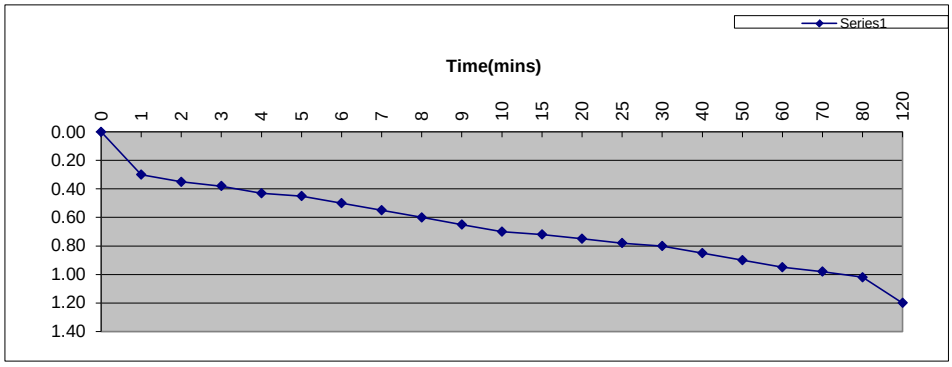
1	Depth of Pit (m)	1.50			**calculated cells**
2	Length of Pit (m)	1.50			
3	Width of Pit (m)	0.50			
4	Volume of water pumped into pit from bowser	1738.50		**Increased pump delivery >366l/m**	
5	Duration of filling (mins)	4.75			
6	EFFECTIVE HEAD of WATER ACHIEVED (Initial depth m)	0.00		PIT	ground level
7	MAXIMUM DEPTH WATER DRAINED (m)	1.20		effect dpth	Invert of pipe = lowest level of drainage pipe = effective depth
8	Effective storage volume water,**Vp_{75-25}**	0.45			
9	Effective area of loss,**ap50(m2)**	3.15		max depth	max depth = to final water level
10	Time for head drop 75% to 25% from graph,**tp_{75-25}(secs)**	2940.00			

Time (Mins)	Depth to induced water (m)
0	0.00
1	0.30
2	0.35
3	0.38
4	0.43
5	0.45
6	0.50
7	0.55
8	0.60
9	0.65
10	0.70
15	0.72
20	0.75
25	0.78
30	0.80
40	0.85
50	0.90
60	0.95
70	0.98
80	1.02
120	1.20

60

3000

11	75% effective depth(m)	0.30	m	NBT for instances where soakaway throughout the full depth of the pit has not been possible. The soakage is calculated from the final water depth achieved
12	25% effective depth(m)	0.90	m	
13	Soil infiltration rate,f(m/s)	**4.859E-05**		



Job Name :	**Swansea Bay Tide Lagoon**		**Test:**	**TPS15.3**
Date :	**09/07/2015**		**Time:**	**11:31:00**
Technician:	**AB**		**High tide:**	**11.45 8.2m**

1	Depth of Pit (m)	1.50	
2	Length of Pit (m)	1.50	
3	Width of Pit (m)	0.50	
4	Volume of water pumped into pit from bowser	1098.00	
5	Duration of filling (mins)	3.00	
6	EFFECTIVE HEAD of WATER ACHIEVED (Initial depth m)	0.00	
7	MAXIMUM DEPTH WATER DRAINED (m)	0.53	
8	Effective storage volume water, **Vp_{75-25}**	0.20	
9	Effective area of loss, **ap50(m2)**	1.81	
10	Time for head drop 75% to 25% from graph, **tp_{75-25}(secs)**	1104.00	

calculated cells

Increased pump delivery >366l/m

PIT

ground level

effect dpth

Invert of pipe = lowest level of drainage pipe = effective depth

max depth

max depth = to final water level

Complete collapse at 43 minutes.

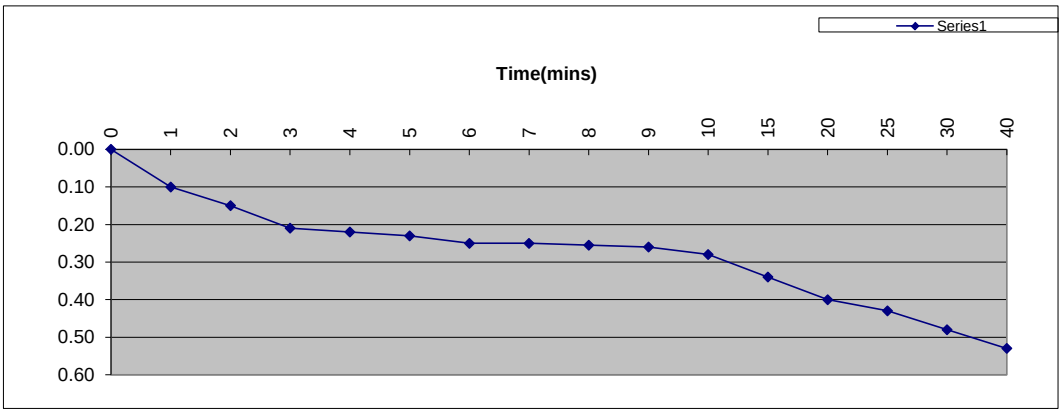
Time (Mins)	Depth to induced water (m)
0	0.00
1	0.10
2	0.15
3	0.21
4	0.22
5	0.23
6	0.25
7	0.25
8	0.26
9	0.26
10	0.28
15	0.34
20	0.40
25	0.43
30	0.48
40	0.53

96

1200

11	75% effective depth(m)	0.13	m
12	25% effective depth(m)	0.40	m
13	Soil infiltration rate,f(m/s)	**9.946E-05**	

NBT for instances where soakaway throughout the full depth of the pit has not been possible. The soakage is calculated from the final water depth achieved

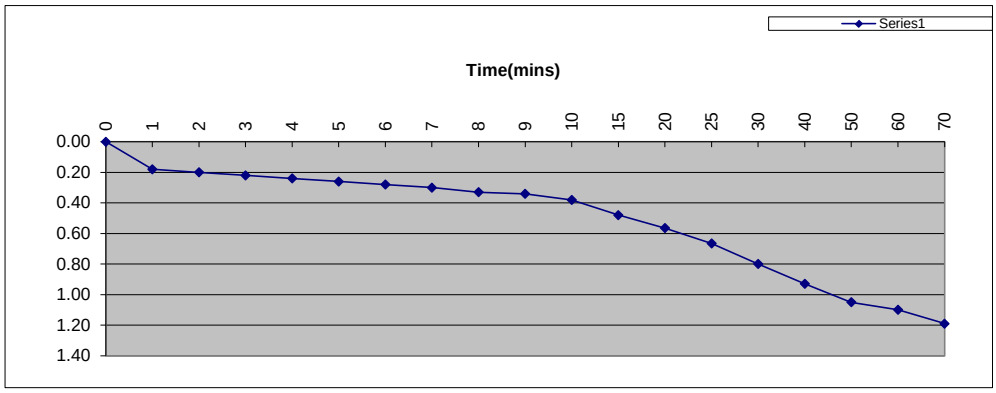


	Job Name :	**Swansea Bay Tide Lagoon**		**Test:**	**TPS16.1**
	Date :	**09/07/2015**		**Time:**	**09:00:00**
	Technician:	**AB**		**High tide:**	**11.45 8.2m**

1	Depth of Pit (m)	1.50			
2	Length of Pit (m)	1.50			calculated cells
3	Width of Pit (m)	0.50			
4	Volume of water pumped into pit from bowser	1281.00		**Increased pump delivery >366l/m**	
5	Duration of filling (mins)	3.50			
6	EFFECTIVE HEAD of WATER ACHIEVED (Initial depth m)	0.00		PIT	ground level
7	MAXIMUM DEPTH WATER DRAINED (m)	1.19		effect dpth	Invert of pipe = lowest level of drainage pipe = effective depth
8	Effective storage volume water,**Vp_{75-25}**	0.45			
9	Effective area of loss,**ap50(m2)**	3.13		max depth	max depth = to final water level
10	Time for head drop 75% to 25% from graph,**tp_{75-25}(sec)**	1796.00			

Time (Mins)	Depth to induced water (m)	
0	0.00	
1	0.18	
2	0.20	
3	0.22	
4	0.24	
5	0.26	
6	0.28	
7	0.30	420
8	0.33	
9	0.34	
10	0.38	
15	0.48	
20	0.57	
25	0.67	
30	0.80	2216
40	0.93	
50	1.05	
60	1.10	
70	1.19	

11	75% effective depth(m)	0.30	m	NBT for instances where soakaway throughout the full depth of the pit has not been possible. The soakage is calculated from the final water depth achieved
12	25% effective depth(m)	0.89	m	
13	Soil infiltration rate,f(m/s)	**7.938E-05**		



Job Name :	**Swansea Bay Tide Lagoon**		**Test:**	**TPS16.2**	
Date :	**09/07/2015**		**Time:**	**10:15:00**	
Technician:	**AB**		**High tide:**	**11.45 8.2m**	

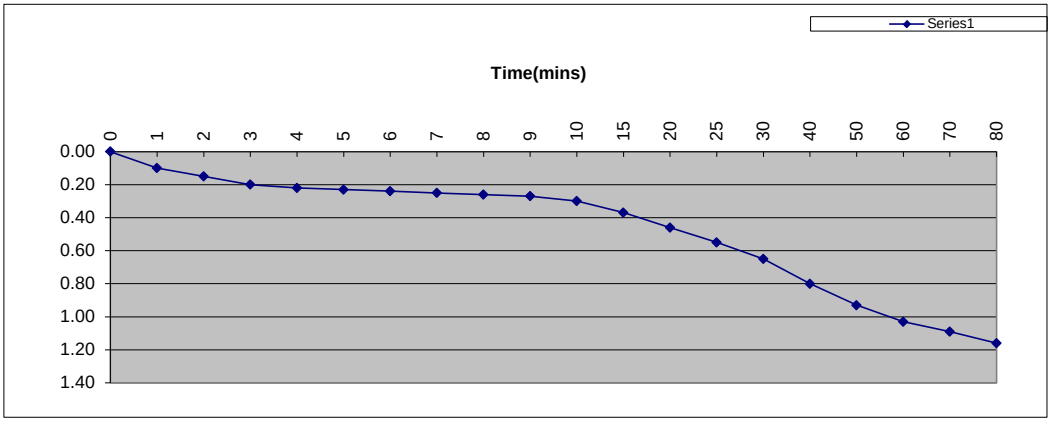
1	Depth of Pit (m)	1.50			
2	Length of Pit (m)	1.50			**calculated cells**
3	Width of Pit (m)	0.50			
4	Volume of water pumped into pit from bowser	1098.00		**Increased pump delivery >366l/m**	
5	Duration of filling (mins)	3.00			
6	EFFECTIVE HEAD of WATER ACHIEVED (Initial depth m)	0.00		PIT	ground level
7	MAXIMUM DEPTH WATER DRAINED (m)	1.16		effect dpth	Invert of pipe = lowest level of drainage pipe = effective depth
8	Effective storage volume water, Vp_{75-25}	0.44			
9	Effective area of loss, **ap50(m2)**	3.07		max depth	max depth = to final water level
10	Time for head drop 75% to 25% from graph, tp_{75-25} **(sec)**	2144.00			

Time (Mins)	Depth to induced water (m)
0	0.00
1	0.10
2	0.15
3	0.20
4	0.22
5	0.23
6	0.24
7	0.25
8	0.26
9	0.27
10	0.30
15	0.37
20	0.46
25	0.55
30	0.65
40	0.80
50	0.93
60	1.03
70	1.09
80	1.16

580

2724

11	75% effective depth(m)	0.29	m	NBT for instances where soakaway throughout the full depth of the pit has not been possible. The soakage is calculated from the final water depth achieved
12	25% effective depth(m)	0.87	m	
13	Soil infiltration rate,f(m/s)	**6.609E-05**		



Job Name :	**Swansea Bay Tide Lagoon**	**Test:**	**TPS16.3**
Date :	**07/07/2015**	**Time:**	**11:50:00**
Technician:	**AB**	**High tide:**	**11.45 8.2m**

1	Depth of Pit (m)	1.50	
2	Length of Pit (m)	1.50	
3	Width of Pit (m)	0.50	
4	Volume of water pumped into pit from bowser	1098.00	
5	Duration of filling (mins)	3.00	
6	EFFECTIVE HEAD of WATER ACHIEVED (Initial depth m)	0.00	
7	MAXIMUM DEPTH WATER DRAINED (m)	1.20	
8	Effective storage volume water, **Vp_{75-25}**	0.45	
9	Effective area of loss, **ap50(m2)**	3.15	
10	Time for head drop 75% to 25% from graph, **tp_{75-25}(sec)**	2717.00	

calculated cells

Increased pump delivery >366l/m

PIT

ground level

effect dpth

Invert of pipe = lowest level of drainage pipe = effective depth

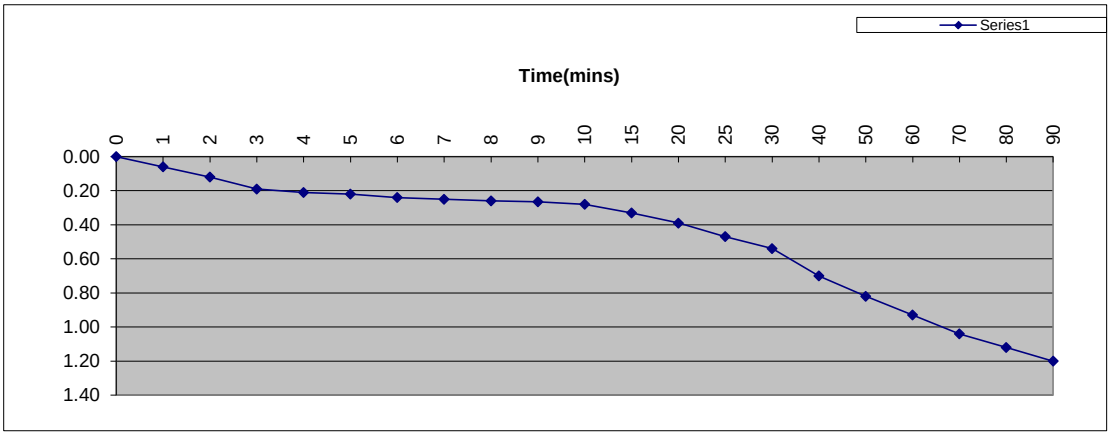
max depth

max depth = to final water level

Time (Mins)	Depth to induced water (m)	
0	0.00	
1	0.06	
2	0.12	
3	0.19	
4	0.21	
5	0.22	
6	0.24	
7	0.25	
8	0.26	
9	0.27	
10	0.28	720
15	0.33	
20	0.39	
25	0.47	
30	0.54	
40	0.70	
50	0.82	3437
60	0.93	
70	1.04	
80	1.12	
90	1.20	

11	75% effective depth(m)	0.30	m
12	25% effective depth(m)	0.90	m
13	Soil infiltration rate,f(m/s)	**5.258E-05**	

NBT for instances where soakaway throughout the full depth of the pit has not been possible. The soakage is calculated from the final water depth achieved

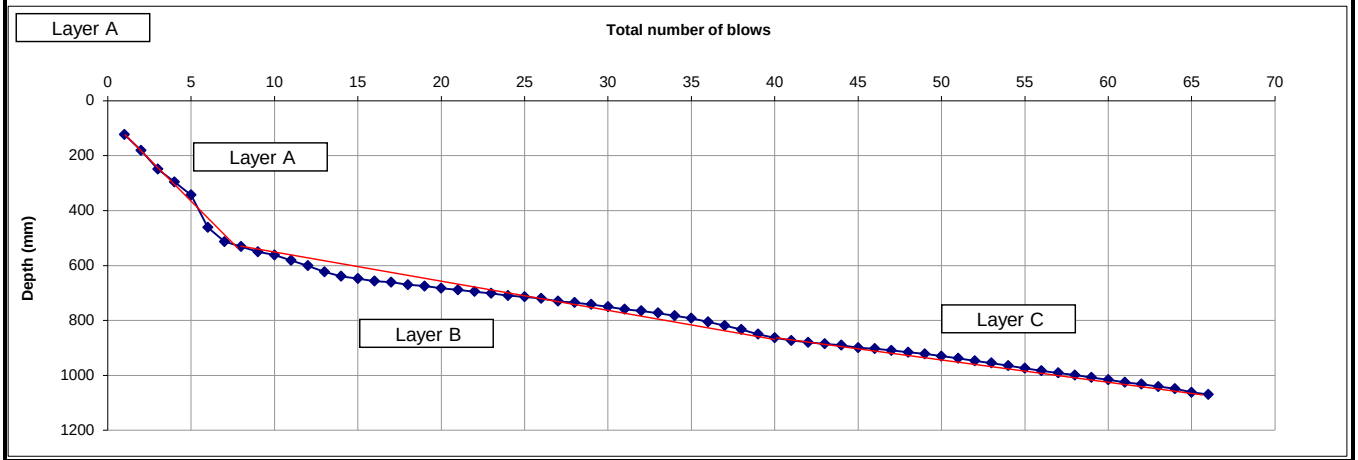


DYNAMIC CONE PENETRATION TEST RESULTS

Client Name	Swansea Bay Tidal Lagoon	Date	02/07/2015
Job Name	Swansea Lagoon	Job No.	10318
		Zero Reading	64
		Test Location	**DCP TP13**

APEX DRILLING SERVICES

No. of Blows	Reading (mm)	Mean penetration per blow (mm)	Layer	Top of layer (mm)	Base of layer (mm)	Blows at top of layer (no)	Blows at base of layer (no)	Mean penetration per blow (mm)	CBR of layer (%)
0	64								
1	123	59	Layer A	0	531	0	8	66.4	**4**
2	181	58							
3	249	68							
4	296	47	Layer B	531	863	8	40	10.4	**25**
5	343	47							
6	461	118							
7	513	52	Layer C	863	1070	40	66	8.0	**34**
8	531	18							
9	550	19							
10	562	12							
11	581	19							
12	601	20							
13	623	22							
14	639	16							
15	648	9							
16	657	9							
17	661	4							
18	670	9							
19	675	5							
20	683	8							
21	689	6							
22	695	6							
23	701	6							
24	710	9							
25	714	4							
26	720	6							
27	730	10							
28	735	5							
29	742	7							
30	750	8							
31	759	9							
32	765	6							
33	773	8							
34	783	10							
35	792	9							
36	805	13							
37	819	14							
38	833	14							
39	850	17							
40	863	13							
41	873	10							
42	880	7							
43	885	5							
44	890	5							
45	899	9							
46	903	4							
47	909	6							
48	916	7							
49	922	6							
50	930	8							
51	938	8							
52	947	9							
53	955	8							
54	965	10							
55	974	9							
56	983	9							
57	991	8							
58	999	8							
59	1008	9							
60	1016	8							
61	1025	9							
62	1032	7							
63	1041	9							
64	1049	8							
65	1062	13							
66	1070	8							



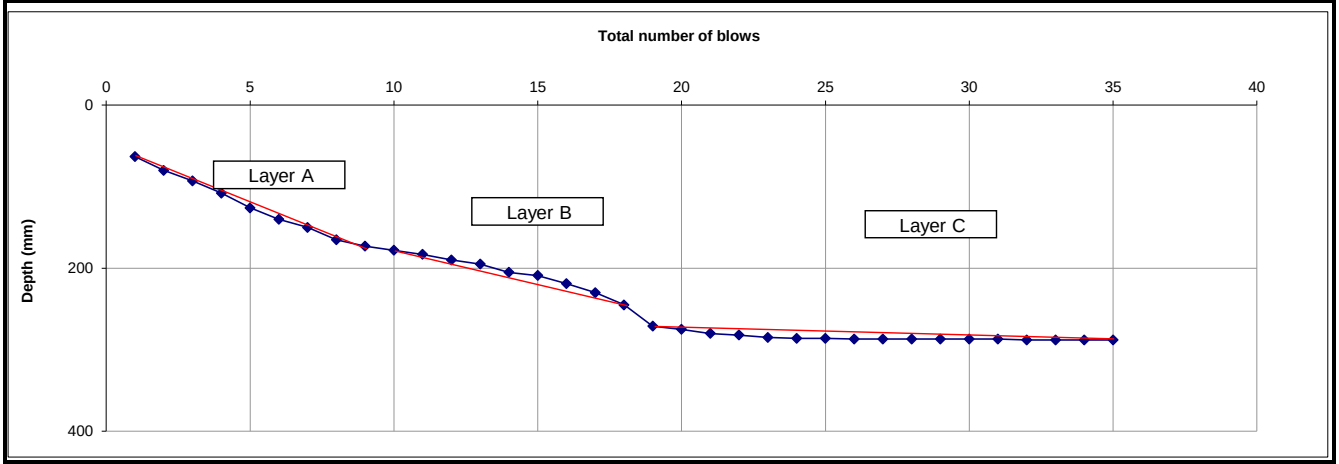
Remarks:							
Note	Test stopped at 1.006 mbgl						
Particles >20mm	Unknown	Weather	Rain Showers			Operators	AH

DYNAMIC CONE PENETRATION TEST RESULTS

Client Name	Swansea Bay Tidal Lagoon	Date	02/07/2015
Job Name	Swansea Lagoon	Job No.	10318
		Zero Reading	45
		Test Location	**DCP TP19**

APEX DRILLING SERVICES

No. of Blows	Reading (mm)	Mean penetration per blow (mm)	Layer	Top of layer (mm)	Base of layer (mm)	Blows at top of layer (no)	Blows at base of layer (no)	Mean penetration per blow (mm)	CBR of layer (%)
0	45								
1	63	18	Layer A	45	173	0	9	14.2	**18.3**
2	80	17							
3	93	13							
4	108	15	Layer B	178	245	10	18	8.4	**31.9**
5	126	18							
6	140	14							
7	150	10	Layer C	271	288	19	35	1.1	**283.3**
8	165	15							
9	173	8							
10	178	5							
11	183	5							
12	190	7							
13	195	5							
14	205	10							
15	209	4							
16	219	10							
17	230	11							
18	245	15							
19	271	26							
20	275	4							
21	280	5							
22	282	2							
23	285	3							
24	286	1							
25	286	0							
26	287	1							
27	287	0							
28	287	0							
29	287	0							
30	287	0							
31	287	0							
32	288	1							
33	288	0							
34	288	0							
35	288	0							



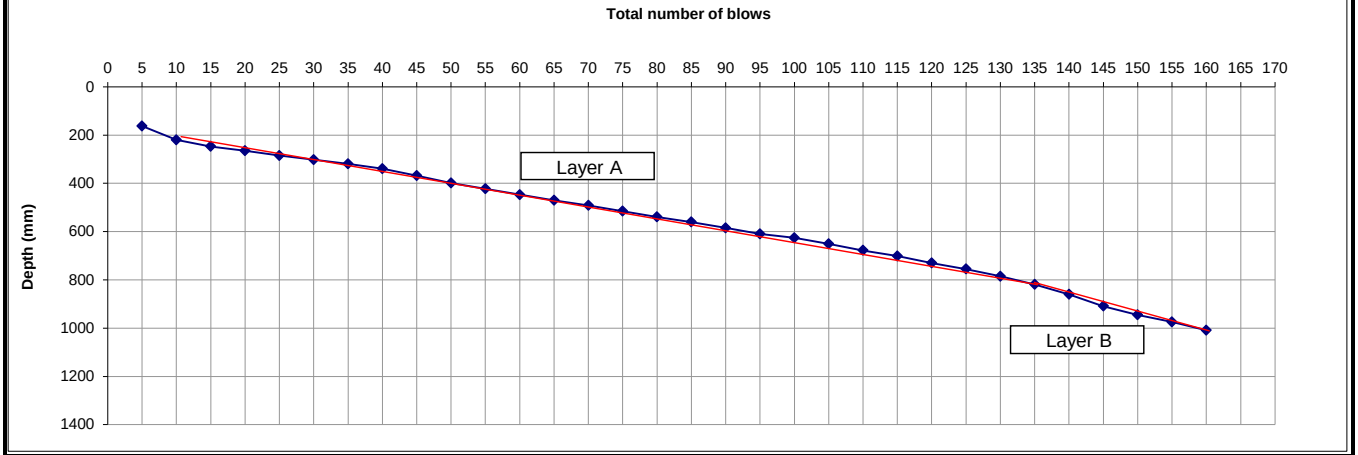
Remarks:	Test terminated due to obstruction						
Note	Test stopped at 0.243m						
Particles >20mm	Unknown		Weather	Rain Showers		Operators	AH

DYNAMIC CONE PENETRATION TEST RESULTS

Client Name	Swansea Bay Tidal Lagoon	Date	02/07/2015
Job Name	Swansea Lagoon	Job No.	10318
		Zero Reading	52
		Test Location	**DCP TP20**

APEX DRILLING SERVICES

No. of Blows	Reading (mm)	Mean penetration per blow (mm)	Layer	Top of layer (mm)	Base of layer (mm)	Blows at top of layer (no)	Blows at base of layer (no)	Mean penetration per blow (mm)	CBR of layer (%)
0	52								
5	163	22	Layer A	220	785	10	130	4.7	**58.7**
10	220	11							
15	247	5							
20	265	4	Layer B	785	1009	130	160	7.5	**36.1**
25	285	4							
30	302	3							
35	319	3							
40	339	4							
45	368	6							
50	399	6							
55	423	5							
60	447	5							
65	470	5							
70	491	4							
75	515	5							
80	539	5							
85	560	4							
90	585	5							
95	610	5							
100	626	3							
105	651	5							
110	678	5							
115	701	5							
120	730	6							
125	755	5							
130	785	6							
135	819	7							
140	860	8							
145	909	10							
150	945	7							
155	975	6							
160	1009	7							



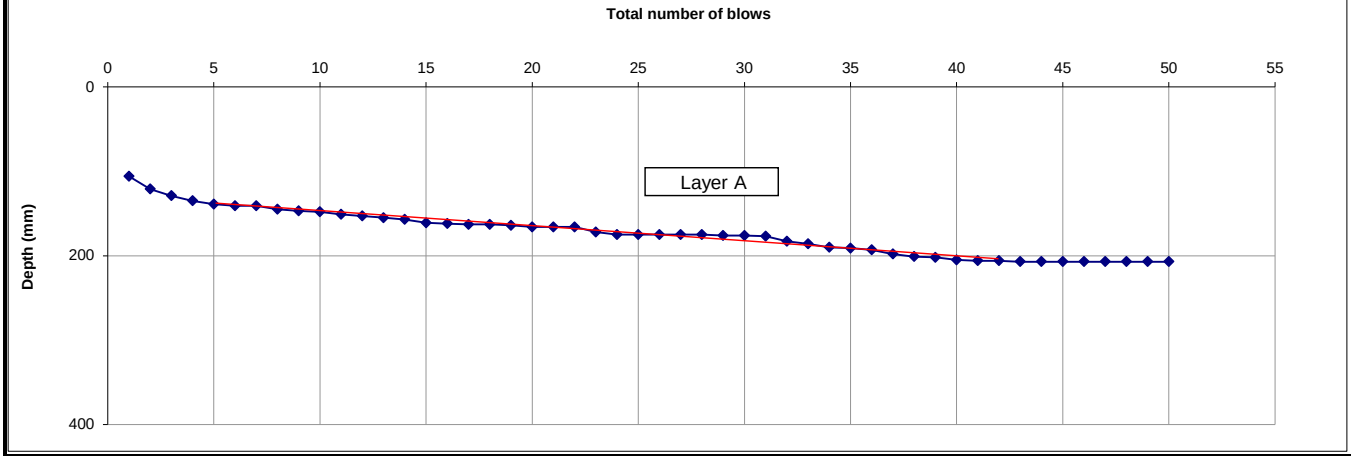
Remarks:							
Note	Test stopped at 1.009m						
Particles >20mm	Unknown	Weather	Rain Showers			Operators	AH

DYNAMIC CONE PENETRATION TEST RESULTS

Client Name	Swansea Bay Tidal Lagoon	Date	02/07/2015
Job Name	Swansea Lagoon	Job No.	10318
		Zero Reading	75
		Test Location	**DCP TP25**

APEX DRILLING SERVICES

No. of Blows	Reading (mm)	Mean penetration per blow (mm)	Layer	Top of layer (mm)	Base of layer (mm)	Blows at top of layer (no)	Blows at base of layer (no)	Mean penetration per blow (mm)	CBR of layer (%)
0	75								
1	106	31	Layer A	139	207	5	43	1.8	**163.3**
2	121	15							
3	129	8							
4	135	6							
5	139	4							
6	141	2							
7	141	0							
8	145	4							
9	147	2							
10	148	1							
11	151	3							
12	153	2							
13	155	2							
14	157	2							
15	161	4							
16	162	1							
17	163	1							
18	163	0							
19	164	1							
20	166	2							
21	166	0							
22	166	0							
23	172	6							
24	175	3							
25	175	0							
26	175	0							
27	175	0							
28	175	0							
29	176	1							
30	176	0							
31	177	1							
32	183	6							
33	186	3							
34	190	4							
35	191	1							
36	193	2							
37	198	5							
38	201	3							
39	202	1							
40	205	3							
41	206	1							
42	206	0							
43	207	1							
44	207	0							
45	207	0							
46	207	0							
47	207	0							
48	207	0							
49	207	0							
50	207	0							



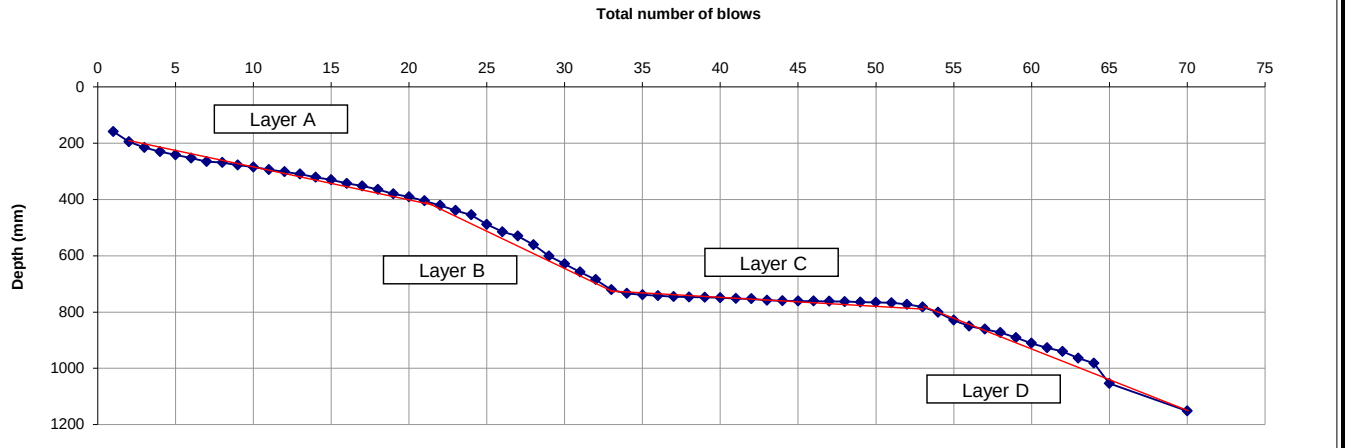
Remarks:	Test terminated due to obstruction and severe deflection of the rods						
Note	Test stopped at 0.132m						
Particles >20mm	Unknown	Weather	Rain Showers			Operators	AH

DYNAMIC CONE PENETRATION TEST RESULTS

Client Name	Swansea Bay Tidal Lagoon	Date	02/07/2015
Job Name	Swansea Lagoon	Job No.	10318
		Zero Reading	105
		Test Location	**DCP TP33**

APEX DRILLING SERVICES

No. of Blows	Reading (mm)	Mean penetration per blow (mm)	Layer	Top of layer (mm)	Base of layer (mm)	Blows at top of layer (no)	Blows at base of layer (no)	Mean penetration per blow (mm)	CBR of layer (%)
0	105								
1	159	54	Layer A	195	405	2	21	11.1	**23.8**
2	195	36							
3	216	21							
4	230	14	Layer B	405	721	21	33	26.3	**9.5**
5	242	12							
6	253	11							
7	266	13	Layer C	721	782	33	53	3.1	**92.9**
8	269	3							
9	278	9							
10	285	7	Layer D	782	1151	53	70	21.7	**11.7**
11	294	9							
12	302	8							
13	310	8							
14	321	11							
15	330	9							
16	343	13							
17	352	9							
18	365	13							
19	380	15							
20	391	11							
21	405	14							
22	421	16							
23	439	18							
24	455	16							
25	489	34							
26	515	26							
27	530	15							
28	561	31							
29	601	40							
30	629	28							
31	658	29							
32	685	27							
33	721	36							
34	734	13							
35	739	5							
36	742	3							
37	745	3							
38	747	2							
39	748	1							
40	749	1							
41	752	3							
42	753	1							
43	758	5							
44	760	2							
45	761	1							
46	761	0							
47	762	1							
48	763	1							
49	765	2							
50	766	1							
51	767	1							
52	773	6							
53	782	9							
54	801	19							
55	829	28							
56	850	21							
57	861	11							
58	873	12							
59	891	18							
60	911	20							
61	927	16							
62	940	13							
63	964	24							
64	982	18							
65	1054	72							
70	1151	19							



Remarks:							
Note	Test stopped at 1.046m						
Particles >20mm		Weather	Rain Showers			Operators	AH

DYNAMIC CONE PENETRATION TEST RESULTS

Client Name	Swansea Bay Tidal Lagoon	Date	02/07/2015
Job Name	Swansea Lagoon	Job No.	10318
		Zero Reading	55
		Test Location	**DCP TP49**

APEX DRILLING SERVICES

No. of Blows	Reading (mm)	Mean penetration per blow (mm)	Layer	Top of layer (mm)	Base of layer (mm)	Blows at top of layer (no)	Blows at base of layer (no)	Mean penetration per blow (mm)	CBR of layer (%)
0	55								
1	100	45	Layer A	55	655	0	50	12.0	**21.8**
2	133	33							
3	156	23							
4	176	20	Layer B	655	1057	50	120	5.7	**47.6**
5	187	11							
6	205	18							
7	217	12							
8	226	9							
9	233	7							
10	241	8							
11	247	6							
12	255	8							
13	270	15							
14	281	11							
15	295	14							
16	308	13							
17	321	13							
18	333	12							
19	346	13							
20	353	7							
21	361	8							
22	372	11							
23	380	8							
24	385	5							
25	396	11							
26	405	9							
27	420	15							
28	435	15							
29	446	11							
30	459	13							
31	471	12							
32	483	12							
33	492	9							
34	501	9							
35	515	14							
36	521	6							
37	527	6							
38	534	7							
39	540	6							
40	551	11							
41	564	13							
42	575	11							
43	581	6							
44	592	11							
45	610	18							
46	618	8							
47	625	7							
48	635	10							
49	644	9							
50	655	11							
55	683	6							
60	700	3							
65	712	2							
70	734	4							
75	760	5							
80	792	6							
85	829	7							
90	865	7							
95	887	4							
100	919	6							
105	948	6							
110	987	8							
115	1020	7							
120	1057	7							

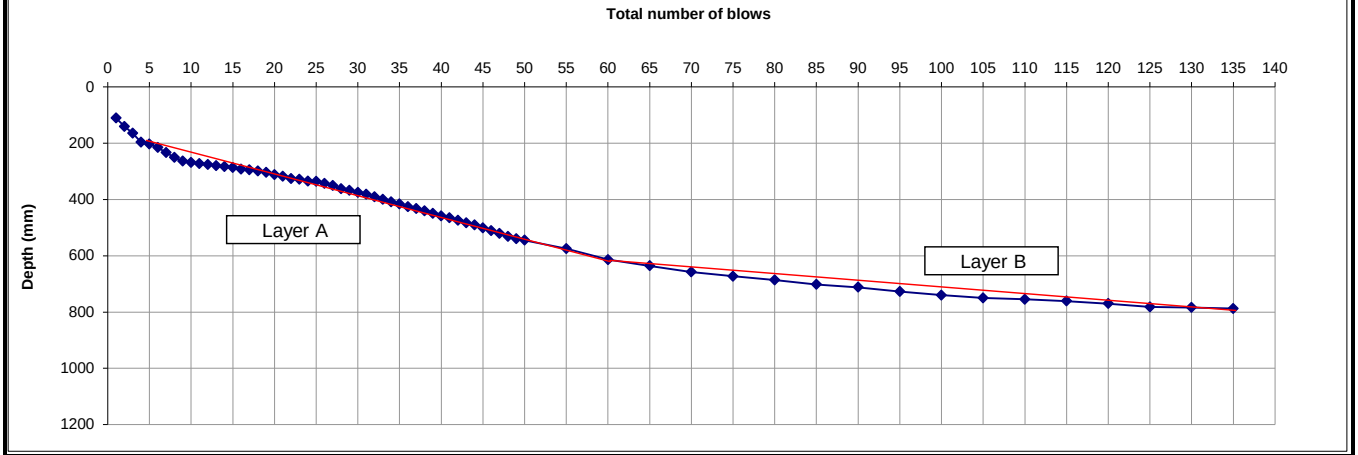
Remarks:							
Note	Test stopped at 1.002m						
Particles >20mm	Unknown	Weather	Rain Showers			Operators	AH

DYNAMIC CONE PENETRATION TEST RESULTS

Client Name	Swansea Bay Tidal Lagoon	Date	02/07/2015
Job Name	Swansea Lagoon	Job No.	10318
		Zero Reading	65
		Test Location	**DCP TP59**

APEX DRILLING SERVICES

No. of Blows	Reading (mm)	Mean penetration per blow (mm)	Layer	Top of layer (mm)	Base of layer (mm)	Blows at top of layer (no)	Blows at base of layer (no)	Mean penetration per blow (mm)	CBR of layer (%)
0	65								
1	111	46	Layer A	203	614	5	60	7.5	**36.0**
2	141	30							
3	165	24							
4	197	32	Layer B	614	788	60	135	2.3	**124.1**
5	203	6							
6	216	13							
7	234	18							
8	251	17							
9	264	13							
10	269	5							
11	273	4							
12	276	3							
13	280	4							
14	284	4							
15	287	3							
16	293	6							
17	295	2							
18	299	4							
19	304	5							
20	312	8							
21	318	6							
22	326	8							
23	329	3							
24	335	6							
25	336	1							
26	343	7							
27	351	8							
28	362	11							
29	368	6							
30	375	7							
31	382	7							
32	391	9							
33	400	9							
34	409	9							
35	416	7							
36	426	10							
37	433	7							
38	441	8							
39	450	9							
40	459	9							
41	465	6							
42	474	9							
43	483	9							
44	491	8							
45	501	10							
46	511	10							
47	521	10							
48	532	11							
49	540	8							
50	545	5							
55	575	6							
60	614	8							
65	636	4							
70	658	4							
75	673	3							
80	686	3							
85	702	3							
90	712	2							
95	727	3							
100	740	3							
105	750	2							
110	755	1							
115	761	1							
120	770	2							
125	782	2							
130	784	0							
135	788	1							



Remarks:	Test terminated due to obstruction						
Note	Test stopped at 0.723m						
Particles >20mm	Unknown	Weather	Rain Showers			Operators	AH

ENCLOSURE D
GEOTECHNICAL LABORATORY TEST RESULTS

TBC

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6708		

Site Ref / Hole ID:	BH1	**Depth (m):**	1.20 - 2.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Black brown clayey sandy GRAVEL
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	17 August 2015

Test Results

Moisture Content (%)	18

Remarks:

QA Ref.	**Apex Testing Solutions**	Approver	Date	Fig
BS1377-2 Rev. 2.0	Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096 7771	K Maid L Maiden, Laboratory Supervisor	25/08/2015	**MC 1**

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6709		

Site Ref / Hole ID:	BH1	**Depth (m):**	2.50 - 3.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Black silty very gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	17 August 2015

Test Results

Moisture Content (%)	16

Remarks:

QA Ref.	**Apex Testing Solutions**	Approver	Date	Fig
BS1377-2 Rev. 2.0	Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096 7771	K Maid	25/08/2015	**MC 2**
		L Maiden, Laboratory Supervisor		

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6710		

Site Ref / Hole ID:	BH3	**Depth (m):**	0.70 - 1.20
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Brown grey silty very sandy GRAVEL with medium cobble content
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	19 August 2015

Test Results

Moisture Content (%)	7.6

Remarks:

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6711		

Site Ref / Hole ID:	BH4	**Depth (m):**	0.50 - 1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Black silty sandy GRAVEL
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	14 August 2015

Test Results

Moisture Content (%)	16

Remarks:

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6713		

Site Ref / Hole ID:	BH5	**Depth (m):**	0.30 - 1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Brown grey slightly silty sandy GRAVEL
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	14 August 2015

Test Results

Moisture Content (%)	12

Remarks:

QA Ref.	**Apex Testing Solutions**	Approver	Date	Fig
BS1377-2 Rev. 2.0	Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096 7771	K Maid L Maiden, Laboratory Supervisor	25/08/2015	**MC 5**

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6714		

Site Ref / Hole ID:	BH9	**Depth (m):**	0.20 - 1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Grey brown slightly silty very sandy GRAVEL
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	14 August 2015

Test Results

Moisture Content (%)	5.3

Remarks:

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6715		

Site Ref / Hole ID:	TP17	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Brown grey silty very gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	19 August 2015

Test Results

Moisture Content (%)	9.1

Remarks:

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6716		

Site Ref / Hole ID:	TP17A	**Depth (m):**	1.40
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Brown grey slightly silty sandy GRAVEL
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	20 August 2015

Test Results

Moisture Content (%)	9.6

Remarks:

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6717		

Site Ref / Hole ID:	TP23	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Light brown slightly silty slightly gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	17 August 2015

Test Results

Moisture Content (%)	5.3

Remarks:

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6718		

Site Ref / Hole ID:	TP24	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Brown grey slightly silty sandy GRAVEL
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	19 August 2015

Test Results

Moisture Content (%)	6.1

Remarks:

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6719		

Site Ref / Hole ID:	TP26	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Brown grey slightly silty gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	17 August 2015

Test Results

Moisture Content (%)	4.3

Remarks:

QA Ref.	**Apex Testing Solutions**		Approver	Date	Fig
BS1377-2 Rev. 2.0	Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096	7771	K Maid L Maiden, Laboratory Supervisor	25/08/2015	**MC 11**

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6720		

Site Ref / Hole ID:	TP28	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Brown grey slightly silty gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	19 August 2015

Test Results

Moisture Content (%)	5.0

Remarks:

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6721		

Site Ref / Hole ID:	TP3	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Black silty very sandy GRAVEL
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	17 August 2015

Test Results

Moisture Content (%)	18

Remarks:

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6722		

Site Ref / Hole ID:	TP32	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Brown grey silty very gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	19 August 2015

Test Results

Moisture Content (%)	7.9

Remarks:

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6723		

Site Ref / Hole ID:	TP34B	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Brown grey silty gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	19 August 2015

Test Results

Moisture Content (%)	9.2

Remarks:

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6724		

Site Ref / Hole ID:	TP37	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Brown grey silty gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	20 August 2015

Test Results

Moisture Content (%)	5.2

Remarks:

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6725		

Site Ref / Hole ID:	TP40	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Brown silty gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	19 August 2015

Test Results

Moisture Content (%)	4.0

Remarks:

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6727		

Site Ref / Hole ID:	TP44	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Light brown slightly silty very sandy GRAVEL
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	19 August 2015

Test Results

Moisture Content (%)	4.7

Remarks:

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6728		

Site Ref / Hole ID:	TP46	**Depth (m):**	2.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Light brown slightly silty slightly gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	19 August 2015

Test Results

Moisture Content (%)	4.2

Remarks:

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6729		

Site Ref / Hole ID:	TP49	**Depth (m):**	2.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Light brown slightly silty slightly gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	20 August 2015

Test Results

Moisture Content (%)	3.9

Remarks:

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6731		

Site Ref / Hole ID:	TP55	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Brown grey silty very sandy GRAVEL
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	19 August 2015

Test Results

Moisture Content (%)	11

Remarks:

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6732		

Site Ref / Hole ID:	TP57	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Brown grey silty very sandy GRAVEL with low cobble content
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	20 August 2015

Test Results

Moisture Content (%)	5.5

Remarks:

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6733		

Site Ref / Hole ID:	TP59	**Depth (m):**	2.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Light brown slightly silty gravelly SAND with low cobble content
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	19 August 2015

Test Results

Moisture Content (%)	5.2

Remarks:

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6734		

Site Ref / Hole ID:	TP6	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Brown grey silty very gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	19 August 2015

Test Results

Moisture Content (%)	11

Remarks:

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6735		

Site Ref / Hole ID:	TP7	**Depth (m):**	2.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Black slightly silty very sandy GRAVEL
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	19 August 2015

Test Results

Moisture Content (%)	21

Remarks:

QA Ref.	**Apex Testing Solutions**		Approver	Date	Fig
BS1377-2 Rev. 2.0	Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096	7771	K Maid L Maiden, Laboratory Supervisor	25/08/2015	**MC 25**

TEST REPORT
MOISTURE CONTENT
BS1377: Part 2: 1990 : Clause 3.2

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6736		

Site Ref / Hole ID:	TP8	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Brown grey silty very sandy GRAVEL
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	19 August 2015

Test Results

Moisture Content (%)	15

Remarks:

TEST REPORT

LIQUID LIMIT, PLASTIC LIMIT & PLASTICITY INDEX

BS 1377:Part 2:1990: Clause 4.3/5.3/5.4

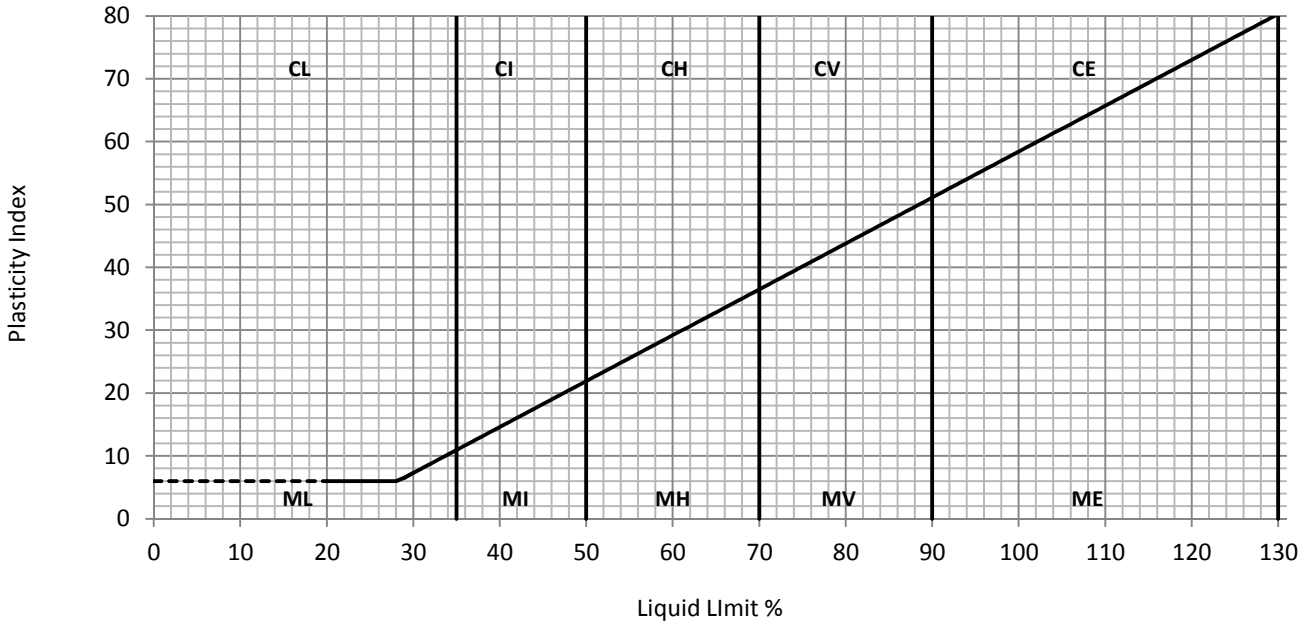
Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6717		

Site Ref / Hole ID:	TP23	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Light brown slightly silty slightly gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	18 August 2015

Test Results

Liquid Limit		%
Plastic Limit	NP	%
Plasticity Index		%

Preparation:	4.2.4 Sieved Specimen	
Proportion retained on 425µm sieve:	44	%



Remarks: Samples dilated - Non plastic

QA Ref. BS1377-2 Rev 3.0	**Apex Testing Solutions** Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096	7771	Approver: K Maid L Maiden, Laboratory Supervisor	Date: 25/08/2015	Fig. **ATT 1**

TEST REPORT

PARTICLE SIZE DISTRIBUTION ANALYSIS

BS 1377:Part 2:1990: Clause 9.2 / 9.4

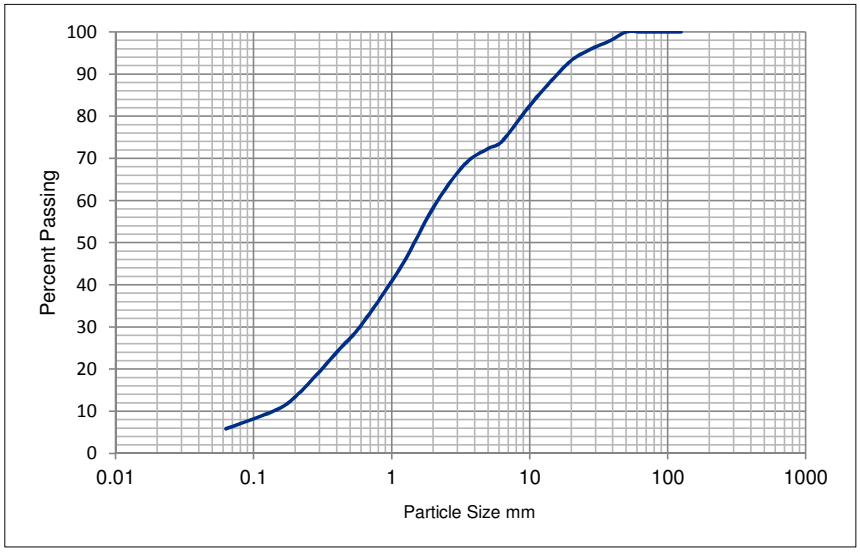
Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6709		

Site Ref / Hole ID:	BH1	**Depth (m):**	2.50 - 3.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Black silty very gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	21 August 2015

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	98
28	96
20	93
14	88
10	82
6.3	74
5.0	72
3.35	68
2.00	58
1.18	44
0.600	30
0.425	25
0.300	19
0.212	14
0.150	10
0.063	6

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	



Sedimentation	
Particle Size mm	% Passing
0.0201	
0.0060	
0.0020	

Sample Portions		Particle Density Mg/m3	Uniformity Coefficient
Cobbles / Boulders	0	N/A	D_{60} / D_{10}
Gravel	42		
Sand	52	**Dry mas of sample, kg**	
Silt / Clay	6	7.4	N/A

Remarks:

QA Ref.					
BS1377 - 2 Rev 3.0	**Apex Testing Solutions** Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096	7771	Approver K Maid L Maiden, Laboratory Supervisor	Date 25/08/2015	Fig **PSD 1**

TEST REPORT
PARTICLE SIZE DISTRIBUTION ANALYSIS
BS 1377:Part 2:1990: Clause 9.2 / 9.4

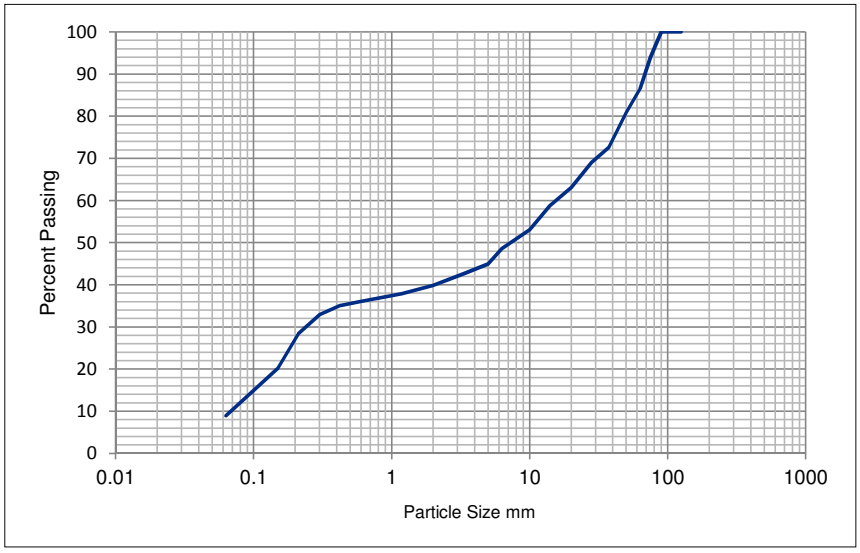
Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6710		

Site Ref / Hole ID:	BH3	**Depth (m):**	0.70 - 1.20
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Brown grey silty very sandy GRAVEL with medium cobble content
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	24 August 2015

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	94
63	87
50	81
37.5	73
28	69
20	63
14	59
10	53
6.3	49
5.0	45
3.35	43
2.00	40
1.18	38
0.600	36
0.425	35
0.300	33
0.212	28
0.150	20
0.063	9

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	



Sedimentation	
Particle Size mm	% Passing
0.0201	
0.0060	
0.0020	

Sample Portions		Particle Density Mg/m3	Uniformity Coefficient
Cobbles / Boulders	13	N/A	D_{60} / D_{10}
Gravel	47		
Sand	31	**Dry mas of sample, kg**	
Silt / Clay	9	14.7	N/A

Remarks: Sample all used - Insufficient material was supplied to provide a representative sample.
[Initial sample mass did not conform with BS1377: 1990: Part 2, Table 3]

TEST REPORT

PARTICLE SIZE DISTRIBUTION ANALYSIS

BS 1377:Part 2:1990: Clause 9.2 / 9.4

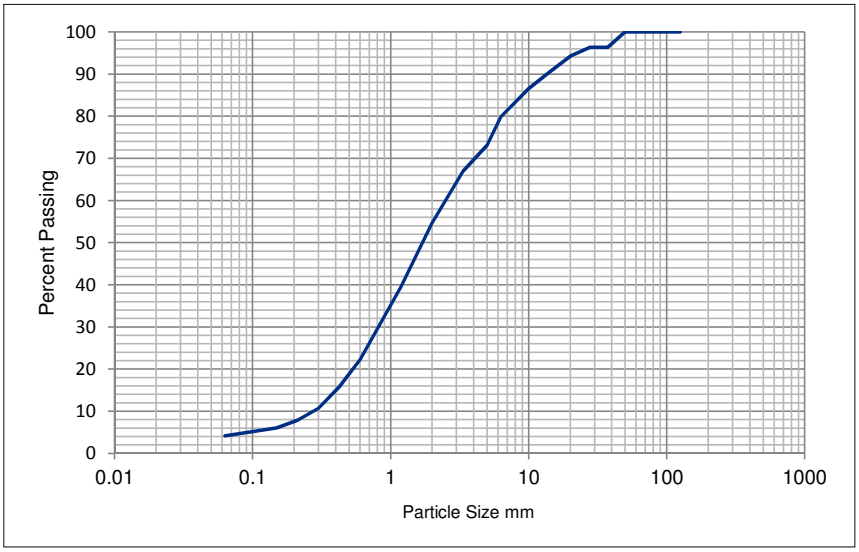
Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6712		

Site Ref / Hole ID:	BH4	**Depth (m):**	2.50 - 3.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Black slightly silty very gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	25 August 2015

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	96
28	96
20	94
14	90
10	87
6.3	80
5.0	73
3.35	67
2.00	55
1.18	39
0.600	22
0.425	16
0.300	11
0.212	8
0.150	6
0.063	4

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	



Sedimentation	
Particle Size mm	% Passing
0.0201	
0.0060	
0.0020	

Sample Portions		Particle Density Mg/m3	Uniformity Coefficient
Cobbles / Boulders	0	N/A	D_{60} / D_{10}
Gravel	45		
Sand	51	**Dry mas of sample, kg**	
Silt / Clay	4	5.0	N/A

Remarks:

QA Ref.					
BS1377 - 2 Rev 3.0	**Apex Testing Solutions** Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096	7771	Approver K Maid L Maiden, Laboratory Supervisor	Date 25/08/2015	Fig **PSD 3**

TEST REPORT

PARTICLE SIZE DISTRIBUTION ANALYSIS

BS 1377:Part 2:1990: Clause 9.2 / 9.4

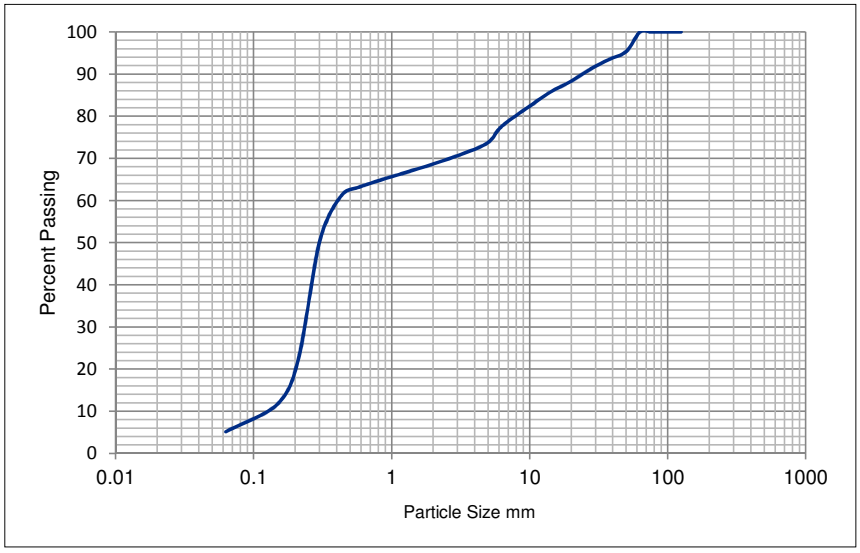
Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6715		

Site Ref / Hole ID:	TP17	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Brown grey silty very gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	24 August 2015

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	95
37.5	93
28	91
20	88
14	86
10	82
6.3	78
5.0	74
3.35	71
2.00	69
1.18	66
0.600	63
0.425	61
0.300	50
0.212	23
0.150	12
0.063	5

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	



Sedimentation	
Particle Size mm	% Passing
0.0201	
0.0060	
0.0020	

Sample Portions		Particle Density Mg/m3	Uniformity Coefficient
Cobbles / Boulders	0	N/A	D_{60} / D_{10}
Gravel	31		
Sand	64	**Dry mas of sample, kg**	
Silt / Clay	5	11.9	N/A

Remarks:

QA Ref.					
BS1377 - 2 Rev 3.0	**Apex Testing Solutions** Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096	7771	Approver K Maid L Maiden, Laboratory Supervisor	Date 25/08/2015	Fig **PSD 4**

TEST REPORT

PARTICLE SIZE DISTRIBUTION ANALYSIS

BS 1377:Part 2:1990: Clause 9.2 / 9.4

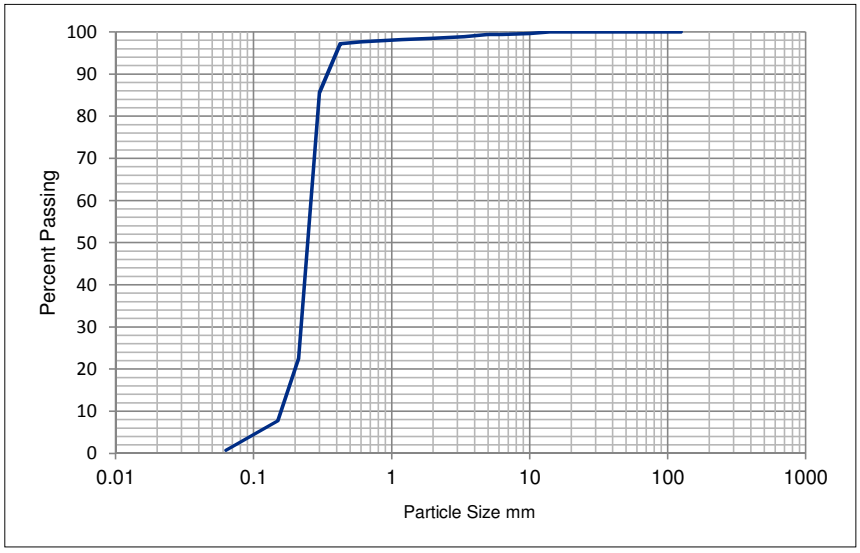
Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6717		

Site Ref / Hole ID:	TP23	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Light brown slightly silty slightly gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	25 August 2015

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	99
5.0	99
3.35	99
2.00	99
1.18	98
0.600	98
0.425	97
0.300	86
0.212	23
0.150	8
0.063	1

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	



Sedimentation	
Particle Size mm	% Passing
0.0201	
0.0060	
0.0020	

Sample Portions		Particle Density Mg/m3	Uniformity Coefficient
Cobbles / Boulders	0	N/A	D_{60} / D_{10}
Gravel	1		
Sand	98	**Dry mas of sample, kg**	
Silt / Clay	1	4.1	N/A

Remarks:

QA Ref.	**Apex Testing Solutions**	Approver	Date	Fig
BS1377 - 2	Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ	K Maid	25/08/2015	**PSD 5**
Rev 3.0	Tel: 01656 746762 Fax: 01656 749096	7771	L Maiden, Laboratory Supervisor	

TEST REPORT
PARTICLE SIZE DISTRIBUTION ANALYSIS
BS 1377:Part 2:1990: Clause 9.2 / 9.4

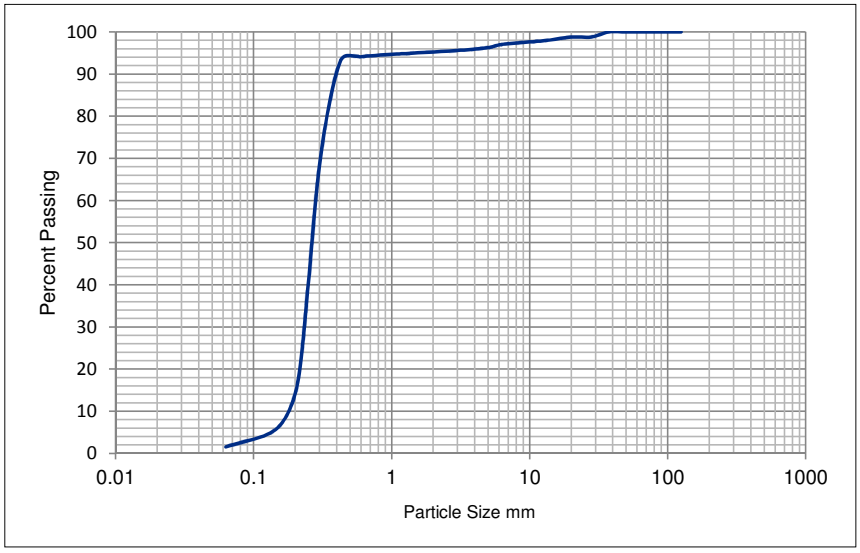
Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6719		

Site Ref / Hole ID:	TP26	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Brown grey slightly silty gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	24 August 2015

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	99
20	99
14	98
10	98
6.3	97
5.0	96
3.35	96
2.00	95
1.18	95
0.600	94
0.425	93
0.300	68
0.212	18
0.150	6
0.063	2

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	



Sedimentation	
Particle Size mm	% Passing
0.0201	
0.0060	
0.0020	

Sample Portions		Particle Density Mg/m3	Uniformity Coefficient
Cobbles / Boulders	0	N/A	D_{60} / D_{10}
Gravel	5		
Sand	93	**Dry mas of sample, kg**	
Silt / Clay	2	4.8	N/A

Remarks:

QA Ref.	Apex Testing Solutions	Approver	Date	Fig
BS1377 - 2 Rev 3.0	Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096 UKAS TESTING 7771	L Maiden L Maiden, Laboratory Supervisor	25/08/2015	PSD 6

TEST REPORT

PARTICLE SIZE DISTRIBUTION ANALYSIS

BS 1377:Part 2:1990: Clause 9.2 / 9.4

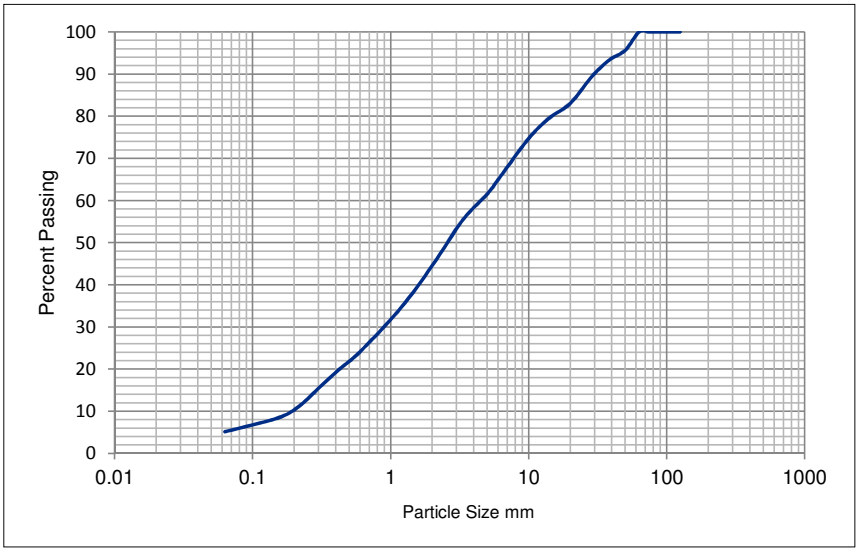
Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6721		

Site Ref / Hole ID:	TP3	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Black silty very sandy GRAVEL
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	24 August 2015

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	96
37.5	93
28	89
20	83
14	79
10	75
6.3	66
5.0	61
3.35	55
2.00	45
1.18	34
0.600	24
0.425	20
0.300	15
0.212	11
0.150	8
0.063	5

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	



Sedimentation	
Particle Size mm	% Passing
0.0201	
0.0060	
0.0020	

Sample Portions		Particle Density Mg/m3	Uniformity Coefficient
Cobbles / Boulders	0	N/A	D_{60} / D_{10}
Gravel	55		
Sand	40	**Dry mas of sample, kg**	
Silt / Clay	5	7.2	N/A

Remarks:

QA Ref.					
BS1377 - 2 Rev 3.0	**Apex Testing Solutions** Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096	7771	Approver K Maid L Maiden, Laboratory Supervisor	Date 25/08/2015	Fig **PSD 7**

TEST REPORT

PARTICLE SIZE DISTRIBUTION ANALYSIS

BS 1377:Part 2:1990: Clause 9.2 / 9.4

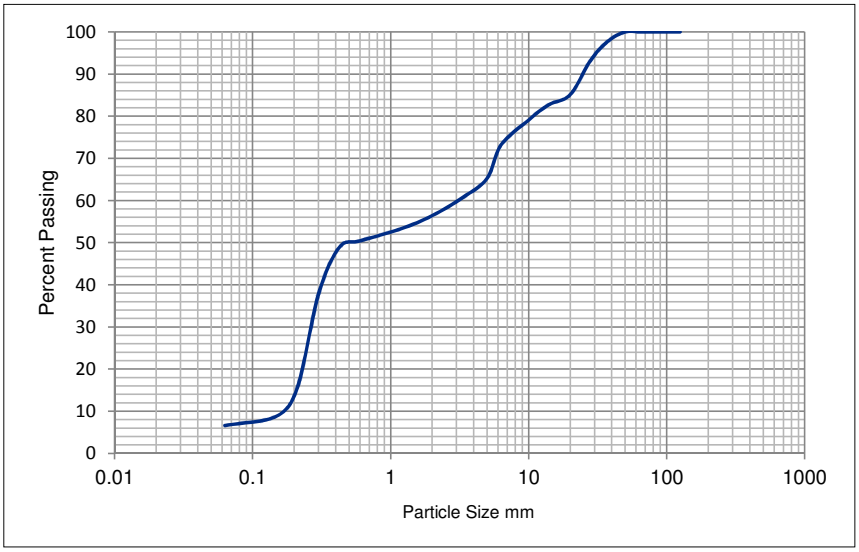
Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6722		

Site Ref / Hole ID:	TP32	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Brown grey silty very gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	24 August 2015

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	98
28	93
20	85
14	83
10	79
6.3	73
5.0	65
3.35	61
2.00	56
1.18	53
0.600	50
0.425	49
0.300	38
0.212	16
0.150	9
0.063	7

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	



Sedimentation	
Particle Size mm	% Passing
0.0201	
0.0060	
0.0020	

Sample Portions		Particle Density Mg/m3	Uniformity Coefficient
Cobbles / Boulders	0	N/A	D_{60} / D_{10}
Gravel	44		
Sand	49	**Dry mas of sample, kg**	
Silt / Clay	7	10.9	N/A

Remarks:

QA Ref.					
BS1377 - 2 Rev 3.0	**Apex Testing Solutions** Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096	7771	Approver K Maid L Maiden, Laboratory Supervisor	Date 25/08/2015	Fig **PSD 8**

TEST REPORT

PARTICLE SIZE DISTRIBUTION ANALYSIS

BS 1377:Part 2:1990: Clause 9.2 / 9.4

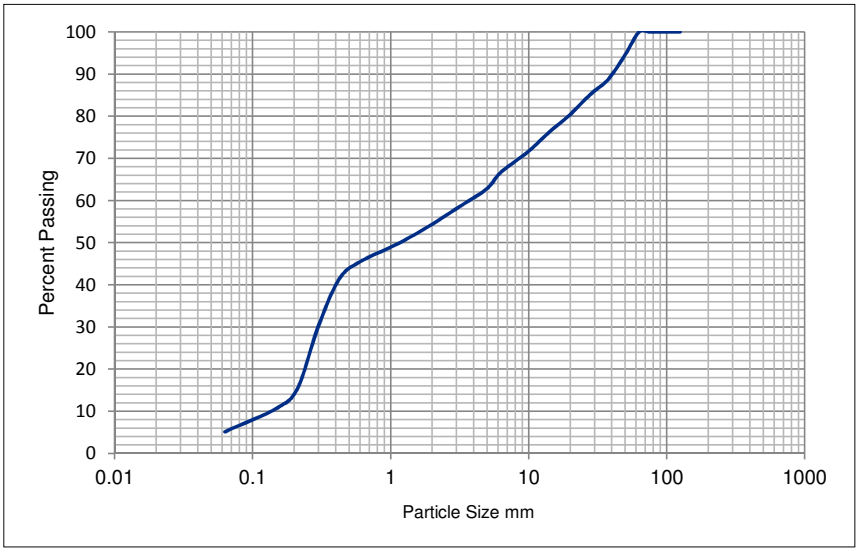
Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6726		

Site Ref / Hole ID:	TP42	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Brown grey silty very gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	24 August 2015

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	95
37.5	89
28	85
20	80
14	76
10	72
6.3	67
5.0	63
3.35	59
2.00	54
1.18	50
0.600	45
0.425	41
0.300	30
0.212	16
0.150	11
0.063	5

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	



Sedimentation	
Particle Size mm	% Passing
0.0201	
0.0060	
0.0020	

Sample Portions		Particle Density Mg/m3	Uniformity Coefficient
Cobbles / Boulders	0	N/A	D_{60} / D_{10}
Gravel	46		
Sand	49	**Dry mas of sample, kg**	
Silt / Clay	5	8.7	N/A

Remarks: Sample all used - Insufficient material was supplied to provide a representative sample.
[Initial sample mass did not conform with BS1377: 1990: Part 2, Table 3]

QA Ref.			Approver	Date	Fig
BS1377 - 2 Rev 3.0	**Apex Testing Solutions** Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096	7771	K Maid L Maiden, Laboratory Supervisor	25/08/2015	**PSD 9**

TEST REPORT

PARTICLE SIZE DISTRIBUTION ANALYSIS

BS 1377:Part 2:1990: Clause 9.2 / 9.4

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6728		

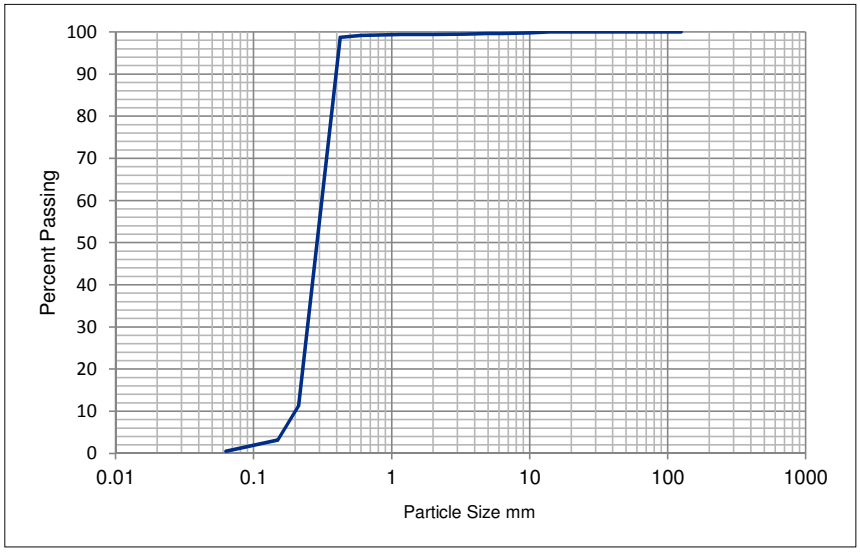
Site Ref / Hole ID:	TP46	**Depth (m):**	2.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Light brown slightly silty slightly gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	24 August 2015

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5.0	100
3.35	99
2.00	99
1.18	99
0.600	99
0.425	99
0.300	55
0.212	11
0.150	3
0.063	0

Sedimentation	
Particle Size mm	% Passing
0.0201	
0.0060	
0.0020	

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	



Sample Portions		Particle Density Mg/m3	Uniformity Coefficient
Cobbles / Boulders	0	N/A	D_{60} / D_{10}
Gravel	1		
Sand	99	**Dry mas of sample, kg**	
Silt / Clay	0	2.8	N/A

Remarks:

QA Ref.	**Apex Testing Solutions**	Approver	Date	Fig
BS1377 - 2	Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ	K Maid	25/08/2015	**PSD 10**
Rev 3.0	Tel: 01656 746762 Fax: 01656 749096	7771	L Maiden, Laboratory Supervisor	

TEST REPORT

PARTICLE SIZE DISTRIBUTION ANALYSIS

BS 1377:Part 2:1990: Clause 9.2 / 9.4

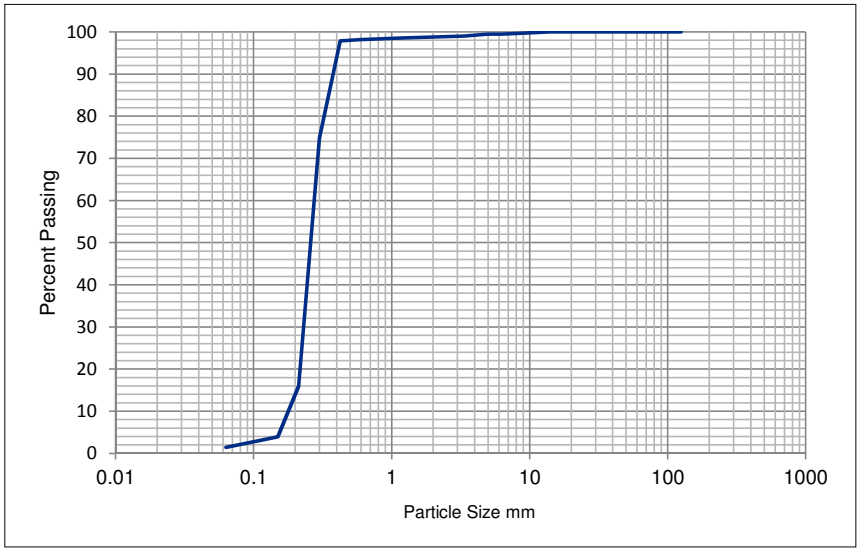
Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6729		

Site Ref / Hole ID:	TP49	**Depth (m):**	2.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Light brown slightly silty slightly gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	24 August 2015

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	99
5.0	99
3.35	99
2.00	99
1.18	99
0.600	98
0.425	98
0.300	75
0.212	16
0.150	4
0.063	1

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	



Sedimentation	
Particle Size mm	% Passing
0.0201	
0.0060	
0.0020	

Sample Portions		Particle Density Mg/m3	Uniformity Coefficient
Cobbles / Boulders	0	N/A	D_{60} / D_{10}
Gravel	1		
Sand	98	**Dry mas of sample, kg**	
Silt / Clay	1	2.6	N/A

Remarks:

QA Ref.	**Apex Testing Solutions**	Approver	Date	Fig
BS1377 - 2 Rev 3.0	Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096 7771	K Maid L Maiden, Laboratory Supervisor	25/08/2015	**PSD 11**

TEST REPORT

PARTICLE SIZE DISTRIBUTION ANALYSIS

BS 1377:Part 2:1990: Clause 9.2 / 9.4

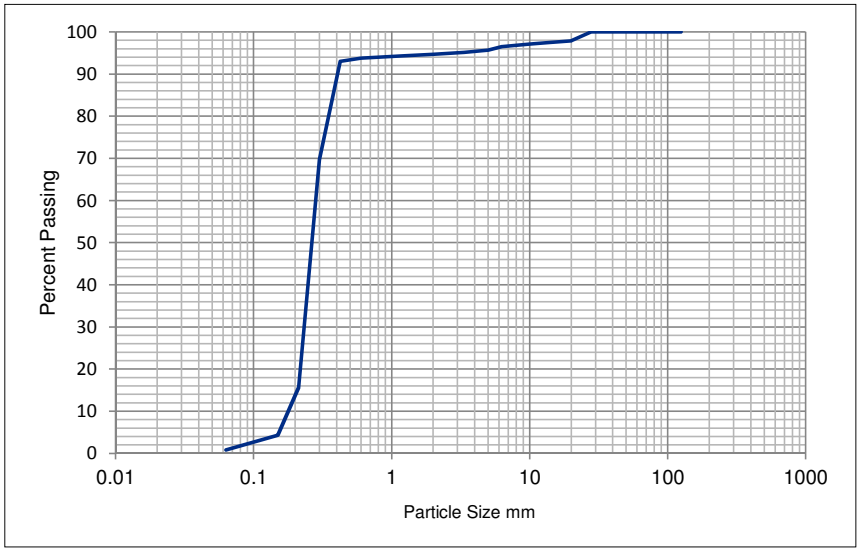
Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6730		

Site Ref / Hole ID:	TP53	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Light brown slightly silty gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	24 August 2015

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	98
14	97
10	97
6.3	96
5.0	96
3.35	95
2.00	95
1.18	94
0.600	94
0.425	93
0.300	70
0.212	16
0.150	4
0.063	1

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	



Sedimentation	
Particle Size mm	% Passing
0.0201	
0.0060	
0.0020	

Sample Portions		Particle Density Mg/m3	Uniformity Coefficient
Cobbles / Boulders	0	N/A	D_{60} / D_{10}
Gravel	5		
Sand	94	**Dry mas of sample, kg**	
Silt / Clay	1	7.5	N/A

Remarks:

QA Ref.	**Apex Testing Solutions**	Approver	Date	Fig
BS1377 - 2 Rev 3.0	Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096 7771	K Maid L Maiden, Laboratory Supervisor	25/08/2015	**PSD 12**

TEST REPORT

PARTICLE SIZE DISTRIBUTION ANALYSIS

BS 1377:Part 2:1990: Clause 9.2 / 9.4

Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6732		

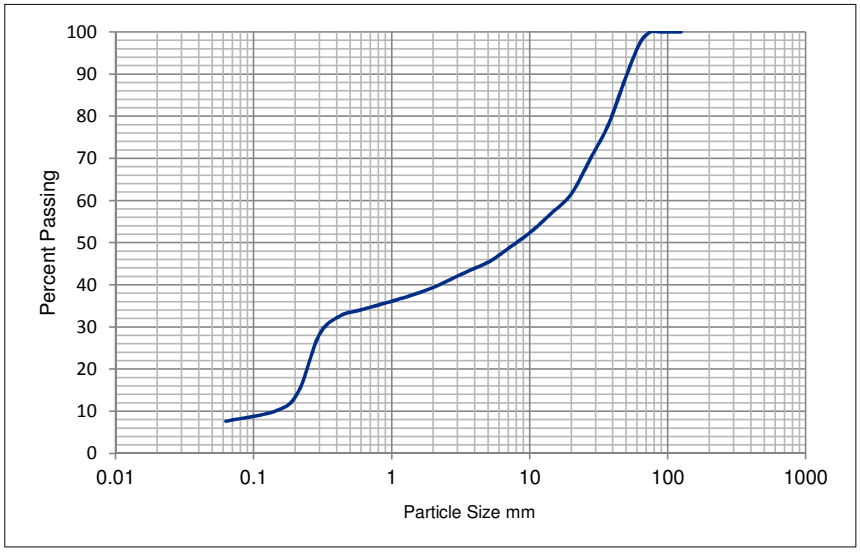
Site Ref / Hole ID:	TP57	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Brown grey silty very sandy GRAVEL with low cobble content
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	21 August 2015

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	97
50	89
37.5	78
28	70
20	62
14	57
10	52
6.3	48
5.0	45
3.35	43
2.00	39
1.18	37
0.600	34
0.425	33
0.300	28
0.212	15
0.150	10
0.063	8

Sedimentation	
Particle Size mm	% Passing
0.0201	
0.0060	
0.0020	

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	



Sample Portions		Particle Density Mg/m3	Uniformity Coefficient
Cobbles / Boulders	3	N/A	D_{60} / D_{10}
Gravel	58		
Sand	31	**Dry mas of sample, kg**	
Silt / Clay	8	17.7	N/A

Remarks: Sample all used - Insufficient material was supplied to provide a representative sample.
[Initial sample mass did not conform with BS1377: 1990: Part 2, Table 3]

TEST REPORT

PARTICLE SIZE DISTRIBUTION ANALYSIS

BS 1377:Part 2:1990: Clause 9.2 / 9.4

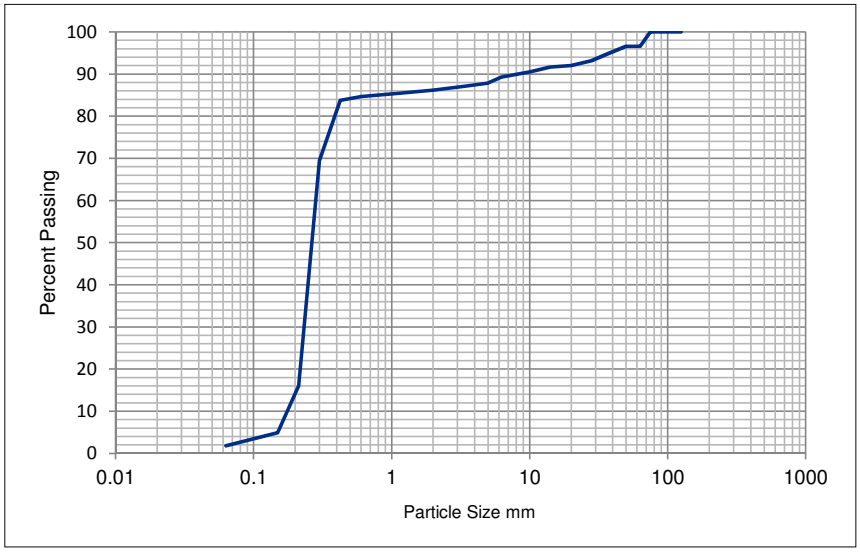
Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6733		

Site Ref / Hole ID:	TP59	**Depth (m):**	2.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Light brown slightly silty gravelly SAND with low cobble content
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	25 August 2015

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	97
50	97
37.5	95
28	93
20	92
14	92
10	90
6.3	89
5.0	88
3.35	87
2.00	86
1.18	86
0.600	85
0.425	84
0.300	69
0.212	16
0.150	5
0.063	2

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	



Sedimentation	
Particle Size mm	% Passing
0.0201	
0.0060	
0.0020	

Sample Portions		Particle Density Mg/m3	Uniformity Coefficient
Cobbles / Boulders	3	N/A	D_{60} / D_{10}
Gravel	11		
Sand	84	**Dry mas of sample, kg**	
Silt / Clay	2	16.2	N/A

Remarks:

QA Ref.					
BS1377 - 2 Rev 3.0	**Apex Testing Solutions** Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096	7771	Approver K Maid L Maiden, Laboratory Supervisor	Date 25/08/2015	Fig **PSD 14**

TEST REPORT

PARTICLE SIZE DISTRIBUTION ANALYSIS

BS 1377:Part 2:1990: Clause 9.2 / 9.4

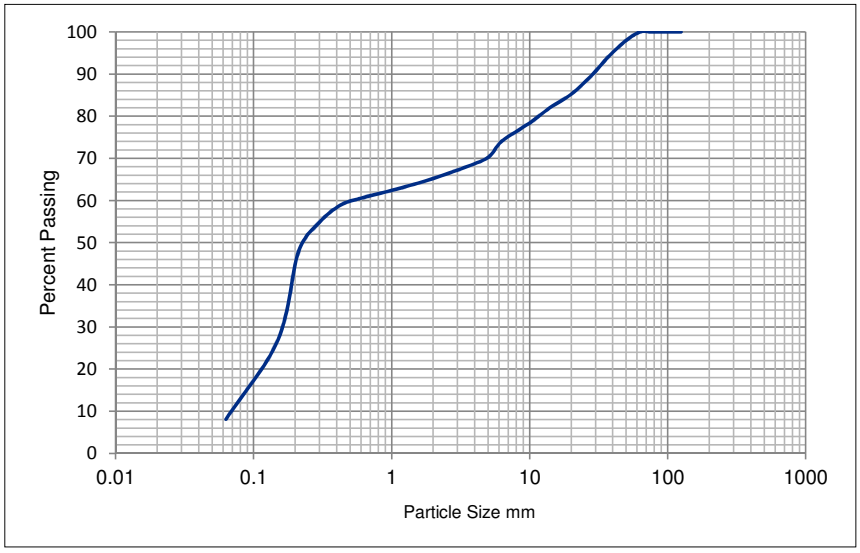
Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6734		

Site Ref / Hole ID:	TP6	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Brown grey silty very gravelly SAND
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	25 August 2015

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	98
37.5	94
28	90
20	85
14	82
10	78
6.3	74
5.0	70
3.35	68
2.00	65
1.18	63
0.600	61
0.425	59
0.300	55
0.212	48
0.150	27
0.063	8

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	



Sedimentation	
Particle Size mm	% Passing
0.0201	
0.0060	
0.0020	

Sample Portions		Particle Density Mg/m3	Uniformity Coefficient
Cobbles / Boulders	0	N/A	D_{60} / D_{10}
Gravel	35		
Sand	57	**Dry mas of sample, kg**	
Silt / Clay	8	10.7	N/A

Remarks:

QA Ref.					
BS1377 - 2 Rev 3.0	**Apex Testing Solutions** Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096	7771	Approver K Maid L Maiden, Laboratory Supervisor	Date 25/08/2015	Fig **PSD 15**

TEST REPORT

PARTICLE SIZE DISTRIBUTION ANALYSIS

BS 1377:Part 2:1990: Clause 9.2 / 9.4

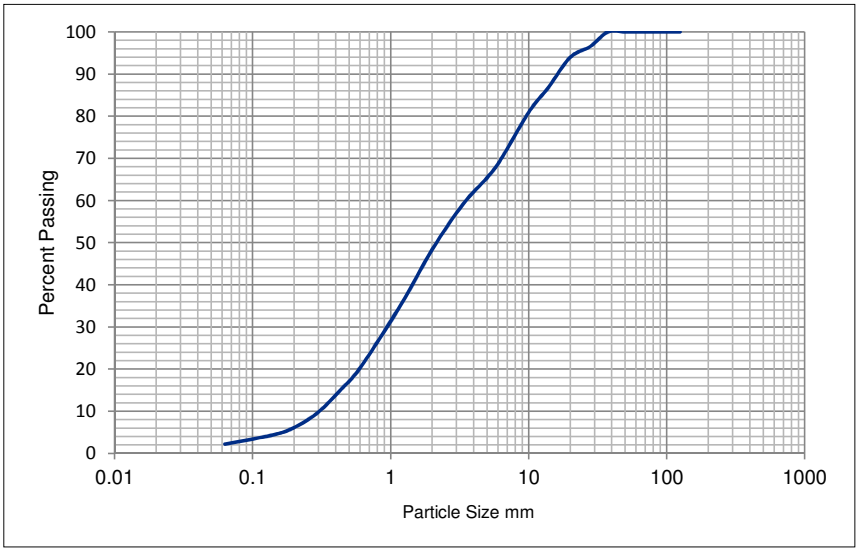
Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6735		

Site Ref / Hole ID:	TP7	**Depth (m):**	2.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Black slightly silty very sandy GRAVEL
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	24 August 2015

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	97
20	94
14	87
10	81
6.3	70
5.0	65
3.35	59
2.00	48
1.18	35
0.600	20
0.425	15
0.300	10
0.212	7
0.150	5
0.063	2

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	



Sedimentation	
Particle Size mm	% Passing
0.0201	
0.0060	
0.0020	

Sample Portions		Particle Density Mg/m3	Uniformity Coefficient
Cobbles / Boulders	0	N/A	D_{60} / D_{10}
Gravel	52		
Sand	46	**Dry mas of sample, kg**	
Silt / Clay	2	8.2	N/A

Remarks:

QA Ref.					
BS1377 - 2 Rev 3.0	**Apex Testing Solutions** Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ Tel: 01656 746762 Fax: 01656 749096	7771	Approver K Maid L Maiden, Laboratory Supervisor	Date 25/08/2015	Fig **PSD 16**

TEST REPORT

PARTICLE SIZE DISTRIBUTION ANALYSIS

BS 1377:Part 2:1990: Clause 9.2 / 9.4

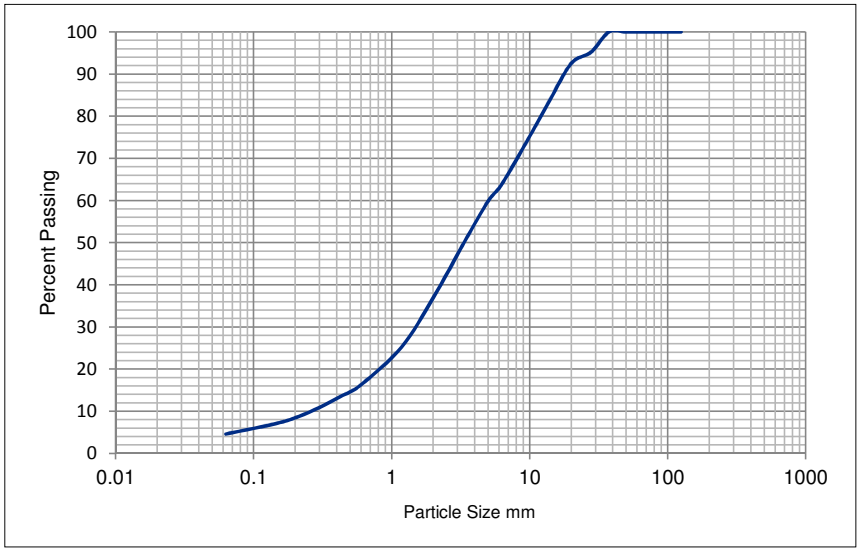
Project No:	D5232-15	**Client:**	Apex Drilling
Project Name:	Swansea Bay Lagoon	**Address:**	Sturmi Way, Village Farm Industrial Estate, Bridgend CF33 6BZ
ATS Sample No:	6736		

Site Ref / Hole ID:	TP8	**Depth (m):**	1.00
Sample No:		**Sample Type:**	Bulk
Sampling Certificate Received:	No	**Material Description:**	Brown grey silty very sandy GRAVEL
Location in Works:	Unknown	**Material Source:**	N/A
Date Sampled:	Unknown	**Material Supplier:**	N/A
Sampled By:	Unknown	**Specification:**	BS1377
Date Received:	12 August 2015	**Date Tested:**	21 August 2015

Test Results

Sieving	
Particle Size mm	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	95
20	93
14	84
10	75
6.3	64
5.0	60
3.35	50
2.00	37
1.18	25
0.600	16
0.425	13
0.300	11
0.212	9
0.150	7
0.063	5

Preparation / Pretreatment	
Sieve:	Pre dried
Pipette:	



Sedimentation	
Particle Size mm	% Passing
0.0201	
0.0060	
0.0020	

Sample Portions		Particle Density Mg/m3	Uniformity Coefficient
Cobbles / Boulders	0	N/A	D_{60} / D_{10}
Gravel	63		
Sand	32	**Dry mas of sample, kg**	
Silt / Clay	5	8.2	N/A

Remarks:

QA Ref.	**Apex Testing Solutions**	Approver	Date	Fig
BS1377 - 2	Sturmi Way, Village Farm Industrial Est, Pyle, Bridgend, CF33 6BZ	K Maid	25/08/2015	**PSD 17**
Rev 3.0	Tel: 01656 746762 Fax: 01656 749096	7771	L Maiden, Laboratory Supervisor	

Laboratory Report

2788

GEO Site & Testing Services Ltd

Contract Number: 27972

Client's Reference:

Report Date: **02-09-2015**

Client **Apex Drilling Services Limited**
Sturmi Way
Village Farm Industrial Estate, Pyle
Bridgend
CF33 6BZ

Contract Title: **Tide Lagoon Swansea Bay**

For the attention of: **Robert Brewer**

Date Received: **18-08-2015**

Date Commenced: **18-08-2015**

Date Completed: **02-09-2015**

Test Description	Qty
Moisture Content 1377 : 1990 Part 2 : 3.2 - * UKAS	6
4 Point Liquid & Plastic Limit (LL/PL) 1377 : 1990 Part 2 : 4.3 & 5.3 - * UKAS	1
PSD Wet Sieve method 1377 : 1990 Part 2 : 9.2 - * UKAS	7
PSD: Sedimentation by pipette carried out with Wet Sieve 1377 : 1990 Part 2 : 9.4 - * UKAS	1
Disposal of Samples on Project	1

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

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

Approved Signatories:
Alex Wynn (Associate Director) - Benjamin Sharp (Contracts Manager) - D V Edwards (Managing Director)
Emma Sharp (Office Manager) - Paul Evans (Quality/Technical Manager)

GEO Site & Testing Services Ltd
Unit 4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN
Tel: 01554 784040 Fax: 01554 784041 info@geo.uk.com geo.uk.com

Test Report: **Method of the Determination of the plastic limit and plasticity index**
BS 1377 : Part 2 : 1990 Method 5

Client ref:

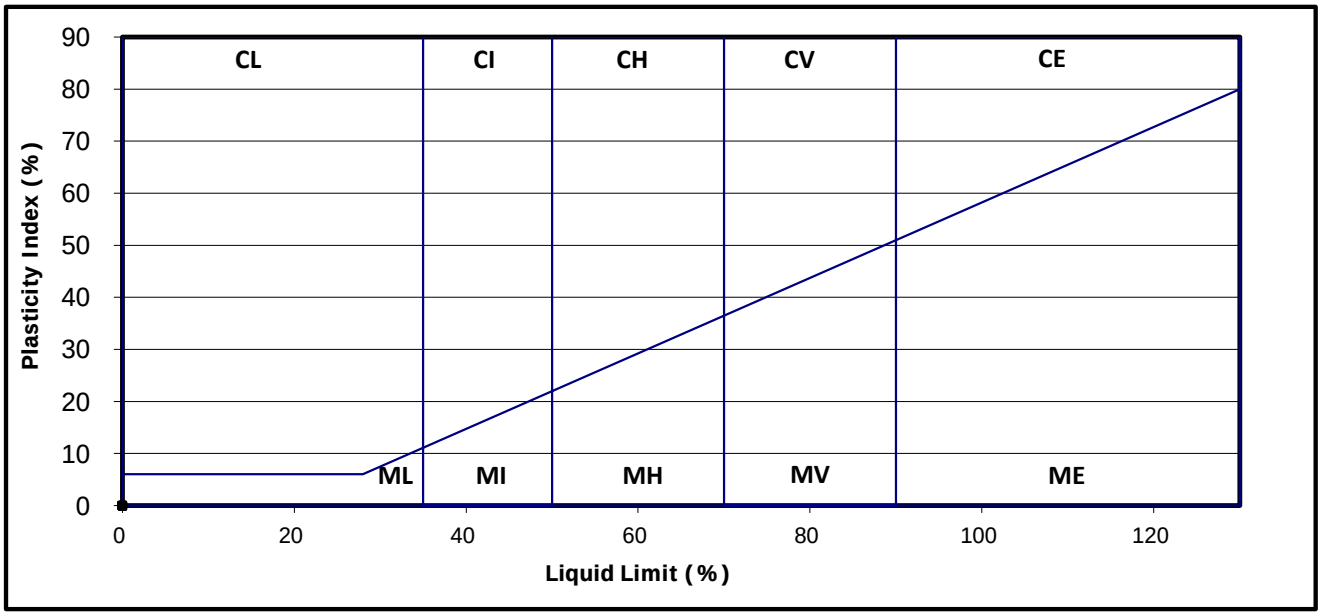
Location: **Tide Lagoon Swansea Bay**

Contract Number: **27972-190815**

Hole / Sample Number	Sample Type	Depth m	Moisture Content % Cl. 3.2	Liquid Limit % Cl. 4.3/4.4	Plastic Limit % Cl. 5.	Plasticity Index % Cl. 6.	% Passing .425mm	Remarks
BH2	B	1.20 - 1.55	6.9					
BH10A	B	3.00 - 3.80	8.0					
TP10	D	2.80	19		NP		80	
TP11	B	3.00	31					
TP12	D	2.00	22					
TP37	ES	2.00	5.8					

Symbols: **NP : Non Plastic** **# : Liquid Limit and Plastic Limit Wet Sieved**

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.
BS 5930:1999+A2:2010



GSTL
GEO SITE & TESTING SERVICES LTD

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Jon Tatam (Office / Quality Assistant)
Date: 2.9.15

UKAS TESTING
2788

Test Report:

Particle Size Distribution Test
BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

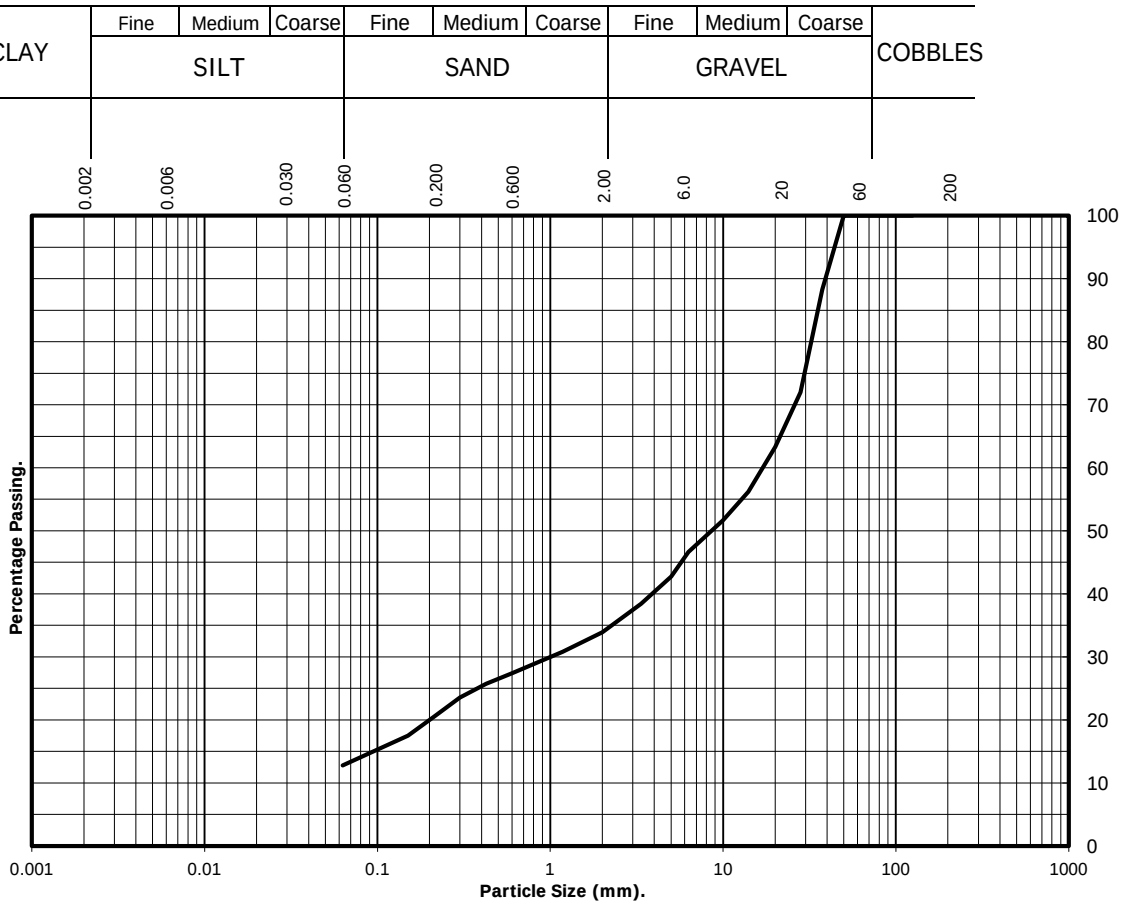
Client Ref.:
Contract Number: 27972-190815
Hole Number: BH2

Sample Number:
Depth from (m): 1.20
Depth to (m): 1.55
Sample Type: B

Location: Tide Lagoon Swansea Bay
Description: Brown silty clayey sandy GRAVEL (fine-coarse)

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	88
28	72
20	63
14	56
10	52
6.3	47
5.0	43
3.35	38
2.00	34
1.18	31
0.60	27
0.425	26
0.300	24
0.212	21
0.150	18
0.063	13

Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#



	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	13	21	66	0	Total Percentage

Remarks:
#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Jon Tatam (Office/Quality Assistant)

Date: 2.9.15

GSTL
GEO SITE & TESTING SERVICES LTD

UKAS TESTING
2788

Test Report:

Particle Size Distribution Test
BS 1377 Part 2:1990.

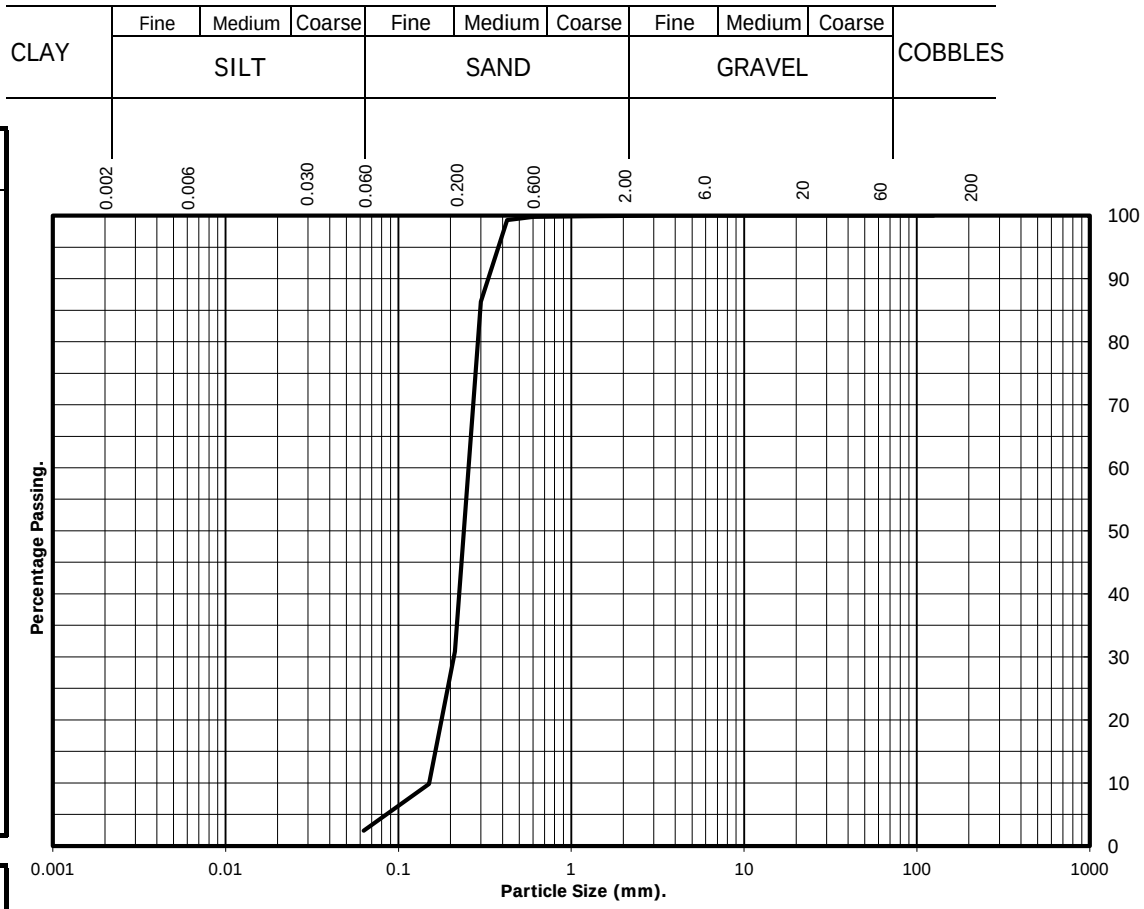
Wet Sieve, Clause 9.2

Client Ref.:
Contract Number: 27972-190815
Hole Number: BH9

Sample Number:
Depth from (m): 2.00
Depth to (m): 3.00
Sample Type: B

Location: Tide Lagoon Swansea Bay
Description: Brown silty clayey SAND

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5.0	100
3.35	100
2.00	100
1.18	100
0.60	100
0.425	99
0.300	86
0.212	31
0.150	10
0.063	2



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	2	98	0	0	Total Percentage

Remarks:
#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Jon Tatam (Office/Quality Assistant)

Date: 2.9.15

GSTL
GEO SITE & TESTING SERVICES LTD

UKAS TESTING
2788

Test Report:

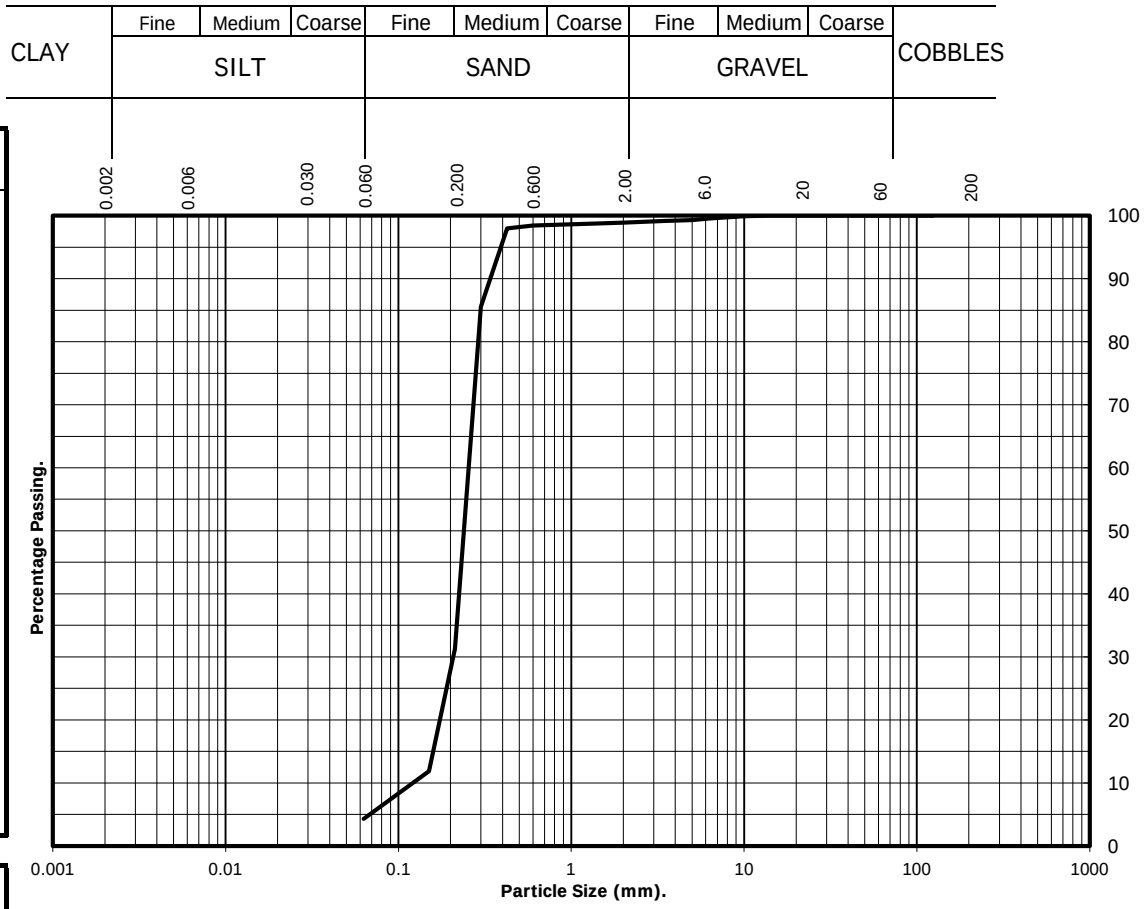
Particle Size Distribution Test
BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

Client Ref.:
Contract Number: 27972-190815
Hole Number: BH10A

Sample Number:
Depth from (m): 3.00
Depth to (m): 3.80
Sample Type: B

Location: Tide Lagoon Swansea Bay
Description: Brown gravelly (fine) silty clayey SAND



BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5.0	99
3.35	99
2.00	99
1.18	99
0.60	98
0.425	98
0.300	86
0.212	31
0.150	12
0.063	4

Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	4	95	1	0	Total Percentage

Remarks:
#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Jon Tatam (Office/Quality Assistant)

Date: 2.9.15

GSTL
GEO SITE & TESTING SERVICES LTD

UKAS TESTING
2788

Test Report:

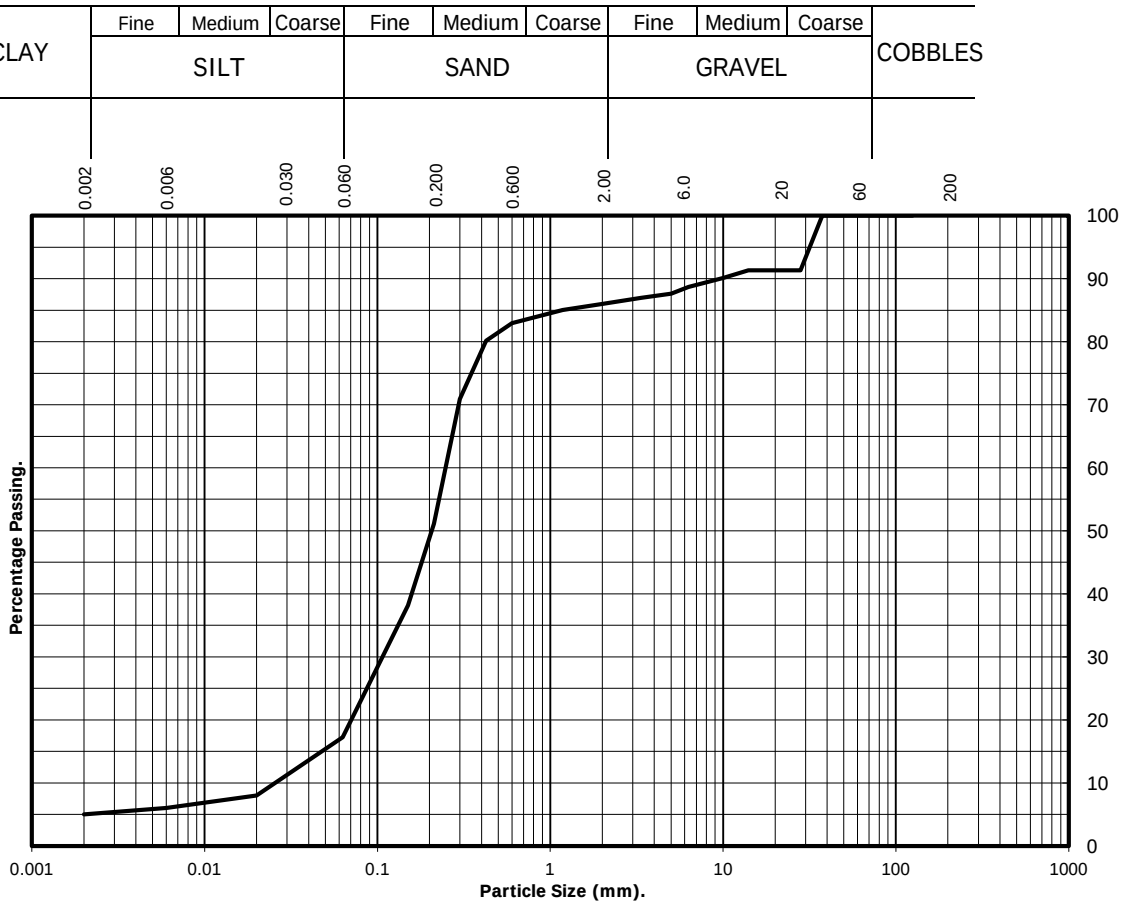
Particle Size Distribution Test
BS 1377 Part 2:1990.

Wet Sieve & Pipette Analysis, Clause 9.2 & 9.4

Client Ref.:
Contract Number: 27972-190815
Hole Number: TP10

Sample Number:
Depth from (m): 2.80
Depth to (m):
Sample Type: D

Location: Tide Lagoon Swansea Bay
Description: Brown clayey silty gravelly (fine-coarse) SAND



BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	91
20	91
14	91
10	90
6.3	89
5.0	88
3.35	87
2.00	86
1.18	85
0.60	83
0.425	80
0.300	71
0.212	51
0.150	38
0.063	17

Particle Diameter	% Passing
0.02	8
0.006	6
0.002	5

Clay	Silt	Sand	Gravel	Cobbles	Soil Fraction
5	12	69	14	0	Total Percentage

Remarks:
Cl 9.4.8 - Sample has not been pretreated

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Jon Tatam (Office/Quality Assistant)

Date: 2.9.15

GSTL
GEO SITE & TESTING SERVICES LTD

UKAS TESTING
2788

Test Report:

Particle Size Distribution Test
BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

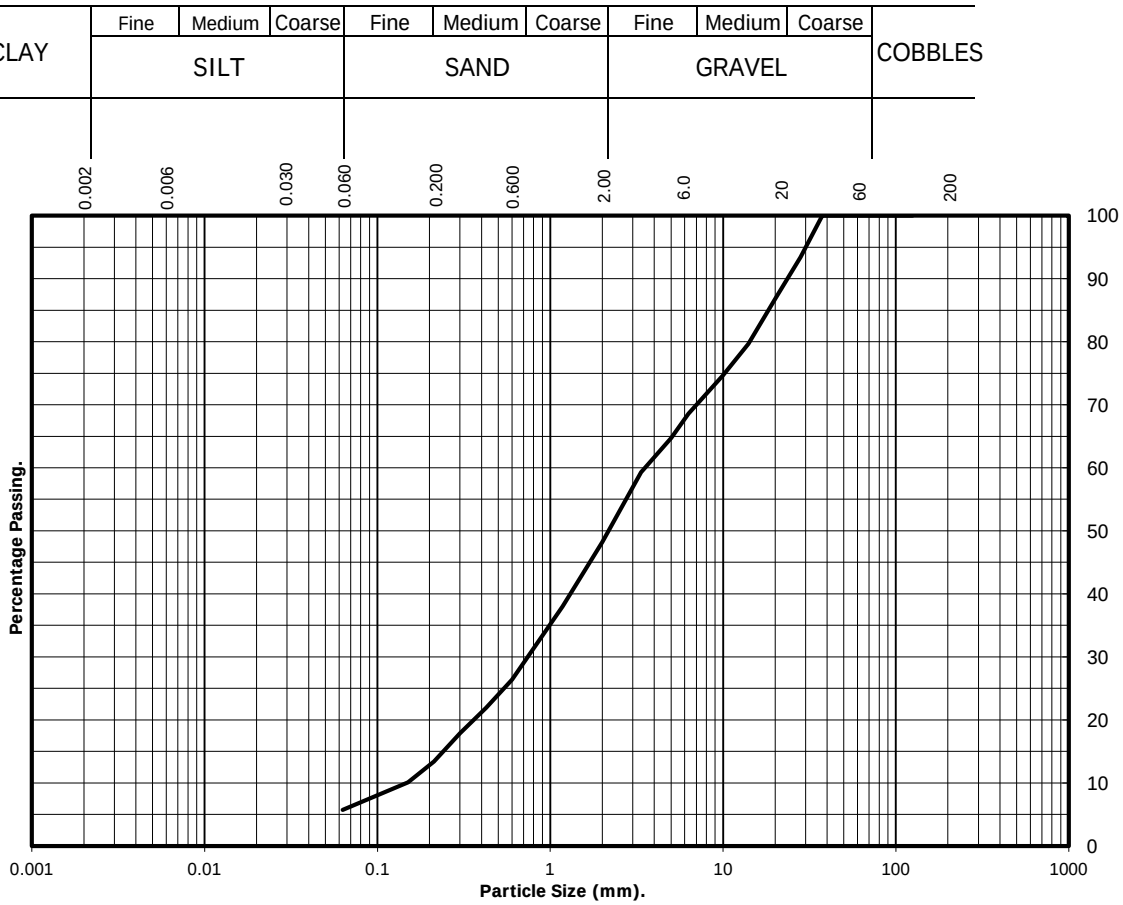
Client Ref.:
Contract Number: 27972-190815
Hole Number: TP11

Sample Number:
Depth from (m): 3.00
Depth to (m):
Sample Type: B

Location: Tide Lagoon Swansea Bay
Description: Brown silty clayey sandy GRAVEL (fine-coarse)

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	93
20	87
14	80
10	75
6.3	69
5.0	65
3.35	59
2.00	48
1.18	38
0.60	26
0.425	22
0.300	18
0.212	13
0.150	10
0.063	6

Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#



	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	6	42	52	0	Total Percentage

Remarks:
#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Jon Tatam (Office/Quality Assistant)

Date: 2.9.15

GSTL
GEO SITE & TESTING SERVICES LTD

UKAS TESTING
2788

Test Report:

Particle Size Distribution Test
BS 1377 Part 2:1990.

Wet Sieve, Clause 9.2

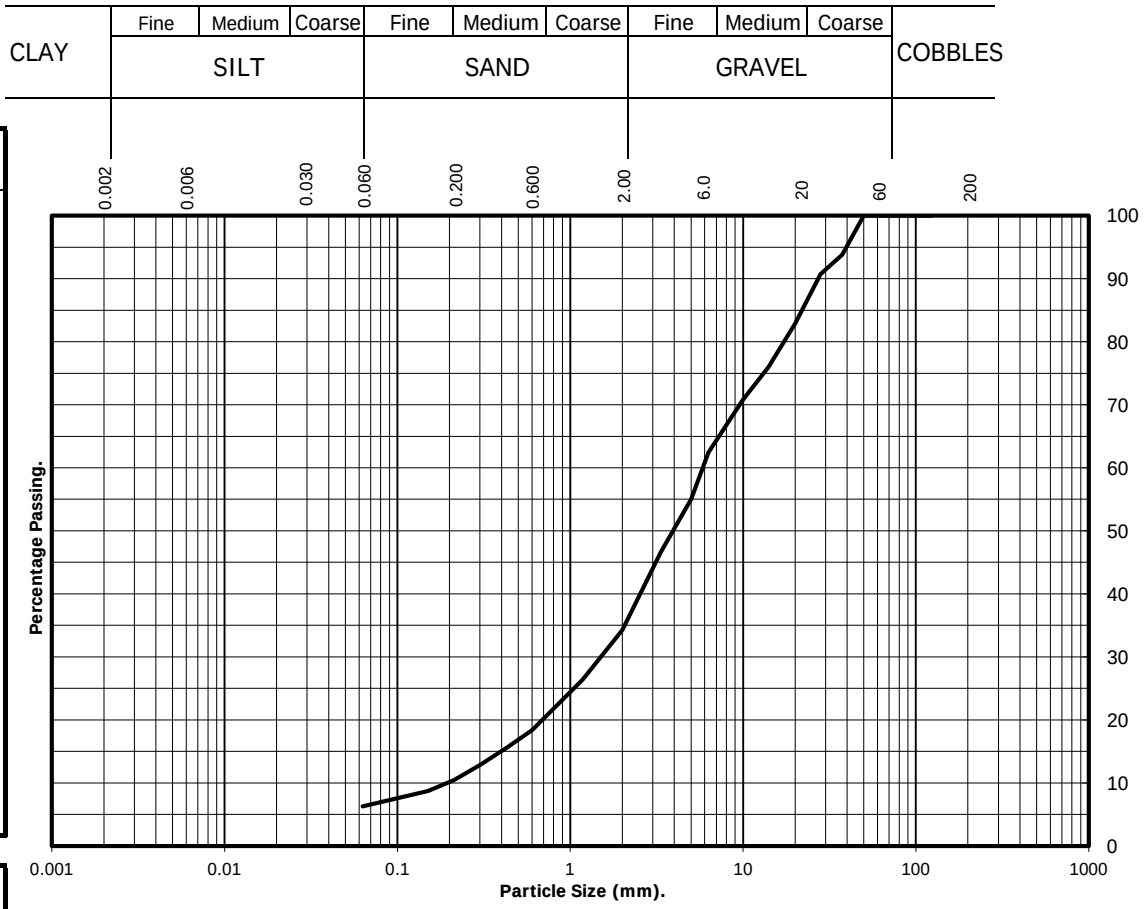
Client Ref.:
Contract Number: 27972-190815
Hole Number: TP12

Sample Number:
Depth from (m): 2.00
Depth to (m):
Sample Type: D

Location: Tide Lagoon Swansea Bay
Description: Brown silty clayey sandy GRAVEL (fine-coarse)

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	94
28	91
20	83
14	76
10	71
6.3	62
5.0	55
3.35	47
2.00	34
1.18	26
0.60	18
0.425	15
0.300	13
0.212	10
0.150	9
0.063	6

Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#



	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	6	28	66	0	Total Percentage

Remarks:
#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Jon Tatam (Office/Quality Assistant)

Date: 2.9.15

GSTL
GEO SITE & TESTING SERVICES LTD

UKAS TESTING
2788

Test Report:

Particle Size Distribution Test
BS 1377 Part 2:1990.

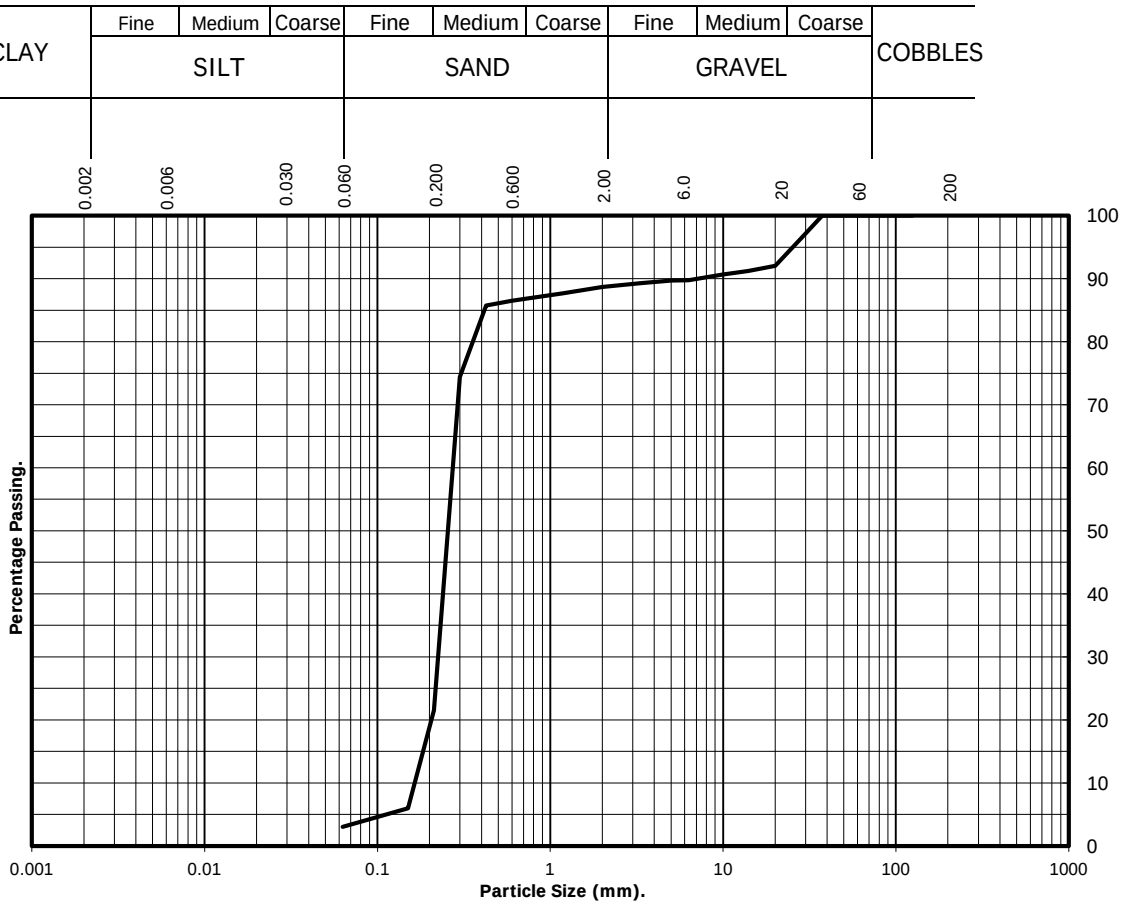
Wet Sieve, Clause 9.2

Client Ref.:
Contract Number: 27972-190815
Hole Number: TP37

Sample Number:
Depth from (m): 2.00
Depth to (m):
Sample Type: ES

Location: Tide Lagoon Swansea Bay
Description: Brown silty clayey gravelly (fine-coarse) SAND

BS Test Sieve	% Passing
125	100
90	100
75	100
63	100
50	100
37.5	100
28	96
20	92
14	91
10	91
6.3	90
5.0	90
3.35	89
2.00	89
1.18	88
0.60	87
0.425	86
0.300	74
0.212	22
0.150	6
0.063	3



Particle Diameter	% Passing
0.02	#
0.006	#
0.002	#

	Silt and Clay	Sand	Gravel	Cobbles	Soil Fraction
	3	86	11	0	Total Percentage

Remarks:
#- not determined

For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Jon Tatam (Office/Quality Assistant)

Date: 2.9.15

GSTL
GEO SITE & TESTING SERVICES LTD

UKAS TESTING
2788

ALcontrol Laboratories

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email: mkt@alcontrol.com
Website: www.alcontrol.com

Apex Drilling Services
Sturmi Way
Village Farm Industrial Estate
Pyle
Bridgend
CF33 6BZ

Attention: Robert Brewer

CERTIFICATE OF ANALYSIS

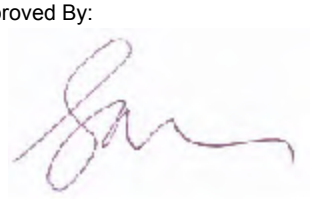
Date:	24 August 2015
Customer:	H_APEXDRL_BGD
Sample Delivery Group (SDG):	150813-10
Your Reference:	10318
Location:	Swansea Bay
Report No:	326800

We received 26 samples on Wednesday August 12, 2015 and 25 of these samples were scheduled for analysis which was completed on Monday August 24, 2015. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:



Sonia McWhan

Operations Manager

Alcontrol Laboratories is a trading division of ALcontrol UK Limited
Registered Office: Units 7 & 8 Hawarden Business Park, Manor Road, Hawarden, Deeside, CH5 3US. Registered in England and Wales No.

CERTIFICATE OF ANALYSIS

SDG:	150813-10	**Location:**	Swansea Bay	**Order Number:**	
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	326800
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
11884357	BH1		1.20 - 2.00	11/08/2015
11884358	BH2		1.20 - 1.55	11/08/2015
11884360	BH5		0.30 - 1.00	11/08/2015
11884361	BH5		1.50 - 2.00	11/08/2015
11884364	BH9		3.65 - 4.00	11/08/2015
11884359	BHA2		0.00 - 0.90	11/08/2015
11884362	BH6A		1.20 - 2.00	11/08/2015
11884363	BH6A		2.00 - 2.70	11/08/2015
11884365	TP007		1.00	11/08/2015
11884366	TP10		1.00	11/08/2015
11884367	TP10		2.00	11/08/2015
11884369	TP21		1.00	11/08/2015
11884371	TP22		2.00	11/08/2015
11884372	TP22		3.00	11/08/2015
11884373	TP26		1.00	11/08/2015
11884374	TP28		1.00	11/08/2015
11884375	TP32		2.50	11/08/2015
11884376	TP35		2.00	11/08/2015
11884377	TP35		2.50	11/08/2015
11884379	TP39		2.00	11/08/2015
11884380	TP40		1.00	11/08/2015
11884381	TP42		1.00	11/08/2015
11884382	TP46		1.00	11/08/2015
11884383	TP55		1.00	11/08/2015
11884384	TP59		1.00	11/08/2015
11884368	TP17A		1.40	11/08/2015

Only received samples which have had analysis scheduled will be shown on the following pages.

ALcontrol Laboratories

Validated

CERTIFICATE OF ANALYSIS

SDG:	150813-10	**Location:**	Swansea Bay	**Order Number:**	
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	326800
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

X Test

N No Determination Possible

Lab Sample No(s)			1184357	1184358	1184360	1184361	1184364	1184362	1184363	1184365	1184366	1184367	1184369	1184371	1184372	1184373	1184374	1184375	1184376	1184377	1184379	1184380	1184381	1184382	1184383	1184384	1184368
Customer Sample Reference			BH1	BH2	BH5	BH5	BH9	BH6A	BH6A	TP007	TP10	TP10	TP21	TP22	TP22	TP26	TP28	TP32	TP35	TP35	TP39	TP40	TP42	TP46	TP55	TP59	TP17A
AGS Reference																											
Depth (m)			1.20 - 2.00	1.20 - 1.55	0.30 - 1.00	1.50 - 2.00	3.65 - 4.00	1.20 - 2.00	2.00 - 2.70	1.00	1.00	2.00	1.00	2.00	3.00	1.00	1.00	2.50	2.00	2.50	2.00	1.00	1.00	1.00	1.00	1.00	1.40
Container			1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB
Anions by Kone (soil)	All	NDPs: 0 Tests: 9	X		X	X						X	X		X		X					X			X		
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 2			X																					X	
Magnesium (BRE)	All	NDPs: 0 Tests: 9	X		X	X						X	X		X		X					X			X		
NO3, NO2 and TON by KONE (s)	All	NDPs: 0 Tests: 9	X		X	X						X	X		X		X					X			X		
pH	All	NDPs: 0 Tests: 9	X		X	X						X	X		X		X					X			X		
Sample description	All	NDPs: 0 Tests: 22	X	X	X	X	X			X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
Total Organic Carbon	All	NDPs: 0 Tests: 18		X			X	X	X	X	X	X	X	X		X		X	X	X	X		X	X		X	X

16:28:21 24/08/2015

CERTIFICATE OF ANALYSIS

SDG:	150813-10	**Location:**	Swansea Bay	**Order Number:**	
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	326800
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
11884357	BH1	1.20 - 2.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	None
11884358	BH2	1.20 - 1.55	Dark Brown	Silty Clay Loam	0.063 - 0.1 mm	Stones	None
11884360	BH5	0.30 - 1.00	Dark Brown	Sand	0.1 - 2 mm	Stones	Crushed Brick
11884361	BH5	1.50 - 2.00	Dark Brown	Sand	0.1 - 2 mm	Stones	None
11884364	BH9	3.65 - 4.00	Grey	Sand	0.1 - 2 mm	Stones	Oil/Petroleum
11884362	BH6A	1.20 - 2.00	Dark Brown	Sand	0.1 - 2 mm	N/A	None
11884363	BH6A	2.00 - 2.70	Dark Brown	Sand	0.1 - 2 mm	N/A	N/A
11884365	TP007	1.00	Dark Brown	Sandy Clay	0.1 - 2 mm	None	None
11884366	TP10	1.00	Dark Brown	Sand	0.1 - 2 mm	Stones	None
11884367	TP10	2.00	Dark Brown	Sand	0.1 - 2 mm	Stones	None
11884369	TP21	1.00	Dark Brown	Sand	0.1 - 2 mm	Stones	N/A
11884371	TP22	2.00	Dark Brown	Sand	0.1 - 2 mm	Stones	None
11884372	TP22	3.00	Dark Brown	Sandy Clay	0.1 - 2 mm	Stones	Oil/Petroleum
11884373	TP26	1.00	Dark Brown	Sand	0.1 - 2 mm	Stones	None
11884374	TP28	1.00	Dark Brown	Sand	0.1 - 2 mm	None	None
11884375	TP32	2.50	Dark Brown	Sand	0.1 - 2 mm	Oil/Petroleum	None
11884376	TP35	2.00	Dark Brown	Sand	0.1 - 2 mm	None	None
11884377	TP35	2.50	Dark Brown	Sand	0.1 - 2 mm	None	None
11884379	TP39	2.00	Dark Brown	Sand	0.1 - 2 mm	Oil/Petroleum	None
11884380	TP40	1.00	Light Brown	Sand	0.1 - 2 mm	None	None
11884381	TP42	1.00	Dark Brown	Sand	0.1 - 2 mm	Stones	Vegetation
11884382	TP46	1.00	Light Brown	Sand	0.1 - 2 mm	Stones	None
11884383	TP55	1.00	Dark Brown	Sand	0.1 - 2 mm	Stones	None
11884384	TP59	1.00	Dark Brown	Sand	0.1 - 2 mm	Stones	Concrete/Aggregate
11884368	TP17A	1.40	Dark Brown	Sand	0.1 - 2 mm	Stones	None

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

CERTIFICATE OF ANALYSIS

SDG:	150813-10	**Location:**	Swansea Bay	**Order Number:**	
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	326800
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH1	BH2	BH5	BH5	BH9	BH6A
			Depth (m)	1.20 - 2.00	1.20 - 1.55	0.30 - 1.00	1.50 - 2.00	3.65 - 4.00	1.20 - 2.00
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015	11/08/2015	11/08/2015
			Sample Time	.	.	.	.	.	.
			Date Received	12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
			SDG Ref	150813-10	150813-10	150813-10	150813-10	150813-10	150813-10
			Lab Sample No.(s)	11884357	11884358	11884360	11884361	11884364	11884362
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		16	8.2	6.6	8.3	15	17
Organic Matter, Total	<0.35 %	TM132			3.03 #			2.26 #	37.1 #
pH	1 pH Units	TM133		7.89 M		8.46 M	8.3 M		
Soluble Sulphate 2:1 extract as SO4 BRE	<0.004 g/l	TM243		0.0563 M		0.0542 M	0.0634 M		
Chloride 2:1 water/soil extract BRE	<0.0025 g/l	TM243		0.0137 M		0.0335 M	0.0061 M		
Nitrate as NO3, 2:1 water soluble (BRE)	<0.0003 g/l	TM243		0.0101		0.0118	0.0177		
Magnesium (BRE)	<0.008 g/l	TM282		<0.008		<0.008	<0.008		

CERTIFICATE OF ANALYSIS

SDG:	150813-10	**Location:**	Swansea Bay	**Order Number:**	
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	326800
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH6A	TP007	TP10	TP10	TP21	TP22
			Depth (m)	2.00 - 2.70	1.00	1.00	2.00	1.00	2.00
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015	11/08/2015	11/08/2015
			Sample Time	.	.	.	.	.	.
			Date Received	12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
			SDG Ref	150813-10	150813-10	150813-10	150813-10	150813-10	150813-10
			Lab Sample No.(s)	11884363	11884365	11884366	11884367	11884369	11884371
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		21	24	13	21	6.7	8.3
Organic Matter, Total	<0.35 %	TM132		35 #	0.976 #	6.19 #	1.39 #	4.28 #	3.57 #
pH	1 pH Units	TM133					8.2 M	8.63 M	
Soluble Sulphate 2:1 extract as SO4 BRE	<0.004 g/l	TM243					0.0649 M	0.0144 M	
Chloride 2:1 water/soil extract BRE	<0.0025 g/l	TM243					0.0071 M	0.0062 M	
Nitrate as NO3, 2:1 water soluble (BRE)	<0.0003 g/l	TM243					0.00044	0.00787	
Magnesium (BRE)	<0.008 g/l	TM282					0.0383	<0.008	

CERTIFICATE OF ANALYSIS

SDG:	150813-10	**Location:**	Swansea Bay	**Order Number:**	
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	326800
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TP22	TP26	TP28	TP32	TP35	TP35
			Depth (m)	3.00	1.00	1.00	2.50	2.00	2.50
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015	11/08/2015	11/08/2015
			Sample Time	.	.	.	.	.	.
			Date Received	12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
			SDG Ref	150813-10	150813-10	150813-10	150813-10	150813-10	150813-10
			Lab Sample No.(s)	11884372	11884373	11884374	11884375	11884376	11884377
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		17	3.8	4.7	14	5.3	5.2
Organic Matter, Total	<0.35 %	TM132			1.62 #		1.02 #	1.1 #	1.07 #
pH	1 pH Units	TM133		6.7 M		8.92 M			
Soluble Sulphate 2:1 extract as SO4 BRE	<0.004 g/l	TM243		0.898 M		0.0057 M			
Chloride 2:1 water/soil extract BRE	<0.0025 g/l	TM243		0.101 M		0.0055 M			
Nitrate as NO3, 2:1 water soluble (BRE)	<0.0003 g/l	TM243		<0.0003		0.00225			
Magnesium (BRE)	<0.008 g/l	TM282		0.0148		<0.008			

CERTIFICATE OF ANALYSIS

SDG:	150813-10	**Location:**	Swansea Bay	**Order Number:**	
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	326800
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TP39	TP40	TP42	TP46	TP55	TP59
			Depth (m)	2.00	1.00	1.00	1.00	1.00	1.00
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	11/08/2015	11/08/2015	11/08/2015	11/08/2015	11/08/2015	11/08/2015
			Sample Time	.	.	.	.	.	.
			Date Received	12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015	12/08/2015
			SDG Ref	150813-10	150813-10	150813-10	150813-10	150813-10	150813-10
			Lab Sample No.(s)	11884379	11884380	11884381	11884382	11884383	11884384
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		4.1	4	8.7	4.3	12	13
Organic Matter, Total	<0.35 %	TM132		0.69 #		6.36 #	0.621 #		23.4 #
pH	1 pH Units	TM133			8.75 M			8.2 M	
Soluble Sulphate 2:1 extract as SO4 BRE	<0.004 g/l	TM243			<0.004 M			0.0679 M	
Chloride 2:1 water/soil extract BRE	<0.0025 g/l	TM243			0.0063 M			0.0425 M	
Nitrate as NO3, 2:1 water soluble (BRE)	<0.0003 g/l	TM243			0.000809			0.0101	
Magnesium (BRE)	<0.008 g/l	TM282			<0.008			<0.008	

CERTIFICATE OF ANALYSIS

SDG:	150813-10	**Location:**	Swansea Bay	**Order Number:**	
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	326800
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

		Customer Sample R	TP17A
		Depth (m)	1.40
		Sample Type	Soil/Solid
		Date Sampled	11/08/2015
		Sample Time	.
		Date Received	12/08/2015
		SDG Ref	150813-10
		Lab Sample No.(s)	11884368
		AGS Reference	
Component	**LOD/Units**	**Method**	
Moisture Content Ratio (% of as received sample)	%	PM024	8.2
Organic Matter, Total	<0.35 %	TM132	5.1 #

CERTIFICATE OF ANALYSIS

SDG:	150813-10	**Location:**	Swansea Bay	**Order Number:**	
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	326800
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Asbestos Identification - Solid Samples

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	BH5 0.30 - 1.00 SOLID 11/08/2015 00:00:00 19/08/2015 19:01:30 150813-10 11884360 TM048	21/08/15	Chris Swindells	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP59 1.00 SOLID 11/08/2015 00:00:00 18/08/2015 20:56:06 150813-10 11884384 TM048	21/08/15	Chris Swindells	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150813-10	**Location:**	Swansea Bay	**Order Number:**	
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	326800
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
ASB_PREP				
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
SUB		Subcontracted Test		
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM243		Mixed Anions In Soils By Kone		
TM282		Extraction of Magnesium by BRE Method		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	150813-10	**Location:**	Swansea Bay	**Order Number:**	
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	326800
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	11884357	11884358	11884360	11884361	11884364	11884362	11884363	11884365	11884366	11884367
Customer Sample Ref.	BH1	BH2	BH5	BH5	BH9	BH6A	BH6A	TP007	TP10	TP10
AGS Ref.										
Depth	1.20 - 2.00	1.20 - 1.55	0.30 - 1.00	1.50 - 2.00	3.65 - 4.00	1.20 - 2.00	2.00 - 2.70	1.00	1.00	2.00
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Anions by Kone (soil)	21-Aug-2015		21-Aug-2015	21-Aug-2015						21-Aug-2015
Asbestos ID in Solid Samples			21-Aug-2015							
Magnesium (BRE)	19-Aug-2015		24-Aug-2015	19-Aug-2015						19-Aug-2015
NO3, NO2 and TON by KONE (s)	24-Aug-2015		24-Aug-2015	24-Aug-2015						24-Aug-2015
pH	21-Aug-2015		21-Aug-2015	20-Aug-2015						20-Aug-2015
Sample description	14-Aug-2015	14-Aug-2015	17-Aug-2015	17-Aug-2015	17-Aug-2015	17-Aug-2015	17-Aug-2015	14-Aug-2015	14-Aug-2015	14-Aug-2015
Total Organic Carbon		19-Aug-2015			19-Aug-2015	19-Aug-2015	19-Aug-2015	19-Aug-2015	19-Aug-2015	19-Aug-2015

Lab Sample No(s)	11884369	11884371	11884372	11884373	11884374	11884375	11884376	11884377	11884379	11884380
Customer Sample Ref.	TP21	TP22	TP22	TP26	TP28	TP32	TP35	TP35	TP39	TP40
AGS Ref.										
Depth	1.00	2.00	3.00	1.00	1.00	2.50	2.00	2.50	2.00	1.00
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Anions by Kone (soil)	21-Aug-2015		21-Aug-2015		21-Aug-2015					21-Aug-2015
Magnesium (BRE)	19-Aug-2015		19-Aug-2015		19-Aug-2015					19-Aug-2015
NO3, NO2 and TON by KONE (s)	24-Aug-2015		24-Aug-2015		24-Aug-2015					24-Aug-2015
pH	20-Aug-2015		20-Aug-2015		20-Aug-2015					20-Aug-2015
Sample description	14-Aug-2015	17-Aug-2015	17-Aug-2015	17-Aug-2015	17-Aug-2015	14-Aug-2015	14-Aug-2015	14-Aug-2015	14-Aug-2015	14-Aug-2015
Total Organic Carbon	19-Aug-2015	19-Aug-2015		19-Aug-2015		19-Aug-2015	19-Aug-2015	19-Aug-2015	19-Aug-2015	

Lab Sample No(s)	11884381	11884382	11884383	11884384	11884368
Customer Sample Ref.	TP42	TP46	TP55	TP59	TP17A
AGS Ref.					
Depth	1.00	1.00	1.00	1.00	1.40
Type	SOLID	SOLID	SOLID	SOLID	SOLID
Anions by Kone (soil)			21-Aug-2015		
Asbestos ID in Solid Samples				21-Aug-2015	
Magnesium (BRE)			19-Aug-2015		
NO3, NO2 and TON by KONE (s)			24-Aug-2015		
pH			20-Aug-2015		
Sample description	14-Aug-2015	14-Aug-2015	14-Aug-2015	14-Aug-2015	17-Aug-2015
Total Organic Carbon	19-Aug-2015	19-Aug-2015		24-Aug-2015	19-Aug-2015

SDG:	150813-10	**Location:**	Swansea Bay	**Order Number:**	
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	326800
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before presevation was performed
§	Sampled on date not provided
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

ENCLOSURE E

GEOENVIRONMENTAL LABORATORY TEST RESULTS

ALcontrol Laboratory Certificate of Analysis

Report No. 319918
319919
320562
320563
320598
320695
320715
320813
320875
321039
321065
321164
321665
321875
321895
323543

ALcontrol Laboratories

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Apex Drilling Services
Sturmi Way
Village Farm Industrial Estate
Pyle
Bridgend
CF33 6BZ

Attention: Robert Brewer

CERTIFICATE OF ANALYSIS

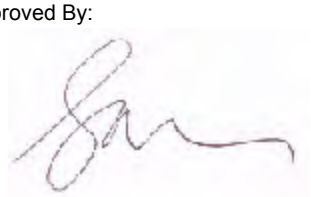
Date:	07 July 2015
Customer:	H_APEXDRL_BGD
Sample Delivery Group (SDG):	150619-1
Your Reference:	10318
Location:	Swansea Bay
Report No:	319918

We received 26 samples on Thursday June 18, 2015 and 17 of these samples were scheduled for analysis which was completed on Tuesday July 07, 2015. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:



Sonia McWhan

Operations Manager

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CERTIFICATE OF ANALYSIS

SDG:	150619-1	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319918
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
11561780	BH001 ES1	ES1	0.00 - 0.10	17/06/2015
11561781	BH001 ES3	ES3	0.25 - 0.50	17/06/2015
11561782	BH001 ES5	ES5	0.80 - 1.00	17/06/2015
11561783	BH001 ES6	ES6	1.20 - 1.50	17/06/2015
11561785	BH001 ES8	ES8	2.00 - 2.50	17/06/2015
11561786	BH001 ES11	ES11	3.40 - 3.65	17/06/2015
11561787	BH001 ES12	ES12	3.70 - 3.90	17/06/2015
11561777	TP3		0.20	17/06/2015
11561778	TP3		1.00	17/06/2015
11561775	TP51		0.20	16/06/2015
11561776	TP51		1.00	16/06/2015
11561799	TP53		0.20	16/06/2015
11561800	TP53		1.00	16/06/2015
11561801	TP53		2.00	16/06/2015
11561795	TP55		0.20	16/06/2015
11561797	TP55		1.00	16/06/2015
11561798	TP55		2.00	16/06/2015
11561789	TP57		0.20	16/06/2015
11561792	TP57		1.00	16/06/2015
11561793	TP57		2.00	16/06/2015
11561794	TP57		2.30	16/06/2015
11561415	TP59		0.20	15/06/2015
11561416	TP59		1.00	15/06/2015
11561417	TP59		2.00	15/06/2015
11561418	TP59		3.00	15/06/2015
11561419	TP59		3.50	15/06/2015

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG:	150619-1	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319918
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

X **Test**

N **No Determination Possible**

Lab Sample No(s)			11561781	11561776	11561799	11561795	11561789	11561415
Customer Sample Reference			BH001 ES3	TP51	TP53	TP55	TP57	TP59
AGS Reference			ES3					
Depth (m)			0.25 - 0.50	1.00	0.20	0.20	0.20	0.20
Container			1kg TUB	250g Amber Jar (AL	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 5	X			X		X				X			X		
Boron Water Soluble	All	NDPs: 0 Tests: 5		X		X		X				X			X		
CEN Readings	All	NDPs: 0 Tests: 1									X						
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 6	X			X		X			X	X			X		
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 1									X						
Dissolved Organic/Inorganic Carbon	All	NDPs: 0 Tests: 1									X						
EPH CWG (Aliphatic) Aqueous GC (W)	All	NDPs: 0 Tests: 1									X						
EPH CWG (Aliphatic) GC (S)	All	NDPs: 0 Tests: 5		X		X		X				X			X		
EPH CWG (Aromatic) Aqueous GC (W)	All	NDPs: 0 Tests: 1									X						
EPH CWG (Aromatic) GC (S)	All	NDPs: 0 Tests: 5		X		X		X				X			X		
GRO by GC-FID (S)	All	NDPs: 0 Tests: 5			X		X			X				X			X
GRO by GC-FID (W)	All	NDPs: 0 Tests: 1									X						
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 5	X			X		X				X			X		
Hexavalent Chromium (w)	All	NDPs: 0 Tests: 1									X						
Mercury Dissolved	All	NDPs: 0 Tests: 1									X						

CERTIFICATE OF ANALYSIS

SDG:	150619-1	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319918
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

X Test

N No Determination Possible

Lab Sample No(s)	11561781	11561776	11561799	11561795	11561789	11561415
Customer Sample Reference	BH001 ES3	TP51	TP53	TP55	TP57	TP59
AGS Reference	ES3					
Depth (m)	0.25 - 0.50	1.00	0.20	0.20	0.20	0.20

Container	1kg TUB	250g Amber Jar (AL	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)	250g Amber Jar (AL	400g Tub (ALE214)	60g VOC (ALE215)
Metals in solid samples by OES	All	NDPs: 0 Tests: 5		X		X			X				X			X		
PAH by GCMS	All	NDPs: 0 Tests: 5		X		X			X				X			X		
PAH Spec MS - Aqueous (W)	All	NDPs: 0 Tests: 1										X						
pH	All	NDPs: 0 Tests: 5	X				X			X				X			X	
pH Value of Filtered Water	All	NDPs: 0 Tests: 1										X						
Sample description	All	NDPs: 0 Tests: 6		X		X			X		X		X			X		
Total Organic Carbon	All	NDPs: 0 Tests: 5		X		X			X				X			X		
TPH CWG (W)	All	NDPs: 0 Tests: 1										X						
TPH CWG GC (S)	All	NDPs: 0 Tests: 5		X		X			X				X			X		
VOC MS (S)	All	NDPs: 0 Tests: 5			X			X			X			X				X
VOC MS (W)	All	NDPs: 0 Tests: 1										X						

CERTIFICATE OF ANALYSIS

SDG:	150619-1	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319918
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
11561781	BH001 ES3	0.25 - 0.50	Dark Brown	Sand	0.1 - 2 mm	Stones	Brick
11561776	TP51	1.00	Light Brown	Sand	0.1 - 2 mm	Vegetation	Stones
11561799	TP53	0.20	Black	Loamy Sand	0.1 - 2 mm	Stones	Vegetation
11561795	TP55	0.20	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Vegetation
11561789	TP57	0.20	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Vegetation
11561415	TP59	0.20	Black	Sandy Loam	0.1 - 2 mm	Stones	Vegetation

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

CERTIFICATE OF ANALYSIS

SDG:	150619-1	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319918
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH001 ES3	TP51	TP53	TP55	TP57	TP59
			Depth (m)	0.25 - 0.50	1.00	0.20	0.20	0.20	0.20
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	17/06/2015	16/06/2015	16/06/2015	16/06/2015	16/06/2015	15/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	18/06/2015	18/06/2015	18/06/2015	18/06/2015	18/06/2015	18/06/2015
			SDG Ref	150619-1	150619-1	150619-1	150619-1	150619-1	150619-1
			Lab Sample No.(s)	11561781	11561776	11561799	11561795	11561789	11561415
			AGS Reference	ES3					
Moisture Content Ratio (% of as received sample)	%	PM024		12	4.8	14	9.3	11	10
Organic Carbon, Total	<0.2 %	TM132		12.1 M	0.529 M	24.8 M		11.6 M	5.71 M
pH	1 pH Units	TM133		8.38 M	9.22 M	7.84 M		7.93 M	8.17 M
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #		<0.6 #	<0.6 #
Cyanide, Total	<1 mg/kg	TM153		<1 M	<1 & M	<1 & M		<1 & M	<1 @ M
Antimony	<0.6 mg/kg	TM181		35.2 #	5.44 #	37.5 #		25 #	46.4 #
Arsenic	<0.6 mg/kg	TM181		228 M	34.8 M	160 M		114 M	58.5 M
Beryllium	<0.01 mg/kg	TM181		1.22 M	0.094 M	0.331 M		2.19 M	0.756 M
Cadmium	<0.02 mg/kg	TM181		8.23 M	3.79 M	3.27 M		3.41 M	5.8 M
Chromium	<0.9 mg/kg	TM181		15.7 M	5.54 M	15.1 M		21.4 M	10.9 M
Copper	<1.4 mg/kg	TM181		198 M	82.9 M	345 M		182 M	305 M
Lead	<0.7 mg/kg	TM181		3890 M	576 M	3340 M		2700 M	6070 M
Mercury	<0.14 mg/kg	TM181		<0.14 M	<0.14 M	0.226 M		<0.14 M	0.301 M
Molybdenum	<0.1 mg/kg	TM181		8.39 #	0.849 #	2.9 #		3.39 #	3.05 #
Nickel	<0.2 mg/kg	TM181		43.6 M	10.6 M	49.9 M		34.6 M	46.4 M
Selenium	<1 mg/kg	TM181		1.01 #	<1 #	<10 #		1.2 #	<1 #
Vanadium	<0.2 mg/kg	TM181		36.9 #	12.6 #	32.9 #		48.9 #	19.4 #
Zinc	<1.9 mg/kg	TM181		6110 M	1610 M	4250 M		5720 M	2430 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M		<1 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150619-1	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319918
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

PAH by GCMS

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH001 ES3	TP51	TP53	TP57	TP59
			Depth (m)	0.25 - 0.50	1.00	0.20	0.20	0.20
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	17/06/2015	16/06/2015	16/06/2015	16/06/2015	15/06/2015
			Sample Time	.	.	.	.	.
			Date Received	18/06/2015	18/06/2015	18/06/2015	18/06/2015	18/06/2015
			SDG Ref	150619-1	150619-1	150619-1	150619-1	150619-1
			Lab Sample No.(s)	11561781	11561776	11561799	11561789	11561415
			AGS Reference	ES3				
Naphthalene-d8 % recovery**	%	TM218		108	100	94.9	124	118
Acenaphthene-d10 % recovery**	%	TM218		107	99.3	91.5	122	116
Phenanthrene-d10 % recovery**	%	TM218		101	97.2	90.6	116	115
Chrysene-d12 % recovery**	%	TM218		105	98.2	96.7	123	124
Perylene-d12 % recovery**	%	TM218		110	101	90.7	125	127
Naphthalene	<9 µg/kg	TM218		487 M	55.3 M	1550 M	3820 M	2300 @ M
Acenaphthylene	<12 µg/kg	TM218		73.8 M	<12 M	173 M	541 M	362 @ M
Acenaphthene	<8 µg/kg	TM218		199 M	76.9 M	797 M	467 M	974 @ M
Fluorene	<10 µg/kg	TM218		144 M	69.8 M	607 M	769 M	746 @ M
Phenanthrene	<15 µg/kg	TM218		2260 M	606 M	11100 M	14500 M	9010 @ M
Anthracene	<16 µg/kg	TM218		557 M	118 M	2290 M	3560 M	2090 @ M
Fluoranthene	<17 µg/kg	TM218		3490 M	581 M	16900 M	21700 M	14600 @ M
Pyrene	<15 µg/kg	TM218		2790 M	458 M	13500 M	17800 M	12300 @ M
Benz(a)anthracene	<14 µg/kg	TM218		1800 M	276 M	8320 M	12900 M	8880 @ M
Chrysene	<10 µg/kg	TM218		2190 M	251 M	8490 M	13000 M	7540 @ M
Benzo(b)fluoranthene	<15 µg/kg	TM218		2820 M	320 M	12000 M	18200 M	11200 @ M
Benzo(k)fluoranthene	<14 µg/kg	TM218		932 M	111 M	4370 M	5960 M	3720 @ M
Benzo(a)pyrene	<15 µg/kg	TM218		1660 M	230 M	8210 M	12900 M	8690 @ M
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218		943 M	123 M	4740 M	7170 M	5070 @ M
Dibenzo(a,h)anthracene	<23 µg/kg	TM218		323 M	41.2 M	1550 M	2430 M	1800 @ M
Benzo(g,h,i)perylene	<24 µg/kg	TM218		1080 M	139 M	5610 M	7600 M	5450 @ M
PAH, Total Detected USEPA 16	<118 µg/kg	TM218		21700	3460	100000	143000	94800

CERTIFICATE OF ANALYSIS

SDG:	150619-1	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319918
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

TPH CWG (S)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH001 ES3	TP51	TP53	TP57	TP59
			Depth (m)	0.25 - 0.50	1.00	0.20	0.20	0.20
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	17/06/2015	16/06/2015	16/06/2015	16/06/2015	15/06/2015
			Sample Time	.	.	.	.	.
			Date Received	18/06/2015	18/06/2015	18/06/2015	18/06/2015	18/06/2015
			SDG Ref	150619-1	150619-1	150619-1	150619-1	150619-1
			Lab Sample No.(s)	11561781	11561776	11561799	11561789	11561415
			AGS Reference	ES3				
GRO Surrogate % recovery**	%	TM089		13 &	62 &	4 &	13 &	20 @
GRO TOT (Moisture Corrected)	<44 µg/kg	TM089		<44 & M	<44 & M	<44 & M	<44 & M	<44 @ M
Methyl tertiary butyl ether (MTBE)	<5 µg/kg	TM089		<5 & M	<5 & M	<5 & M	<5 & M	<5 @ M
Benzene	<10 µg/kg	TM089		<10 & M	<10 & M	<10 & M	<10 & M	<10 @ M
Toluene	<2 µg/kg	TM089		4.52 & M	<2 & M	<2 & M	<2 & M	<2 @ M
Ethylbenzene	<3 µg/kg	TM089		10.2 & M	<3 & M	<3 & M	<3 & M	3.33 @ M
m,p-Xylene	<6 µg/kg	TM089		6.78 & M	<6 & M	<6 & M	<6 & M	<6 @ M
o-Xylene	<3 µg/kg	TM089		<3 & M	<3 & M	<3 & M	<3 & M	<3 @ M
sum of detected mpo xylene by GC	<9 µg/kg	TM089		<9 &	<9 &	<9 &	<9 &	<9 @
sum of detected BTEX by GC	<24 µg/kg	TM089		<24 &	<24 &	<24 &	<24 &	<24 @
Aliphatics >C5-C6	<10 µg/kg	TM089		<10 &	<10 &	<10 &	<10 &	<10 @
Aliphatics >C6-C8	<10 µg/kg	TM089		<10 &	<10 &	<10 &	<10 &	11.1 @
Aliphatics >C8-C10	<10 µg/kg	TM089		<10 &	<10 &	<10 &	<10 &	<10 @
Aliphatics >C10-C12	<10 µg/kg	TM089		<10 &	<10 &	<10 &	<10 &	<10 @
Aliphatics >C12-C16	<100 µg/kg	TM173		640	<100	1810	914	1160
Aliphatics >C16-C21	<100 µg/kg	TM173		3360	<100	14500	2650	4530
Aliphatics >C21-C35	<100 µg/kg	TM173		19100	6240	127000	16200	38500
Aliphatics >C35-C44	<100 µg/kg	TM173		1730	<100	29200	<100	13500
Total Aliphatics >C12-C44	<100 µg/kg	TM173		24800	6240	173000	19800	57700
Aromatics >EC5-EC7	<10 µg/kg	TM089		<10 &	<10 &	<10 &	<10 &	<10 @
Aromatics >EC7-EC8	<10 µg/kg	TM089		<10 &	<10 &	<10 &	<10 &	<10 @
Aromatics >EC8-EC10	<10 µg/kg	TM089		18.1 &	<10 &	<10 &	<10 &	13.3 @
Aromatics >EC10-EC12	<10 µg/kg	TM089		<10 &	<10 &	<10 &	<10 &	<10 @
Aromatics >EC12-EC16	<100 µg/kg	TM173		1070	<100	10100	3800	6810
Aromatics >EC16-EC21	<100 µg/kg	TM173		14200	1980	91400	33600	48700
Aromatics >EC21-EC35	<100 µg/kg	TM173		55400	8050	309000	132000	160000
Aromatics >EC35-EC44	<100 µg/kg	TM173		12700	1690	78900	43400	55600
Aromatics >EC40-EC44	<100 µg/kg	TM173		3940	<100	24600	14100	20300
Total Aromatics >EC12-EC44	<100 µg/kg	TM173		83400	11700	490000	212000	271000
Total Aliphatics & Aromatics >C5-C44	<100 µg/kg	TM173		108000	18000	662000	232000	329000

CERTIFICATE OF ANALYSIS

SDG:	150619-1	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319918
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

VOC MS (S)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH001 ES3	TP51	TP53	TP57	TP59
			Depth (m)	0.25 - 0.50	1.00	0.20	0.20	0.20
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	17/06/2015	16/06/2015	16/06/2015	16/06/2015	15/06/2015
			Sample Time	.	.	.	.	.
			Date Received	18/06/2015	18/06/2015	18/06/2015	18/06/2015	18/06/2015
			SDG Ref	150619-1	150619-1	150619-1	150619-1	150619-1
			Lab Sample No.(s)	11561781	11561776	11561799	11561789	11561415
			AGS Reference	ES3				
Toluene-d8**	%	TM116		75.6 &	92.2 &	95.7 &	72.7 &	81.1 @
Methyl Tertiary Butyl Ether	<10 µg/kg	TM116		<10 & M	<10 & M	<200 & M	<10 & M	<10 @ M
Benzene	<9 µg/kg	TM116		12.8 & M	<9 & M	<180 & M	<9 & M	<9 @ M
Toluene	<7 µg/kg	TM116		12.1 & M	<7 & M	<140 & M	<7 & M	<7 @ M
Ethylbenzene	<4 µg/kg	TM116		46.6 & M	<4 & M	<80 & M	<4 & M	<4 @ M
p/m-Xylene	<10 µg/kg	TM116		23 & #	<10 & #	<200 & #	<10 & #	<10 @ #
o-Xylene	<10 µg/kg	TM116		<10 & M	<10 & M	<200 & M	<10 & M	<10 @ M

CERTIFICATE OF ANALYSIS

SDG:	150619-1	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319918
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Asbestos Identification - Solid Samples

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	BH001 ES3 ES 3 0.25 - 0.50 SOLID 17/06/2015 00:00:00 24/06/2015 13:08:39 150619-1 11561781 TM048	26/6/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP51 1.00 SOLID 16/06/2015 00:00:00 24/06/2015 08:15:14 150619-1 11561776 TM048	26/6/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP53 0.20 SOLID 16/06/2015 00:00:00 24/06/2015 13:08:38 150619-1 11561799 TM048	26/6/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP57 0.20 SOLID 16/06/2015 00:00:00 24/06/2015 13:12:56 150619-1 11561789 TM048	26/6/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP59 0.20 SOLID 15/06/2015 00:00:00 24/06/2015 08:28:24 150619-1 11561415 TM048	26/6/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150619-1	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319918
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.100	**Natural Moisture Content (%)**	11.7
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	89.5
Particle Size <4mm	>95%		

Case	
SDG	150619-1
Lab Sample Number(s)	11561795
Sampled Date	16-Jun-2015
Customer Sample Ref.	TP55
Depth (m)	0.20

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Hexavalent Chromium	<0.03	<0.03	<0.3	<0.3	-	-	-
pH Value of Filtered Water	7.8	<0.001	78	<0.01	-	-	-
Mercury Dissolved (CVAF)	0.0000201	<0.00001	0.000201	<0.0001	-	-	-
Antimony	0.00411	<0.00016	0.0411	<0.0016	-	-	-
Arsenic	0.0107	<0.00012	0.107	<0.0012	-	-	-
Total Cyanide (W)	<0.05	<0.05	<0.5	<0.5	-	-	-
Beryllium	<0.00007	<0.00007	<0.0007	<0.0007	-	-	-
Boron	0.029	<0.0094	0.29	<0.094	-	-	-
Cadmium	<0.0001	<0.0001	<0.001	<0.001	-	-	-
Chromium	0.00125	<0.00022	0.0125	<0.0022	-	-	-
Copper	0.00571	<0.00085	0.0571	<0.0085	-	-	-
Lead	0.00212	<0.00002	0.0212	<0.0002	-	-	-
Molybdenum	0.00598	<0.00024	0.0598	<0.0024	-	-	-
Nickel	0.000382	<0.00015	0.00382	<0.0015	-	-	-
Selenium	0.00102	<0.00039	0.0102	<0.0039	-	-	-
Vanadium	0.00118	<0.00024	0.0118	<0.0024	-	-	-
Zinc	0.00416	<0.00041	0.0416	<0.0041	-	-	-
PAH Spec MS - Aqueous (W)							
Naphthalene by GCMS	<0.0001	<0.0001	<0.001	<0.001	-	-	-
Acenaphthene by GCMS	<0.000015	<0.000015	<0.00015	<0.00015	-	-	-
Acenaphthylene by GCMS	<0.000011	<0.000011	<0.00011	<0.00011	-	-	-
Fluoranthene by GCMS	0.0000952	<0.000017	0.000952	<0.00017	-	-	-
Anthracene by GCMS	0.0000211	<0.000015	0.000211	<0.00015	-	-	-
Phenanthrene by GCMS	0.000075	<0.000022	0.00075	<0.00022	-	-	-
Fluorene by GCMS	<0.000014	<0.000014	<0.00014	<0.00014	-	-	-
Chrysene by GCMS	0.0000709	<0.000013	0.000709	<0.00013	-	-	-
Pyrene by GCMS	0.0000786	<0.000015	0.000786	<0.00015	-	-	-
Benz(a)anthracene by GCMS	0.0000182	<0.000017	0.000182	<0.00017	-	-	-
Benzo(b)fluoranthene by GCMS	0.0000866	<0.000023	0.000866	<0.00023	-	-	-
Benzo(k)fluoranthene by GCMS	0.0000358	<0.000027	0.000358	<0.00027	-	-	-
Benzo(a)pyrene by GCMS	0.0000354	<0.000009	0.000354	<0.00009	-	-	-
Dibenzo(ah)anthracene by GCMS	<0.000016	<0.000016	<0.00016	<0.00016	-	-	-
Benzo(ghi)perylene by GCMS	0.0000368	<0.000016	0.000368	<0.00016	-	-	-
Indeno(123cd)pyrene by GCMS	0.0000282	<0.000014	0.000282	<0.00014	-	-	-
PAH 16 EPA Total by GCMS	0.000582	<0.000344	0.00582	<0.00344	-	-	-

Leach Test Information

Date Prepared	24-Jun-2015
pH (pH Units)	8.30
Conductivity (µS/cm)	107.00
Temperature (°C)	22.10
Volume Leachant (Litres)	0.889

Mcerts Certification does not apply to leachates

07/07/2015 09:37:30

09:37:21 07/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150619-1	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319918
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.100	**Natural Moisture Content (%)**	11.7
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	89.5
Particle Size <4mm	>95%		

Case	
SDG	150619-1
Lab Sample Number(s)	11561795
Sampled Date	16-Jun-2015
Customer Sample Ref.	TP55
Depth (m)	0.20

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
TPH CWG (W)							
Surrogate Recovery	-	<0	-	<0	-	-	-
GRO TOT (C5-C12)	<0.05	<0.05	<0.5	<0.5	-	-	-
Aliphatics C5-C6	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C6-C8	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C8-C10	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C10-C12	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C12-C16	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C16-C21	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C21-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Total Aliphatics >C12-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics C6-C7	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >C7-C8	<0.01	<0.01	<0.1	<0.1	-	-	-
MTBE GC-FID	<0.003	<0.003	<0.03	<0.03	-	-	-
Aromatics >EC8 -EC10	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC10-EC12	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC12-EC16	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC16-EC21	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC21-EC35	<0.01	<0.01	<0.1	<0.1	-	-	-
Total Aromatics >EC12-EC35	<0.01	<0.01	<0.1	<0.1	-	-	-
Benzene by GC	<0.007	<0.007	<0.07	<0.07	-	-	-
TPH (Total Aliphatics + Total Aromatics) >C5-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Toluene by GC	<0.004	<0.004	<0.04	<0.04	-	-	-
Ethylbenzene by GC	<0.005	<0.005	<0.05	<0.05	-	-	-
m & p Xylene by GC	<0.008	<0.008	<0.08	<0.08	-	-	-
o Xylene by GC	<0.003	<0.003	<0.03	<0.03	-	-	-
Sum m&p and o Xylene by GC	<0.011	<0.011	<0.11	<0.11	-	-	-
Sum of BTEX by GC	<0.028	<0.028	<0.28	<0.28	-	-	-
VOC MS (W)							
Toluene-d8	-	<0	-	<0	-	-	-
Tert-butyl methyl ether	<0.1	<0.1	<1	<1	-	-	-
Benzene	<0.1	<0.1	<1	<1	-	-	-
Toluene	<0.1	<0.1	<1	<1	-	-	-
Ethylbenzene	<0.1	<0.1	<1	<1	-	-	-
p/m-Xylene	<0.1	<0.1	<1	<1	-	-	-
o-Xylene	<0.1	<0.1	<1	<1	-	-	-

Leach Test Information

Date Prepared	24-Jun-2015
pH (pH Units)	8.30
Conductivity (µS/cm)	107.00
Temperature (°C)	22.10
Volume Leachant (Litres)	0.889

Mcerts Certification does not apply to leachates

07/07/2015 09:37:30

09:37:21 07/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150619-1	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319918
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
PM115		Leaching Procedure for CEN One Stage Leach Test 2:1 & 10:1 1 Step		
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM061	Method for the Determination of EPH,Massachusetts Dept.of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)		
TM062 (S)	National Grid Property Holdings Methods for the Collection & Analysis of Samples from National Grid Sites version 1 Sec 3.9	Determination of Phenols in Soils by HPLC		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water		
TM116	Modified: US EPA Method 8260, 8120, 8020, 624, 610 & 602	Determination of Volatile Organic Compounds by Headspace / GC-MS		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser		
TM157	HP 6890 Gas Chromatograph (GC) system and HP 5973 Mass Selective Detector (MSD).	Determination of SVOC in Soils by GC-MS extracted by sonication in DCM/Acetone		
TM168	EPA Method 8082, Polychlorinated Biphenyls by Gas Chromatography	Determination of WHO12 and EC7 Polychlorinated Biphenyl Congeners by GC-MS in Soils		
TM173	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID		
TM174	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Waters by GC-FID		
TM178	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM208	Modified: US EPA Method 8260b & 624	Determination of Volatile Organic Compounds by Headspace / GC-MS in Waters		
TM218	Microwave extraction – EPA method 3546	Microwave extraction - EPA method 3546		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		
TM227	Standard methods for the examination of waters and wastewaters 20th Edition, AWWA/APHA Method 4500.	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate		
TM241	Methods for the Examination of Waters and Associated Materials; Chromium in Raw and Potable Waters and Sewage Effluents 1980.	The Determination of Hexavalent Chromium in Waters and Leachates using the Kone Analyser		
TM245	By GC-FID	Determination of GRO by Headspace in waters		
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	150619-1	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319918
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	11561781	11561776	11561799	11561795	11561789	11561415
Customer Sample Ref.	BH001 ES3	TP51	TP53	TP55	TP57	TP59
AGS Ref.	ES3					
Depth	0.25 - 0.50	1.00	0.20	0.20	0.20	0.20
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples	26-Jun-2015	26-Jun-2015	26-Jun-2015		26-Jun-2015	26-Jun-2015
Boron Water Soluble	02-Jul-2015	01-Jul-2015	01-Jul-2015		02-Jul-2015	01-Jul-2015
CEN 10:1 Leachate (1 Stage)				24-Jun-2015		
CEN Readings				29-Jun-2015		
Cyanide Comp/Free/Total/Thiocyanate	02-Jul-2015	02-Jul-2015	02-Jul-2015	01-Jul-2015	03-Jul-2015	02-Jul-2015
Dissolved Metals by ICP-MS				03-Jul-2015		
Dissolved Organic/Inorganic Carbon				01-Jul-2015		
EPH CWG (Aliphatic) Aqueous GC (W)				06-Jul-2015		
EPH CWG (Aliphatic) GC (S)	06-Jul-2015	30-Jun-2015	30-Jun-2015		03-Jul-2015	30-Jun-2015
EPH CWG (Aromatic) Aqueous GC (W)				06-Jul-2015		
EPH CWG (Aromatic) GC (S)	06-Jul-2015	30-Jun-2015	30-Jun-2015		03-Jul-2015	30-Jun-2015
GRO by GC-FID (S)	02-Jul-2015	02-Jul-2015	02-Jul-2015		07-Jul-2015	02-Jul-2015
GRO by GC-FID (W)				03-Jul-2015		
Hexavalent Chromium (s)	03-Jul-2015	03-Jul-2015	03-Jul-2015		03-Jul-2015	03-Jul-2015
Hexavalent Chromium (w)				03-Jul-2015		
Mercury Dissolved				01-Jul-2015		
Metals in solid samples by OES	02-Jul-2015	03-Jul-2015	02-Jul-2015		06-Jul-2015	03-Jul-2015
PAH by GCMS	01-Jul-2015	02-Jul-2015	03-Jul-2015		01-Jul-2015	02-Jul-2015
PAH Spec MS - Aqueous (W)				06-Jul-2015		
pH	06-Jul-2015	06-Jul-2015	06-Jul-2015		06-Jul-2015	06-Jul-2015
pH Value of Filtered Water				02-Jul-2015		
Sample description	29-Jun-2015	25-Jun-2015	25-Jun-2015	24-Jun-2015	29-Jun-2015	25-Jun-2015
Total Organic Carbon	06-Jul-2015	06-Jul-2015	06-Jul-2015		02-Jul-2015	06-Jul-2015
TPH CWG (W)				06-Jul-2015		
TPH CWG GC (S)	06-Jul-2015	02-Jul-2015	02-Jul-2015		07-Jul-2015	02-Jul-2015
VOC MS (S)	03-Jul-2015	03-Jul-2015	06-Jul-2015		06-Jul-2015	03-Jul-2015
VOC MS (W)				07-Jul-2015		

SDG:	150619-1	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319918
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before presevation was performed
§	Sampled on date not provided
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

ALcontrol Laboratories

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Apex Drilling Services
Sturmi Way
Village Farm Industrial Estate
Pyle
Bridgend
CF33 6BZ

Attention: Robert Brewer

CERTIFICATE OF ANALYSIS

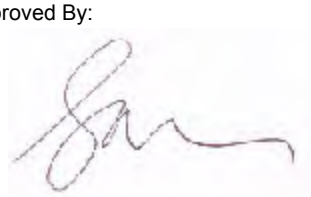
Date:	07 July 2015
Customer:	H_APEXDRL_BGD
Sample Delivery Group (SDG):	150621-10
Your Reference:	10318
Location:	Swansea Bay
Report No:	319919

We received 11 samples on Saturday June 20, 2015 and 4 of these samples were scheduled for analysis which was completed on Tuesday July 07, 2015. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:



Sonia McWhan

Operations Manager

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CERTIFICATE OF ANALYSIS

SDG:	150621-10	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319919
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
11575863	BH002		0.65	17/06/2015
11575858	BH005	ES1	0.00 - 0.30	18/06/2015
11575859	BH005	ES3	0.30 - 0.80	18/06/2015
11575860	BH005	ES5	1.50 - 2.00	18/06/2015
11575861	BH005	ES7	2.00 - 3.00	18/06/2015
11575862	NO ID			18/06/2015
11575853	TP008		0.20	18/06/2015
11575854	TP008		1.00	18/06/2015
11575855	TP008		2.00	18/06/2015
11575856	TP008		3.00	18/06/2015
11575857	TP008		3.60	18/06/2015

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG:	150621-10	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319919
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

X Test

N No Determination Possible

Lab Sample No(s)			11575863	11575859	11575853	11575854
Customer Sample Reference			BH002	BH005	TP008	TP008
AGS Reference				ES3		
Depth (m)			0.65	0.30 - 0.80	0.20	1.00
Container			250g Amber Jar (AL	1kg TUB 250g Amber Jar (AL	60g VOC (ALE215) 1kg TUB	250g Amber Jar (AL 60g VOC (ALE215) 1kg TUB 250g Amber Jar (AL
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 2		X	X	
Asbestos Identification	All	NDPs: 0 Tests: 1	X			
Asbestos Quantification - Full	All	NDPs: 0 Tests: 1			X	
Boron Water Soluble	All	NDPs: 0 Tests: 2		X	X	
CEN Readings	All	NDPs: 0 Tests: 1				X
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 3		X	X	X
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 1				X
Dissolved Organic/Inorganic Carbon	All	NDPs: 0 Tests: 1				X
EPH CWG (Aliphatic) Aqueous GC (W)	All	NDPs: 0 Tests: 1				X
EPH CWG (Aliphatic) GC (S)	All	NDPs: 0 Tests: 2		X	X	
EPH CWG (Aromatic) Aqueous GC (W)	All	NDPs: 0 Tests: 1				X
EPH CWG (Aromatic) GC (S)	All	NDPs: 0 Tests: 2		X	X	
GRO by GC-FID (S)	All	NDPs: 0 Tests: 2		X	X	
GRO by GC-FID (W)	All	NDPs: 0 Tests: 1				X
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 2		X	X	

CERTIFICATE OF ANALYSIS

SDG:	150621-10	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319919
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

X **Test**

N **No Determination Possible**

			Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container
			11575863	BH002		0.65	250g Amber Jar (AL
			11575859	BH005	ES3	0.30 - 0.80	1kg TUB 250g Amber Jar (AL 60g VOC (ALE215)
			11575853	TP008		0.20	1kg TUB 250g Amber Jar (AL
			11575854	TP008		1.00	60g VOC (ALE215) 1kg TUB 250g Amber Jar (AL
Hexavalent Chromium (w)	All	NDPs: 0 Tests: 1					X
Mercury Dissolved	All	NDPs: 0 Tests: 1					X
Metals in solid samples by OES	All	NDPs: 0 Tests: 2			X	X	
PAH by GCMS	All	NDPs: 0 Tests: 2			X	X	
PAH Spec MS - Aqueous (W)	All	NDPs: 0 Tests: 1					X
pH	All	NDPs: 0 Tests: 2	X			X	
pH Value of Filtered Water	All	NDPs: 0 Tests: 1					X
Sample description	All	NDPs: 0 Tests: 3			X	X	X
Total Organic Carbon	All	NDPs: 0 Tests: 2			X	X	
TPH CWG (W)	All	NDPs: 0 Tests: 1					X
TPH CWG GC (S)	All	NDPs: 0 Tests: 2			X	X	
VOC MS (S)	All	NDPs: 0 Tests: 2			X	X	
VOC MS (W)	All	NDPs: 0 Tests: 1					X

CERTIFICATE OF ANALYSIS

SDG:	150621-10	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319919
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
11575859	BH005	0.30 - 0.80	Black	Sandy Loam	0.1 - 2 mm	Stones	Vegetation
11575853	TP008	0.20	Dark Brown	Loamy Sand	0.1 - 2 mm	Stones	Vegetation
11575854	TP008	1.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	None

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

CERTIFICATE OF ANALYSIS

SDG:	150621-10	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319919
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH005	TP008	TP008
			Depth (m)	0.30 - 0.80	0.20	1.00
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	18/06/2015	18/06/2015	18/06/2015
			Sample Time	.	.	.
			Date Received	20/06/2015	20/06/2015	20/06/2015
			SDG Ref	150621-10	150621-10	150621-10
			Lab Sample No.(s)	11575859	11575853	11575854
			AGS Reference	ES3		
Moisture Content Ratio (% of as received sample)	%	PM024		9.8	14	12
Organic Carbon, Total	<0.2 %	TM132		4.25 M	22.8 M	
pH	1 pH Units	TM133		9.3 M	8.13 M	
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	
Cyanide, Total	<1 mg/kg	TM153		<1 M	<1 M	
Antimony	<0.6 mg/kg	TM181		25.8 #	14.2 #	
Arsenic	<0.6 mg/kg	TM181		73.1 M	51 M	
Beryllium	<0.01 mg/kg	TM181		0.685 M	1.52 M	
Cadmium	<0.02 mg/kg	TM181		4.28 M	12.8 M	
Chromium	<0.9 mg/kg	TM181		14.4 M	17.8 M	
Copper	<1.4 mg/kg	TM181		145 M	424 M	
Lead	<0.7 mg/kg	TM181		2380 M	1250 M	
Mercury	<0.14 mg/kg	TM181		0.164 M	<0.14 M	
Molybdenum	<0.1 mg/kg	TM181		4.75 #	8.42 #	
Nickel	<0.2 mg/kg	TM181		75.5 M	49.6 M	
Selenium	<1 mg/kg	TM181		<1 #	<1 #	
Vanadium	<0.2 mg/kg	TM181		26 #	37 #	
Zinc	<1.9 mg/kg	TM181		2980 M	3500 M	
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	

CERTIFICATE OF ANALYSIS

SDG:	150621-10	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319919
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

PAH by GCMS

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH005	TP008				
			Depth (m)	0.30 - 0.80	0.20				
			Sample Type	Soil/Solid	Soil/Solid				
			Date Sampled	18/06/2015	18/06/2015				
			Sample Time	.	.				
			Date Received	20/06/2015	20/06/2015				
			SDG Ref	150621-10	150621-10				
			Lab Sample No.(s)	11575859	11575853				
			AGS Reference	ES3					
Naphthalene-d8 % recovery**	%	TM218		97.9	85				
Acenaphthene-d10 % recovery**	%	TM218		96.5	83.9				
Phenanthrene-d10 % recovery**	%	TM218		95.9	82.3				
Chrysene-d12 % recovery**	%	TM218		102	87.8				
Perylene-d12 % recovery**	%	TM218		105	85.3				
Naphthalene	<9 µg/kg	TM218		458 M	2860 M				
Acenaphthylene	<12 µg/kg	TM218		89.7 M	211 M				
Acenaphthene	<8 µg/kg	TM218		220 M	700 M				
Fluorene	<10 µg/kg	TM218		204 M	495 M				
Phenanthrene	<15 µg/kg	TM218		2860 M	10100 M				
Anthracene	<16 µg/kg	TM218		691 M	2480 M				
Fluoranthene	<17 µg/kg	TM218		4310 M	15100 M				
Pyrene	<15 µg/kg	TM218		3380 M	12100 M				
Benz(a)anthracene	<14 µg/kg	TM218		2450 M	8300 M				
Chrysene	<10 µg/kg	TM218		2240 M	7360 M				
Benzo(b)fluoranthene	<15 µg/kg	TM218		3490 M	12500 M				
Benzo(k)fluoranthene	<14 µg/kg	TM218		1120 M	4690 M				
Benzo(a)pyrene	<15 µg/kg	TM218		2340 M	8500 M				
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218		1370 M	5590 M				
Dibenzo(a,h)anthracene	<23 µg/kg	TM218		488 M	1780 M				
Benzo(g,h,i)perylene	<24 µg/kg	TM218		1500 M	6450 M				
PAH, Total Detected USEPA 16	<118 µg/kg	TM218		27200	99200				

CERTIFICATE OF ANALYSIS

SDG:	150621-10	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319919
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

TPH CWG (S)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH005	TP008				
			Depth (m)	0.30 - 0.80	0.20				
			Sample Type	Soil/Solid	Soil/Solid				
			Date Sampled	18/06/2015	18/06/2015				
			Sample Time	.	.				
			Date Received	20/06/2015	20/06/2015				
			SDG Ref	150621-10	150621-10				
			Lab Sample No.(s)	11575859	11575853				
			AGS Reference	ES3					
GRO Surrogate % recovery**	%	TM089		15	11 &				
GRO TOT (Moisture Corrected)	<44 µg/kg	TM089		<44 M	<44 & M				
Methyl tertiary butyl ether (MTBE)	<5 µg/kg	TM089		<5 M	<5 & M				
Benzene	<10 µg/kg	TM089		<10 M	<10 & M				
Toluene	<2 µg/kg	TM089		2.22 M	<2 & M				
Ethylbenzene	<3 µg/kg	TM089		<3 M	<3 & M				
m,p-Xylene	<6 µg/kg	TM089		<6 M	<6 & M				
o-Xylene	<3 µg/kg	TM089		<3 M	<3 & M				
sum of detected mpo xylene by GC	<9 µg/kg	TM089		<9	<9 &				
sum of detected BTEX by GC	<24 µg/kg	TM089		<24	<24 &				
Aliphatics >C5-C6	<10 µg/kg	TM089		<10	<10 &				
Aliphatics >C6-C8	<10 µg/kg	TM089		<10	<10 &				
Aliphatics >C8-C10	<10 µg/kg	TM089		<10	<10 &				
Aliphatics >C10-C12	<10 µg/kg	TM089		<10	<10 &				
Aliphatics >C12-C16	<100 µg/kg	TM173		983	28000				
Aliphatics >C16-C21	<100 µg/kg	TM173		5420	116000				
Aliphatics >C21-C35	<100 µg/kg	TM173		38900	281000				
Aliphatics >C35-C44	<100 µg/kg	TM173		11700	56100				
Total Aliphatics >C12-C44	<100 µg/kg	TM173		57000	481000				
Aromatics >EC5-EC7	<10 µg/kg	TM089		<10	<10 &				
Aromatics >EC7-EC8	<10 µg/kg	TM089		<10	<10 &				
Aromatics >EC8-EC10	<10 µg/kg	TM089		<10	<10 &				
Aromatics >EC10-EC12	<10 µg/kg	TM089		<10	<10 &				
Aromatics >EC12-EC16	<100 µg/kg	TM173		2690	12700				
Aromatics >EC16-EC21	<100 µg/kg	TM173		17600	86200				
Aromatics >EC21-EC35	<100 µg/kg	TM173		72800	295000				
Aromatics >EC35-EC44	<100 µg/kg	TM173		31600	74500				
Aromatics >EC40-EC44	<100 µg/kg	TM173		12100	22700				
Total Aromatics >EC12-EC44	<100 µg/kg	TM173		125000	468000				
Total Aliphatics & Aromatics >C5-C44	<100 µg/kg	TM173		182000	949000				

CERTIFICATE OF ANALYSIS

SDG:	150621-10	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319919
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

VOC MS (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH005	TP008				
			Depth (m)	0.30 - 0.80	0.20				
			Sample Type	Soil/Solid	Soil/Solid				
			Date Sampled	18/06/2015	18/06/2015				
			Sample Time	.	.				
			Date Received	20/06/2015	20/06/2015				
			SDG Ref	150621-10	150621-10				
			Lab Sample No.(s)	11575859	11575853				
			AGS Reference	ES3					
Toluene-d8**	%	TM116		77.5	78.3 &				
Methyl Tertiary Butyl Ether	<10 µg/kg	TM116		<10 M	<10 & M				
Benzene	<9 µg/kg	TM116		<9 M	<9 & M				
Toluene	<7 µg/kg	TM116		<7 M	<7 & M				
Ethylbenzene	<4 µg/kg	TM116		<4 M	<4 & M				
p/m-Xylene	<10 µg/kg	TM116		<10 #	<10 & #				
o-Xylene	<10 µg/kg	TM116		<10 M	<10 & M				

CERTIFICATE OF ANALYSIS

SDG:	150621-10	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319919
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Asbestos Identification - Bulk

		Date of Analysis	Analysed by	Comments	Actinolite, Fibrous	Anthophyllite, Fibrous	Asbestos, Amosite (brown)	Asbestos, Chrysotile (white)	Asbestos, Crocidolite (blue)	Non-asbestos fibre	Tremolite, Fibrous
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	BH002 0.65 SOLID 17/06/2015 00:00:00 21/06/2015 13:12:37 150621-10 11575863 TM048	26/6/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected	Not Detected (#)

CERTIFICATE OF ANALYSIS

SDG:	150621-10	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319919
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Asbestos Identification - Solid Samples

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	BH005 ES 3 0.30 - 0.80 SOLID 18/06/2015 00:00:00 23/06/2015 11:12:23 150621-10 11575859 TM048	26/6/15	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP008 0.20 SOLID 18/06/2015 00:00:00 23/06/2015 11:26:04 150621-10 11575853 TM048	26/6/15	Kevin Hughes	Loose fibres in soil	Not Detected (#)	Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150621-10	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319919
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Asbestos Quantification - Full

		Additional Asbestos Components (Using TM048)	Analysts Comments	Asbestos Quantification - Gravimetric - %	Asbestos Quantification - PCOM Evaluation - %	Asbestos Quantification - Total - %
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP008 0.20 SOLID 18/06/2015 00:00:00 30/06/2015 07:54:17 150621-10 11575853 TM 304	None (#)	N/C	<0.001 (#)	<0.001 (#)	<0.001 (#)

CERTIFICATE OF ANALYSIS

SDG:	150621-10	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319919
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.104	**Natural Moisture Content (%)**	16
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	86.2
Particle Size <4mm	>95%		

Case	
SDG	150621-10
Lab Sample Number(s)	11575854
Sampled Date	18-Jun-2015
Customer Sample Ref.	TP008
Depth (m)	1.00

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Hexavalent Chromium	<0.03	<0.03	<0.3	<0.3	-	-	-
pH Value of Filtered Water	7.4	<0.001	74	<0.01	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	0.00504	<0.00016	0.0504	<0.0016	-	-	-
Arsenic	0.00124	<0.00012	0.0124	<0.0012	-	-	-
Total Cyanide (W)	<0.05	<0.05	<0.5	<0.5	-	-	-
Beryllium	<0.00007	<0.00007	<0.0007	<0.0007	-	-	-
Boron	0.0146	<0.0094	0.146	<0.094	-	-	-
Cadmium	0.00351	<0.0001	0.0351	<0.001	-	-	-
Chromium	0.000249	<0.00022	0.00249	<0.0022	-	-	-
Copper	0.00476	<0.00085	0.0476	<0.0085	-	-	-
Lead	0.107	<0.00002	1.07	<0.0002	-	-	-
Molybdenum	0.00199	<0.00024	0.0199	<0.0024	-	-	-
Nickel	0.00188	<0.00015	0.0188	<0.0015	-	-	-
Selenium	<0.00039	<0.00039	<0.0039	<0.0039	-	-	-
Vanadium	<0.00024	<0.00024	<0.0024	<0.0024	-	-	-
Zinc	1.3	<0.0041	13	<0.041	-	-	-
PAH Spec MS - Aqueous (W)							
Naphthalene by GCMS	<0.0001	<0.0001	<0.001	<0.001	-	-	-
Acenaphthene by GCMS	<0.000015	<0.000015	<0.00015	<0.00015	-	-	-
Acenaphthylene by GCMS	<0.000011	<0.000011	<0.00011	<0.00011	-	-	-
Fluoranthene by GCMS	<0.000017	<0.000017	<0.00017	<0.00017	-	-	-
Anthracene by GCMS	<0.000015	<0.000015	<0.00015	<0.00015	-	-	-
Phenanthrene by GCMS	<0.000022	<0.000022	<0.00022	<0.00022	-	-	-
Fluorene by GCMS	<0.000014	<0.000014	<0.00014	<0.00014	-	-	-
Chrysene by GCMS	<0.000013	<0.000013	<0.00013	<0.00013	-	-	-
Pyrene by GCMS	<0.000015	<0.000015	<0.00015	<0.00015	-	-	-
Benz(a)anthracene by GCMS	<0.000017	<0.000017	<0.00017	<0.00017	-	-	-
Benzo(b)fluoranthene by GCMS	<0.000023	<0.000023	<0.00023	<0.00023	-	-	-
Benzo(k)fluoranthene by GCMS	<0.000027	<0.000027	<0.00027	<0.00027	-	-	-
Benzo(a)pyrene by GCMS	<0.000009	<0.000009	<0.00009	<0.00009	-	-	-
Dibenzo(ah)anthracene by GCMS	<0.000016	<0.000016	<0.00016	<0.00016	-	-	-
Benzo(ghi)perylene by GCMS	<0.000016	<0.000016	<0.00016	<0.00016	-	-	-
Indeno(123cd)pyrene by GCMS	<0.000014	<0.000014	<0.00014	<0.00014	-	-	-
PAH 16 EPA Total by GCMS	<0.000344	<0.000344	<0.00344	<0.00344	-	-	-

Leach Test Information

Date Prepared	24-Jun-2015
pH (pH Units)	7.64
Conductivity (µS/cm)	66.70
Temperature (°C)	22.20
Volume Leachant (Litres)	0.886

Mcerts Certification does not apply to leachates

07/07/2015 09:37:35

09:37:27 07/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150621-10	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319919
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.104	**Natural Moisture Content (%)**	16
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	86.2
Particle Size <4mm	>95%		

Case	
SDG	150621-10
Lab Sample Number(s)	11575854
Sampled Date	18-Jun-2015
Customer Sample Ref.	TP008
Depth (m)	1.00

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
TPH CWG (W)							
Surrogate Recovery	-	<0	-	<0	-	-	-
GRO TOT (C5-C12)	<0.05	<0.05	<0.5	<0.5	-	-	-
Aliphatics C5-C6	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C6-C8	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C8-C10	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C10-C12	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C12-C16	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C16-C21	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C21-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Total Aliphatics >C12-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics C6-C7	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >C7-C8	<0.01	<0.01	<0.1	<0.1	-	-	-
MTBE GC-FID	<0.003	<0.003	<0.03	<0.03	-	-	-
Aromatics >EC8 -EC10	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC10-EC12	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC12-EC16	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC16-EC21	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC21-EC35	<0.01	<0.01	<0.1	<0.1	-	-	-
Total Aromatics >EC12-EC35	<0.01	<0.01	<0.1	<0.1	-	-	-
Benzene by GC	<0.007	<0.007	<0.07	<0.07	-	-	-
TPH (Total Aliphatics + Total Aromatics) >C5-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Toluene by GC	<0.004	<0.004	<0.04	<0.04	-	-	-
Ethylbenzene by GC	<0.005	<0.005	<0.05	<0.05	-	-	-
m & p Xylene by GC	<0.008	<0.008	<0.08	<0.08	-	-	-
o Xylene by GC	<0.003	<0.003	<0.03	<0.03	-	-	-
Sum m&p and o Xylene by GC	<0.011	<0.011	<0.11	<0.11	-	-	-
Sum of BTEX by GC	<0.028	<0.028	<0.28	<0.28	-	-	-
VOC MS (W)							
Toluene-d8	-	<0	-	<0	-	-	-
Tert-butyl methyl ether	<0.001	<0.001	<0.01	<0.01	-	-	-
Benzene	<0.001	<0.001	<0.01	<0.01	-	-	-
Toluene	<0.001	<0.001	<0.01	<0.01	-	-	-
Ethylbenzene	<0.001	<0.001	<0.01	<0.01	-	-	-
p/m-Xylene	<0.001	<0.001	<0.01	<0.01	-	-	-
o-Xylene	<0.001	<0.001	<0.01	<0.01	-	-	-

Leach Test Information

Date Prepared	24-Jun-2015
pH (pH Units)	7.64
Conductivity (µS/cm)	66.70
Temperature (°C)	22.20
Volume Leachant (Litres)	0.886

Mcerts Certification does not apply to leachates

07/07/2015 09:37:35

09:37:27 07/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150621-10	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319919
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
PM115		Leaching Procedure for CEN One Stage Leach Test 2:1 & 10:1 1 Step		
TM 304				
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM061	Method for the Determination of EPH,Massachusetts Dept.of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water		
TM116	Modified: US EPA Method 8260, 8120, 8020, 624, 610 & 602	Determination of Volatile Organic Compounds by Headspace / GC-MS		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser		
TM173	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID		
TM174	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Waters by GC-FID		
TM178	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM208	Modified: US EPA Method 8260b & 624	Determination of Volatile Organic Compounds by Headspace / GC-MS in Waters		
TM218	Microwave extraction – EPA method 3546	Microwave extraction - EPA method 3546		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		
TM227	Standard methods for the examination of waters and wastewaters 20th Edition, AWWA/APHA Method 4500.	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate		
TM241	Methods for the Examination of Waters and Associated Materials; Chromium in Raw and Potable Waters and Sewage Effluents 1980.	The Determination of Hexavalent Chromium in Waters and Leachates using the Kone Analyser		
TM245	By GC-FID	Determination of GRO by Headspace in waters		
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	150621-10	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319919
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	11575863	11575859	11575853	11575854
Customer Sample Ref.	BH002	BH005	TP008	TP008
AGS Ref.		ES3		
Depth	0.65	0.30 - 0.80	0.20	1.00
Type	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples		26-Jun-2015	26-Jun-2015	
Asbestos Identification	26-Jun-2015			
Asbestos Quantification - Full			01-Jul-2015	
Boron Water Soluble		02-Jul-2015	02-Jul-2015	
CEN 10:1 Leachate (1 Stage)				24-Jun-2015
CEN Readings				29-Jun-2015
Cyanide Comp/Free/Total/Thiocyanate		02-Jul-2015	02-Jul-2015	01-Jul-2015
Dissolved Metals by ICP-MS				03-Jul-2015
Dissolved Organic/Inorganic Carbon				01-Jul-2015
EPH CWG (Aliphatic) Aqueous GC (W)				06-Jul-2015
EPH CWG (Aliphatic) GC (S)		30-Jun-2015	26-Jun-2015	
EPH CWG (Aromatic) Aqueous GC (W)				06-Jul-2015
EPH CWG (Aromatic) GC (S)		30-Jun-2015	26-Jun-2015	
GRO by GC-FID (S)		02-Jul-2015	07-Jul-2015	
GRO by GC-FID (W)				03-Jul-2015
Hexavalent Chromium (s)		03-Jul-2015	03-Jul-2015	
Hexavalent Chromium (w)				03-Jul-2015
Mercury Dissolved				01-Jul-2015
Metals in solid samples by OES		03-Jul-2015	03-Jul-2015	
PAH by GCMS		02-Jul-2015	03-Jul-2015	
PAH Spec MS - Aqueous (W)				06-Jul-2015
pH		03-Jul-2015	03-Jul-2015	
pH Value of Filtered Water				02-Jul-2015
Sample description		25-Jun-2015	23-Jun-2015	23-Jun-2015
Total Organic Carbon		06-Jul-2015	29-Jun-2015	
TPH CWG (W)				06-Jul-2015
TPH CWG GC (S)		02-Jul-2015	07-Jul-2015	
VOC MS (S)		03-Jul-2015	06-Jul-2015	
VOC MS (W)				06-Jul-2015

SDG:	150621-10	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319919
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before presevation was performed
§	Sampled on date not provided
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

ALcontrol Laboratories

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Website: www.alcontrol.com

Apex Drilling Services
Sturmi Way
Village Farm Industrial Estate
Pyle
Bridgend
CF33 6BZ

Attention: Robert Brewer

CERTIFICATE OF ANALYSIS

Date:	07 July 2015
Customer:	H_APEXDRL_BGD
Sample Delivery Group (SDG):	150621-6
Your Reference:	10318
Location:	Swansea Bay
Report No:	319925

We received 19 samples on Saturday June 20, 2015 and 9 of these samples were scheduled for analysis which was completed on Tuesday July 07, 2015. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager

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Registered Office: Units 7 & 8 Hawarden Business Park, Manor Road, Hawarden, Deeside, CH5 3US. Registered in England and Wales No.

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319925
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
11575661	BH007	ES1	0.00 - 0.10	19/06/2015
11575662	BH007	ES2	0.10 - 0.50	19/06/2015
11575663	BH009	ES1	0.00 - 0.10	19/06/2015
11575664	BH009	ES2	0.20 - 0.80	19/06/2015
11575665	BH009	ES4	1.20 - 1.50	19/06/2015
11575666	BH009	ES6	2.00 - 2.50	19/06/2015
11575667	BH009	ES9	3.65 - 4.00	19/06/2015
11575668	BH006A	ES1	0.00 - 0.10	19/06/2015
11575669	BH006A	ES2	0.10 - 0.60	19/06/2015
11575670	BH006A	ES4	1.20 - 1.50	19/06/2015
11575671	BH006A	ES6	2.00 - 2.30	19/06/2015
11575653	TP10		0.40	19/06/2015
11575654	TP10		1.00	19/06/2015
11575655	TP10		2.00	19/06/2015
11575656	TP10		2.80	19/06/2015
11575657	TP11		0.20	19/06/2015
11575658	TP11		1.00	19/06/2015
11575659	TP11		2.00	19/06/2015
11575660	TP11		3.00	19/06/2015

Only received samples which have had analysis scheduled will be shown on the following pages.

ALcontrol Laboratories

Validated

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319925
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

X Test

N No Determination Possible

Lab Sample No(s)			11575662			11575664			11575670			11575653		11575654		11575655		11575657			11575658		11575659	
Customer Sample Reference			BH007			BH009			BH006A			TP10		TP10		TP10		TP11			TP11		TP11	
AGS Reference			ES2			ES2			ES4															
Depth (m)			0.10 - 0.50			0.20 - 0.80			1.20 - 1.50			0.40		1.00		2.00		0.20			1.00		2.00	
Container			1kg TUB	250g Amber Jar (AL	60g VOC (ALE215)	1kg TUB	250g Amber Jar (AL	60g VOC (ALE215)	1kg TUB	250g Amber Jar (AL	60g VOC (ALE215)	1kg TUB	250g Amber Jar (AL	1kg TUB	250g Amber Jar (AL	1kg TUB	250g Amber Jar (AL	1kg TUB	250g Amber Jar (AL	60g VOC (ALE215)	1kg TUB	250g Amber Jar (AL	1kg TUB	250g Amber Jar (AL
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 4	X			X			X									X						
Boron Water Soluble	All	NDPs: 0 Tests: 9		X			X			X			X		X		X		X			X		X
CEN Readings	All	NDPs: 0 Tests: 1										X												
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 5	X			X			X			X						X						
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 1										X												
Dissolved Organic/Inorganic Carbon	All	NDPs: 0 Tests: 1										X												
EPH CWG (Aliphatic) Aqueous GC (W)	All	NDPs: 0 Tests: 1										X												
EPH CWG (Aliphatic) GC (S)	All	NDPs: 0 Tests: 4		X			X			X									X					
EPH CWG (Aromatic) Aqueous GC (W)	All	NDPs: 0 Tests: 1										X												
EPH CWG (Aromatic) GC (S)	All	NDPs: 0 Tests: 4		X			X			X									X					
GRO by GC-FID (S)	All	NDPs: 0 Tests: 4			X			X			X									X				
GRO by GC-FID (W)	All	NDPs: 0 Tests: 1										X												
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 9	X			X			X			X		X		X		X			X		X	
Hexavalent Chromium (w)	All	NDPs: 0 Tests: 1										X												
Mercury Dissolved	All	NDPs: 0 Tests: 1										X												

10:04:20 07/07/2015

ALcontrol Laboratories

Validated

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319925
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

- X Test
- N No Determination Possible

Lab Sample No(s)			11575662			11575664			11575670			11575653		11575654		11575655		11575657			11575658		11575659	
Customer Sample Reference			BH007			BH009			BH006A			TP10		TP10		TP10		TP11			TP11		TP11	
AGS Reference			ES2			ES2			ES4															
Depth (m)			0.10 - 0.50			0.20 - 0.80			1.20 - 1.50			0.40		1.00		2.00		0.20			1.00		2.00	
Container			1kg TUB	250g Amber Jar (AL	60g VOC (ALE215)	1kg TUB	250g Amber Jar (AL	60g VOC (ALE215)	1kg TUB	250g Amber Jar (AL	60g VOC (ALE215)	1kg TUB	250g Amber Jar (AL	1kg TUB	250g Amber Jar (AL	1kg TUB	250g Amber Jar (AL	1kg TUB	250g Amber Jar (AL	60g VOC (ALE215)	1kg TUB	250g Amber Jar (AL	1kg TUB	250g Amber Jar (AL
Metals in solid samples by OES	All	NDPs: 0 Tests: 9		X			X			X			X		X		X		X			X		X
PAH by GCMS	All	NDPs: 0 Tests: 4		X			X			X									X					
PAH Spec MS - Aqueous (W)	All	NDPs: 0 Tests: 1										X												
pH	All	NDPs: 0 Tests: 4	X			X			X									X						
pH Value of Filtered Water	All	NDPs: 0 Tests: 1										X												
Sample description	All	NDPs: 0 Tests: 9		X			X			X			X		X		X		X			X		X
Total Organic Carbon	All	NDPs: 0 Tests: 4		X			X			X									X					
TPH CWG (W)	All	NDPs: 0 Tests: 1										X												
TPH CWG GC (S)	All	NDPs: 0 Tests: 4		X			X			X									X					
VOC MS (S)	All	NDPs: 0 Tests: 4			X			X			X									X				
VOC MS (W)	All	NDPs: 0 Tests: 1										X												

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319925
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
11575662	BH007	0.10 - 0.50	Dark Brown	Loamy Sand	0.1 - 2 mm	Vegetation	Concrete/Aggregate
11575664	BH009	0.20 - 0.80	Dark Brown	Sand	0.1 - 2 mm	Stones	Vegetation
11575670	BH006A	1.20 - 1.50	Dark Brown	Gravel	2 - 10 mm	Stones	N/A
11575653	TP10	0.40	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	Stones
11575654	TP10	1.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	None
11575655	TP10	2.00	Dark Brown	Silty Clay Loam	0.063 - 0.1 mm	Stones	Vegetation
11575657	TP11	0.20	Dark Brown	Sand	0.1 - 2 mm	Crushed Brick	Stones
11575658	TP11	1.00	Dark Brown	Loamy Sand	0.1 - 2 mm	Stones	Vegetation
11575659	TP11	2.00	Black	N/A	0.1 - 2 mm	Vegetation	Coal fragments

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319925
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH007	BH009	BH006A	TP10	TP10	TP10
			Depth (m)	0.10 - 0.50	0.20 - 0.80	1.20 - 1.50	0.40	1.00	2.00
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	19/06/2015	19/06/2015	19/06/2015	19/06/2015	19/06/2015	19/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	20/06/2015	20/06/2015	20/06/2015	20/06/2015	20/06/2015	20/06/2015
			SDG Ref	150621-6	150621-6	150621-6	150621-6	150621-6	150621-6
			Lab Sample No.(s)	11575662	11575664	11575670	11575653	11575654	11575655
			AGS Reference	ES2	ES2	ES4			
Moisture Content Ratio (% of as received sample)	%	PM024		4.1	5.5	20	9.6	14	23
Organic Carbon, Total	<0.2 %	TM132		6.29 M	1.25 M	14.6 #			
pH	1 pH Units	TM133		8.16 M	8.54 M	6.91 #			
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #
Cyanide, Total	<1 mg/kg	TM153		<1 M	<1 M	<1 #			
Antimony	<0.6 mg/kg	TM181		29.2 #	3.22 #	370 #	19 #	6.17 #	1.93 #
Arsenic	<0.6 mg/kg	TM181		44.7 M	24.5 M	406 #	95 M	28.7 M	14.9 M
Beryllium	<0.01 mg/kg	TM181		0.523 M	0.251 M	<0.1 #	1.62 M	0.545 M	0.512 M
Cadmium	<0.02 mg/kg	TM181		3.62 M	1.49 M	90.6 #	4.99 M	2.17 M	0.734 M
Chromium	<0.9 mg/kg	TM181		217 M	13.6 M	20.1 #	20.4 M	11.8 M	17.3 M
Copper	<1.4 mg/kg	TM181		243 M	42.1 M	2090 #	155 M	46.2 M	20.8 M
Lead	<0.7 mg/kg	TM181		1720 M	338 M	19100 #	2030 M	527 M	100 M
Mercury	<0.14 mg/kg	TM181		<0.14 M	<0.14 M	<0.14 #	0.219 M	<0.14 M	<0.14 M
Molybdenum	<0.1 mg/kg	TM181		3.34 #	0.407 #	2.69 #	3.87 #	1.32 #	0.77 #
Nickel	<0.2 mg/kg	TM181		20.1 M	14.2 M	49.3 #	69.9 M	29.9 M	21.1 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<10 #	<1 #	<1 #	<1 #
Vanadium	<0.2 mg/kg	TM181		82.6 #	19.4 #	35 #	26.2 #	17.3 #	25.6 #
Zinc	<1.9 mg/kg	TM181		2640 M	585 M	47800 #	3240 M	1130 M	595 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 #	<1 M	<1 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319925
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TP11	TP11	TP11			
			Depth (m)	0.20	1.00	2.00			
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid			
			Date Sampled	19/06/2015	19/06/2015	19/06/2015			
			Sample Time	.	.	.			
			Date Received	20/06/2015	20/06/2015	20/06/2015			
			SDG Ref	150621-6	150621-6	150621-6			
			Lab Sample No.(s)	11575657	11575658	11575659			
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		9.3	14	20			
Organic Carbon, Total	<0.2 %	TM132		3.27 M					
pH	1 pH Units	TM133		8.49 M					
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	1.28 #	27.4			
Cyanide, Total	<1 mg/kg	TM153		<1 M					
Antimony	<0.6 mg/kg	TM181		50.7 #	88.2 #	305			
Arsenic	<0.6 mg/kg	TM181		83.3 M	125 M	159			
Beryllium	<0.01 mg/kg	TM181		0.414 M	0.646 M	0.848			
Cadmium	<0.02 mg/kg	TM181		7.58 M	13.5 M	9.52			
Chromium	<0.9 mg/kg	TM181		8.81 M	12.2 M	14.7			
Copper	<1.4 mg/kg	TM181		197 M	365 M	1790			
Lead	<0.7 mg/kg	TM181		8200 M	11100 M	35300			
Mercury	<0.14 mg/kg	TM181		<0.14 M	<0.14 M	<0.14			
Molybdenum	<0.1 mg/kg	TM181		8.01 #	12.8 #	7.87			
Nickel	<0.2 mg/kg	TM181		145 M	75.5 M	53.2			
Selenium	<1 mg/kg	TM181		<1 #	<1 #	3.36			
Vanadium	<0.2 mg/kg	TM181		19.5 #	26.6 #	29.8			
Zinc	<1.9 mg/kg	TM181		10900 M	19300 M	24800			
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1			

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319925
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

PAH by GCMS

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH007	BH009	BH006A	TP11		
			Depth (m)	0.10 - 0.50	0.20 - 0.80	1.20 - 1.50	0.20		
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid		
			Date Sampled	19/06/2015	19/06/2015	19/06/2015	19/06/2015		
			Sample Time	.	.	.	.		
			Date Received	20/06/2015	20/06/2015	20/06/2015	20/06/2015		
			SDG Ref	150621-6	150621-6	150621-6	150621-6		
			Lab Sample No.(s)	11575662	11575664	11575670	11575657		
			AGS Reference	ES2	ES2	ES4			
Naphthalene-d8 % recovery**	%	TM218		99.7	103	98.5	107		
Acenaphthene-d10 % recovery**	%	TM218		98.8	101	95.1	106		
Phenanthrene-d10 % recovery**	%	TM218		94.6	98.5	73.7	101		
Chrysene-d12 % recovery**	%	TM218		95.4	105	42.1	108		
Perylene-d12 % recovery**	%	TM218		96.3	114	32.2	116		
Naphthalene	<9 µg/kg	TM218		251 M	61.5 M	1070 #	287 M		
Acenaphthylene	<12 µg/kg	TM218		71.3 M	51.6 M	68.9 #	52.9 M		
Acenaphthene	<8 µg/kg	TM218		110 M	134 M	51.5 #	107 M		
Fluorene	<10 µg/kg	TM218		82 M	134 M	73.8 #	123 M		
Phenanthrene	<15 µg/kg	TM218		1350 M	1990 M	1140 #	1530 M		
Anthracene	<16 µg/kg	TM218		262 M	598 M	146 #	436 M		
Fluoranthene	<17 µg/kg	TM218		2010 M	5740 M	1380 #	2660 M		
Pyrene	<15 µg/kg	TM218		1630 M	3900 M	1120 #	2040 M		
Benz(a)anthracene	<14 µg/kg	TM218		964 M	3420 M	480 #	1180 M		
Chrysene	<10 µg/kg	TM218		1100 M	3080 M	603 #	1360 M		
Benzo(b)fluoranthene	<15 µg/kg	TM218		1620 M	4020 M	918 #	1480 M		
Benzo(k)fluoranthene	<14 µg/kg	TM218		566 M	1550 M	229 #	709 M		
Benzo(a)pyrene	<15 µg/kg	TM218		1010 M	2570 M	565 #	1210 M		
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218		666 M	1520 M	498 #	686 M		
Dibenzo(a,h)anthracene	<23 µg/kg	TM218		227 M	650 M	105 #	258 M		
Benzo(g,h,i)perylene	<24 µg/kg	TM218		828 M	1650 M	817 #	849 M		
PAH, Total Detected USEPA 16	<118 µg/kg	TM218		12700	31100	9270	15000		

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319925
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

TPH CWG (S)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH007	BH009	BH006A	TP11		
			Depth (m)	0.10 - 0.50	0.20 - 0.80	1.20 - 1.50	0.20		
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid		
			Date Sampled	19/06/2015	19/06/2015	19/06/2015	19/06/2015		
			Sample Time	.	.	.	.		
			Date Received	20/06/2015	20/06/2015	20/06/2015	20/06/2015		
			SDG Ref	150621-6	150621-6	150621-6	150621-6		
			Lab Sample No.(s)	11575662	11575664	11575670	11575657		
			AGS Reference	ES2	ES2	ES4			
GRO Surrogate % recovery**	%	TM089		14	58	36	34		
GRO TOT (Moisture Corrected)	<44 µg/kg	TM089		<44 M	<44 M	777 #	<44 M		
Methyl tertiary butyl ether (MTBE)	<5 µg/kg	TM089		<5 M	<5 M	<5 #	<5 M		
Benzene	<10 µg/kg	TM089		<10 M	<10 M	<10 #	<10 M		
Toluene	<2 µg/kg	TM089		2.08 M	<2 M	<2 #	<2 M		
Ethylbenzene	<3 µg/kg	TM089		<3 M	<3 M	5.04 #	<3 M		
m,p-Xylene	<6 µg/kg	TM089		<6 M	<6 M	7.56 #	<6 M		
o-Xylene	<3 µg/kg	TM089		<3 M	<3 M	<3 #	<3 M		
sum of detected mpo xylene by GC	<9 µg/kg	TM089		<9	<9	<9	<9		
sum of detected BTEX by GC	<24 µg/kg	TM089		<24	<24	<24	<24		
Aliphatics >C5-C6	<10 µg/kg	TM089		<10	<10	10.1	<10		
Aliphatics >C6-C8	<10 µg/kg	TM089		<10	<10	32.8	<10		
Aliphatics >C8-C10	<10 µg/kg	TM089		<10	<10	194	12.1		
Aliphatics >C10-C12	<10 µg/kg	TM089		<10	<10	237	<10		
Aliphatics >C12-C16	<100 µg/kg	TM173		4980	1560	134000	737		
Aliphatics >C16-C21	<100 µg/kg	TM173		9480	5520	46800	4110		
Aliphatics >C21-C35	<100 µg/kg	TM173		84200	10800	134000	35500		
Aliphatics >C35-C44	<100 µg/kg	TM173		74900	9290	31500	11700		
Total Aliphatics >C12-C44	<100 µg/kg	TM173		174000	27200	346000	52000		
Aromatics >EC5-EC7	<10 µg/kg	TM089		<10	<10	<10	<10		
Aromatics >EC7-EC8	<10 µg/kg	TM089		<10	<10	<10	<10		
Aromatics >EC8-EC10	<10 µg/kg	TM089		<10	<10	142	<10		
Aromatics >EC10-EC12	<10 µg/kg	TM089		<10	<10	158	<10		
Aromatics >EC12-EC16	<100 µg/kg	TM173		3320	2070	18500	913		
Aromatics >EC16-EC21	<100 µg/kg	TM173		13200	19800	35600	9110		
Aromatics >EC21-EC35	<100 µg/kg	TM173		98300	72500	101000	43200		
Aromatics >EC35-EC44	<100 µg/kg	TM173		136000	44100	39500	15600		
Aromatics >EC40-EC44	<100 µg/kg	TM173		70100	21300	14900	5590		
Total Aromatics >EC12-EC44	<100 µg/kg	TM173		251000	138000	194000	68800		
Total Aliphatics & Aromatics >C5-C44	<100 µg/kg	TM173		425000	166000	541000	121000		

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319925
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

VOC MS (S)

Results Legend

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*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
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Component	LOD/Units	Method	Customer Sample R	BH007	BH009	BH006A	TP11		
			Depth (m)	0.10 - 0.50	0.20 - 0.80	1.20 - 1.50	0.20		
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid		
			Date Sampled	19/06/2015	19/06/2015	19/06/2015	19/06/2015		
			Sample Time	.	.	.	.		
			Date Received	20/06/2015	20/06/2015	20/06/2015	20/06/2015		
			SDG Ref	150621-6	150621-6	150621-6	150621-6		
			Lab Sample No.(s)	11575662	11575664	11575670	11575657		
			AGS Reference	ES2	ES2	ES4			
Toluene-d8**	%	TM116		83.1	92.7	71.9	93		
Methyl Tertiary Butyl Ether	<10 µg/kg	TM116		<10 M	<10 M	<10 #	<10 M		
Benzene	<9 µg/kg	TM116		<9 M	<9 M	<9 #	<9 M		
Toluene	<7 µg/kg	TM116		<7 M	<7 M	<7 #	<7 M		
Ethylbenzene	<4 µg/kg	TM116		<4 M	<4 M	7.11 #	<4 M		
p/m-Xylene	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #		
o-Xylene	<10 µg/kg	TM116		<10 M	<10 M	<10 #	<10 M		

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319925
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Asbestos Identification - Solid Samples

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	BH007 ES 2 0.10 - 0.50 SOLID 19/06/2015 00:00:00 23/06/2015 11:31:11 150621-6 11575662 TM048	26/6/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	BH009 ES 2 0.20 - 0.80 SOLID 19/06/2015 00:00:00 23/06/2015 11:19:49 150621-6 11575664 TM048	26/6/15.	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	BH006A ES 4 1.20 - 1.50 SOLID 19/06/2015 00:00:00 23/06/2015 11:09:32 150621-6 11575670 TM048	26/6/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP11 0.20 SOLID 19/06/2015 00:00:00 23/06/2015 11:18:39 150621-6 11575657 TM048	25/6/15	Rebecca Rawlings	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319925
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.102	**Natural Moisture Content (%)**	13.2
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	88.4
Particle Size <4mm	>95%		

Case	
SDG	150621-6
Lab Sample Number(s)	11575653
Sampled Date	19-Jun-2015
Customer Sample Ref.	TP10
Depth (m)	0.40

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Hexavalent Chromium	<0.03	<0.03	<0.3	<0.3	-	-	-
pH Value of Filtered Water	7.7	<0.001	77	<0.01	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	0.00574	<0.00016	0.0574	<0.0016	-	-	-
Arsenic	0.00958	<0.00012	0.0958	<0.0012	-	-	-
Total Cyanide (W)	<0.05	<0.05	<0.5	<0.5	-	-	-
Beryllium	<0.00007	<0.00007	<0.0007	<0.0007	-	-	-
Boron	0.0178	<0.0094	0.178	<0.094	-	-	-
Cadmium	0.000117	<0.0001	0.00117	<0.001	-	-	-
Chromium	0.00125	<0.00022	0.0125	<0.0022	-	-	-
Copper	0.00448	<0.00085	0.0448	<0.0085	-	-	-
Lead	0.00531	<0.00002	0.0531	<0.0002	-	-	-
Molybdenum	0.0158	<0.00024	0.158	<0.0024	-	-	-
Nickel	0.000571	<0.00015	0.00571	<0.0015	-	-	-
Selenium	<0.00039	<0.00039	<0.0039	<0.0039	-	-	-
Vanadium	0.000841	<0.00024	0.00841	<0.0024	-	-	-
Zinc	0.0119	<0.00041	0.119	<0.0041	-	-	-
PAH Spec MS - Aqueous (W)							
Naphthalene by GCMS	<0.0001	<0.0001	<0.001	<0.001	-	-	-
Acenaphthene by GCMS	<0.000015	<0.000015	<0.00015	<0.00015	-	-	-
Acenaphthylene by GCMS	<0.000011	<0.000011	<0.00011	<0.00011	-	-	-
Fluoranthene by GCMS	<0.000017	<0.000017	<0.00017	<0.00017	-	-	-
Anthracene by GCMS	<0.000015	<0.000015	<0.00015	<0.00015	-	-	-
Phenanthrene by GCMS	<0.000022	<0.000022	<0.00022	<0.00022	-	-	-
Fluorene by GCMS	<0.000014	<0.000014	<0.00014	<0.00014	-	-	-
Chrysene by GCMS	<0.000013	<0.000013	<0.00013	<0.00013	-	-	-
Pyrene by GCMS	<0.000015	<0.000015	<0.00015	<0.00015	-	-	-
Benz(a)anthracene by GCMS	<0.000017	<0.000017	<0.00017	<0.00017	-	-	-
Benzo(b)fluoranthene by GCMS	<0.000023	<0.000023	<0.00023	<0.00023	-	-	-
Benzo(k)fluoranthene by GCMS	<0.000027	<0.000027	<0.00027	<0.00027	-	-	-
Benzo(a)pyrene by GCMS	<0.000009	<0.000009	<0.00009	<0.00009	-	-	-
Dibenzo(ah)anthracene by GCMS	<0.000016	<0.000016	<0.00016	<0.00016	-	-	-
Benzo(ghi)perylene by GCMS	<0.000016	<0.000016	<0.00016	<0.00016	-	-	-
Indeno(123cd)pyrene by GCMS	<0.000014	<0.000014	<0.00014	<0.00014	-	-	-
PAH 16 EPA Total by GCMS	<0.000344	<0.000344	<0.00344	<0.00344	-	-	-

Leach Test Information

Date Prepared	24-Jun-2015
pH (pH Units)	8.03
Conductivity (µS/cm)	106.00
Temperature (°C)	23.20
Volume Leachant (Litres)	0.888

Mcerts Certification does not apply to leachates

07/07/2015 10:04:26

10:04:20 07/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319925
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.102	**Natural Moisture Content (%)**	13.2
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	88.4
Particle Size <4mm	>95%		

Case	
SDG	150621-6
Lab Sample Number(s)	11575653
Sampled Date	19-Jun-2015
Customer Sample Ref.	TP10
Depth (m)	0.40

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
TPH CWG (W)							
Surrogate Recovery	-	<0	-	<0	-	-	-
GRO TOT (C5-C12)	<0.05	<0.05	<0.5	<0.5	-	-	-
Aliphatics C5-C6	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C6-C8	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C8-C10	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C10-C12	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C12-C16	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C16-C21	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C21-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Total Aliphatics >C12-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics C6-C7	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >C7-C8	<0.01	<0.01	<0.1	<0.1	-	-	-
MTBE GC-FID	<0.003	<0.003	<0.03	<0.03	-	-	-
Aromatics >EC8 -EC10	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC10-EC12	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC12-EC16	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC16-EC21	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC21-EC35	<0.01	<0.01	<0.1	<0.1	-	-	-
Total Aromatics >EC12-EC35	<0.01	<0.01	<0.1	<0.1	-	-	-
Benzene by GC	<0.007	<0.007	<0.07	<0.07	-	-	-
TPH (Total Aliphatics + Total Aromatics) >C5-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Toluene by GC	<0.004	<0.004	<0.04	<0.04	-	-	-
Ethylbenzene by GC	<0.005	<0.005	<0.05	<0.05	-	-	-
m & p Xylene by GC	<0.008	<0.008	<0.08	<0.08	-	-	-
o Xylene by GC	<0.003	<0.003	<0.03	<0.03	-	-	-
Sum m&p and o Xylene by GC	<0.011	<0.011	<0.11	<0.11	-	-	-
Sum of BTEX by GC	<0.028	<0.028	<0.28	<0.28	-	-	-
VOC MS (W)							
Toluene-d8	-	<0	-	<0	-	-	-
Tert-butyl methyl ether	<0.001	<0.001	<0.01	<0.01	-	-	-
Benzene	<0.001	<0.001	<0.01	<0.01	-	-	-
Toluene	<0.001	<0.001	<0.01	<0.01	-	-	-
Ethylbenzene	<0.001	<0.001	<0.01	<0.01	-	-	-
p/m-Xylene	<0.001	<0.001	<0.01	<0.01	-	-	-
o-Xylene	<0.001	<0.001	<0.01	<0.01	-	-	-

Leach Test Information

Date Prepared	24-Jun-2015
pH (pH Units)	8.03
Conductivity (µS/cm)	106.00
Temperature (°C)	23.20
Volume Leachant (Litres)	0.888

Mcerts Certification does not apply to leachates

07/07/2015 10:04:26

10:04:20 07/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319925
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
PM115		Leaching Procedure for CEN One Stage Leach Test 2:1 & 10:1 1 Step		
TM 304				
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM061	Method for the Determination of EPH,Massachusetts Dept.of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water		
TM116	Modified: US EPA Method 8260, 8120, 8020, 624, 610 & 602	Determination of Volatile Organic Compounds by Headspace / GC-MS		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser		
TM173	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID		
TM174	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Waters by GC-FID		
TM178	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM208	Modified: US EPA Method 8260b & 624	Determination of Volatile Organic Compounds by Headspace / GC-MS in Waters		
TM218	Microwave extraction – EPA method 3546	Microwave extraction - EPA method 3546		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		
TM227	Standard methods for the examination of waters and wastewaters 20th Edition, AWWA/APHA Method 4500.	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate		
TM241	Methods for the Examination of Waters and Associated Materials; Chromium in Raw and Potable Waters and Sewage Effluents 1980.	The Determination of Hexavalent Chromium in Waters and Leachates using the Kone Analyser		
TM245	By GC-FID	Determination of GRO by Headspace in waters		
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319925
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	11575662	11575664	11575670	11575653	11575654	11575655	11575657	11575658	11575659
Customer Sample Ref.	BH007	BH009	BH006A	TP10	TP10	TP10	TP11	TP11	TP11
AGS Ref.	ES2	ES2	ES4						
Depth	0.10 - 0.50	0.20 - 0.80	1.20 - 1.50	0.40	1.00	2.00	0.20	1.00	2.00
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples	26-Jun-2015	26-Jun-2015	26-Jun-2015				26-Jun-2015		
Boron Water Soluble	01-Jul-2015	01-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	01-Jul-2015	25-Jun-2015	01-Jul-2015	02-Jul-2015
CEN 10:1 Leachate (1 Stage)				03-Jul-2015					
CEN Readings				06-Jul-2015					
Cyanide Comp/Free/Total/Thiocyanate	30-Jun-2015	30-Jun-2015	30-Jun-2015	01-Jul-2015			30-Jun-2015		
Dissolved Metals by ICP-MS				03-Jul-2015					
Dissolved Organic/Inorganic Carbon				01-Jul-2015					
EPH CWG (Aliphatic) Aqueous GC (W)				07-Jul-2015					
EPH CWG (Aliphatic) GC (S)	29-Jun-2015	29-Jun-2015	29-Jun-2015				26-Jun-2015		
EPH CWG (Aromatic) Aqueous GC (W)				07-Jul-2015					
EPH CWG (Aromatic) GC (S)	29-Jun-2015	29-Jun-2015	29-Jun-2015				26-Jun-2015		
GRO by GC-FID (S)	30-Jun-2015	30-Jun-2015	01-Jul-2015				30-Jun-2015		
GRO by GC-FID (W)				01-Jul-2015					
Hexavalent Chromium (s)	01-Jul-2015	01-Jul-2015	01-Jul-2015	03-Jul-2015	03-Jul-2015	03-Jul-2015	01-Jul-2015	03-Jul-2015	03-Jul-2015
Hexavalent Chromium (w)				03-Jul-2015					
Mercury Dissolved				01-Jul-2015					
Metals in solid samples by OES	01-Jul-2015	30-Jun-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	29-Jun-2015	02-Jul-2015	02-Jul-2015
PAH by GCMS	30-Jun-2015	30-Jun-2015	01-Jul-2015				01-Jul-2015		
PAH Spec MS - Aqueous (W)				03-Jul-2015					
pH	02-Jul-2015	02-Jul-2015	02-Jul-2015				03-Jul-2015		
pH Value of Filtered Water				02-Jul-2015					
Sample description	24-Jun-2015	24-Jun-2015	24-Jun-2015	24-Jun-2015	26-Jun-2015	26-Jun-2015	23-Jun-2015	26-Jun-2015	26-Jun-2015
Total Organic Carbon	01-Jul-2015	01-Jul-2015	01-Jul-2015				29-Jun-2015		
TPH CWG (W)				07-Jul-2015					
TPH CWG GC (S)	30-Jun-2015	30-Jun-2015	01-Jul-2015				30-Jun-2015		
VOC MS (S)	30-Jun-2015	30-Jun-2015	03-Jul-2015				30-Jun-2015		
VOC MS (W)				01-Jul-2015					

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	319925
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before presevation was performed
§	Sampled on date not provided
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

ALcontrol Laboratories

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Apex Drilling Services
Sturmi Way
Village Farm Industrial Estate
Pyle
Bridgend
CF33 6BZ

Attention: Robert Brewer

CERTIFICATE OF ANALYSIS

Date:	13 July 2015
Customer:	H_APEXDRL_BGD
Sample Delivery Group (SDG):	150623-71
Your Reference:	10318
Location:	Swansea Bay
Report No:	320562

We received 16 samples on Tuesday June 23, 2015 and 16 of these samples were scheduled for analysis which was completed on Monday July 13, 2015. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager

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CERTIFICATE OF ANALYSIS

SDG:	150623-71	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320562
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
11586754	BH010A	ES1	0.00 - 0.10	19/06/2015
11586755	BH010A	ES2	0.20 - 1.00	19/06/2015
11586756	BH010A	ES4	1.20 - 1.60	19/06/2015
11586757	BH010A	ES6	1.60 - 1.70	19/06/2015
11586758	BH010A	ES7	2.00 - 2.50	19/06/2015
11586759	BH010A	ES10	3.60 - 3.80	19/06/2015
11586750	TP12		0.40	19/06/2015
11586751	TP12		1.00	19/06/2015
11586752	TP12		2.00	19/06/2015
11586753	TP12		3.00	19/06/2015
11586760	TP16		0.20	22/06/2015
11586761	TP16		1.00	22/06/2015
11586762	TP16		1.50	22/06/2015
11586763	TP17		0.20	22/06/2015
11586764	TP17		1.00	22/06/2015
11586765	TP17		1.40	22/06/2015

Only received samples which have had analysis scheduled will be shown on the following pages.

ALcontrol Laboratories

CERTIFICATE OF ANALYSIS

Validated

SDG: 150623-71	**Location:** Swansea Bay	**Order Number:** 3074
Job: H_APEXDRL_BGD-42	**Customer:** Apex Drilling Services	**Report Number:** 320562
Client Reference: 10318	**Attention:** Robert Brewer	**Superseded Report:**

SOLID

Results Legend

- X — Test
- N — No Determination Possible

Lab Sample No(s)			11586755	11586755	11586755	11586757	11586750	11586750	11586751	11586751	11586752	11586752	11586760	11586760	11586760	11586764	11586764	11586764
Customer Sample Reference			BH010A	BH010A	BH010A	BH010A	TP12	TP12	TP12	TP12	TP12	TP12	TP16	TP16	TP16	TP17	TP17	TP17
AGS Reference			ES2	ES2	ES2	ES6												
Depth (m)			0.20 - 1.00	0.20 - 1.00	0.20 - 1.00	1.60 - 1.70	0.40	0.40	1.00	1.00	2.00	2.00	0.20	0.20	0.20	1.00	1.00	1.00
Container			1kg TUB	250g Amber Jar (AL	60g VOC (ALE215)	250g Amber Jar (AL	1kg TUB	250g Amber Jar (AL	1kg TUB	250g Amber Jar (AL	1kg TUB	250g Amber Jar (AL	1kg TUB	250g Amber Jar (AL	60g VOC (ALE215)	1kg TUB	250g Amber Jar (AL	60g VOC (ALE215)
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 4	X				X						X			X		
Boron Water Soluble	All	NDPs: 0 Tests: 6		X				X		X		X		X			X	
CEN Readings	All	NDPs: 0 Tests: 1							X									
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 4	X						X				X			X		
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 1							X									
Dissolved Organic/Inorganic Carbon	All	NDPs: 0 Tests: 1							X									
EPH CWG (Aliphatic) Aqueous GC (W)	All	NDPs: 0 Tests: 1							X									
EPH CWG (Aliphatic) GC (S)	All	NDPs: 0 Tests: 3		X										X			X	
EPH CWG (Aromatic) Aqueous GC (W)	All	NDPs: 0 Tests: 1							X									
EPH CWG (Aromatic) GC (S)	All	NDPs: 0 Tests: 3		X										X			X	
GRO by GC-FID (S)	All	NDPs: 0 Tests: 3			X										X			X
GRO by GC-FID (W)	All	NDPs: 0 Tests: 1							X									
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 6	X				X		X		X		X			X		
Hexavalent Chromium (w)	All	NDPs: 0 Tests: 1							X									
Mercury Dissolved	All	NDPs: 0 Tests: 1							X									

09:31:28 13/07/2015

ALcontrol Laboratories

CERTIFICATE OF ANALYSIS

Validated

SDG:	150623-71	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320562
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

- X — Test
- N — No Determination Possible

	Lab Sample No(s)		11586755			11586757	11586750		11586751		11586752		11586760			11586764		
	Customer Sample Reference		BH010A			BH010A	TP12		TP12		TP12		TP16			TP17		
	AGS Reference		ES2			ES6												
	Depth (m)		0.20 - 1.00			1.60 - 1.70	0.40		1.00		2.00		0.20			1.00		
	Container		1kg TUB	250g Amber Jar (AL	60g VOC (ALE215)	250g Amber Jar (AL	1kg TUB	250g Amber Jar (AL	1kg TUB	250g Amber Jar (AL	1kg TUB	250g Amber Jar (AL	1kg TUB	250g Amber Jar (AL	60g VOC (ALE215)	1kg TUB	250g Amber Jar (AL	60g VOC (ALE215)
Metals in solid samples by OES	All	NDPs: 0 Tests: 6		X				X		X		X		X			X	
PAH by GCMS	All	NDPs: 0 Tests: 3		X										X			X	
PAH Spec MS - Aqueous (W)	All	NDPs: 0 Tests: 1							X									
pH	All	NDPs: 0 Tests: 3	X										X			X		
pH Value of Filtered Water	All	NDPs: 0 Tests: 1							X									
Sample description	All	NDPs: 0 Tests: 6		X		X				X		X		X			X	
Total Organic Carbon	All	NDPs: 0 Tests: 3		X										X			X	
TPH CWG (W)	All	NDPs: 0 Tests: 1							X									
TPH CWG GC (S)	All	NDPs: 0 Tests: 3		X										X			X	

CERTIFICATE OF ANALYSIS

SDG:	150623-71	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320562
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	**fine**	0.063mm - 0.1mm	**medium**	0.1mm - 2mm	**coarse**	2mm - 10mm	**very coarse**	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
11586755	BH010A	0.20 - 1.00	Dark Brown	Sand	0.1 - 2 mm	Vegetation	Stones
11586757	BH010A	1.60 - 1.70	Dark Brown	Sand	0.1 - 2 mm	Vegetation	Stones
11586750	TP12	0.40	Dark Brown	Loamy Sand	0.1 - 2 mm	Brick	Stones
11586751	TP12	1.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	Stones
11586752	TP12	2.00	Black	Sand	0.1 - 2 mm	Stones	N/A
11586760	TP16	0.20	Dark Brown	Sand	0.1 - 2 mm	Vegetation	Stones
11586764	TP17	1.00	Dark Brown	Sand	0.1 - 2 mm	Stones	Vegetation

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

CERTIFICATE OF ANALYSIS

SDG:	150623-71	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320562
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH010A	TP12	TP12	TP12	TP16	TP17
			Depth (m)	0.20 - 1.00	0.40	1.00	2.00	0.20	1.00
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	19/06/2015	19/06/2015	19/06/2015	19/06/2015	22/06/2015	22/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	23/06/2015	23/06/2015	23/06/2015	23/06/2015	23/06/2015	23/06/2015
			SDG Ref	150623-71	150623-71	150623-71	150623-71	150623-71	150623-71
			Lab Sample No.(s)	11586755	11586750	11586751	11586752	11586760	11586764
			AGS Reference	ES2					
Moisture Content Ratio (% of as received sample)	%	PM024		9.3	11	17	14	7.1	8.2
Organic Carbon, Total	<0.2 %	TM132		1.15 M				2.47 M	2.36 M
pH	1 pH Units	TM133		7.86 M				8.51 M	8.14 M
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #	1.55 #	<1.2 #	<3 #
Cyanide, Total	<1 mg/kg	TM153		<1 M				<1 M	<1 M
Antimony	<0.6 mg/kg	TM181		3.66 #	79.6 #	35.2 #	368 #	8.34 #	7.62 #
Arsenic	<0.6 mg/kg	TM181		22.9 M	204 M	365 M	232 M	24.9 M	42.3 M
Beryllium	<0.01 mg/kg	TM181		0.31 M	0.954 M	0.738 M	0.932 M	0.814 M	0.24 M
Cadmium	<0.02 mg/kg	TM181		1.63 M	16.8 M	5.77 M	45.6 M	3.26 M	2.34 M
Chromium	<0.9 mg/kg	TM181		7.85 M	14.1 M	15.7 M	13.4 M	13.2 M	9.78 M
Copper	<1.4 mg/kg	TM181		45.1 M	496 M	190 M	1460 M	67.1 M	385 M
Lead	<0.7 mg/kg	TM181		358 M	9890 M	3000 M	25400 M	372 M	796 M
Mercury	<0.14 mg/kg	TM181		<0.14 M	<0.14 M	<0.14 M	<0.14 M	<0.14 M	<0.14 M
Molybdenum	<0.1 mg/kg	TM181		0.471 #	23.9 #	4.49 #	38.3 #	1.27 #	2.06 #
Nickel	<0.2 mg/kg	TM181		12.6 M	38.8 M	129 M	63 M	26.9 M	16.4 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	3.72 #	<1 #	<1 #
Vanadium	<0.2 mg/kg	TM181		14.4 #	33.1 #	24.7 #	29.2 #	24.5 #	16.4 #
Zinc	<1.9 mg/kg	TM181		680 M	16200 M	4830 M	61300 M	1040 M	1780 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150623-71	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320562
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

PAH by GCMS

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH010A	TP16	TP17			
			Depth (m)	0.20 - 1.00	0.20	1.00			
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid			
			Date Sampled	19/06/2015	22/06/2015	22/06/2015			
			Sample Time	.	.	.			
			Date Received	23/06/2015	23/06/2015	23/06/2015			
			SDG Ref	150623-71	150623-71	150623-71			
			Lab Sample No.(s)	11586755	11586760	11586764			
			AGS Reference	ES2					
Naphthalene-d8 % recovery**	%	TM218		91.4	87.2	85.4			
Acenaphthene-d10 % recovery**	%	TM218		89.8	82.2	78.2			
Phenanthrene-d10 % recovery**	%	TM218		89.9	80.9	75.3			
Chrysene-d12 % recovery**	%	TM218		94.9	76.9	67.1			
Perylene-d12 % recovery**	%	TM218		97.7	80.6	68.7			
Naphthalene	<9 µg/kg	TM218		228 M	786 M	104 M			
Acenaphthylene	<12 µg/kg	TM218		29.8 M	18.2 M	<60 M			
Acenaphthene	<8 µg/kg	TM218		166 M	102 M	<40 M			
Fluorene	<10 µg/kg	TM218		131 M	1030 M	<50 M			
Phenanthrene	<15 µg/kg	TM218		2200 M	1680 M	361 M			
Anthracene	<16 µg/kg	TM218		429 M	16400 M	<80 M			
Fluoranthene	<17 µg/kg	TM218		3770 M	1100 M	587 M			
Pyrene	<15 µg/kg	TM218		3170 M	958 M	496 M			
Benz(a)anthracene	<14 µg/kg	TM218		2000 M	570 M	313 M			
Chrysene	<10 µg/kg	TM218		2010 M	645 M	317 M			
Benzo(b)fluoranthene	<15 µg/kg	TM218		2480 M	824 M	489 M			
Benzo(k)fluoranthene	<14 µg/kg	TM218		1030 M	272 M	174 M			
Benzo(a)pyrene	<15 µg/kg	TM218		2050 M	613 M	331 M			
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218		1050 M	324 M	214 M			
Dibenzo(a,h)anthracene	<23 µg/kg	TM218		350 M	97.5 M	<115 M			
Benzo(g,h,i)perylene	<24 µg/kg	TM218		1330 M	414 M	302 M			
PAH, Total Detected USEPA 16	<118 µg/kg	TM218		22400	25800	3690			

CERTIFICATE OF ANALYSIS

SDG:	150623-71	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320562
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

TPH CWG (S)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH010A	TP16	TP17			
			Depth (m)	0.20 - 1.00	0.20	1.00			
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid			
			Date Sampled	19/06/2015	22/06/2015	22/06/2015			
			Sample Time	.	.	.			
			Date Received	23/06/2015	23/06/2015	23/06/2015			
			SDG Ref	150623-71	150623-71	150623-71			
			Lab Sample No.(s)	11586755	11586760	11586764			
			AGS Reference	ES2					
GRO Surrogate % recovery**	%	TM089		86	39	60			
GRO TOT (Moisture Corrected)	<44 µg/kg	TM089		2570 M	254 M	178 M			
Methyl tertiary butyl ether (MTBE)	<5 µg/kg	TM089		<5 M	<5 M	<5 M			
Benzene	<10 µg/kg	TM089		62.7 M	34.4 M	<10 M			
Toluene	<2 µg/kg	TM089		<2 M	2.15 M	6.54 M			
Ethylbenzene	<3 µg/kg	TM089		39.6 M	17.2 M	4.36 M			
m,p-Xylene	<6 µg/kg	TM089		25.3 M	8.61 M	8.72 M			
o-Xylene	<3 µg/kg	TM089		<3 M	<3 M	3.27 M			
sum of detected mpo xylene by GC	<9 µg/kg	TM089		25.3	<9	12			
sum of detected BTEX by GC	<24 µg/kg	TM089		128	53.8	<24			
Aliphatics >C5-C6	<10 µg/kg	TM089		139	26.9	24			
Aliphatics >C6-C8	<10 µg/kg	TM089		287	61.3	46.9			
Aliphatics >C8-C10	<10 µg/kg	TM089		597	43	27.3			
Aliphatics >C10-C12	<10 µg/kg	TM089		613	18.3	18.5			
Aliphatics >C12-C16	<100 µg/kg	TM173		286	852	4190			
Aliphatics >C16-C21	<100 µg/kg	TM173		925	2060	20900			
Aliphatics >C21-C35	<100 µg/kg	TM173		8320	18500	49700			
Aliphatics >C35-C44	<100 µg/kg	TM173		1070	5830	17200			
Total Aliphatics >C12-C44	<100 µg/kg	TM173		10600	27200	92000			
Aromatics >EC5-EC7	<10 µg/kg	TM089		62.7	34.4	<10			
Aromatics >EC7-EC8	<10 µg/kg	TM089		<10	<10	<10			
Aromatics >EC8-EC10	<10 µg/kg	TM089		463	54.9	32.7			
Aromatics >EC10-EC12	<10 µg/kg	TM089		408	12.9	12			
Aromatics >EC12-EC16	<100 µg/kg	TM173		1010	937	1030			
Aromatics >EC16-EC21	<100 µg/kg	TM173		17000	5610	11000			
Aromatics >EC21-EC35	<100 µg/kg	TM173		53000	27700	65900			
Aromatics >EC35-EC44	<100 µg/kg	TM173		14300	12300	43500			
Aromatics >EC40-EC44	<100 µg/kg	TM173		4220	4520	17800			
Total Aromatics >EC12-EC44	<100 µg/kg	TM173		85300	46600	122000			
Total Aliphatics & Aromatics >C5-C44	<100 µg/kg	TM173		98500	74000	214000			

CERTIFICATE OF ANALYSIS

SDG:	150623-71	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320562
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Asbestos Identification - Solid Samples

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	BH010A ES 2 0.20 - 1.00 SOLID 19/06/2015 00:00:00 25/06/2015 07:25:30 150623-71 11586755 TM048	26/6/15	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP12 0.40 SOLID 19/06/2015 00:00:00 27/06/2015 14:50:03 150623-71 11586750 TM048	30/6/15	Chris Swindells	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP16 0.20 SOLID 22/06/2015 00:00:00 25/06/2015 06:35:28 150623-71 11586760 TM048	26/6/15	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP17 1.00 SOLID 22/06/2015 00:00:00 25/06/2015 06:49:40 150623-71 11586764 TM048	26/6/15	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150623-71	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320562
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.110	**Natural Moisture Content (%)**	21.7
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	82.2
Particle Size <4mm	>95%		

Case	
SDG	150623-71
Lab Sample Number(s)	11586751
Sampled Date	19-Jun-2015
Customer Sample Ref.	TP12
Depth (m)	1.00

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	-	<3	-	<30	-	-	-
Hexavalent Chromium	<0.03	<0.03	<0.3	<0.3	-	-	-
pH Value of Filtered Water	7.8	<0.001	78	<0.01	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	0.0507	<0.00016	0.507	<0.0016	-	-	-
Arsenic	0.0477	<0.00012	0.477	<0.0012	-	-	-
Total Cyanide (W)	<0.05	<0.05	<0.5	<0.5	-	-	-
Beryllium	<0.00007	<0.00007	<0.0007	<0.0007	-	-	-
Boron	0.0619	<0.0094	0.619	<0.094	-	-	-
Cadmium	<0.0001	<0.0001	<0.001	<0.001	-	-	-
Chromium	0.000386	<0.00022	0.00386	<0.0022	-	-	-
Copper	0.00534	<0.00085	0.0534	<0.0085	-	-	-
Lead	0.0015	<0.00002	0.015	<0.0002	-	-	-
Molybdenum	0.0156	<0.00024	0.156	<0.0024	-	-	-
Nickel	0.00123	<0.00015	0.0123	<0.0015	-	-	-
Selenium	0.000622	<0.00039	0.00622	<0.0039	-	-	-
Vanadium	0.00117	<0.00024	0.0117	<0.0024	-	-	-
Zinc	0.00838	<0.00041	0.0838	<0.0041	-	-	-
PAH Spec MS - Aqueous (W)							
Naphthalene by GCMS	<0.0001	<0.0001	<0.001	<0.001	-	-	-
Acenaphthene by GCMS	0.0000328	<0.000015	0.000328	<0.00015	-	-	-
Acenaphthylene by GCMS	<0.000011	<0.000011	<0.00011	<0.00011	-	-	-
Fluoranthene by GCMS	0.0000452	<0.000017	0.000452	<0.00017	-	-	-
Anthracene by GCMS	<0.000015	<0.000015	<0.00015	<0.00015	-	-	-
Phenanthrene by GCMS	0.0000269	<0.000022	0.000269	<0.00022	-	-	-
Fluorene by GCMS	0.0000314	<0.000014	0.000314	<0.00014	-	-	-
Chrysene by GCMS	0.0000163	<0.000013	0.000163	<0.00013	-	-	-
Pyrene by GCMS	0.0000317	<0.000015	0.000317	<0.00015	-	-	-
Benz(a)anthracene by GCMS	<0.000017	<0.000017	<0.00017	<0.00017	-	-	-
Benzo(b)fluoranthene by GCMS	<0.000023	<0.000023	<0.00023	<0.00023	-	-	-
Benzo(k)fluoranthene by GCMS	<0.000027	<0.000027	<0.00027	<0.00027	-	-	-
Benzo(a)pyrene by GCMS	0.00000948	<0.000009	0.0000948	<0.00009	-	-	-
Dibenzo(ah)anthracene by GCMS	<0.000016	<0.000016	<0.00016	<0.00016	-	-	-
Benzo(ghi)perylene by GCMS	<0.000016	<0.000016	<0.00016	<0.00016	-	-	-
Indeno(123cd)pyrene by GCMS	<0.000014	<0.000014	<0.00014	<0.00014	-	-	-
PAH 16 EPA Total by GCMS	<0.000344	<0.000344	<0.00344	<0.00344	-	-	-

Leach Test Information

Date Prepared	25-Jun-2015
pH (pH Units)	6.36
Conductivity (µS/cm)	0.72
Temperature (°C)	22.00
Volume Leachant (Litres)	0.880

Mcerts Certification does not apply to leachates

13/07/2015 09:31:45

09:31:28 13/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150623-71	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320562
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.110	**Natural Moisture Content (%)**	21.7
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	82.2
Particle Size <4mm	>95%		

Case	
SDG	150623-71
Lab Sample Number(s)	11586751
Sampled Date	19-Jun-2015
Customer Sample Ref.	TP12
Depth (m)	1.00

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
TPH CWG (W)							
Surrogate Recovery	-	<0	-	<0	-	-	-
GRO TOT (C5-C12)	<0.05	<0.05	<0.5	<0.5	-	-	-
Aliphatics C5-C6	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C6-C8	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C8-C10	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C10-C12	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C12-C16	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C16-C21	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C21-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Total Aliphatics >C12-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics C6-C7	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >C7-C8	<0.01	<0.01	<0.1	<0.1	-	-	-
MTBE GC-FID	<0.003	<0.003	<0.03	<0.03	-	-	-
Aromatics >EC8 -EC10	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC10-EC12	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC12-EC16	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC16-EC21	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC21-EC35	<0.01	<0.01	<0.1	<0.1	-	-	-
Total Aromatics >EC12-EC35	<0.01	<0.01	<0.1	<0.1	-	-	-
Benzene by GC	<0.007	<0.007	<0.07	<0.07	-	-	-
TPH (Total Aliphatics + Total Aromatics) >C5-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Toluene by GC	<0.004	<0.004	<0.04	<0.04	-	-	-
Ethylbenzene by GC	<0.005	<0.005	<0.05	<0.05	-	-	-
m & p Xylene by GC	<0.008	<0.008	<0.08	<0.08	-	-	-
o Xylene by GC	<0.003	<0.003	<0.03	<0.03	-	-	-
Sum m&p and o Xylene by GC	<0.011	<0.011	<0.11	<0.11	-	-	-
Sum of BTEX by GC	<0.028	<0.028	<0.28	<0.28	-	-	-

Leach Test Information

Date Prepared	25-Jun-2015
pH (pH Units)	6.36
Conductivity (µS/cm)	0.72
Temperature (°C)	22.00
Volume Leachant (Litres)	0.880

Mcerts Certification does not apply to leachates

13/07/2015 09:31:45

09:31:28 13/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150623-71	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320562
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
PM115		Leaching Procedure for CEN One Stage Leach Test 2:1 & 10:1 1 Step		
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM061	Method for the Determination of EPH,Massachusetts Dept.of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)		
TM062 (S)	National Grid Property Holdings Methods for the Collection & Analysis of Samples from National Grid Sites version 1 Sec 3.9	Determination of Phenols in Soils by HPLC		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser		
TM168	EPA Method 8082, Polychlorinated Biphenyls by Gas Chromatography	Determination of WHO12 and EC7 Polychlorinated Biphenyl Congeners by GC-MS in Soils		
TM173	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID		
TM174	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Waters by GC-FID		
TM178	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM218	Microwave extraction – EPA method 3546	Microwave extraction - EPA method 3546		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		
TM227	Standard methods for the examination of waters and wastewaters 20th Edition, AWWA/APHA Method 4500.	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate		
TM241	Methods for the Examination of Waters and Associated Materials; Chromium in Raw and Potable Waters and Sewage Effluents 1980.	The Determination of Hexavalent Chromium in Waters and Leachates using the Kone Analyser		
TM245	By GC-FID	Determination of GRO by Headspace in waters		
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	150623-71	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320562
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	11586755	11586757	11586750	11586751	11586752	11586760	11586764
Customer Sample Ref.	BH010A	BH010A	TP12	TP12	TP12	TP16	TP17
AGS Ref.	ES2	ES6					
Depth	0.20 - 1.00	1.60 - 1.70	0.40	1.00	2.00	0.20	1.00
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples	26-Jun-2015		01-Jul-2015			26-Jun-2015	26-Jun-2015
Boron Water Soluble	03-Jul-2015		02-Jul-2015	01-Jul-2015	03-Jul-2015	02-Jul-2015	02-Jul-2015
CEN 10:1 Leachate (1 Stage)				25-Jun-2015			
CEN Readings				29-Jun-2015			
Cyanide Comp/Free/Total/Thiocyanate	04-Jul-2015			07-Jul-2015		03-Jul-2015	03-Jul-2015
Dissolved Metals by ICP-MS				13-Jul-2015			
Dissolved Organic/Inorganic Carbon				07-Jul-2015			
EPH CWG (Aliphatic) Aqueous GC (W)				07-Jul-2015			
EPH CWG (Aliphatic) GC (S)	01-Jul-2015					01-Jul-2015	01-Jul-2015
EPH CWG (Aromatic) Aqueous GC (W)				07-Jul-2015			
EPH CWG (Aromatic) GC (S)	01-Jul-2015					01-Jul-2015	01-Jul-2015
GRO by GC-FID (S)	03-Jul-2015					03-Jul-2015	03-Jul-2015
GRO by GC-FID (W)				03-Jul-2015			
Hexavalent Chromium (s)	07-Jul-2015		30-Jun-2015	03-Jul-2015	03-Jul-2015	07-Jul-2015	07-Jul-2015
Hexavalent Chromium (w)				07-Jul-2015			
Mercury Dissolved				07-Jul-2015			
Metals in solid samples by OES	06-Jul-2015		03-Jul-2015	02-Jul-2015	03-Jul-2015	03-Jul-2015	03-Jul-2015
PAH by GCMS	06-Jul-2015					02-Jul-2015	02-Jul-2015
PAH Spec MS - Aqueous (W)				07-Jul-2015			
pH	07-Jul-2015					07-Jul-2015	07-Jul-2015
pH Value of Filtered Water				07-Jul-2015			
Sample description	25-Jun-2015	24-Jun-2015	26-Jun-2015	25-Jun-2015	01-Jul-2015	25-Jun-2015	25-Jun-2015
Total Organic Carbon	02-Jul-2015					02-Jul-2015	02-Jul-2015
TPH CWG (W)				07-Jul-2015			
TPH CWG GC (S)	03-Jul-2015					03-Jul-2015	03-Jul-2015

SDG:	150623-71	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320562
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before presevation was performed
§	Sampled on date not provided
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

ALcontrol Laboratories

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Apex Drilling Services
Sturmi Way
Village Farm Industrial Estate
Pyle
Bridgend
CF33 6BZ

Attention: Robert Brewer

CERTIFICATE OF ANALYSIS

Date:	13 July 2015
Customer:	H_APEXDRL_BGD
Sample Delivery Group (SDG):	150620-7
Your Reference:	10318
Location:	Swansea Bay
Report No:	320563

We received 31 samples on Friday June 19, 2015 and 7 of these samples were scheduled for analysis which was completed on Monday July 13, 2015. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager

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CERTIFICATE OF ANALYSIS

SDG:	150620-7	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320563
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
11570998	BH002	ES1	0.00 - 0.10	17/06/2015
11570999	BH002	ES3	0.20 - 0.50	17/06/2015
11571000	BH002	ES5	0.80 - 1.20	18/06/2015
11571002	BH002	ES8	1.55 - 2.00	18/06/2015
11571003	BH002	ES10	2.00 - 2.50	18/06/2015
11571004	BH002	ES12	3.00 - 3.50	18/06/2015
11571005	BH003	ES1	0.00 - 0.10	17/06/2015
11571007	BH003	ES2	0.20 - 0.50	17/06/2015
11571008	BH003	ES4	0.70 - 1.00	17/06/2015
11571009	BH003	ES6	1.30 - 1.80	17/06/2015
11571011	BH003	ES8	2.00 - 2.50	17/06/2015
11571012	BH003	ES10	2.90 - 3.20	17/06/2015
11571013	BH003	ES11	3.20 - 3.50	17/06/2015
11571014	BH004	ES1	0.00 - 0.10	18/06/2015
11571016	BH004	ES3	0.20 - 0.50	18/06/2015
11571017	BH004	ES5	1.20 - 1.50	18/06/2015
11571018	BH004	ES7	2.00 - 2.50	18/06/2015
11571019	BH004	ES9	3.45 - 4.00	18/06/2015
11571021	TP003		0.20	17/06/2015
11571022	TP003		1.00	17/06/2015
11571023	TP003		2.00	17/06/2015
11571024	TP003		3.00	17/06/2015
11571025	TP006		0.40	18/06/2015
11571027	TP006		1.00	18/06/2015
11571028	TP006		2.00	18/06/2015
11571029	TP006		3.00	18/06/2015
11571030	TP007		0.40	18/06/2015
11571032	TP007		1.00	18/06/2015
11571033	TP007		2.00	18/06/2015
11571034	TP007		3.00	18/06/2015
11571035	TP007		3.70	18/06/2015

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG:	150620-7	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320563
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

X Test

N No Determination Possible

Lab Sample No(s)			11570999		11571007		11571017		11571022		11571025		11571030		11571033	
Customer Sample Reference			BH002		BH003		BH004		TP003		TP006		TP007		TP007	
AGS Reference			ES3		ES2		ES5									
Depth (m)			0.20 - 0.50		0.20 - 0.50		1.20 - 1.50		1.00		0.40		0.40		2.00	
Container			1kg TUB	250g Amber Jar (AL	1kg TUB	60g VOC (ALE215)	250g Amber Jar (AL	60g VOC (ALE215)	1kg TUB	250g Amber Jar (AL	1kg TUB	60g VOC (ALE215)	250g Amber Jar (AL	60g VOC (ALE215)	1kg TUB	250g Amber Jar (AL
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 6	X		X		X		X		X		X			
Boron Water Soluble	All	NDPs: 0 Tests: 6		X		X		X		X		X		X		
CEN Readings	All	NDPs: 0 Tests: 1													X	
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 7	X		X		X		X		X		X		X	
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 1													X	
Dissolved Organic/Inorganic Carbon	All	NDPs: 0 Tests: 1													X	
EPH CWG (Aliphatic) Aqueous GC (W)	All	NDPs: 0 Tests: 1													X	
EPH CWG (Aliphatic) GC (S)	All	NDPs: 0 Tests: 6		X		X		X		X		X		X		
EPH CWG (Aromatic) Aqueous GC (W)	All	NDPs: 0 Tests: 1													X	
EPH CWG (Aromatic) GC (S)	All	NDPs: 0 Tests: 6		X		X		X		X		X		X		
GRO by GC-FID (S)	All	NDPs: 0 Tests: 6			X		X		X		X		X			
GRO by GC-FID (W)	All	NDPs: 0 Tests: 1													X	
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 6	X		X		X		X		X		X			
Hexavalent Chromium (w)	All	NDPs: 0 Tests: 1													X	
Mercury Dissolved	All	NDPs: 0 Tests: 1													X	

CERTIFICATE OF ANALYSIS

SDG:	150620-7	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320563
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

X Test

N No Determination Possible

Lab Sample No(s)	11570999	11571007	11571017	11571022	11571025	11571030	11571033
Customer Sample Reference	BH002	BH003	BH004	TP003	TP006	TP007	TP007
AGS Reference	ES3	ES2	ES5				
Depth (m)	0.20 - 0.50	0.20 - 0.50	1.20 - 1.50	1.00	0.40	0.40	2.00
Container	1kg TUB / 250g Amber Jar (AL)	60g VOC (ALE215)	1kg TUB / 250g Amber Jar (AL)	60g VOC (ALE215)	1kg TUB / 250g Amber Jar (AL)	60g VOC (ALE215)	1kg TUB / 250g Amber Jar (AL)	60g VOC (ALE215)	1kg TUB / 250g Amber Jar (AL)	60g VOC (ALE215)	1kg TUB / 250g Amber Jar (AL)	60g VOC (ALE215)	1kg TUB / 250g Amber Jar (AL)
Metals in solid samples by OES	All	NDPs: 0 Tests: 6	X		X		X		X		X		X		
PAH by GCMS	All	NDPs: 0 Tests: 6	X		X		X		X		X		X		
PAH Spec MS - Aqueous (W)	All	NDPs: 0 Tests: 1												X	
pH	All	NDPs: 0 Tests: 6	X		X		X		X		X		X		
pH Value of Filtered Water	All	NDPs: 0 Tests: 1												X	
Sample description	All	NDPs: 0 Tests: 6	X		X		X				X		X		X
Total Organic Carbon	All	NDPs: 0 Tests: 6	X		X		X		X		X		X		
TPH CWG (W)	All	NDPs: 0 Tests: 1												X	
TPH CWG GC (S)	All	NDPs: 0 Tests: 6	X		X		X		X		X		X		
VOC MS (S)	All	NDPs: 0 Tests: 6		X		X		X		X		X			
VOC MS (W)	All	NDPs: 0 Tests: 1												X	

CERTIFICATE OF ANALYSIS

SDG:	150620-7	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320563
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
11570999	BH002	0.20 - 0.50	Black	Sandy Clay Loam	0.1 - 2 mm	Brick	Stones
11571007	BH003	0.20 - 0.50	Dark Brown	Loamy Sand	0.1 - 2 mm	Stones	Vegetation
11571017	BH004	1.20 - 1.50	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Stones
11571022	TP003	1.00	Dark Brown	Sandy Clay Loam	0.1 - 2 mm	Concrete/Aggregate	Vegetation
11571025	TP006	0.40	Dark Brown	Sandy Loam	0.1 - 2 mm	Crushed Brick	Stones
11571030	TP007	0.40	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Stones
11571033	TP007	2.00	Black	N/A	0.1 - 2 mm	Vegetation	Coal fragments

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

CERTIFICATE OF ANALYSIS

SDG:	150620-7	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320563
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH002	BH003	BH004	TP003	TP006	TP007
			Depth (m)	0.20 - 0.50	0.20 - 0.50	1.20 - 1.50	1.00	0.40	0.40
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	17/06/2015	17/06/2015	18/06/2015	17/06/2015	18/06/2015	18/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	19/06/2015	19/06/2015	19/06/2015	19/06/2015	19/06/2015	19/06/2015
			SDG Ref	150620-7	150620-7	150620-7	150620-7	150620-7	150620-7
			Lab Sample No.(s)	11570999	11571007	11571017	11571022	11571025	11571030
			AGS Reference	ES3	ES2	ES5			
Moisture Content Ratio (% of as received sample)	%	PM024		12	15	13	12	8.5	13
Organic Carbon, Total	<0.2 %	TM132		8.55 M	14.9 M	26.8 M	3.16 M	5.5 M	21 M
pH	1 pH Units	TM133		8.61 M	8.11 M	7.02 M	8.05 M	8.05 M	7.44 M
Chromium, Hexavalent	<0.6 mg/kg	TM151		<1.2 #	<0.6 #	5.31 #	<1.2 #	<0.6 #	<0.6 #
Cyanide, Total	<1 mg/kg	TM153		<1 & M	<1 & M	<1 & M	<1 & M	<1 & M	<1 & M
Antimony	<0.6 mg/kg	TM181		20.9 #	15 #	533 #	11 #	12.6 #	224 #
Arsenic	<0.6 mg/kg	TM181		88.9 M	30.1 M	334 M	33.7 M	32.5 M	227 M
Beryllium	<0.01 mg/kg	TM181		1.39 M	1.43 M	0.794 M	0.725 M	0.77 M	1.37 M
Cadmium	<0.02 mg/kg	TM181		6.16 M	7.98 M	57.6 M	7.32 M	1.21 M	18.5 M
Chromium	<0.9 mg/kg	TM181		14.2 M	18.5 M	10.7 M	11.8 M	42.2 M	24.1 M
Copper	<1.4 mg/kg	TM181		151 M	141 M	1330 M	74.5 M	99.7 M	627 M
Lead	<0.7 mg/kg	TM181		1690 M	1960 M	39400 M	634 M	742 M	23500 M
Mercury	<0.14 mg/kg	TM181		0.448 M	<0.14 M	0.372 M	0.226 M	0.334 M	0.512 M
Molybdenum	<0.1 mg/kg	TM181		3.83 #	9.17 #	53.1 #	1.26 #	3.29 #	39.4 #
Nickel	<0.2 mg/kg	TM181		137 M	113 M	41.2 M	33.6 M	98.7 M	264 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	3.92 #	<1 #	<1 #	3.4 #
Vanadium	<0.2 mg/kg	TM181		25.4 #	34.4 #	32.1 #	18 #	32.7 #	56.4 #
Zinc	<1.9 mg/kg	TM181		3510 M	3630 M	7440 M	3210 M	828 M	22000 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150620-7	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320563
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Customer Sample R			TP007
Depth (m)			2.00
Sample Type			Soil/Solid
Date Sampled			18/06/2015
Sample Time			.
Date Received			19/06/2015
SDG Ref			150620-7
Lab Sample No.(s)			11571033
AGS Reference			
Component	**LOD/Units**	**Method**	
Moisture Content Ratio (% of as received sample)	%	PM024	14

CERTIFICATE OF ANALYSIS

SDG:	150620-7	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320563
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

PAH by GCMS

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH002	BH003	BH004	TP003	TP006	TP007
			Depth (m)	0.20 - 0.50	0.20 - 0.50	1.20 - 1.50	1.00	0.40	0.40
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	17/06/2015	17/06/2015	18/06/2015	17/06/2015	18/06/2015	18/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	19/06/2015	19/06/2015	19/06/2015	19/06/2015	19/06/2015	19/06/2015
			SDG Ref	150620-7	150620-7	150620-7	150620-7	150620-7	150620-7
			Lab Sample No.(s)	11570999	11571007	11571017	11571022	11571025	11571030
			AGS Reference	ES3	ES2	ES5			
Naphthalene-d8 % recovery**	%	TM218		88.5	98.1	93.4	87.6	85.2	94.2
Acenaphthene-d10 % recovery**	%	TM218		84	96.9	89.9	83.3	79	92.9
Phenanthrene-d10 % recovery**	%	TM218		83.2	96.2	83.8	81.3	75.3	92.3
Chrysene-d12 % recovery**	%	TM218		84.3	100	72.2	79.1	70.6	94.8
Perylene-d12 % recovery**	%	TM218		88.2	105	58.6	85.4	69.9	91.3
Naphthalene	<9 µg/kg	TM218		427 M	<9 M	13.1 & M	182 M	288 M	780 M
Acenaphthylene	<12 µg/kg	TM218		133 M	<12 M	<12 & M	50.3 M	<60 M	129 M
Acenaphthene	<8 µg/kg	TM218		336 M	<8 M	<8 & M	118 M	327 M	412 M
Fluorene	<10 µg/kg	TM218		457 M	<10 M	<10 & M	95.2 M	272 M	312 M
Phenanthrene	<15 µg/kg	TM218		4010 M	<15 M	60.2 & M	797 M	3470 M	5030 M
Anthracene	<16 µg/kg	TM218		1320 M	<16 M	<16 & M	175 M	693 M	1140 M
Fluoranthene	<17 µg/kg	TM218		6820 M	29.6 M	74.5 & M	1250 M	4620 M	7860 M
Pyrene	<15 µg/kg	TM218		5020 M	46 M	54 & M	1040 M	3720 M	6030 M
Benz(a)anthracene	<14 µg/kg	TM218		3490 M	30.8 M	111 & M	730 M	2060 M	3760 M
Chrysene	<10 µg/kg	TM218		3140 M	<10 M	132 & M	662 M	2110 M	4110 M
Benzo(b)fluoranthene	<15 µg/kg	TM218		3860 M	<15 M	228 & M	975 M	2730 M	4730 M
Benzo(k)fluoranthene	<14 µg/kg	TM218		1310 M	<14 M	71.9 & M	327 M	1060 M	1940 M
Benzo(a)pyrene	<15 µg/kg	TM218		2820 M	<15 M	118 & M	705 M	1930 M	3520 M
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218		1340 M	<18 M	109 & M	375 M	1080 M	1940 M
Dibenzo(a,h)anthracene	<23 µg/kg	TM218		489 M	<23 M	66.9 & M	130 M	351 M	728 M
Benzo(g,h,i)perylene	<24 µg/kg	TM218		1460 M	<24 M	100 & M	435 M	1310 M	2310 M
PAH, Total Detected USEPA 16	<118 µg/kg	TM218		36400	<118	1140	8050	26000	44700

CERTIFICATE OF ANALYSIS

SDG:	150620-7	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320563
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

TPH CWG (S)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH002	BH003	BH004	TP003	TP006	TP007
			Depth (m)	0.20 - 0.50	0.20 - 0.50	1.20 - 1.50	1.00	0.40	0.40
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	17/06/2015	17/06/2015	18/06/2015	17/06/2015	18/06/2015	18/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	19/06/2015	19/06/2015	19/06/2015	19/06/2015	19/06/2015	19/06/2015
			SDG Ref	150620-7	150620-7	150620-7	150620-7	150620-7	150620-7
			Lab Sample No.(s)	11570999	11571007	11571017	11571022	11571025	11571030
			AGS Reference	ES3	ES2	ES5			
GRO Surrogate % recovery**	%	TM089		18 &	31 &	38 &	38 &	27 &	8 &
GRO TOT (Moisture Corrected)	<44 µg/kg	TM089		<44 & M	<44 & M	<44 & M	<44 & M	<44 & M	<44 & M
Methyl tertiary butyl ether (MTBE)	<5 µg/kg	TM089		<5 & M	<5 & M	<5 & M	<5 & M	<5 & M	<5 & M
Benzene	<10 µg/kg	TM089		<10 & M	<10 & M	<10 & M	<10 & M	<10 & M	<10 & M
Toluene	<2 µg/kg	TM089		2.26 & M	4.72 & M	<2 & M	2.28 & M	<2 & M	<2 & M
Ethylbenzene	<3 µg/kg	TM089		<3 & M	<3 & M	<3 & M	<3 & M	<3 & M	<3 & M
m,p-Xylene	<6 µg/kg	TM089		<6 & M	<6 & M	<6 & M	<6 & M	<6 & M	<6 & M
o-Xylene	<3 µg/kg	TM089		<3 & M	<3 & M	<3 & M	<3 & M	<3 & M	<3 & M
sum of detected mpo xylene by GC	<9 µg/kg	TM089		<9 &	<9 &	<9 &	<9 &	<9 &	<9 &
sum of detected BTEX by GC	<24 µg/kg	TM089		<24 &	<24 &	<24 &	<24 &	<24 &	<24 &
Aliphatics >C5-C6	<10 µg/kg	TM089		<10 &	<10 &	<10 &	<10 &	<10 &	<10 &
Aliphatics >C6-C8	<10 µg/kg	TM089		<10 &	<10 &	<10 &	<10 &	<10 &	<10 &
Aliphatics >C8-C10	<10 µg/kg	TM089		<10 &	<10 &	<10 &	<10 &	<10 &	<10 &
Aliphatics >C10-C12	<10 µg/kg	TM089		<10 &	<10 &	<10 &	<10 &	<10 &	<10 &
Aliphatics >C12-C16	<100 µg/kg	TM173		3440	<100	<100	1700	756	2070
Aliphatics >C16-C21	<100 µg/kg	TM173		11700	1930	<100	2430	4430	8930
Aliphatics >C21-C35	<100 µg/kg	TM173		42700	6500	<100	7130	38600	72600
Aliphatics >C35-C44	<100 µg/kg	TM173		5840	585	<100	<100	6010	9550
Total Aliphatics >C12-C44	<100 µg/kg	TM173		63700	9020	<100	11300	49800	93200
Aromatics >EC5-EC7	<10 µg/kg	TM089		<10 &	<10 &	<10 &	<10 &	<10 &	<10 &
Aromatics >EC7-EC8	<10 µg/kg	TM089		<10 &	<10 &	<10 &	<10 &	<10 &	<10 &
Aromatics >EC8-EC10	<10 µg/kg	TM089		<10 &	<10 &	<10 &	<10 &	<10 &	<10 &
Aromatics >EC10-EC12	<10 µg/kg	TM089		<10 &	<10 &	<10 &	<10 &	<10 &	<10 &
Aromatics >EC12-EC16	<100 µg/kg	TM173		4620	267	<100	1720	2360	3810
Aromatics >EC16-EC21	<100 µg/kg	TM173		26400	4350	<100	8940	25000	32600
Aromatics >EC21-EC35	<100 µg/kg	TM173		87700	15400	520	29500	98400	120000
Aromatics >EC35-EC44	<100 µg/kg	TM173		23200	2780	<100	7340	34100	29200
Aromatics >EC40-EC44	<100 µg/kg	TM173		7700	565	<100	1950	11900	9470
Total Aromatics >EC12-EC44	<100 µg/kg	TM173		142000	22800	520	47500	160000	186000
Total Aliphatics & Aromatics >C5-C44	<100 µg/kg	TM173		206000	31800	522	58800	210000	279000

CERTIFICATE OF ANALYSIS

SDG:	150620-7	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320563
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

VOC MS (S)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH002	BH003	BH004	TP003	TP006	TP007
			Depth (m)	0.20 - 0.50	0.20 - 0.50	1.20 - 1.50	1.00	0.40	0.40
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	17/06/2015	17/06/2015	18/06/2015	17/06/2015	18/06/2015	18/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	19/06/2015	19/06/2015	19/06/2015	19/06/2015	19/06/2015	19/06/2015
			SDG Ref	150620-7	150620-7	150620-7	150620-7	150620-7	150620-7
			Lab Sample No.(s)	11570999	11571007	11571017	11571022	11571025	11571030
			AGS Reference	ES3	ES2	ES5			
Toluene-d8**	%	TM116		99.2 &	92.5 &	97.9	86.9 &	83.5	74.6
Methyl Tertiary Butyl Ether	<10 µg/kg	TM116		<100 & M	<10 & M	<10 M	<10 & M	<10 M	<10 M
Benzene	<9 µg/kg	TM116		<90 & M	<9 & M	<9 M	<9 & M	<9 M	10.7 M
Toluene	<7 µg/kg	TM116		<70 & M	<7 & M	<7 M	<7 & M	<7 M	<7 M
Ethylbenzene	<4 µg/kg	TM116		<40 & M	<4 & M	<4 M	<4 & M	<4 M	<4 M
p/m-Xylene	<10 µg/kg	TM116		<100 & #	<10 & #	<10 #	<10 & #	<10 #	<10 #
o-Xylene	<10 µg/kg	TM116		<100 & M	<10 & M	<10 M	<10 & M	<10 M	<10 M

CERTIFICATE OF ANALYSIS

SDG:	150620-7	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320563
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Asbestos Identification - Solid Samples

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	BH002 ES 3 0.20 - 0.50 SOLID 17/06/2015 00:00:00 23/06/2015 11:26:39 150620-7 11570999 TM048	26/6/15	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	BH003 ES 2 0.20 - 0.50 SOLID 17/06/2015 00:00:00 23/06/2015 11:12:01 150620-7 11571007 TM048	26/6/15	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	BH004 ES 5 1.20 - 1.50 SOLID 18/06/2015 00:00:00 23/06/2015 11:06:28 150620-7 11571017 TM048	26/6/15	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP003 1.00 SOLID 17/06/2015 00:00:00 23/06/2015 11:21:16 150620-7 11571022 TM048	26/6/15	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP006 0.40 SOLID 18/06/2015 00:00:00 23/06/2015 11:31:02 150620-7 11571025 TM048	26/6/15	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150620-7	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320563
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP007 0.40 SOLID 18/06/2015 00:00:00 23/06/2015 11:19:51 150620-7 11571030 TM048	26/6/15	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150620-7	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320563
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.109	**Natural Moisture Content (%)**	20.7
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	82.8
Particle Size <4mm	>95%		

Case	
SDG	150620-7
Lab Sample Number(s)	11571033
Sampled Date	18-Jun-2015
Customer Sample Ref.	TP007
Depth (m)	2.00

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Hexavalent Chromium	<0.03	<0.03	<0.3	<0.3	-	-	-
pH Value of Filtered Water	7.6	<0.001	76	<0.01	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	0.00042	<0.00016	0.0042	<0.0016	-	-	-
Arsenic	0.000432	<0.00012	0.00432	<0.0012	-	-	-
Total Cyanide (W)	<0.05	<0.05	<0.5	<0.5	-	-	-
Beryllium	<0.00007	<0.00007	<0.0007	<0.0007	-	-	-
Boron	0.0107	<0.0094	0.107	<0.094	-	-	-
Cadmium	0.00615	<0.0001	0.0615	<0.001	-	-	-
Chromium	0.000341	<0.00022	0.00341	<0.0022	-	-	-
Copper	<0.00085	<0.00085	<0.0085	<0.0085	-	-	-
Lead	0.00124	<0.00002	0.0124	<0.0002	-	-	-
Molybdenum	0.00651	<0.00024	0.0651	<0.0024	-	-	-
Nickel	0.00703	<0.00015	0.0703	<0.0015	-	-	-
Selenium	0.00185	<0.00039	0.0185	<0.0039	-	-	-
Vanadium	<0.00024	<0.00024	<0.0024	<0.0024	-	-	-
Zinc	0.503	<0.00041	5.03	<0.0041	-	-	-
PAH Spec MS - Aqueous (W)							
Naphthalene by GCMS	<0.0001	<0.0001	<0.001	<0.001	-	-	-
Acenaphthene by GCMS	0.0000428	<0.000015	0.000428	<0.00015	-	-	-
Acenaphthylene by GCMS	<0.000011	<0.000011	<0.00011	<0.00011	-	-	-
Fluoranthene by GCMS	<0.000017	<0.000017	<0.00017	<0.00017	-	-	-
Anthracene by GCMS	<0.000015	<0.000015	<0.00015	<0.00015	-	-	-
Phenanthrene by GCMS	<0.000022	<0.000022	<0.00022	<0.00022	-	-	-
Fluorene by GCMS	0.0000184	<0.000014	0.000184	<0.00014	-	-	-
Chrysene by GCMS	<0.000013	<0.000013	<0.00013	<0.00013	-	-	-
Pyrene by GCMS	<0.000015	<0.000015	<0.00015	<0.00015	-	-	-
Benz(a)anthracene by GCMS	<0.000017	<0.000017	<0.00017	<0.00017	-	-	-
Benzo(b)fluoranthene by GCMS	<0.000023	<0.000023	<0.00023	<0.00023	-	-	-
Benzo(k)fluoranthene by GCMS	<0.000027	<0.000027	<0.00027	<0.00027	-	-	-
Benzo(a)pyrene by GCMS	<0.000009	<0.000009	<0.00009	<0.00009	-	-	-
Dibenzo(ah)anthracene by GCMS	<0.000016	<0.000016	<0.00016	<0.00016	-	-	-
Benzo(ghi)perylene by GCMS	<0.000016	<0.000016	<0.00016	<0.00016	-	-	-
Indeno(123cd)pyrene by GCMS	<0.000014	<0.000014	<0.00014	<0.00014	-	-	-
PAH 16 EPA Total by GCMS	<0.000344	<0.000344	<0.00344	<0.00344	-	-	-

Leach Test Information

Date Prepared	25-Jun-2015
pH (pH Units)	8.20
Conductivity (µS/cm)	160.00
Temperature (°C)	22.10
Volume Leachant (Litres)	0.881

Mcerts Certification does not apply to leachates

13/07/2015 09:31:49

09:31:30 13/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150620-7	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320563
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.109	**Natural Moisture Content (%)**	20.7
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	82.8
Particle Size <4mm	>95%		

Case	
SDG	150620-7
Lab Sample Number(s)	11571033
Sampled Date	18-Jun-2015
Customer Sample Ref.	TP007
Depth (m)	2.00

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
TPH CWG (W)							
Surrogate Recovery	-	<0	-	<0	-	-	-
GRO TOT (C5-C12)	<0.05	<0.05	<0.5	<0.5	-	-	-
Aliphatics C5-C6	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C6-C8	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C8-C10	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C10-C12	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C12-C16	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C16-C21	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C21-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Total Aliphatics >C12-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics C6-C7	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >C7-C8	<0.01	<0.01	<0.1	<0.1	-	-	-
MTBE GC-FID	<0.003	<0.003	<0.03	<0.03	-	-	-
Aromatics >EC8 -EC10	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC10-EC12	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC12-EC16	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC16-EC21	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC21-EC35	<0.01	<0.01	<0.1	<0.1	-	-	-
Total Aromatics >EC12-EC35	<0.01	<0.01	<0.1	<0.1	-	-	-
Benzene by GC	<0.007	<0.007	<0.07	<0.07	-	-	-
TPH (Total Aliphatics + Total Aromatics) >C5-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Toluene by GC	<0.004	<0.004	<0.04	<0.04	-	-	-
Ethylbenzene by GC	<0.005	<0.005	<0.05	<0.05	-	-	-
m & p Xylene by GC	<0.008	<0.008	<0.08	<0.08	-	-	-
o Xylene by GC	<0.003	<0.003	<0.03	<0.03	-	-	-
Sum m&p and o Xylene by GC	<0.011	<0.011	<0.11	<0.11	-	-	-
Sum of BTEX by GC	<0.028	<0.028	<0.28	<0.28	-	-	-
VOC MS (W)							
Toluene-d8	-	<0	-	<0	-	-	-
Tert-butyl methyl ether	<0.001	<0.001	<0.01	<0.01	-	-	-
Benzene	<0.001	<0.001	<0.01	<0.01	-	-	-
Toluene	<0.001	<0.001	<0.01	<0.01	-	-	-
Ethylbenzene	<0.001	<0.001	<0.01	<0.01	-	-	-
p/m-Xylene	<0.001	<0.001	<0.01	<0.01	-	-	-
o-Xylene	<0.001	<0.001	<0.01	<0.01	-	-	-

Leach Test Information

Date Prepared	25-Jun-2015
pH (pH Units)	8.20
Conductivity (µS/cm)	160.00
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Volume Leachant (Litres)	0.881

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CERTIFICATE OF ANALYSIS

SDG:	150620-7	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320563
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
PM115		Leaching Procedure for CEN One Stage Leach Test 2:1 & 10:1 1 Step		
TM 304				
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM061	Method for the Determination of EPH,Massachusetts Dept.of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water		
TM116	Modified: US EPA Method 8260, 8120, 8020, 624, 610 & 602	Determination of Volatile Organic Compounds by Headspace / GC-MS		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser		
TM173	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID		
TM174	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Waters by GC-FID		
TM178	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM208	Modified: US EPA Method 8260b & 624	Determination of Volatile Organic Compounds by Headspace / GC-MS in Waters		
TM218	Microwave extraction – EPA method 3546	Microwave extraction - EPA method 3546		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		
TM227	Standard methods for the examination of waters and wastewaters 20th Edition, AWWA/APHA Method 4500.	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate		
TM241	Methods for the Examination of Waters and Associated Materials; Chromium in Raw and Potable Waters and Sewage Effluents 1980.	The Determination of Hexavalent Chromium in Waters and Leachates using the Kone Analyser		
TM245	By GC-FID	Determination of GRO by Headspace in waters		
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	150620-7	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320563
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	11570999	11571007	11571017	11571022	11571025	11571030	11571033
Customer Sample Ref.	BH002	BH003	BH004	TP003	TP006	TP007	TP007
AGS Ref.	ES3	ES2	ES5				
Depth	0.20 - 0.50	0.20 - 0.50	1.20 - 1.50	1.00	0.40	0.40	2.00
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples	26-Jun-2015	26-Jun-2015	26-Jun-2015	26-Jun-2015	26-Jun-2015	26-Jun-2015	
Boron Water Soluble	07-Jul-2015	02-Jul-2015	02-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	
CEN 10:1 Leachate (1 Stage)							25-Jun-2015
CEN Readings							29-Jun-2015
Cyanide Comp/Free/Total/Thiocyanate	06-Jul-2015	04-Jul-2015	04-Jul-2015	06-Jul-2015	06-Jul-2015	06-Jul-2015	07-Jul-2015
Dissolved Metals by ICP-MS							13-Jul-2015
Dissolved Organic/Inorganic Carbon							07-Jul-2015
EPH CWG (Aliphatic) Aqueous GC (W)							07-Jul-2015
EPH CWG (Aliphatic) GC (S)	07-Jul-2015	01-Jul-2015	01-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	
EPH CWG (Aromatic) Aqueous GC (W)							07-Jul-2015
EPH CWG (Aromatic) GC (S)	07-Jul-2015	01-Jul-2015	01-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	
GRO by GC-FID (S)	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	
GRO by GC-FID (W)							03-Jul-2015
Hexavalent Chromium (s)	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	
Hexavalent Chromium (w)							07-Jul-2015
Mercury Dissolved							07-Jul-2015
Metals in solid samples by OES	07-Jul-2015	06-Jul-2015	06-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	
PAH by GCMS	06-Jul-2015	06-Jul-2015	06-Jul-2015	06-Jul-2015	06-Jul-2015	06-Jul-2015	
PAH Spec MS - Aqueous (W)							07-Jul-2015
pH	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	
pH Value of Filtered Water							07-Jul-2015
Sample description	25-Jun-2015	25-Jun-2015	25-Jun-2015	25-Jun-2015	25-Jun-2015	25-Jun-2015	25-Jun-2015
Total Organic Carbon	07-Jul-2015	02-Jul-2015	01-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	
TPH CWG (W)							07-Jul-2015
TPH CWG GC (S)	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	
VOC MS (S)	07-Jul-2015	06-Jul-2015	06-Jul-2015	06-Jul-2015	06-Jul-2015	06-Jul-2015	
VOC MS (W)							06-Jul-2015

SDG:	150620-7	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320563
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before presevation was performed
§	Sampled on date not provided
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

ALcontrol Laboratories

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Apex Drilling Services
Sturmi Way
Village Farm Industrial Estate
Pyle
Bridgend
CF33 6BZ

Attention: Robert Brewer

CERTIFICATE OF ANALYSIS

Date:	13 July 2015
Customer:	H_APEXDRL_BGD
Sample Delivery Group (SDG):	150627-48
Your Reference:	10318
Location:	Swansea Bay
Report No:	320598

We received 16 samples on Saturday June 27, 2015 and 16 of these samples were scheduled for analysis which was completed on Monday July 13, 2015. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager

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CERTIFICATE OF ANALYSIS

SDG:	150627-48	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320598
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
11615322	TPA1		0.00 - 0.30	25/06/2015
11615323	TPA1		0.30 - 0.90	25/06/2015
11615320	TPA13		0.00 - 0.30	25/06/2015
11615321	TPA13		0.30 - 0.90	25/06/2015
11615318	TPA14		0.00 - 0.30	25/06/2015
11615319	TPA14		0.30 - 0.90	25/06/2015
11615316	TPA25		0.00 - 0.30	25/06/2015
11615317	TPA25		0.30 - 0.90	25/06/2015
11615314	TPA26		0.00 - 0.30	25/06/2015
11615315	TPA26		0.30 - 0.90	25/06/2015
11615312	TPA37		0.00 - 0.30	25/06/2015
11615313	TPA37		0.30 - 0.90	25/06/2015
11615310	TPA38		0.00 - 0.30	25/06/2015
11615311	TPA38		0.30 - 0.90	25/06/2015
11615308	TPA49		0.00 - 0.30	25/06/2015
11615309	TPA49		0.30 - 0.90	25/06/2015

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG:	150627-48	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320598
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

X Test

N No Determination Possible

Lab Sample No(s)	1615322	1615323	1615320	1615321	1615318	1615319	1615316	1615317	1615314	1615315	1615312	1615313	1615310	1615311	1615308	1615309
Customer Sample Reference	TPA1	TPA1	TPA13	TPA13	TPA14	TPA14	TPA25	TPA25	TPA26	TPA26	TPA37	TPA37	TPA38	TPA38	TPA49	TPA49
AGS Reference																
Depth (m)	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
Container	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB	1kg TUB
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 8	X	X	X		X			X	X	X	X			
Asbestos Quantification - Full	All	NDPs: 0 Tests: 1									X					
Boron Water Soluble	All	NDPs: 0 Tests: 15	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
CEN Readings	All	NDPs: 0 Tests: 1							X							
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 1							X							
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 15	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
Hexavalent Chromium (w)	All	NDPs: 0 Tests: 1							X							
Mercury Dissolved	All	NDPs: 0 Tests: 1							X							
Metals in solid samples by OES	All	NDPs: 0 Tests: 15	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X
Sample description	All	NDPs: 0 Tests: 16	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

CERTIFICATE OF ANALYSIS

SDG:	150627-48	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320598
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
11615322	TPA1	0.00 - 0.30	Black	Sand	0.1 - 2 mm	Crushed Brick	Stones
11615323	TPA1	0.30 - 0.90	Dark Brown	Sand	0.1 - 2 mm	Brick	Stones
11615320	TPA13	0.00 - 0.30	Dark Brown	Sand	0.1 - 2 mm	Crushed Brick	Stones
11615321	TPA13	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Vegetation
11615318	TPA14	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Vegetation
11615319	TPA14	0.30 - 0.90	Dark Brown	Sand	0.1 - 2 mm	Stones	None
11615316	TPA25	0.00 - 0.30	Dark Brown	Sand	0.1 - 2 mm	Stones	Vegetation
11615317	TPA25	0.30 - 0.90	Dark Brown	Sand	0.1 - 2 mm	Stones	Vegetation
11615314	TPA26	0.00 - 0.30	Black	Sand	0.1 - 2 mm	Brick	Vegetation
11615315	TPA26	0.30 - 0.90	Black	Sand	0.1 - 2 mm	Crushed Brick	Stones
11615312	TPA37	0.00 - 0.30	Dark Brown	Sand	0.1 - 2 mm	Crushed Brick	Stones
11615313	TPA37	0.30 - 0.90	Black	Sand	0.1 - 2 mm	Crushed Brick	Stones
11615310	TPA38	0.00 - 0.30	Dark Brown	Sand	0.1 - 2 mm	Stones	Vegetation
11615311	TPA38	0.30 - 0.90	Green	Sand	0.1 - 2 mm	Stones	None
11615308	TPA49	0.00 - 0.30	Dark Brown	Sand	0.1 - 2 mm	Stones	Vegetation
11615309	TPA49	0.30 - 0.90	Dark Brown	Sand	0.1 - 2 mm	Stones	None

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

CERTIFICATE OF ANALYSIS

SDG:	150627-48	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320598
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TPA1	TPA1	TPA13	TPA13	TPA14	TPA14
			Depth (m)	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	25/06/2015	25/06/2015	25/06/2015	25/06/2015	25/06/2015	25/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	27/06/2015	27/06/2015	27/06/2015	27/06/2015	27/06/2015	27/06/2015
			SDG Ref	150627-48	150627-48	150627-48	150627-48	150627-48	150627-48
			Lab Sample No.(s)	11615322	11615323	11615320	11615321	11615318	11615319
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		6.4	6.8	7.2	13	4.9	4.7
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #	<0.6 #	<3 #	<0.6 #
Antimony	<0.6 mg/kg	TM181		20.3 #	10.6 #	5.97 #	2.9 #	5.22 #	2.77 #
Arsenic	<0.6 mg/kg	TM181		67.2 M	40.6 M	27.9 M	18.1 M	26.9 M	28.1 M
Beryllium	<0.01 mg/kg	TM181		0.556 M	0.379 M	0.564 M	0.544 M	0.593 M	0.438 M
Cadmium	<0.02 mg/kg	TM181		5.25 M	3.28 M	1.94 M	0.725 M	1.85 M	1.08 M
Chromium	<0.9 mg/kg	TM181		10.4 M	7.71 M	10.7 M	12.1 M	12.9 M	7.8 M
Copper	<1.4 mg/kg	TM181		116 M	74.7 M	65 M	39.8 M	96.6 M	52.4 M
Lead	<0.7 mg/kg	TM181		2250 M	1170 M	1050 M	259 M	426 M	126 M
Mercury	<0.14 mg/kg	TM181		<0.14 M	0.48 M	1.28 M	0.393 M	0.447 M	<0.14 M
Molybdenum	<0.1 mg/kg	TM181		3.55 #	2.33 #	2.58 #	1.97 #	1.46 #	0.78 #
Nickel	<0.2 mg/kg	TM181		39.5 M	14.1 M	19 M	16.9 M	23.9 M	14.1 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Vanadium	<0.2 mg/kg	TM181		17.8 #	16.4 #	17.4 #	18.4 #	22.1 #	14.7 #
Zinc	<1.9 mg/kg	TM181		3970 M	2350 M	1820 M	460 M	728 M	286 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150627-48	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320598
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TPA25	TPA25	TPA26	TPA26	TPA37	TPA37
			Depth (m)	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	25/06/2015	25/06/2015	25/06/2015	25/06/2015	25/06/2015	25/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	27/06/2015	27/06/2015	27/06/2015	27/06/2015	27/06/2015	27/06/2015
			SDG Ref	150627-48	150627-48	150627-48	150627-48	150627-48	150627-48
			Lab Sample No.(s)	11615316	11615317	11615314	11615315	11615312	11615313
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		5.7	7.7	6.5	11	8.7	9.7
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #		<0.6 #	<0.6 #	<3 #	<3 #
Antimony	<0.6 mg/kg	TM181		8.72 #		42.9 #	61.7 #	20.9 #	18.3 #
Arsenic	<0.6 mg/kg	TM181		40.6 M		199 M	260 M	127 M	68.3 M
Beryllium	<0.01 mg/kg	TM181		0.589 M		0.954 M	1.23 M	0.719 M	0.94 M
Cadmium	<0.02 mg/kg	TM181		3.16 M		6.95 M	11.6 M	3.82 M	6.34 M
Chromium	<0.9 mg/kg	TM181		13.8 M		16.3 M	34.9 M	14.8 M	15.4 M
Copper	<1.4 mg/kg	TM181		124 M		251 M	374 M	115 M	162 M
Lead	<0.7 mg/kg	TM181		769 M		6670 M	8050 M	1140 M	2750 M
Mercury	<0.14 mg/kg	TM181		0.141 M		0.497 M	0.462 M	<0.14 M	<0.14 M
Molybdenum	<0.1 mg/kg	TM181		1.7 #		6.57 #	10.6 #	2.17 #	4.7 #
Nickel	<0.2 mg/kg	TM181		30.6 M		50.7 M	104 M	81.2 M	302 M
Selenium	<1 mg/kg	TM181		<1 #		<1 #	<1 #	<1 #	<1 #
Vanadium	<0.2 mg/kg	TM181		26.7 #		25.3 #	41 #	21.7 #	24 #
Zinc	<1.9 mg/kg	TM181		1350 M		5200 M	8030 M	1630 M	2670 M
Boron, water soluble	<1 mg/kg	TM222		<1 M		<1 M	<1 M	<1 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150627-48	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320598
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TPA38	TPA38	TPA49	TPA49		
			Depth (m)	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90		
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid		
			Date Sampled	25/06/2015	25/06/2015	25/06/2015	25/06/2015		
			Sample Time	.	.	.	.		
			Date Received	27/06/2015	27/06/2015	27/06/2015	27/06/2015		
			SDG Ref	150627-48	150627-48	150627-48	150627-48		
			Lab Sample No.(s)	11615310	11615311	11615308	11615309		
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		6.5	5.4	4.8	3.8		
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #	<0.6 #		
Antimony	<0.6 mg/kg	TM181		15.5 #	9.68 #	19.2 #	3.86 #		
Arsenic	<0.6 mg/kg	TM181		47.4 M	37.5 M	43.1 M	21 M		
Beryllium	<0.01 mg/kg	TM181		0.659 M	0.769 M	0.513 M	0.208 M		
Cadmium	<0.02 mg/kg	TM181		7.1 M	3.46 M	5.43 M	0.957 M		
Chromium	<0.9 mg/kg	TM181		10.9 M	8.58 M	9.6 M	5.43 M		
Copper	<1.4 mg/kg	TM181		107 M	82 M	111 M	52.1 M		
Lead	<0.7 mg/kg	TM181		1830 M	1200 M	2390 M	427 M		
Mercury	<0.14 mg/kg	TM181		<0.14 M	0.641 M	<0.14 M	<0.14 M		
Molybdenum	<0.1 mg/kg	TM181		5.2 #	4.41 #	4.01 #	0.898 #		
Nickel	<0.2 mg/kg	TM181		34 M	28.8 M	23.2 M	8.92 M		
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #		
Vanadium	<0.2 mg/kg	TM181		21.6 #	18.4 #	23.5 #	12.5 #		
Zinc	<1.9 mg/kg	TM181		4390 M	2730 M	4470 M	548 M		
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M	<1 M		

CERTIFICATE OF ANALYSIS

SDG:	150627-48	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320598
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Asbestos Identification - Solid Samples

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA1 0.00 - 0.30 SOLID 25/06/2015 00:00:00 01/07/2015 06:31:53 150627-48 11615322 TM048	3/7/15	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA1 0.30 - 0.90 SOLID 25/06/2015 00:00:00 01/07/2015 06:27:22 150627-48 11615323 TM048	3/7/15	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA13 0.00 - 0.30 SOLID 25/06/2015 00:00:00 01/07/2015 06:22:59 150627-48 11615320 TM048	3/7/15	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA14 0.00 - 0.30 SOLID 25/06/2015 00:00:00 01/07/2015 08:08:18 150627-48 11615318 TM048	3/7/15	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA26 0.00 - 0.30 SOLID 25/06/2015 00:00:00 01/07/2015 07:36:16 150627-48 11615314 TM048	3/7/15	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150627-48	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320598
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA26 0.30 - 0.90 SOLID 25/06/2015 00:00:00 01/07/2015 07:40:25 150627-48 11615315 TM048	3/7/15	Kevin Hughes	Loose fibres in soil	Not Detected (#)	Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA37 0.00 - 0.30 SOLID 25/06/2015 00:00:00 01/07/2015 07:39:10 150627-48 11615312 TM048	3/7/15	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA37 0.30 - 0.90 SOLID 25/06/2015 00:00:00 01/07/2015 07:33:34 150627-48 11615313 TM048	3/7/15	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150627-48	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320598
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Asbestos Quantification - Full

		Additional Asbestos Components (Using TM048)	Analysts Comments	Asbestos Quantification - Gravimetric - %	Asbestos Quantification - PCOM Evaluation - %	Asbestos Quantification - Total - %
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA26 0.30 - 0.90 SOLID 25/06/2015 00:00:00 06/07/2015 08:23:22 150627-48 11615315 TM 304	Amosite (Loose fibres in soil). (#)	N/C	<0.001 (#)	0.0018 (#)	0.002 (#)

CERTIFICATE OF ANALYSIS

SDG:	150627-48	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320598
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.099	**Natural Moisture Content (%)**	10.1
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	90.8
Particle Size <4mm	>95%		

Case	
SDG	150627-48
Lab Sample Number(s)	11615317
Sampled Date	25-Jun-2015
Customer Sample Ref.	TPA25
Depth (m)	0.30 - 0.90

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Hexavalent Chromium	<0.03	<0.03	<0.3	<0.3	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	0.0027	<0.00016	0.027	<0.0016	-	-	-
Arsenic	0.00664	<0.00012	0.0664	<0.0012	-	-	-
Beryllium	<0.00007	<0.00007	<0.0007	<0.0007	-	-	-
Boron	0.0208	<0.0094	0.208	<0.094	-	-	-
Cadmium	<0.0001	<0.0001	<0.001	<0.001	-	-	-
Chromium	0.000491	<0.00022	0.00491	<0.0022	-	-	-
Copper	0.00401	<0.00085	0.0401	<0.0085	-	-	-
Lead	0.00188	<0.00002	0.0188	<0.0002	-	-	-
Molybdenum	0.00412	<0.00024	0.0412	<0.0024	-	-	-
Nickel	0.000233	<0.00015	0.00233	<0.0015	-	-	-
Selenium	<0.00039	<0.00039	<0.0039	<0.0039	-	-	-
Vanadium	0.0054	<0.00024	0.054	<0.0024	-	-	-
Zinc	0.00304	<0.00041	0.0304	<0.0041	-	-	-

Leach Test Information

Date Prepared	30-Jun-2015
pH (pH Units)	8.61
Conductivity (µS/cm)	72.30
Temperature (°C)	20.90
Volume Leachant (Litres)	0.891

Mcerts Certification does not apply to leachates

13/07/2015 12:34:48

12:34:33 13/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150627-48	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320598
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
PM115		Leaching Procedure for CEN One Stage Leach Test 2:1 & 10:1 1 Step		
TM 304				
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		
TM241	Methods for the Examination of Waters and Associated Materials; Chromium in Raw and Potable Waters and Sewage Effluents 1980.	The Determination of Hexavalent Chromium in Waters and Leachates using the Kone Analyser		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	150627-48	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320598
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	11615322	11615323	11615320	11615321	11615318	11615319	11615316	11615317	11615314	11615315
Customer Sample Ref.	TPA1	TPA1	TPA13	TPA13	TPA14	TPA14	TPA25	TPA25	TPA26	TPA26
AGS Ref.										
Depth	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples	03-Jul-2015	03-Jul-2015	03-Jul-2015		03-Jul-2015				03-Jul-2015	03-Jul-2015
Asbestos Quantification - Full										13-Jul-2015
Boron Water Soluble	03-Jul-2015	03-Jul-2015	03-Jul-2015	02-Jul-2015	06-Jul-2015	02-Jul-2015	02-Jul-2015		06-Jul-2015	03-Jul-2015
CEN 10:1 Leachate (1 Stage)								30-Jun-2015		
CEN Readings								03-Jul-2015		
Dissolved Metals by ICP-MS								09-Jul-2015		
Hexavalent Chromium (s)	03-Jul-2015	03-Jul-2015	03-Jul-2015	03-Jul-2015	07-Jul-2015	03-Jul-2015	03-Jul-2015		03-Jul-2015	03-Jul-2015
Hexavalent Chromium (w)								04-Jul-2015		
Mercury Dissolved								03-Jul-2015		
Metals in solid samples by OES	06-Jul-2015	06-Jul-2015	06-Jul-2015	06-Jul-2015	07-Jul-2015	06-Jul-2015	06-Jul-2015		07-Jul-2015	06-Jul-2015
Sample description	29-Jun-2015	29-Jun-2015	29-Jun-2015	29-Jun-2015	29-Jun-2015	29-Jun-2015	29-Jun-2015	29-Jun-2015	29-Jun-2015	29-Jun-2015

Lab Sample No(s)	11615312	11615313	11615310	11615311	11615308	11615309
Customer Sample Ref.	TPA37	TPA37	TPA38	TPA38	TPA49	TPA49
AGS Ref.						
Depth	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples	03-Jul-2015	03-Jul-2015				
Boron Water Soluble	03-Jul-2015	06-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015
Hexavalent Chromium (s)	07-Jul-2015	07-Jul-2015	03-Jul-2015	03-Jul-2015	03-Jul-2015	03-Jul-2015
Metals in solid samples by OES	06-Jul-2015	07-Jul-2015	06-Jul-2015	06-Jul-2015	03-Jul-2015	06-Jul-2015
Sample description	29-Jun-2015	29-Jun-2015	29-Jun-2015	29-Jun-2015	29-Jun-2015	29-Jun-2015

SDG:	150627-48	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320598
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before presevation was performed
§	Sampled on date not provided
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

ALcontrol Laboratories

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Apex Drilling Services
Sturmi Way
Village Farm Industrial Estate
Pyle
Bridgend
CF33 6BZ

Attention: Robert Brewer

CERTIFICATE OF ANALYSIS

Date:	14 July 2015
Customer:	H_APEXDRL_BGD
Sample Delivery Group (SDG):	150701-8
Your Reference:	10318
Location:	Swansea Bay
Report No:	320695

We received 32 samples on Tuesday June 30, 2015 and 32 of these samples were scheduled for analysis which was completed on Tuesday July 14, 2015. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager

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CERTIFICATE OF ANALYSIS

SDG:	150701-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320695
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
11630851	TP A2		0.00 - 0.30	29/06/2015
11630852	TP A2		0.30 - 0.90	29/06/2015
11630853	TP A3		0.00 - 0.30	29/06/2015
11630854	TP A3		0.30 - 0.90	29/06/2015
11630855	TP A11		0.00 - 0.30	29/06/2015
11630856	TP A11		0.30 - 0.90	29/06/2015
11630849	TP A12		0.00 - 0.30	29/06/2015
11630850	TP A12		0.30 - 0.90	29/06/2015
11630870	TP A15		0.00 - 0.30	26/06/2015
11630871	TP A15		0.30 - 0.90	26/06/2015
11630857	TP A16		0.00 - 0.30	29/06/2015
11630858	TP A16		0.30 - 0.90	29/06/2015
11630859	TP A23		0.00 - 0.30	29/06/2015
11630860	TP A23		0.30 - 0.90	29/06/2015
11630872	TP A24		0.00 - 0.30	26/06/2015
11630873	TP A24		0.30 - 0.90	26/06/2015
11630865	TP A27		0.00 - 0.30	26/06/2015
11630866	TP A27		0.30 - 0.90	26/06/2015
11630861	TP A28		0.00 - 0.30	29/06/2015
11630862	TP A28		0.30 - 0.90	29/06/2015
11630863	TP A35		0.00 - 0.30	29/06/2015
11630864	TP A35		0.30 - 0.90	29/06/2015
11630878	TP A36		0.00 - 0.30	26/06/2015
11630879	TP A36		0.30 - 0.90	26/06/2015
11630876	TP A39		0.00 - 0.30	26/06/2015
11630877	TP A39		0.30 - 0.90	26/06/2015
11630874	TP A48		0.00 - 0.30	26/06/2015
11630875	TP A48		0.30 - 0.90	26/06/2015
11630880	TP A50		0.00 - 0.30	26/06/2015
11630881	TP A50		0.30 - 0.90	26/06/2015
11630867	TP A57		0.00 - 0.30	26/06/2015
11630869	TP A57		0.30 - 0.90	26/06/2015

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG:	150701-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320695
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

X — Test

N — No Determination Possible

	Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container
	11630851	TP A2		0.00 - 0.30	400g Tub (ALE214)
	11630852	TP A2		0.30 - 0.90	400g Tub (ALE214)
	11630853	TP A3		0.00 - 0.30	400g Tub (ALE214)
	11630854	TP A3		0.30 - 0.90	400g Tub (ALE214)
	11630855	TP A11		0.00 - 0.30	400g Tub (ALE214)
	11630856	TP A11		0.30 - 0.90	400g Tub (ALE214)
	11630849	TP A12		0.00 - 0.30	400g Tub (ALE214)
	11630850	TP A12		0.30 - 0.90	400g Tub (ALE214)
	11630870	TP A15		0.00 - 0.30	400g Tub (ALE214)
	11630871	TP A15		0.30 - 0.90	400g Tub (ALE214)
	11630857	TP A16		0.00 - 0.30	400g Tub (ALE214)
	11630858	TP A16		0.30 - 0.90	400g Tub (ALE214)
	11630859	TP A23		0.00 - 0.30	400g Tub (ALE214)
	11630860	TP A23		0.30 - 0.90	400g Tub (ALE214)
	11630872	TP A24		0.00 - 0.30	1kg TUB
	11630873	TP A24		0.30 - 0.90	1kg TUB
	11630865	TP A27		0.00 - 0.30	1kg TUB
	11630866	TP A27		0.30 - 0.90	1kg TUB
	11630861	TP A28		0.00 - 0.30	400g Tub (ALE214)
	11630862	TP A28		0.30 - 0.90	400g Tub (ALE214)
	11630863	TP A35		0.00 - 0.30	400g Tub (ALE214)
	11630864	TP A35		0.30 - 0.90	400g Tub (ALE214)
	11630878	TP A36		0.00 - 0.30	1kg TUB
	11630879	TP A36		0.30 - 0.90	1kg TUB
	11630876	TP A39		0.00 - 0.30	1kg TUB
	11630877	TP A39		0.30 - 0.90	1kg TUB
	11630874	TP A48		0.00 - 0.30	1kg TUB
	11630875	TP A48		0.30 - 0.90	1kg TUB
	11630880	TP A50		0.00 - 0.30	1kg TUB
	11630881	TP A50		0.30 - 0.90	1kg TUB
	11630867	TP A57		0.00 - 0.30	1kg TUB
	11630869	TP A57		0.30 - 0.90	1kg TUB
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 11			X X X X X X X X X X X
Asbestos Quantification - Full	All	NDPs: 0 Tests: 1			X
Boron Water Soluble	All	NDPs: 0 Tests: 32			X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 32			X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X
Metals in solid samples by OES	All	NDPs: 0 Tests: 32			X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X
Sample description	All	NDPs: 0 Tests: 30			X X X X X X X X X X X X X X X X X X X X X X X X X X X X X X

CERTIFICATE OF ANALYSIS

SDG:	150701-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320695
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
11630851	TP A2	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Vegetation
11630852	TP A2	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Coal fragments
11630853	TP A3	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Vegetation
11630854	TP A3	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	None
11630855	TP A11	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	None
11630856	TP A11	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Vegetation
11630849	TP A12	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	None
11630850	TP A12	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Vegetation
11630870	TP A15	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	Stones
11630871	TP A15	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	None
11630857	TP A16	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	None
11630858	TP A16	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	None
11630859	TP A23	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	Stones
11630860	TP A23	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	None
11630872	TP A24	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	None
11630873	TP A24	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	None
11630865	TP A27	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	Brick
11630866	TP A27	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Vegetation
11630861	TP A28	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Vegetation
11630862	TP A28	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	None
11630863	TP A35	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	None
11630864	TP A35	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	Brick
11630878	TP A36	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Vegetation
11630879	TP A36	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	None
11630876	TP A39	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	None
11630877	TP A39	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Vegetation
11630874	TP A48	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	None
11630875	TP A48	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	None
11630880	TP A50	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Vegetation
11630881	TP A50	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Vegetation
11630867	TP A57	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	None
11630869	TP A57	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	None

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

CERTIFICATE OF ANALYSIS

SDG:	150701-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320695
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TP A2	TP A2	TP A3	TP A3	TP A11	TP A11
			Depth (m)	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	29/06/2015	29/06/2015	29/06/2015	29/06/2015	29/06/2015	29/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	30/06/2015	30/06/2015	30/06/2015	30/06/2015	30/06/2015	30/06/2015
			SDG Ref	150701-8	150701-8	150701-8	150701-8	150701-8	150701-8
			Lab Sample No.(s)	11630851	11630852	11630853	11630854	11630855	11630856
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		9.3	8.9	8.7	9.7	9.7	11
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<1.2 #	<0.6 #	<0.6 #	<0.6 #
Antimony	<0.6 mg/kg	TM181		17.6 #	6.39 #	9.24 #	21.5 #	6.32 #	189 #
Arsenic	<0.6 mg/kg	TM181		301 M	95.3 M	115 M	64.1 M	99.5 M	>500 M
Beryllium	<0.01 mg/kg	TM181		0.589 M	0.391 M	0.408 M	0.811 M	0.688 M	1.07 M
Cadmium	<0.02 mg/kg	TM181		3.41 M	1.67 M	1.84 M	1.8 M	1.28 M	33.4 M
Chromium	<0.9 mg/kg	TM181		20 M	12.1 M	11.3 M	26.6 M	12.1 M	22.3 M
Copper	<1.4 mg/kg	TM181		197 M	129 M	177 M	212 M	58.7 M	502 M
Lead	<0.7 mg/kg	TM181		1370 M	629 M	896 M	4150 M	484 M	4060 M
Mercury	<0.14 mg/kg	TM181		0.502 M	0.187 M	0.149 M	0.198 M	0.193 M	1.28 M
Molybdenum	<0.1 mg/kg	TM181		3.31 #	2.04 #	2.34 #	3.27 #	1.47 #	7.87 #
Nickel	<0.2 mg/kg	TM181		23 M	19.9 M	21.1 M	25.5 M	20.5 M	48 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #	<1 #	2.85 #
Vanadium	<0.2 mg/kg	TM181		22.4 #	17.5 #	19.5 #	24 #	18.8 #	36.7 #
Zinc	<1.9 mg/kg	TM181		1780 M	749 M	752 M	1520 M	644 M	2330 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150701-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320695
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TP A12	TP A12	TP A15	TP A15	TP A16	TP A16
			Depth (m)	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	29/06/2015	29/06/2015	26/06/2015	26/06/2015	29/06/2015	29/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	30/06/2015	30/06/2015	30/06/2015	30/06/2015	30/06/2015	30/06/2015
			SDG Ref	150701-8	150701-8	150701-8	150701-8	150701-8	150701-8
			Lab Sample No.(s)	11630849	11630850	11630870	11630871	11630857	11630858
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		8.8	9.5	10	14	8.6	11
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<1.2 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #
Antimony	<0.6 mg/kg	TM181		9.72 #	24.2 #	6.15 #	7.49 #	4.23 #	93.4 #
Arsenic	<0.6 mg/kg	TM181		41.7 M	443 M	40.6 M	95 M	58.1 M	5920 M
Beryllium	<0.01 mg/kg	TM181		0.782 M	1.23 M	0.594 M	0.653 M	0.602 M	0.829 M
Cadmium	<0.02 mg/kg	TM181		2.5 M	5.62 M	2.32 M	2.1 M	0.938 M	7.08 M
Chromium	<0.9 mg/kg	TM181		18.9 M	19 M	13.9 M	17.6 M	10.6 M	26.9 M
Copper	<1.4 mg/kg	TM181		98.2 M	298 M	73.1 M	1390 M	39.4 M	420 M
Lead	<0.7 mg/kg	TM181		588 M	1050 M	557 M	488 M	239 M	3500 M
Mercury	<0.14 mg/kg	TM181		0.231 M	1.45 M	0.147 M	0.324 M	<0.14 M	0.851 M
Molybdenum	<0.1 mg/kg	TM181		2.04 #	3.18 #	1.96 #	1.4 #	1.16 #	2.55 #
Nickel	<0.2 mg/kg	TM181		31.1 M	23.1 M	29.6 M	28.7 M	16.5 M	64.6 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #	<1 #	2.08 #
Vanadium	<0.2 mg/kg	TM181		26.6 #	23.6 #	20.2 #	22.7 #	16.5 #	24 #
Zinc	<1.9 mg/kg	TM181		1150 M	2390 M	1170 M	1090 M	562 M	1510 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150701-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320695
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TP A23	TP A23	TP A24	TP A24	TP A27	TP A27
			Depth (m)	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	29/06/2015	29/06/2015	26/06/2015	26/06/2015	26/06/2015	26/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	30/06/2015	30/06/2015	30/06/2015	30/06/2015	30/06/2015	30/06/2015
			SDG Ref	150701-8	150701-8	150701-8	150701-8	150701-8	150701-8
			Lab Sample No.(s)	11630859	11630860	11630872	11630873	11630865	11630866
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		9	9.5	5.8	6.6	7.1	7.6
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #
Antimony	<0.6 mg/kg	TM181		5.44 #	5.19 #	9.67 #	5.12 #	8.51 #	5.62 #
Arsenic	<0.6 mg/kg	TM181		25.7 M	41.1 M	21 M	24.3 M	28.9 M	131 M
Beryllium	<0.01 mg/kg	TM181		0.673 M	0.569 M	0.498 M	0.366 M	0.567 M	0.586 M
Cadmium	<0.02 mg/kg	TM181		1.48 M	1.66 M	0.809 M	0.773 M	1.9 M	1.26 M
Chromium	<0.9 mg/kg	TM181		13.1 M	14.1 M	10.3 M	7.94 M	17.5 M	10.8 M
Copper	<1.4 mg/kg	TM181		47.4 M	52.2 M	51.5 M	48.2 M	54.4 M	71.6 M
Lead	<0.7 mg/kg	TM181		402 M	437 M	133 M	3770 M	582 M	320 M
Mercury	<0.14 mg/kg	TM181		0.172 M	<0.14 M	<0.14 M	<0.14 M	<0.14 M	2.23 M
Molybdenum	<0.1 mg/kg	TM181		1.31 #	1.55 #	0.573 #	0.941 #	1.63 #	1.67 #
Nickel	<0.2 mg/kg	TM181		19 M	18.9 M	18.2 M	13.5 M	23 M	25.9 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Vanadium	<0.2 mg/kg	TM181		19 #	19.6 #	15 #	14.8 #	20.5 #	15.6 #
Zinc	<1.9 mg/kg	TM181		855 M	828 M	532 M	437 M	1240 M	570 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150701-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320695
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TP A28	TP A28	TP A35	TP A35	TP A36	TP A36
			Depth (m)	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	29/06/2015	29/06/2015	29/06/2015	29/06/2015	26/06/2015	26/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	30/06/2015	30/06/2015	30/06/2015	30/06/2015	30/06/2015	30/06/2015
			SDG Ref	150701-8	150701-8	150701-8	150701-8	150701-8	150701-8
			Lab Sample No.(s)	11630861	11630862	11630863	11630864	11630878	11630879
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		12	13	9.5	12	8.2	11
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<1.2 #	<0.6 #	<0.6 #	<1.2 #	<0.6 #
Antimony	<0.6 mg/kg	TM181		15 #	40.8 #	10.1 #	25 #	5.93 #	21.5 #
Arsenic	<0.6 mg/kg	TM181		38 M	257 M	47.5 M	109 M	48.4 M	46 M
Beryllium	<0.01 mg/kg	TM181		0.439 M	0.62 M	0.833 M	0.532 M	0.802 M	0.656 M
Cadmium	<0.02 mg/kg	TM181		3.21 M	6.19 M	2.2 M	7.95 M	2.2 M	2.13 M
Chromium	<0.9 mg/kg	TM181		12.2 M	16.4 M	13.2 M	15.3 M	12.8 M	11.5 M
Copper	<1.4 mg/kg	TM181		68.8 M	232 M	85 M	162 M	50.6 M	152 M
Lead	<0.7 mg/kg	TM181		1140 M	3590 M	783 M	2840 M	549 M	3760 M
Mercury	<0.14 mg/kg	TM181		<0.14 M	0.2 M	0.303 M	0.321 M	<0.14 M	<0.14 M
Molybdenum	<0.1 mg/kg	TM181		1.93 #	2.92 #	2.06 #	3.48 #	1.53 #	2.74 #
Nickel	<0.2 mg/kg	TM181		22.4 M	47.7 M	48.7 M	166 M	24.2 M	19.6 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Vanadium	<0.2 mg/kg	TM181		17.7 #	23.2 #	18.8 #	22.2 #	19 #	21.5 #
Zinc	<1.9 mg/kg	TM181		2590 M	2810 M	1300 M	4060 M	942 M	2480 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150701-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320695
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TP A39	TP A39	TP A48	TP A48	TP A50	TP A50
			Depth (m)	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	26/06/2015	26/06/2015	26/06/2015	26/06/2015	26/06/2015	26/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	30/06/2015	30/06/2015	30/06/2015	30/06/2015	30/06/2015	30/06/2015
			SDG Ref	150701-8	150701-8	150701-8	150701-8	150701-8	150701-8
			Lab Sample No.(s)	11630876	11630877	11630874	11630875	11630880	11630881
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		7	8.8	4.3	9.1	4.3	6.5
Chromium, Hexavalent	<0.6 mg/kg	TM151		<1.2 #	<0.6 #	<0.6 #	<0.6 #	<1.2 #	<3 #
Antimony	<0.6 mg/kg	TM181		12 #	6.4 #	10.9 #	4.1 #	11.6 #	6.74 #
Arsenic	<0.6 mg/kg	TM181		38.7 M	30.8 M	29.2 M	21.1 M	38.6 M	33 M
Beryllium	<0.01 mg/kg	TM181		0.998 M	0.518 M	0.744 M	0.554 M	0.514 M	0.927 M
Cadmium	<0.02 mg/kg	TM181		2.99 M	2.71 M	4.77 M	1.12 M	4.69 M	4.31 M
Chromium	<0.9 mg/kg	TM181		29.1 M	13.6 M	9.69 M	10.2 M	11.2 M	11.3 M
Copper	<1.4 mg/kg	TM181		97.7 M	70.2 M	106 M	46.5 M	115 M	93.7 M
Lead	<0.7 mg/kg	TM181		1720 M	553 M	1120 M	386 M	1160 M	684 M
Mercury	<0.14 mg/kg	TM181		0.21 M	<0.14 M	0.642 M	<0.14 M	1.18 M	1.32 M
Molybdenum	<0.1 mg/kg	TM181		3.12 #	1.71 #	2.75 #	1.16 #	4.38 #	2.03 #
Nickel	<0.2 mg/kg	TM181		29.5 M	69.6 M	40.2 M	18.1 M	36.8 M	22.5 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Vanadium	<0.2 mg/kg	TM181		50 #	21.7 #	21 #	16 #	24.7 #	17.9 #
Zinc	<1.9 mg/kg	TM181		2160 M	1810 M	3050 M	696 M	2460 M	1390 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150701-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320695
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TP A57	TP A57				
			Depth (m)	0.00 - 0.30	0.30 - 0.90				
			Sample Type	Soil/Solid	Soil/Solid				
			Date Sampled	26/06/2015	26/06/2015				
			Sample Time	.	.				
			Date Received	30/06/2015	30/06/2015				
			SDG Ref	150701-8	150701-8				
			Lab Sample No.(s)	11630867	11630869				
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		4.2	3.8				
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #				
Antimony	<0.6 mg/kg	TM181		1.25 #	1.17 #				
Arsenic	<0.6 mg/kg	TM181		16.8 M	14.2 M				
Beryllium	<0.01 mg/kg	TM181		0.148 M	0.197 M				
Cadmium	<0.02 mg/kg	TM181		0.231 M	0.214 M				
Chromium	<0.9 mg/kg	TM181		5.29 M	5.56 M				
Copper	<1.4 mg/kg	TM181		21.1 M	18.2 M				
Lead	<0.7 mg/kg	TM181		51.6 M	31.4 M				
Mercury	<0.14 mg/kg	TM181		<0.14 M	<0.14 M				
Molybdenum	<0.1 mg/kg	TM181		0.369 #	0.427 #				
Nickel	<0.2 mg/kg	TM181		5.98 M	6.16 M				
Selenium	<1 mg/kg	TM181		<1 #	<1 #				
Vanadium	<0.2 mg/kg	TM181		11.5 #	11.1 #				
Zinc	<1.9 mg/kg	TM181		112 M	82.9 M				
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M				

CERTIFICATE OF ANALYSIS

SDG:	150701-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320695
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Asbestos Identification - Solid Samples

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP A2 0.00 - 0.30 SOLID 29/06/2015 00:00:00 03/07/2015 07:38:27 150701-8 11630851 TM048	8/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP A2 0.30 - 0.90 SOLID 29/06/2015 00:00:00 02/07/2015 20:19:09 150701-8 11630852 TM048	7/7/15	Kevin Hughes	Fibre clumps in soil	Not Detected (#)	Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP A3 0.00 - 0.30 SOLID 29/06/2015 00:00:00 03/07/2015 07:46:48 150701-8 11630853 TM048	8/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP A11 0.30 - 0.90 SOLID 29/06/2015 00:00:00 03/07/2015 07:33:25 150701-8 11630856 TM048	8/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP A12 0.30 - 0.90 SOLID 29/06/2015 00:00:00 03/07/2015 07:42:00 150701-8 11630850 TM048	8/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150701-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320695
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP A27 0.00 - 0.30 SOLID 26/06/2015 00:00:00 03/07/2015 07:38:20 150701-8 11630865 TM048	7/7/15	Kevin Gill	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP A28 0.00 - 0.30 SOLID 29/06/2015 00:00:00 02/07/2015 20:31:20 150701-8 11630861 TM048	7/7/15	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP A35 0.30 - 0.90 SOLID 29/06/2015 00:00:00 02/07/2015 20:20:47 150701-8 11630864 TM048	7/7/15	Kevin Gill	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP A39 0.30 - 0.90 SOLID 26/06/2015 00:00:00 02/07/2015 21:06:41 150701-8 11630877 TM048	7/7/15	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP A50 0.00 - 0.30 SOLID 26/06/2015 00:00:00 02/07/2015 21:05:16 150701-8 11630880 TM048	8/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP A50 0.30 - 0.90 SOLID 26/06/2015 00:00:00 02/07/2015 21:03:45 150701-8 11630881 TM048	7/7/15	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150701-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320695
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Asbestos Quantification - Full

		Additional Asbestos Components (Using TM048)	Analysts Comments	Asbestos Quantification - Gravimetric - %	Asbestos Quantification - PCOM Evaluation - %	Asbestos Quantification - Total - %
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP A2 0.30 - 0.90 SOLID 29/06/2015 00:00:00 09/07/2015 08:05:18 150701-8 11630852 TM 304	None (#)	N/C	<0.001 (#)	<0.001 (#)	<0.001 (#)

CERTIFICATE OF ANALYSIS

SDG:	150701-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320695
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
TM 304				
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	150701-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320695
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	11630851	11630852	11630853	11630854	11630855	11630856	11630849	11630850	11630870	11630871
Customer Sample Ref.	TP A2	TP A2	TP A3	TP A3	TP A11	TP A11	TP A12	TP A12	TP A15	TP A15
AGS Ref.										
Depth	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples	08-Jul-2015	08-Jul-2015	08-Jul-2015			08-Jul-2015		08-Jul-2015		
Asbestos Quantification - Full		14-Jul-2015								
Boron Water Soluble	09-Jul-2015	09-Jul-2015	09-Jul-2015	07-Jul-2015	08-Jul-2015	09-Jul-2015	07-Jul-2015	09-Jul-2015	08-Jul-2015	07-Jul-2015
Hexavalent Chromium (s)	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015
Metals in solid samples by OES	09-Jul-2015	09-Jul-2015	09-Jul-2015	08-Jul-2015	08-Jul-2015	09-Jul-2015	07-Jul-2015	09-Jul-2015	07-Jul-2015	07-Jul-2015
Sample description	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015

Lab Sample No(s)	11630857	11630858	11630859	11630860	11630872	11630873	11630865	11630866	11630861	11630862
Customer Sample Ref.	TP A16	TP A16	TP A23	TP A23	TP A24	TP A24	TP A27	TP A27	TP A28	TP A28
AGS Ref.										
Depth	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples							08-Jul-2015		08-Jul-2015	
Boron Water Soluble	07-Jul-2015	07-Jul-2015	07-Jul-2015	08-Jul-2015	07-Jul-2015	07-Jul-2015	09-Jul-2015	08-Jul-2015	09-Jul-2015	08-Jul-2015
Hexavalent Chromium (s)	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015
Metals in solid samples by OES	07-Jul-2015	07-Jul-2015	08-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	09-Jul-2015	08-Jul-2015	09-Jul-2015	07-Jul-2015
Sample description	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015

Lab Sample No(s)	11630863	11630864	11630878	11630879	11630876	11630877	11630874	11630875	11630880	11630881
Customer Sample Ref.	TP A35	TP A35	TP A36	TP A36	TP A39	TP A39	TP A48	TP A48	TP A50	TP A50
AGS Ref.										
Depth	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples		08-Jul-2015				08-Jul-2015			08-Jul-2015	08-Jul-2015
Boron Water Soluble	07-Jul-2015	09-Jul-2015	08-Jul-2015	08-Jul-2015	08-Jul-2015	09-Jul-2015	07-Jul-2015	07-Jul-2015	09-Jul-2015	09-Jul-2015
Hexavalent Chromium (s)	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015
Metals in solid samples by OES	07-Jul-2015	09-Jul-2015	08-Jul-2015	08-Jul-2015	07-Jul-2015	09-Jul-2015	07-Jul-2015	07-Jul-2015	09-Jul-2015	09-Jul-2015
Sample description	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015

Lab Sample No(s)	11630867	11630869
Customer Sample Ref.	TP A57	TP A57
AGS Ref.		
Depth	0.00 - 0.30	0.30 - 0.90
Type	SOLID	SOLID
Boron Water Soluble	08-Jul-2015	08-Jul-2015
Hexavalent Chromium (s)	09-Jul-2015	09-Jul-2015
Metals in solid samples by OES	07-Jul-2015	07-Jul-2015
Sample description	02-Jul-2015	02-Jul-2015

SDG:	150701-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320695
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before presevation was performed
§	Sampled on date not provided
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

ALcontrol Laboratories

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Apex Drilling Services
Sturmi Way
Village Farm Industrial Estate
Pyle
Bridgend
CF33 6BZ

Attention: Robert Brewer

CERTIFICATE OF ANALYSIS

Date:	14 July 2015
Customer:	H_APEXDRL_BGD
Sample Delivery Group (SDG):	150701-1
Your Reference:	10318
Location:	Swansea Bay
Report No:	320715

We received 6 samples on Tuesday June 30, 2015 and 6 of these samples were scheduled for analysis which was completed on Tuesday July 14, 2015. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager

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Registered Office: Units 7 & 8 Hawarden Business Park, Manor Road, Hawarden, Deeside, CH5 3US. Registered in England and Wales No.

CERTIFICATE OF ANALYSIS

SDG:	150701-1	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320715
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
11630066	ES1 AWS1	ES1	0.00 - 0.20	26/06/2015
11630067	ES2 AWS1	ES2	0.20 - 1.30	26/06/2015
11630068	ES3 AWS1	ES3	1.30 - 2.30	26/06/2015
11630069	ES4 AWS2	ES4	0.00 - 0.90	26/06/2015
11630070	ES5 AWS2	ES5	0.90 - 1.30	26/06/2015
11630071	ES6 AWS2	ES6	1.30 - 2.30	26/06/2015

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG:	150701-1	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320715
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

X **Test**

N **No Determination Possible**

			Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container
			11630066	ES1 AWS1	ES1	0.00 - 0.20	1kg TUB
			11630066	ES1 AWS1	ES1	0.00 - 0.20	250g Amber Jar (AL
			11630067	ES2 AWS1	ES2	0.20 - 1.30	1kg TUB
			11630067	ES2 AWS1	ES2	0.20 - 1.30	250g Amber Jar (AL
			11630068	ES3 AWS1	ES3	1.30 - 2.30	1kg TUB
			11630068	ES3 AWS1	ES3	1.30 - 2.30	250g Amber Jar (AL
			11630069	ES4 AWS2	ES4	0.00 - 0.90	1kg TUB
			11630069	ES4 AWS2	ES4	0.00 - 0.90	250g Amber Jar (AL
			11630070	ES5 AWS2	ES5	0.90 - 1.30	1kg TUB
			11630070	ES5 AWS2	ES5	0.90 - 1.30	250g Amber Jar (AL
			11630071	ES6 AWS2	ES6	1.30 - 2.30	1kg TUB
			11630071	ES6 AWS2	ES6	1.30 - 2.30	250g Amber Jar (AL
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 1					
							X
Asbestos Quantification - Full	All	NDPs: 0 Tests: 1					
							X
Boron Water Soluble	All	NDPs: 0 Tests: 6					
							X
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 6					
			X				
Metals in solid samples by OES	All	NDPs: 0 Tests: 6					
							X
Sample description	All	NDPs: 0 Tests: 5					
							X

CERTIFICATE OF ANALYSIS

SDG:	150701-1	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320715
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
11630066	ES1 AWS1	0.00 - 0.20	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Vegetation
11630067	ES2 AWS1	0.20 - 1.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Vegetation
11630068	ES3 AWS1	1.30 - 2.30	Dark Brown	Sand	0.1 - 2 mm	Stones	None
11630069	ES4 AWS2	0.00 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Crushed Brick
11630070	ES5 AWS2	0.90 - 1.30	Dark Brown	Sand	0.1 - 2 mm	Stones	None
11630071	ES6 AWS2	1.30 - 2.30	Dark Brown	Sand	0.1 - 2 mm	Stones	None

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

CERTIFICATE OF ANALYSIS

SDG:	150701-1	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320715
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	ES1 AWS1	ES2 AWS1	ES3 AWS1	ES4 AWS2	ES5 AWS2	ES6 AWS2
			Depth (m)	0.00 - 0.20	0.20 - 1.30	1.30 - 2.30	0.00 - 0.90	0.90 - 1.30	1.30 - 2.30
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	26/06/2015	26/06/2015	26/06/2015	26/06/2015	26/06/2015	26/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	30/06/2015	30/06/2015	30/06/2015	30/06/2015	30/06/2015	30/06/2015
			SDG Ref	150701-1	150701-1	150701-1	150701-1	150701-1	150701-1
			Lab Sample No.(s)	11630066	11630067	11630068	11630069	11630070	11630071
			AGS Reference	ES1	ES2	ES3	ES4	ES5	ES6
Moisture Content Ratio (% of as received sample)	%	PM024		6.8	15	17	8	13	28
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<3 #	<1.2 #	<0.6 #	<0.6 #	10.7 #
Antimony	<0.6 mg/kg	TM181		15.2 #	27.1 #	436 #	44.4 #	4.03 #	288 #
Arsenic	<0.6 mg/kg	TM181		33.3 M	75.4 M	920 M	97.8 M	20.7 M	299 M
Beryllium	<0.01 mg/kg	TM181		1.07 M	0.713 M	0.338 M	0.359 M	0.373 M	0.776 M
Cadmium	<0.02 mg/kg	TM181		4.64 M	7.24 M	22.3 M	10.3 M	0.465 M	19.9 M
Chromium	<0.9 mg/kg	TM181		12.9 M	16.1 M	16.8 M	26.6 M	10.6 M	16.8 M
Copper	<1.4 mg/kg	TM181		89.5 M	294 M	2000 M	269 M	40.4 M	1930 M
Lead	<0.7 mg/kg	TM181		1290 M	2390 M	35100 M	6540 M	217 M	46000 M
Mercury	<0.14 mg/kg	TM181		<0.14 M	0.219 M	<0.14 M	0.163 M	<0.14 M	<0.14 M
Molybdenum	<0.1 mg/kg	TM181		2.63 #	3.76 #	<1 #	7.65 #	0.494 #	9.84 #
Nickel	<0.2 mg/kg	TM181		29.9 M	57.6 M	40.2 M	117 M	16.8 M	53.3 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<10 #	<1 #	<1 #	3.01 #
Vanadium	<0.2 mg/kg	TM181		20.2 #	23.8 #	23.6 #	32.1 #	15.7 #	29.9 #
Zinc	<1.9 mg/kg	TM181		7600 M	3680 M	41300 M	11000 M	428 M	46100 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	1.09 M	<1 M	<1 M	<1 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150701-1	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320715
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Asbestos Identification - Solid Samples

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	ES4 AWS2 ES 4 0.00 - 0.90 SOLID 26/06/2015 00:00:00 03/07/2015 07:46:34 150701-1 11630069 TM048	7/7/15	Kevin Gill	Loose fibres in soil	Not Detected (#)	Trace (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150701-1	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320715
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Asbestos Quantification - Full

		Additional Asbestos Components (Using TM048)	Analysts Comments	Asbestos Quantification - Gravimetric - %	Asbestos Quantification - PCOM Evaluation - %	Asbestos Quantification - Total - %
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	ES4 AWS2 ES 4 0.00 - 0.90 SOLID 26/06/2015 00:00:00 09/07/2015 11:48:46 150701-1 11630069 TM 304	None (#)	N/C	<0.001 (#)	<0.001 (#)	<0.001 (#)

CERTIFICATE OF ANALYSIS

SDG:	150701-1	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320715
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
TM 304				
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	150701-1	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320715
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	11630066	11630067	11630068	11630069	11630070	11630071
Customer Sample Ref.	ES1 AWS1	ES2 AWS1	ES3 AWS1	ES4 AWS2	ES5 AWS2	ES6 AWS2
AGS Ref.	ES1	ES2	ES3	ES4	ES5	ES6
Depth	0.00 - 0.20	0.20 - 1.30	1.30 - 2.30	0.00 - 0.90	0.90 - 1.30	1.30 - 2.30
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples				07-Jul-2015		
Asbestos Quantification - Full				14-Jul-2015		
Boron Water Soluble	08-Jul-2015	08-Jul-2015	08-Jul-2015	09-Jul-2015	08-Jul-2015	08-Jul-2015
Hexavalent Chromium (s)	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015
Metals in solid samples by OES	07-Jul-2015	07-Jul-2015	08-Jul-2015	09-Jul-2015	07-Jul-2015	08-Jul-2015
Sample description	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015

SDG:	150701-1	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320715
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before presevation was performed
§	Sampled on date not provided
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

ALcontrol Laboratories

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Apex Drilling Services
Sturmi Way
Village Farm Industrial Estate
Pyle
Bridgend
CF33 6BZ

Attention: Robert Brewer

CERTIFICATE OF ANALYSIS

Date:	14 July 2015
Customer:	H_APEXDRL_BGD
Sample Delivery Group (SDG):	150703-112
Your Reference:	10318
Location:	Swansea Bay
Report No:	320813

We received 8 samples on Friday July 03, 2015 and 8 of these samples were scheduled for analysis which was completed on Tuesday July 14, 2015. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager

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Registered Office: Units 7 & 8 Hawarden Business Park, Manor Road, Hawarden, Deeside, CH5 3US. Registered in England and Wales No.

CERTIFICATE OF ANALYSIS

SDG:	150703-112	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320813
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
11653162	TPA6		0.00 - 0.30	01/07/2015
11653159	TPA6		0.30 - 0.90	01/07/2015
11653158	TPA7		0.00 - 0.30	01/07/2015
11653156	TPA7		0.30 - 0.90	01/07/2015
11653169	TPA19		0.00 - 0.30	01/07/2015
11653170	TPA19		0.30 - 0.90	01/07/2015
11653164	TPA20		0.00 - 0.30	01/07/2015
11653166	TPA20		0.30 - 0.90	01/07/2015

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG:	150703-112	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320813
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

X Test

N No Determination Possible

			Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container
			1165316	TPA6		0.00 - 0.30	1kg TUB
			1165315	TPA6		0.30 - 0.90	1kg TUB
			1165315	TPA7		0.00 - 0.30	1kg TUB
			1165315	TPA7		0.30 - 0.90	1kg TUB
			1165316	TPA19		0.00 - 0.30	1kg TUB
			1165317	TPA19		0.30 - 0.90	1kg TUB
			1165316	TPA20		0.00 - 0.30	1kg TUB
			1165316	TPA20		0.30 - 0.90	1kg TUB
Boron Water Soluble	All	NDPs: 0 Tests: 8	X	X	X	X	X	X	X	X
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 8	X	X	X	X	X	X	X	X
Metals in solid samples by OES	All	NDPs: 0 Tests: 8	X	X	X	X	X	X	X	X
Sample description	All	NDPs: 0 Tests: 8	X	X	X	X	X	X	X	X

CERTIFICATE OF ANALYSIS

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Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320813
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	**fine**	0.063mm - 0.1mm	**medium**	0.1mm - 2mm	**coarse**	2mm - 10mm	**very coarse**	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
11653159	TPA6	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Vegetation
11653162	TPA6	0.00 - 0.30	Dark Brown	Loamy Sand	0.1 - 2 mm	Brick	Vegetation
11653156	TPA7	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	None
11653158	TPA7	0.00 - 0.30	Dark Brown	Loamy Sand	0.1 - 2 mm	Brick	Vegetation
11653169	TPA19	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	Stones
11653170	TPA19	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	None
11653164	TPA20	0.00 - 0.30	Dark Brown	Loamy Sand	0.1 - 2 mm	Stones	Vegetation
11653166	TPA20	0.30 - 0.90	Dark Brown	Loamy Sand	0.1 - 2 mm	Brick	Vegetation

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

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Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TPA6	TPA6	TPA7	TPA7	TPA19	TPA19
			Depth (m)	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	01/07/2015	01/07/2015	01/07/2015	01/07/2015	01/07/2015	01/07/2015
			Sample Time	.	.	.	.	.	.
			Date Received	03/07/2015	03/07/2015	03/07/2015	03/07/2015	03/07/2015	03/07/2015
			SDG Ref	150703-112	150703-112	150703-112	150703-112	150703-112	150703-112
			Lab Sample No.(s)	11653162	11653159	11653158	11653156	11653169	11653170
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		5.9	7.9	7.8	11	7	10
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #
Antimony	<0.6 mg/kg	TM181		14.3 #	27.9 #	8.59 #	16.2 #	15.4 #	27.8 #
Arsenic	<0.6 mg/kg	TM181		57.6 M	96.6 M	98.1 M	93 M	99.7 M	123 M
Beryllium	<0.01 mg/kg	TM181		0.592 M	1.15 M	0.533 M	0.694 M	0.667 M	0.76 M
Cadmium	<0.02 mg/kg	TM181		3.61 M	5.55 M	2.64 M	3.97 M	3.32 M	5.11 M
Chromium	<0.9 mg/kg	TM181		11.2 M	14.3 M	10.2 M	12.2 M	13.7 M	24.2 M
Copper	<1.4 mg/kg	TM181		124 M	167 M	110 M	134 M	117 M	167 M
Lead	<0.7 mg/kg	TM181		2000 M	2430 M	698 M	1490 M	1810 M	2430 M
Mercury	<0.14 mg/kg	TM181		0.831 M	0.36 M	1.12 M	0.221 M	0.309 M	<0.14 M
Molybdenum	<0.1 mg/kg	TM181		2.75 #	3.99 #	1.44 #	2.55 #	2.62 #	5.84 #
Nickel	<0.2 mg/kg	TM181		23.9 M	29.9 M	19.9 M	43.6 M	32 M	92.8 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Vanadium	<0.2 mg/kg	TM181		17.9 #	25.6 #	16.5 #	20.2 #	20.2 #	29.9 #
Zinc	<1.9 mg/kg	TM181		2610 M	3200 M	1270 M	2390 M	2200 M	3840 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M

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Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
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*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TPA20	TPA20
			Depth (m)	0.00 - 0.30	0.30 - 0.90
			Sample Type	Soil/Solid	Soil/Solid
			Date Sampled	01/07/2015	01/07/2015
			Sample Time	.	.
			Date Received	03/07/2015	03/07/2015
			SDG Ref	150703-112	150703-112
			Lab Sample No.(s)	11653164	11653166
			AGS Reference		
Moisture Content Ratio (% of as received sample)	%	PM024		8.6	10
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #
Antimony	<0.6 mg/kg	TM181		11.4 #	27.8 #
Arsenic	<0.6 mg/kg	TM181		37 M	88.3 M
Beryllium	<0.01 mg/kg	TM181		0.37 M	0.827 M
Cadmium	<0.02 mg/kg	TM181		3.34 M	4.96 M
Chromium	<0.9 mg/kg	TM181		11.5 M	17 M
Copper	<1.4 mg/kg	TM181		112 M	152 M
Lead	<0.7 mg/kg	TM181		777 M	2970 M
Mercury	<0.14 mg/kg	TM181		2.65 M	0.737 M
Molybdenum	<0.1 mg/kg	TM181		1.99 #	4.03 #
Nickel	<0.2 mg/kg	TM181		52.8 M	86.4 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #
Vanadium	<0.2 mg/kg	TM181		15.4 #	21.1 #
Zinc	<1.9 mg/kg	TM181		1850 M	3930 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M

CERTIFICATE OF ANALYSIS

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Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

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Test Completion Dates

Lab Sample No(s)	11653159	11653162	11653156	11653158	11653169	11653170	11653164	11653166
Customer Sample Ref.	TPA6	TPA6	TPA7	TPA7	TPA19	TPA19	TPA20	TPA20
AGS Ref.								
Depth	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Boron Water Soluble	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015
Hexavalent Chromium (s)	13-Jul-2015	13-Jul-2015	13-Jul-2015	14-Jul-2015	13-Jul-2015	13-Jul-2015	14-Jul-2015	13-Jul-2015
Metals in solid samples by OES	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	10-Jul-2015	13-Jul-2015
Sample description	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015

SDG:	150703-112	**Location:**	Swansea Bay	**Order Number:**	3074
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Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before presevation was performed
§	Sampled on date not provided
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

ALcontrol Laboratories

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Website: www.alcontrol.com

Apex Drilling Services
Sturmi Way
Village Farm Industrial Estate
Pyle
Bridgend
CF33 6BZ

Attention: Robert Brewer

CERTIFICATE OF ANALYSIS

Date:	15 July 2015
Customer:	H_APEXDRL_BGD
Sample Delivery Group (SDG):	150625-113
Your Reference:	10318
Location:	Swansea Bay
Report No:	320875

We received 25 samples on Thursday June 25, 2015 and 10 of these samples were scheduled for analysis which was completed on Tuesday July 14, 2015. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager

Alcontrol Laboratories is a trading division of ALcontrol UK Limited
Registered Office: Units 7 & 8 Hawarden Business Park, Manor Road, Hawarden, Deeside, CH5 3US. Registered in England and Wales No.

CERTIFICATE OF ANALYSIS

SDG:	150625-113	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
11604431	TP24	ES1	0.20	23/06/2015
11604432	TP24	ES2	1.00	23/06/2015
11604433	TP24	ES3	2.00	23/06/2015
11604434	TP26	ES4	0.30	23/06/2015
11604435	TP26	ES5	1.00	23/06/2015
11604436	TP26	ES6	2.00	23/06/2015
11604437	TP28	ES7	0.30	23/06/2015
11604438	TP28	ES8	1.00	23/06/2015
11604440	TP28	ES9	1.50	23/06/2015
11604441	TP30	ES10	0.30	23/06/2015
11604442	TP30	ES11	1.00	23/06/2015
11604443	TP30	ES12	1.80	23/06/2015
11604444	TP32	ES1	0.20	24/06/2015
11604445	TP32	ES2	1.00	24/06/2015
11604446	TP32		2.00	24/06/2015
11604447	TP32	ES3	2.50	24/06/2015
11604448	TP34	ES4	0.30	24/06/2015
11604449	TP34	ES5	1.00	24/06/2015
11604450	TP34	ES6	1.50	24/06/2015
11604451	TP37	ES7	0.30	24/06/2015
11604452	TP37	ES8	1.00	24/06/2015
11604453	TP37	ES9	2.00	24/06/2015
11604455	TP39	ES10	0.30	24/06/2015
11604456	TP39	ES11	1.00	24/06/2015
11604457	TP39	ES12	2.00	24/06/2015

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG:	150625-113	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

X Test

N No Determination Possible

Lab Sample No(s)			11604431	11604435	11604437	11604438	11604441	11604447	11604449	11604451	11604456	11604457
Customer Sample Reference			TP24	TP26	TP28	TP28	TP30	TP32	TP34	TP37	TP39	TP39
AGS Reference			ES1	ES5	ES7	ES8	ES10	ES3	ES5	ES7	ES11	ES12
Depth (m)			0.20	1.00	0.30	1.00	0.30	2.50	1.00	0.30	1.00	2.00
Container			1kg TUB / 250g Amber Jar (AL)	60g VOC (ALE215) / 1kg TUB	250g Amber Jar (AL) / 60g VOC (ALE215)	1kg TUB / 250g Amber Jar (AL)	60g VOC (ALE215) / 1kg TUB	250g Amber Jar (AL) / 60g VOC (ALE215)	1kg TUB / 250g Amber Jar (AL)	60g VOC (ALE215) / 1kg TUB	250g Amber Jar (AL) / 60g VOC (ALE215)	1kg TUB / 250g Amber Jar (AL)
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 8	X	X		X	X	X	X	X	X	
Boron Water Soluble	All	NDPs: 0 Tests: 8	X	X		X	X	X	X	X	X	
CEN Readings	All	NDPs: 0 Tests: 2			X							X
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 10	X	X	X	X	X	X	X	X	X	X
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 2			X							X
Dissolved Organic/Inorganic Carbon	All	NDPs: 0 Tests: 2			X							X
EPH CWG (Aliphatic) Aqueous GC (W)	All	NDPs: 0 Tests: 2			X							X
EPH CWG (Aliphatic) GC (S)	All	NDPs: 0 Tests: 8	X	X		X	X	X	X	X	X	
EPH CWG (Aromatic) Aqueous GC (W)	All	NDPs: 0 Tests: 2			X							X
EPH CWG (Aromatic) GC (S)	All	NDPs: 0 Tests: 8	X	X		X	X	X	X	X	X	
GRO by GC-FID (S)	All	NDPs: 0 Tests: 8		X	X		X	X	X	X	X	
GRO by GC-FID (W)	All	NDPs: 0 Tests: 2			X							X
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 8	X	X		X	X	X	X	X	X	
Hexavalent Chromium (w)	All	NDPs: 0 Tests: 2			X							X
Mercury Dissolved	All	NDPs: 0 Tests: 2			X							X

CERTIFICATE OF ANALYSIS

SDG:	150625-113	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

X **Test**

N **No Determination Possible**

			Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container
			11604431	TP24	ES1	0.20	1kg TUB / 250g Amber Jar (AL
			11604435	TP26	ES5	1.00	1kg TUB / 60g VOC (ALE215) / 250g Amber Jar (AL
			11604437	TP28	ES7	0.30	1kg TUB / 250g Amber Jar (AL
			11604438	TP28	ES8	1.00	1kg TUB / 60g VOC (ALE215) / 250g Amber Jar (AL
			11604441	TP30	ES10	0.30	1kg TUB / 60g VOC (ALE215) / 250g Amber Jar (AL
			11604447	TP32	ES3	2.50	1kg TUB / 60g VOC (ALE215) / 250g Amber Jar (AL
			11604449	TP34	ES5	1.00	1kg TUB / 60g VOC (ALE215) / 250g Amber Jar (AL
			11604451	TP37	ES7	0.30	1kg TUB / 60g VOC (ALE215) / 250g Amber Jar (AL
			11604456	TP39	ES11	1.00	1kg TUB / 60g VOC (ALE215) / 250g Amber Jar (AL
			11604457	TP39	ES12	2.00	1kg TUB / 250g Amber Jar (AL
Metals in solid samples by OES	All	NDPs: 0 Tests: 8					X X X X X X X X
PAH by GCMS	All	NDPs: 0 Tests: 8					X X X X X X X X
PAH Spec MS - Aqueous (W)	All	NDPs: 0 Tests: 2					X X
pH	All	NDPs: 0 Tests: 8					X X X X X X X X
pH Value of Filtered Water	All	NDPs: 0 Tests: 2					X X
Sample description	All	NDPs: 0 Tests: 10					X X X X X X X X X X
Total Organic Carbon	All	NDPs: 0 Tests: 8					X X X X X X X X
TPH CWG (W)	All	NDPs: 0 Tests: 2					X X
TPH CWG GC (S)	All	NDPs: 0 Tests: 8					X X X X X X X X

CERTIFICATE OF ANALYSIS

SDG:	150625-113	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
11604431	TP24	0.20	Dark Brown	Sand	0.1 - 2 mm	Stones	Vegetation
11604435	TP26	1.00	Light Brown	Sand	0.1 - 2 mm	None	None
11604437	TP28	0.30	Dark Brown	Sand	0.1 - 2 mm	Vegetation	None
11604438	TP28	1.00	Light Brown	Sand	0.1 - 2 mm	Stones	None
11604441	TP30	0.30	Dark Brown	Sand	0.1 - 2 mm	Stones	Vegetation
11604447	TP32	2.50	Light Brown	Sand	0.1 - 2 mm	Stones	N/A
11604449	TP34	1.00	Dark Brown	Sand	0.1 - 2 mm	Vegetation	N/A
11604451	TP37	0.30	Dark Brown	Sand	0.1 - 2 mm	Stones	Vegetation
11604456	TP39	1.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	Stones
11604457	TP39	2.00	Light Brown	Sand	0.1 - 2 mm	Vegetation	Oil/Petroleum

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

CERTIFICATE OF ANALYSIS

SDG:	150625-113	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TP24	TP26	TP28	TP28	TP30	TP32
			Depth (m)	0.20	1.00	0.30	1.00	0.30	2.50
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	23/06/2015	23/06/2015	23/06/2015	23/06/2015	23/06/2015	24/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	25/06/2015	25/06/2015	25/06/2015	25/06/2015	25/06/2015	25/06/2015
			SDG Ref	150625-113	150625-113	150625-113	150625-113	150625-113	150625-113
			Lab Sample No.(s)	11604431	11604435	11604437	11604438	11604441	11604447
			AGS Reference	ES1	ES5	ES7	ES8	ES10	ES3
Moisture Content Ratio (% of as received sample)	%	PM024		2.8	3.2	2.4	0	5.6	12
Organic Carbon, Total	<0.2 %	TM132		1.13 M	0.344 M		0.401 M	1.94 M	0.485 M
pH	1 pH Units	TM133		8.65 M	9.03 M		9.08 M	7.97 M	8.66 M
Chromium, Hexavalent	<0.6 mg/kg	TM151		<1.2 #	<0.6 #		<0.6 #	<1.2 #	<0.6 #
Cyanide, Total	<1 mg/kg	TM153		<1 ♦ M	<1 ♦ M		<1 ♦ M	<1 ♦ M	<1 M
Antimony	<0.6 mg/kg	TM181		3.43 #	0.769 #		0.746 #	2.92 #	1.12 #
Arsenic	<0.6 mg/kg	TM181		26.3 M	14.2 M		15.9 M	25.9 M	20 M
Beryllium	<0.01 mg/kg	TM181		0.375 M	0.147 M		0.116 M	0.335 M	0.152 M
Cadmium	<0.02 mg/kg	TM181		1.14 M	0.548 M		0.682 M	0.471 M	0.547 M
Chromium	<0.9 mg/kg	TM181		9.85 M	5.26 M		5.7 M	9.34 M	6.29 M
Copper	<1.4 mg/kg	TM181		46.5 M	19.6 M		20.4 M	47.8 M	49.4 M
Lead	<0.7 mg/kg	TM181		237 M	32.3 M		48.7 M	357 M	72.9 M
Mercury	<0.14 mg/kg	TM181		<0.14 M	<0.14 M		<0.14 M	<0.14 M	<0.14 M
Molybdenum	<0.1 mg/kg	TM181		0.861 #	0.293 #		0.151 #	0.412 #	0.14 #
Nickel	<0.2 mg/kg	TM181		16.5 M	6.12 M		9.29 M	20.2 M	9.12 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #		<1 #	<1 #	<1 #
Vanadium	<0.2 mg/kg	TM181		17.1 #	11.1 #		11.7 #	16.1 #	11.8 #
Zinc	<1.9 mg/kg	TM181		495 M	112 M		234 M	457 M	219 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M		<1 M	<1 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150625-113	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TP34	TP37	TP39	TP39		
			Depth (m)	1.00	0.30	1.00	2.00		
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid		
			Date Sampled	24/06/2015	24/06/2015	24/06/2015	24/06/2015		
			Sample Time	.	.	.	.		
			Date Received	25/06/2015	25/06/2015	25/06/2015	25/06/2015		
			SDG Ref	150625-113	150625-113	150625-113	150625-113		
			Lab Sample No.(s)	11604449	11604451	11604456	11604457		
			AGS Reference	ES5	ES7	ES11	ES12		
Moisture Content Ratio (% of as received sample)	%	PM024		7.5	5.8	4.9	4.6		
Organic Carbon, Total	<0.2 %	TM132		3.63 M	7.87 M	0.265 M			
pH	1 pH Units	TM133		9.64 M	8.27 M	8.23 M			
Chromium, Hexavalent	<0.6 mg/kg	TM151		<1.2 #	<1.2 #	<0.6 #			
Cyanide, Total	<1 mg/kg	TM153		<1 M	<1 M	<1 M			
Antimony	<0.6 mg/kg	TM181		9.82 #	35.3 #	<0.6 #			
Arsenic	<0.6 mg/kg	TM181		73.1 M	248 M	11.1 M			
Beryllium	<0.01 mg/kg	TM181		0.319 M	0.51 M	0.0501 M			
Cadmium	<0.02 mg/kg	TM181		2.2 M	2.94 M	0.232 M			
Chromium	<0.9 mg/kg	TM181		10 M	12.4 M	4.12 M			
Copper	<1.4 mg/kg	TM181		130 M	196 M	15.4 M			
Lead	<0.7 mg/kg	TM181		1120 M	5380 M	6.72 M			
Mercury	<0.14 mg/kg	TM181		<0.14 M	0.21 M	<0.14 M			
Molybdenum	<0.1 mg/kg	TM181		0.965 #	3.39 #	<0.1 #			
Nickel	<0.2 mg/kg	TM181		19.5 M	31.2 M	4.21 M			
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #			
Vanadium	<0.2 mg/kg	TM181		18.3 #	25 #	10.2 #			
Zinc	<1.9 mg/kg	TM181		2050 M	12400 M	32.9 M			
Boron, water soluble	<1 mg/kg	TM222		1.2 M	1.11 M	<1 M			

CERTIFICATE OF ANALYSIS

SDG:	150625-113	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

PAH by GCMS

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TP24	TP26	TP28	TP30	TP32	TP34
			Depth (m)	0.20	1.00	1.00	0.30	2.50	1.00
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	23/06/2015	23/06/2015	23/06/2015	23/06/2015	24/06/2015	24/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	25/06/2015	25/06/2015	25/06/2015	25/06/2015	25/06/2015	25/06/2015
			SDG Ref	150625-113	150625-113	150625-113	150625-113	150625-113	150625-113
			Lab Sample No.(s)	11604431	11604435	11604438	11604441	11604447	11604449
			AGS Reference	ES1	ES5	ES8	ES10	ES3	ES5
Naphthalene-d8 % recovery**	%	TM218		99.4	99.2	100	103	106	99.6
Acenaphthene-d10 % recovery**	%	TM218		97.7	97.6	97.9	101	107	97.2
Phenanthrene-d10 % recovery**	%	TM218		97	97.2	96.3	101	105	96.6
Chrysene-d12 % recovery**	%	TM218		92.6	89.2	86	93.6	97.4	92.8
Perylene-d12 % recovery**	%	TM218		95.4	91.8	84.8	95.3	98.1	95.5
Naphthalene	<9 µg/kg	TM218		47.8 M	16.7 M	13.6 M	135 M	56 M	150 M
Acenaphthylene	<12 µg/kg	TM218		58.7 M	<12 M	<12 M	25.4 M	<12 M	98.3 M
Acenaphthene	<8 µg/kg	TM218		190 M	9.02 M	11 M	95.3 M	22.8 M	411 M
Fluorene	<10 µg/kg	TM218		194 M	<10 M	<10 M	73.1 M	<10 M	328 M
Phenanthrene	<15 µg/kg	TM218		2270 M	106 M	109 M	1420 M	197 M	3560 M
Anthracene	<16 µg/kg	TM218		724 M	20.6 M	18.2 M	239 M	44.9 M	597 M
Fluoranthene	<17 µg/kg	TM218		6010 M	231 M	142 M	2330 M	277 M	5350 M
Pyrene	<15 µg/kg	TM218		4100 M	176 M	118 M	1870 M	300 M	3930 M
Benz(a)anthracene	<14 µg/kg	TM218		3430 M	131 M	73.7 M	990 M	107 M	2380 M
Chrysene	<10 µg/kg	TM218		3140 M	122 M	78.2 M	1080 M	130 M	2590 M
Benzo(b)fluoranthene	<15 µg/kg	TM218		5320 M	219 M	117 M	1680 M	224 M	4140 M
Benzo(k)fluoranthene	<14 µg/kg	TM218		1950 M	62.8 M	39.8 M	535 M	73.8 M	1350 M
Benzo(a)pyrene	<15 µg/kg	TM218		2980 M	116 M	70.2 M	1040 M	147 M	2350 M
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218		1750 M	79.5 M	52.9 M	582 M	92 M	1360 M
Dibenzo(a,h)anthracene	<23 µg/kg	TM218		691 M	28.7 M	<23 M	180 M	29.2 M	493 M
Benzo(g,h,i)perylene	<24 µg/kg	TM218		1930 M	117 M	74.8 M	710 M	133 M	1600 M
PAH, Total Detected USEPA 16	<118 µg/kg	TM218		34800	1430	917	13000	1830	30700

CERTIFICATE OF ANALYSIS

SDG:	150625-113	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

PAH by GCMS

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TP37	TP39				
			Depth (m)	0.30	1.00				
			Sample Type	Soil/Solid	Soil/Solid				
			Date Sampled	24/06/2015	24/06/2015				
			Sample Time	.	.				
			Date Received	25/06/2015	25/06/2015				
			SDG Ref	150625-113	150625-113				
			Lab Sample No.(s)	11604451	11604456				
			AGS Reference	ES7	ES11				
Naphthalene-d8 % recovery**	%	TM218		104	92.9				
Acenaphthene-d10 % recovery**	%	TM218		103	94.2				
Phenanthrene-d10 % recovery**	%	TM218		101	95.9				
Chrysene-d12 % recovery**	%	TM218		92.7	107				
Perylene-d12 % recovery**	%	TM218		92.2	118				
Naphthalene	<9 µg/kg	TM218		165 M	429 M				
Acenaphthylene	<12 µg/kg	TM218		57.8 M	<12 M				
Acenaphthene	<8 µg/kg	TM218		105 M	241 M				
Fluorene	<10 µg/kg	TM218		100 M	707 M				
Phenanthrene	<15 µg/kg	TM218		1650 M	1220 M				
Anthracene	<16 µg/kg	TM218		320 M	372 M				
Fluoranthene	<17 µg/kg	TM218		2860 M	171 M				
Pyrene	<15 µg/kg	TM218		2220 M	372 M				
Benz(a)anthracene	<14 µg/kg	TM218		1360 M	125 M				
Chrysene	<10 µg/kg	TM218		1400 M	155 M				
Benzo(b)fluoranthene	<15 µg/kg	TM218		2210 M	132 M				
Benzo(k)fluoranthene	<14 µg/kg	TM218		863 M	<14 M				
Benzo(a)pyrene	<15 µg/kg	TM218		1410 M	121 M				
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218		767 M	77.7 M				
Dibenzo(a,h)anthracene	<23 µg/kg	TM218		272 M	26.5 M				
Benzo(g,h,i)perylene	<24 µg/kg	TM218		924 M	130 M				
PAH, Total Detected USEPA 16	<118 µg/kg	TM218		16700	4280				

CERTIFICATE OF ANALYSIS

SDG:	150625-113	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

TPH CWG (S)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TP24	TP26	TP28	TP30	TP32	TP34
			Depth (m)	0.20	1.00	1.00	0.30	2.50	1.00
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	23/06/2015	23/06/2015	23/06/2015	23/06/2015	24/06/2015	24/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	25/06/2015	25/06/2015	25/06/2015	25/06/2015	25/06/2015	25/06/2015
			SDG Ref	150625-113	150625-113	150625-113	150625-113	150625-113	150625-113
			Lab Sample No.(s)	11604431	11604435	11604438	11604441	11604447	11604449
			AGS Reference	ES1	ES5	ES8	ES10	ES3	ES5
GRO Surrogate % recovery**	%	TM089		51	87	74	65	98	93
GRO TOT (Moisture Corrected)	<44 µg/kg	TM089		<44 M	<44 M	<44 M	<44 M	1810000 3 M	272 M
Methyl tertiary butyl ether (MTBE)	<5 µg/kg	TM089		<5 M	<5 M	<5 M	<5 M	<100 M	<5 M
Benzene	<10 µg/kg	TM089		<10 M	<10 M	<10 M	<10 M	<200 M	<10 M
Toluene	<2 µg/kg	TM089		<2 M	<2 M	<2 M	<2 M	<40 M	<2 M
Ethylbenzene	<3 µg/kg	TM089		7.2 M	4.13 M	3 M	<3 M	<60 M	<3 M
m,p-Xylene	<6 µg/kg	TM089		<6 M	<6 M	<6 M	<6 M	<120 M	<6 M
o-Xylene	<3 µg/kg	TM089		<3 M	<3 M	<3 M	<3 M	<60 M	<3 M
sum of detected mpo xylene by GC	<9 µg/kg	TM089		<9	<9	<9	<9	<9	<9
sum of detected BTEX by GC	<24 µg/kg	TM089		<24	<24	<24	<24	<24	<24
Aliphatics >C5-C6	<10 µg/kg	TM089		<10	<10	<10	<10	<200 3	17.3
Aliphatics >C6-C8	<10 µg/kg	TM089		<10	<10	<10	<10	1330 3	27.1
Aliphatics >C8-C10	<10 µg/kg	TM089		<10	<10	<10	<10	410000 3	46.5
Aliphatics >C10-C12	<10 µg/kg	TM089		<10	<10	<10	<10	674000 3	87.6
Aliphatics >C12-C16	<100 µg/kg	TM173		707	507	874	382	185000	1560
Aliphatics >C16-C21	<100 µg/kg	TM173		1950	4930	<100	585	129000	6280
Aliphatics >C21-C35	<100 µg/kg	TM173		4690	7750	<100	6560	34600	63900
Aliphatics >C35-C44	<100 µg/kg	TM173		1420	129	<100	<100	1740	20800
Total Aliphatics >C12-C44	<100 µg/kg	TM173		8770	13300	874	7530	351000	92600
Aromatics >EC5-EC7	<10 µg/kg	TM089		<10	<10	<10	<10	<200 3	<10
Aromatics >EC7-EC8	<10 µg/kg	TM089		<10	<10	<10	<10	<200 3	<10
Aromatics >EC8-EC10	<10 µg/kg	TM089		11.3	13.4	<10	<10	273000 3	32.5
Aromatics >EC10-EC12	<10 µg/kg	TM089		<10	<10	<10	<10	449000 3	58.4
Aromatics >EC12-EC16	<100 µg/kg	TM173		413	1540	1350	471	40200	1860
Aromatics >EC16-EC21	<100 µg/kg	TM173		23200	2870	2000	8290	46300	17600
Aromatics >EC21-EC35	<100 µg/kg	TM173		132000	9760	5990	30500	41100	83200
Aromatics >EC35-EC44	<100 µg/kg	TM173		36400	3610	2740	8780	13100	47700
Aromatics >EC40-EC44	<100 µg/kg	TM173		13000	1250	1110	3110	5220	19600
Total Aromatics >EC12-EC44	<100 µg/kg	TM173		192000	17800	12100	48000	141000	150000
Total Aliphatics & Aromatics >C5-C44	<100 µg/kg	TM173		201000	31100	13000	55500	2300000	243000

CERTIFICATE OF ANALYSIS

SDG:	150625-113	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

TPH CWG (S)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TP37	TP39				
			Depth (m)	0.30	1.00				
			Sample Type	Soil/Solid	Soil/Solid				
			Date Sampled	24/06/2015	24/06/2015				
			Sample Time	.	.				
			Date Received	25/06/2015	25/06/2015				
			SDG Ref	150625-113	150625-113				
			Lab Sample No.(s)	11604451	11604456				
			AGS Reference	ES7	ES11				
GRO Surrogate % recovery**	%	TM089		32	110 ♦				
GRO TOT (Moisture Corrected)	<44 µg/kg	TM089		303 M	761000 ♦ M				
Methyl tertiary butyl ether (MTBE)	<5 µg/kg	TM089		<5 M	<100 ♦ M				
Benzene	<10 µg/kg	TM089		<10 M	<200 ♦ M				
Toluene	<2 µg/kg	TM089		<2 M	<40 ♦ M				
Ethylbenzene	<3 µg/kg	TM089		<3 M	<60 ♦ M				
m,p-Xylene	<6 µg/kg	TM089		<6 M	<120 ♦ M				
o-Xylene	<3 µg/kg	TM089		<3 M	<60 ♦ M				
sum of detected mpo xylene by GC	<9 µg/kg	TM089		<9	<9 ♦				
sum of detected BTEX by GC	<24 µg/kg	TM089		<24	<24 ♦				
Aliphatics >C5-C6	<10 µg/kg	TM089		21.2	<200 ♦				
Aliphatics >C6-C8	<10 µg/kg	TM089		83.8	19700 ♦				
Aliphatics >C8-C10	<10 µg/kg	TM089		45.6	179000 ♦				
Aliphatics >C10-C12	<10 µg/kg	TM089		73.2	266000 ♦				
Aliphatics >C12-C16	<100 µg/kg	TM173		2640	938000				
Aliphatics >C16-C21	<100 µg/kg	TM173		4700	618000				
Aliphatics >C21-C35	<100 µg/kg	TM173		39100	601000				
Aliphatics >C35-C44	<100 µg/kg	TM173		5100	132000				
Total Aliphatics >C12-C44	<100 µg/kg	TM173		51500	2290000				
Aromatics >EC5-EC7	<10 µg/kg	TM089		<10	<200 ♦				
Aromatics >EC7-EC8	<10 µg/kg	TM089		<10	<200 ♦				
Aromatics >EC8-EC10	<10 µg/kg	TM089		30.8	119000 ♦				
Aromatics >EC10-EC12	<10 µg/kg	TM089		48.8	177000 ♦				
Aromatics >EC12-EC16	<100 µg/kg	TM173		1680	69600				
Aromatics >EC16-EC21	<100 µg/kg	TM173		15400	131000				
Aromatics >EC21-EC35	<100 µg/kg	TM173		60400	261000				
Aromatics >EC35-EC44	<100 µg/kg	TM173		16400	79200				
Aromatics >EC40-EC44	<100 µg/kg	TM173		5800	29100				
Total Aromatics >EC12-EC44	<100 µg/kg	TM173		94000	541000				
Total Aliphatics & Aromatics >C5-C44	<100 µg/kg	TM173		146000	3590000				

CERTIFICATE OF ANALYSIS

SDG:	150625-113	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Asbestos Identification - Solid Samples

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP24 ES 1 0.20 SOLID 23/06/2015 00:00:00 27/06/2015 14:54:28 150625-113 11604431 TM048	30/6/15	Rebecca Rawlings	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP26 ES 5 1.00 SOLID 23/06/2015 00:00:00 29/06/2015 06:29:57 150625-113 11604435 TM048	30/6/15	Rebecca Rawlings	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP28 ES 8 1.00 SOLID 23/06/2015 00:00:00 29/06/2015 06:22:43 150625-113 11604438 TM048	30/6/15	Rebecca Rawlings	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP30 ES 10 0.30 SOLID 23/06/2015 00:00:00 29/06/2015 06:34:42 150625-113 11604441 TM048	30/6/15	Rebecca Rawlings	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP32 ES 3 2.50 SOLID 24/06/2015 00:00:00 27/06/2015 08:26:27 150625-113 11604447 TM048	30/6/15	Rebecca Rawlings	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150625-113	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP34 ES 5 1.00 SOLID 24/06/2015 00:00:00 27/06/2015 08:32:25 150625-113 11604449 TM048	30/6/15	Rebecca Rawlings	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP37 ES 7 0.30 SOLID 24/06/2015 00:00:00 27/06/2015 08:20:00 150625-113 11604451 TM048	30/6/15	Rebecca Rawlings	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP39 ES 11 1.00 SOLID 24/06/2015 00:00:00 27/06/2015 15:27:06 150625-113 11604456 TM048	30/6/15	Rebecca Rawlings	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150625-113	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.094	**Natural Moisture Content (%)**	4.28
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	95.9
Particle Size <4mm	>95%		

Case	
SDG	150625-113
Lab Sample Number(s)	11604437
Sampled Date	23-Jun-2015
Customer Sample Ref.	TP28 ES7
Depth (m)	0.30

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Hexavalent Chromium	<0.03	<0.03	<0.3	<0.3	-	-	-
pH Value of Filtered Water	7.6	<0.001	76	<0.01	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	0.00159	<0.00016	0.0159	<0.0016	-	-	-
Arsenic	0.00458	<0.00012	0.0458	<0.0012	-	-	-
Total Cyanide (W)	<0.05	<0.05	<0.5	<0.5	-	-	-
Beryllium	<0.00007	<0.00007	<0.0007	<0.0007	-	-	-
Boron	0.0409	<0.0094	0.409	<0.094	-	-	-
Cadmium	<0.0001	<0.0001	<0.001	<0.001	-	-	-
Chromium	0.00085	<0.00022	0.0085	<0.0022	-	-	-
Copper	0.00916	<0.00085	0.0916	<0.0085	-	-	-
Lead	0.00931	<0.00002	0.0931	<0.0002	-	-	-
Molybdenum	0.00121	<0.00024	0.0121	<0.0024	-	-	-
Nickel	0.00156	<0.00015	0.0156	<0.0015	-	-	-
Selenium	<0.00039	<0.00039	<0.0039	<0.0039	-	-	-
Vanadium	0.00202	<0.00024	0.0202	<0.0024	-	-	-
Zinc	0.0174	<0.00041	0.174	<0.0041	-	-	-
PAH Spec MS - Aqueous (W)							
Naphthalene by GCMS	<0.0001	<0.0001	<0.001	<0.001	-	-	-
Acenaphthene by GCMS	<0.000015	<0.000015	<0.00015	<0.00015	-	-	-
Acenaphthylene by GCMS	<0.000011	<0.000011	<0.00011	<0.00011	-	-	-
Fluoranthene by GCMS	0.000039	<0.000017	0.00039	<0.00017	-	-	-
Anthracene by GCMS	<0.000015	<0.000015	<0.00015	<0.00015	-	-	-
Phenanthrene by GCMS	0.0000359	<0.000022	0.000359	<0.00022	-	-	-
Fluorene by GCMS	<0.000014	<0.000014	<0.00014	<0.00014	-	-	-
Chrysene by GCMS	0.0000236	<0.000013	0.000236	<0.00013	-	-	-
Pyrene by GCMS	0.0000273	<0.000015	0.000273	<0.00015	-	-	-
Benz(a)anthracene by GCMS	<0.000017	<0.000017	<0.00017	<0.00017	-	-	-
Benzo(b)fluoranthene by GCMS	0.0000305	<0.000023	0.000305	<0.00023	-	-	-
Benzo(k)fluoranthene by GCMS	<0.000027	<0.000027	<0.00027	<0.00027	-	-	-
Benzo(a)pyrene by GCMS	0.0000138	<0.000009	0.000138	<0.00009	-	-	-
Dibenzo(ah)anthracene by GCMS	<0.000016	<0.000016	<0.00016	<0.00016	-	-	-
Benzo(ghi)perylene by GCMS	0.0000344	<0.000016	0.000344	<0.00016	-	-	-
Indeno(123cd)pyrene by GCMS	0.000019	<0.000014	0.00019	<0.00014	-	-	-
PAH 16 EPA Total by GCMS	<0.000344	<0.000344	<0.00344	<0.00344	-	-	-

Leach Test Information

Date Prepared	30-Jun-2015
pH (pH Units)	8.58
Conductivity (µS/cm)	103.00
Temperature (°C)	21.50
Volume Leachant (Litres)	0.896

Mcerts Certification does not apply to leachates

15/07/2015 05:32:31

05:32:21 15/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150625-113	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

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Case	
SDG	150625-113
Lab Sample Number(s)	11604437
Sampled Date	23-Jun-2015
Customer Sample Ref.	TP28 ES7
Depth (m)	0.30

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
TPH CWG (W)							
Surrogate Recovery	-	<0	-	<0	-	-	-
GRO TOT (C5-C12)	<0.05	<0.05	<0.5	<0.5	-	-	-
Aliphatics C5-C6	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C6-C8	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C8-C10	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C10-C12	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C12-C16	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C16-C21	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C21-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Total Aliphatics >C12-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics C6-C7	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >C7-C8	<0.01	<0.01	<0.1	<0.1	-	-	-
MTBE GC-FID	<0.003	<0.003	<0.03	<0.03	-	-	-
Aromatics >EC8 -EC10	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC10-EC12	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC12-EC16	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC16-EC21	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC21-EC35	<0.01	<0.01	<0.1	<0.1	-	-	-
Total Aromatics >EC12-EC35	<0.01	<0.01	<0.1	<0.1	-	-	-
Benzene by GC	<0.007	<0.007	<0.07	<0.07	-	-	-
TPH (Total Aliphatics + Total Aromatics) >C5-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Toluene by GC	<0.004	<0.004	<0.04	<0.04	-	-	-
Ethylbenzene by GC	<0.005	<0.005	<0.05	<0.05	-	-	-
m & p Xylene by GC	<0.008	<0.008	<0.08	<0.08	-	-	-
o Xylene by GC	<0.003	<0.003	<0.03	<0.03	-	-	-
Sum m&p and o Xylene by GC	<0.011	<0.011	<0.11	<0.11	-	-	-
Sum of BTEX by GC	<0.028	<0.028	<0.28	<0.28	-	-	-

Leach Test Information

Date Prepared	30-Jun-2015
pH (pH Units)	8.58
Conductivity (µS/cm)	103.00
Temperature (°C)	21.50
Volume Leachant (Litres)	0.896

Mcerts Certification does not apply to leachates

15/07/2015 05:32:31

05:32:21 15/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150625-113	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.095	**Natural Moisture Content (%)**	4.95
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	95.3
Particle Size <4mm	>95%		

Case	
SDG	150625-113
Lab Sample Number(s)	11604457
Sampled Date	24-Jun-2015
Customer Sample Ref.	TP39 ES12
Depth (m)	2.00

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Hexavalent Chromium	<0.03	<0.03	<0.3	<0.3	-	-	-
pH Value of Filtered Water	7.7	<0.001	77	<0.01	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	0.00332	<0.00016	0.0332	<0.0016	-	-	-
Arsenic	0.0563	<0.00012	0.563	<0.0012	-	-	-
Total Cyanide (W)	<0.05	<0.05	<0.5	<0.5	-	-	-
Beryllium	<0.00007	<0.00007	<0.0007	<0.0007	-	-	-
Boron	0.0433	<0.0094	0.433	<0.094	-	-	-
Cadmium	<0.0001	<0.0001	<0.001	<0.001	-	-	-
Chromium	0.000399	<0.00022	0.00399	<0.0022	-	-	-
Copper	0.00681	<0.00085	0.0681	<0.0085	-	-	-
Lead	0.00166	<0.00002	0.0166	<0.0002	-	-	-
Molybdenum	0.0039	<0.00024	0.039	<0.0024	-	-	-
Nickel	0.000917	<0.00015	0.00917	<0.0015	-	-	-
Selenium	<0.00039	<0.00039	<0.0039	<0.0039	-	-	-
Vanadium	0.0178	<0.00024	0.178	<0.0024	-	-	-
Zinc	0.00582	<0.00041	0.0582	<0.0041	-	-	-
PAH Spec MS - Aqueous (W)							
Naphthalene by GCMS	<0.0002	<0.0002	<0.002	<0.002	-	-	-
Acenaphthene by GCMS	<0.00003	<0.00003	<0.0003	<0.0003	-	-	-
Acenaphthylene by GCMS	0.000167	<0.000022	0.00167	<0.00022	-	-	-
Fluoranthene by GCMS	0.000586	<0.000034	0.00586	<0.00034	-	-	-
Anthracene by GCMS	<0.00003	<0.00003	<0.0003	<0.0003	-	-	-
Phenanthrene by GCMS	<0.000044	<0.000044	<0.00044	<0.00044	-	-	-
Fluorene by GCMS	<0.000028	<0.000028	<0.00028	<0.00028	-	-	-
Chrysene by GCMS	0.000353	<0.000026	0.00353	<0.00026	-	-	-
Pyrene by GCMS	0.00132	<0.00003	0.0132	<0.0003	-	-	-
Benz(a)anthracene by GCMS	0.000443	<0.000034	0.00443	<0.00034	-	-	-
Benzo(b)fluoranthene by GCMS	0.000434	<0.000046	0.00434	<0.00046	-	-	-
Benzo(k)fluoranthene by GCMS	0.000104	<0.000054	0.00104	<0.00054	-	-	-
Benzo(a)pyrene by GCMS	0.000313	<0.000018	0.00313	<0.00018	-	-	-
Dibenzo(ah)anthracene by GCMS	0.0000899	<0.000032	0.000899	<0.00032	-	-	-
Benzo(ghi)perylene by GCMS	0.00037	<0.000032	0.0037	<0.00032	-	-	-
Indeno(123cd)pyrene by GCMS	0.000221	<0.000028	0.00221	<0.00028	-	-	-
PAH 16 EPA Total by GCMS	0.0044	<0.000688	0.044	<0.00688	-	-	-

Leach Test Information

Date Prepared	30-Jun-2015
pH (pH Units)	8.57
Conductivity (µS/cm)	104.00
Temperature (°C)	21.40
Volume Leachant (Litres)	0.896

Mcerts Certification does not apply to leachates

15/07/2015 05:32:31

05:32:21 15/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150625-113	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.095	**Natural Moisture Content (%)**	4.95
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	95.3
Particle Size <4mm	>95%		

Case	
SDG	150625-113
Lab Sample Number(s)	11604457
Sampled Date	24-Jun-2015
Customer Sample Ref.	TP39 ES12
Depth (m)	2.00

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
TPH CWG (W)							
Surrogate Recovery	-	<0	-	<0	-	-	-
GRO TOT (C5-C12)	7.18	<0.05	71.8	<0.5	-	-	-
Aliphatics C5-C6	0.024	<0.01	0.24	<0.1	-	-	-
Aliphatics >C6-C8	0.836	<0.01	8.36	<0.1	-	-	-
Aliphatics >C8-C10	1.34	<0.01	13.4	<0.1	-	-	-
Aliphatics >C10-C12	2.45	<0.01	24.5	<0.1	-	-	-
Aliphatics >C12-C16	2.12	<0.01	21.2	<0.1	-	-	-
Aliphatics >C16-C21	1.79	<0.01	17.9	<0.1	-	-	-
Aliphatics >C21-C35	1.62	<0.01	16.2	<0.1	-	-	-
Total Aliphatics >C12-C35	5.53	<0.01	55.3	<0.1	-	-	-
Aromatics C6-C7	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >C7-C8	<0.01	<0.01	<0.1	<0.1	-	-	-
MTBE GC-FID	<0.003	<0.003	<0.03	<0.03	-	-	-
Aromatics >EC8 -EC10	0.893	<0.01	8.93	<0.1	-	-	-
Aromatics >EC10-EC12	1.64	<0.01	16.4	<0.1	-	-	-
Aromatics >EC12-EC16	0.07	<0.01	0.7	<0.1	-	-	-
Aromatics >EC16-EC21	0.245	<0.01	2.45	<0.1	-	-	-
Aromatics >EC21-EC35	0.585	<0.01	5.85	<0.1	-	-	-
Total Aromatics >EC12-EC35	0.9	<0.01	9	<0.1	-	-	-
Benzene by GC	<0.007	<0.007	<0.07	<0.07	-	-	-
TPH (Total Aliphatics + Total Aromatics) >C5-C35	13.6	<0.01	136	<0.1	-	-	-
Toluene by GC	<0.004	<0.004	<0.04	<0.04	-	-	-
Ethylbenzene by GC	<0.005	<0.005	<0.05	<0.05	-	-	-
m & p Xylene by GC	<0.008	<0.008	<0.08	<0.08	-	-	-
o Xylene by GC	<0.003	<0.003	<0.03	<0.03	-	-	-
Sum m&p and o Xylene by GC	<0.011	<0.011	<0.11	<0.11	-	-	-
Sum of BTEX by GC	<0.028	<0.028	<0.28	<0.28	-	-	-

Leach Test Information

Date Prepared	30-Jun-2015
pH (pH Units)	8.57
Conductivity (µS/cm)	104.00
Temperature (°C)	21.40
Volume Leachant (Litres)	0.896

Mcerts Certification does not apply to leachates

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CERTIFICATE OF ANALYSIS

SDG:	150625-113	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
PM115		Leaching Procedure for CEN One Stage Leach Test 2:1 & 10:1 1 Step		
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM061	Method for the Determination of EPH,Massachusetts Dept.of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser		
TM173	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID		
TM174	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Waters by GC-FID		
TM178	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM218	Microwave extraction – EPA method 3546	Microwave extraction - EPA method 3546		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		
TM227	Standard methods for the examination of waters and wastewaters 20th Edition, AWWA/APHA Method 4500.	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate		
TM241	Methods for the Examination of Waters and Associated Materials; Chromium in Raw and Potable Waters and Sewage Effluents 1980.	The Determination of Hexavalent Chromium in Waters and Leachates using the Kone Analyser		
TM245	By GC-FID	Determination of GRO by Headspace in waters		
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	150625-113	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	11604431	11604435	11604437	11604438	11604441	11604447	11604449	11604451	11604456	11604457
Customer Sample Ref.	TP24	TP26	TP28	TP28	TP30	TP32	TP34	TP37	TP39	TP39
AGS Ref.	ES1	ES5	ES7	ES8	ES10	ES3	ES5	ES7	ES11	ES12
Depth	0.20	1.00	0.30	1.00	0.30	2.50	1.00	0.30	1.00	2.00
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples	30-Jun-2015	30-Jun-2015		30-Jun-2015	30-Jun-2015	30-Jun-2015	30-Jun-2015	30-Jun-2015	30-Jun-2015	
Boron Water Soluble	07-Jul-2015	07-Jul-2015		07-Jul-2015	08-Jul-2015	08-Jul-2015	08-Jul-2015	08-Jul-2015	08-Jul-2015	
CEN 10:1 Leachate (1 Stage)			30-Jun-2015							30-Jun-2015
CEN Readings			03-Jul-2015							03-Jul-2015
Cyanide Comp/Free/Total/Thiocyanate	10-Jul-2015	09-Jul-2015	07-Jul-2015	10-Jul-2015	09-Jul-2015	10-Jul-2015	10-Jul-2015	10-Jul-2015	10-Jul-2015	07-Jul-2015
Dissolved Metals by ICP-MS			14-Jul-2015							14-Jul-2015
Dissolved Organic/Inorganic Carbon			07-Jul-2015							07-Jul-2015
EPH CWG (Aliphatic) Aqueous GC (W)			08-Jul-2015							08-Jul-2015
EPH CWG (Aliphatic) GC (S)	07-Jul-2015	07-Jul-2015		07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	08-Jul-2015	07-Jul-2015	
EPH CWG (Aromatic) Aqueous GC (W)			08-Jul-2015							08-Jul-2015
EPH CWG (Aromatic) GC (S)	07-Jul-2015	07-Jul-2015		07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	06-Jul-2015	07-Jul-2015	
GRO by GC-FID (S)	08-Jul-2015	08-Jul-2015		09-Jul-2015	09-Jul-2015	09-Jul-2015	07-Jul-2015	09-Jul-2015	09-Jul-2015	
GRO by GC-FID (W)			03-Jul-2015							03-Jul-2015
Hexavalent Chromium (s)	09-Jul-2015	07-Jul-2015		07-Jul-2015	07-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	
Hexavalent Chromium (w)			09-Jul-2015							09-Jul-2015
Mercury Dissolved			08-Jul-2015							08-Jul-2015
Metals in solid samples by OES	07-Jul-2015	07-Jul-2015		07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	08-Jul-2015	07-Jul-2015	
PAH by GCMS	06-Jul-2015	06-Jul-2015		06-Jul-2015	06-Jul-2015	06-Jul-2015	06-Jul-2015	06-Jul-2015	07-Jul-2015	
PAH Spec MS - Aqueous (W)			09-Jul-2015							09-Jul-2015
pH	08-Jul-2015	08-Jul-2015		08-Jul-2015	08-Jul-2015	08-Jul-2015	08-Jul-2015	08-Jul-2015	08-Jul-2015	
pH Value of Filtered Water			07-Jul-2015							07-Jul-2015
Sample description	01-Jul-2015	01-Jul-2015	29-Jun-2015	01-Jul-2015	01-Jul-2015	01-Jul-2015	01-Jul-2015	01-Jul-2015	30-Jun-2015	29-Jun-2015
Total Organic Carbon	09-Jul-2015	09-Jul-2015		09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	
TPH CWG (W)			08-Jul-2015							08-Jul-2015
TPH CWG GC (S)	08-Jul-2015	08-Jul-2015		09-Jul-2015	09-Jul-2015	09-Jul-2015	07-Jul-2015	09-Jul-2015	09-Jul-2015	

SDG:	150625-113	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	320875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before presevation was performed
§	Sampled on date not provided
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

ALcontrol Laboratories

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Apex Drilling Services
Sturmi Way
Village Farm Industrial Estate
Pyle
Bridgend
CF33 6BZ

Attention: Robert Brewer

CERTIFICATE OF ANALYSIS

Date:	16 July 2015
Customer:	H_APEXDRL_BGD
Sample Delivery Group (SDG):	150626-130
Your Reference:	10318
Location:	Swansea Bay
Report No:	321039

We received 22 samples on Friday June 26, 2015 and 7 of these samples were scheduled for analysis which was completed on Wednesday July 15, 2015. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager

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Registered Office: Units 7 & 8 Hawarden Business Park, Manor Road, Hawarden, Deeside, CH5 3US. Registered in England and Wales No.

CERTIFICATE OF ANALYSIS

SDG:	150626-130	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321039
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
11611659	TP35	ES7	0.20	25/06/2015
11611660	TP35	ES8	1.00	25/06/2015
11611661	TP35	ES9	2.00	25/06/2015
11611662	TP35	ES10	2.50	25/06/2015
11611653	TP40	ES1	0.20	24/06/2015
11611654	TP40	ES2	1.00	24/06/2015
11611655	TP40	ES3	1.80	24/06/2015
11611656	TP42	ES4	0.20	24/06/2015
11611657	TP42	ES5	1.00	24/06/2015
11611658	TP42	ES6	2.00	24/06/2015
11611663	TP44	ES11	0.20	25/06/2015
11611664	TP44	ES12	1.00	25/06/2015
11611665	TP44	ES13	2.00	25/06/2015
11611666	TP46	ES1	0.20	25/06/2015
11611667	TP46	ES2	1.00	25/06/2015
11611668	TP46	ES3	2.00	25/06/2015
11611669	TP48	ES4	0.20	25/06/2015
11611670	TP48	ES5	1.00	25/06/2015
11611671	TP48	ES6	2.00	25/06/2015
11611672	TP49	ES7	0.20	25/06/2015
11611673	TP49	ES8	1.00	25/06/2015
11611674	TP49	ES9	2.00	25/06/2015

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG:	150626-130	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321039
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

X Test

N No Determination Possible

Lab Sample No(s)			11611662	11611653	11611657	11611663	11611666	11611670	11611672
Customer Sample Reference			TP35	TP40	TP42	TP44	TP46	TP48	TP49
AGS Reference			ES10	ES1	ES5	ES11	ES1	ES5	ES7
Depth (m)			2.50	0.20	1.00	0.20	0.20	1.00	0.20
Container			1kg TUB / 250g Amber Jar (AL) / 60g VOC (ALE215)	1kg TUB / 250g Amber Jar (AL) / 60g VOC (ALE215)	1kg TUB / 250g Amber Jar (AL) / 60g VOC (ALE215)	1kg TUB / 250g Amber Jar (AL) / 60g VOC (ALE215)	1kg TUB / 250g Amber Jar (AL) / 60g VOC (ALE215)	1kg TUB / 250g Amber Jar (AL) / 60g VOC (ALE215)	1kg TUB / 250g Amber Jar (AL) / 60g VOC (ALE215)
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 6	X	X	X		X	X	X
Asbestos Quantification - Full	All	NDPs: 0 Tests: 2		X	X				
Boron Water Soluble	All	NDPs: 0 Tests: 6	X	X	X		X	X	X
CEN Readings	All	NDPs: 0 Tests: 1				X			
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 7	X	X	X	X	X	X	X
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 1				X			
Dissolved Organic/Inorganic Carbon	All	NDPs: 0 Tests: 1				X			
EPH CWG (Aliphatic) Aqueous GC (W)	All	NDPs: 0 Tests: 1				X			
EPH CWG (Aliphatic) GC (S)	All	NDPs: 0 Tests: 6	X	X	X		X	X	X
EPH CWG (Aromatic) Aqueous GC (W)	All	NDPs: 0 Tests: 1				X			
EPH CWG (Aromatic) GC (S)	All	NDPs: 0 Tests: 6	X	X	X		X	X	X
GRO by GC-FID (S)	All	NDPs: 0 Tests: 6		X	X	X	X	X	X
GRO by GC-FID (W)	All	NDPs: 0 Tests: 1				X			
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 6	X	X	X		X	X	X
Hexavalent Chromium (w)	All	NDPs: 0 Tests: 1				X			

CERTIFICATE OF ANALYSIS

SDG:	150626-130	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321039
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

X **Test**

N **No Determination Possible**

			Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container
			11611662	TP35	ES10	2.50	1kg TUB / 250g Amber Jar (AL / 60g VOC (ALE215)
			11611653	TP40	ES1	0.20	1kg TUB / 250g Amber Jar (AL / 60g VOC (ALE215)
			11611657	TP42	ES5	1.00	1kg TUB / 250g Amber Jar (AL / 60g VOC (ALE215)
			11611663	TP44	ES11	0.20	1kg TUB / 250g Amber Jar (AL / 60g VOC (ALE215)
			11611666	TP46	ES1	0.20	1kg TUB / 250g Amber Jar (AL / 60g VOC (ALE215)
			11611670	TP48	ES5	1.00	1kg TUB / 250g Amber Jar (AL / 60g VOC (ALE215)
			11611672	TP49	ES7	0.20	1kg TUB / 250g Amber Jar (AL / 60g VOC (ALE215)
Mercury Dissolved	All	NDPs: 0 Tests: 1					X
Metals in solid samples by OES	All	NDPs: 0 Tests: 6		X		X	X		X		X		X		X	
PAH by GCMS	All	NDPs: 0 Tests: 6		X		X		X			X		X		X	
PAH Spec MS - Aqueous (W)	All	NDPs: 0 Tests: 1					X									
pH	All	NDPs: 0 Tests: 6	X		X		X			X		X		X		
pH Value of Filtered Water	All	NDPs: 0 Tests: 1					X									
Sample description	All	NDPs: 0 Tests: 7		X		X		X		X	X		X		X	
Total Organic Carbon	All	NDPs: 0 Tests: 6		X		X		X			X		X		X	
TPH CWG (W)	All	NDPs: 0 Tests: 1					X									
TPH CWG GC (S)	All	NDPs: 0 Tests: 6		X		X		X			X		X		X	

CERTIFICATE OF ANALYSIS

SDG:	150626-130	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321039
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
11611662	TP35	2.50	Dark Brown	Loamy Sand	0.1 - 2 mm	Stones	Vegetation
11611653	TP40	0.20	Dark Brown	Loamy Sand	0.1 - 2 mm	Brick	Stones
11611657	TP42	1.00	Dark Brown	Loamy Sand	0.1 - 2 mm	Vegetation	None
11611663	TP44	0.20	Black	Sand	0.1 - 2 mm	Stones	Vegetation
11611666	TP46	0.20	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Vegetation
11611670	TP48	1.00	Black	Loamy Sand	0.1 - 2 mm	Stones	None
11611672	TP49	0.20	Black	Sandy Loam	0.1 - 2 mm	Stones	Vegetation

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

CERTIFICATE OF ANALYSIS

SDG:	150626-130	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321039
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TP35	TP40	TP42	TP44	TP46	TP48
			Depth (m)	2.50	0.20	1.00	0.20	0.20	1.00
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	25/06/2015	24/06/2015	24/06/2015	25/06/2015	25/06/2015	25/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	26/06/2015	26/06/2015	26/06/2015	26/06/2015	26/06/2015	26/06/2015
			SDG Ref	150626-130	150626-130	150626-130	150626-130	150626-130	150626-130
			Lab Sample No.(s)	11611662	11611653	11611657	11611663	11611666	11611670
			AGS Reference	ES10	ES1	ES5	ES11	ES1	ES5
Moisture Content Ratio (% of as received sample)	%	PM024		6.1	11	7.7	11	15	8.1
Organic Carbon, Total	<0.2 %	TM132		<0.2 M	11.8 M	2.03 M		13.8 M	2.2 M
pH	1 pH Units	TM133		7.96 M	7.71 M	8.89 M		8.16 M	8.86 M
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #		<3 #	<1.2 #
Cyanide, Total	<1 mg/kg	TM153		<1 M	<1 & M	<1 & M		<1 M	<1 M
Antimony	<0.6 mg/kg	TM181		1.19 #	106 #	5.79 #		58 #	9.91 #
Arsenic	<0.6 mg/kg	TM181		9.41 M	437 M	30.9 M		293 M	38.2 M
Beryllium	<0.01 mg/kg	TM181		0.273 M	0.756 M	0.496 M		1.62 M	0.686 M
Cadmium	<0.02 mg/kg	TM181		1.05 M	5.55 M	0.965 M		2.72 M	5.5 M
Chromium	<0.9 mg/kg	TM181		7.57 M	19 M	10.5 M		17.5 M	10.2 M
Copper	<1.4 mg/kg	TM181		30.3 M	455 M	60.3 M		295 M	82.2 M
Lead	<0.7 mg/kg	TM181		29.7 M	11200 M	465 M		5840 M	847 M
Mercury	<0.14 mg/kg	TM181		<0.14 M	0.449 M	<0.14 M		0.194 M	<0.14 M
Molybdenum	<0.1 mg/kg	TM181		<0.1 #	14.1 #	1.44 #		7.27 #	1.28 #
Nickel	<0.2 mg/kg	TM181		11.6 M	47.9 M	23.7 M		69.1 M	23 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #		<1 #	<1 #
Vanadium	<0.2 mg/kg	TM181		13.7 #	36.3 #	18.5 #		47 #	14.7 #
Zinc	<1.9 mg/kg	TM181		326 M	14400 M	1110 M		7770 M	2670 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M		1.08 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150626-130	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321039
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Customer Sample R	TP49
Depth (m)	0.20
Sample Type	Soil/Solid
Date Sampled	25/06/2015
Sample Time	.
Date Received	26/06/2015
SDG Ref	150626-130
Lab Sample No.(s)	11611672
AGS Reference	ES7

Component	LOD/Units	Method	
Moisture Content Ratio (% of as received sample)	%	PM024	10
Organic Carbon, Total	<0.2 %	TM132	13.6 M
pH	1 pH Units	TM133	8.06 M
Chromium, Hexavalent	<0.6 mg/kg	TM151	<1.2 #
Cyanide, Total	<1 mg/kg	TM153	<1 M
Antimony	<0.6 mg/kg	TM181	17.6 #
Arsenic	<0.6 mg/kg	TM181	94.2 M
Beryllium	<0.01 mg/kg	TM181	1.87 M
Cadmium	<0.02 mg/kg	TM181	3.22 M
Chromium	<0.9 mg/kg	TM181	43.3 M
Copper	<1.4 mg/kg	TM181	268 M
Lead	<0.7 mg/kg	TM181	1310 M
Mercury	<0.14 mg/kg	TM181	<0.14 M
Molybdenum	<0.1 mg/kg	TM181	5.87 #
Nickel	<0.2 mg/kg	TM181	68.4 M
Selenium	<1 mg/kg	TM181	<1 #
Vanadium	<0.2 mg/kg	TM181	67.9 #
Zinc	<1.9 mg/kg	TM181	3030 M
Boron, water soluble	<1 mg/kg	TM222	1.49 M

CERTIFICATE OF ANALYSIS

SDG:	150626-130	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321039
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

PAH by GCMS

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TP35	TP40	TP42	TP46	TP48	TP49
			Depth (m)	2.50	0.20	1.00	0.20	1.00	0.20
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	25/06/2015	24/06/2015	24/06/2015	25/06/2015	25/06/2015	25/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	26/06/2015	26/06/2015	26/06/2015	26/06/2015	26/06/2015	26/06/2015
			SDG Ref	150626-130	150626-130	150626-130	150626-130	150626-130	150626-130
			Lab Sample No.(s)	11611662	11611653	11611657	11611666	11611670	11611672
			AGS Reference	ES10	ES1	ES5	ES1	ES5	ES7
Naphthalene-d8 % recovery**	%	TM218		95.4	93.6	98.6	105	94.7	97.6
Acenaphthene-d10 % recovery**	%	TM218		93.5	92.1	99.6	104	92.7	99
Phenanthrene-d10 % recovery**	%	TM218		86.8	88.4	95.3	105	88.9	94.7
Chrysene-d12 % recovery**	%	TM218		95.4	88.4	94.2	119	90.4	95
Perylene-d12 % recovery**	%	TM218		109	91.8	86.6	123	100	86.6
Naphthalene	<9 µg/kg	TM218		12.6 M	510 M	132 M	835 M	36.5 M	270 M
Acenaphthylene	<12 µg/kg	TM218		<12 M	127 M	57.3 M	541 M	22.3 M	68.3 M
Acenaphthene	<8 µg/kg	TM218		<8 M	984 M	99.7 M	1630 M	19.3 M	107 M
Fluorene	<10 µg/kg	TM218		<10 M	763 M	83.7 M	1520 M	21.7 M	171 M
Phenanthrene	<15 µg/kg	TM218		<15 M	8740 M	1370 M	15100 M	345 M	2130 M
Anthracene	<16 µg/kg	TM218		<16 M	1660 M	444 M	3750 M	88.3 M	420 M
Fluoranthene	<17 µg/kg	TM218		<17 M	11500 M	2350 M	25700 M	539 M	3330 M
Pyrene	<15 µg/kg	TM218		57.9 M	9260 M	1890 M	20800 M	423 M	2600 M
Benz(a)anthracene	<14 µg/kg	TM218		<14 M	6380 M	1050 M	16200 M	300 M	1760 M
Chrysene	<10 µg/kg	TM218		<10 M	5830 M	1150 M	15200 M	320 M	1800 M
Benzo(b)fluoranthene	<15 µg/kg	TM218		60.5 M	7740 M	1770 M	22400 M	509 M	2430 M
Benzo(k)fluoranthene	<14 µg/kg	TM218		25.4 M	2980 M	607 M	8470 M	189 M	932 M
Benzo(a)pyrene	<15 µg/kg	TM218		88.1 M	6320 M	1020 M	15800 M	351 M	1590 M
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218		80.1 M	3750 M	670 M	8470 M	227 M	1050 M
Dibenzo(a,h)anthracene	<23 µg/kg	TM218		<23 M	1180 M	233 M	3080 M	70.2 M	375 M
Benzo(g,h,i)perylene	<24 µg/kg	TM218		94 M	3820 M	813 M	9340 M	237 M	1260 M
PAH, Total Detected USEPA 16	<118 µg/kg	TM218		419	71600	13700	169000	3700	20300

CERTIFICATE OF ANALYSIS

SDG:	150626-130	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321039
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

TPH CWG (S)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TP35	TP40	TP42	TP46	TP48	TP49
			Depth (m)	2.50	0.20	1.00	0.20	1.00	0.20
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	25/06/2015	24/06/2015	24/06/2015	25/06/2015	25/06/2015	25/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	26/06/2015	26/06/2015	26/06/2015	26/06/2015	26/06/2015	26/06/2015
			SDG Ref	150626-130	150626-130	150626-130	150626-130	150626-130	150626-130
			Lab Sample No.(s)	11611662	11611653	11611657	11611666	11611670	11611672
			AGS Reference	ES10	ES1	ES5	ES1	ES5	ES7
GRO Surrogate % recovery**	%	TM089		126	32	63	13	67	15
GRO TOT (Moisture Corrected)	<44 µg/kg	TM089		11800 M	<44 M	<44 M	<44 M	<44 M	57.7 M
Methyl tertiary butyl ether (MTBE)	<5 µg/kg	TM089		<5 M	<5 M	<5 M	<5 M	<5 M	<5 M
Benzene	<10 µg/kg	TM089		<10 M	<10 M	<10 M	<10 M	<10 M	<10 M
Toluene	<2 µg/kg	TM089		<2 M	<2 M	<2 M	<2 M	<2 M	4.44 M
Ethylbenzene	<3 µg/kg	TM089		<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
m,p-Xylene	<6 µg/kg	TM089		<6 M	<6 M	<6 M	<6 M	<6 M	<6 M
o-Xylene	<3 µg/kg	TM089		<3 M	<3 M	<3 M	<3 M	<3 M	<3 M
sum of detected mpo xylene by GC	<9 µg/kg	TM089		<9	<9	<9	<9	<9	<9
sum of detected BTEX by GC	<24 µg/kg	TM089		<24	<24	<24	<24	<24	<24
Aliphatics >C5-C6	<10 µg/kg	TM089		24.5	<10	<10	<10	<10	<10
Aliphatics >C6-C8	<10 µg/kg	TM089		29.8	<10	<10	<10	<10	13.3
Aliphatics >C8-C10	<10 µg/kg	TM089		1550	<10	<10	<10	<10	<10
Aliphatics >C10-C12	<10 µg/kg	TM089		5520	<10	<10	<10	<10	<10
Aliphatics >C12-C16	<100 µg/kg	TM173		463000	3960	879	1230	<100	2470
Aliphatics >C16-C21	<100 µg/kg	TM173		281000	6020	1140	5710	<100	3600
Aliphatics >C21-C35	<100 µg/kg	TM173		60100	28300	6820	39300	5680	23500
Aliphatics >C35-C44	<100 µg/kg	TM173		7740	4450	<100	4910	<100	8250
Total Aliphatics >C12-C44	<100 µg/kg	TM173		812000	42700	8830	51100	5680	37800
Aromatics >EC5-EC7	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aromatics >EC7-EC8	<10 µg/kg	TM089		<10	<10	<10	<10	<10	<10
Aromatics >EC8-EC10	<10 µg/kg	TM089		1030	<10	<10	<10	<10	12.2
Aromatics >EC10-EC12	<10 µg/kg	TM089		3680	<10	<10	<10	<10	<10
Aromatics >EC12-EC16	<100 µg/kg	TM173		18500	3150	<100	4060	<100	2650
Aromatics >EC16-EC21	<100 µg/kg	TM173		32500	43800	6210	59600	1390	24700
Aromatics >EC21-EC35	<100 µg/kg	TM173		22300	142000	25900	236000	8250	94400
Aromatics >EC35-EC44	<100 µg/kg	TM173		757	31600	7230	64500	2100	38200
Aromatics >EC40-EC44	<100 µg/kg	TM173		<100	8010	2460	22200	625	15500
Total Aromatics >EC12-EC44	<100 µg/kg	TM173		74000	220000	39300	364000	11700	160000
Total Aliphatics & Aromatics >C5-C44	<100 µg/kg	TM173		898000	263000	48200	415000	17400	198000

CERTIFICATE OF ANALYSIS

SDG:	150626-130	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321039
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Asbestos Identification - Solid Samples

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP35 ES 10 2.50 SOLID 25/06/2015 00:00:00 30/06/2015 08:36:31 150626-130 11611662 TM048	1/7/15	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP40 ES 1 0.20 SOLID 24/06/2015 00:00:00 30/06/2015 08:54:09 150626-130 11611653 TM048	1/7/15	Kevin Hughes	Loose fibres in soil	Not Detected (#)	Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP42 ES 5 1.00 SOLID 24/06/2015 00:00:00 30/06/2015 10:16:51 150626-130 11611657 TM048	1/7/15	Kevin Hughes	Loose fibres in soil	Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP46 ES 1 0.20 SOLID 25/06/2015 00:00:00 30/06/2015 10:08:21 150626-130 11611666 TM048	1/7/15	Chris Swindells	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP48 ES 5 1.00 SOLID 25/06/2015 00:00:00 30/06/2015 09:41:29 150626-130 11611670 TM048	1/7/15	Kevin Hughes	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150626-130	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321039
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP49 ES 7 0.20 SOLID 25/06/2015 00:00:00 30/06/2015 09:51:46 150626-130 11611672 TM048	1/7/15	Chris Swindells	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150626-130	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321039
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Asbestos Quantification - Full

		Additional Asbestos Components (Using TM048)	Analysts Comments	Asbestos Quantification - Gravimetric - %	Asbestos Quantification - PCOM Evaluation - %	Asbestos Quantification - Total - %
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP40 ES 1 0.20 SOLID 24/06/2015 00:00:00 03/07/2015 08:21:52 150626-130 11611653 TM 304	Amosite (Loose fibres in soil). (#)	N/C	<0.001 (#)	<0.001 (#)	<0.001 (#)
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP42 ES 5 1.00 SOLID 24/06/2015 00:00:00 03/07/2015 20:56:59 150626-130 11611657 TM 304	Chrysotile (Fibre bundle in soil). (#)	N/C	0.0010 (#)	<0.001 (#)	0.0012 (#)

CERTIFICATE OF ANALYSIS

SDG:	150626-130	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321039
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.096	**Natural Moisture Content (%)**	6.29
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	94.1
Particle Size <4mm	>95%		

Case	
SDG	150626-130
Lab Sample Number(s)	11611663
Sampled Date	25-Jun-2015
Customer Sample Ref.	TP44 ES11
Depth (m)	0.20

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	5.7	<3	57	<30	-	-	-
Hexavalent Chromium	<0.06	<0.06	<0.6	<0.6	-	-	-
pH Value of Filtered Water	7.9	<0.001	79	<0.01	-	-	-
Mercury Dissolved (CVAF)	0.000162	<0.00001	0.00162	<0.0001	-	-	-
Antimony	0.00475	<0.00016	0.0475	<0.0016	-	-	-
Arsenic	0.0199	<0.00012	0.199	<0.0012	-	-	-
Total Cyanide (W)	<0.05	<0.05	<0.5	<0.5	-	-	-
Beryllium	<0.00007	<0.00007	<0.0007	<0.0007	-	-	-
Boron	0.0893	<0.0094	0.893	<0.094	-	-	-
Cadmium	<0.0001	<0.0001	<0.001	<0.001	-	-	-
Chromium	0.00107	<0.00022	0.0107	<0.0022	-	-	-
Copper	0.0181	<0.00085	0.181	<0.0085	-	-	-
Lead	0.0108	<0.00002	0.108	<0.0002	-	-	-
Molybdenum	0.00132	<0.00024	0.0132	<0.0024	-	-	-
Nickel	0.000782	<0.00015	0.00782	<0.0015	-	-	-
Selenium	0.000845	<0.00039	0.00845	<0.0039	-	-	-
Vanadium	0.00188	<0.00024	0.0188	<0.0024	-	-	-
Zinc	0.0951	<0.00041	0.951	<0.0041	-	-	-
PAH Spec MS - Aqueous (W)							
Naphthalene by GCMS	<0.0001	<0.0001	<0.001	<0.001	-	-	-
Acenaphthene by GCMS	0.0000158	<0.000015	0.000158	<0.00015	-	-	-
Acenaphthylene by GCMS	0.0000475	<0.000011	0.000475	<0.00011	-	-	-
Fluoranthene by GCMS	0.000121	<0.000017	0.00121	<0.00017	-	-	-
Anthracene by GCMS	0.000275	<0.000015	0.00275	<0.00015	-	-	-
Phenanthrene by GCMS	0.0000821	<0.000022	0.000821	<0.00022	-	-	-
Fluorene by GCMS	0.0000198	<0.000014	0.000198	<0.00014	-	-	-
Chrysene by GCMS	0.0000869	<0.000013	0.000869	<0.00013	-	-	-
Pyrene by GCMS	0.000121	<0.000015	0.00121	<0.00015	-	-	-
Benz(a)anthracene by GCMS	0.0000585	<0.000017	0.000585	<0.00017	-	-	-
Benzo(b)fluoranthene by GCMS	0.000685	<0.000023	0.00685	<0.00023	-	-	-
Benzo(k)fluoranthene by GCMS	0.000194	<0.000027	0.00194	<0.00027	-	-	-
Benzo(a)pyrene by GCMS	0.000195	<0.000009	0.00195	<0.00009	-	-	-
Dibenzo(ah)anthracene by GCMS	0.000113	<0.000016	0.00113	<0.00016	-	-	-
Benzo(ghi)perylene by GCMS	0.000341	<0.000016	0.00341	<0.00016	-	-	-
Indeno(123cd)pyrene by GCMS	0.000247	<0.000014	0.00247	<0.00014	-	-	-
PAH 16 EPA Total by GCMS	0.0026	<0.000344	0.026	<0.00344	-	-	-

Leach Test Information

Date Prepared	02-Jul-2015
pH (pH Units)	8.14
Conductivity (µS/cm)	71.20
Temperature (°C)	22.40
Volume Leachant (Litres)	0.894

Mcerts Certification does not apply to leachates

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05:31:23 16/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150626-130	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321039
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

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Mass Sample taken (kg)	0.096	**Natural Moisture Content (%)**	6.29
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	94.1
Particle Size <4mm	>95%		

Case	
SDG	150626-130
Lab Sample Number(s)	11611663
Sampled Date	25-Jun-2015
Customer Sample Ref.	TP44 ES11
Depth (m)	0.20

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
TPH CWG (W)							
Surrogate Recovery	-	<0	-	<0	-	-	-
GRO TOT (C5-C12)	<0.05	<0.05	<0.5	<0.5	-	-	-
Aliphatics C5-C6	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C6-C8	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C8-C10	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C10-C12	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C12-C16	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C16-C21	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C21-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Total Aliphatics >C12-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics C6-C7	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >C7-C8	<0.01	<0.01	<0.1	<0.1	-	-	-
MTBE GC-FID	<0.003	<0.003	<0.03	<0.03	-	-	-
Aromatics >EC8 -EC10	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC10-EC12	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC12-EC16	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC16-EC21	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC21-EC35	<0.01	<0.01	<0.1	<0.1	-	-	-
Total Aromatics >EC12-EC35	<0.01	<0.01	<0.1	<0.1	-	-	-
Benzene by GC	<0.007	<0.007	<0.07	<0.07	-	-	-
TPH (Total Aliphatics + Total Aromatics) >C5-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Toluene by GC	<0.004	<0.004	<0.04	<0.04	-	-	-
Ethylbenzene by GC	<0.005	<0.005	<0.05	<0.05	-	-	-
m & p Xylene by GC	<0.008	<0.008	<0.08	<0.08	-	-	-
o Xylene by GC	<0.003	<0.003	<0.03	<0.03	-	-	-
Sum m&p and o Xylene by GC	<0.011	<0.011	<0.11	<0.11	-	-	-
Sum of BTEX by GC	<0.028	<0.028	<0.28	<0.28	-	-	-

Leach Test Information

Date Prepared	02-Jul-2015
pH (pH Units)	8.14
Conductivity (µS/cm)	71.20
Temperature (°C)	22.40
Volume Leachant (Litres)	0.894

Mcerts Certification does not apply to leachates

16/07/2015 05:31:32

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CERTIFICATE OF ANALYSIS

SDG:	150626-130	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321039
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
PM115		Leaching Procedure for CEN One Stage Leach Test 2:1 & 10:1 1 Step		
TM 304				
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM061	Method for the Determination of EPH,Massachusetts Dept.of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser		
TM173	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID		
TM174	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Waters by GC-FID		
TM178	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM218	Microwave extraction – EPA method 3546	Microwave extraction - EPA method 3546		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		
TM227	Standard methods for the examination of waters and wastewaters 20th Edition, AWWA/APHA Method 4500.	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate		
TM241	Methods for the Examination of Waters and Associated Materials; Chromium in Raw and Potable Waters and Sewage Effluents 1980.	The Determination of Hexavalent Chromium in Waters and Leachates using the Kone Analyser		
TM245	By GC-FID	Determination of GRO by Headspace in waters		
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	150626-130	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321039
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	11611662	11611653	11611657	11611663	11611666	11611670	11611672
Customer Sample Ref.	TP35	TP40	TP42	TP44	TP46	TP48	TP49
AGS Ref.	ES10	ES1	ES5	ES11	ES1	ES5	ES7
Depth	2.50	0.20	1.00	0.20	0.20	1.00	0.20
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples	02-Jul-2015	02-Jul-2015	02-Jul-2015		02-Jul-2015	02-Jul-2015	02-Jul-2015
Asbestos Quantification - Full		10-Jul-2015	10-Jul-2015				
Boron Water Soluble	08-Jul-2015	09-Jul-2015	08-Jul-2015		08-Jul-2015	07-Jul-2015	08-Jul-2015
CEN 10:1 Leachate (1 Stage)				10-Jul-2015			
CEN Readings				13-Jul-2015			
Cyanide Comp/Free/Total/Thiocyanate	10-Jul-2015	10-Jul-2015	10-Jul-2015	10-Jul-2015	10-Jul-2015	10-Jul-2015	10-Jul-2015
Dissolved Metals by ICP-MS				15-Jul-2015			
Dissolved Organic/Inorganic Carbon				10-Jul-2015			
EPH CWG (Aliphatic) Aqueous GC (W)				09-Jul-2015			
EPH CWG (Aliphatic) GC (S)	07-Jul-2015	07-Jul-2015	07-Jul-2015		07-Jul-2015	07-Jul-2015	07-Jul-2015
EPH CWG (Aromatic) Aqueous GC (W)				09-Jul-2015			
EPH CWG (Aromatic) GC (S)	07-Jul-2015	07-Jul-2015	07-Jul-2015		07-Jul-2015	07-Jul-2015	07-Jul-2015
GRO by GC-FID (S)	09-Jul-2015	09-Jul-2015	09-Jul-2015		10-Jul-2015	09-Jul-2015	09-Jul-2015
GRO by GC-FID (W)				09-Jul-2015			
Hexavalent Chromium (s)	09-Jul-2015	09-Jul-2015	09-Jul-2015		09-Jul-2015	09-Jul-2015	09-Jul-2015
Hexavalent Chromium (w)				09-Jul-2015			
Mercury Dissolved				09-Jul-2015			
Metals in solid samples by OES	07-Jul-2015	10-Jul-2015	07-Jul-2015		08-Jul-2015	08-Jul-2015	08-Jul-2015
PAH by GCMS	07-Jul-2015	07-Jul-2015	07-Jul-2015		08-Jul-2015	07-Jul-2015	07-Jul-2015
PAH Spec MS - Aqueous (W)				13-Jul-2015			
pH	10-Jul-2015	10-Jul-2015	10-Jul-2015		10-Jul-2015	10-Jul-2015	10-Jul-2015
pH Value of Filtered Water				09-Jul-2015			
Sample description	01-Jul-2015	01-Jul-2015	01-Jul-2015	01-Jul-2015	01-Jul-2015	01-Jul-2015	01-Jul-2015
Total Organic Carbon	09-Jul-2015	09-Jul-2015	10-Jul-2015		09-Jul-2015	09-Jul-2015	09-Jul-2015
TPH CWG (W)				09-Jul-2015			
TPH CWG GC (S)	09-Jul-2015	09-Jul-2015	09-Jul-2015		10-Jul-2015	09-Jul-2015	09-Jul-2015

SDG:	150626-130	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321039
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before presevation was performed
§	Sampled on date not provided
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

ALcontrol Laboratories

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Apex Drilling Services
Sturmi Way
Village Farm Industrial Estate
Pyle
Bridgend
CF33 6BZ

Attention: Robert Brewer

CERTIFICATE OF ANALYSIS

Date:	16 July 2015
Customer:	H_APEXDRL_BGD
Sample Delivery Group (SDG):	150624-101
Your Reference:	10318
Location:	Swansea Bay
Report No:	321065

We received 17 samples on Wednesday June 24, 2015 and 7 of these samples were scheduled for analysis which was completed on Thursday July 16, 2015. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager

Alcontrol Laboratories is a trading division of ALcontrol UK Limited
Registered Office: Units 7 & 8 Hawarden Business Park, Manor Road, Hawarden, Deeside, CH5 3US. Registered in England and Wales No.

CERTIFICATE OF ANALYSIS

SDG:	150624-101	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321065
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
11594278	BH001		3.55	22/06/2015
11594279	BH009		3.44	22/06/2015
11594281	TP19		0.30	22/06/2015
11594282	TP20		0.30	22/06/2015
11594283	TP20		1.00	22/06/2015
11594284	TP20		2.00	22/06/2015
11594285	TP21		0.30	22/06/2015
11594286	TP21		1.00	22/06/2015
11594287	TP21		2.00	22/06/2015
11594288	TP22		0.20	23/06/2015
11594289	TP22		1.00	23/06/2015
11594290	TP22		2.00	23/06/2015
11594291	TP22		3.00	23/06/2015
11594292	TP23		0.30	23/06/2015
11594293	TP23		1.00	23/06/2015
11594294	TP23		2.00	23/06/2015
11594295	TP23		2.80	23/06/2015

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG:	150624-101	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321065
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

LIQUID

Results Legend

X **Test**

N **No Determination Possible**

			Lab Sample No(s)	11594278	11594279
			Customer Sample Reference	BH001	BH009
			AGS Reference		
			Depth (m)	3.55	3.44
			Container	0.5l glass bottle (AL	1lplastic (ALE221)	Dissolved Metals Pr	NaOH (ALE245)	0.5l glass bottle (AL	1lplastic (ALE221)	Dissolved Metals Pr	NaOH (ALE245)
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 2				X			X
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 2		X				X		
EPH CWG (Aliphatic) Aqueous GC (W)	All	NDPs: 0 Tests: 2	X				X			
EPH CWG (Aromatic) Aqueous GC (W)	All	NDPs: 0 Tests: 2	X				X			
GRO by GC-FID (W)	All	NDPs: 0 Tests: 2	X				X			
Hexavalent Chromium (w)	All	NDPs: 0 Tests: 2		X				X		
Mercury Dissolved	All	NDPs: 0 Tests: 2			X				X	
PAH Spec MS - Aqueous (W)	All	NDPs: 0 Tests: 2	X				X			
pH Value	All	NDPs: 0 Tests: 2		X				X		
Total Organic and Inorganic Carbon	All	NDPs: 0 Tests: 2	X				X			
TPH CWG (W)	All	NDPs: 0 Tests: 2	X				X			

CERTIFICATE OF ANALYSIS

SDG:	150624-101	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321065
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

X **Test**

N **No Determination Possible**

			Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container
			11594281	TP19		0.30	1kg TUB
							250g Amber Jar (AL
							60g VOC (ALE215)
			11594283	TP20		1.00	1kg TUB
							250g Amber Jar (AL
							60g VOC (ALE215)
			11594286	TP21		1.00	1kg TUB
							250g Amber Jar (AL
			11594288	TP22		0.20	1kg TUB
							250g Amber Jar (AL
							60g VOC (ALE215)
			11594294	TP23		2.00	1kg TUB
							250g Amber Jar (AL
							60g VOC (ALE215)
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 4	X		X		X		X		X		
Asbestos Quantification - Full	All	NDPs: 0 Tests: 1					X						
Boron Water Soluble	All	NDPs: 0 Tests: 4		X		X				X		X	
CEN Readings	All	NDPs: 0 Tests: 1						X					
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 5	X		X		X		X		X		
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 1						X					
EPH CWG (Aliphatic) Aqueous GC (W)	All	NDPs: 0 Tests: 1						X					
EPH CWG (Aliphatic) GC (S)	All	NDPs: 0 Tests: 4		X		X				X		X	
EPH CWG (Aromatic) Aqueous GC (W)	All	NDPs: 0 Tests: 1						X					
EPH CWG (Aromatic) GC (S)	All	NDPs: 0 Tests: 4		X		X				X		X	
GRO by GC-FID (S)	All	NDPs: 0 Tests: 4			X		X				X		X
GRO by GC-FID (W)	All	NDPs: 0 Tests: 1						X					
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 4	X		X				X		X		
Hexavalent Chromium (w)	All	NDPs: 0 Tests: 1						X					
Mercury Dissolved	All	NDPs: 0 Tests: 1						X					

CERTIFICATE OF ANALYSIS

SDG:	150624-101	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321065
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

X **Test**

N **No Determination Possible**

			Lab Sample No(s)	11594281		11594283		11594286		11594288		11594294	
			Customer Sample Reference	TP19		TP20		TP21		TP22		TP23	
			AGS Reference										
			Depth (m)	0.30		1.00		1.00		0.20		2.00	
			Container	1kg TUB	250g Amber Jar (AL	1kg TUB	250g Amber Jar (AL	1kg TUB	250g Amber Jar (AL	1kg TUB	250g Amber Jar (AL	1kg TUB	250g Amber Jar (AL
					60g VOC (ALE215)		60g VOC (ALE215)				60g VOC (ALE215)		60g VOC (ALE215)
Metals in solid samples by OES	All	NDPs: 0 Tests: 4			X		X				X		X
PAH by GCMS	All	NDPs: 0 Tests: 4			X		X				X		X
PAH Spec MS - Aqueous (W)	All	NDPs: 0 Tests: 1						X					
pH	All	NDPs: 0 Tests: 4		X		X				X		X	
pH Value of Filtered Water	All	NDPs: 0 Tests: 1						X					
Sample description	All	NDPs: 0 Tests: 5			X		X		X		X		X
Total Organic Carbon	All	NDPs: 0 Tests: 4			X		X				X		X
TPH CWG (W)	All	NDPs: 0 Tests: 1						X					
TPH CWG GC (S)	All	NDPs: 0 Tests: 4			X		X				X		X

CERTIFICATE OF ANALYSIS

SDG:	150624-101	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321065
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	**fine**	0.063mm - 0.1mm	**medium**	0.1mm - 2mm	**coarse**	2mm - 10mm	**very coarse**	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
11594281	TP19	0.30	Dark Brown	Loamy Sand	0.1 - 2 mm	Crushed Brick	Vegetation
11594283	TP20	1.00	Dark Brown	Loamy Sand	0.1 - 2 mm	Stones	Vegetation
11594286	TP21	1.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Vegetation
11594288	TP22	0.20	Dark Brown	Loamy Sand	0.1 - 2 mm	Stones	Vegetation
11594294	TP23	2.00	Dark Brown	Sand	0.1 - 2 mm	Stones	None

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

CERTIFICATE OF ANALYSIS

SDG:	150624-101	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321065
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH001	BH009	TP19	TP20	TP21	TP22
			Depth (m)	3.55	3.44	0.30	1.00	1.00	0.20
			Sample Type	Water(GW/SW)	Water(GW/SW)	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	22/06/2015	22/06/2015	22/06/2015	22/06/2015	22/06/2015	23/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	24/06/2015	24/06/2015	24/06/2015	24/06/2015	24/06/2015	24/06/2015
			SDG Ref	150624-101	150624-101	150624-101	150624-101	150624-101	150624-101
			Lab Sample No.(s)	11594278	11594279	11594281	11594283	11594286	11594288
			AGS Reference						
Organic Carbon, Total	<3 mg/l	TM090		3.79 & #	11.9 & #				
Antimony (diss.filt)	<0.16 µg/l	TM152		4.39	2.82				
Arsenic (diss.filt)	<0.12 µg/l	TM152		10.3 #	<0.12 #				
Beryllium (diss.filt)	<0.07 µg/l	TM152		<0.07 #	<0.07 #				
Boron (diss.filt)	<9.4 µg/l	TM152		126 #	569 #				
Cadmium (diss.filt)	<0.1 µg/l	TM152		10.6 #	<0.1 #				
Chromium (diss.filt)	<0.22 µg/l	TM152		3.68 #	10 #				
Copper (diss.filt)	<0.85 µg/l	TM152		21.3 #	6.74 #				
Lead (diss.filt)	<0.02 µg/l	TM152		48 #	2.8 #				
Molybdenum (diss.filt)	<0.24 µg/l	TM152		9.15 #	6.22 #				
Nickel (diss.filt)	<0.15 µg/l	TM152		36.9 #	6.92 #				
Selenium (diss.filt)	<0.39 µg/l	TM152		68.1 #	<0.39 #				
Vanadium (diss.filt)	<0.24 µg/l	TM152		1.2 #	3.58 #				
Zinc (diss.filt)	<0.41 µg/l	TM152		4570 #	9.17 #				
Mercury (diss.filt)	<0.01 µg/l	TM183		<0.01 #	<0.01 #				
Cyanide, Total	<0.05 mg/l	TM227		<0.05 & #	<0.05 & #				
Chromium, Hexavalent	<0.03 mg/l	TM241		<0.03 #	<0.03 #				
pH	<1 pH Units	TM256		7.53 #	7.55 #				
Moisture Content Ratio (% of as received sample)	%	PM024				9	8.5	7.3	4.3
Organic Carbon, Total	<0.2 %	TM132				5.61 M	1.82 M		1.31 M
pH	1 pH Units	TM133				8.76 M	8.47 M		8.67 M
Chromium, Hexavalent	<0.6 mg/kg	TM151				<0.6 #	<0.6 #		<0.6 #
Cyanide, Total	<1 mg/kg	TM153				<1 M	<1 M		<1 M
Antimony	<0.6 mg/kg	TM181				1.82 #	8.67 #		3.01 #
Arsenic	<0.6 mg/kg	TM181				17.7 M	52 M		23.5 M
Beryllium	<0.01 mg/kg	TM181				2.06 M	0.482 M		0.326 M
Cadmium	<0.02 mg/kg	TM181				0.663 M	3.18 M		1.16 M
Chromium	<0.9 mg/kg	TM181				13.2 M	11.7 M		10.8 M
Copper	<1.4 mg/kg	TM181				58.8 M	105 M		38.4 M
Lead	<0.7 mg/kg	TM181				108 M	1380 M		232 M
Mercury	<0.14 mg/kg	TM181				<0.14 M	0.254 M		0.173 M
Molybdenum	<0.1 mg/kg	TM181				1.48 #	1.07 #		0.493 #

CERTIFICATE OF ANALYSIS

SDG:	150624-101	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321065
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH001	BH009	TP19	TP20	TP21	TP22
			Depth (m)	3.55	3.44	0.30	1.00	1.00	0.20
			Sample Type	Water(GW/SW)	Water(GW/SW)	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	22/06/2015	22/06/2015	22/06/2015	22/06/2015	22/06/2015	23/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	24/06/2015	24/06/2015	24/06/2015	24/06/2015	24/06/2015	24/06/2015
			SDG Ref	150624-101	150624-101	150624-101	150624-101	150624-101	150624-101
			Lab Sample No.(s)	11594278	11594279	11594281	11594283	11594286	11594288
			AGS Reference						
Nickel	<0.2 mg/kg	TM181				19.3 M	19.7 M		20.7 M
Selenium	<1 mg/kg	TM181				<1 #	<1 #		<1 #
Vanadium	<0.2 mg/kg	TM181				17.2 #	24.7 #		17.7 #
Zinc	<1.9 mg/kg	TM181				298 M	2210 M		492 M
Boron, water soluble	<1 mg/kg	TM222				<1 M	<1 M		<1 M

CERTIFICATE OF ANALYSIS

SDG:	150624-101	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321065
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Customer Sample R	TP23
Depth (m)	2.00
Sample Type	Soil/Solid
Date Sampled	23/06/2015
Sample Time	.
Date Received	24/06/2015
SDG Ref	150624-101
Lab Sample No.(s)	11594294
AGS Reference	

Component	LOD/Units	Method	
Moisture Content Ratio (% of as received sample)	%	PM024	7.4
Organic Carbon, Total	<0.2 %	TM132	0.951 M
pH	1 pH Units	TM133	8.91 M
Chromium, Hexavalent	<0.6 mg/kg	TM151	<0.6 #
Cyanide, Total	<1 mg/kg	TM153	<1 M
Antimony	<0.6 mg/kg	TM181	3.5 #
Arsenic	<0.6 mg/kg	TM181	22.4 M
Beryllium	<0.01 mg/kg	TM181	0.212 M
Cadmium	<0.02 mg/kg	TM181	0.577 M
Chromium	<0.9 mg/kg	TM181	6.69 M
Copper	<1.4 mg/kg	TM181	40.5 M
Lead	<0.7 mg/kg	TM181	147 M
Mercury	<0.14 mg/kg	TM181	<0.14 M
Molybdenum	<0.1 mg/kg	TM181	0.643 #
Nickel	<0.2 mg/kg	TM181	9.39 M
Selenium	<1 mg/kg	TM181	<1 #
Vanadium	<0.2 mg/kg	TM181	13 #
Zinc	<1.9 mg/kg	TM181	435 M
Boron, water soluble	<1 mg/kg	TM222	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150624-101	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321065
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

PAH by GCMS

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TP19	TP20	TP22	TP23		
			Depth (m)	0.30	1.00	0.20	2.00		
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid		
			Date Sampled	22/06/2015	22/06/2015	23/06/2015	23/06/2015		
			Sample Time	.	.	.	.		
			Date Received	24/06/2015	24/06/2015	24/06/2015	24/06/2015		
			SDG Ref	150624-101	150624-101	150624-101	150624-101		
			Lab Sample No.(s)	11594281	11594283	11594288	11594294		
			AGS Reference						
Naphthalene-d8 % recovery**	%	TM218		100	87.8	90.3	92.2		
Acenaphthene-d10 % recovery**	%	TM218		99.5	83.9	88.5	90.9		
Phenanthrene-d10 % recovery**	%	TM218		99.3	81.8	88.5	90.6		
Chrysene-d12 % recovery**	%	TM218		104	79.6	94.2	94.8		
Perylene-d12 % recovery**	%	TM218		107	85.7	96.1	98.3		
Naphthalene	<9 µg/kg	TM218		249 M	87.6 M	69.7 M	1090 M		
Acenaphthylene	<12 µg/kg	TM218		78.6 M	27.3 M	14.4 M	<12 M		
Acenaphthene	<8 µg/kg	TM218		221 M	50.4 M	38.1 M	276 M		
Fluorene	<10 µg/kg	TM218		224 M	32.8 M	33.1 M	130 M		
Phenanthrene	<15 µg/kg	TM218		2890 M	632 M	420 M	687 M		
Anthracene	<16 µg/kg	TM218		623 M	118 M	76.7 M	106 M		
Fluoranthene	<17 µg/kg	TM218		4210 M	1340 M	729 M	738 M		
Pyrene	<15 µg/kg	TM218		3280 M	1090 M	614 M	688 M		
Benz(a)anthracene	<14 µg/kg	TM218		2360 M	849 M	434 M	375 M		
Chrysene	<10 µg/kg	TM218		2230 M	938 M	383 M	442 M		
Benzo(b)fluoranthene	<15 µg/kg	TM218		2600 M	1420 M	541 M	404 M		
Benzo(k)fluoranthene	<14 µg/kg	TM218		965 M	450 M	291 M	226 M		
Benzo(a)pyrene	<15 µg/kg	TM218		2190 M	898 M	457 M	391 M		
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218		1170 M	560 M	288 M	189 M		
Dibenzo(a,h)anthracene	<23 µg/kg	TM218		421 M	187 M	98.3 M	64 M		
Benzo(g,h,i)perylene	<24 µg/kg	TM218		1410 M	629 M	370 M	252 M		
PAH, Total Detected USEPA 16	<118 µg/kg	TM218		25100	9310	4860	6060		

CERTIFICATE OF ANALYSIS

SDG:	150624-101	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321065
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

PAH Spec MS - Aqueous (W)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH001	BH009
			Depth (m)	3.55	3.44
			Sample Type	Water(GW/SW)	Water(GW/SW)
			Date Sampled	22/06/2015	22/06/2015
			Sample Time	.	.
			Date Received	24/06/2015	24/06/2015
			SDG Ref	150624-101	150624-101
			Lab Sample No.(s)	11594278	11594279
			AGS Reference		
Naphthalene (aq)	<0.1 µg/l	TM178		4.11 & #	<5 & #
Acenaphthene (aq)	<0.015 µg/l	TM178		5.48 & #	6.1 & #
Acenaphthylene (aq)	<0.011 µg/l	TM178		1.63 & #	2.34 & #
Fluoranthene (aq)	<0.017 µg/l	TM178		236 & #	45.1 & #
Anthracene (aq)	<0.015 µg/l	TM178		29.1 & #	3.73 & #
Phenanthrene (aq)	<0.022 µg/l	TM178		123 & #	18.4 & #
Fluorene (aq)	<0.014 µg/l	TM178		4.43 & #	4.04 & #
Chrysene (aq)	<0.013 µg/l	TM178		167 & #	31.5 & #
Pyrene (aq)	<0.015 µg/l	TM178		213 & #	42.2 & #
Benzo(a)anthracene (aq)	<0.017 µg/l	TM178		162 & #	31.6 & #
Benzo(b)fluoranthene (aq)	<0.023 µg/l	TM178		204 & #	56.1 & #
Benzo(k)fluoranthene (aq)	<0.027 µg/l	TM178		79.5 & #	19 & #
Benzo(a)pyrene (aq)	<0.009 µg/l	TM178		163 & #	37.4 & #
Dibenzo(a,h)anthracene (aq)	<0.016 µg/l	TM178		30.3 & #	9.53 & #
Benzo(g,h,i)perylene (aq)	<0.016 µg/l	TM178		117 & #	37.8 & #
Indeno(1,2,3-cd)pyrene (aq)	<0.014 µg/l	TM178		89.1 & #	20.6 & #
PAH, Total Detected USEPA 16 (aq)	<0.344 µg/l	TM178		1630 &	365 &

CERTIFICATE OF ANALYSIS

SDG:	150624-101	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321065
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

TPH CWG (S)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TP19	TP20	TP22	TP23		
			Depth (m)	0.30	1.00	0.20	2.00		
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid		
			Date Sampled	22/06/2015	22/06/2015	23/06/2015	23/06/2015		
			Sample Time	.	.	.	.		
			Date Received	24/06/2015	24/06/2015	24/06/2015	24/06/2015		
			SDG Ref	150624-101	150624-101	150624-101	150624-101		
			Lab Sample No.(s)	11594281	11594283	11594288	11594294		
			AGS Reference						
GRO Surrogate % recovery**	%	TM089		11	67	52	85		
GRO TOT (Moisture Corrected)	<44 µg/kg	TM089		<44 M	<44 M	<44 M	<44 M		
Methyl tertiary butyl ether (MTBE)	<5 µg/kg	TM089		<5 M	<5 M	<5 M	<5 M		
Benzene	<10 µg/kg	TM089		<10 M	<10 M	<10 M	<10 M		
Toluene	<2 µg/kg	TM089		<2 M	<2 M	<2 M	<2 M		
Ethylbenzene	<3 µg/kg	TM089		<3 M	<3 M	<3 M	<3 M		
m,p-Xylene	<6 µg/kg	TM089		<6 M	<6 M	<6 M	<6 M		
o-Xylene	<3 µg/kg	TM089		<3 M	<3 M	<3 M	<3 M		
sum of detected mpo xylene by GC	<9 µg/kg	TM089		<9	<9	<9	<9		
sum of detected BTEX by GC	<24 µg/kg	TM089		<24	<24	<24	<24		
Aliphatics >C5-C6	<10 µg/kg	TM089		<10	<10	<10	<10		
Aliphatics >C6-C8	<10 µg/kg	TM089		<10	<10	<10	<10		
Aliphatics >C8-C10	<10 µg/kg	TM089		<10	<10	<10	<10		
Aliphatics >C10-C12	<10 µg/kg	TM089		<10	<10	<10	<10		
Aliphatics >C12-C16	<100 µg/kg	TM173		2420	3190	1890	<100		
Aliphatics >C16-C21	<100 µg/kg	TM173		6990	6980	5340	<100		
Aliphatics >C21-C35	<100 µg/kg	TM173		49600	43500	33400	<100		
Aliphatics >C35-C44	<100 µg/kg	TM173		8940	19600	3820	<100		
Total Aliphatics >C12-C44	<100 µg/kg	TM173		67900	73200	44500	<100		
Aromatics >EC5-EC7	<10 µg/kg	TM089		<10	<10	<10	<10		
Aromatics >EC7-EC8	<10 µg/kg	TM089		<10	<10	<10	<10		
Aromatics >EC8-EC10	<10 µg/kg	TM089		<10	<10	<10	<10		
Aromatics >EC10-EC12	<10 µg/kg	TM089		<10	<10	<10	<10		
Aromatics >EC12-EC16	<100 µg/kg	TM173		2370	2510	927	<100		
Aromatics >EC16-EC21	<100 µg/kg	TM173		21700	23600	3610	1100		
Aromatics >EC21-EC35	<100 µg/kg	TM173		88000	110000	25000	3800		
Aromatics >EC35-EC44	<100 µg/kg	TM173		28500	43200	10000	<100		
Aromatics >EC40-EC44	<100 µg/kg	TM173		11300	17000	4310	<100		
Total Aromatics >EC12-EC44	<100 µg/kg	TM173		141000	180000	39500	4900		
Total Aliphatics & Aromatics >C5-C44	<100 µg/kg	TM173		208000	253000	84000	4900		

CERTIFICATE OF ANALYSIS

SDG:	150624-101	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321065
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

TPH CWG (W)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	BH001	BH009				
			Depth (m)	3.55	3.44				
			Sample Type	Water(GW/SW)	Water(GW/SW)				
			Date Sampled	22/06/2015	22/06/2015				
			Sample Time	.	.				
			Date Received	24/06/2015	24/06/2015				
			SDG Ref	150624-101	150624-101				
			Lab Sample No.(s)	11594278	11594279				
			AGS Reference						
GRO Surrogate % recovery**	%	TM245		29 1	89 1				
GRO >C5-C12	<50 µg/l	TM245		358 1 #	23700 1 #				
Methyl tertiary butyl ether (MTBE)	<3 µg/l	TM245		<3 1 #	<3 1 #				
Benzene	<7 µg/l	TM245		<7 1 #	12 1 #				
Toluene	<4 µg/l	TM245		<4 1 #	<4 1 #				
Ethylbenzene	<5 µg/l	TM245		<5 1 #	<5 1 #				
m,p-Xylene	<8 µg/l	TM245		<8 1 #	<8 1 #				
o-Xylene	<3 µg/l	TM245		<3 1 #	<3 1 #				
Sum of detected Xylenes	<11 µg/l	TM245		<11 1	<11 1				
Sum of detected BTEX	<28 µg/l	TM245		<28 1	<28 1				
Aliphatics >C5-C6	<10 µg/l	TM245		<10 1	25 1				
Aliphatics >C6-C8	<10 µg/l	TM245		<10 1	2260 1				
Aliphatics >C8-C10	<10 µg/l	TM245		111 1	5040 1				
Aliphatics >C10-C12	<10 µg/l	TM245		91 1	7800 1				
Aliphatics >C12-C16 (aq)	<10 µg/l	TM174		<10	19900				
Aliphatics >C16-C21 (aq)	<10 µg/l	TM174		<10	6770				
Aliphatics >C21-C35 (aq)	<10 µg/l	TM174		92	8290				
Total Aliphatics >C12-C35 (aq)	<10 µg/l	TM174		92	34900				
Aromatics >EC5-EC7	<10 µg/l	TM245		<10 1	12 1				
Aromatics >EC7-EC8	<10 µg/l	TM245		<10 1	<10 1				
Aromatics >EC8-EC10	<10 µg/l	TM245		77 1	3360 1				
Aromatics >EC10-EC12	<10 µg/l	TM245		61 1	5200 1				
Aromatics >EC12-EC16 (aq)	<10 µg/l	TM174		<10	1480				
Aromatics >EC16-EC21 (aq)	<10 µg/l	TM174		<10	1410				
Aromatics >EC21-EC35 (aq)	<10 µg/l	TM174		<10	2380				
Total Aromatics >EC12-EC35 (aq)	<10 µg/l	TM174		<10	5280				
Total Aliphatics & Aromatics >C5-35 (aq)	<10 µg/l	TM174		450	63900				

CERTIFICATE OF ANALYSIS

SDG:	150624-101	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321065
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Asbestos Identification - Solid Samples

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP19 0.30 SOLID 22/06/2015 00:00:00 27/06/2015 07:25:08 150624-101 11594281 TM048	30/6/15	Rebecca Rawlings	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP20 1.00 SOLID 22/06/2015 00:00:00 27/06/2015 07:30:44 150624-101 11594283 TM048	30/6/15	Rebecca Rawlings	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP22 0.20 SOLID 23/06/2015 00:00:00 27/06/2015 09:28:00 150624-101 11594288 TM048	30/6/15	Rebecca Rawlings	Fibre bundles in soil	Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP23 2.00 SOLID 23/06/2015 00:00:00 27/06/2015 10:22:19 150624-101 11594294 TM048	30/6/15	Rebecca Rawlings	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150624-101	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321065
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Asbestos Quantification - Full

		Additional Asbestos Components (Using TM048)	Analysts Comments	Asbestos Quantification - Gravimetric - %	Asbestos Quantification - PCOM Evaluation - %	Asbestos Quantification - Total - %
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP22 0.20 SOLID 23/06/2015 00:00:00 02/07/2015 15:02:39 150624-101 11594288 TM 304	None (#)	N/C	<0.001 (#)	<0.001 (#)	<0.001 (#)

CERTIFICATE OF ANALYSIS

SDG:	150624-101	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321065
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.096	**Natural Moisture Content (%)**	6.34
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	94
Particle Size <4mm	>95%		

Case	
SDG	150624-101
Lab Sample Number(s)	11594286
Sampled Date	22-Jun-2015
Customer Sample Ref.	TP21
Depth (m)	1.00

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Hexavalent Chromium	<0.03	<0.03	<0.3	<0.3	-	-	-
pH Value of Filtered Water	7.5	<0.001	75	<0.01	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	0.0041	<0.0016	0.041	<0.016	-	-	-
Arsenic	0.00545	<0.0012	0.0545	<0.012	-	-	-
Total Cyanide (W)	<0.05	<0.05	<0.5	<0.5	-	-	-
Beryllium	<0.0007	<0.0007	<0.007	<0.007	-	-	-
Boron	0.2	<0.094	2	<0.94	-	-	-
Cadmium	<0.001	<0.001	<0.01	<0.01	-	-	-
Chromium	0.00647	<0.0022	0.0647	<0.022	-	-	-
Copper	<0.0085	<0.0085	<0.085	<0.085	-	-	-
Lead	0.00291	<0.0002	0.0291	<0.002	-	-	-
Molybdenum	0.00347	<0.0024	0.0347	<0.024	-	-	-
Nickel	0.00288	<0.0015	0.0288	<0.015	-	-	-
Selenium	<0.0039	<0.0039	<0.039	<0.039	-	-	-
Vanadium	<0.0024	<0.0024	<0.024	<0.024	-	-	-
Zinc	0.0051	<0.0041	0.051	<0.041	-	-	-
PAH Spec MS - Aqueous (W)							
Naphthalene by GCMS	<0.0001	<0.0001	<0.001	<0.001	-	-	-
Acenaphthene by GCMS	<0.000015	<0.000015	<0.00015	<0.00015	-	-	-
Acenaphthylene by GCMS	<0.000011	<0.000011	<0.00011	<0.00011	-	-	-
Fluoranthene by GCMS	0.00015	<0.000017	0.0015	<0.00017	-	-	-
Anthracene by GCMS	<0.000015	<0.000015	<0.00015	<0.00015	-	-	-
Phenanthrene by GCMS	<0.000022	<0.000022	<0.00022	<0.00022	-	-	-
Fluorene by GCMS	<0.000014	<0.000014	<0.00014	<0.00014	-	-	-
Chrysene by GCMS	0.0000436	<0.000013	0.000436	<0.00013	-	-	-
Pyrene by GCMS	0.000144	<0.000015	0.00144	<0.00015	-	-	-
Benz(a)anthracene by GCMS	0.0000285	<0.000017	0.000285	<0.00017	-	-	-
Benzo(b)fluoranthene by GCMS	0.0000354	<0.000023	0.000354	<0.00023	-	-	-
Benzo(k)fluoranthene by GCMS	<0.000027	<0.000027	<0.00027	<0.00027	-	-	-
Benzo(a)pyrene by GCMS	0.0000186	<0.000009	0.000186	<0.00009	-	-	-
Dibenzo(ah)anthracene by GCMS	<0.000016	<0.000016	<0.00016	<0.00016	-	-	-
Benzo(ghi)perylene by GCMS	0.0000162	<0.000016	0.000162	<0.00016	-	-	-
Indeno(123cd)pyrene by GCMS	<0.000014	<0.000014	<0.00014	<0.00014	-	-	-
PAH 16 EPA Total by GCMS	0.000436	<0.000344	0.00436	<0.00344	-	-	-
TPH CWG (W)							
Surrogate Recovery	-	<0	-	<0	-	-	-

Leach Test Information

Date Prepared	30-Jun-2015
pH (pH Units)	8.30
Conductivity (µS/cm)	66.90
Temperature (°C)	21.00
Volume Leachant (Litres)	0.894

Mcerts Certification does not apply to leachates

16/07/2015 10:02:33

10:02:18 16/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150624-101	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321065
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.096	**Natural Moisture Content (%)**	6.34
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	94
Particle Size <4mm	>95%		

Case	
SDG	150624-101
Lab Sample Number(s)	11594286
Sampled Date	22-Jun-2015
Customer Sample Ref.	TP21
Depth (m)	1.00

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
TPH CWG (W)							
GRO TOT (C5-C12)	<0.05	<0.05	<0.5	<0.5	-	-	-
Aliphatics C5-C6	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C6-C8	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C8-C10	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C10-C12	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C12-C16	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C16-C21	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C21-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Total Aliphatics >C12-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics C6-C7	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >C7-C8	<0.01	<0.01	<0.1	<0.1	-	-	-
MTBE GC-FID	<0.003	<0.003	<0.03	<0.03	-	-	-
Aromatics >EC8 -EC10	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC10-EC12	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC12-EC16	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC16-EC21	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC21-EC35	<0.01	<0.01	<0.1	<0.1	-	-	-
Total Aromatics >EC12-EC35	<0.01	<0.01	<0.1	<0.1	-	-	-
Benzene by GC	<0.007	<0.007	<0.07	<0.07	-	-	-
TPH (Total Aliphatics + Total Aromatics) >C5-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Toluene by GC	<0.004	<0.004	<0.04	<0.04	-	-	-
Ethylbenzene by GC	<0.005	<0.005	<0.05	<0.05	-	-	-
m & p Xylene by GC	<0.008	<0.008	<0.08	<0.08	-	-	-
o Xylene by GC	<0.003	<0.003	<0.03	<0.03	-	-	-
Sum m&p and o Xylene by GC	<0.011	<0.011	<0.11	<0.11	-	-	-
Sum of BTEX by GC	<0.028	<0.028	<0.28	<0.28	-	-	-

Leach Test Information

Date Prepared	30-Jun-2015
pH (pH Units)	8.30
Conductivity (µS/cm)	66.90
Temperature (°C)	21.00
Volume Leachant (Litres)	0.894

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16/07/2015 10:02:33

10:02:18 16/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150624-101	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321065
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
PM115		Leaching Procedure for CEN One Stage Leach Test 2:1 & 10:1 1 Step		
TM 304				
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM061	Method for the Determination of EPH,Massachusetts Dept.of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser		
TM173	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID		
TM174	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Waters by GC-FID		
TM178	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM218	Microwave extraction – EPA method 3546	Microwave extraction - EPA method 3546		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		
TM227	Standard methods for the examination of waters and wastewaters 20th Edition, AWWA/APHA Method 4500.	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate		
TM241	Methods for the Examination of Waters and Associated Materials; Chromium in Raw and Potable Waters and Sewage Effluents 1980.	The Determination of Hexavalent Chromium in Waters and Leachates using the Kone Analyser		
TM245	By GC-FID	Determination of GRO by Headspace in waters		
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	150624-101	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321065
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	11594278	11594279	11594281	11594283	11594286	11594288	11594294
Customer Sample Ref.	BH001	BH009	TP19	TP20	TP21	TP22	TP23
AGS Ref.							
Depth	3.55	3.44	0.30	1.00	1.00	0.20	2.00
Type	LIQUID	LIQUID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples			30-Jun-2015	30-Jun-2015		30-Jun-2015	30-Jun-2015
Asbestos Quantification - Full						03-Jul-2015	
Boron Water Soluble			03-Jul-2015	03-Jul-2015		06-Jul-2015	03-Jul-2015
CEN 10:1 Leachate (1 Stage)					30-Jun-2015		
CEN Readings					03-Jul-2015		
Cyanide Comp/Free/Total/Thiocyanate	01-Jul-2015	30-Jun-2015	03-Jul-2015	03-Jul-2015	07-Jul-2015	03-Jul-2015	03-Jul-2015
Dissolved Metals by ICP-MS	14-Jul-2015	10-Jul-2015			16-Jul-2015		
Dissolved Organic/Inorganic Carbon					08-Jul-2015		
EPH CWG (Aliphatic) Aqueous GC (W)	07-Jul-2015	07-Jul-2015			07-Jul-2015		
EPH CWG (Aliphatic) GC (S)			02-Jul-2015	02-Jul-2015		02-Jul-2015	01-Jul-2015
EPH CWG (Aromatic) Aqueous GC (W)	07-Jul-2015	07-Jul-2015			07-Jul-2015		
EPH CWG (Aromatic) GC (S)			02-Jul-2015	02-Jul-2015		02-Jul-2015	01-Jul-2015
GRO by GC-FID (S)			06-Jul-2015	02-Jul-2015		02-Jul-2015	02-Jul-2015
GRO by GC-FID (W)	06-Jul-2015	03-Jul-2015			03-Jul-2015		
Hexavalent Chromium (s)			03-Jul-2015	03-Jul-2015		03-Jul-2015	03-Jul-2015
Hexavalent Chromium (w)	04-Jul-2015	04-Jul-2015			07-Jul-2015		
Mercury Dissolved	06-Jul-2015	29-Jun-2015			07-Jul-2015		
Metals in solid samples by OES			03-Jul-2015	03-Jul-2015		06-Jul-2015	03-Jul-2015
PAH by GCMS			06-Jul-2015	02-Jul-2015		06-Jul-2015	06-Jul-2015
PAH Spec MS - Aqueous (W)	07-Jul-2015	07-Jul-2015			07-Jul-2015		
pH			07-Jul-2015	07-Jul-2015		07-Jul-2015	06-Jul-2015
pH Value	06-Jul-2015	06-Jul-2015					
pH Value of Filtered Water					07-Jul-2015		
Sample description			26-Jun-2015	26-Jun-2015	26-Jun-2015	26-Jun-2015	27-Jun-2015
Total Organic and Inorganic Carbon	06-Jul-2015	02-Jul-2015					
Total Organic Carbon			02-Jul-2015	02-Jul-2015		07-Jul-2015	02-Jul-2015
TPH CWG (W)	07-Jul-2015	07-Jul-2015			07-Jul-2015		
TPH CWG GC (S)			06-Jul-2015	02-Jul-2015		02-Jul-2015	02-Jul-2015

SDG:	150624-101	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321065
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before presevation was performed
§	Sampled on date not provided
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

ALcontrol Laboratories

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Apex Drilling Services
Sturmi Way
Village Farm Industrial Estate
Pyle
Bridgend
CF33 6BZ

Attention: Robert Brewer

CERTIFICATE OF ANALYSIS

Date:	16 July 2015
Customer:	H_APEXDRL_BGD
Sample Delivery Group (SDG):	150621-6
Your Reference:	10318
Location:	Swansea Bay
Report No:	321164

This report has been revised and directly supersedes 321140 in its entirety.

We received 19 samples on Saturday June 20, 2015 and 9 of these samples were scheduled for analysis which was completed on Thursday July 16, 2015. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan
Operations Manager

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Registered Office: Units 7 & 8 Hawarden Business Park, Manor Road, Hawarden, Deeside, CH5 3US. Registered in England and Wales No. 4057291.

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321164
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	321140

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
11575661	BH007	ES1	0.00 - 0.10	19/06/2015
11575662	BH007	ES2	0.10 - 0.50	19/06/2015
11575663	BH009	ES1	0.00 - 0.10	19/06/2015
11575664	BH009	ES2	0.20 - 0.80	19/06/2015
11575665	BH009	ES4	1.20 - 1.50	19/06/2015
11575666	BH009	ES6	2.00 - 2.50	19/06/2015
11575667	BH009	ES9	3.65 - 4.00	19/06/2015
11575668	BH006A	ES1	0.00 - 0.10	19/06/2015
11575669	BH006A	ES2	0.10 - 0.60	19/06/2015
11575670	BH006A	ES4	1.20 - 1.50	19/06/2015
11575671	BH006A	ES6	2.00 - 2.30	19/06/2015
11575653	TP10		0.40	19/06/2015
11575654	TP10		1.00	19/06/2015
11575655	TP10		2.00	19/06/2015
11575656	TP10		2.80	19/06/2015
11575657	TP11		0.20	19/06/2015
11575658	TP11		1.00	19/06/2015
11575659	TP11		2.00	19/06/2015
11575660	TP11		3.00	19/06/2015

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321164
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	321140

SOLID

Results Legend

X Test

N No Determination Possible

Lab Sample No(s)	11575662	11575664	11575670	11575653	11575654	11575655	11575657	11575658	11575659
Customer Sample Reference	BH007	BH009	BH006A	TP10	TP10	TP10	TP11	TP11	TP11
AGS Reference	ES2	ES2	ES4						
Depth (m)	0.10 - 0.50	0.20 - 0.80	1.20 - 1.50	0.40	1.00	2.00	0.20	1.00	2.00
Container	1kg TUB	250g Amber Jar	60g VOC (ALE215)	1kg TUB	250g Amber Jar	60g VOC (ALE215)	1kg TUB	250g Amber Jar	60g VOC (ALE215)	1kg TUB	250g Amber Jar	60g VOC (ALE215)	1kg TUB	250g Amber Jar	60g VOC (ALE215)	1kg TUB	250g Amber Jar	60g VOC (ALE215)	1kg TUB	250g Amber Jar	60g VOC (ALE215)	1kg TUB	250g Amber Jar	60g VOC (ALE215)	1kg TUB	250g Amber Jar	60g VOC (ALE215)	1kg TUB	250g Amber Jar	60g VOC (ALE215)
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 4	X		X		X										X													
Boron Water Soluble	All	NDPs: 0 Tests: 9		X		X		X		X			X		X		X		X				X		X		X		X	X
CEN Readings	All	NDPs: 0 Tests: 1								X																				
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 5	X		X		X			X							X													
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 1								X																				
Dissolved Organic/Inorganic Carbon	All	NDPs: 0 Tests: 1								X																				
EPH CWG (Aliphatic) Aqueous GC (W)	All	NDPs: 0 Tests: 1								X																				
EPH CWG (Aliphatic) GC (S)	All	NDPs: 0 Tests: 4		X		X		X							X															
EPH CWG (Aromatic) Aqueous GC (W)	All	NDPs: 0 Tests: 1								X																				
EPH CWG (Aromatic) GC (S)	All	NDPs: 0 Tests: 4		X		X		X							X															
GRO by GC-FID (S)	All	NDPs: 0 Tests: 4			X		X		X							X														
GRO by GC-FID (W)	All	NDPs: 0 Tests: 1								X																				
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 8	X		X		X		X		X		X		X		X				X									
Hexavalent Chromium (w)	All	NDPs: 0 Tests: 1								X																				
Mercury Dissolved	All	NDPs: 0 Tests: 1								X																				

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321164
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	321140

SOLID

Results Legend

X **Test**

N **No Determination Possible**

		Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container
		11575662	BH007	ES2	0.10 - 0.50	1kg TUB
						250g Amber Jar
		11575664	BH009	ES2	0.20 - 0.80	60g VOC (ALE215)
						1kg TUB
						250g Amber Jar
		11575670	BH006A	ES4	1.20 - 1.50	60g VOC (ALE215)
						1kg TUB
						250g Amber Jar
		11575653	TP10		0.40	60g VOC (ALE215)
						1kg TUB
						250g Amber Jar
		11575654	TP10		1.00	1kg TUB
						250g Amber Jar
		11575655	TP10		2.00	1kg TUB
						250g Amber Jar
		11575657	TP11		0.20	1kg TUB
						250g Amber Jar
						60g VOC (ALE215)
		11575658	TP11		1.00	1kg TUB
						250g Amber Jar
		11575659	TP11		2.00	250g Amber Jar
Metals in solid samples by OES	All	NDPs: 0 Tests: 9				X X X X X X X X X
PAH by GCMS	All	NDPs: 0 Tests: 4				X X X X
PAH Spec MS - Aqueous (W)	All	NDPs: 0 Tests: 1				X
pH	All	NDPs: 0 Tests: 4				X X X X
pH Value of Filtered Water	All	NDPs: 0 Tests: 1				X
Sample description	All	NDPs: 0 Tests: 9				X X X X X X X X X
Total Organic Carbon	All	NDPs: 0 Tests: 4				X X X X
TPH CWG (W)	All	NDPs: 0 Tests: 1				X
TPH CWG GC (S)	All	NDPs: 0 Tests: 4				X X X X
VOC MS (S)	All	NDPs: 0 Tests: 4				X X X X
VOC MS (W)	All	NDPs: 0 Tests: 1				X

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321164
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	321140

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
11575662	BH007	0.10 - 0.50	Dark Brown	Loamy Sand	0.1 - 2 mm	Vegetation	Concrete/Aggregate
11575664	BH009	0.20 - 0.80	Dark Brown	Sand	0.1 - 2 mm	Stones	Vegetation
11575670	BH006A	1.20 - 1.50	Dark Brown	Gravel	2 - 10 mm	Stones	N/A
11575653	TP10	0.40	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	Stones
11575654	TP10	1.00	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	None
11575655	TP10	2.00	Dark Brown	Silty Clay Loam	0.063 - 0.1 mm	Stones	Vegetation
11575657	TP11	0.20	Dark Brown	Sand	0.1 - 2 mm	Crushed Brick	Stones
11575658	TP11	1.00	Dark Brown	Loamy Sand	0.1 - 2 mm	Stones	Vegetation
11575659	TP11	2.00	Black	N/A	0.1 - 2 mm	Vegetation	Coal fragments

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321164
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	321140

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	BH007	BH009	BH006A	TP10	TP10	TP10
			Depth (m)	0.10 - 0.50	0.20 - 0.80	1.20 - 1.50	0.40	1.00	2.00
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	19/06/2015	19/06/2015	19/06/2015	19/06/2015	19/06/2015	19/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	20/06/2015	20/06/2015	20/06/2015	20/06/2015	20/06/2015	20/06/2015
			SDG Ref	150621-6	150621-6	150621-6	150621-6	150621-6	150621-6
			Lab Sample No.(s)	11575662	11575664	11575670	11575653	11575654	11575655
			AGS Reference	ES2	ES2	ES4			
Moisture Content Ratio (% of as received sample)	%	PM024		4.1	5.5	20	9.6	14	23
Organic Carbon, Total	<0.2 %	TM132		6.29 M	1.25 M	14.6 #			
pH	1 pH Units	TM133		8.16 M	8.54 M	6.91 #			
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #
Cyanide, Total	<1 mg/kg	TM153		<1 M	<1 M	<1 #			
Antimony	<0.6 mg/kg	TM181		29.2 #	3.22 #	370 #	19 #	6.17 #	1.93 #
Arsenic	<0.6 mg/kg	TM181		44.7 M	24.5 M	406 #	95 M	28.7 M	14.9 M
Beryllium	<0.01 mg/kg	TM181		0.523 M	0.251 M	<0.1 #	1.62 M	0.545 M	0.512 M
Cadmium	<0.02 mg/kg	TM181		3.62 M	1.49 M	90.6 #	4.99 M	2.17 M	0.734 M
Chromium	<0.9 mg/kg	TM181		217 M	13.6 M	20.1 #	20.4 M	11.8 M	17.3 M
Copper	<1.4 mg/kg	TM181		243 M	42.1 M	2090 #	155 M	46.2 M	20.8 M
Lead	<0.7 mg/kg	TM181		1720 M	338 M	19100 #	2030 M	527 M	100 M
Mercury	<0.14 mg/kg	TM181		<0.14 M	<0.14 M	<0.14 #	0.219 M	<0.14 M	<0.14 M
Molybdenum	<0.1 mg/kg	TM181		3.34 #	0.407 #	2.69 #	3.87 #	1.32 #	0.77 #
Nickel	<0.2 mg/kg	TM181		20.1 M	14.2 M	49.3 #	69.9 M	29.9 M	21.1 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<10 #	<1 #	<1 #	<1 #
Vanadium	<0.2 mg/kg	TM181		82.6 #	19.4 #	35 #	26.2 #	17.3 #	25.6 #
Zinc	<1.9 mg/kg	TM181		2640 M	585 M	47800 #	3240 M	1130 M	595 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 #	<1 M	<1 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321164
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	321140

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	TP11	TP11	TP11			
			Depth (m)	0.20	1.00	2.00			
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid			
			Date Sampled	19/06/2015	19/06/2015	19/06/2015			
			Sample Time	.	.	.			
			Date Received	20/06/2015	20/06/2015	20/06/2015			
			SDG Ref	150621-6	150621-6	150621-6			
			Lab Sample No.(s)	11575657	11575658	11575659			
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		9.3	14	20			
Organic Carbon, Total	<0.2 %	TM132		3.27 M					
pH	1 pH Units	TM133		8.49 M					
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	1.28 #	17.4 3 #			
Cyanide, Total	<1 mg/kg	TM153		<1 M					
Antimony	<0.6 mg/kg	TM181		50.7 #	88.2 #	305			
Arsenic	<0.6 mg/kg	TM181		83.3 M	125 M	159			
Beryllium	<0.01 mg/kg	TM181		0.414 M	0.646 M	0.848			
Cadmium	<0.02 mg/kg	TM181		7.58 M	13.5 M	9.52			
Chromium	<0.9 mg/kg	TM181		8.81 M	12.2 M	14.7			
Copper	<1.4 mg/kg	TM181		197 M	365 M	1790			
Lead	<0.7 mg/kg	TM181		8200 M	11100 M	35300			
Mercury	<0.14 mg/kg	TM181		<0.14 M	<0.14 M	<0.14			
Molybdenum	<0.1 mg/kg	TM181		8.01 #	12.8 #	7.87			
Nickel	<0.2 mg/kg	TM181		145 M	75.5 M	53.2			
Selenium	<1 mg/kg	TM181		<1 #	<1 #	3.36			
Vanadium	<0.2 mg/kg	TM181		19.5 #	26.6 #	29.8			
Zinc	<1.9 mg/kg	TM181		10900 M	19300 M	24800			
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1			

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321164
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	321140

PAH by GCMS

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	BH007	BH009	BH006A	TP11		
			Depth (m)	0.10 - 0.50	0.20 - 0.80	1.20 - 1.50	0.20		
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid		
			Date Sampled	19/06/2015	19/06/2015	19/06/2015	19/06/2015		
			Sample Time	.	.	.	.		
			Date Received	20/06/2015	20/06/2015	20/06/2015	20/06/2015		
			SDG Ref	150621-6	150621-6	150621-6	150621-6		
			Lab Sample No.(s)	11575662	11575664	11575670	11575657		
			AGS Reference	ES2	ES2	ES4			
Naphthalene-d8 % recovery**	%	TM218		99.7	103	98.5	107		
Acenaphthene-d10 % recovery**	%	TM218		98.8	101	95.1	106		
Phenanthrene-d10 % recovery**	%	TM218		94.6	98.5	73.7	101		
Chrysene-d12 % recovery**	%	TM218		95.4	105	42.1	108		
Perylene-d12 % recovery**	%	TM218		96.3	114	32.2	116		
Naphthalene	<9 µg/kg	TM218		251 M	61.5 M	1070 #	287 M		
Acenaphthylene	<12 µg/kg	TM218		71.3 M	51.6 M	68.9 #	52.9 M		
Acenaphthene	<8 µg/kg	TM218		110 M	134 M	51.5 #	107 M		
Fluorene	<10 µg/kg	TM218		82 M	134 M	73.8 #	123 M		
Phenanthrene	<15 µg/kg	TM218		1350 M	1990 M	1140 #	1530 M		
Anthracene	<16 µg/kg	TM218		262 M	598 M	146 #	436 M		
Fluoranthene	<17 µg/kg	TM218		2010 M	5740 M	1380 #	2660 M		
Pyrene	<15 µg/kg	TM218		1630 M	3900 M	1120 #	2040 M		
Benz(a)anthracene	<14 µg/kg	TM218		964 M	3420 M	480 #	1180 M		
Chrysene	<10 µg/kg	TM218		1100 M	3080 M	603 #	1360 M		
Benzo(b)fluoranthene	<15 µg/kg	TM218		1620 M	4020 M	918 #	1480 M		
Benzo(k)fluoranthene	<14 µg/kg	TM218		566 M	1550 M	229 #	709 M		
Benzo(a)pyrene	<15 µg/kg	TM218		1010 M	2570 M	565 #	1210 M		
Indeno(1,2,3-cd)pyrene	<18 µg/kg	TM218		666 M	1520 M	498 #	686 M		
Dibenzo(a,h)anthracene	<23 µg/kg	TM218		227 M	650 M	105 #	258 M		
Benzo(g,h,i)perylene	<24 µg/kg	TM218		828 M	1650 M	817 #	849 M		
PAH, Total Detected USEPA 16	<118 µg/kg	TM218		12700	31100	9270	15000		

CERTIFICATE OF ANALYSIS

SDG: 150621-6 **Location:** Swansea Bay **Order Number:** 3074
Job: H_APEXDRL_BGD-42 **Customer:** Apex Drilling Services **Report Number:** 321164
Client Reference: 10318 **Attention:** Robert Brewer **Superseded Report:** 321140

TPH CWG (S)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	BH007	BH009	BH006A	TP11		
			Depth (m)	0.10 - 0.50	0.20 - 0.80	1.20 - 1.50	0.20		
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid		
			Date Sampled	19/06/2015	19/06/2015	19/06/2015	19/06/2015		
			Sample Time	.	.	.	.		
			Date Received	20/06/2015	20/06/2015	20/06/2015	20/06/2015		
			SDG Ref	150621-6	150621-6	150621-6	150621-6		
			Lab Sample No.(s)	11575662	11575664	11575670	11575657		
			AGS Reference	ES2	ES2	ES4			
GRO Surrogate % recovery**	%	TM089		14	58	36	34		
GRO TOT (Moisture Corrected)	<44 µg/kg	TM089		<44 M	<44 M	777 #	<44 M		
Methyl tertiary butyl ether (MTBE)	<5 µg/kg	TM089		<5 M	<5 M	<5 #	<5 M		
Benzene	<10 µg/kg	TM089		<10 M	<10 M	<10 #	<10 M		
Toluene	<2 µg/kg	TM089		2.08 M	<2 M	<2 #	<2 M		
Ethylbenzene	<3 µg/kg	TM089		<3 M	<3 M	5.04 #	<3 M		
m,p-Xylene	<6 µg/kg	TM089		<6 M	<6 M	7.56 #	<6 M		
o-Xylene	<3 µg/kg	TM089		<3 M	<3 M	<3 #	<3 M		
sum of detected mpo xylene by GC	<9 µg/kg	TM089		<9	<9	<9	<9		
sum of detected BTEX by GC	<24 µg/kg	TM089		<24	<24	<24	<24		
Aliphatics >C5-C6	<10 µg/kg	TM089		<10	<10	10.1	<10		
Aliphatics >C6-C8	<10 µg/kg	TM089		<10	<10	32.8	<10		
Aliphatics >C8-C10	<10 µg/kg	TM089		<10	<10	194	12.1		
Aliphatics >C10-C12	<10 µg/kg	TM089		<10	<10	237	<10		
Aliphatics >C12-C16	<100 µg/kg	TM173		4980	1560	134000	737		
Aliphatics >C16-C21	<100 µg/kg	TM173		9480	5520	46800	4110		
Aliphatics >C21-C35	<100 µg/kg	TM173		84200	10800	134000	35500		
Aliphatics >C35-C44	<100 µg/kg	TM173		74900	9290	31500	11700		
Total Aliphatics >C12-C44	<100 µg/kg	TM173		174000	27200	346000	52000		
Aromatics >EC5-EC7	<10 µg/kg	TM089		<10	<10	<10	<10		
Aromatics >EC7-EC8	<10 µg/kg	TM089		<10	<10	<10	<10		
Aromatics >EC8-EC10	<10 µg/kg	TM089		<10	<10	142	<10		
Aromatics >EC10-EC12	<10 µg/kg	TM089		<10	<10	158	<10		
Aromatics >EC12-EC16	<100 µg/kg	TM173		3320	2070	18500	913		
Aromatics >EC16-EC21	<100 µg/kg	TM173		13200	19800	35600	9110		
Aromatics >EC21-EC35	<100 µg/kg	TM173		98300	72500	101000	43200		
Aromatics >EC35-EC44	<100 µg/kg	TM173		136000	44100	39500	15600		
Aromatics >EC40-EC44	<100 µg/kg	TM173		70100	21300	14900	5590		
Total Aromatics >EC12-EC44	<100 µg/kg	TM173		251000	138000	194000	68800		
Total Aliphatics & Aromatics >C5-C44	<100 µg/kg	TM173		425000	166000	541000	121000		

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321164
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	321140

VOC MS (S)

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample Ref.	BH007	BH009	BH006A	TP11		
			Depth (m)	0.10 - 0.50	0.20 - 0.80	1.20 - 1.50	0.20		
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid		
			Date Sampled	19/06/2015	19/06/2015	19/06/2015	19/06/2015		
			Sample Time	.	.	.	.		
			Date Received	20/06/2015	20/06/2015	20/06/2015	20/06/2015		
			SDG Ref	150621-6	150621-6	150621-6	150621-6		
			Lab Sample No.(s)	11575662	11575664	11575670	11575657		
			AGS Reference	ES2	ES2	ES4			
Toluene-d8**	%	TM116		83.1	92.7	71.9	93		
Methyl Tertiary Butyl Ether	<10 µg/kg	TM116		<10 M	<10 M	<10 #	<10 M		
Benzene	<9 µg/kg	TM116		<9 M	<9 M	<9 #	<9 M		
Toluene	<7 µg/kg	TM116		<7 M	<7 M	<7 #	<7 M		
Ethylbenzene	<4 µg/kg	TM116		<4 M	<4 M	7.11 #	<4 M		
p/m-Xylene	<10 µg/kg	TM116		<10 #	<10 #	<10 #	<10 #		
o-Xylene	<10 µg/kg	TM116		<10 M	<10 M	<10 #	<10 M		

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321164
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	321140

Asbestos Identification - Solid Samples

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	BH007 ES 2 0.10 - 0.50 SOLID 19/06/2015 00:00:00 23/06/2015 11:31:11 150621-6 11575662 TM048	26/6/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	BH009 ES 2 0.20 - 0.80 SOLID 19/06/2015 00:00:00 23/06/2015 11:19:49 150621-6 11575664 TM048	26/6/15.	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	BH006A ES 4 1.20 - 1.50 SOLID 19/06/2015 00:00:00 23/06/2015 11:09:32 150621-6 11575670 TM048	26/6/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TP11 0.20 SOLID 19/06/2015 00:00:00 23/06/2015 11:18:39 150621-6 11575657 TM048	25/6/15	Rebecca Rawlings	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321164
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	321140

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.102	**Natural Moisture Content (%)**	13.2
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	88.4
Particle Size <4mm	>95%		

Case	
SDG	150621-6
Lab Sample Number(s)	11575653
Sampled Date	19-Jun-2015
Customer Sample Ref.	TP10
Depth (m)	0.40

Eluate Analysis	**C_2 Concⁿ in 10:1 eluate (mg/l)**		**A_2 10:1 concⁿ leached (mg/kg)**				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Dissolved Organic Carbon	<3	<3	<30	<30	-	-	-
Hexavalent Chromium	<0.03	<0.03	<0.3	<0.3	-	-	-
pH Value of Filtered Water	7.7	<0.001	77	<0.01	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	0.00574	<0.00016	0.0574	<0.0016	-	-	-
Arsenic	0.00958	<0.00012	0.0958	<0.0012	-	-	-
Total Cyanide (W)	<0.05	<0.05	<0.5	<0.5	-	-	-
Beryllium	<0.00007	<0.00007	<0.0007	<0.0007	-	-	-
Boron	0.0178	<0.0094	0.178	<0.094	-	-	-
Cadmium	0.000117	<0.0001	0.00117	<0.001	-	-	-
Chromium	0.00125	<0.00022	0.0125	<0.0022	-	-	-
Copper	0.00448	<0.00085	0.0448	<0.0085	-	-	-
Lead	0.00531	<0.00002	0.0531	<0.0002	-	-	-
Molybdenum	0.0158	<0.00024	0.158	<0.0024	-	-	-
Nickel	0.000571	<0.00015	0.00571	<0.0015	-	-	-
Selenium	<0.00039	<0.00039	<0.0039	<0.0039	-	-	-
Vanadium	0.000841	<0.00024	0.00841	<0.0024	-	-	-
Zinc	0.0119	<0.00041	0.119	<0.0041	-	-	-
PAH Spec MS - Aqueous (W)							
Naphthalene by GCMS	<0.0001	<0.0001	<0.001	<0.001	-	-	-
Acenaphthene by GCMS	<0.000015	<0.000015	<0.00015	<0.00015	-	-	-
Acenaphthylene by GCMS	<0.000011	<0.000011	<0.00011	<0.00011	-	-	-
Fluoranthene by GCMS	<0.000017	<0.000017	<0.00017	<0.00017	-	-	-
Anthracene by GCMS	<0.000015	<0.000015	<0.00015	<0.00015	-	-	-
Phenanthrene by GCMS	<0.000022	<0.000022	<0.00022	<0.00022	-	-	-
Fluorene by GCMS	<0.000014	<0.000014	<0.00014	<0.00014	-	-	-
Chrysene by GCMS	<0.000013	<0.000013	<0.00013	<0.00013	-	-	-
Pyrene by GCMS	<0.000015	<0.000015	<0.00015	<0.00015	-	-	-
Benz(a)anthracene by GCMS	<0.000017	<0.000017	<0.00017	<0.00017	-	-	-
Benzo(b)fluoranthene by GCMS	<0.000023	<0.000023	<0.00023	<0.00023	-	-	-
Benzo(k)fluoranthene by GCMS	<0.000027	<0.000027	<0.00027	<0.00027	-	-	-
Benzo(a)pyrene by GCMS	<0.000009	<0.000009	<0.00009	<0.00009	-	-	-
Dibenzo(ah)anthracene by GCMS	<0.000016	<0.000016	<0.00016	<0.00016	-	-	-
Benzo(ghi)perylene by GCMS	<0.000016	<0.000016	<0.00016	<0.00016	-	-	-
Indeno(123cd)pyrene by GCMS	<0.000014	<0.000014	<0.00014	<0.00014	-	-	-
PAH 16 EPA Total by GCMS	<0.000344	<0.000344	<0.00344	<0.00344	-	-	-

Leach Test Information

Date Prepared	24-Jun-2015
pH (pH Units)	8.03
Conductivity (µS/cm)	106.00
Temperature (°C)	23.20
Volume Leachant (Litres)	0.888

Mcerts Certification does not apply to leachates

16/07/2015 15:10:43

15:10:33 16/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321164
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	321140

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.102	**Natural Moisture Content (%)**	13.2
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	88.4
Particle Size <4mm	>95%		

Case	
SDG	150621-6
Lab Sample Number(s)	11575653
Sampled Date	19-Jun-2015
Customer Sample Ref.	TP10
Depth (m)	0.40

Eluate Analysis	**C_2 Conc^n in 10:1 eluate (mg/l)**		**A_2 10:1 conc^n leached (mg/kg)**				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
TPH CWG (W)							
Surrogate Recovery	-	<0	-	<0	-	-	-
GRO TOT (C5-C12)	<0.05	<0.05	<0.5	<0.5	-	-	-
Aliphatics C5-C6	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C6-C8	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C8-C10	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C10-C12	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C12-C16	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C16-C21	<0.01	<0.01	<0.1	<0.1	-	-	-
Aliphatics >C21-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Total Aliphatics >C12-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics C6-C7	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >C7-C8	<0.01	<0.01	<0.1	<0.1	-	-	-
MTBE GC-FID	<0.003	<0.003	<0.03	<0.03	-	-	-
Aromatics >EC8 -EC10	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC10-EC12	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC12-EC16	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC16-EC21	<0.01	<0.01	<0.1	<0.1	-	-	-
Aromatics >EC21-EC35	<0.01	<0.01	<0.1	<0.1	-	-	-
Total Aromatics >EC12-EC35	<0.01	<0.01	<0.1	<0.1	-	-	-
Benzene by GC	<0.007	<0.007	<0.07	<0.07	-	-	-
TPH (Total Aliphatics + Total Aromatics) >C5-C35	<0.01	<0.01	<0.1	<0.1	-	-	-
Toluene by GC	<0.004	<0.004	<0.04	<0.04	-	-	-
Ethylbenzene by GC	<0.005	<0.005	<0.05	<0.05	-	-	-
m & p Xylene by GC	<0.008	<0.008	<0.08	<0.08	-	-	-
o Xylene by GC	<0.003	<0.003	<0.03	<0.03	-	-	-
Sum m&p and o Xylene by GC	<0.011	<0.011	<0.11	<0.11	-	-	-
Sum of BTEX by GC	<0.028	<0.028	<0.28	<0.28	-	-	-
VOC MS (W)							
Toluene-d8	-	<0	-	<0	-	-	-
Tert-butyl methyl ether	<0.001	<0.001	<0.01	<0.01	-	-	-
Benzene	<0.001	<0.001	<0.01	<0.01	-	-	-
Toluene	<0.001	<0.001	<0.01	<0.01	-	-	-
Ethylbenzene	<0.001	<0.001	<0.01	<0.01	-	-	-
p/m-Xylene	<0.001	<0.001	<0.01	<0.01	-	-	-
o-Xylene	<0.001	<0.001	<0.01	<0.01	-	-	-

Leach Test Information

Date Prepared	24-Jun-2015
pH (pH Units)	8.03
Conductivity (µS/cm)	106.00
Temperature (°C)	23.20
Volume Leachant (Litres)	0.888

Mcerts Certification does not apply to leachates
16/07/2015 15:10:43
15:10:33 16/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321164
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	321140

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
PM115		Leaching Procedure for CEN One Stage Leach Test 2:1 & 10:1 1 Step		
TM 304				
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM061	Method for the Determination of EPH,Massachusetts Dept.of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)		
TM089	Modified: US EPA Methods 8020 & 602	Determination of Gasoline Range Hydrocarbons (GRO) and BTEX (MTBE) compounds by Headspace GC-FID (C4-C12)		
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water		
TM116	Modified: US EPA Method 8260, 8120, 8020, 624, 610 & 602	Determination of Volatile Organic Compounds by Headspace / GC-MS		
TM132	In - house Method	ELTRA CS800 Operators Guide		
TM133	BS 1377: Part 3 1990;BS 6068-2.5	Determination of pH in Soil and Water using the GLpH pH Meter		
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM153	Method 4500A,B,C, I, M AWWA/APHA, 20th Ed., 1999	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate using the Skalar SANS+ System Segmented Flow Analyser		
TM173	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Soils by GC-FID		
TM174	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Waters by GC-FID		
TM178	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM208	Modified: US EPA Method 8260b & 624	Determination of Volatile Organic Compounds by Headspace / GC-MS in Waters		
TM218	Microwave extraction – EPA method 3546	Microwave extraction - EPA method 3546		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		
TM227	Standard methods for the examination of waters and wastewaters 20th Edition, AWWA/APHA Method 4500.	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate		
TM241	Methods for the Examination of Waters and Associated Materials; Chromium in Raw and Potable Waters and Sewage Effluents 1980.	The Determination of Hexavalent Chromium in Waters and Leachates using the Kone Analyser		
TM245	By GC-FID	Determination of GRO by Headspace in waters		
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321164
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	321140

Test Completion Dates

Lab Sample No(s)	11575662	11575664	11575670	11575653	11575654	11575655	11575657	11575658	11575659
Customer Sample Ref.	BH007	BH009	BH006A	TP10	TP10	TP10	TP11	TP11	TP11
AGS Ref.	ES2	ES2	ES4						
Depth	0.10 - 0.50	0.20 - 0.80	1.20 - 1.50	0.40	1.00	2.00	0.20	1.00	2.00
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples	26-Jun-2015	26-Jun-2015	26-Jun-2015				26-Jun-2015		
Boron Water Soluble	01-Jul-2015	01-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	01-Jul-2015	25-Jun-2015	01-Jul-2015	02-Jul-2015
CEN 10:1 Leachate (1 Stage)				03-Jul-2015					
CEN Readings				06-Jul-2015					
Cyanide Comp/Free/Total/Thiocyanate	30-Jun-2015	30-Jun-2015	30-Jun-2015	01-Jul-2015			30-Jun-2015		
Dissolved Metals by ICP-MS				03-Jul-2015					
Dissolved Organic/Inorganic Carbon				01-Jul-2015					
EPH CWG (Aliphatic) Aqueous GC (W)				07-Jul-2015					
EPH CWG (Aliphatic) GC (S)	29-Jun-2015	29-Jun-2015	29-Jun-2015				26-Jun-2015		
EPH CWG (Aromatic) Aqueous GC (W)				07-Jul-2015					
EPH CWG (Aromatic) GC (S)	29-Jun-2015	29-Jun-2015	29-Jun-2015				26-Jun-2015		
GRO by GC-FID (S)	30-Jun-2015	30-Jun-2015	01-Jul-2015				30-Jun-2015		
GRO by GC-FID (W)				01-Jul-2015					
Hexavalent Chromium (s)	01-Jul-2015	01-Jul-2015	01-Jul-2015	03-Jul-2015	03-Jul-2015	03-Jul-2015	01-Jul-2015	03-Jul-2015	16-Jul-2015
Hexavalent Chromium (w)				03-Jul-2015					
Mercury Dissolved				01-Jul-2015					
Metals in solid samples by OES	01-Jul-2015	30-Jun-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	02-Jul-2015	29-Jun-2015	02-Jul-2015	09-Jul-2015
PAH by GCMS	30-Jun-2015	30-Jun-2015	01-Jul-2015				01-Jul-2015		
PAH Spec MS - Aqueous (W)				03-Jul-2015					
pH	02-Jul-2015	02-Jul-2015	02-Jul-2015				03-Jul-2015		
pH Value of Filtered Water				02-Jul-2015					
Sample description	24-Jun-2015	24-Jun-2015	24-Jun-2015	24-Jun-2015	26-Jun-2015	26-Jun-2015	23-Jun-2015	26-Jun-2015	26-Jun-2015
Total Organic Carbon	01-Jul-2015	01-Jul-2015	01-Jul-2015				29-Jun-2015		
TPH CWG (W)				07-Jul-2015					
TPH CWG GC (S)	30-Jun-2015	30-Jun-2015	01-Jul-2015				30-Jun-2015		
VOC MS (S)	30-Jun-2015	30-Jun-2015	03-Jul-2015				30-Jun-2015		
VOC MS (W)				01-Jul-2015					

SDG:	150621-6	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321164
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	321140

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors
employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5 -C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before presevation was performed
§	Sampled on date not provided
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

ALcontrol Laboratories

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Pyle
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CF33 6BZ

Attention: Robert Brewer

CERTIFICATE OF ANALYSIS

Date:	20 July 2015
Customer:	H_APEXDRL_BGD
Sample Delivery Group (SDG):	150703-8
Your Reference:	10318
Location:	Swansea Bay
Report No:	321665

We received 22 samples on Thursday July 02, 2015 and 22 of these samples were scheduled for analysis which was completed on Monday July 20, 2015. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager

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Registered Office: Units 7 & 8 Hawarden Business Park, Manor Road, Hawarden, Deeside, CH5 3US. Registered in England and Wales No.

CERTIFICATE OF ANALYSIS

SDG:	150703-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321665
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
11647181	TPA 30		0.00 - 0.30	30/06/2015
11647182	TPA 30		0.30 - 0.90	30/06/2015
11647201	TPA 31		0.00 - 0.30	01/07/2015
11647202	TPA 31		0.30 - 0.90	01/07/2015
11647199	TPA 32		0.00 - 0.30	01/07/2015
11647200	TPA 32		0.30 - 0.90	01/07/2015
11647183	TPA 33		0.00 - 0.30	30/06/2015
11647184	TPA 33		0.30 - 0.90	30/06/2015
11647185	TPA 42		0.00 - 0.30	30/06/2015
11647186	TPA 42		0.30 - 0.90	30/06/2015
11647197	TPA 43		0.00 - 0.30	01/07/2015
11647198	TPA 43		0.30 - 0.90	01/07/2015
11647195	TPA 44		0.00 - 0.30	01/07/2015
11647196	TPA 44		0.30 - 0.90	01/07/2015
11647187	TPA 45		0.00 - 0.30	30/06/2015
11647188	TPA 45		0.30 - 0.90	30/06/2015
11647189	TPA 53		0.00 - 0.30	30/06/2015
11647190	TPA 53		0.30 - 0.90	30/06/2015
11647191	TPA 54		0.00 - 0.30	30/06/2015
11647192	TPA 54		0.30 - 0.90	30/06/2015
11647193	TPA 60		0.00 - 0.30	30/06/2015
11647194	TPA 60		0.30 - 0.90	30/06/2015

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG:	150703-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321665
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

X Test

N No Determination Possible

Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container
11647181	TPA 30		0.00 - 0.30	1kg TUB
11647182	TPA 30		0.30 - 0.90	1kg TUB
11647201	TPA 31		0.00 - 0.30	1kg TUB
11647202	TPA 31		0.30 - 0.90	1kg TUB
11647199	TPA 32		0.00 - 0.30	1kg TUB
11647200	TPA 32		0.30 - 0.90	1kg TUB
11647183	TPA 33		0.00 - 0.30	1kg TUB
11647184	TPA 33		0.30 - 0.90	1kg TUB
11647185	TPA 42		0.00 - 0.30	1kg TUB
11647186	TPA 42		0.30 - 0.90	1kg TUB
11647197	TPA 43		0.00 - 0.30	1kg TUB
11647198	TPA 43		0.30 - 0.90	1kg TUB
11647195	TPA 44		0.00 - 0.30	1kg TUB
11647196	TPA 44		0.30 - 0.90	1kg TUB
11647187	TPA 45		0.00 - 0.30	1kg TUB
11647188	TPA 45		0.30 - 0.90	1kg TUB
11647189	TPA 53		0.00 - 0.30	1kg TUB
11647190	TPA 53		0.30 - 0.90	1kg TUB
11647191	TPA 54		0.00 - 0.30	1kg TUB
11647192	TPA 54		0.30 - 0.90	1kg TUB
11647193	TPA 60		0.00 - 0.30	1kg TUB
11647194	TPA 60		0.30 - 0.90	1kg TUB

Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 12	X	X	X	X	X		X	X		X		X			X	X					X
Boron Water Soluble	All	NDPs: 0 Tests: 20	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
CEN Readings	All	NDPs: 0 Tests: 2												X								X	
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 2												X								X	
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 20	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
Hexavalent Chromium (w)	All	NDPs: 0 Tests: 2												X								X	
Mercury Dissolved	All	NDPs: 0 Tests: 2												X								X	
Metals in solid samples by OES	All	NDPs: 0 Tests: 20	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X
Sample description	All	NDPs: 0 Tests: 22	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

CERTIFICATE OF ANALYSIS

SDG:	150703-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321665
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
11647181	TPA 30	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Vegetation
11647182	TPA 30	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Vegetation
11647201	TPA 31	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	Crushed Brick
11647202	TPA 31	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Crushed Brick
11647199	TPA 32	0.00 - 0.30	Dark Brown	Sandy Silt Loam	0.1 - 2 mm	Brick	Vegetation
11647200	TPA 32	0.30 - 0.90	Dark Brown	Sandy Silt Loam	0.1 - 2 mm	Stones	Vegetation
11647183	TPA 33	0.00 - 0.30	Dark Brown	Loamy Sand	0.1 - 2 mm	Brick	Vegetation
11647184	TPA 33	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Stones
11647185	TPA 42	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Vegetation
11647186	TPA 42	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Stones
11647197	TPA 43	0.00 - 0.30	Dark Brown	Loamy Sand	0.1 - 2 mm	Stones	Vegetation
11647198	TPA 43	0.30 - 0.90	Dark Brown	Sandy Silt Loam	0.1 - 2 mm	Brick	Vegetation
11647195	TPA 44	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Vegetation
11647196	TPA 44	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Vegetation
11647187	TPA 45	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Brick
11647188	TPA 45	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Brick
11647189	TPA 53	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	Stones
11647190	TPA 53	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Vegetation
11647191	TPA 54	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	Stones
11647192	TPA 54	0.30 - 0.90	Dark Brown	Sandy Clay Loam	0.1 - 2 mm	Stones	Vegetation
11647193	TPA 60	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Vegetation
11647194	TPA 60	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Fibres	Stones

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

CERTIFICATE OF ANALYSIS

SDG:	150703-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321665
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TPA 30	TPA 30	TPA 31	TPA 31	TPA 32	TPA 32
			Depth (m)	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	30/06/2015	30/06/2015	01/07/2015	01/07/2015	01/07/2015	01/07/2015
			Sample Time	.	.	.	.	.	.
			Date Received	02/07/2015	02/07/2015	02/07/2015	02/07/2015	02/07/2015	02/07/2015
			SDG Ref	150703-8	150703-8	150703-8	150703-8	150703-8	150703-8
			Lab Sample No.(s)	11647181	11647182	11647201	11647202	11647199	11647200
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		5.8	9.8	5.2	9.6	5.7	8.9
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #
Antimony	<0.6 mg/kg	TM181		44.5 #	14.3 #	38.6 #	39.7 #	6.03 #	13.9 #
Arsenic	<0.6 mg/kg	TM181		93.1 M	49.1 M	92.3 M	103 M	32.4 M	34.5 M
Beryllium	<0.01 mg/kg	TM181		0.705 M	0.555 M	0.593 M	0.628 M	0.673 M	0.744 M
Cadmium	<0.02 mg/kg	TM181		10.1 M	3.45 M	11.9 M	7.09 M	1.87 M	2.76 M
Chromium	<0.9 mg/kg	TM181		13.2 M	15.7 M	9.78 M	16.2 M	17.2 M	20.4 M
Copper	<1.4 mg/kg	TM181		193 M	107 M	173 M	171 M	56.6 M	118 M
Lead	<0.7 mg/kg	TM181		5000 M	1580 M	4810 M	3350 M	967 M	1220 M
Mercury	<0.14 mg/kg	TM181		0.184 M	0.16 M	0.236 M	0.191 M	<0.14 M	<0.14 M
Molybdenum	<0.1 mg/kg	TM181		8.3 #	2.27 #	7.75 #	5.42 #	1.48 #	2.34 #
Nickel	<0.2 mg/kg	TM181		43.1 M	94.4 M	25.9 M	42.3 M	21.9 M	43.9 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Vanadium	<0.2 mg/kg	TM181		25 #	18.2 #	21.7 #	23.7 #	22 #	21.8 #
Zinc	<1.9 mg/kg	TM181		9950 M	2600 M	9680 M	5950 M	1060 M	2080 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150703-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321665
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TPA 33	TPA 33	TPA 42	TPA 42	TPA 43	TPA 43
			Depth (m)	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	30/06/2015	30/06/2015	30/06/2015	30/06/2015	01/07/2015	01/07/2015
			Sample Time	.	.	.	.	.	.
			Date Received	02/07/2015	02/07/2015	02/07/2015	02/07/2015	02/07/2015	02/07/2015
			SDG Ref	150703-8	150703-8	150703-8	150703-8	150703-8	150703-8
			Lab Sample No.(s)	11647183	11647184	11647185	11647186	11647197	11647198
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		4.1	8.8	6.2	9.2	5.9	8.8
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #	
Antimony	<0.6 mg/kg	TM181		20.1 #	43.6 #	17.6 #	37.4 #	16.3 #	
Arsenic	<0.6 mg/kg	TM181		55.8 M	51.8 M	53.2 M	61 M	42.9 M	
Beryllium	<0.01 mg/kg	TM181		0.616 M	0.542 M	0.521 M	0.984 M	1.06 M	
Cadmium	<0.02 mg/kg	TM181		6.88 M	9.83 M	4.93 M	6.24 M	4.77 M	
Chromium	<0.9 mg/kg	TM181		9.3 M	11.8 M	13.4 M	24.5 M	17.6 M	
Copper	<1.4 mg/kg	TM181		130 M	179 M	108 M	154 M	100 M	
Lead	<0.7 mg/kg	TM181		2950 M	2740 M	1990 M	3280 M	1460 M	
Mercury	<0.14 mg/kg	TM181		<0.14 M	<0.14 M	<0.14 M	<0.14 M	0.384 M	
Molybdenum	<0.1 mg/kg	TM181		4.11 #	3.95 #	3.16 #	7.58 #	3.23 #	
Nickel	<0.2 mg/kg	TM181		30.3 M	30.6 M	32.3 M	47.6 M	41.4 M	
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #	<1 #	
Vanadium	<0.2 mg/kg	TM181		19.2 #	21.7 #	22.6 #	26.7 #	21.8 #	
Zinc	<1.9 mg/kg	TM181		2860 M	7820 M	4530 M	7170 M	2470 M	
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M	<1 M	<1 M	

CERTIFICATE OF ANALYSIS

SDG:	150703-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321665
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TPA 44	TPA 44	TPA 45	TPA 45	TPA 53	TPA 53
			Depth (m)	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	01/07/2015	01/07/2015	30/06/2015	30/06/2015	30/06/2015	30/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	02/07/2015	02/07/2015	02/07/2015	02/07/2015	02/07/2015	02/07/2015
			SDG Ref	150703-8	150703-8	150703-8	150703-8	150703-8	150703-8
			Lab Sample No.(s)	11647195	11647196	11647187	11647188	11647189	11647190
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		7.4	9.4	5.6	8.2	5.3	9.1
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #	4.83 #
Antimony	<0.6 mg/kg	TM181		8.48 #	43.6 #	16.4 #	39.3 #	7.49 #	44.3 #
Arsenic	<0.6 mg/kg	TM181		23.1 M	55.5 M	47.5 M	64.8 M	23.9 M	54.6 M
Beryllium	<0.01 mg/kg	TM181		0.671 M	0.778 M	0.691 M	0.704 M	0.62 M	0.668 M
Cadmium	<0.02 mg/kg	TM181		1.62 M	5.75 M	3.43 M	5.09 M	1.92 M	10 M
Chromium	<0.9 mg/kg	TM181		11.9 M	13.8 M	14.3 M	12.5 M	15.3 M	13.8 M
Copper	<1.4 mg/kg	TM181		57.1 M	157 M	99.5 M	225 M	88.1 M	171 M
Lead	<0.7 mg/kg	TM181		447 M	2450 M	2030 M	3070 M	598 M	7930 M
Mercury	<0.14 mg/kg	TM181		<0.14 M	<0.14 M	<0.14 M	0.245 M	0.505 M	<0.14 M
Molybdenum	<0.1 mg/kg	TM181		1.19 #	5.12 #	2.94 #	7.03 #	1.58 #	9.35 #
Nickel	<0.2 mg/kg	TM181		23.4 M	51.1 M	31.2 M	33.5 M	28.1 M	60.2 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Vanadium	<0.2 mg/kg	TM181		16.8 #	22.6 #	19.9 #	21.9 #	19.6 #	26.5 #
Zinc	<1.9 mg/kg	TM181		893 M	4320 M	2710 M	4750 M	1140 M	9850 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150703-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321665
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TPA 54	TPA 54	TPA 60	TPA 60		
			Depth (m)	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90		
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid		
			Date Sampled	30/06/2015	30/06/2015	30/06/2015	30/06/2015		
			Sample Time	.	.	.	.		
			Date Received	02/07/2015	02/07/2015	02/07/2015	02/07/2015		
			SDG Ref	150703-8	150703-8	150703-8	150703-8		
			Lab Sample No.(s)	11647191	11647192	11647193	11647194		
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		9.2	9.9	8.6	12		
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #		<0.6 #	<0.6 #		
Antimony	<0.6 mg/kg	TM181		<6 #		20 #	78.5 #		
Arsenic	<0.6 mg/kg	TM181		21.5 M		37.9 M	99.4 M		
Beryllium	<0.01 mg/kg	TM181		0.304 M		1.46 M	0.945 M		
Cadmium	<0.02 mg/kg	TM181		2.13 M		3.92 M	15.1 M		
Chromium	<0.9 mg/kg	TM181		13.3 M		14.1 M	17.3 M		
Copper	<1.4 mg/kg	TM181		45.2 M		96.3 M	289 M		
Lead	<0.7 mg/kg	TM181		473 M		1710 M	8240 M		
Mercury	<0.14 mg/kg	TM181		<1.4 M		<0.14 M	<0.14 M		
Molybdenum	<0.1 mg/kg	TM181		<1 #		3.19 #	11.6 #		
Nickel	<0.2 mg/kg	TM181		27.9 M		40.3 M	69.8 M		
Selenium	<1 mg/kg	TM181		<10 #		1.03 #	1 #		
Vanadium	<0.2 mg/kg	TM181		18.1 #		20.4 #	28.2 #		
Zinc	<1.9 mg/kg	TM181		1230 M		3960 M	18400 M		
Boron, water soluble	<1 mg/kg	TM222		<1 M		<1 M	<1 M		

CERTIFICATE OF ANALYSIS

SDG:	150703-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321665
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Asbestos Identification - Solid Samples

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA 30 0.00 - 0.30 SOLID 30/06/2015 00:00:00 09/07/2015 10:04:56 150703-8 11647181 TM048	13/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA 30 0.30 - 0.90 SOLID 30/06/2015 00:00:00 09/07/2015 10:03:30 150703-8 11647182 TM048	13/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA 31 0.00 - 0.30 SOLID 01/07/2015 00:00:00 09/07/2015 08:17:22 150703-8 11647201 TM048	13/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA 31 0.30 - 0.90 SOLID 01/07/2015 00:00:00 09/07/2015 08:19:00 150703-8 11647202 TM048	13/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA 32 0.00 - 0.30 SOLID 01/07/2015 00:00:00 09/07/2015 11:42:48 150703-8 11647199 TM048	13/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150703-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321665
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA 33 0.00 - 0.30 SOLID 30/06/2015 00:00:00 09/07/2015 10:01:29 150703-8 11647183 TM048	13/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA 33 0.30 - 0.90 SOLID 30/06/2015 00:00:00 09/07/2015 10:08:52 150703-8 11647184 TM048	13/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA 42 0.30 - 0.90 SOLID 30/06/2015 00:00:00 09/07/2015 10:06:20 150703-8 11647186 TM048	13/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA 43 0.30 - 0.90 SOLID 01/07/2015 00:00:00 09/07/2015 11:44:33 150703-8 11647198 TM048	13/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA 45 0.00 - 0.30 SOLID 30/06/2015 00:00:00 09/07/2015 06:55:46 150703-8 11647187 TM048	13/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA 45 0.30 - 0.90 SOLID 30/06/2015 00:00:00 09/07/2015 07:02:53 150703-8 11647188 TM048	13/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

Validated

CERTIFICATE OF ANALYSIS

SDG:	150703-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321665
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA 60 0.30 - 0.90 SOLID 30/06/2015 00:00:00 09/07/2015 08:02:21 150703-8 11647194 TM048	13/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150703-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321665
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.102	**Natural Moisture Content (%)**	12.7
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	88.7
Particle Size <4mm	>95%		

Case	
SDG	150703-8
Lab Sample Number(s)	11647192
Sampled Date	30-Jun-2015
Customer Sample Ref.	TPA 54
Depth (m)	0.30 - 0.90

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Hexavalent Chromium	<0.03	<0.03	<0.3	<0.3	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	0.00769	<0.00016	0.0769	<0.0016	-	-	-
Arsenic	0.00606	<0.00012	0.0606	<0.0012	-	-	-
Beryllium	<0.00007	<0.00007	<0.0007	<0.0007	-	-	-
Boron	0.0685	<0.0094	0.685	<0.094	-	-	-
Cadmium	<0.0001	<0.0001	<0.001	<0.001	-	-	-
Chromium	0.000851	<0.00022	0.00851	<0.0022	-	-	-
Copper	0.00377	<0.00085	0.0377	<0.0085	-	-	-
Lead	0.00322	<0.00002	0.0322	<0.0002	-	-	-
Molybdenum	0.0167	<0.00024	0.167	<0.0024	-	-	-
Nickel	0.00058	<0.00015	0.0058	<0.0015	-	-	-
Selenium	0.00101	<0.00039	0.0101	<0.0039	-	-	-
Vanadium	0.00125	<0.00024	0.0125	<0.0024	-	-	-
Zinc	0.00633	<0.00041	0.0633	<0.0041	-	-	-

Leach Test Information

Date Prepared	08-Jul-2015
pH (pH Units)	7.99
Conductivity (µS/cm)	105.00
Temperature (°C)	21.30
Volume Leachant (Litres)	0.889

Mcerts Certification does not apply to leachates

20/07/2015 14:50:21

14:50:12 20/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150703-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321665
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.099	**Natural Moisture Content (%)**	9.65
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	91.2
Particle Size <4mm	>95%		

Case	
SDG	150703-8
Lab Sample Number(s)	11647198
Sampled Date	01-Jul-2015
Customer Sample Ref.	TPA 43
Depth (m)	0.30 - 0.90

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Hexavalent Chromium	<0.03	<0.03	<0.3	<0.3	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	0.00549	<0.00016	0.0549	<0.0016	-	-	-
Arsenic	0.00506	<0.00012	0.0506	<0.0012	-	-	-
Beryllium	<0.00007	<0.00007	<0.0007	<0.0007	-	-	-
Boron	0.0404	<0.0094	0.404	<0.094	-	-	-
Cadmium	<0.0001	<0.0001	<0.001	<0.001	-	-	-
Chromium	0.00123	<0.00022	0.0123	<0.0022	-	-	-
Copper	0.00372	<0.00085	0.0372	<0.0085	-	-	-
Lead	0.0038	<0.00002	0.038	<0.0002	-	-	-
Molybdenum	0.0163	<0.00024	0.163	<0.0024	-	-	-
Nickel	0.000484	<0.00015	0.00484	<0.0015	-	-	-
Selenium	0.000865	<0.00039	0.00865	<0.0039	-	-	-
Vanadium	0.00162	<0.00024	0.0162	<0.0024	-	-	-
Zinc	0.00619	<0.00041	0.0619	<0.0041	-	-	-

Leach Test Information

Date Prepared	09-Jul-2015
pH (pH Units)	8.46
Conductivity (µS/cm)	85.10
Temperature (°C)	21.10
Volume Leachant (Litres)	0.891

Mcerts Certification does not apply to leachates

20/07/2015 14:50:21

14:50:12 20/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150703-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321665
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
PM115		Leaching Procedure for CEN One Stage Leach Test 2:1 & 10:1 1 Step		
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		
TM241	Methods for the Examination of Waters and Associated Materials; Chromium in Raw and Potable Waters and Sewage Effluents 1980.	The Determination of Hexavalent Chromium in Waters and Leachates using the Kone Analyser		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	150703-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321665
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	11647181	11647182	11647201	11647202	11647199	11647200	11647183	11647184	11647185	11647186
Customer Sample Ref.	TPA 30	TPA 30	TPA 31	TPA 31	TPA 32	TPA 32	TPA 33	TPA 33	TPA 42	TPA 42
AGS Ref.										
Depth	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples	14-Jul-2015	14-Jul-2015	14-Jul-2015	14-Jul-2015	14-Jul-2015		14-Jul-2015	14-Jul-2015		14-Jul-2015
Boron Water Soluble	13-Jul-2015	15-Jul-2015	15-Jul-2015	15-Jul-2015	15-Jul-2015	13-Jul-2015	15-Jul-2015	15-Jul-2015	15-Jul-2015	13-Jul-2015
Hexavalent Chromium (s)	14-Jul-2015	14-Jul-2015	14-Jul-2015	14-Jul-2015	14-Jul-2015	14-Jul-2015	14-Jul-2015	14-Jul-2015	14-Jul-2015	14-Jul-2015
Metals in solid samples by OES	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	15-Jul-2015	13-Jul-2015
Sample description	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015

Lab Sample No(s)	11647197	11647198	11647195	11647196	11647187	11647188	11647189	11647190	11647191	11647192
Customer Sample Ref.	TPA 43	TPA 43	TPA 44	TPA 44	TPA 45	TPA 45	TPA 53	TPA 53	TPA 54	TPA 54
AGS Ref.										
Depth	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples		14-Jul-2015			14-Jul-2015	14-Jul-2015				
Boron Water Soluble	13-Jul-2015		13-Jul-2015	15-Jul-2015	15-Jul-2015	15-Jul-2015	15-Jul-2015	15-Jul-2015	15-Jul-2015	
CEN 10:1 Leachate (1 Stage)		09-Jul-2015								08-Jul-2015
CEN Readings		10-Jul-2015								13-Jul-2015
Dissolved Metals by ICP-MS		20-Jul-2015								20-Jul-2015
Hexavalent Chromium (s)	14-Jul-2015		14-Jul-2015	14-Jul-2015	14-Jul-2015	14-Jul-2015	14-Jul-2015	14-Jul-2015	14-Jul-2015	
Hexavalent Chromium (w)		13-Jul-2015								13-Jul-2015
Mercury Dissolved		13-Jul-2015								13-Jul-2015
Metals in solid samples by OES	13-Jul-2015		13-Jul-2015	14-Jul-2015	13-Jul-2015	13-Jul-2015	15-Jul-2015	15-Jul-2015	13-Jul-2015	
Sample description	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015	07-Jul-2015

Lab Sample No(s)	11647193	11647194
Customer Sample Ref.	TPA 60	TPA 60
AGS Ref.		
Depth	0.00 - 0.30	0.30 - 0.90
Type	SOLID	SOLID
Asbestos ID in Solid Samples		14-Jul-2015
Boron Water Soluble	15-Jul-2015	13-Jul-2015
Hexavalent Chromium (s)	14-Jul-2015	14-Jul-2015
Metals in solid samples by OES	13-Jul-2015	13-Jul-2015
Sample description	07-Jul-2015	07-Jul-2015

SDG:	150703-8	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321665
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before presevation was performed
§	Sampled on date not provided
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

ALcontrol Laboratories

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Apex Drilling Services
Sturmi Way
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CF33 6BZ

Attention: Robert Brewer

CERTIFICATE OF ANALYSIS

Date:	21 July 2015
Customer:	H_APEXDRL_BGD
Sample Delivery Group (SDG):	150702-9
Your Reference:	10318
Location:	Swansea Bay
Report No:	321875

We received 46 samples on Wednesday July 01, 2015 and 46 of these samples were scheduled for analysis which was completed on Tuesday July 21, 2015. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan

Operations Manager

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Registered Office: Units 7 & 8 Hawarden Business Park, Manor Road, Hawarden, Deeside, CH5 3US. Registered in England and Wales No.

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
11639107	TPA4		0.00 - 0.30	30/06/2015
11639108	TPA4		0.30 - 0.90	30/06/2015
11639109	TPA5		0.00 - 0.30	30/06/2015
11639111	TPA5		0.30 - 0.90	30/06/2015
11639112	TPA9		0.00 - 0.30	30/06/2015
11639113	TPA9		0.30 - 0.90	30/06/2015
11639105	TPA10		0.00 - 0.30	30/06/2015
11639106	TPA10		0.30 - 0.90	30/06/2015
11639103	TPA17		0.00 - 0.30	30/06/2015
11639104	TPA17		0.30 - 0.90	30/06/2015
11639114	TPA18		0.00 - 0.30	30/06/2015
11639115	TPA18		0.30 - 0.90	30/06/2015
11639116	TPA21		0.00 - 0.30	30/06/2015
11639117	TPA21		0.30 - 0.90	30/06/2015
11639101	TPA22		0.00 - 0.30	30/06/2015
11639102	TPA22		0.30 - 0.90	30/06/2015
11639097	TPA29		0.00 - 0.30	30/06/2015
11639098	TPA29		0.30 - 0.90	30/06/2015
11639095	TPA34		0.00 - 0.30	30/06/2015
11639096	TPA34		0.30 - 0.90	30/06/2015
11639070	TPA40		0.00 - 0.30	29/06/2015
11639071	TPA40		0.30 - 0.90	29/06/2015
11639093	TPA41		0.00 - 0.30	30/06/2015
11639094	TPA41		0.30 - 0.90	30/06/2015
11639091	TPA46		0.00 - 0.30	30/06/2015
11639092	TPA46		0.30 - 0.90	30/06/2015
11639072	TPA47		0.00 - 0.30	29/06/2015
11639073	TPA47		0.30 - 0.90	29/06/2015
11639074	TPA51		0.00 - 0.30	29/06/2015
11639075	TPA51		0.30 - 0.90	29/06/2015
11639089	TPA52		0.00 - 0.30	30/06/2015
11639090	TPA52		0.30 - 0.90	30/06/2015
11639087	TPA55		0.00 - 0.30	30/06/2015
11639088	TPA55		0.30 - 0.90	30/06/2015
11639076	TPA56		0.00 - 0.30	30/06/2015
11639078	TPA56		0.30 - 0.90	30/06/2015
11639079	TPA58		0.00 - 0.30	30/06/2015
11639080	TPA58		0.30 - 0.90	30/06/2015
11639099	TPA59		0.00 - 0.30	30/06/2015
11639100	TPA59		0.30 - 0.90	30/06/2015
11639085	TPA61		0.00 - 0.30	30/06/2015
11639086	TPA61		0.30 - 0.90	30/06/2015
11639081	TPA62		0.00 - 0.30	30/06/2015
11639082	TPA62		0.30 - 0.90	30/06/2015
11639083	TPA63		0.00 - 0.30	30/06/2015
11639084	TPA63		0.30 - 0.90	30/06/2015

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

X **Test**

N **No Determination Possible**

	Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container
	11639107	TPA4		0.00 - 0.30	400g Tub (ALE214)
	11639108	TPA4		0.30 - 0.90	400g Tub (ALE214)
	11639109	TPA5		0.00 - 0.30	400g Tub (ALE214)
	11639111	TPA5		0.30 - 0.90	400g Tub (ALE214)
	11639112	TPA9		0.00 - 0.30	400g Tub (ALE214)
	11639113	TPA9		0.30 - 0.90	400g Tub (ALE214)
	11639105	TPA10		0.00 - 0.30	400g Tub (ALE214)
	11639106	TPA10		0.30 - 0.90	400g Tub (ALE214)
	11639103	TPA17		0.00 - 0.30	400g Tub (ALE214)
	11639104	TPA17		0.30 - 0.90	400g Tub (ALE214)
	11639114	TPA18		0.00 - 0.30	1kg TUB
	11639115	TPA18		0.30 - 0.90	1kg TUB
	11639116	TPA21		0.00 - 0.30	1kg TUB
	11639117	TPA21		0.30 - 0.90	1kg TUB
	11639101	TPA22		0.00 - 0.30	400g Tub (ALE214)
	11639102	TPA22		0.30 - 0.90	400g Tub (ALE214)
	11639097	TPA29		0.00 - 0.30	400g Tub (ALE214)
	11639098	TPA29		0.30 - 0.90	400g Tub (ALE214)
	11639095	TPA34		0.00 - 0.30	400g Tub (ALE214)
	11639096	TPA34		0.30 - 0.90	400g Tub (ALE214)
	11639070	TPA40		0.00 - 0.30	400g Tub (ALE214)
	11639071	TPA40		0.30 - 0.90	400g Tub (ALE214)
	11639093	TPA41		0.00 - 0.30	400g Tub (ALE214)
	11639094	TPA41		0.30 - 0.90	400g Tub (ALE214)
	11639091	TPA46		0.00 - 0.30	400g Tub (ALE214)
	11639092	TPA46		0.30 - 0.90	400g Tub (ALE214)
	11639072	TPA47		0.00 - 0.30	400g Tub (ALE214)
	11639073	TPA47		0.30 - 0.90	400g Tub (ALE214)
	11639074	TPA51		0.00 - 0.30	400g Tub (ALE214)
	11639075	TPA51		0.30 - 0.90	400g Tub (ALE214)
	11639089	TPA52		0.00 - 0.30	400g Tub (ALE214)
	11639090	TPA52		0.30 - 0.90	400g Tub (ALE214)
	11639087	TPA55		0.00 - 0.30	400g Tub (ALE214)
	11639088	TPA55		0.30 - 0.90	400g Tub (ALE214)
	11639076	TPA56		0.00 - 0.30	400g Tub (ALE214)
	11639078	TPA56		0.30 - 0.90	400g Tub (ALE214)
	11639079	TPA58		0.00 - 0.30	400g Tub (ALE214)
	11639080	TPA58		0.30 - 0.90	400g Tub (ALE214)
	11639099	TPA59		0.00 - 0.30	400g Tub (ALE214)
	11639100	TPA59		0.30 - 0.90	400g Tub (ALE214)
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 25			
Boron Water Soluble	All	NDPs: 0 Tests: 42			
CEN Readings	All	NDPs: 0 Tests: 4			
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 4			
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 42			
Hexavalent Chromium (w)	All	NDPs: 0 Tests: 4			
Mercury Dissolved	All	NDPs: 0 Tests: 4			
Metals in solid samples by OES	All	NDPs: 0 Tests: 42			
Sample description	All	NDPs: 0 Tests: 41			

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

X **Test**

N **No Determination Possible**

			Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container
			11639085	TPA61		0.00 - 0.30	400g Tub (ALE214)
			11639086	TPA61		0.30 - 0.90	400g Tub (ALE214)
			11639081	TPA62		0.00 - 0.30	400g Tub (ALE214)
			11639082	TPA62		0.30 - 0.90	400g Tub (ALE214)
			11639083	TPA63		0.00 - 0.30	400g Tub (ALE214)
			11639084	TPA63		0.30 - 0.90	400g Tub (ALE214)
Asbestos ID in Solid Samples	All	NDPs: 0 Tests: 25			X	X	X	X
Asbestos Quantification - Full	All	NDPs: 0 Tests: 1						X
Boron Water Soluble	All	NDPs: 0 Tests: 42	X	X	X	X	X	X
Hexavalent Chromium (s)	All	NDPs: 0 Tests: 42	X	X	X	X	X	X
Metals in solid samples by OES	All	NDPs: 0 Tests: 42	X	X	X	X	X	X
Sample description	All	NDPs: 0 Tests: 41	X	X	X	X	X	X

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Sample Descriptions

Grain Sizes

very fine	<0.063mm	fine	0.063mm - 0.1mm	medium	0.1mm - 2mm	coarse	2mm - 10mm	very coarse	>10mm

Lab Sample No(s)	Customer Sample Ref.	Depth (m)	Colour	Description	Grain size	Inclusions	Inclusions 2
11639107	TPA4	0.00 - 0.30	Dark Brown	Sandy Clay Loam	0.1 - 2 mm	Stones	Vegetation
11639108	TPA4	0.30 - 0.90	Dark Brown	Sand	0.1 - 2 mm	Stones	Vegetation
11639109	TPA5	0.00 - 0.30	Dark Brown	Sandy Clay Loam	0.1 - 2 mm	Stones	Vegetation
11639111	TPA5	0.30 - 0.90	Dark Brown	Loamy Sand	0.1 - 2 mm	Stones	Vegetation
11639112	TPA9	0.00 - 0.30	Dark Brown	Loamy Sand	0.1 - 2 mm	Stones	Crushed Brick
11639113	TPA9	0.30 - 0.90	Dark Brown	Loamy Sand	0.1 - 2 mm	Stones	Vegetation
11639105	TPA10	0.00 - 0.30	Dark Brown	Sandy Clay Loam	0.1 - 2 mm	Stones	Vegetation
11639106	TPA10	0.30 - 0.90	Dark Brown	Loamy Sand	0.1 - 2 mm	Stones	Vegetation
11639103	TPA17	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	None
11639104	TPA17	0.30 - 0.90	Dark Brown	Sand	0.1 - 2 mm	Vegetation	Stones
11639114	TPA18	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Crushed Brick
11639115	TPA18	0.30 - 0.90	Dark Brown	Sand	0.1 - 2 mm	Stones	None
11639116	TPA21	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Brick
11639117	TPA21	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Crushed Brick
11639101	TPA22	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Vegetation
11639102	TPA22	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	None
11639097	TPA29	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Vegetation
11639098	TPA29	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Vegetation
11639095	TPA34	0.00 - 0.30	Dark Brown	Loamy Sand	0.1 - 2 mm	Stones	None
11639096	TPA34	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	None
11639070	TPA40	0.00 - 0.30	Dark Brown	Loamy Sand	0.1 - 2 mm	Brick	Vegetation
11639071	TPA40	0.30 - 0.90	Dark Brown	Loamy Sand	0.1 - 2 mm	Brick	Stones
11639093	TPA41	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	Stones
11639094	TPA41	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Vegetation
11639091	TPA46	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	Stones
11639092	TPA46	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Vegetation
11639072	TPA47	0.00 - 0.30	Dark Brown	Loamy Sand	0.1 - 2 mm	Brick	Stones
11639073	TPA47	0.30 - 0.90	Dark Brown	Loamy Sand	0.1 - 2 mm	Brick	Stones
11639074	TPA51	0.00 - 0.30	Dark Brown	Loamy Sand	0.1 - 2 mm	Brick	Vegetation
11639075	TPA51	0.30 - 0.90	Dark Brown	Loamy Sand	0.1 - 2 mm	Brick	Stones
11639089	TPA52	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Vegetation
11639090	TPA52	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Stones
11639087	TPA55	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	Stones
11639088	TPA55	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Stones	Vegetation
11639076	TPA56	0.00 - 0.30	Dark Brown	Loamy Sand	0.1 - 2 mm	Brick	Stones
11639078	TPA56	0.30 - 0.90	Dark Brown	Loamy Sand	0.1 - 2 mm	Brick	Stones
11639079	TPA58	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Vegetation
11639080	TPA58	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Vegetation

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

			Colour	Description	Grain size	Inclusions	Inclusions 2
11639099	TPA59	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	Brick
11639100	TPA59	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Vegetation
11639085	TPA61	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	None
11639086	TPA61	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Vegetation	Stones
11639081	TPA62	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Vegetation
11639082	TPA62	0.30 - 0.90	Dark Brown	Loamy Sand	0.1 - 2 mm	Brick	Stones
11639083	TPA63	0.00 - 0.30	Dark Brown	Sandy Loam	0.1 - 2 mm	Concrete/Aggregate	Vegetation
11639084	TPA63	0.30 - 0.90	Dark Brown	Sandy Loam	0.1 - 2 mm	Brick	Vegetation

These descriptions are only intended to act as a cross check if sample identities are questioned, and to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions.

We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally ocurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample.

Other coarse granular materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TPA4	TPA4	TPA5	TPA5	TPA9	TPA9
			Depth (m)	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	30/06/2015	30/06/2015	30/06/2015	30/06/2015	30/06/2015	30/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	01/07/2015	01/07/2015	01/07/2015	01/07/2015	01/07/2015	01/07/2015
			SDG Ref	150702-9	150702-9	150702-9	150702-9	150702-9	150702-9
			Lab Sample No.(s)	11639107	11639108	11639109	11639111	11639112	11639113
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		7.8	9.7	9.5	8.6	8.7	3.9
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #
Antimony	<0.6 mg/kg	TM181		6.26 #	10.8 #	14.4 #	8.6 #	17.3 #	13.6 #
Arsenic	<0.6 mg/kg	TM181		71.1 M	322 M	48.6 M	36.5 M	59.6 M	77.8 M
Beryllium	<0.01 mg/kg	TM181		0.597 M	0.519 M	0.567 M	0.337 M	0.82 M	0.303 M
Cadmium	<0.02 mg/kg	TM181		1.75 M	4.15 M	3.68 M	1.82 M	4.44 M	5.35 M
Chromium	<0.9 mg/kg	TM181		44.9 M	14.7 M	13.2 M	9.51 M	12.9 M	9.85 M
Copper	<1.4 mg/kg	TM181		61.6 M	181 M	106 M	60.5 M	124 M	115 M
Lead	<0.7 mg/kg	TM181		486 M	484 M	1290 M	851 M	1980 M	1070 M
Mercury	<0.14 mg/kg	TM181		<0.14 M	0.491 M	0.439 M	<0.14 M	0.349 M	0.289 M
Molybdenum	<0.1 mg/kg	TM181		1.26 #	1.68 #	2.62 #	1.82 #	5.16 #	2.15 #
Nickel	<0.2 mg/kg	TM181		18.7 M	24.8 M	46.4 M	16.9 M	37.8 M	17.2 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Vanadium	<0.2 mg/kg	TM181		45.4 #	23.8 #	22.3 #	15.2 #	21.6 #	17.1 #
Zinc	<1.9 mg/kg	TM181		841 M	1360 M	2440 M	1170 M	3320 M	2110 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TPA10	TPA10	TPA17	TPA17	TPA18	TPA18
			Depth (m)	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	30/06/2015	30/06/2015	30/06/2015	30/06/2015	30/06/2015	30/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	01/07/2015	01/07/2015	01/07/2015	01/07/2015	01/07/2015	01/07/2015
			SDG Ref	150702-9	150702-9	150702-9	150702-9	150702-9	150702-9
			Lab Sample No.(s)	11639105	11639106	11639103	11639104	11639114	11639115
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		7.9	8.7	6.5	10	11	11
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #	<0.6 #		<0.6 #
Antimony	<0.6 mg/kg	TM181		14.9 #	177 #	1.72 #	3.49 #		7.75 #
Arsenic	<0.6 mg/kg	TM181		164 M	>5000 M	18.2 M	43.9 M		35.3 M
Beryllium	<0.01 mg/kg	TM181		0.403 M	0.492 M	0.7 M	0.465 M		0.445 M
Cadmium	<0.02 mg/kg	TM181		2.76 M	55.8 M	0.702 M	1 M		2.82 M
Chromium	<0.9 mg/kg	TM181		17.4 M	13 M	11.7 M	11.9 M		24.1 M
Copper	<1.4 mg/kg	TM181		90.5 M	>500 M	35.6 M	57.8 M		90.4 M
Lead	<0.7 mg/kg	TM181		1330 M	3150 M	128 M	263 M		671 M
Mercury	<0.14 mg/kg	TM181		0.294 M	6.03 M	<0.14 M	<0.14 M		<0.14 M
Molybdenum	<0.1 mg/kg	TM181		1.74 #	3.41 #	0.79 #	0.971 #		1.68 #
Nickel	<0.2 mg/kg	TM181		22.9 M	80.2 M	19.1 M	19.4 M		32.3 M
Selenium	<1 mg/kg	TM181		<1 #	4.36 #	<1 #	<1 #		<1 #
Vanadium	<0.2 mg/kg	TM181		21.6 #	21 #	16.5 #	18.1 #		23.8 #
Zinc	<1.9 mg/kg	TM181		1390 M	3750 M	369 M	450 M		1260 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M	<1 M		<1 M

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TPA21	TPA21	TPA22	TPA22	TPA29	TPA29
			Depth (m)	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	30/06/2015	30/06/2015	30/06/2015	30/06/2015	30/06/2015	30/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	01/07/2015	01/07/2015	01/07/2015	01/07/2015	01/07/2015	01/07/2015
			SDG Ref	150702-9	150702-9	150702-9	150702-9	150702-9	150702-9
			Lab Sample No.(s)	11639116	11639117	11639101	11639102	11639097	11639098
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		8.3	12	7.6	9.8	7.3	8.2
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #
Antimony	<0.6 mg/kg	TM181		18.4 #	35.2 #	27.7 #	26 #	37.3 #	32.6 #
Arsenic	<0.6 mg/kg	TM181		66.4 M	95.9 M	42.5 M	46.6 M	68.6 M	101 M
Beryllium	<0.01 mg/kg	TM181		0.349 M	0.792 M	0.623 M	0.756 M	0.824 M	0.796 M
Cadmium	<0.02 mg/kg	TM181		3.91 M	7.21 M	5.44 M	5.47 M	9.08 M	8.89 M
Chromium	<0.9 mg/kg	TM181		233 M	14.8 M	11.6 M	13.3 M	21.3 M	12.2 M
Copper	<1.4 mg/kg	TM181		129 M	196 M	132 M	138 M	178 M	220 M
Lead	<0.7 mg/kg	TM181		1290 M	4630 M	2070 M	1750 M	2980 M	2350 M
Mercury	<0.14 mg/kg	TM181		<0.14 M	0.492 M	<0.14 M	<0.14 M	0.994 M	0.72 M
Molybdenum	<0.1 mg/kg	TM181		3.48 #	7.46 #	3.01 #	3 #	5.94 #	5.17 #
Nickel	<0.2 mg/kg	TM181		25.4 M	41.6 M	135 M	64 M	245 M	257 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Vanadium	<0.2 mg/kg	TM181		107 #	24.8 #	18.9 #	22.4 #	30.1 #	22.4 #
Zinc	<1.9 mg/kg	TM181		2060 M	4370 M	3780 M	6020 M	5890 M	4950 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TPA34	TPA34	TPA40	TPA40	TPA41	TPA41
			Depth (m)	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	30/06/2015	30/06/2015	29/06/2015	29/06/2015	30/06/2015	30/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	01/07/2015	01/07/2015	01/07/2015	01/07/2015	01/07/2015	01/07/2015
			SDG Ref	150702-9	150702-9	150702-9	150702-9	150702-9	150702-9
			Lab Sample No.(s)	11639095	11639096	11639070	11639071	11639093	11639094
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		8.6	12	7.9	10	7.6	12
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #	<0.6 #
Antimony	<0.6 mg/kg	TM181		41.4 #	33.3 #	24.6 #	27 #	39 #	44.6 #
Arsenic	<0.6 mg/kg	TM181		146 M	108 M	83.8 M	75.6 M	83.4 M	101 M
Beryllium	<0.01 mg/kg	TM181		0.566 M	0.734 M	0.765 M	0.697 M	1.39 M	0.971 M
Cadmium	<0.02 mg/kg	TM181		8.96 M	5.79 M	5.09 M	5.43 M	11.4 M	16.1 M
Chromium	<0.9 mg/kg	TM181		12.8 M	12.4 M	15.6 M	13.7 M	15.4 M	18 M
Copper	<1.4 mg/kg	TM181		204 M	291 M	146 M	153 M	244 M	273 M
Lead	<0.7 mg/kg	TM181		4770 M	2980 M	1350 M	1610 M	4510 M	4640 M
Mercury	<0.14 mg/kg	TM181		<0.14 M	<0.14 M	0.234 M	0.226 M	0.384 M	1.43 M
Molybdenum	<0.1 mg/kg	TM181		10.6 #	4.75 #	3.9 #	3.45 #	8.18 #	9.2 #
Nickel	<0.2 mg/kg	TM181		209 M	35.7 M	121 M	133 M	114 M	250 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #	<1 #	<1 #
Vanadium	<0.2 mg/kg	TM181		24.3 #	22.8 #	23.6 #	21.6 #	32 #	46.9 #
Zinc	<1.9 mg/kg	TM181		9380 M	5190 M	2070 M	2820 M	<19 M	9240 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M	<1 M	<1 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TPA46	TPA46	TPA47	TPA47	TPA51	TPA51
			Depth (m)	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	30/06/2015	30/06/2015	29/06/2015	29/06/2015	29/06/2015	29/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	01/07/2015	01/07/2015	01/07/2015	01/07/2015	01/07/2015	01/07/2015
			SDG Ref	150702-9	150702-9	150702-9	150702-9	150702-9	150702-9
			Lab Sample No.(s)	11639091	11639092	11639072	11639073	11639074	11639075
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		10	11	8.7	10	7.4	7.4
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #		<0.6 #	<0.6 #
Antimony	<0.6 mg/kg	TM181		24.3 #	51.3 #	12.8 #		12.5 #	14.8 #
Arsenic	<0.6 mg/kg	TM181		70.4 M	163 M	146 M		56.1 M	51.8 M
Beryllium	<0.01 mg/kg	TM181		0.861 M	0.842 M	0.743 M		0.634 M	0.642 M
Cadmium	<0.02 mg/kg	TM181		5.14 M	7.24 M	3.01 M		4.57 M	5.68 M
Chromium	<0.9 mg/kg	TM181		14.4 M	13.3 M	11.7 M		18 M	11 M
Copper	<1.4 mg/kg	TM181		141 M	243 M	134 M		98.5 M	106 M
Lead	<0.7 mg/kg	TM181		2900 M	2930 M	999 M		830 M	958 M
Mercury	<0.14 mg/kg	TM181		0.313 M	0.316 M	0.257 M		0.164 M	0.338 M
Molybdenum	<0.1 mg/kg	TM181		3.54 #	9.94 #	2.7 #		2.48 #	2.92 #
Nickel	<0.2 mg/kg	TM181		81.5 M	168 M	25.9 M		45.3 M	28.3 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #		<1 #	<1 #
Vanadium	<0.2 mg/kg	TM181		23.8 #	22.4 #	20.3 #		23.3 #	19.5 #
Zinc	<1.9 mg/kg	TM181		4990 M	5880 M	1930 M		1670 M	2210 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M		<1 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TPA52	TPA52	TPA55	TPA55	TPA56	TPA56
			Depth (m)	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	30/06/2015	30/06/2015	30/06/2015	30/06/2015	30/06/2015	30/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	01/07/2015	01/07/2015	01/07/2015	01/07/2015	01/07/2015	01/07/2015
			SDG Ref	150702-9	150702-9	150702-9	150702-9	150702-9	150702-9
			Lab Sample No.(s)	11639089	11639090	11639087	11639088	11639076	11639078
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		6.7	9.6	8.8	9.9	5.7	9.1
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #		<0.6 #	<0.6 #	<0.6 #	<0.6 #
Antimony	<0.6 mg/kg	TM181		14.3 #		23.6 #	25.4 #	11.6 #	11.3 #
Arsenic	<0.6 mg/kg	TM181		37.1 M		28.4 M	46.8 M	36.1 M	31.8 M
Beryllium	<0.01 mg/kg	TM181		0.813 M		0.711 M	0.945 M	0.782 M	0.648 M
Cadmium	<0.02 mg/kg	TM181		3.1 M		2.6 M	4.01 M	3.34 M	2.95 M
Chromium	<0.9 mg/kg	TM181		18.9 M		18.8 M	16.3 M	20.4 M	19 M
Copper	<1.4 mg/kg	TM181		97.3 M		95.1 M	160 M	105 M	89.7 M
Lead	<0.7 mg/kg	TM181		1250 M		1790 M	1920 M	922 M	677 M
Mercury	<0.14 mg/kg	TM181		0.217 M		<0.14 M	0.22 M	0.336 M	0.275 M
Molybdenum	<0.1 mg/kg	TM181		2.82 #		2.21 #	4.75 #	2.67 #	2.14 #
Nickel	<0.2 mg/kg	TM181		89.7 M		49.8 M	256 M	26.1 M	30.9 M
Selenium	<1 mg/kg	TM181		<1 #		<1 #	<1 #	<1 #	<1 #
Vanadium	<0.2 mg/kg	TM181		22.3 #		25.2 #	26.6 #	24 #	38.8 #
Zinc	<1.9 mg/kg	TM181		2430 M		3750 M	3300 M	1700 M	1010 M
Boron, water soluble	<1 mg/kg	TM222		<1 M		<1 M	<1 M	<1 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TPA58	TPA58	TPA59	TPA59	TPA61	TPA61
			Depth (m)	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid
			Date Sampled	30/06/2015	30/06/2015	30/06/2015	30/06/2015	30/06/2015	30/06/2015
			Sample Time	.	.	.	.	.	.
			Date Received	01/07/2015	01/07/2015	01/07/2015	01/07/2015	01/07/2015	01/07/2015
			SDG Ref	150702-9	150702-9	150702-9	150702-9	150702-9	150702-9
			Lab Sample No.(s)	11639079	11639080	11639099	11639100	11639085	11639086
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		7.9	9	8.8	12	10	12
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #		<0.6 #	<0.6 #
Antimony	<0.6 mg/kg	TM181		16.3 #	34.2 #	14.2 #		14.1 #	27.8 #
Arsenic	<0.6 mg/kg	TM181		39 M	39.5 M	38.5 M		55.8 M	53.6 M
Beryllium	<0.01 mg/kg	TM181		0.707 M	1.12 M	0.796 M		1.01 M	1.16 M
Cadmium	<0.02 mg/kg	TM181		2.64 M	4.41 M	3.09 M		2.93 M	8.44 M
Chromium	<0.9 mg/kg	TM181		43.1 M	11.1 M	14.6 M		16.8 M	42.6 M
Copper	<1.4 mg/kg	TM181		96.6 M	102 M	102 M		110 M	189 M
Lead	<0.7 mg/kg	TM181		1250 M	2260 M	849 M		1070 M	2600 M
Mercury	<0.14 mg/kg	TM181		0.946 M	1.18 M	<0.14 M		<0.14 M	0.178 M
Molybdenum	<0.1 mg/kg	TM181		2.43 #	3.92 #	2.02 #		2.63 #	4.75 #
Nickel	<0.2 mg/kg	TM181		45.3 M	36.5 M	75.3 M		57.3 M	180 M
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #		<1 #	<1 #
Vanadium	<0.2 mg/kg	TM181		22.5 #	19.3 #	21.9 #		23.8 #	36.2 #
Zinc	<1.9 mg/kg	TM181		1460 M	3800 M	1600 M		1920 M	4310 M
Boron, water soluble	<1 mg/kg	TM222		<1 M	<1 M	<1 M		<1 M	<1 M

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	TPA62	TPA62	TPA63	TPA63		
			Depth (m)	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90		
			Sample Type	Soil/Solid	Soil/Solid	Soil/Solid	Soil/Solid		
			Date Sampled	30/06/2015	30/06/2015	30/06/2015	30/06/2015		
			Sample Time	.	.	.	.		
			Date Received	01/07/2015	01/07/2015	01/07/2015	01/07/2015		
			SDG Ref	150702-9	150702-9	150702-9	150702-9		
			Lab Sample No.(s)	11639081	11639082	11639083	11639084		
			AGS Reference						
Moisture Content Ratio (% of as received sample)	%	PM024		7.6	10	5.8	7.8		
Chromium, Hexavalent	<0.6 mg/kg	TM151		<0.6 #	<0.6 #	<0.6 #	<0.6 #		
Antimony	<0.6 mg/kg	TM181		31.9 #	21.3 #	83.9 #	44.5 #		
Arsenic	<0.6 mg/kg	TM181		56.3 M	51.4 M	60 M	68.6 M		
Beryllium	<0.01 mg/kg	TM181		1.08 M	0.996 M	0.795 M	1.16 M		
Cadmium	<0.02 mg/kg	TM181		6.38 M	4.67 M	7.92 M	12.8 M		
Chromium	<0.9 mg/kg	TM181		13.2 M	87.4 M	15.9 M	38.3 M		
Copper	<1.4 mg/kg	TM181		197 M	202 M	180 M	267 M		
Lead	<0.7 mg/kg	TM181		5220 M	1740 M	3350 M	2830 M		
Mercury	<0.14 mg/kg	TM181		0.233 M	0.298 M	0.163 M	0.773 M		
Molybdenum	<0.1 mg/kg	TM181		6.45 #	4.38 #	4.27 #	4.04 #		
Nickel	<0.2 mg/kg	TM181		40 M	80.8 M	208 M	102 M		
Selenium	<1 mg/kg	TM181		<1 #	<1 #	<1 #	<1 #		
Vanadium	<0.2 mg/kg	TM181		26.2 #	42.5 #	24 #	41.8 #		
Zinc	<1.9 mg/kg	TM181		5810 M	2410 M	5940 M	5370 M		
Boron, water soluble	<1 mg/kg	TM222		<1 M	1.2 M	<1 M	<1 M		

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Asbestos Identification - Solid Samples

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA9 0.00 - 0.30 SOLID 30/06/2015 00:00:00 09/07/2015 11:35:52 150702-9 11639112 TM048	13/7/15	Chris Swindells	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA18 0.00 - 0.30 SOLID 30/06/2015 00:00:00 09/07/2015 12:35:58 150702-9 11639114 TM048	10/7/15	Kevin Gill	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA21 0.00 - 0.30 SOLID 30/06/2015 00:00:00 09/07/2015 12:37:33 150702-9 11639116 TM048	10/7/15	Kevin Gill	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA21 0.30 - 0.90 SOLID 30/06/2015 00:00:00 09/07/2015 12:38:56 150702-9 11639117 TM048	10/7/15	Kevin Gill	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA22 0.00 - 0.30 SOLID 30/06/2015 00:00:00 06/07/2015 11:06:52 150702-9 11639101 TM048	13/7/15	Kevin Gill	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA29 0.00 - 0.30 SOLID 30/06/2015 00:00:00 06/07/2015 10:54:54 150702-9 11639097 TM048	13/7/15	Chris Swindells	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA29 0.30 - 0.90 SOLID 30/06/2015 00:00:00 06/07/2015 11:02:25 150702-9 11639098 TM048	13/7/15	Chris Swindells	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA40 0.00 - 0.30 SOLID 29/06/2015 00:00:00 09/07/2015 06:59:05 150702-9 11639070 TM048	13/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA40 0.30 - 0.90 SOLID 29/06/2015 00:00:00 09/07/2015 06:57:52 150702-9 11639071 TM048	13/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA41 0.30 - 0.90 SOLID 30/06/2015 00:00:00 06/07/2015 11:05:03 150702-9 11639094 TM048	13/7/15	Chris Swindells	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA47 0.00 - 0.30 SOLID 29/06/2015 00:00:00 09/07/2015 06:45:19 150702-9 11639072 TM048	13/7/15	Chris Swindells	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA47 0.30 - 0.90 SOLID 29/06/2015 00:00:00 09/07/2015 06:49:52 150702-9 11639073 TM048	13/7/15	Kevin Gill	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA51 0.00 - 0.30 SOLID 29/06/2015 00:00:00 09/07/2015 06:53:29 150702-9 11639074 TM048	13/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA51 0.30 - 0.90 SOLID 29/06/2015 00:00:00 09/07/2015 06:51:31 150702-9 11639075 TM048	13/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA52 0.30 - 0.90 SOLID 30/06/2015 00:00:00 09/07/2015 11:16:04 150702-9 11639090 TM048	13/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA56 0.00 - 0.30 SOLID 30/06/2015 00:00:00 09/07/2015 06:48:15 150702-9 11639076 TM048	13/7/15	Chris Swindells	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA56 0.30 - 0.90 SOLID 30/06/2015 00:00:00 09/07/2015 06:46:35 150702-9 11639078 TM048	13/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA58 0.00 - 0.30 SOLID 30/06/2015 00:00:00 06/07/2015 08:11:01 150702-9 11639079 TM048	13/7/15	Kevin Gill	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA58 0.30 - 0.90 SOLID 30/06/2015 00:00:00 06/07/2015 08:07:31 150702-9 11639080 TM048	13/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA59 0.00 - 0.30 SOLID 30/06/2015 00:00:00 06/07/2015 11:03:45 150702-9 11639099 TM048	13/7/15	Chris Swindells	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA59 0.30 - 0.90 SOLID 30/06/2015 00:00:00 06/07/2015 10:56:57 150702-9 11639100 TM048	13/7/15	Chris Swindells	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA62 0.00 - 0.30 SOLID 30/06/2015 00:00:00 06/07/2015 08:14:38 150702-9 11639081 TM048	13/7/15	Simon Postlewhite	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA62 0.30 - 0.90 SOLID 30/06/2015 00:00:00 09/07/2015 06:55:36 150702-9 11639082 TM048	13/7/15	Kevin Gill	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

		Date of Analysis	Analysed By	Comments	Amosite (Brown) Asbestos	Chrysotile (White) Asbestos	Crocidolite (Blue) Asbestos	Fibrous Actinolite	Fibrous Anthophyllite	Fibrous Tremolite	Non-Asbestos Fibre
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA63 0.00 - 0.30 SOLID 30/06/2015 00:00:00 06/07/2015 07:20:11 150702-9 11639083 TM048	13/7/15	Kevin Gill	-	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA63 0.30 - 0.90 SOLID 30/06/2015 00:00:00 06/07/2015 07:15:44 150702-9 11639084 TM048	13/7/15	Kevin Gill	Fibre bundles in soil	Not Detected (#)	Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected (#)	Not Detected

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Asbestos Quantification - Full

		Additional Asbestos Components (Using TM048)	Analysts Comments	Asbestos Quantification - Gravimetric - %	Asbestos Quantification - PCOM Evaluation - %	Asbestos Quantification - Total - %
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	TPA63 0.30 - 0.90 SOLID 30/06/2015 00:00:00 15/07/2015 12:40:09 150702-9 11639084 TM 304	None (#)	N/C	0.0033 (#)	<0.001 (#)	0.004 (#)

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.096	**Natural Moisture Content (%)**	6.33
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	94.1
Particle Size <4mm	>95%		

Case	
SDG	150702-9
Lab Sample Number(s)	11639073
Sampled Date	29-Jun-2015
Customer Sample Ref.	TPA47
Depth (m)	0.30 - 0.90

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Hexavalent Chromium	<0.03	<0.03	<0.3	<0.3	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	0.00368	<0.00016	0.0368	<0.0016	-	-	-
Arsenic	0.0412	<0.00012	0.412	<0.0012	-	-	-
Beryllium	<0.00007	<0.00007	<0.0007	<0.0007	-	-	-
Boron	0.05	<0.0094	0.5	<0.094	-	-	-
Cadmium	<0.0001	<0.0001	<0.001	<0.001	-	-	-
Chromium	0.00104	<0.00022	0.0104	<0.0022	-	-	-
Copper	0.0035	<0.00085	0.035	<0.0085	-	-	-
Lead	0.00286	<0.00002	0.0286	<0.0002	-	-	-
Molybdenum	0.00578	<0.00024	0.0578	<0.0024	-	-	-
Nickel	0.000442	<0.00015	0.00442	<0.0015	-	-	-
Selenium	0.000748	<0.00039	0.00748	<0.0039	-	-	-
Vanadium	0.0015	<0.00024	0.015	<0.0024	-	-	-
Zinc	0.00559	<0.00041	0.0559	<0.0041	-	-	-

Leach Test Information

Date Prepared	08-Jul-2015
pH (pH Units)	8.34
Conductivity (µS/cm)	85.70
Temperature (°C)	22.40
Volume Leachant (Litres)	0.894

Mcerts Certification does not apply to leachates

21/07/2015 17:55:45

17:55:33 21/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.099	**Natural Moisture Content (%)**	10.6
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	90.4
Particle Size <4mm	>95%		

Case	
SDG	150702-9
Lab Sample Number(s)	11639090
Sampled Date	30-Jun-2015
Customer Sample Ref.	TPA52
Depth (m)	0.30 - 0.90

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Hexavalent Chromium	<0.03	<0.03	<0.3	<0.3	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	0.00633	<0.00016	0.0633	<0.0016	-	-	-
Arsenic	0.00849	<0.00012	0.0849	<0.0012	-	-	-
Beryllium	<0.00007	<0.00007	<0.0007	<0.0007	-	-	-
Boron	0.073	<0.0094	0.73	<0.094	-	-	-
Cadmium	<0.0001	<0.0001	<0.001	<0.001	-	-	-
Chromium	0.00133	<0.00022	0.0133	<0.0022	-	-	-
Copper	0.00587	<0.00085	0.0587	<0.0085	-	-	-
Lead	0.00234	<0.00002	0.0234	<0.0002	-	-	-
Molybdenum	0.0124	<0.00024	0.124	<0.0024	-	-	-
Nickel	0.000817	<0.00015	0.00817	<0.0015	-	-	-
Selenium	0.0011	<0.00039	0.011	<0.0039	-	-	-
Vanadium	0.00312	<0.00024	0.0312	<0.0024	-	-	-
Zinc	0.00496	<0.00041	0.0496	<0.0041	-	-	-

Leach Test Information

Date Prepared	06-Jul-2015
pH (pH Units)	8.35
Conductivity (µS/cm)	101.00
Temperature (°C)	22.20
Volume Leachant (Litres)	0.890

Mcerts Certification does not apply to leachates

21/07/2015 17:55:45

17:55:33 21/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.096	**Natural Moisture Content (%)**	6.33
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	94.1
Particle Size <4mm	>95%		

Case	
SDG	150702-9
Lab Sample Number(s)	11639100
Sampled Date	30-Jun-2015
Customer Sample Ref.	TPA59
Depth (m)	0.30 - 0.90

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Hexavalent Chromium	<0.03	<0.03	<0.3	<0.3	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	0.0123	<0.00016	0.123	<0.0016	-	-	-
Arsenic	0.00538	<0.00012	0.0538	<0.0012	-	-	-
Beryllium	<0.00007	<0.00007	<0.0007	<0.0007	-	-	-
Boron	0.0917	<0.0094	0.917	<0.094	-	-	-
Cadmium	0.000123	<0.0001	0.00123	<0.001	-	-	-
Chromium	0.00239	<0.00022	0.0239	<0.0022	-	-	-
Copper	0.00521	<0.00085	0.0521	<0.0085	-	-	-
Lead	0.00593	<0.00002	0.0593	<0.0002	-	-	-
Molybdenum	0.0201	<0.00024	0.201	<0.0024	-	-	-
Nickel	0.0011	<0.00015	0.011	<0.0015	-	-	-
Selenium	0.00137	<0.00039	0.0137	<0.0039	-	-	-
Vanadium	0.00143	<0.00024	0.0143	<0.0024	-	-	-
Zinc	0.0114	<0.00041	0.114	<0.0041	-	-	-

Leach Test Information

Date Prepared	08-Jul-2015
pH (pH Units)	8.18
Conductivity (µS/cm)	83.80
Temperature (°C)	22.10
Volume Leachant (Litres)	0.894

Mcerts Certification does not apply to leachates

21/07/2015 17:55:45

17:55:33 21/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

CEN 10:1 SINGLE STAGE LEACHATE TEST

CEN ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference		**Site Location**	Swansea Bay
Mass Sample taken (kg)	0.096	**Natural Moisture Content (%)**	6.43
Mass of dry sample (kg)	0.175	**Dry Matter Content (%)**	94
Particle Size <4mm	>95%		

Case	
SDG	150702-9
Lab Sample Number(s)	11639114
Sampled Date	30-Jun-2015
Customer Sample Ref.	TPA18
Depth (m)	0.00 - 0.30

Eluate Analysis	**C_2** Conc^n in 10:1 eluate (mg/l)		**A_2** 10:1 conc^n leached (mg/kg)				
	Result	**Limit of Detection**	**Result**	**Limit of Detection**			
Hexavalent Chromium	<0.03	<0.03	<0.3	<0.3	-	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	-	-	-
Antimony	0.00217	<0.00016	0.0217	<0.0016	-	-	-
Arsenic	0.00439	<0.00012	0.0439	<0.0012	-	-	-
Beryllium	<0.00007	<0.00007	<0.0007	<0.0007	-	-	-
Boron	0.059	<0.0094	0.59	<0.094	-	-	-
Cadmium	<0.0001	<0.0001	<0.001	<0.001	-	-	-
Chromium	0.000961	<0.00022	0.00961	<0.0022	-	-	-
Copper	0.00292	<0.00085	0.0292	<0.0085	-	-	-
Lead	0.00194	<0.00002	0.0194	<0.0002	-	-	-
Molybdenum	0.00573	<0.00024	0.0573	<0.0024	-	-	-
Nickel	0.000396	<0.00015	0.00396	<0.0015	-	-	-
Selenium	0.00115	<0.00039	0.0115	<0.0039	-	-	-
Vanadium	0.00112	<0.00024	0.0112	<0.0024	-	-	-
Zinc	0.00354	<0.00041	0.0354	<0.0041	-	-	-

Leach Test Information

Date Prepared	08-Jul-2015
pH (pH Units)	8.49
Conductivity (µS/cm)	87.70
Temperature (°C)	22.40
Volume Leachant (Litres)	0.894

Mcerts Certification does not apply to leachates

21/07/2015 17:55:45

17:55:33 21/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
ASB_PREP				
PM001		Preparation of Samples for Metals Analysis		
PM024	Modified BS 1377	Soil preparation including homogenisation, moisture screens of soils for Asbestos Containing Material		
PM115		Leaching Procedure for CEN One Stage Leach Test 2:1 & 10:1 1 Step		
TM 304				
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		
TM151	Method 3500D, AWWA/APHA, 20th Ed., 1999	Determination of Hexavalent Chromium using Kone analyser		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM181	US EPA Method 6010B	Determination of Routine Metals in Soil by iCap 6500 Duo ICP-OES		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM222	In-House Method	Determination of Hot Water Soluble Boron in Soils (10:1 Water:soil) by IRIS Emission Spectrometer		
TM241	Methods for the Examination of Waters and Associated Materials; Chromium in Raw and Potable Waters and Sewage Effluents 1980.	The Determination of Hexavalent Chromium in Waters and Leachates using the Kone Analyser		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	11639107	11639108	11639109	11639111	11639112	11639113	11639105	11639106	11639103	11639104
Customer Sample Ref.	TPA4	TPA4	TPA5	TPA5	TPA9	TPA9	TPA10	TPA10	TPA17	TPA17
AGS Ref.										
Depth	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples					14-Jul-2015					
Boron Water Soluble	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	10-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	08-Jul-2015	13-Jul-2015
Hexavalent Chromium (s)	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015
Metals in solid samples by OES	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	13-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015	08-Jul-2015	09-Jul-2015
Sample description	06-Jul-2015	06-Jul-2015	06-Jul-2015	06-Jul-2015	06-Jul-2015	06-Jul-2015	06-Jul-2015	06-Jul-2015	03-Jul-2015	06-Jul-2015

Lab Sample No(s)	11639114	11639115	11639116	11639117	11639101	11639102	11639097	11639098	11639095	11639096
Customer Sample Ref.	TPA18	TPA18	TPA21	TPA21	TPA22	TPA22	TPA29	TPA29	TPA34	TPA34
AGS Ref.										
Depth	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples	10-Jul-2015		10-Jul-2015	10-Jul-2015	14-Jul-2015		14-Jul-2015	14-Jul-2015		
Boron Water Soluble		10-Jul-2015	09-Jul-2015	09-Jul-2015	10-Jul-2015	08-Jul-2015	10-Jul-2015	10-Jul-2015	08-Jul-2015	08-Jul-2015
CEN 10:1 Leachate (1 Stage)	08-Jul-2015									
CEN Readings	10-Jul-2015									
Dissolved Metals by ICP-MS	17-Jul-2015									
Hexavalent Chromium (s)		13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	09-Jul-2015	13-Jul-2015	13-Jul-2015
Hexavalent Chromium (w)	13-Jul-2015									
Mercury Dissolved	13-Jul-2015									
Metals in solid samples by OES		09-Jul-2015	09-Jul-2015	09-Jul-2015	13-Jul-2015	08-Jul-2015	13-Jul-2015	13-Jul-2015	07-Jul-2015	08-Jul-2015
Sample description	06-Jul-2015	06-Jul-2015	06-Jul-2015	06-Jul-2015	03-Jul-2015	03-Jul-2015	03-Jul-2015	03-Jul-2015	03-Jul-2015	03-Jul-2015

Lab Sample No(s)	11639070	11639071	11639093	11639094	11639091	11639092	11639072	11639073	11639074	11639075
Customer Sample Ref.	TPA40	TPA40	TPA41	TPA41	TPA46	TPA46	TPA47	TPA47	TPA51	TPA51
AGS Ref.										
Depth	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples	14-Jul-2015	14-Jul-2015		14-Jul-2015			14-Jul-2015	14-Jul-2015	14-Jul-2015	14-Jul-2015
Boron Water Soluble	10-Jul-2015	10-Jul-2015	08-Jul-2015	10-Jul-2015	08-Jul-2015	08-Jul-2015	10-Jul-2015		10-Jul-2015	10-Jul-2015
CEN 10:1 Leachate (1 Stage)								08-Jul-2015		
CEN Readings								10-Jul-2015		
Dissolved Metals by ICP-MS								17-Jul-2015		
Hexavalent Chromium (s)	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015		13-Jul-2015	13-Jul-2015
Hexavalent Chromium (w)								13-Jul-2015		
Mercury Dissolved								13-Jul-2015		
Metals in solid samples by OES	13-Jul-2015	13-Jul-2015	08-Jul-2015	13-Jul-2015	08-Jul-2015	08-Jul-2015	13-Jul-2015		13-Jul-2015	13-Jul-2015
Sample description	06-Jul-2015	06-Jul-2015	03-Jul-2015	03-Jul-2015	03-Jul-2015	03-Jul-2015	06-Jul-2015	06-Jul-2015	06-Jul-2015	06-Jul-2015

Lab Sample No(s)	11639089	11639090	11639087	11639088	11639076	11639078	11639079	11639080	11639099	11639100
Customer Sample Ref.	TPA52	TPA52	TPA55	TPA55	TPA56	TPA56	TPA58	TPA58	TPA59	TPA59
AGS Ref.										
Depth	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples		14-Jul-2015			14-Jul-2015	14-Jul-2015	14-Jul-2015	14-Jul-2015	14-Jul-2015	14-Jul-2015
Boron Water Soluble	08-Jul-2015		08-Jul-2015	08-Jul-2015	10-Jul-2015	10-Jul-2015	10-Jul-2015	10-Jul-2015	10-Jul-2015	
CEN 10:1 Leachate (1 Stage)		06-Jul-2015								08-Jul-2015
CEN Readings		10-Jul-2015								10-Jul-2015
Dissolved Metals by ICP-MS		17-Jul-2015								17-Jul-2015
Hexavalent Chromium (s)	13-Jul-2015		13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	
Hexavalent Chromium (w)		13-Jul-2015								13-Jul-2015
Mercury Dissolved		10-Jul-2015								13-Jul-2015
Metals in solid samples by OES	08-Jul-2015		08-Jul-2015	08-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	
Sample description	03-Jul-2015	03-Jul-2015	03-Jul-2015	03-Jul-2015	06-Jul-2015	06-Jul-2015	03-Jul-2015	03-Jul-2015	03-Jul-2015	03-Jul-2015

CERTIFICATE OF ANALYSIS

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Lab Sample No(s)	11639085	11639086	11639081	11639082	11639083	11639084
Customer Sample Ref.	TPA61	TPA61	TPA62	TPA62	TPA63	TPA63
AGS Ref.						
Depth	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90	0.00 - 0.30	0.30 - 0.90
Type	SOLID	SOLID	SOLID	SOLID	SOLID	SOLID
Asbestos ID in Solid Samples			14-Jul-2015	14-Jul-2015	14-Jul-2015	14-Jul-2015
Asbestos Quantification - Full						21-Jul-2015
Boron Water Soluble	08-Jul-2015	08-Jul-2015	10-Jul-2015	10-Jul-2015	10-Jul-2015	10-Jul-2015
Hexavalent Chromium (s)	09-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015
Metals in solid samples by OES	08-Jul-2015	08-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015	13-Jul-2015
Sample description	03-Jul-2015	03-Jul-2015	03-Jul-2015	06-Jul-2015	03-Jul-2015	03-Jul-2015

SDG:	150702-9	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321875
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before presevation was performed
§	Sampled on date not provided
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

ALcontrol Laboratories

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Apex Drilling Services
Sturmi Way
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CF33 6BZ

Attention: Robert Brewer

CERTIFICATE OF ANALYSIS

Date:	22 July 2015
Customer:	H_APEXDRL_BGD
Sample Delivery Group (SDG):	150704-89
Your Reference:	10318
Location:	Swansea Bay
Report No:	321895

We received 4 samples on Saturday July 04, 2015 and 4 of these samples were scheduled for analysis which was completed on Wednesday July 22, 2015. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan
Operations Manager

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CERTIFICATE OF ANALYSIS

SDG:	150704-89	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321895
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
11657900	AWS1		2.30	02/07/2015
11657902	AWS2		2.43	02/07/2015
11657901	BH001		3.60	02/07/2015
11657903	BH009		3.46	02/07/2015

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG:	150704-89	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321895
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

LIQUID

Results Legend

X **Test**

N **No Determination Possible**

			Lab Sample No(s)	Customer Sample Reference	AGS Reference	Depth (m)	Container
			11657900	AWS1		2.30	0.5l glass bottle (AL
							1lplastic (ALE221)
							Dissolved Metals Pr
							HNO3 Filtered (ALE
							NaOH (ALE245)
			11657902	AWS2		2.43	0.5l glass bottle (AL
							Dissolved Metals Pr
			11657901	BH001		3.60	0.5l glass bottle (AL
							1lplastic (ALE221)
							Dissolved Metals Pr
			11657903	BH009		3.46	0.5l glass bottle (AL
							Dissolved Metals Pr
Cyanide Comp/Free/Total/Thiocyanate	All	NDPs: 0 Tests: 4					X X X X
Dissolved Metals by ICP-MS	All	NDPs: 0 Tests: 4					X X X X
EPH CWG (Aliphatic) Aqueous GC (W)	All	NDPs: 0 Tests: 4	X				X X X
EPH CWG (Aromatic) Aqueous GC (W)	All	NDPs: 0 Tests: 4	X				X X X
GRO by GC-FID (W)	All	NDPs: 1 Tests: 3	X				N X X
Hexavalent Chromium (w)	All	NDPs: 0 Tests: 4		X			X X X
Mercury Dissolved	All	NDPs: 0 Tests: 4			X		X X X X
PAH Spec MS - Aqueous (W)	All	NDPs: 1 Tests: 3	X				N X X
pH Value	All	NDPs: 0 Tests: 4		X			X X X
Total Organic and Inorganic Carbon	All	NDPs: 0 Tests: 4	X				X X X
TPH CWG (W)	All	NDPs: 1 Tests: 3	X				N X X

CERTIFICATE OF ANALYSIS

SDG:	150704-89	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321895
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Results Legend

#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	AWS1	AWS2	BH001	BH009		
			Depth (m)	2.30	2.43	3.60	3.46		
			Sample Type	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)		
			Date Sampled	02/07/2015	02/07/2015	02/07/2015	02/07/2015		
			Sample Time	.	.	.	.		
			Date Received	04/07/2015	04/07/2015	04/07/2015	04/07/2015		
			SDG Ref	150704-89	150704-89	150704-89	150704-89		
			Lab Sample No.(s)	11657900	11657902	11657901	11657903		
			AGS Reference						
Organic Carbon, Total	<3 mg/l	TM090		<3 & #	10 & #	<3 & #	9.35 & #		
Antimony (diss.filt)	<0.16 µg/l	TM152		2.53	2.39	3.13	1.53		
Arsenic (diss.filt)	<0.12 µg/l	TM152		46 #	6.75 #	7.89 #	3.31 #		
Beryllium (diss.filt)	<0.07 µg/l	TM152		<0.07 #	<0.07 #	<0.07 #	<0.07 #		
Boron (diss.filt)	<9.4 µg/l	TM152		108 #	473 #	124 #	530 #		
Cadmium (diss.filt)	<0.1 µg/l	TM152		0.435 #	10.3 #	7.98 #	<0.1 #		
Chromium (diss.filt)	<0.22 µg/l	TM152		1.2 #	2.78 #	3.93 #	4.93 #		
Copper (diss.filt)	<0.85 µg/l	TM152		<0.85 #	8.29 #	27.9 #	2.29 #		
Lead (diss.filt)	<0.02 µg/l	TM152		22 #	90.7 #	46.1 #	2.54 #		
Nickel (diss.filt)	<0.15 µg/l	TM152		3.14 #	10.6 #	33.9 #	3.96 #		
Selenium (diss.filt)	<0.39 µg/l	TM152		<0.39 #	0.436 #	50.7 #	5 #		
Vanadium (diss.filt)	<0.24 µg/l	TM152		0.352 #	0.744 #	1.35 #	2.01 #		
Zinc (diss.filt)	<0.41 µg/l	TM152		7090 #	6050 #	4190 #	82.4 #		
Mercury (diss.filt)	<0.01 µg/l	TM183		<0.01 #	<0.01 #	<0.01 #	<0.01 #		
Cyanide, Total	<0.05 mg/l	TM227		<0.05 & #	<0.05 & #	<0.05 & #	<0.05 & #		
Chromium, Hexavalent	<0.03 mg/l	TM241		<0.03 #	<0.03 #	<0.03 #	<0.03 #		
pH	<1 pH Units	TM256		7.71 #	7.85 #	7.68 #	7.79 #		

CERTIFICATE OF ANALYSIS

SDG:	150704-89	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321895
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

EPH CWG (Aliphatic) Aqueous GC (W)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	
			AWS2	
			Depth (m)	2.43
			Sample Type	Water(GW/SW)
			Date Sampled	02/07/2015
			Sample Time	.
			Date Received	04/07/2015
			SDG Ref	150704-89
			Lab Sample No.(s)	11657902
			AGS Reference	
Aliphatics >C12-C16 (aq)	<10 µg/l	TM174	66	
Aliphatics >C16-C21 (aq)	<10 µg/l	TM174	674	
Aliphatics >C21-C35 (aq)	<10 µg/l	TM174	1820	
Total Aliphatics >C12-C35 (aq)	<10 µg/l	TM174	2560	

ALcontrol Laboratories

Validated

CERTIFICATE OF ANALYSIS

SDG:	150704-89	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321895
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

EPH CWG (Aromatic) Aqueous GC (W)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&♦§@	Sample deviation (see appendix)

Customer Sample R	AWS2
Depth (m)	2.43
Sample Type	Water(GW/SW)
Date Sampled	02/07/2015
Sample Time	.
Date Received	04/07/2015
SDG Ref	150704-89
Lab Sample No.(s)	11657902
AGS Reference	

Component	LOD/Units	Method	
Aromatics >EC12-EC16 (aq)	<10 µg/l	TM174	28
Aromatics >EC16-EC21 (aq)	<10 µg/l	TM174	435
Aromatics >EC21-EC35 (aq)	<10 µg/l	TM174	1100
Total Aromatics >EC12-EC35 (aq)	<10 µg/l	TM174	1560

07:56:50 22/07/2015

CERTIFICATE OF ANALYSIS

SDG:	150704-89	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321895
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

PAH Spec MS - Aqueous (W)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	AWS1	BH001	BH009			
			Depth (m)	2.30	3.60	3.46			
			Sample Type	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)			
			Date Sampled	02/07/2015	02/07/2015	02/07/2015			
			Sample Time	.	.	.			
			Date Received	04/07/2015	04/07/2015	04/07/2015			
			SDG Ref	150704-89	150704-89	150704-89			
			Lab Sample No.(s)	11657900	11657901	11657903			
			AGS Reference						
Naphthalene (aq)	<0.1 µg/l	TM178		<0.1 #	0.619 #	<0.4 #			
Acenaphthene (aq)	<0.015 µg/l	TM178		<0.015 #	0.734 #	<0.06 #			
Acenaphthylene (aq)	<0.011 µg/l	TM178		<0.011 #	0.21 #	0.0836 #			
Fluoranthene (aq)	<0.017 µg/l	TM178		0.0672 #	22.8 #	1.61 #			
Anthracene (aq)	<0.015 µg/l	TM178		<0.015 #	2.65 #	0.144 #			
Phenanthrene (aq)	<0.022 µg/l	TM178		0.0694 #	12.3 #	0.475 #			
Fluorene (aq)	<0.014 µg/l	TM178		<0.014 #	0.581 #	<0.056 #			
Chrysene (aq)	<0.013 µg/l	TM178		0.047 #	18.2 #	1.18 #			
Pyrene (aq)	<0.015 µg/l	TM178		0.0596 #	20.2 #	1.32 #			
Benzo(a)anthracene (aq)	<0.017 µg/l	TM178		0.0359 #	16.7 #	1.2 #			
Benzo(b)fluoranthene (aq)	<0.023 µg/l	TM178		0.0427 #	19.9 #	3.59 #			
Benzo(k)fluoranthene (aq)	<0.027 µg/l	TM178		<0.027 #	7.65 #	1.14 #			
Benzo(a)pyrene (aq)	<0.009 µg/l	TM178		0.0288 #	14.9 #	2.57 #			
Dibenzo(a,h)anthracene (aq)	<0.016 µg/l	TM178		<0.016 #	2.65 #	0.661 #			
Benzo(g,h,i)perylene (aq)	<0.016 µg/l	TM178		0.0225 #	10.8 #	2.64 #			
Indeno(1,2,3-cd)pyrene (aq)	<0.014 µg/l	TM178		<0.014 #	7.29 #	1.97 #			
PAH, Total Detected USEPA 16 (aq)	<0.344 µg/l	TM178		0.373	158	18.6			

CERTIFICATE OF ANALYSIS

SDG:	150704-89	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321895
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

TPH CWG (W)

Results Legend	
#	ISO17025 accredited.
M	*m*CERTS accredited.
aq	Aqueous / settled sample.
diss.filt	Dissolved / filtered sample.
tot.unfilt	Total / unfiltered sample.
*	Subcontracted test.
**	% recovery of the surrogate standard to check the efficiency of the method. The results of individual compounds within samples aren't corrected for the recovery
(F)	Trigger breach confirmed
1-5&+§@	Sample deviation (see appendix)

Component	LOD/Units	Method	Customer Sample R	AWS1	BH001	BH009			
			Depth (m)	2.30	3.60	3.46			
			Sample Type	Water(GW/SW)	Water(GW/SW)	Water(GW/SW)			
			Date Sampled	02/07/2015	02/07/2015	02/07/2015			
			Sample Time	.	.	.			
			Date Received	04/07/2015	04/07/2015	04/07/2015			
			SDG Ref	150704-89	150704-89	150704-89			
			Lab Sample No.(s)	11657900	11657901	11657903			
			AGS Reference						
GRO Surrogate % recovery**	%	TM245		84 2	56 1	80 1			
GRO >C5-C12	<50 µg/l	TM245		<50 2 #	<50 1 #	512 1 #			
Methyl tertiary butyl ether (MTBE)	<3 µg/l	TM245		<3 2 #	<3 1 #	<3 1 #			
Benzene	<7 µg/l	TM245		<7 2 #	<7 1 #	<7 1 #			
Toluene	<4 µg/l	TM245		<4 2 #	<4 1 #	<4 1 #			
Ethylbenzene	<5 µg/l	TM245		<5 2 #	<5 1 #	<5 1 #			
m,p-Xylene	<8 µg/l	TM245		<8 2 #	<8 1 #	<8 1 #			
o-Xylene	<3 µg/l	TM245		<3 2 #	<3 1 #	<3 1 #			
Sum of detected Xylenes	<11 µg/l	TM245		<11 2	<11 1	<11 1			
Sum of detected BTEX	<28 µg/l	TM245		<28 2	<28 1	<28 1			
Aliphatics >C5-C6	<10 µg/l	TM245		<10 2	<10 1	<10 1			
Aliphatics >C6-C8	<10 µg/l	TM245		<10 2	<10 1	<10 1			
Aliphatics >C8-C10	<10 µg/l	TM245		<10 2	<10 1	67 1			
Aliphatics >C10-C12	<10 µg/l	TM245		<10 2	<10 1	232 1			
Aliphatics >C12-C16 (aq)	<10 µg/l	TM174		<10	23	863			
Aliphatics >C16-C21 (aq)	<10 µg/l	TM174		<10	86	529			
Aliphatics >C21-C35 (aq)	<10 µg/l	TM174		<10	659	562			
Total Aliphatics >C12-C35 (aq)	<10 µg/l	TM174		<10	768	1950			
Aromatics >EC5-EC7	<10 µg/l	TM245		<10 2	<10 1	<10 1			
Aromatics >EC7-EC8	<10 µg/l	TM245		<10 2	<10 1	<10 1			
Aromatics >EC8-EC10	<10 µg/l	TM245		<10 2	<10 1	45 1			
Aromatics >EC10-EC12	<10 µg/l	TM245		<10 2	<10 1	155 1			
Aromatics >EC12-EC16 (aq)	<10 µg/l	TM174		<10	23	69			
Aromatics >EC16-EC21 (aq)	<10 µg/l	TM174		<10	65	232			
Aromatics >EC21-EC35 (aq)	<10 µg/l	TM174		<10	232	574			
Total Aromatics >EC12-EC35 (aq)	<10 µg/l	TM174		<10	320	875			
Total Aliphatics & Aromatics >C5-35 (aq)	<10 µg/l	TM174		<10	1090	3340			

CERTIFICATE OF ANALYSIS

SDG:	150704-89	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321895
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Notification of NDPs (No determination possible)

Date Received : 04/07/2015 15:29:03

Sample No	Customer Sample Ref.	Depth (m)	Test	Comment
11657902	AWS2	2.43	TPH CWG (W)	Insufficient Sample
11657902	AWS2	2.43	GRO by GC-FID (W)	Insufficient Sample
11657902	AWS2	2.43	PAH Spec MS - Aqueous (W)	Insufficient Sample

CERTIFICATE OF ANALYSIS

SDG:	150704-89	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321895
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
TM061	Method for the Determination of EPH,Massachusetts Dept.of EP, 1998	Determination of Extractable Petroleum Hydrocarbons by GC-FID (C10-C40)		
TM090	Method 5310, AWWA/APHA, 20th Ed., 1999 / Modified: US EPA Method 415.1 & 9060	Determination of Total Organic Carbon/Total Inorganic Carbon in Water and Waste Water		
TM152	Method 3125B, AWWA/APHA, 20th Ed., 1999	Analysis of Aqueous Samples by ICP-MS		
TM174	Analysis of Petroleum Hydrocarbons in Environmental Media – Total Petroleum Hydrocarbon Criteria	Determination of Speciated Extractable Petroleum Hydrocarbons in Waters by GC-FID		
TM178	Modified: US EPA Method 8100	Determination of Polynuclear Aromatic Hydrocarbons (PAH) by GC-MS in Waters		
TM183	BS EN 23506:2002, (BS 6068-2.74:2002) ISBN 0 580 38924 3	Determination of Trace Level Mercury in Waters and Leachates by PSA Cold Vapour Atomic Fluorescence Spectrometry		
TM227	Standard methods for the examination of waters and wastewaters 20th Edition, AWWA/APHA Method 4500.	Determination of Total Cyanide, Free (Easily Liberatable) Cyanide and Thiocyanate		
TM241	Methods for the Examination of Waters and Associated Materials; Chromium in Raw and Potable Waters and Sewage Effluents 1980.	The Determination of Hexavalent Chromium in Waters and Leachates using the Kone Analyser		
TM245	By GC-FID	Determination of GRO by Headspace in waters		
TM256	The measurement of Electrical Conductivity and the Laboratory determination of pH Value of Natural, Treated and Wastewaters. HMSO, 1978. ISBN 011 751428 4.	Determination of pH in Water and Leachate using the GLpH pH Meter		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	150704-89	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321895
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	11657900	11657902	11657901	11657903
Customer Sample Ref.	AWS1	AWS2	BH001	BH009
AGS Ref.				
Depth	2.30	2.43	3.60	3.46
Type	LIQUID	LIQUID	LIQUID	LIQUID
Cyanide Comp/Free/Total/Thiocyanate	13-Jul-2015	14-Jul-2015	14-Jul-2015	14-Jul-2015
Dissolved Metals by ICP-MS	22-Jul-2015	22-Jul-2015	21-Jul-2015	21-Jul-2015
EPH CWG (Aliphatic) Aqueous GC (W)	15-Jul-2015	15-Jul-2015	15-Jul-2015	15-Jul-2015
EPH CWG (Aromatic) Aqueous GC (W)	15-Jul-2015	15-Jul-2015	15-Jul-2015	15-Jul-2015
GRO by GC-FID (W)	13-Jul-2015		15-Jul-2015	13-Jul-2015
Hexavalent Chromium (w)	14-Jul-2015	14-Jul-2015	14-Jul-2015	14-Jul-2015
Mercury Dissolved	09-Jul-2015	09-Jul-2015	09-Jul-2015	09-Jul-2015
PAH Spec MS - Aqueous (W)	15-Jul-2015		15-Jul-2015	15-Jul-2015
pH Value	15-Jul-2015	15-Jul-2015	14-Jul-2015	15-Jul-2015
Total Organic and Inorganic Carbon	11-Jul-2015	11-Jul-2015	11-Jul-2015	11-Jul-2015
TPH CWG (W)	15-Jul-2015		15-Jul-2015	15-Jul-2015

SDG:	150704-89	**Location:**	Swansea Bay	**Order Number:**	3074
Job:	H_APEXDRL_BGD-42	**Customer:**	Apex Drilling Services	**Report Number:**	321895
Client Reference:	10318	**Attention:**	Robert Brewer	**Superseded Report:**	

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

7. If no separate volatile sample is supplied by the client, or if a headspace or sediment is present in the volatile sample, the integrity of the data may be compromised. This will be flagged up as an invalid VOC on the test schedule and the result marked as deviating on the test certificate.

8. If appropriate preserved bottles are not received preservation will take place on receipt. However, the integrity of the data may be compromised.

9. NDP -No determination possible due to insufficient/unsuitable sample.

10. Metals in water are performed on a filtered sample, and therefore represent dissolved metals -total metals must be requested separately.

11. Results relate only to the items tested.

12. LODs for wet tests reported on a dry weight basis are not corrected for moisture content.

13. **Surrogate recoveries** - Surrogates are added to your sample to monitor recovery of the test requested. A % recovery is reported, results are not corrected for the recovery measured. Typical recoveries for organics tests are 70-130%, they are generally wider for volatiles analysis, 50-150%. Recoveries in soils are affected by organic rich or clay rich matrices. Waters can be affected by remediation fluids or high amounts of sediment. Test results are only ever reported if all of the associated quality checks pass; it is assumed that all recoveries outside of the values above are due to matrix affect.

14. **Product analyses** -Organic analyses on products can only be semi-quantitative due to the matrix effects and high dilution factors employed.

15. Phenols monohydric by HPLC include phenol, cresols (2-Methylphenol, 3-Methylphenol and 4-Methylphenol) and Xylenols (2,3 Dimethylphenol, 2,4 Dimethylphenol, 2,5 Dimethylphenol, 2,6 Dimethylphenol, 3,4 Dimethyphenol, 3,5 Dimethylphenol).

16. Total of 5 speciated phenols by HPLC includes Phenol, 2,3,5-Trimethyl Phenol, 2-Isopropylphenol, Cresols and Xylenols (as detailed in 15).

17. Stones/debris are not routinely removed. We always endeavour to take a representative sub sample from the received sample.

18. In certain circumstances the method detection limit may be elevated due to the sample being outside the calibration range. Other factors that may contribute to this include possible interferences. In both cases the sample would be diluted which would cause the method detection limit to be raised.

19. Mercury results quoted on soils will not include volatile mercury as the analysis is performed on a dried and crushed sample.

20. For the BSEN 12457-3 two batch process to allow the cumulative release to be calculated, the volume of the leachate produced is measured and filtered for all tests. We therefore cannot carry out any unfiltered analysis. The tests affected include volatiles GCFID/GCMS and all subcontracted analysis.

21. For all leachate preparations (NRA, DIN, TCLP, BSEN 12457-1, 2, 3) volatile loss may occur, as we do not employ zero headspace extraction.

22. We are accredited to MCERTS for sand, clay and loam/topsoil, or any of these materials - whether these are derived from naturally occurring soil profiles, or from fill/made ground, as long as these materials constitute the major part of the sample. Other coarse granular material such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

23. Analysis and identification of specific compounds using GCFID is by retention time only, and we routinely calibrate and quantify for benzene, toluene, ethylbenzenes and xylenes (BTEX). For total volatiles in the C5-C12 range, the total area of the chromatogram is integrated and expressed as ug/kg or ug/l. Although this analysis is commonly used for the quantification of gasoline range organics (GRO), the system will also detect other compounds such as chlorinated solvents, and this may lead to a falsely high result with respect to hydrocarbons only. It is not possible to specifically identify these non-hydrocarbons, as standards are not routinely run for any other compounds, and for more definitive identification, volatiles by GCMS should be utilised.

Sample Deviations

1	Container with Headspace provided for volatiles analysis
2	Incorrect container received
3	Deviation from method
4	Holding time exceeded before sample received
5	Samples exceeded holding time before presevation was performed
§	Sampled on date not provided
♦	Sample holding time exceeded in laboratory
@	Sample holding time exceeded due to sampled on date
&	Sample Holding Time exceeded - Late arrival of instructions.

Asbestos

Identification of Asbestos in Bulk Materials & Soils

The results for identification of asbestos in bulk materials are obtained from supplied bulk materials which have been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
Chrysotile	White Asbestos
Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

ALcontrol Laboratories

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Manor Road (off Manor Lane)
Hawarden
Deeside
CH5 3US
Tel: (01244) 528700
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email: mkt@alcontrol.com
Website: www.alcontrol.com

Apex Drilling Services
Sturmi Way
Village Farm Industrial Estate
Pyle
Bridgend
CF33 6BZ

Attention: Robert Brewer

CERTIFICATE OF ANALYSIS

Date:	31 July 2015
Customer:	H_APEXDRL_BGD
Sample Delivery Group (SDG):	150724-131
Your Reference:	
Location:	AGC Swansea
Report No:	323543

We received 1 sample on Friday July 24, 2015 and 1 of these samples were scheduled for analysis which was completed on Friday July 31, 2015. Accredited laboratory tests are defined within the report, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

All chemical testing (unless subcontracted) is performed at ALcontrol Hawarden Laboratories.

Approved By:

Sonia McWhan
Operations Manager

Alcontrol Laboratories is a trading division of ALcontrol UK Limited
Registered Office: Units 7 & 8 Hawarden Business Park, Manor Road, Hawarden, Deeside, CH5 3US. Registered in England and Wales No.

CERTIFICATE OF ANALYSIS

SDG:	150724-131	**Location:**	AGC Swansea	**Order Number:**	
Job:	H_APEXDRL_BGD-49	**Customer:**	Apex Drilling Services	**Report Number:**	323543
Client Reference:		**Attention:**	Robert Brewer	**Superseded Report:**	

Received Sample Overview

Lab Sample No(s)	Customer Sample Ref.	AGS Ref.	Depth (m)	Sampled Date
11776673	S11		1.00 - 1.50	

Only received samples which have had analysis scheduled will be shown on the following pages.

CERTIFICATE OF ANALYSIS

SDG:	150724-131	**Location:**	AGC Swansea	**Order Number:**	
Job:	H_APEXDRL_BGD-49	**Customer:**	Apex Drilling Services	**Report Number:**	323543
Client Reference:		**Attention:**	Robert Brewer	**Superseded Report:**	

SOLID

Results Legend

X **Test**

N **No Determination Possible**

Lab Sample No(s)			1177673
Customer Sample Reference			S11
AGS Reference			
Depth (m)			1.00 - 1.50
Container			BAG
Asbestos Identification	All	NDPs: 0 Tests: 1	X

CERTIFICATE OF ANALYSIS

SDG:	150724-131	**Location:**	AGC Swansea	**Order Number:**	
Job:	H_APEXDRL_BGD-49	**Customer:**	Apex Drilling Services	**Report Number:**	323543
Client Reference:		**Attention:**	Robert Brewer	**Superseded Report:**	

Asbestos Identification - Bulk

		Date of Analysis	Analysed by	Comments	Actinolite, Fibrous	Anthophyllite, Fibrous	Asbestos, Amosite (brown)	Asbestos, Chrysotile (white)	Asbestos, Crocidolite (blue)	Non-asbestos fibre	Tremolite, Fibrous
Cust. Sample Ref. Depth (m) Sample Type Date Sampled Date Receieved SDG Original Sample Method Number	S11 1.00 - 1.50 SOLID 24/07/2015 16:32:22 150724-131 11776673 TM048	31/07/15	Paul Poynton	Material typical of asbestos cement	Not Detected (#)	Not Detected (#)	Not Detected (#)	Detected (#)	Not Detected (#)	Not Detected	Not Detected (#)

CERTIFICATE OF ANALYSIS

SDG:	150724-131	**Location:**	AGC Swansea	**Order Number:**	
Job:	H_APEXDRL_BGD-49	**Customer:**	Apex Drilling Services	**Report Number:**	323543
Client Reference:		**Attention:**	Robert Brewer	**Superseded Report:**	

Table of Results - Appendix

Method No	Reference	Description	Wet/Dry Sample [1]	Surrogate Corrected
TM048	HSG 248, Asbestos: The analysts' guide for sampling, analysis and clearance procedures	Identification of Asbestos in Bulk Material		

[1] Applies to Solid samples only. DRY indicates samples have been dried at 35°C. NA = not applicable.

CERTIFICATE OF ANALYSIS

SDG:	150724-131	**Location:**	AGC Swansea	**Order Number:**	
Job:	H_APEXDRL_BGD-49	**Customer:**	Apex Drilling Services	**Report Number:**	323543
Client Reference:		**Attention:**	Robert Brewer	**Superseded Report:**	

Test Completion Dates

Lab Sample No(s)	11776673
Customer Sample Ref.	S11
AGS Ref.	
Depth	1.00 - 1.50
Type	SOLID
Asbestos Identification	31-Jul-2015

SDG:	150724-131	**Location:**	AGC Swansea	**Order Number:**	
Job:	H_APEXDRL_BGD-49	**Customer:**	Apex Drilling Services	**Report Number:**	323543
Client Reference:		**Attention:**	Robert Brewer	**Superseded Report:**	

Appendix

General

1. Results are expressed on a dry weight basis (dried at 35ºC) for all soil analyses except for the following: NRA and CEN Leach tests, flash point LOI, pH, ammonium as NH4 by the BRE method, VOC TICS and SVOC TICS.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. If sufficient sample is received a sub sample will be retained free of charge for 30 days after analysis is completed (e-mailed) for all sample types unless the sample is destroyed on testing. The prepared soil sub sample that is analysed for asbestos will be retained for a period of 6 months after the analysis date. All bulk samples will be retained for a period of 6 months after the analysis date. All samples received and not scheduled will be disposed of one month after the date of receipt unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage. ALcontrol Laboratories reserve the right to charge for samples received and stored but not analysed.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS/MCERTS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS/MCERTS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, the individual sub sample scheduled will be analysed in house for the presence of asbestos fibres and asbestos containing material by our documented in house method TM048 based on HSG 248 (2005), which is accredited to ISO17025. If a specific asbestos fibre type is not found this will be reported as “Not detected”. If no asbestos fibre types are found all will be reported as “Not detected” and the sub sample analysed deemed to be clear of asbestos. If an asbestos fibre type is found it will be reported as detected (for each fibre type found). Testing can be carried out on asbestos positive samples, but, due to Health and Safety considerations, may be replaced by alternative tests or reported as No Determination Possible. The quantity of asbestos present is not determined unless specifically requested.

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Asbestos

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The results for identification of asbestos in soils are obtained from a homogenised sub sample which has been examined to determine the presence of asbestos fibres using Alcontrol Laboratories (Hawarden) in-house method of transmitted/polarised light microscopy and central stop dispersion staining, based on HSG 248 (2005).

Asbestos Type	Common Name
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Amosite	Brown Asbestos
Crocidolite	Blue Asbestos
Fibrous Actinolite	-
Fibrous Anthophyllite	-
Fibrous Tremolite	-

Visual Estimation Of Fibre Content

Estimation of fibre content is not permitted as part of our UKAS accredited test other than: - Trace - Where only one or two asbestos fibres were identified.

Further guidance on typical asbestos fibre content of manufactured products can be found in HSG 264.

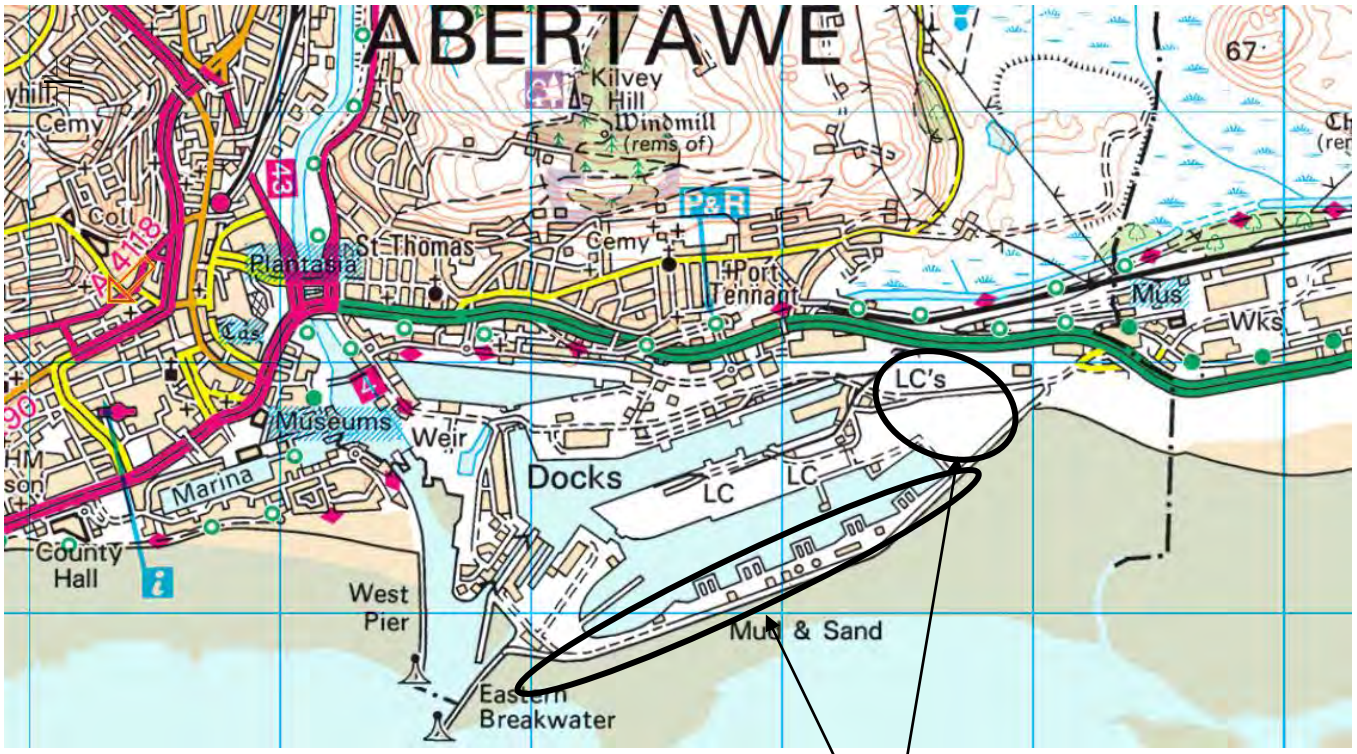
The identification of asbestos containing materials and soils falls within our schedule of tests for which we hold UKAS accreditation, however opinions, interpretations and all other information contained in the report are outside the scope of UKAS accreditation.

ENCLOSURE F

DRAWINGS

Site Location Plan	F1
Exploratory Hole Location Plan	Borehole Trial Pits Trial Pits – Arsenic Area Trial Pits – Soakaway CBR Road Cores

Site Location Plan



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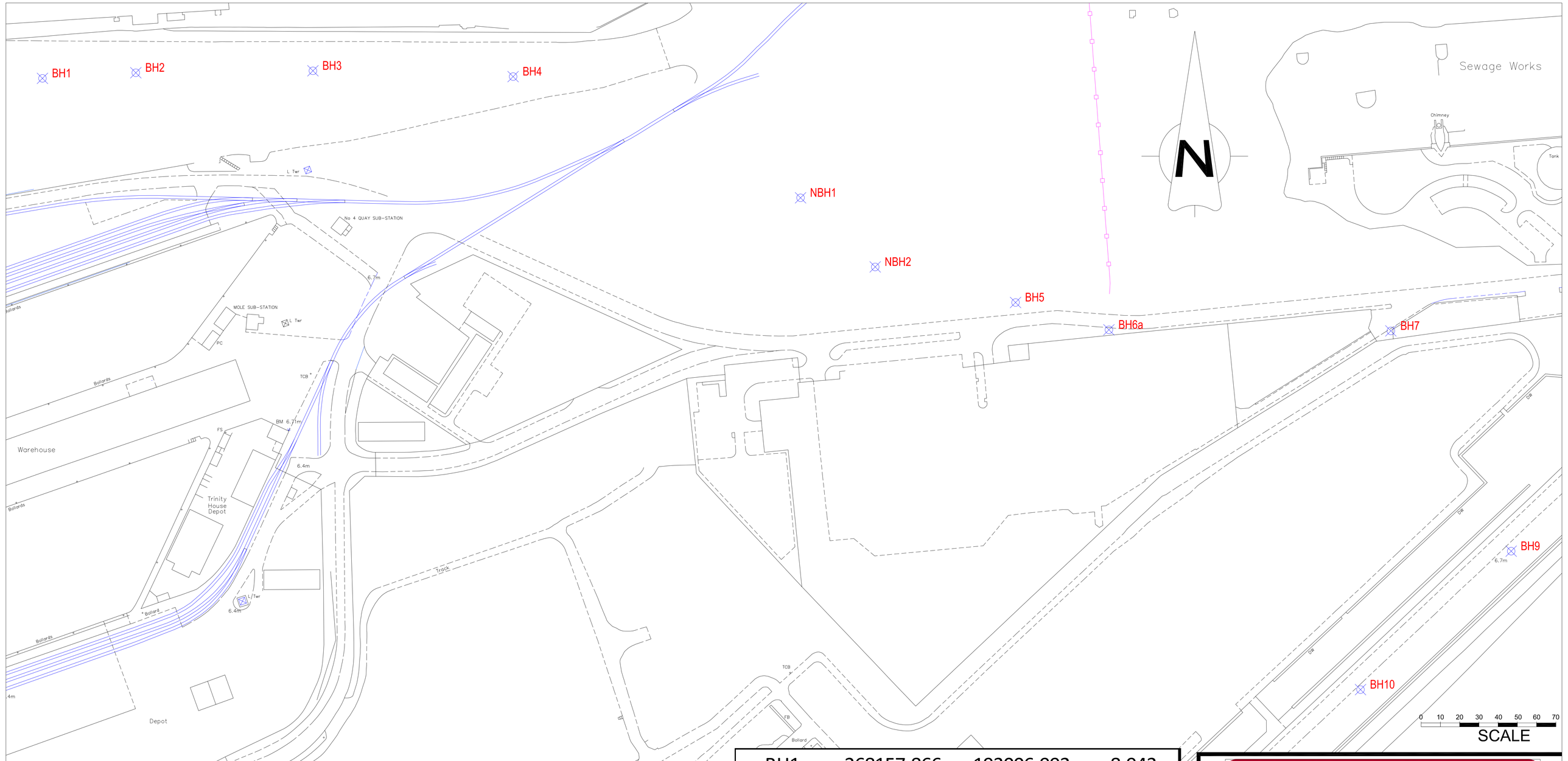
Notes: NTS	Project	Swansea Bay Tidal Lagoon C133 Onshore Ground Investigation	Figure
	Project No.	10318	F1
	Carried out for	Tidal Lagoon Swansea Bay Plc.	



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BH7	268858.287	192875.743	6.786
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BH10	268842.504	192689.349	6.768
NBH1	268551.632	192944.928	7.402
NBH2	268590.429	192908.986	7.356

GRIFFITHS
civil engineering and construction

Project

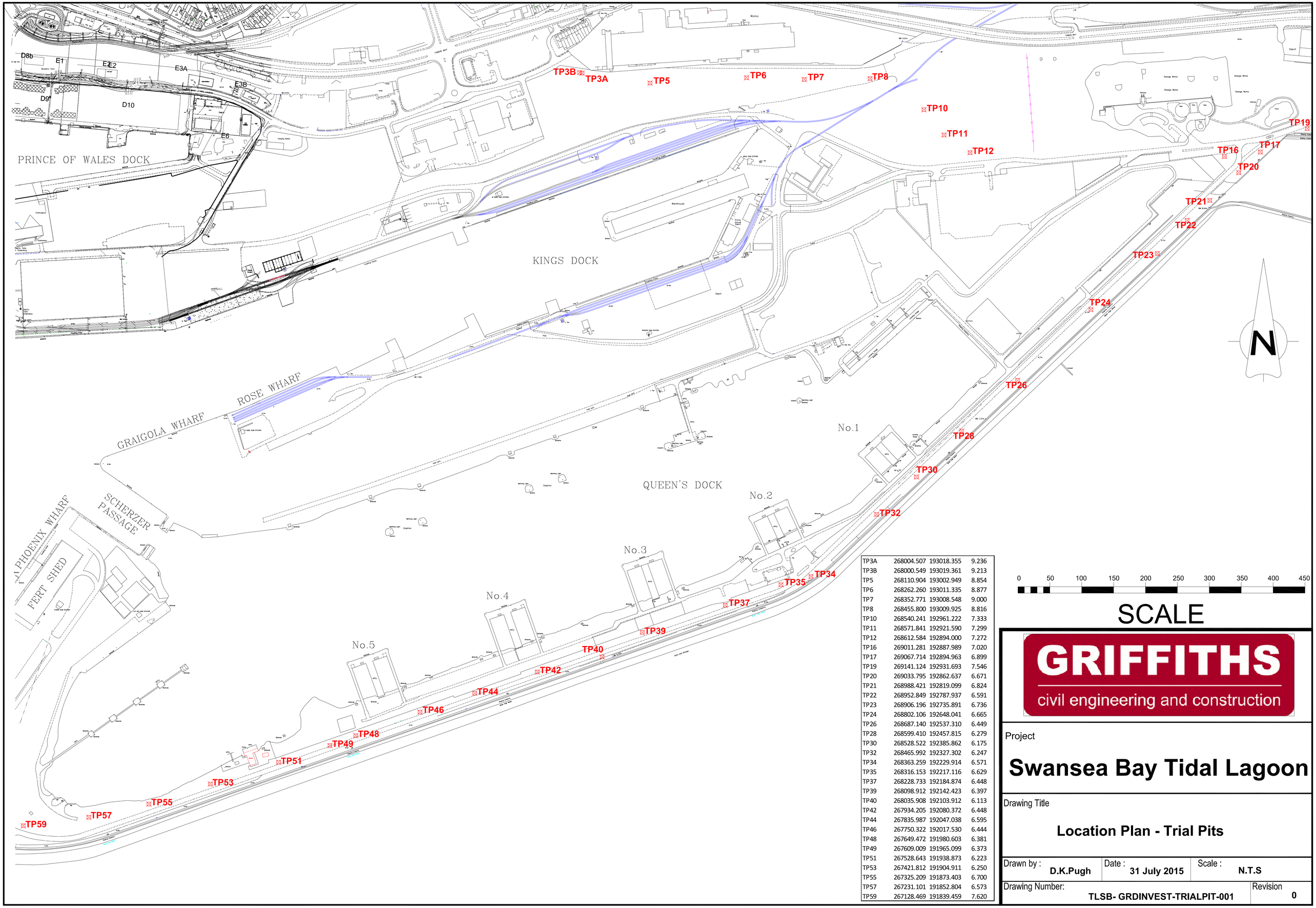
Swansea Bay Tidal Lagoon

Drawing Title

Location Plan - Borehole Trial Pits

Drawn by :	Date :	Scale :
D.K.Pugh	31 July 2015	N.T.S

Drawing Number:	Revision
TLSB- GRDINVEST-BOREH-001	0



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TP55	267325.209	191873.403	6.700
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TP59	267128.469	191839.459	7.620

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SCALE

GRIFFITHS
civil engineering and construction

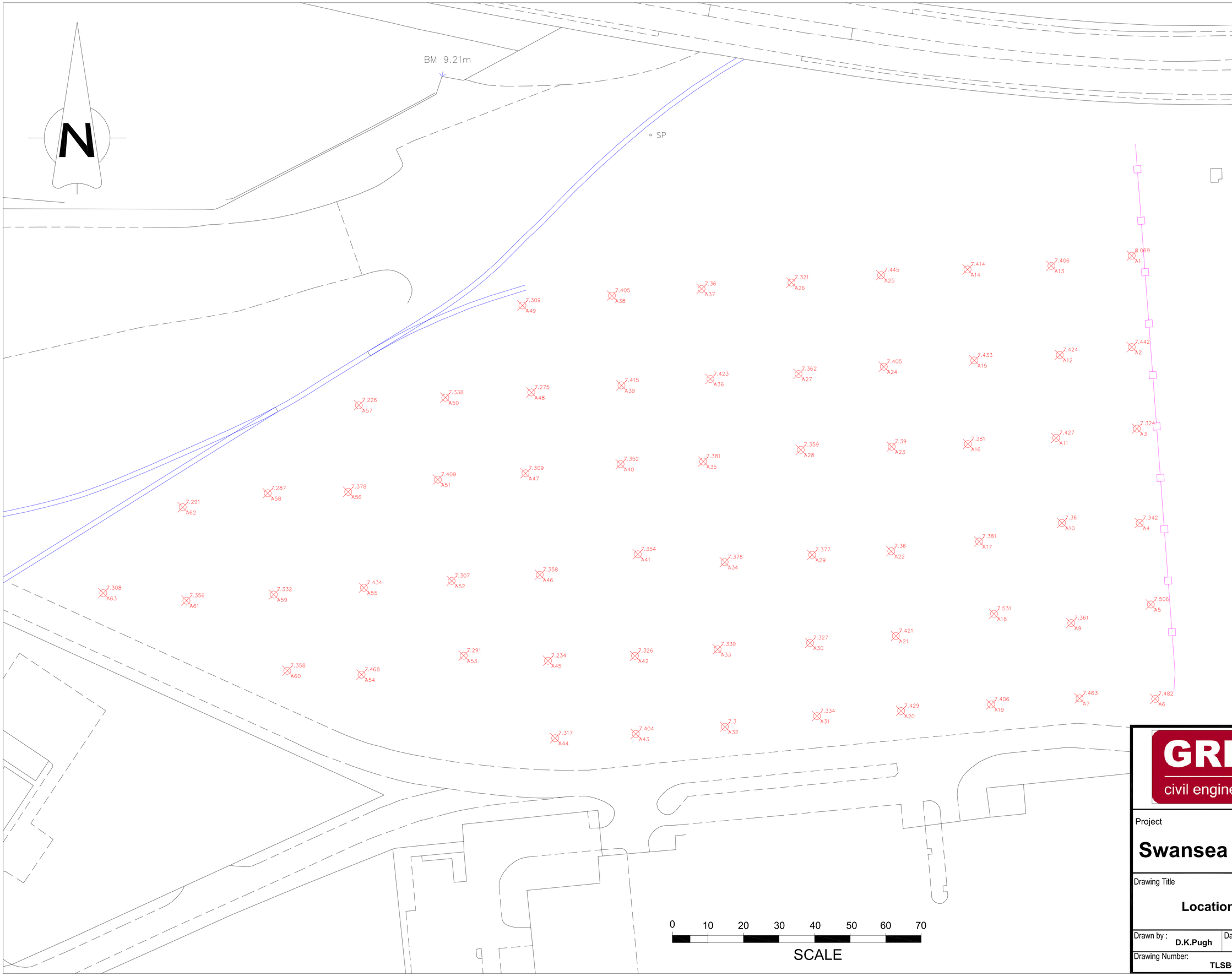
Project

Swansea Bay Tidal Lagoon

Drawing Title

Location Plan - Trial Pits

Drawn by :	Date :	Scale :	
D.K.Pugh	31 July 2015	N.T.S	
Drawing Number: TLSB- GRDINVEST-TRIALPIT-001			Revision 0



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A7	268685.623	192893.338	7.463
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A27	268606.584	192984.547	7.362
A28	268607.204	192963.214	7.359
A29	268610.429	192933.684	7.377
A30	268609.813	192908.920	7.327
A31	268611.779	192888.331	7.334
A32	268585.877	192885.328	7.300
A33	268583.825	192907.124	7.339
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A35	268579.759	192959.926	7.381
A36	268581.799	192983.124	7.423
A37	268579.306	193008.446	7.360
A38	268554.102	193006.567	7.405
A39	268556.778	192981.320	7.415
A40	268556.532	192959.184	7.352
A41	268561.370	192933.843	7.354
A42	268560.577	192905.284	7.326
A43	268560.783	192883.329	7.404
A44	268538.131	192882.131	7.317
A45	268536.123	192903.909	7.234
A46	268533.793	192928.067	7.358
A47	268529.793	192956.622	7.309
A48	268531.422	192979.340	7.275
A49	268528.925	193003.793	7.309
A50	268507.239	192977.888	7.338
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A56	268479.914	192951.408	7.378
A57	268482.920	192975.724	7.226
A58	268457.281	192950.997	7.287
A59	268458.992	192922.520	7.332
A60	268462.789	192901.086	7.358
A61	268434.427	192920.786	7.356
A62	268433.362	192947.076	7.291
A63	268411.024	192922.918	7.308

GRIFFITHS
civil engineering and construction

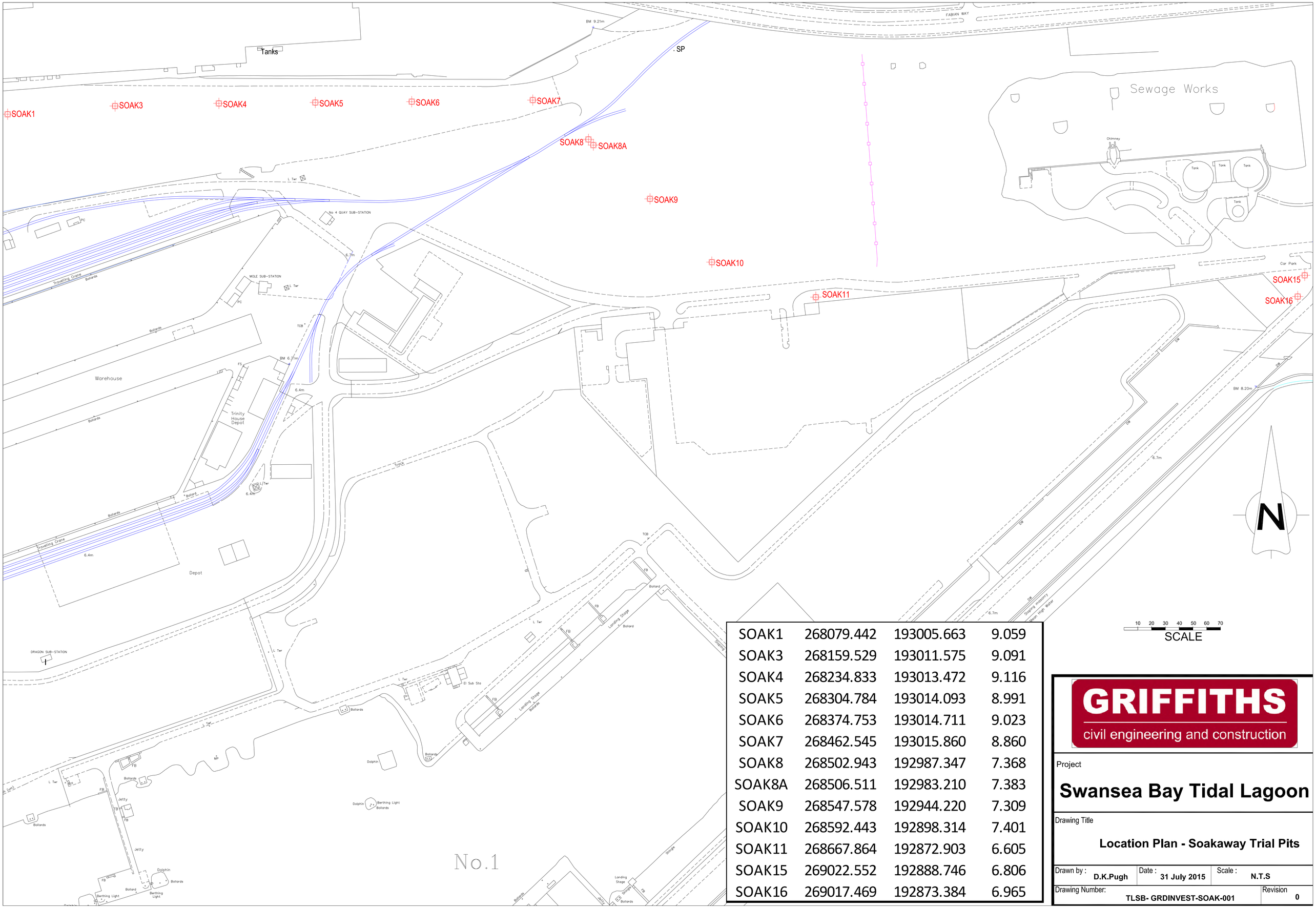
Project

Swansea Bay Tidal Lagoon

Drawing Title

Location Plan - Arsenic Trial Pits

Drawn by : D.K.Pugh	Date : 31 July 2015	Scale : 1:1000 @ A3	
Drawing Number: TLSB- GRDINVEST-ARSENIC-001			Revision 0



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Project

Swansea Bay Tidal Lagoon

Drawing Title

Location Plan - Soakaway Trial Pits

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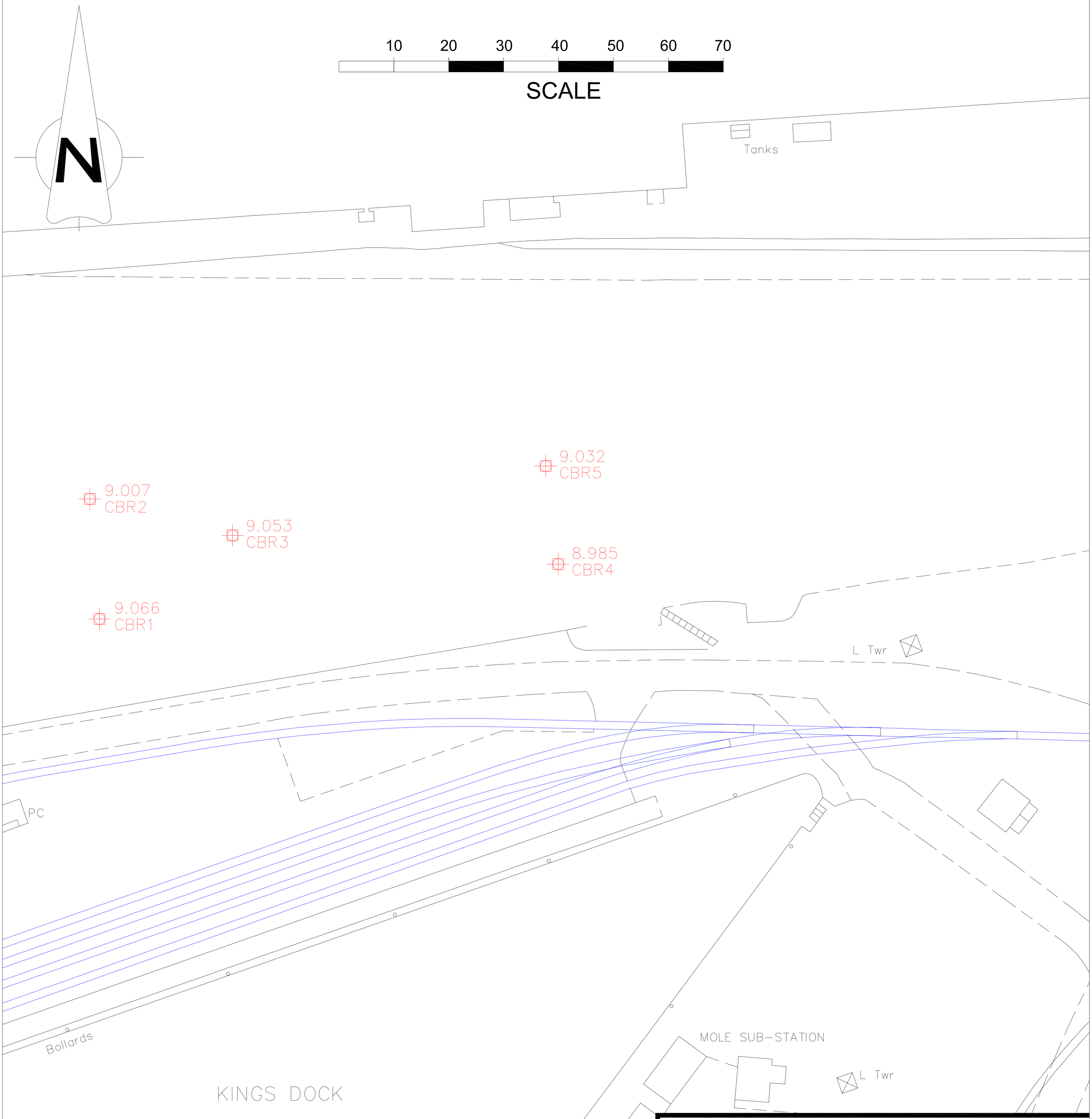

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Project

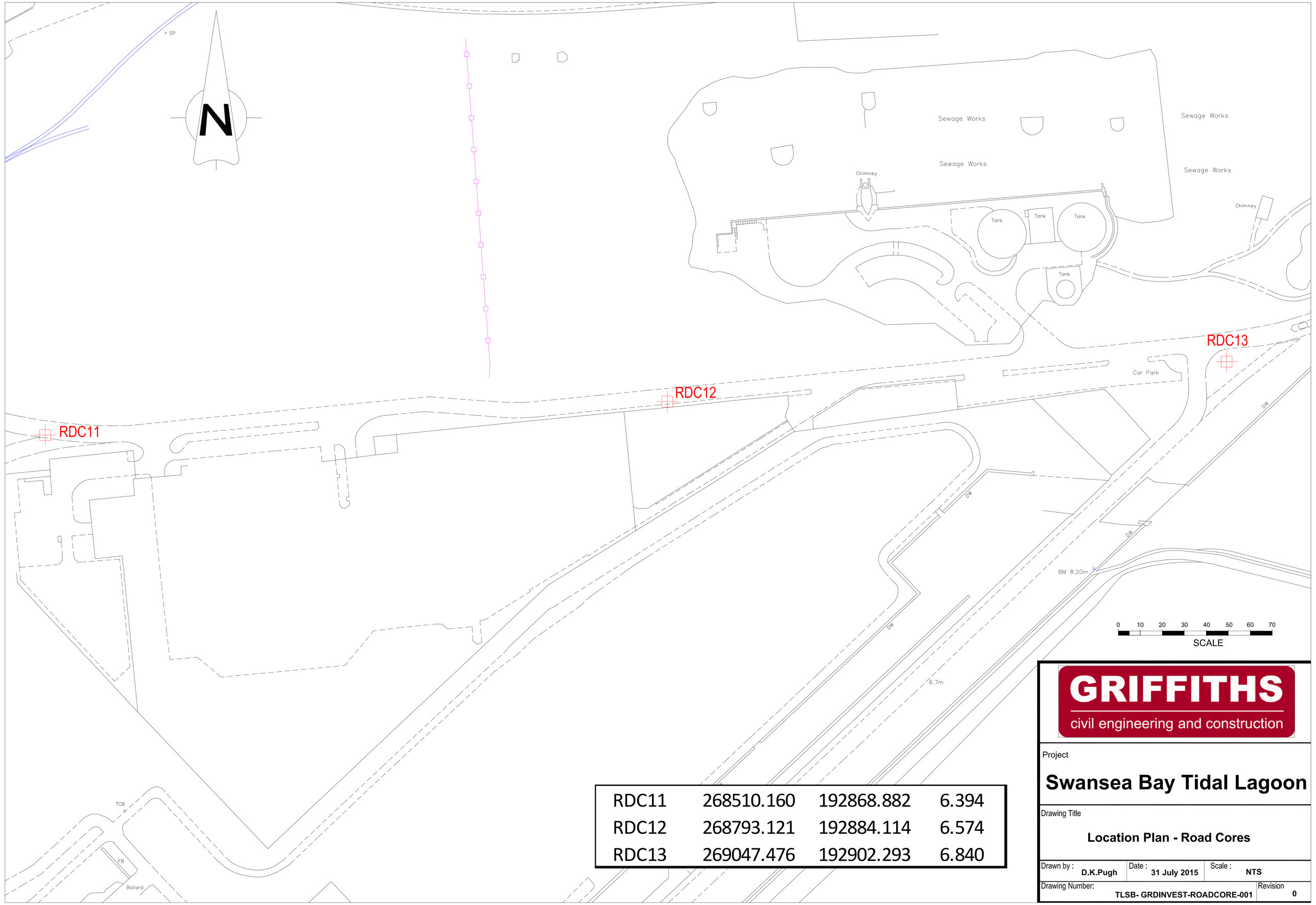
Swansea Bay Tidal Lagoon

Drawing Title

Location Plan - CBR Trial Pits

Drawn by :	Date :	Scale :
D.K.Pugh	31 July 2015	1:1000 @ A4

Drawing Number:	Revision
TLSB- GRDINVEST-CBR-001	0



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Project

Swansea Bay Tidal Lagoon

Drawing Title

Location Plan - Road Cores

Drawn by :	Date :	Scale :
D.K.Pugh	31 July 2015	NTS

Drawing Number: TLSB- GRDINVEST-ROADCORE-001

Revision 0

Appendix D. BACTEC Threat Assessment Report

BACTEC | Globally Trusted Locally Dependable

Explosive Ordnance Threat Assessment in respect of Swansea Docks to Baglan burrows

for
Atkins Limited

5603TA

8th September 2014

BACTEC

Explosive Ordnance Threat Assessment

in respect of

Swansea Docks to Baglan Burrows

for

Atkins Limited

5603TA 8th September 2014

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This Report has been produced in compliance with the Construction Industry Research and Information Association guidelines for the preparation of Detailed Risk Assessments in the management of UXO risks in the construction industry.

Glossary of Terms

AAA	Anti-Aircraft Artillery
ARP	Air-raid Precautions
BDO	Bomb Disposal Officer
EOD	Explosive Ordnance Disposal (current term for "bomb" disposal)
HE	High Explosive
HG	Home Guard
IB	Incendiary Bomb
kg	Kilogram
LCC	London County Council
LM	Land Mine
LSA	Land Service Ammunition (includes grenades, mortars, etc.)
Luftwaffe	German Air Force
m bgl	Metres Below Ground Level
MoD	Ministry of Defence
OB	Oil Bomb
PM	Parachute Mine
RAF	Royal Air Force
SI	Site Investigation
SAA	Small Arms Ammunition (small calibre cartridges used in rifles & machine guns)
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
V-1	"Doodlebug" the first cruise type missile, used against London from June 1944. Also known as 'Flying Bomb'.
V-2	The first ballistic missile, used against London from September 1944
WWI	First World War (1914 -1918)
WWII	Second World War (1939 – 1945)

Executive Summary

The Site: The study area occupies a large section of coastline immediately east of Swansea, West Glamorgan. It stretches from the western tip of the Queen's Dock sea wall, along Fabian Way (A482), through Crymlyn Burrows, over the River Neath to the eastern extent; the Baglan Bay CCGT Power Plant.

It is situated between the following two approximate OS grid reference: SS 67089 91867 (west) and SS 73508 92815 (east).

Proposed Works: The proposed works include a series of trial pits and windowless sample holes to depths of between 4m to 6m bgl, with deeper boreholes down to 25m bgl in the area of the River Neath Estuary and associated tidal flats.

Risk Assessment Methodology: In accordance with CIRIA guidelines this assessment has carried out research, analysed the evidence and considered the risks that the site has been contaminated with unexploded ordnance; that such items remained on site; that they could be encountered during the proposed works and the consequences that could result. Appropriate risk mitigation measures have been proposed.

Explosive Ordnance Risk Assessment: BACTEC concludes that there are areas of **Low** and **High** risk from encountering UXO on site. This is based on the following factors:

- Swansea was one of the most consistently bombed cities in Britain during WWII, suffering damage to three quarters of its pre-war housing stock during 82 air raids, three of which were heavy 'Blitz' scale attacks.
- The Queen's Dock (western end of the site), as well as a railway maintenance yard, flanking the northern site boundary, were both identified by the Luftwaffe as bombing targets. As a result, the local area was subject to a moderate bombing density, as confirmed by official statistics.
- An ARP bomb plot map records three HE bomb strikes immediately adjacent to the northern boundary of the site. Anecdotal evidence suggests that bombs fell on the docks area during at least seven raids. In addition, HE and incendiary incidents are recorded in the Baglan Moors area, possibly in close proximity to the eastern extent of the site. Furthermore, 1941 Luftwaffe reconnaissance photography also exhibits several HE bomb craters in coastal sand, immediately adjacent to the central part of the site as well as bomb damage to one storage tank on site.
- Generally, access to the site would have been higher at the western extent. The docks (and storage tank farm) were vital to the local war effort and post-raid checks for UXO were likely carried out along the working quayside, the railway sidings and within the buildings.
- However undeveloped/unused land within the docks may have been neglected, increasing the possibility of UXO remaining undetected. The remainder of the site was undeveloped, apparently unused and therefore a UXB strike could easily have fallen unobserved, especially since most raids occurred at night.
- With the exception of one storage tank, the large buildings on site appear to have survived the war intact and therefore a UXB strike to these undamaged buildings, as well as the railway sidings, will have caused obvious damage which would have been noted and dealt with at the time.
- The remainder of the study area however was occupied by bare earth, grass, beach, marsh, mud flat and the River Neath; types of ground cover within which evidence of a UXB impact could have become obscured. Note that the entry hole of an SC50 UXB, the most commonly deployed German HE bomb, may have been as little as 20cm in diameter.
- Up to four HAA batteries were situated immediately adjacent to the site boundary during WWII, with thousands of AA shells stored at these sites during the course of the war. These installations are likely to have had a designated burning area to dispose of any faulty or surplus shells. Furthermore, during the period of anticipated invasion (1940-41), the RAF personnel that operated these batteries were probably issued with weapons and would have taken part in amphibious invasion defence training, possibly within the study area.
- Records indicate that three Home Guard battalions were stationed in the city. These personnel would have manned the several pillboxes which guarded the docks (western section of the site), as well as a 4.7" naval gun emplacement and an observation post. In addition they are also likely to have patrolled the coastline and carried out aforementioned anti-invasion training.
- It is known that the Army occupied land east of Crymlyn Burrows during WWII. This is confirmed by the 1921 OS map, which records two rifle ranges close to the eastern extent of the site. Therefore live fire practice and training on other weapons is likely to have taken place within the eastern site boundary. This is substantiated by the recovery (by BACTEC) of two live HE shells at the neighbouring Baglan Bay CCGT Power Station between 2001-2002.
- Experience has shown that the 'housekeeping' of military personnel during WWII was often poor with items of faulty/surplus/expended UXO often burnt, buried, misplaced or otherwise discarded in civilian areas. Therefore the possibility of land service/small arms ammunition contamination on site cannot be discounted.

Some intrusive work has have taken place on site in the post-war period. Within these locations the threat from shallow-buried items of UXO (especially anti-aircraft shells, 1kg incendiary bombs, LSA/SAA) will have been partly mitigated since any such items may have been encountered during initial shallow excavations. The risk however

from deep-buried German HE UXBs will not have been mitigated to any significant degree across the entire study area.

The shells found close to the site in 2001-2002 appear to have been deposited there during reclamation, possibly caused by their migration from a former adjacent naval range into the dredging borrow area. They could also have originated from a stockpile of ordnance rejected by the munitions re-processing works to the north, known to have been in operation, to the north of the study area.

Bomb Penetration Assessment: It has been assessed that a 500kg bomb would have had a maximum bomb penetration depth of up to **8-10m** below WWII ground level. Penetration depth could potentially have been greater if the UXB was larger (though only 4% of German bombs used in WWII over Britain were of that size). Note that UXBs may be found at any depth between just below the WWII ground level and the maximum penetration depth. This assessment has been made using generic geological information.

Risk Mitigation Measures: The following risk mitigation measures are recommended to support any future proposed redevelopment works:

Both Risk Zones

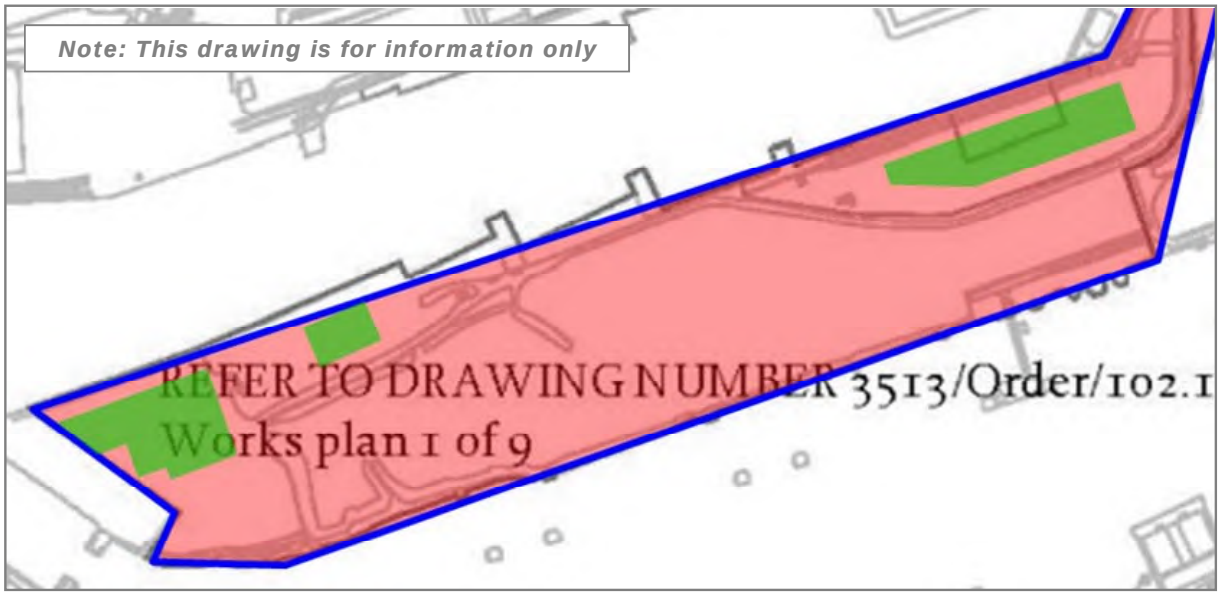
- Explosive Ordnance Safety and Awareness Briefings to all personnel conducting intrusive works.
- The Provision of Unexploded Ordnance Site Safety Instructions.

High Risk Zone only

- On greenfield areas only: Non-Intrusive Magnetometer Survey and target investigation ahead of any intrusive works.
- Where a non-intrusive magnetometer survey is not possible: Explosive Ordnance Disposal (EOD) Engineer presence on site to supervise all open excavations.
- Intrusive Magnetometer Survey of any pile/borehole locations and Target Investigation, if necessary. Investigation of Suspect Anomalies, if required.

In making this assessment and recommending these risk mitigation measures, the proposed works outlined in the 'Scope of the Proposed Works' section were considered. Should the planned works be modified or additional intrusive engineering works be considered, BACTEC should be consulted to see if a re-assessment of the risk or mitigation recommendations is necessary.

Risk Map – Note that this map only shows a small portion of the *High Risk Zone*. For full map, see ***Annex S***.



High Risk Zone

Low Risk Zone

Generalised / approximate site boundary

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Explosive Ordnance Threat Assessment

In Respect of

Swansea Docks to Baglan Burrows

1. Introduction

1.1. Background

Atkins Limited has commissioned BACTEC International Limited to conduct an Explosive Ordnance Threat Assessment for the Swansea Docks to Baglan Burrows site, West Glamorgan, Wales.

Unexploded Ordnance (UXO) presents a significant threat to construction projects in parts of the UK as a result of enemy actions during the two 20th Century World Wars and historic British and Allied military activity.

It is estimated that over 20% of the UK landmass has been used for military training at some point and between 2006 and 2009, over 15,000 items of ordnance (excluding small arms ammunition) were found on UK construction site (CIRIA).

One of the legacies of these conflicts is buried unexploded air-dropped bombs or anti-aircraft projectiles resulting from the failure of a proportion of the weapons to function as designed. It is commonly accepted that the failure rate of these munitions was approximately 10% and, depending on their shape, weight, velocity and ground conditions many penetrated the ground and came to rest at depth. Intensive efforts were made during and after the war to locate and render safe all UXO but, unsurprisingly, not all were found and dealt with. This is evidenced by the regular, on-going discoveries of unexploded ordnance during construction-related intrusive ground works.

The UK was bombed during WWI, though to a much lesser extent, and it is thought that a similar proportion of these weapons also malfunctioned. There have been occasional finds of unexploded WWI bombs in recent years but the risk of encountering them today is generally very low.

As a result of a generally increased risk awareness amongst professionals involved in ground engineering works and proactive health and safety measures, the threat to life and limb from unexploded ordnance has been minimised. However even the simple discovery of a suspected device during on-going works can cause considerable disruption to production and cause unwanted delays and expense.

Such risks can be more fully controlled by a better understanding of the site-specific threat and the implementation of appropriate risk mitigation measures.

2. Construction Industry Duties and Responsibilities

2.1. The UK Regulatory Environment

There is no specific legislation covering the management and control of the UXO risk in the UK construction industry but issues regarding health and safety are addressed under a number of regulatory instruments, as outlined below.

In practice the regulations impose a responsibility on the construction industry to ensure that they discharge their obligations to protect those engaged in ground-intrusive operations (such as archaeology, site investigation, drilling, piling or excavations) from any reasonably foreseeable UXO risk.

2.2. The Health and Safety at Work Act, 1974

The Act places a duty of care on an employer to put in place safe systems of work to address, as far as is reasonably practicable, all risks (to employees and the general public) that are reasonably foreseeable.

2.3. Construction (Design and Management) Regulations 2007

This legislation defines the responsibilities of all parties (primarily the Client, the CDM Co-ordinator, the Designer and the Principal Contractor) involved with works.

Although UXO issues are not specifically addressed the regulations effectively place obligations on all these parties to:

- Ensure that any potential UXO risk is properly assessed
- Put in place appropriate risk mitigation measures if necessary
- Keep all parties affected by the risk fully informed
- Prepare a suitably robust emergency response plan

2.4. Other Legislation

Other relevant legislation includes the "Management of Health and Safety at Work Regulations 1999" and "The Corporate Manslaughter and Corporate Homicide Act 2007".

3. The Role of the Authorities and Commercial Contractors

3.1. The Authorities

The Police have the responsibilities for co-ordinating the emergency services in the case of an ordnance-related incident on a construction site. They will make an initial assessment (i.e. is there a risk that the find is ordnance or not?) and if they judge necessary impose a safety cordon and/or evacuation and call the military authorities (JSEODOC - Joint Services Explosive Ordnance Disposal Operations Centre) to arrange for investigation and/or disposal. In the absence of an EOD specialist on site many Police Officers will use the precautionary principle, impose cordon(s)/evacuation and await advice from the JSEODOC.

The priority given to the request by JSEODOC will depend on their judgement of the nature of the threat (ordnance, location, people and assets at risk) and the availability of resources. They may respond immediately or as resources are freed up. Depending on the on-site risk assessment the item of ordnance may be removed or demolished (by controlled explosion) in situ. In the latter case additional cordons and/or evacuations may be necessary.

Note that the military authorities will only carry out further investigations or clearances in very high profile or high risk situations. If there are regular ordnance finds on a site the JSEODOC may not treat each occurrence as an emergency and will encourage the construction company to put in place alternative procedures (i.e. the appointment of a commercial contractor) to manage the situation and relieve pressure from the JSEODOC disposal teams.

3.2. Commercial Contractors

In addition to pre-construction site surveys and clearances a commercial contractor is able to provide a reactive service on construction site. The presence of a qualified EOD Engineer with ordnance recognition skills will avoid unnecessary call-outs to the authorities and the Contractor will be able to arrange for the removal and disposal of low risk ordnance. If high risk ordnance is discovered actions will be co-ordinated with the authorities with the objective of causing the minimum possible disruption to site operations whilst putting immediate, safe and appropriate measures in place.

4. This Report

4.1. Aims and Objectives

The aim of this report is to examine the possibility of encountering any explosive ordnance during the proposed works at the Swansea Docks to Baglan Burrows site. Risk mitigation measures will be recommended, if deemed necessary, to reduce the threat from explosive ordnance during the envisaged works. The report follows the CIRIA Guidelines.

4.2. Risk Assessment Methodology

The following issues will be addressed in the report:

- The risk that the site was contaminated with unexploded ordnance.
- The risk that unexploded ordnance remains on site.
- The risk that ordnance may be encountered during the proposed works.
- The risk that ordnance may be initiated.
- The consequences of initiating or encountering ordnance.

Risk mitigation measures, appropriate to the assessed level of risk and site conditions, will be recommended if required.

4.3. Approach

In preparing this Explosive Ordnance Threat Assessment Report, BACTEC has considered general and, as far as possible, site specific factors including:

- Evidence of German bombing and delivery of UXBs.
- Site history, occupancy and conditions during WWII.
- The legacy of Allied military activity.
- Details of any known EOD clearance activity.
- The extent of any post war redevelopment.
- Scope of the current proposed works.

4.4. Sources of Information

BACTEC has carried out detailed historical research for this Explosive Ordnance Threat Assessment including accessing military records and archived material held in the public domain and in the MoD.

Material from the following sources has been consulted:

- The National Archives, Kew.
- F!ND Maps.
- The National Monuments Record of Wales.
- Britain From Above Project.
- Council for British Archaeology.

- Relevant information supplied by Atkins Limited.
- Available material from 33 Engineer Regiment (EOD) Archive.
- BACTEC's extensive archives built up over many years of research and hands-on Explosive Ordnance Disposal activities in the UK.
- Open sources such as published books, local historical records and the internet.

4.5. Reliability of Historical Records

4.5.1. General Considerations

This report is based upon research of historical evidence. Whilst every effort has been made to locate all relevant material BACTEC cannot be held responsible for any changes to the assessed level of risk or risk mitigation measures based on documentation or other information that may come to light at a later date.

The accuracy and comprehensiveness of wartime records is frequently difficult or impossible to verify. As a result conclusions as to the exact location, quantity and nature of the ordnance threat can never be definitive but must be based on the accumulation and careful analysis of all accessible evidence. BACTEC cannot be held responsible for inaccuracies or gaps in the available historical information.

4.5.2. Bombing Records

During WWII considerable efforts were expended in recording enemy air raids. Air Raid Precautions (ARP) wardens were responsible for making records of bomb strikes either through direct observation or by post-raid surveys. However their immediate priority was to deal with casualties and limit damage, so it is to be expected that records are often incomplete and sometimes contradictory. Record keeping in the early days of bombing was not comprehensive and details of bombing in the early part of the war were sometimes destroyed in subsequent attacks. Some reports may cover a single attack, others a period of months or the entire war.

Records of raids that took place on sparsely or uninhabited areas were often based upon third party or hearsay information and are not always reliable; records of attacks on military or strategic targets were often maintained separately from the general records and have not always survived.

5. The Site

5.1. Site Location

The study area occupies a large section of coastline immediately east of Swansea, West Glamorgan. It stretches from the western tip of the Queen's Dock sea wall, through Crymlyn Burrows, over the River Neath to the eastern extent; the Baglan Bay CCGT Power Plant.

It is situated between the following two approximate OS grid reference: SS 67089 91867 (west) and SS 73508 92815 (east).

Site location maps are presented in Annex A.

5.2. Site Description

The site is a vast and complex area. The western docks portion occupies the sea wall, Queen's Dock Quay, a section of Langdon Road and some areas of open ground.

Immediately east is an unidentified, partially subterranean facility, which gives way to a narrow undeveloped corridor section that follows Fabian Way (A482) east until it enters an area of estuary marsh/tidal flat associated with the River Neath. The site crosses and occupies part of the river, before narrowing again and following an unlabelled road down to a section of the Baglan Bay CCGT Power Plant.

A recent aerial photograph showing the boundaries of the site is presented in Annex B.

6. Scope of the Proposed Works

The proposed works include a series of trial pits and windowless sample holes to depths of between 4m to 6m bgl, with deeper boreholes down to 25m bgl in the area of the River Neath Estuary and associated tidal flats.

A current site plan is presented in Annex C.

7. Ground Conditions

Published BGS data for boreholes sunk at the western and eastern extents as well as at the centre of the site, record the following general geological sequences:

Western - 6m of Made Ground, 3m of sand with shells, 8.5m of light blue clay.
Centre – 6m of yellow sand, 4.5m of sand and shells, 3m of sandy clay, 4m of Sandstone
Eastern – 4m of sand, 3.1m of black sandy clay, 4m of running sand, 8.8m of sand with clay laminations.

8. Site History

8.1. General

Pre and post WWII historical OS maps[1], as well as pre-WWII oblique aerial photographs were obtained from F!ND Maps and the Britain From Above Project respectively. These are presented in Annex D and E.

8.1.1. Pre-WWII OS Map

The 1921 (1:10,560 scale) OS map shows the docks area to be significantly different from today. The Queen's Dock Quay is occupied by a *Fuel Works* and several railway sidings leading to quayside hoists. At the south-western tip of the study area, a small *Fish Meat Factory* is apparent.

The northern portion crosses many more railway sidings and also encroaches on an *Arsenic Works*. Immediately east of the docks are section of open ground, as well as more railway infrastructure and a small *Hydraulic Power Station*.

The central and eastern extents of the site occupy tidal flats/marshland. Note that approximately 270m east of the eastern extent of the site are two *Rifle Ranges* up to 600 yards in length.

The immediate surrounding area is a mixture of industry and open grassland, saltings, marsh.

8.1.2. Pre-WWII Aerial Photography

A 1933 oblique photograph of the western portion of the site (presented in Annex E) shows the docks area. The central Queen's Dock Quay has been developed further with some larger warehouse type buildings, however the Arsenic Works has apparently been demolished. Also noteworthy is the presence of eight cylindrical storage tanks within the study area, immediately east of the docks.

8.1.3. Post-WWII OS Map

A section of the 1951 (1:2,500 scale) OS map, showing just the western docks area, is presented in Annex D-2. This map confirms the two additional buildings on site as a *Warehouse* and a *Goods Shed*. Furthermore, the *Fuel Works* has been extended.

Therefore it is likely that these buildings survived the war intact, however it is also possible that they sustained bomb damage but were repaired prior to 1951.

[1] *Latest pre-war and earliest post-war*

Note the presence of several *Ruins*, to the north; features indicative of serious bomb damage on early post-war OS maps.

9. The Threat from Aerial Bombing

9.1. General Bombing History of West Glamorgan

9.1.1. First World War

There is no evidence to indicate that Wales suffered aerial bombardment during WWI. Consequently the threat from WWI UXBs is considered negligible and will not be further addressed in this report.

9.1.2. Second World War

The Luftwaffe bombing campaign in southern Wales began in June 1940 and ended in March 1944, with the last bombs falling on Cardiff. In the summer and autumn of 1940 the Luftwaffe planned to destroy key military installations, including RAF airfields and Royal Navy bases, during a series of daylight bombing raids. After the Battle of Britain these tactics were modified to include both economic and industrial sites. Targets included dock facilities, railway infrastructure, power stations, weapon manufacturing plants and gas works.

As a result of aircraft losses, daylight raids were reduced in favour of attacking targets under the cover of darkness. During this period merchant navy convoys were also targeted in the narrow mine swept coastal channels but also whilst in dock.

As the war progressed the strategy changed to one of attempting to destroy the morale of the civilian population by the "carpet bombing" of London and several other major British cities, including Swansea. In Wales the vast majority of ordnance was dropped on West Glamorgan, however many other towns and isolated targets also experienced air raids.

By May 1941, concentrated attacks on both land targets and shipping ceased as the Luftwaffe was diverted east to prepare for 'Operation Barbarossa', the invasion of the Soviet Union. By the end of the war 984 people had been killed and 1,221 seriously injured in Wales.

9.2. Aerial Delivered Ordnance in the Second World War

9.2.1. Generic Types of WWII German Air-delivered Ordnance

The nature and characteristics of the ordnance used by the Luftwaffe allows an informed assessment of the hazards posed by any unexploded items that may remain today. Detailed illustrations of German air delivered ordnance are presented at Annex F.

- HE Bombs: In terms of weight of ordnance dropped, HE bombs were the most frequent weapon deployed. Most bombs were 50kg, 250kg or 500kg (overall weight, about half of which was the high explosive) though large bombs of up to 2000kg were also used. HE bombs had the weight, velocity and shape to easily penetrate the ground intact if they failed to explode. Post-raid surveys would not always have spotted the entry hole or other indications that a bomb penetrated the ground and failed to explode and contemporary ARP documents describe the danger of assuming that damage, actually caused by a large UXB, was due to an exploded 50kg bomb. Unexploded HE bombs therefore present the greatest risk to present–day intrusive works.
- Blast Bombs/ Parachute Mines: Blast bombs generally had a slow rate of descent and were extremely unlikely to have penetrated the ground. Non-retarded mines would have shattered on most ground types, if they had failed to explode. There have been extreme cases when these items have been found unexploded, but this was where the ground was either very soft or where standing water had reduced the impact. BACTEC does not consider there to be a significant threat from this type of munition on land.
- Large incendiary bombs: This type of bomb ranged in size from 36kg to 255kg and had a number of inflammable fill materials (including oil and white phosphorus), and a small explosive charge. They were designed to explode and burn close to the surface but their shape and weight meant that they did have penetration capability. If they penetrated the

ground complete combustion did not always occur and in such cases they remain a risk to intrusive works.

- 1 kg Incendiary Bombs (IB): These bombs, which were jettisoned from air-dropped containers, were unlikely to penetrate the ground and in urban areas would usually have been located in post-raid surveys. However, if bombs did not initiate and fell in water or dense vegetation, or became mixed with rubble in bomb damaged areas they could have been overlooked. Some variants had explosive heads and these present a risk of detonation during intrusive works.
- Anti-personnel (AP) Bomblets: AP bombs had little ground penetration ability and should have been located by the post-raid survey unless they fell into water, dense vegetation or bomb rubble.
- Specialist Bombs (smoke, flare, etc): These types do not contain high explosive and therefore a detonation consequence is unlikely. They were not designed to penetrate the ground.

9.2.2. German Air-delivered Ordnance Failure Rate

It has been estimated that 10% of the German HE bombs dropped during WWII failed to explode as designed. This estimate is probably based on the statistics of wartime recovered UXBs and therefore will not have taken account of the unknown numbers of UXBs that were not recorded at the time, and is probably an underestimate.

The reasons for failures include:

- Fuze or gaine malfunction due to manufacturing fault, sabotage (by forced labour) or faulty installation.
- Clockwork mechanism failure in delayed action bombs.
- Failure of the bomber aircraft to arm the bombs (charge the electrical condensers which supplied the energy to initiate the detonation sequence) due to human error or equipment defect.
- Jettison of the bomb before it was armed or from a very low altitude. Most likely if the bomber was under attack or crashing.

War Office Statistics document that a daily average of 84 bombs which failed to function were dropped on civilian targets in Great Britain between 21st September 1940 and 5th July 1941. 1 in 12 of these (probably mostly fitted with time delay fuzes) exploded sometime after they fell - the remainder were unintentional failures.

From 1940 to 1945 bomb disposal teams dealt with a total of 50,000 explosive items of 50 kg and over (i.e. German bombs), 7000 AAA shells and 300,000 beach mines. These operations resulted in the deaths of 394 officers and men. However, unexploded ordnance is still regularly encountered across the UK (see recent press articles, Annex G-1).

9.2.3. UXB Ground Penetration

9.2.3.1. General Considerations

The actual penetration depth of aerial delivered bombs into the ground will have been determined by the mass and shape of the bomb, the velocity and angle of the bomb on impact (dependent on the height of release) and the nature of the ground and ground cover; the softer the ground, the greater the potential penetration. Peat, alluvium and soft clays are easier to penetrate than gravel and sand. Bombs are brought to rest or are commonly deflected by bedrock or large boulders.

9.2.3.2. The "j" Curve Effect

An air-dropped bomb falling from normal bombing altitude (say 5000m) into homogeneous ground will continue its line of flight but turn in an upwards curve towards the surface as it comes to rest. This offset from vertical is generally thought to be about one third of the penetration depth, but can be up to 15m depending on ground conditions or the bomb's angle of impact.

9.2.3.3. Second World War Bomb Penetration Studies

During WWII the Ministry of Home Security undertook a major study on actual bomb penetration depths, carrying out statistical analysis on the measured depths of 1328 bombs as reported by Bomb Disposal, mostly in the London area. They then came to conclusions as to the likely average and maximum depths of penetration of different sized bombs in different geological strata.

The median penetration of 430 x 50kg German bombs in London Clay was 4.6m and the maximum penetration observed for the SC50 bomb was 9m.

They concluded that the largest common German bomb, 500kg, had a likely penetration depth of 6m in sand or gravel but 8.7m in clay. The maximum observed depth for a 500kg bomb was 10.2m and for a 1000kg bomb 12.7m. Theoretical calculations suggested that significantly greater penetration depths were probable.

9.2.4. Initiation of Unexploded Bombs

Unexploded bombs do not spontaneously explode. All high explosive requires significant energy to create the conditions for detonation to occur. In the case of unexploded German bombs discovered within the construction site environment, there are a number of potential initiation mechanisms:

- Direct impact onto the main body of the bomb: Unless the fuze or fuze pocket is struck, there needs to be a significant impact (e.g. from piling or large and violent mechanical excavation) to initiate a buried iron bomb. Such violent action can cause the bomb to detonate.
- Re-starting the clock timer in the fuze: Only a small proportion of German WWII bombs employed clockwork fuzes. It is probable that significant corrosion has taken place within the fuze mechanism over the last 60 years that would prevent clockwork mechanisms from functioning, nevertheless it was reported that the fuze in a UXB dealt with by 33 EOD Regiment in Surrey in 2002 did re-commence.
- Induction of a static charge, causing a current in an electric fuze: The majority of German WWII bombs employed electric fuzes. It is probable that significant corrosion has taken place within the fuze mechanism over the last 60 years such that the fuze circuit could not be activated.
- Friction impact initiating the (shock-sensitive) fuze explosive: This is the most likely scenario resulting in the bomb detonating.

Annex G-2 details UXB incidents where intrusive works have caused UXBs to detonate, resulting in death or injury and damage to plant.

9.3. Bombing of The Swansea Docks / Baglan Burrows Area

9.3.1. Second World War Overview

Situated in an ideal location for military-based industries and munitions manufacture, with the docks providing transportation for weapons and troops, the Swansea Bay area was vital to the war effort. The city was a major industrial centre, housing metal refineries, a large coal depot and the Llandarcy Oil Refinery (approximately 1.5km to the north of the site).

Swansea experienced around forty air-raids, including six major "Blitz" attacks, with the most severe damage to Swansea caused during the "Three Nights' Blitz" of the 19th – 21st February 1941, when forty-one acres of the city was destroyed. Generally, much of the docks and industrial areas escaped the majority of air-raids, with residential and commercial districts suffering more substantial damage.

A Luftwaffe target map (presented in Annex H) highlights several industrial targets within the docks section of the site. Due to the immediate proximity of the site to the docks, it is considered not unlikely that an HE bomb could fall within the study area and is now lying on the sea bed.

Located approximately 5km to the east of the site was Port Talbot's docks, which provided transportation for weapons, raw materials and troops. During the early twentieth century, the docks and a major steelworks attracted considerable investment to Port Talbot. By 1900, the

docks were exporting over 500,000 tonnes of coal; reaching a peak of over three million tonnes in 1923 and continuing throughout WWII. As a consequence Port Talbot was subject to several air raids.

It was not uncommon for bomber crews to drop their bomb loads prematurely/indiscriminately before returning to base. This was usually due to intense AA fire over a target or harassment from British fighter aircraft. A likely flight-path to Swansea would have been from the sea and therefore it is possible that such 'tip and run' incidents occurred within the study area, especially since Swansea was heavily defended by anti-aircraft measures.

Records of bombing incidents in the Swansea area were collected by the Air Raid Precautions wardens and collated by the Civil Defence Office. Records would be in the form of typed or hand written incident notes, maps and statistics. It is understood that the majority of ARP records for the region were destroyed when the Civil Defence organisation was disbanded in the 1960s[2]. The available records of bombing incidents for Swansea and Neath are presented in the following sections.

9.3.2. Second World War Bombing Statistics

The following table summarises the quantity of German bombs (excluding 1kg incendiaries and anti-personnel bombs) falling on the County Borough of Swansea and the Metropolitan Borough of Neath between 1940 and 1945. Note that the eastern third of the site was located within the latter.

Record of German Ordnance Dropped on the County Borough of Swansea & The Metropolitan Borough of Neath		
District	*Swansea CB*	*Neath MB*
Area Acreage	21,600	4,350
High Explosive Bombs (all types)	1,496	58
Parachute Mines	4	0
Oil Bombs	0	1
Phosphorus Bombs	5	0
Pilotless Aircraft (V1)	0	0
Fire Pot	12	0
Long Range Rocket (V2)	0	0
Total	1,517	59
Items Per 1,000 Acres	**70.2**	**13.6**

Source: Home Office Records

Detailed records of the quantity and locations of the 1kg incendiary and anti-personnel bombs were not routinely maintained by the authorities as they were frequently too numerous to record. Although the incendiaries are not particularly significant in the threat they pose, they nevertheless are items of ordnance that were designed to cause damage and inflict injury and should not be overlooked in assessing the general risk to personnel and equipment. The anti-personnel bombs were used in much smaller quantities and are rarely found today but are potentially more dangerous.

This table does not include UXO found during or after WWII.

[2] *Alban, J R, The 'Three Nights' Blitz'*

9.3.3. ARP Air Raid Reports

As original ARP reports are unavailable, a generalised record of air raids in the Swansea Bay area[3] is listed below. Those incidents closest to the site have been highlighted.

Date	Weapon	Location	Remarks
29/06/1940	H.E	Swansea, Morriston	1 aircraft.
10/07/1940	H.E	**Swansea King's Dock** and Llandarcy	Small raid.
18/07/1940	H.E	Jersey Marine and Briton Ferry	N/A
20/07/1940	H.E	**Swansea Docks** and Elba Crescent	N/A
22/07/1940	H.E	Talefrewe Farm, Cockett	2 H.E bombs dropped. Slight damage to farm buildings.
27/07/1940	H.E	**Swansea docks**	First night raid.
29/07/1940	H.E and I.B	**Baglan Moors**	N/A
30/07/1940	H.E	Banc Mawr, Reddiffusion Station, Cockett, Swansea	2 H.E bombs dropped. No damage.
02/08/1940	H.E and I.B	Swansea: Mumbles foreshore, the Uplands Girl's High School, St James Church and Treboeth	14 H.E bombs and numerous Incendiary bombs dropped.
03/08/1940	H.E and I.B	Waunarlwydd and in Swansea Bay near West Cross.	2 H.E bombs and numerous incendiaries dropped.
06/08/1940	H.E	Swansea Bay near West Cross.	10 H.E bombs dropped.
10/08/1940	H.E	Swansea: Landore's railway viaduct, Manselton, Cwbwrla, Brynhyfryd, Singleton Park, Clyne and Ravenhill areas.	31 H.E bombs dropped.
13/08/1940	H.E	Neath	N/A
14/08/1940	H.E	Neath	
17/08/1940	H.E and UXB	Swansea: Hafod, Cwmbwrla, Greenhill, Treboeth areas and Cadle Common	16 H.E bombs including 7 unexploded bombs reported and between 7 and 12 people were injured.
18/08/1940	H.E	Swansea: Gors Avenue, Greenhill, Cwmbwrla, Foxhole and St Thomas areas	12 H.E bombs including 3 UXBs dropped. Damage to residential property with 1 death and 3 injuries.
24/08/1940	I.B	Swansea: Dunvant to Kilvey Hill	Numerous I.Bs dropped, no damage or casualties.
01/09/1940	H.E and I.B	Swansea city centre	First heavy raid lasting 7 hours. 251 H.E bombs and over 1000 I.Bs dropped. Widespread damage.
		Llandarcy Oil Refinery	Several oil tanks set ablaze
02/09/1940	H.E	**Briton Ferry**, Neath Abbey and Skewen	N/A

[3] *http://www.islandfarm.fsnet.co.uk/Luftwaffe%20Attacks%20On%20South%20Wales.htm*

Date	Weapon	Location	Remarks
04/09/1940	H.E and D.A	Llansamlet, Swansea	4 H.E bombs dropped on farmland. 1 of the bombs did not explode until the following day. No damage or casualties.
11/09/1940	H.E	Brynmill and Langland Terrace, Swansea	A single plane dropped 3 H.E. 1 failed to explode. Slight damage.
24/09/1940	H.E, I.B and oil bomb	New Cut Bridge, **King's Dock**, Rutland Street, Wind Street and Dyfatty Street, Swansea	2 H.E bombs and Incendiaries dropped over. An oil bomb was also dropped destroying 2 houses were.
25/09/1940	H.E and I.B	Swansea city centre	9 H.E bombs and numerous incendiaries dropped. Slight damage but no casualties.
09/10/1940	H.E and I.B	**Prince of Wales Dock**, Kilvey Hill, St. Thomas, Bonymaen, Winchwen and Morriston areas, Swansea	6 H.E bombs and numerous incendiaries dropped. Minor damage.
21/10/1940	H.E and I.B	Gors Avenue, Winchwen, Cockett, Mayhill and Llansamlet, Swansea	15 H.E bombs and numerous incendiaries dropped. No casualties.
02/01/1941	H.E	Ynystawe, Swansea	2 small H.E bombs dropped on an empty field. No damage
05/01/1941	H.E and I.B	St. Thomas, Sketty, Derwen Fawr and Glais areas, Swansea	12 H.E bombs and 200 incendiaries dropped. Many small fires reported but all were easily extinguished. 20 casualties reported.
13/01/1941	H.E	**Kings Dock Road, Swansea**	2 H.E bombs dropped. Only slight structural damage.
17/01/1941	H.E and I.B	**Swansea docks,** St Thomas and Hafod areas.	Second heavy raid lasting several hours. 178 H.E bombs and 7000 incendiaries dropped.
19/02/1941	H.E and I.B	Swansea	Three consecutive heavy Blitz raids. 896 H.E bombs and numerous incendiaries over a total of 14 hours. City centre obliterated.
20/02/1941			
21/02/1941			
03/03/1941	H.E	Cockett and the Cefn Coed area.	6 H.E bombs deposited on open fields. Only slight structural damage.
04/03/1941	H.E	Swansea	12 H.E bombs dropped on the foreshore Swansea and Mumbles. No damage or casualties.
12/03/1941	H.E	Hafod, Swansea	15 H.E bombs. 8 houses were demolished and others sustained significant damage. substantial damage to Gas and Water mains.
14/03/1941	I.B	Bonymaen and Llansamlet	100 incendiaries dropped. Minimal damage and no casualties
24/03/1941	H.E	Danygraig Road and Crymlyn Bog, Swansea	4 H.E bombs dropped causing minimal damage.
08/04/1941	H.E and I.B	Mumbles Head and Limeslade.	800 incendiaries and 1 H.E bomb dropped causing slight damage.
22/04/1941	Parachute Mine	Frederick Place, Swansea	2 parachute mines dropped causing 13 casualties. One failed to explode.
20/05/1941	H.E	Morriston (Swansea), Neath and Skewen	1 H.E bomb dropped on Morriston; 3 casualties.

Date	Weapon	Location	Remarks
31/05/1941	H.E	Treboeth and Morriston, Swansea	4 H.E bombs dropped. Slight damage and 4 casualties.
02/01/1941	H.E and UXB	Between Langland Bay and Caswell Bay.	4 H.E bombs landed in the sea off the cliff walk path. An unexploded bomb was found at Mayhill Gardens.
28/11/1941	Parachute Mine	Swansea Strand and Burrows area.	2 Parachute Mines dropped. 1 person was killed with 23 casualties.
01/07/1942	H.E	Llandarcy and Neath Abbey	N/A
02/07/1942	I.B	Birchgrove, Swansea	240 incendiaries dropped. No damage
16/02/1943	H.E and I.B	Swansea	Sixth and final heavy raid. 32 H.E bombs and numerous incendiaries dropped.

It should be noted that the above table is not considered to be a comprehensive list of all the raids / bombing incidents that occurred in Swansea during WWII.

9.3.4. Swansea ARP Bomb Plot Map

An undated bomb plot map covering the western half of the study area and recording bombing from a single air raid is presented in Annex I.

It records several clusters of HE bomb strikes within central Swansea but also a HE Parachute Mine strike immediately adjacent to the north-western extent of the site, near present day Langdon Road.

In addition a pair of 500kg HE bombs are plotted at the northern site boundary, next to present day Fabian Way, approximately 550m north-east of Queen's Dock.

9.3.5. Luftwaffe Target and Post-Raid Assessment Photography

Luftwaffe aerial reconnaissance photographs dated 15th February 1941 are presented in Annex J. These highlighted various features of interest. Note that these images were produced immediately prior to the three night Blitz raids.

The western docks are shown to be highlighted as a target, with several oil tankers also noted. In addition several barrage balloons have been circled and numerous HE bomb craters in open ground have been highlighted to the north of the site.

Within the eastern portion of the study area, there are several significant observations. The large rail maintenance and infrastructure yard immediately north of the site boundary is earmarked for attack. The nine oil tanks on site are also highlighted and one tank is ringed, signifying that it has been damaged by bombing; as has several more tanks within the Llandarcy Oil Refinery to the north.

Further east, towards the River Neath a heavy anti-aircraft battery has been highlighted immediately north of the site boundary, with some unidentified features immediately east.

The most significant observation is the cluster of HE bomb craters noted very close to the site boundary, at the centre of the study area.

9.3.6. Second World War-Era Aerial Photographs

Aerial photography of the site was obtained from the National Monuments Record of Wales and the Britain From Above Project. Mid-war and post-war images are presented in Annex K and described below.

The 1941 image was taken after the main Blitz period of bombing in Swansea and just shows the eastern undeveloped half of the study area. The small scale and low resolution indicates

any HE bomb craters would unlikely be identifiable, furthermore, the eastern extent of the site occupies an area of (probable) dunes and undulating ground with dense vegetation, therefore making assessment of any evidence of bombing impossible.

This photograph clearly records two heavy anti-aircraft gun batteries (eight gun emplacements in total) just north of the site.

The 1947 image was taken approximately three years after the cessation of bombing in Wales and shows the docks area only. Like the OS map, this photograph suggests that the warehouse, goods shed, fuel works and hydraulic power station buildings all survived the war intact; note however it is conceivable that any damage to these facilities would have been quickly repaired as a priority over damage to residential areas.

A comparison of the quayside areas with the surrounding docks land, suggests that the former were laid to hard-standing, as might be expected and the latter areas (with a darker appearance) were occupied by bare earth/sporadic vegetation.

9.3.7. Abandoned Bombs

A post-air raid survey of buildings, facilities and installations would have included a search for evidence of bomb entry holes. If evidence were encountered, Bomb Disposal Officer teams would normally have been requested to attempt to locate, render safe and dispose of the bomb. Occasionally evidence of UXBs was discovered but due to a relatively benign position, access problems or a shortage of resources the UXB could not be exposed and rendered safe. Such an incident may have been recorded and noted as an Abandoned Bomb.

Given the inaccuracy of WWII records and the fact that these bombs were 'abandoned', their locations cannot be considered definitive, nor the lists exhaustive. The MoD states that 'action to make the devices safe would be taken only if it was thought they were unstable'. It should be noted that other than the 'officially' abandoned bombs, there will inevitably be UXBs that were never recorded.

BACTEC holds no records of officially registered abandoned bombs on or close to the site.

9.3.8. Site Specific Bomb Penetration Considerations

When considering an assessment of the bomb penetration at the Swansea Docks to Baglan Burrows Site, the following parameters would be used:

- Geology – (Made ground within the western end only) 4-6m of sand, 4.5m of sand and shells, 3m of sandy clay.
- Impact Angle and Velocity – 80-90° from horizontal and 267 metres per second.
- Bomb Mass and Configuration – The 500kg SC (General Purpose) HE bomb, without retarder units or armour piercing nose. This was the largest of the common bombs used against Britain.

Although the geology across the site differs, taking into account the above-mentioned factors it has been assessed that a 500kg bomb would have had a maximum bomb penetration depth of up to **8-10m** below WWII ground level.

Penetration depth could potentially have been greater if the UXB was larger (though only 4% of German bombs used in WWII over Britain were of that size). Note that UXBs may be found at any depth between just below the WWII ground level and the maximum penetration depth. This assessment has been made using the available site-specific information as presented in Section 7.

9.4. Likelihood of Post-raid UXO Detection

Utilising the available historical bombing records as reviewed in sections 9.1 to 9.3, it is possible to make an assessment of the likelihood that evidence of unexploded ordnance would have been noted on a site during the war and the incident dealt with or recorded at the time. Factors such as bombing density, frequency of access, ground cover, damage and failure rate have been taken into consideration.

9.4.1. Density of Bombing

Bombing density is an important consideration for assessing the possibility that UXBs remain in an area. A very high density of bombs can for example result in increased levels of damage sustained to structures, greater likelihood of errors in record keeping and a higher risk that UXBs fell over the area.

Official statistics indicate that the study area was situated in an area of moderate bombing density during WWII, however bombing will have been less intense at the eastern extent due to its distance from Swansea city centre and the aforementioned outlying industrial targets.

An ARP bomb plot map plots three HE bomb strikes immediately adjacent to the northern boundary of the site. Anecdotal evidence suggests that aside from bombing during the three consecutive heavy Blitz air raids, bombs fell on the docks area (western study area) during at least seven additional raids. Furthermore, HE and incendiary incidents are recorded in the Baglan Moors area, possibly in close proximity to the eastern study area. 1941 Luftwaffe reconnaissance photography also exhibits several HE bomb craters in coastal sand, immediately adjacent to the central part of the site.

9.4.2. Frequency of Access

Unexploded ordnance at site where human access was infrequent would have a higher chance of being overlooked than at those site which were subject to greater occupancy. The importance of a site or facility to the war effort is also an important consideration as such site are likely to have been both frequently accessed and are also likely to have been subject to post-raid checks for evidence of UXO.

The docks and neighbouring storage tanks were an important part of Swansea's war effort and therefore a great deal of effort would have been made to keep them in operation. Specific dock ARP teams are likely to have conducted post-raid damage assessments as well as searches for UXO and it is likely that the railway tracks would have been routinely checked for damage/buckling following an air raid. The various dock buildings appear to have survived the war undamaged and therefore the level of access would have been high here.

However the docks also included large areas of undeveloped ground which may have been neglected due to their apparent lack of specific use. Although the central corridor section of the site was located immediately adjacent to a large railway maintenance yard and a HAA battery, it is also situated right on the coastline and therefore it's peripheral nature suggests it probably wasn't subject to searched for UXO. Therefore it is conceivable that a UXB could have fallen unnoticed here.

The eastern extent of the site was isolated from any built up areas and situated in a river estuary mudflat/dunes environment. Therefore had any UXO fallen here, it is more likely to have done so without being observed or recorded as this land will have been relatively inaccessible.

9.4.3. Ground Cover

The degree and type of groundcover present during WWII would have a significant effect on the visual evidence at ground level which may have indicated the presence of buried UXO.

The majority of the docks area appears to have been occupied by bare earth/unmaintained vegetation and railway sidings, not hard-standing. Had a UXB hit the dock buildings, tanks or rail tracks it would have caused obvious damage (even without detonating) which would have been observed and dealt with at the time.

However it is conceivable that such an incident between neighbouring sidings or in open ground may have remained undetected. Note that the entry hole of an SC50 UXB, the most commonly deployed German HE bomb, may have been as little as 20cm in diameter and therefore easily obscured by vegetation in soft ground. This is also the case for the remainder of the study area which was occupied by coastal sand, vegetation, marsh, mudflats, dunes and the River Neath.

Furthermore, had a UXB fallen in the dock basin immediately adjacent to the site boundary it will have bee immediately obscured beneath the waterline and could have come to rest within the study area due to the J-Curve Effect; see Section 9.2.3.2.

Also noteworthy is that during WWII German 1kg incendiary bombs were observed to penetrate to significant depths when falling on soft ground; see Annex L. Therefore the possibility cannot be discounted that such munitions (known to have been deployed over Swansea) remain buried in open ground on site.

9.4.4. Damage

If structures on a site have been subject to significant bomb or fire damage, rubble and debris are likely to have been present; similarly a HE bomb strike on open ground is likely to have resulted in a degree of soil disturbance. Under such conditions there is a greater risk of the entry holes of unexploded bombs dropped during subsequent raids being obscured and going unnoticed.

WWII-era aerial photography highlights one bomb damaged storage tank on site. Although considered unlikely, had a subsequent UXB fallen within this ruined structure, it may have remained undetected, obscured with rubble and debris.

9.4.5. Bomb Failure Rate

There is no evidence to suggest that the bomb failure rate in the vicinity of the site would have been different from the "approximately 10%" figure normally used.

10. The Threat from Allied Military Ordnance

10.1. General

BACTEC has found evidence to suggest that the area of the site was formerly used for military purposes, which could have led to ordnance contamination.

The following potential military uses have been considered:

- Anti-Aircraft Defences
- Home Guard
- Training or firing ranges or the storage of ammunition
- Military bases
- Defensive minefields (including pipemines)
- Defensive Fortifications
- Manufacture of explosives or ordnance

The most likely sources of British / Allied ordnance are described below. A map showing potential UXO risk contributing features is presented in Annex M.

10.2. Defending Swansea from Aerial Attack

Both passive and active defences were deployed against enemy bombers attacking targets in the Swansea region.

Passive defences included measures to hinder the identification of targets (such as a lighting blackout at night and the camouflaging of strategic installations); to mislead bomber pilots into attacking decoy site located away from the city and to force attacking aircraft to higher altitudes with the use of barrage balloons.

Active air defence relied on a coordinated combination of fighter aircraft to act as interceptors, anti-aircraft gun batteries and later the use of rockets, in order to actively engage and oppose attacking aircraft.

10.2.1. Anti-Aircraft Artillery Batteries

Up to four HAA batteries were situated adjacent to the site boundary during WWII. At the start of the war two types of AAA guns were deployed: Heavy Anti-Aircraft Artillery (HAA), using large calibre weapons such as the 3.7" QF (Quick Firing) gun and Light Anti-Aircraft Artillery (LAA) using smaller calibre weapons such as 40mm Bofors gun.

During the early war period there was a severe shortage of AAA available and older WWI 3" and modified naval 4.5" guns were deployed alongside those available 3.7" weapons. The maximum ceiling height of fire at that time was around 11,000m (for the 3.7" gun and less for other weapons). As the war progressed improved variants of the 3.7" gun were introduced and, from 1942, large 5.25 inch weapons began to be brought into service. These had significantly improved ceiling heights of fire reaching over 18,000m.

The LAA batteries were intended to engage fast low flying aircraft and were typically deployed around airfields or strategic installations. These batteries were mobile and could be moved to new positions with relative ease when required. The most numerous of these was the 40mm Bofors gun which could fire up to 120 x 40mm HE shells per minute to over 1,800m.

Thousands of AA shells would have been stored at the two batteries during the course of the war. These installations are likely to have had a designated burning area to dispose of any faulty or surplus shells. Furthermore, during the period of anticipated invasion (1940-41), the RAF personnel that operated the battery were probably issued with weapons and would have taken part in amphibious invasion defence exercises along the coast, possibly within the study area.

10.2.2. Expended Anti-Aircraft Artillery Projectiles

After four years of war, the country still lacked the engineering skills to produce a reliable fuse. This resulted in a considerable number of AA projectiles either exploding prematurely, killing the gunners or failing to explode at all; falling to the ground as UXBs. In January 1944 more people in London were killed by HAA shells than by German bombs.

Nine HAA batteries were constructed within 5km of the site during the war. These batteries would have engaged Luftwaffe formations in the area and with four guns per battery firing several rounds per minute, AA batteries could expel numerous shells in even the shortest engagements. Unexploded AA projectiles could land several kilometres from their batteries and therefore, due to the undeveloped nature of much of the site, there is considered to be an elevated risk of unexploded AA shell contamination.

Numerous unexploded AAA shells were recovered during and following WWII and are still occasionally encountered on sites today.

10.3. Home Guard

The Home Guard (HG) was a defence organisation of the British Army, operational between 1940 and 1944. It comprised 1.5 million local volunteers, otherwise ineligible for military service, and acted as a secondary defence force, in case of enemy invasion. The HG guarded the coastal areas of Britain and other important facilities such as airfields, factories and explosives stores.

Records indicate that the Swansea Home Guard Garrison comprised three battalions; the 12th Glamorganshire, the 14th Glamorganshire and the 18th Glamorganshire.

Information taken from the Council for British Archaeology's study of the WWII anti-invasion landscape of England, (mapping the locations and types of existing defences around the country) indicates that several pillboxes guarded the docks (western section of the site), as well as a 4.7" naval gun emplacement and an observation post.

Thousands of these concrete fortifications were strategically positioned around the UK during the period of anticipated invasion in 1940. HG personnel would have occupied these positions during the war and therefore their presence on site is certain. In addition it is likely they would have patrolled the coastal section of the site and may have carried out live fire anti-invasion training on the beaches.

Today, items of ordnance related to the HG are occasionally encountered by members of the public and the construction industry in the British countryside. Experience has shown that the 'housekeeping' of less disciplined/voluntary HG personnel during WWII was often poor with items of faulty/surplus/expended UXO often burnt, buried, misplaced or otherwise discarded in civilian areas. Therefore the possibility of land service/small arms ammunition contamination on site cannot be discounted.

10.4. Baglan Burrows Army Training Area

It is known that the Army occupied land east of Crymlyn Burrows during WWII[4]. This is confirmed by the 1921 OS map, which records two rifle ranges close to the eastern extent of the site. However no additional information regarding this military activity could be located.

Although the 1941 aerial photograph of this area doesn't show any military presence, the terrain is the type which could have been used for training and unidentifiable craters may have existed here, obscured by the ground cover and low resolution imagery.

Also noteworthy is the presence (on the 1921 map) of a tramline terminating in this area which has no buildings or other structures. It is conceivable therefore that this narrow gauge line was used to move heavy military equipment/ammunition in and out of the training area. Another possibility is that this isolated, unused area was used for munitions disposal.

11. Threat Posed By Allied Explosive Ordnance

11.1. General

The strong military presence in the area means a variety of ordnance was likely used on site. The most likely items of UXO to be encountered are listed below.

11.2. Anti-Aircraft Artillery Shells

The HAA projectiles were high explosive shells, usually fitted with a time delay or barometric pressure fuze to make them explode at a pre-determined height. These shells are frequently mistakenly identified as small German air-delivered bombs, but are differentiated by the copper driving band found in front of the base.

Although the larger unexploded projectiles could enter the ground they did not have great penetration ability and are therefore likely to be found close to WWII ground level. With a HE fill and fragmentation hazard these items of UXO also present a significant risk if encountered.

The smaller 40mm projectiles are similar in appearance and effect to small arms ammunition and, although still dangerous, present a lower risk. Pictures of AAA projectiles are presented in Annex N. Details of the most commonly deployed WWII AAA projectiles are shown below:

Gun type	Calibre	Shell Weight	Shell Dimensions
3.7 Inch	94mm	12.7kg	94mm x 438mm
4.5 Inch	114mm	24.7kg	114mm x 578mm
40mm	40mm	0.9kg	40mm x 311mm

11.3. Artillery Projectiles

In general, projectiles fall into two categories – Shot and Filling. Small projectiles pose a similar threat to heavy anti-aircraft shells. Pictures of artillery projectiles are presented in Annex O.

11.3.1. Shot

- Practice shot – Used over sea ranges. These projectiles are usually solid cast iron of the same weight as the service projectile.

[4] *Environmental Statement Chapter 21. Cultural Heritage – Tidal Lagoon Swansea Bay Plc*

- Proof shot – For the proof of guns, howitzers and charges. They are made of forged steel of the same weight as the corresponding service projectile.
- Paper shot – Used to test the mounting of guns which cannot fire service projectiles owing to their position (i.e. close to occupied areas).
- Case shot - Generally consisting of three or more long steel segments held in position and filled with bullets allowing them to escape during firing.

11.3.2. Filling

- HE – Designed to cause damage to material by the force of their burst or to personnel and aircraft by fragmentation.
- Smoke – Used for the production of smoke screens, various fillings are used, the commonest being white phosphorus.
- Shrapnel – Designed to be used primarily against personnel these are filled with the maximum amount of bullets possible.
- Star - Designed to illuminate an area or target.

Practice – Commonly a solid shot filled with a spotting charge which gives an indication of where it lands.

11.4. Land Service Ammunition (LSA)

11.4.1. General

The term Land Service Ammunition covers all items of ordnance that are propelled, placed or thrown during land warfare. They may be filled or charged with explosives, smoke, incendiary or pyrotechnics. They can be broken into five main groups:

a. Mortars
b. Grenades
c. Projectiles
d. Rockets
e. Landmines

Unexploded or partially unexploded Mortars and Grenades are among the most common items of LSA encountered in the UK as they could be transported and utilised anywhere. They are commonly encountered in areas used by the military for training and are often found discarded on or near historic military bases. Examples of Grenades and Mortars are presented in Annex P.

Items of ordnance do not become inert or lose their effectiveness with age. Time can indeed cause items to become more sensitive and less stable. This applies equally to items submerged in water or embedded in silts, clays or similar materials. The greatest risk occurs when an item of ordnance is struck or interfered with. This is likely to occur when mechanical equipment is used or when unqualified personnel pick up munitions.

11.4.2. Mortars

A mortar bomb is a fin-stabilised munition, normally nose-fuzed and fitted with its own propelling charge (primary cartridge). Range is increased by adding extra propellant (augmenting charges). They are either High Explosive or Carrier and generally identified by their tear-drop shape (older variants however are parallel sided) and a finned 'spigot tube' screwed or welded to the rear end of the body housing the propellant charge. A mortar relies on a striker hitting a detonator for explosion to occur. It is possible that the striker may already be in contact with the detonator and that only a slight increase in pressure would be required for initiation. Discarded augmenting charges are often encountered around mortar firing areas/bases.

11.4.3. Grenades

A grenade is a short range weapon which may be thrown by hand, fired from the end of a rifle or projected/propelled from a special purpose grenade launcher. They are divided into two categories; High Explosive and Carrier (generally smoke). As with mortars, a grenade striker may either be in contact with the detonator or still be retained by a spring under tension, and therefore shock may cause it to function. A grenade can have an explosive range of 15-20m. Common older variants have a classic 'pineapple' shape; modern grenades tend to be smooth-sided.

11.5. Small Arms Ammunition (SAA)

Even if an item functioned the explosion would not be contained within a barrel and detonation would only result in local overpressure and very minor fragmentation from the cartridge case. SAA of 20mm calibre and above would have included a small 4g HE or incendiary charge that if handled incorrectly could cause injury. These bullets were used by some aircraft during the war and therefore it is possible that such items may have fallen in the vicinity of the site. Images of SAA are presented in Annex Q.

12. Ordnance Clearance and Post-WWII Ground Works

12.1. General

The extent to which any ordnance clearance activities have taken place on site or extensive ground works have occurred is relevant since on the one hand they may indicate previous ordnance contamination but also may have reduced the risk that ordnance remains undiscovered.

12.2. Explosive Ordnance Clearance Tasks

12.2.1. British Army

BACTEC holds a number of official records of explosive ordnance disposal operations during and following WWII, obtained from the Explosive Ordnance Disposal (EOD) Archive Information Office at 33 Engineer Regiment (EOD).

The Army carried out one such task (Ref:4756) in May 2000 at the eastern extent of the study area, within the Baglan Bay Energy park (exact location unknown). Although no UXO was recovered, the fact this task was ordered suggests a historical military use of the area.

12.2.2. BACTEC

BACTEC provided Explosive Ordnance Risk Mitigation services to a client in 2000, in connection with the construction of the facility immediately north of the Baglan Bay CCGT Power Station, at the eastern extent of the site. This area had been used historically for re-processing munitions cases. The ordnance found on this adjacent site included bomb cases, chemical weapon containers (empty) and artillery projectiles; some of these items were live and hazardous.

Then in 2001 and 2002 BACTEC EOD engineers supervised construction works at the Baglan Bay CCGT Power Station. During the period of BACTEC's involvement there were two further discoveries of live ordnance and three of ordnance scrap.

A 4.5" naval shell (see Annex R) was discovered during grading operations on 25th July 2001. After evacuation of operatives to a safe distance it was identified by the attending BACTEC EOD Engineer as live, but in a "safe to move" condition. The shell was subsequently removed to a cache area so as to enable grading work to continue.

The discovery was reported to the police, who after verification of the facts arranged for the Royal Logistic Corps to be dispatched to site. The RLC decided that the shell should be destroyed on site, and it was then removed to the lagoon area and detonated.

A second 4.5" naval shell was uncovered on a spoil heap on 16th January 2002. Operatives were released early so as to clear the area, after which it was identified, judged to be live but safe to move and removed to the lagoon area for detonation.

12.3. Post war Redevelopment

The majority of the site has remained undeveloped in the post-war period. Some construction has occurred within the docks area, the unidentified facility immediately east and the power station at the eastern extent, however none of this is likely to have resulted in widespread and deep earth works or the use of pile foundations.

Note that some reclamation has taken place on site, particularly in the area immediately associated with the River Neath.

13. The Overall Explosive Ordnance Threat Assessment

13.1. General Considerations

Taking into account the quality of the historical evidence, the assessment of the overall threat to the proposed works from unexploded ordnance must evaluate the following risks:

- That the site was contaminated with unexploded ordnance
- That unexploded ordnance remains on site
- That such items will be encountered during the proposed works
- That ordnance may be activated by the works operations
- The consequences of encountering or initiating ordnance

13.2. The Risk that the Site was Contaminated with Unexploded Ordnance

BACTEC believes that there is a risk that the site has been historically contaminated with items of UXO. This is based on the following:

- Swansea was one of the most consistently bombed cities in Britain during WWII, suffering damage to three quarters of its pre-war housing stock during 82 air raids, three of which were heavy 'Blitz' scale attacks.
- The Queen's Dock (western end of the site), as well as a railway maintenance yard, flanking the northern site boundary, were both identified by the Luftwaffe as bombing targets. As a result, the local area was subject to a moderate bombing density, as confirmed by official statistics.
- An ARP bomb plot map records three HE bomb strikes immediately adjacent to the northern boundary of the site. Anecdotal evidence suggests that bombs fell on the docks area during at least seven raids. In addition, HE and incendiary incidents are recorded in the Baglan Moors area, possibly in close proximity to the eastern extent of the site. Furthermore, 1941 Luftwaffe reconnaissance photography also exhibits several HE bomb craters in coastal sand, immediately adjacent to the central part of the site as well as bomb damage to one storage tank on site.
- Generally, access to the site would have been higher at the western extent. The docks (and storage tank farm) were vital to the local war effort and post-raid checks for UXO were likely carried out along the working quayside, the railway sidings and within the buildings.
- However undeveloped/unused land within the docks may have been neglected, increasing the possibility of UXO remaining undetected. The remainder of the site was undeveloped, apparently unused and therefore a UXB strike could easily have fallen unobserved, especially since most raids occurred at night.
- With the exception of one storage tank, the large buildings on site appear to have survived the war intact and therefore a UXB strike to these undamaged buildings, as well as the railway sidings, will have caused obvious damage which would have been noted and dealt with at the time.

- The remainder of the study area however was occupied by bare earth, grass, beach, marsh, mud flat and the River Neath; types of ground cover within which evidence of a UXB impact could have become obscured. Note that the entry hole of an SC50 UXB, the most commonly deployed German HE bomb, may have been as little as 20cm in diameter.
- Up to four HAA batteries were situated immediately adjacent to the site boundary during WWII, with thousands of AA shells stored at these sites during the course of the war. These installations are likely to have had a designated burning area to dispose of any faulty or surplus shells. Furthermore, during the period of anticipated invasion (1940-41), the RAF personnel that operated these batteries were probably issued with weapons and would have taken part in amphibious invasion defence training, possibly within the study area.
- Records indicate that three Home Guard battalions were stationed in the city. These personnel would have manned the several pillboxes which guarded the docks (western section of the site), as well as a 4.7" naval gun emplacement and an observation post. In addition they are also likely to have patrolled the coastline and carried out aforementioned anti-invasion training.
- It is known that the Army occupied land east of Crymlyn Burrows during WWII. This is confirmed by the 1921 OS map, which records two rifle ranges close to the eastern extent of the site. Therefore live fire practice and training on other weapons is likely to have taken place within the eastern site boundary. This is substantiated by the recovery (by BACTEC) of two live HE shells at the neighbouring Baglan Bay CCGT Power Station between 2001-2002.
- Experience has shown that the 'housekeeping' of military personnel during WWII was often poor with items of faulty/surplus/expended UXO often burnt, buried, misplaced or otherwise discarded in civilian areas. Therefore the possibility of land service/small arms ammunition contamination on site cannot be discounted.

13.3. The Risk that Unexploded Ordnance Remains on Site

Some intrusive work has have taken place on site in the post-war period. Within these locations the threat from shallow-buried items of UXO (especially anti-aircraft shells, 1kg incendiary bombs, LSA/SAA) will have been partly mitigated since any such items may have been encountered during initial shallow excavations. The risk however from deep-buried German HE UXBs will not have been mitigated to any significant degree across the entire study area.

The shells found close to the site in 2001-2002 appear to have been deposited there during reclamation, possibly caused by their migration from a former adjacent naval range into the dredging borrow area. They could also have originated from a stockpile of ordnance rejected by the munitions re-processing works to the north, known to have been in operation, to the north of the study area.

13.4. The Risk that Ordnance may be Encountered during the Works

The most likely scenarios under which a UXO could be encountered during construction works is during piling, drilling operations or bulk excavations for basement levels. The overall risk will depend on the extent of the works, such as the numbers of boreholes/piles (if required) and the volume of the excavations.

Since an air-dropped bomb may come to rest at any depth between just below ground level and its maximum penetration depth there is also a chance that such an item could be encountered during shallow excavations (for services or site investigations) into the original WWII ground level.

13.5. The Risk that Ordnance may be Initiated

The risk that UXO could be initiated if encountered will depend on its condition, how it is found and the energy with which it is struck. The most violent activity on most construction site is percussive piling.

As a result items that are shallow buried present a lower risk than those that are deep buried, since the force of impact is usually lower and they are more likely to be observed – when immediate mitigating actions can be taken.

13.6. The Consequences of Encountering or Initiating Ordnance

Clearly the consequences of an inadvertent detonation of UXO during construction operations would be catastrophic with a serious risk to life, damage to plant and a total site shutdown during follow-up investigations.

Since the risk of initiating ordnance is comparatively low if appropriate mitigation measures are undertaken, the most important consequence of the discovery of ordnance will be economic. This would be particularly so in the case of high profile locations and could involve the evacuation of the public. The unexpected discovery of ordnance may require the closing of the site for any time between a few hours and a week with a potentially significant cost in lost time. Note also that the suspected find of ordnance, if handled solely through the authorities, may also involve loss of production since the first action of the Police in most cases will be to isolate the locale whilst awaiting military assistance, even if this turns out to have been unnecessary.

13.7. BACTEC's Assessment

Taking into consideration the findings of this study, BACTEC considers the risk of encountering UXO at to be heterogeneous and can therefore be divided into **Low** and **High** Risk Zones. These are described below and illustrated in a Risk Map presented in Annex S.

Low Risk Zone – Occupied by buildings which survived the war intact.

	Level of Risk			
Type of Ordnance	**Negligible**	**Low**	**Medium**	**High**
German HE UXBs		✓		
German 1kg Incendiaries	✓			
British AAA	✓			
British LSA / SAA	✓			

High Risk Zone – The location of post-war reclamation and recent British UXO finds.

	Level of Risk			
Type of Ordnance	**Negligible**	**Low**	**Medium**	**High**
German HE UXBs				✓
German 1kg Incendiaries			✓	
British AAA			✓	
British LSA / SAA				✓

14. Proposed Risk Mitigation Methodology

14.1. General

BACTEC believes the following risk mitigation measures should be deployed to support the proposed works at the Swansea Docks to Baglan Burrows Site.

14.2. Recommended Risk Mitigation Measures

Both Risk Zones

- ***Explosive Ordnance Safety and Awareness Briefings to all personnel conducting intrusive works:*** A specialised briefing is always advisable when there is a possibility of explosive ordnance contamination. It is an essential component of the Health & Safety Plan for the site and conforms to requirements of CDM Regulations 2007. All personnel working on the site should be instructed on the identification of UXB, actions to be taken to alert site management and to keep people and equipment away from the hazard. Posters and information of a general nature on the UXB threat should be held in the site office for reference and as a reminder.
- ***The Provision of Unexploded Ordnance Site Safety Instructions:*** These written instructions contain information detailing actions to be taken in the event that unexploded ordnance is discovered. They are to be retained on site and will both assist in making a preliminary assessment of a suspect object and provide guidance on the immediate steps to be taken in the event that ordnance is believed to have been found.

High Risk Zone only

- ***On greenfield areas only: Non-Intrusive Magnetometer Survey and target investigation ahead of any intrusive works*** – This survey is carried out using caesium vapour magnetometers linked to a data logger. Data is interpreted using advanced proprietary software which is capable of modelling the magnetic anomalies for mass, depth and location, thus providing information which can be used to locate discrete buried objects that may be ordnance. The system will typically locate buried ordnance to a depth of 4m for a 50kg bomb (the smallest HE bomb used by the Luftwaffe) and deeper for larger bombs. Additionally the survey will locate any buried services with a magnetic signature, will indicate areas of gross magnetic "contamination" (which may indicate unknown underground obstructions) and provide information on archaeological features.
- ***Explosive Ordnance Disposal (EOD) Engineer presence on Site to support shallow intrusive works, where a non-intrusive magnetometer survey is not possible:*** When on site the role of the EOD Engineer would include; monitoring works using visual recognition and instrumentation and immediate response to reports of suspicious objects or suspected items of ordnance that have been recovered by the ground workers on site; providing Explosive Ordnance Safety and Awareness briefings to any staff that have not received them earlier and advise staff of the need to modify working practices to take account of the ordnance threat, and finally to aid Incident Management which would involve liaison with the local authorities and Police should ordnance be identified and present an explosive hazard.
- ***Intrusive Magnetometer Survey of any borehole and pile locations down to a maximum bomb penetration depth:*** BACTEC can deploy a range of intrusive magnetometry techniques to clear ahead of all the pile locations. The appropriate technique is governed by a number of factors, but most importantly the site's ground conditions. The appropriate survey methodology would be confirmed once the enabling works have been completed. A site meeting would be required between BACTEC and the client to determine the methodology suitable for this site. Target investigation or avoidance will be recommended as appropriate.

In making this assessment and recommending these risk mitigation measures, the proposed works outlined in the 'Scope of the Proposed Works' section were considered. Should the planned works be modified or additional intrusive engineering works be considered, BACTEC should be consulted to see if a re-assessment of the risk or mitigation recommendations is necessary.

BACTEC International Limited 8th September 2014

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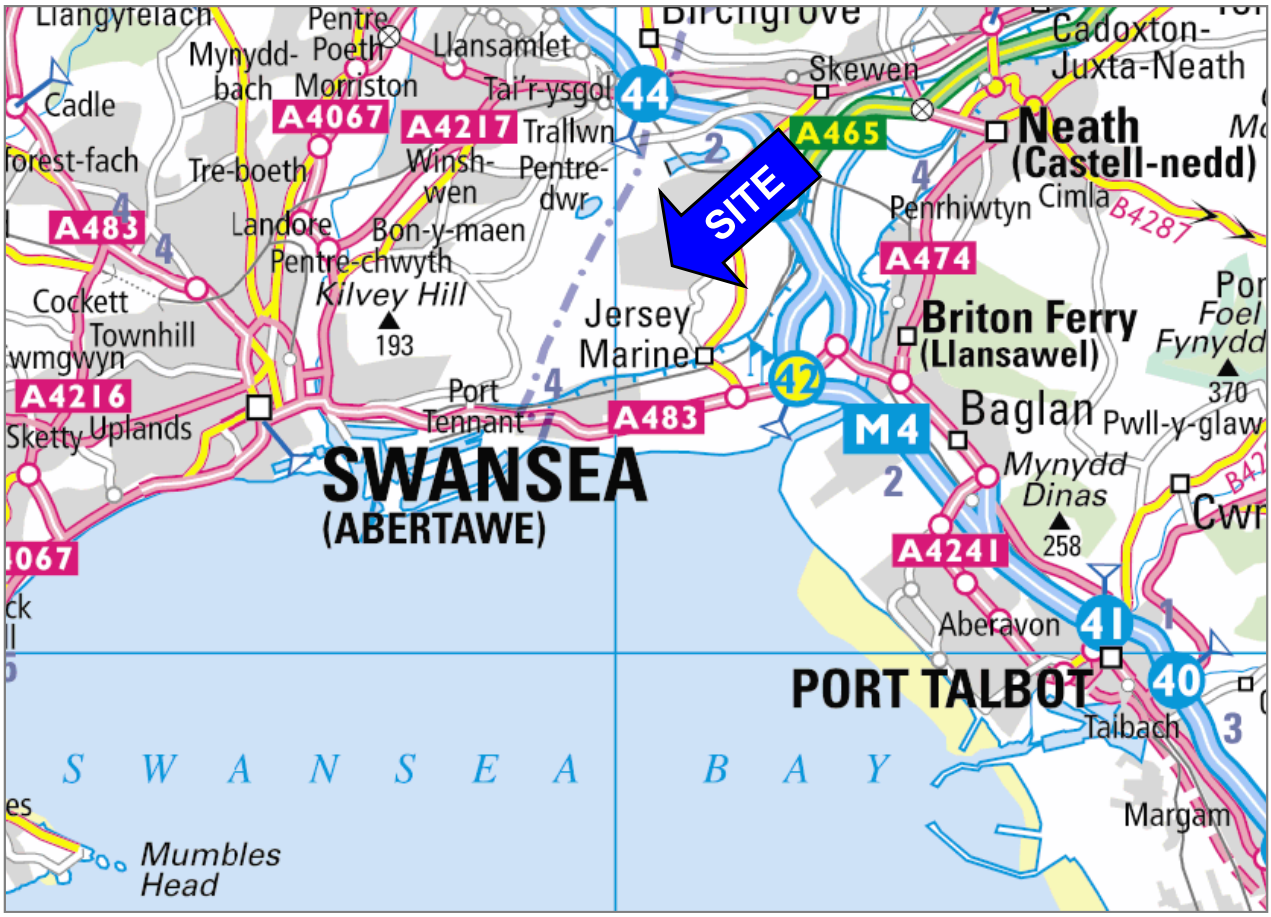
North



Report Reference:	Client:	
5603TA	Atkins Limited	BACTEC
	Project: Swansea Docks to Baglan Burrows	

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North

Generalised/approximate site boundary

Report Reference: 5603TA	Client: Atkins Limited	BACTEC
	Project: Swansea Docks to Baglan Burrows	
Source: Google Earth		

North

REFER TO DRAWING NUMBER 3513/Order/102.1
Works plan 1 of 9

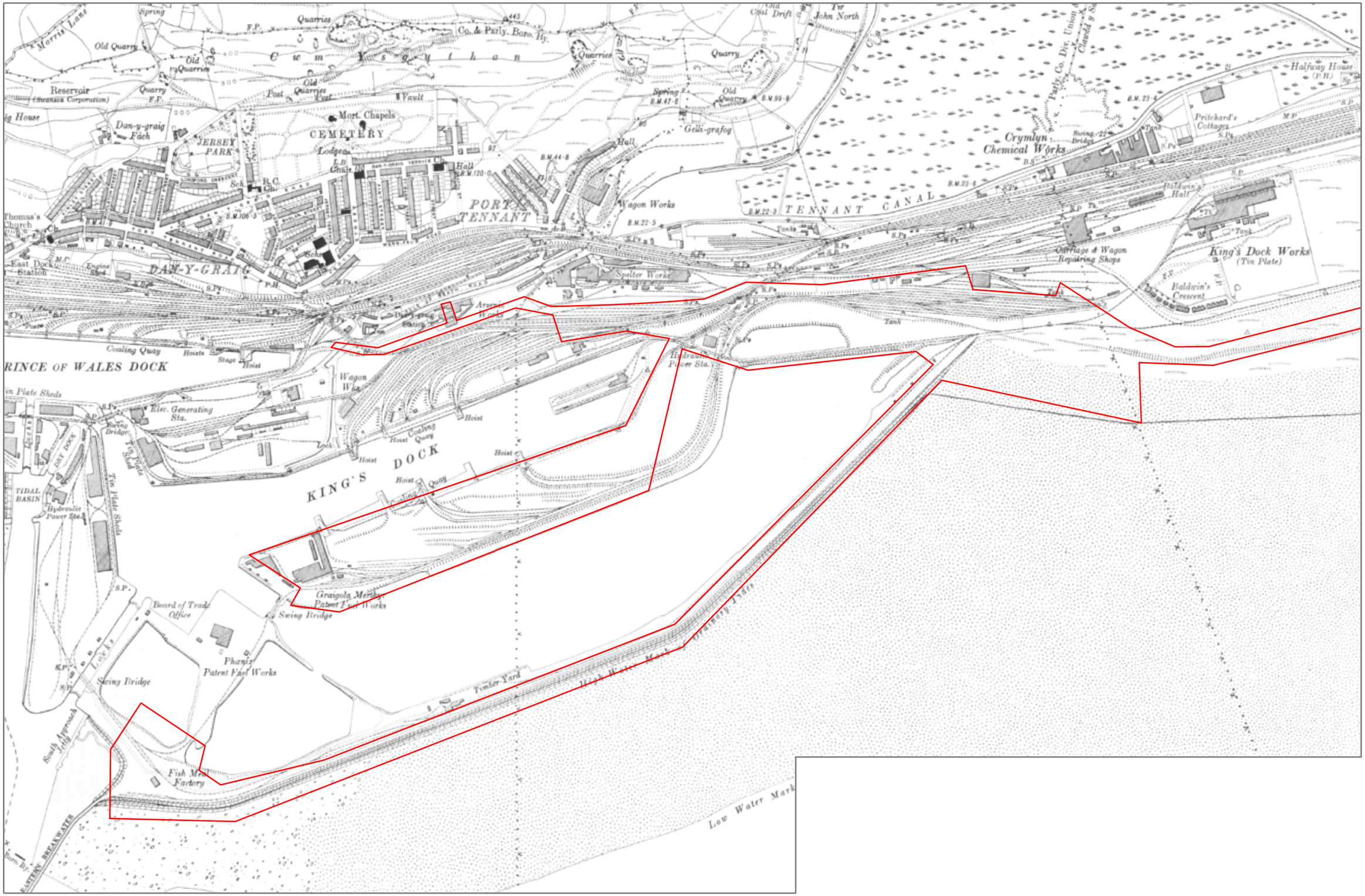
REFER TO DRAWING NUMBER 3513/Order/102.2
Works plan 2 of 9

REFER TO DRAWING NUMBER 3513/Order/102.3
Works plan 3 of 9

Generalised/approximate site boundary

Report Reference: 5603TA	Client: Atkins Limited	BAC TEC
	Project: Swansea Docks to Baglan Burrows	
Source: Atkins Limited		

North



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	Project: Swansea Docks to Baglan Burrows	
Source: F!ND Maps		

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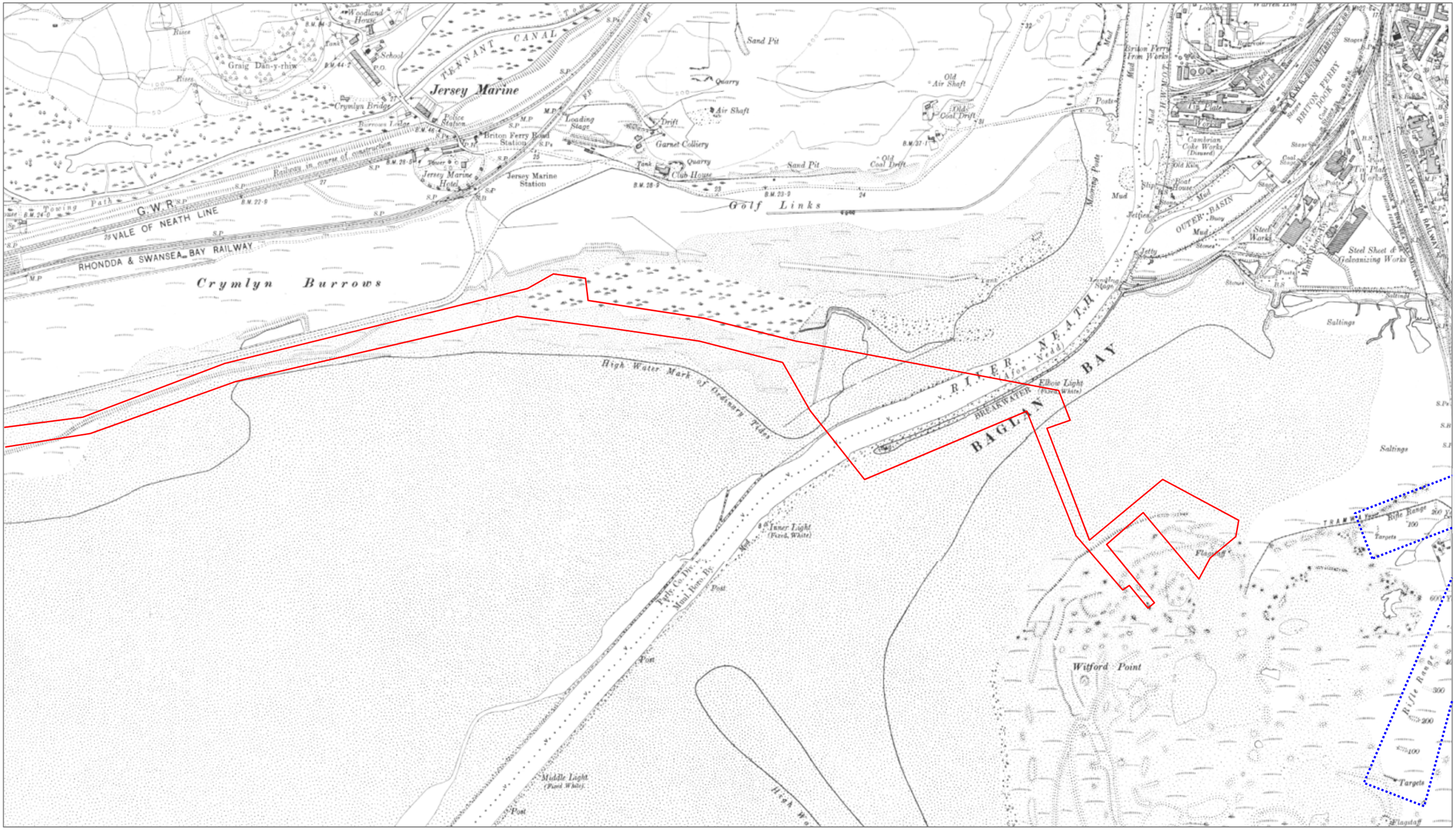


Generalised/approximate site boundary

Rifle Ranges

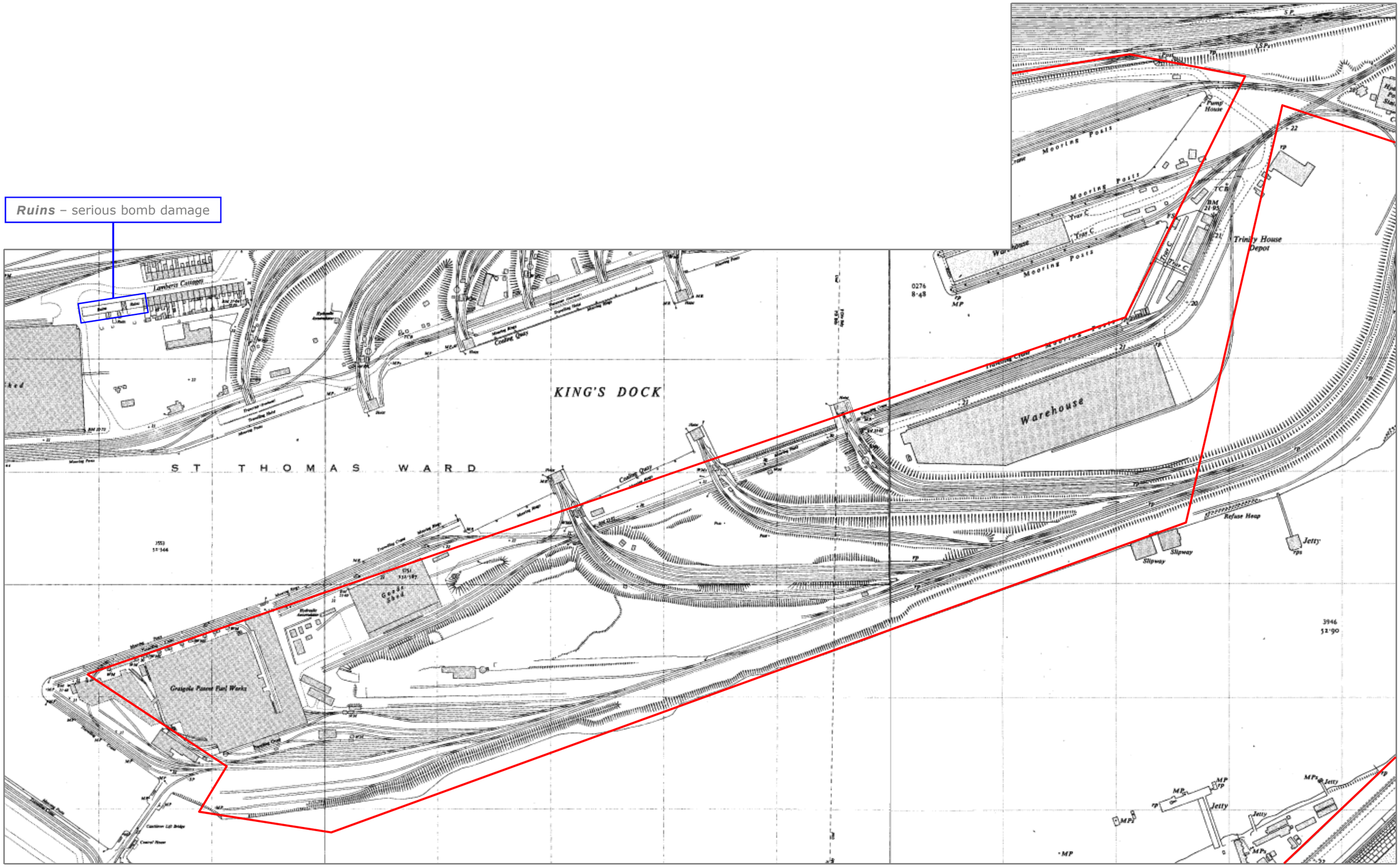
Report Reference: 5603TA	Client: Atkins Limited	BACTEC
	Project: Swansea Docks to Baglan Burrows	
Source: F!ND Maps		

North

Report Reference:	Client:	
5603TA	Atkins Limited	BAC TEC
	Project: Swansea Docks to Baglan Burrows	
Source: Britain From Above Project		

North

Ruins – serious bomb damage



Generalised/approximate site boundary

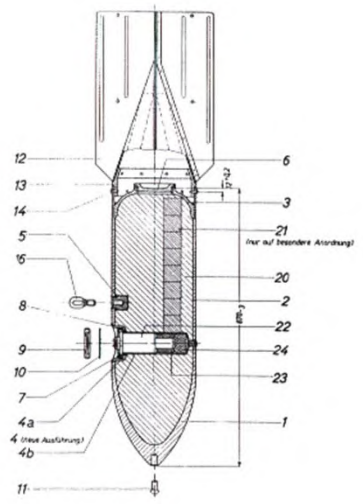
Report Reference: 5603TA	Client: Atkins Limited	BAC TEC
	Project: Swansea Docks to Baglan Burrows	
Source: F!ND Maps		

SC 50

Bomb Weight:	40-54kg (110-119lb)
Explosive Weight:	c25kg (55lb)
Fuze Type:	Impact fuze/electro-mechanical time delay fuze
Bomb Dimensions:	1,090 x 280mm (42.9 x 11.0in)
Body Diameter:	200mm (7.87in)
Use:	Against lightly damageable materials, hangars, railway rolling stock, ammunition depots, light bridges and buildings up to three stories.
Remarks:	The smallest and most common conventional German bomb. Nearly 70% of bombs dropped on the UK were 50kg.

50kg bomb, London Docklands

Minus tail section

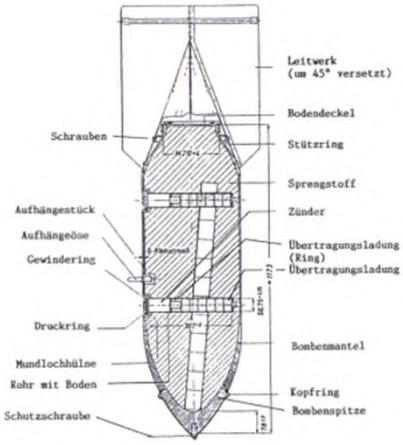


SC-50 JA (Güteklasse 1)

SC 250

Bomb weight:	245-256kg (540-564lb)
Explosive weight:	125-130kg (276-287lb)
Fuze type:	Electrical impact/mechanical time delay fuze.
Bomb dimensions:	1640 x 512mm (64.57 x 20.16in)
Body diameter:	368mm (14.5in)
Use:	Against railway installations, embankments, flyovers, underpasses, large buildings and below-ground installations.

250kg bomb, Hawkinge

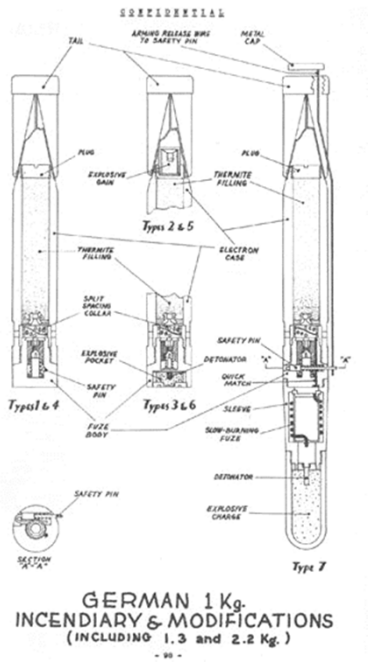


SC-250 JA (Güteklasse I)

1kg Incendiary Bomb

Bomb weight:	1.0 and 1.3kg (2.2 and 2.87lb)
Filling:	680gm (1.3lb) Thermite
Fuze type:	Impact fuze
Bomb dimensions:	350 x 50mm (13.8 x 1.97in)
Body diameter:	50mm (1.97in)
Use:	As incendiary – dropped in clusters against towns and industrial complexes
Remarks:	Jettisoned from air-dropped containers. Magnesium alloy case. Sometimes fitted with high explosive charge

1. Scaffold pipe
2. Incendiary 1kg bomb
3. Incendiary bomb recently found on site in UK



GERMAN 1 Kg. INCENDIARY & MODIFICATIONS (INCLUDING 1.3 and 2.2 Kg.)

Report Reference: 5603TA	Client: Atkins Limited	BACTEC
	Project: Swansea Docks to Baglan Burrows	

Source: BACTEC International Limited and various historical sources

1st September 2012 News – **Unexploded World War II Device** detonated on Bournemouth beach
An unexploded World War II device has been detonated on Bournemouth beach, according to Dorset Police. The discovery was made on Friday at 19:11 BST near the junction of East Overcliff Drive and Manor Road.
http://www.bbc.co.uk/news/uk-england-dorset-19445172

31st August 2012 News – **Suspected Unexploded Weapon** found on Cornwall's Porthmeor beach
Lifeguards have found what is believed to be a section of an unexploded weapon on a Cornish beach.The object, which witnesses have said looks like a corroded depth charge - an anti-submarine warfare weapon - has been found at Porthmeor Beach, in St Ives, Falmouth Coastguard has said.
http://www.bbc.co.uk/news/uk-england-cornwall-19440291

11th August 2012 News – **Unexploded Bomb** uncovered by workmen in Carlisle
Army bomb disposal experts have been called to Carlisle after what is thought to be an unexploded bomb was dug up. Workmen on a building site at Trinity School uncovered the device earlier. Cumbria Police said a cordon had been put in place and the sports centre on Strand Road had been evacuated as a precaution. A bomb disposal unit from Catterick Garrison, in North Yorkshire, attended the scene.
http://www.bbc.co.uk/news/uk-england-cumbria-19224152

28th July 2012 News – Alert over **'unexploded shells'** in Sheerness Harbour
Thirty-nine people were evacuated from two vessels in Kent after suspected unexploded shells were found. A 100m exclusion zone was also put around Sheerness Harbour on Saturday afternoon after two separate calls. The first call came from a catamaran which had an 18in by 5in shell on its deck at about 14:00 BST. At 15:30 BST, a 90m cable layer reported having a 12in by 4in shell on board. The shells were later declared safe by Royal Navy experts.
http://www.bbc.co.uk/news/uk-england-kent-19034493

10th July 2012 News – **Unexploded WWII Bomb** safely detonated off Kent coast
An unexploded wartime German bomb found off the coast of Kent has been safely detonated, coastguards have said. The 500lb (226kg) device was discovered by a dredger in Dover harbour on Monday but it could not be made safe as the tidal conditions were not right. Dover Coastguard worked with a four-man Royal Navy bomb disposal team from Portsmouth to move it to a remote area. A spokeswoman said it was detonated at 08:45 BST, three-and-a-half miles (5.6km) east of Deal Pier. The World War II explosive was 3.3ft (1m) in length and was said to have had fins which had rusted off.
http://www.bbc.co.uk/news/uk-england-kent-18765547

8th April 2012 News – Huge explosion as experts detonate **large WWII Mine**
Water and ash were propelled more than 120m (390ft) into the air when Royal Navy experts detonated a German mine in the Thames estuary. The 750kg (1,650lb) unexploded World War II (WWII) weapon was placed on the sea bed after it was caught in the nets of a fishing boat earlier in the week. Divers brought it to the surface and then took it to a spot off Kent, during a "delicate" seven-hour operation.
http://www.bbc.co.uk/news/uk-england-kent-17652116

5th March 2012 News – Beach open after **WWII shell found**
A beach in County Londonderry has reopened after an unexploded World War II shell was found on Sunday. The device was discovered lying near the water on Benone beach by a member of the public. The beach was evacuated just before 16:00 GMT, and a controlled explosion was carried out by army bomb experts
http://www.bbc.co.uk/news/uk-northern-ireland-foyle-west-17255505

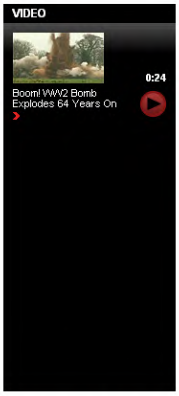
21st February 2012 News – **Two WWII bombs** detonated near Lincolnshire village
Bomb disposal experts have carried out a controlled explosion on two devices found near Manby in Lincolnshire. Anglian Water found the unexploded World War II shells near the former RAF Manby airfield, opposite the Motorplex building, on Monday. The area was cordoned off and police remained at the scene until experts from the Ministry of Defence explosive ordnance disposal team arrived.
http://www.bbc.co.uk/news/uk-england-lincolnshire-17111021

9th January 2012 News – County Durham road reopens after **WWII shell uncovered**
A road in County Durham was closed after an unexploded WWII shell was found. The shell was found on land at Slaidburn Road, Stanley, near the A693 Chester Road. Durham Police advised people to avoid the area, closing Chester Road and evacuating a local bus depot and nearby garage as a precaution. Catterick's bomb squad carried out a controlled explosion and all cordons have now been lifted.
http://www.bbc.co.uk/news/uk-england-tyne-16473968

13th October 2011 News – **WWII grenades** found near Gatwick Airport
Unexploded World War II hand grenades have been discovered close to Gatwick Airport. Network Rail staff found the explosives while working near Gatwick Airport railway station in West Sussex. A bomb disposal team was called in to carry out a controlled explosion at about 10:50 BST, Sussex Police said. The bomb disposal team found three hand grenades, one four-inch mortar and a smoke grenade in a metal container and identified them as World War II explosives, he added. Outgoing flights from the airport and rail services were halted as a precaution for about 15 minutes but have since resumed. The alert affected train services run by Gatwick Express, Southern, First Capital Connect and First Great Western.
http://www.bbc.co.uk/news/uk-england-sussex-15292719

SKY NEWS Website of the Year — FIRST FOR BREAKING NEWS

M62 Motorway Closed For Detonation Of World War Two Bomb



5:04pm UK, Friday January 04, 2008
A busy motorway has been closed to allow for a wartime bomb to be detonated nearby.

The controlled explosion

Army expertsdestroyed the huge Second World War device in a controlled explosion near the M62.

The motorway was shut in both directions between junctions 37 and 38 as a safety precaution.

The "deeply buried" bomb had lain dormant in an East Yorkshire field for almost 64 years.

The device was discovered by a metal detecting enthusiast on New Year's Eve in a field near the B1230 at Balkholme, near Howden, which was also closed.

An Army bomb disposal team travelled up from Essex to join police, ambulance and fire services and utility companies at the scene.

Captain Tim Ives, of 33 Engineer Regiment, earlier said 10 soldiers would be employed to "reduce the effects of the controlled explosion by packing sand around the device".

Page last updated at 14:45 GMT, Friday, 22 May 2009 15:45 UK
E-mail this to a friend Printable version

Building site WWII bomb exploded

Building site WWII bomb exploded

A controlled explosion has been carried out on a World War II bomb found on a building site in East Sussex.

The 110lb (50kg) SC50 bomb, thought to have been dropped from a German aircraft in 1940 or 1941, was found at the Hollenden House site in Bexhill.

Children at St Peter and St Paul Primary School next door in Buckhurst Road were sent home early after the discovery on Thursday.

Police said a 160ft (50m) cordon was put round the site during the blast.

BBC 14:23 GMT, Thursday, 5 June 2008 15:23 UK
E-mail this to a friend Printable version

Unexploded bomb 'started to tick'

An unexploded World War II bomb started to tick and ooze liquid as experts tried to defuse it, police have said.

The large bomb was found in a river at Sugar House Lane, near Bromley-by-Bow Tube station in east London, on Monday.

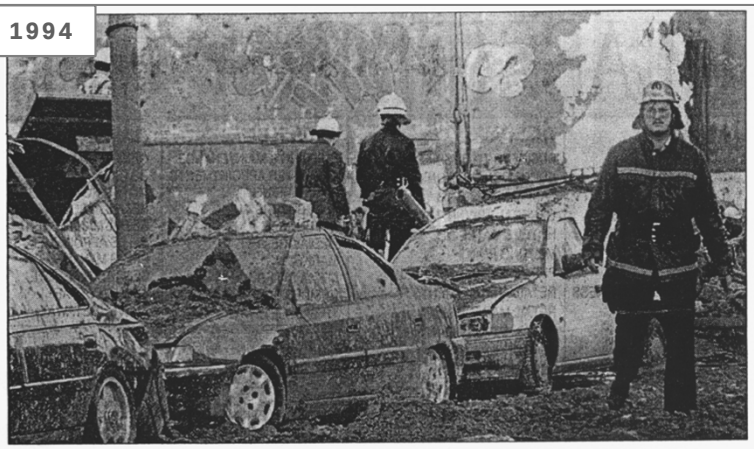
Rush-hour travel was disrupted as overnight work to make the bomb safe continued into Thursday morning.

Police commander Simon O'Brien said: "It started to tick and ooze some pretty horrible substances." It stopped ticking when doused with liquid.

'Hero colleague'

"It measures approximately the size and length of a man, and weighs around 1,000kg (2,200lb).

1994



Blown up by history

RESCUE workers search for survivors after a Second World War bomb exploded at a building site in Berlin, killing three people and injuring at least eight others.

A fire brigade spokesman said he feared the final death toll could be higher. One worker was still missing, believed to be trapped under a machine. "We've found human remains 100 metres away but we can't tell if they belong to the dead already found," the spokesman said.

The blast, set off by drilling work on Frankfurter Allee, one of east Berlin's busiest avenues, trapped workers under building machinery and sent huge chunks of concrete tumbling through the air.

A large office block was being built on the site of the explosion which sent shoppers scrambling for shelter and paralysed dense afternoon traffic. One eyewitness said: "There was a bang, then silence, and then it started raining stones and dirt."

Dozens of cars within a 250-metre radius were wrecked and the top two floors of a nearby apartment block caved in.

Radio reports claimed that the total number of injured stood at 14.

World War II bomb kills three in Germany

Three people have been killed and six injured trying to defuse a World War II bomb in central Germany.

Workers building a sports stadium had earlier unearthed the bomb in the town of Goettingen.

It was not immediately clear why the bomb, reportedly weighing 500kg (1,100lb), had detonated.

Unexploded WWII bombs dropped by Allied planes are frequently found in Germany, though it is unusual for them to explode unexpectedly.

2010

WW2 bomb blast kills digger driver in Germany

The bomb went off as the machine lifted up earth and debris

A World War Two bomb has exploded at a construction site near a west German town, killing a man and injuring eight others, police say.

The explosion occurred after a digger accidentally struck the device during excavation work in Euskirchen in the state of North Rhine-Westphalia.

The machine's operator died on the spot. Two of those hurt were critically wounded, the dpa news agency reports.

2014

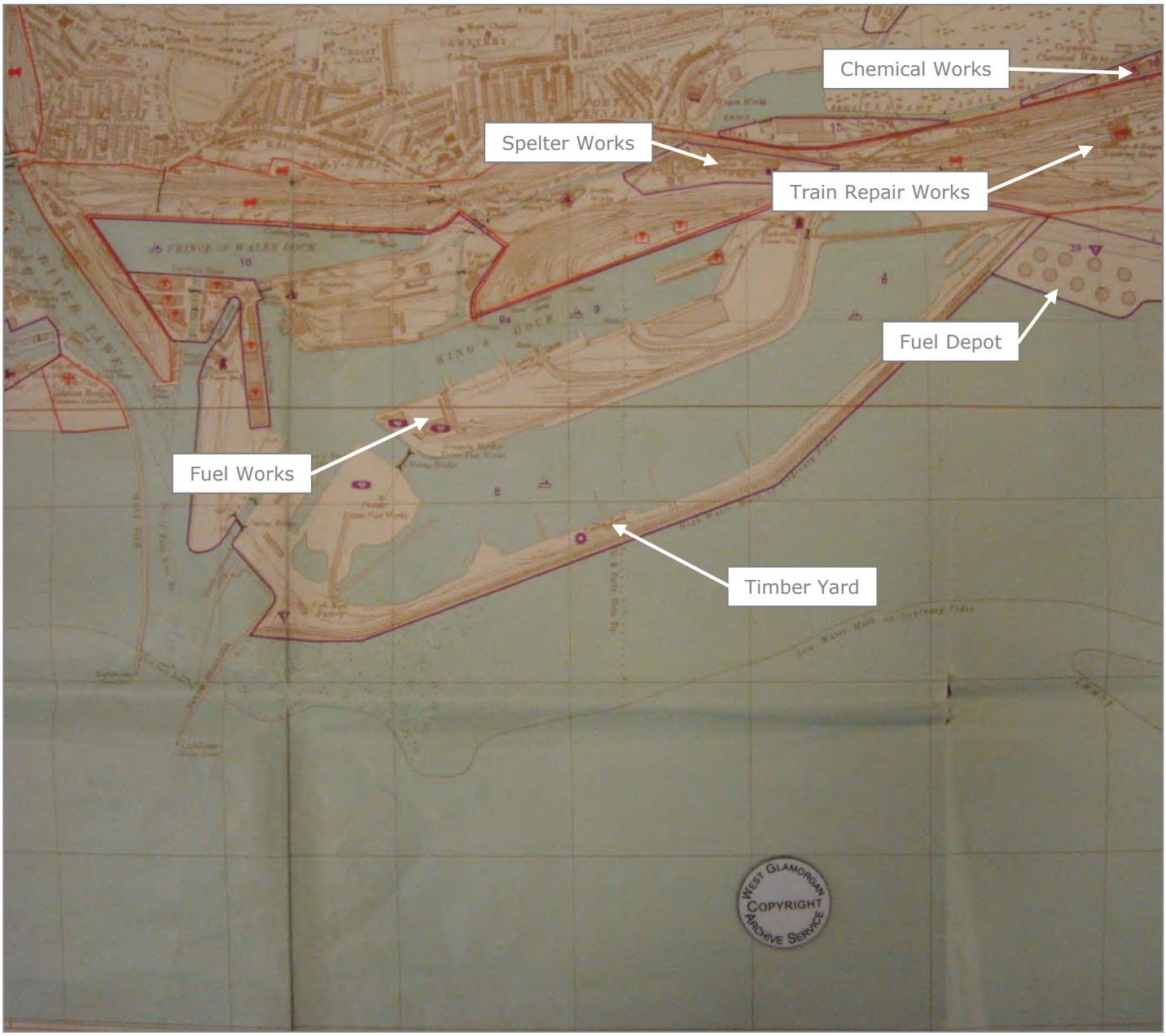
2008

2006

2006

Top Left: WWII bomb killed 3 and injured 8 in Berlin – 1994.
Middle Left: WWII bomb killed 3 in Goettingen, Germany – 2010.
Bottom Left: Excavator operator killed by WWII bomb in Euskirchen, Germany – 2014.
Top Right: WWII bomb injures 17 at construction site in Hattingen, Germany - 2008.
Middle Right: A highway construction worker in Germany accidentally struck a WWII bomb, killing himself and wrecking several passing cars - 2006.
Bottom Right: Destroyed piling rig and dump truck after detonation of WWII UXB in Austria - 2006.

North



Approximate partial site boundary

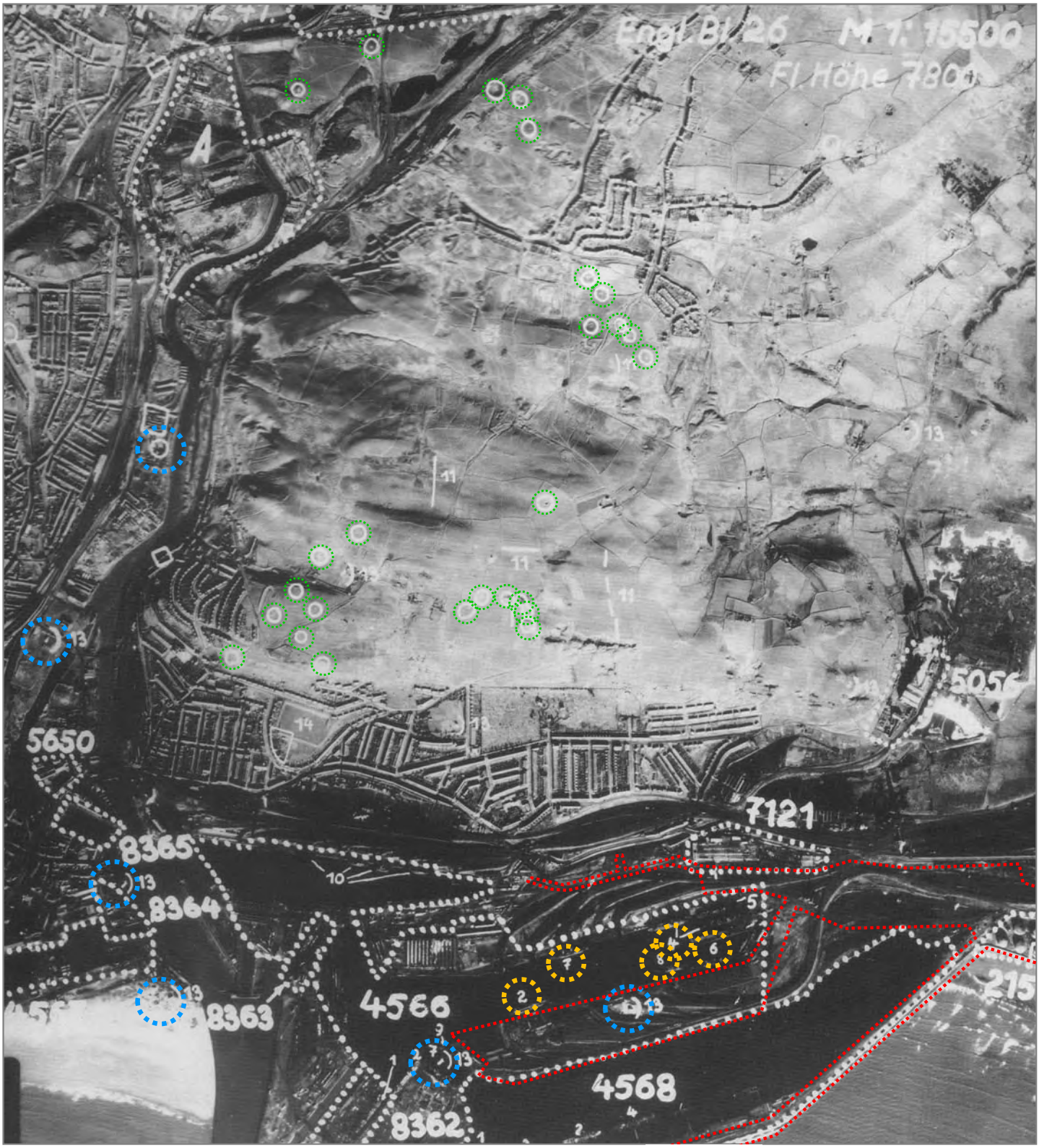
Swansea Bomb Plot Map – *date unknown*

Annex I

Report Reference:	Client: Atkins Limited
5603TA	Project: Swansea Docks to Baglan Burrows

Source: The National Archives

BACTEC



'4650' '7121' etc - Luftwaffe Targets Designations

- Barrage Balloon
- Luftwaffe Highlighted Bomb Crater
- Oil tankers at anchor
- Approximate site boundary

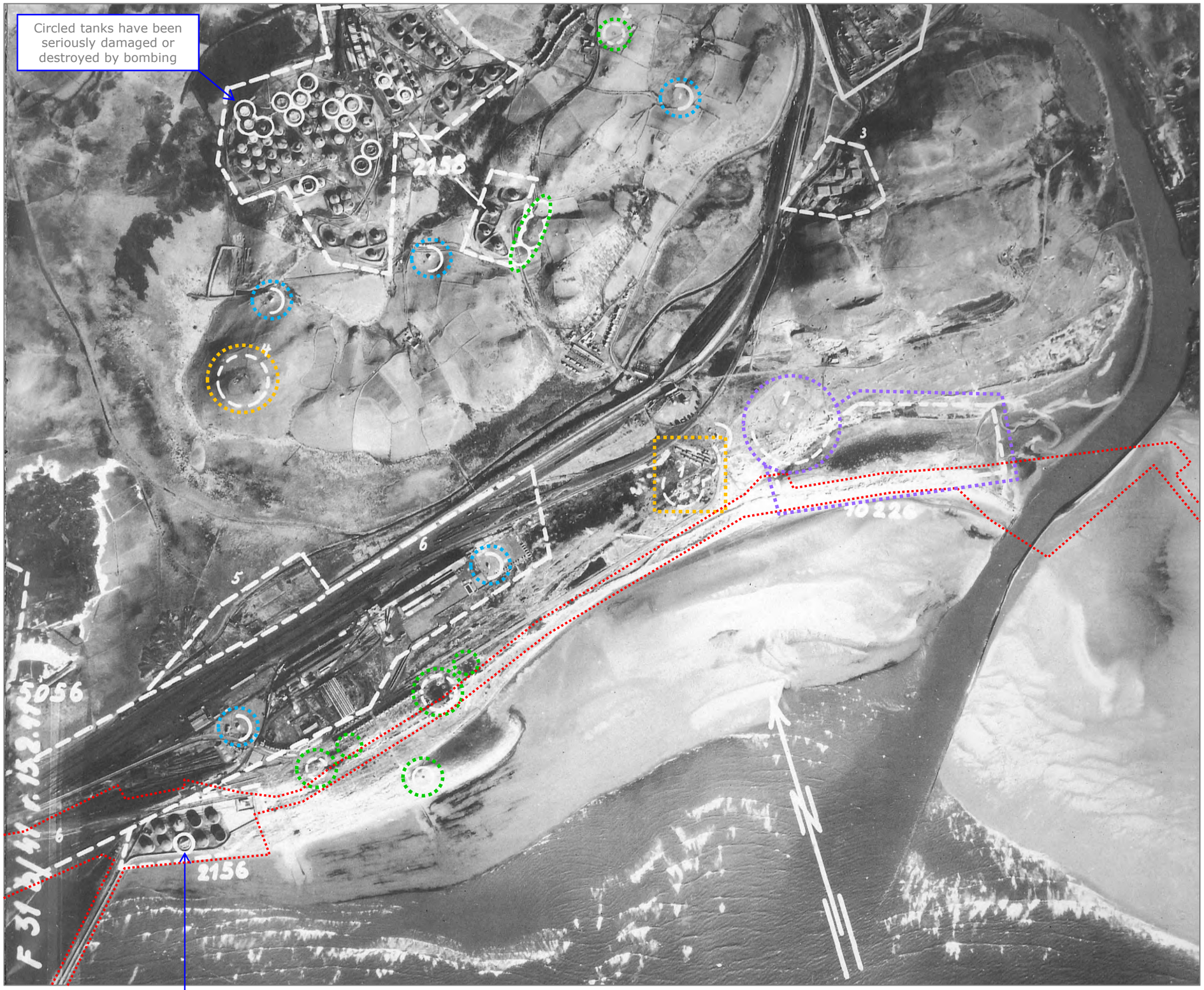
Report Reference:	Client:	
5603TA	Atkins Limited	BAC TEC
	Project: Swansea Docks to Baglan Burrows	

Source: N. A. Robins, *The Luftwaffe Aerial Photographs of Swansea*, 1993

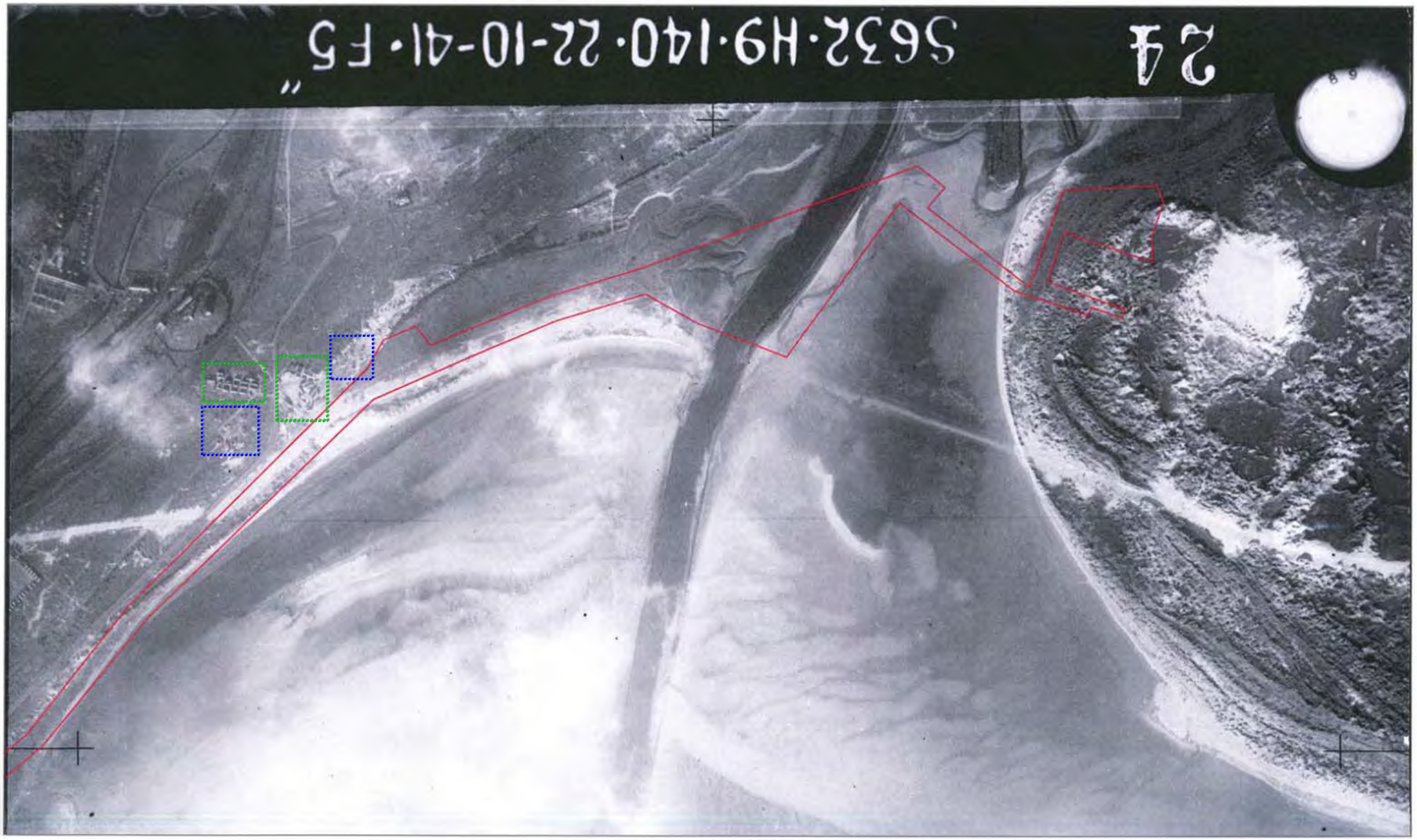
North

'2156'- Oil Storage Tanks highlighted as targets

- Barrage Balloon
- Luftwaffe Highlighted Bomb Crater
- Anti-Aircraft Battery
- Unidentified Luftwaffe highlighted feature (close to the site)
- Generalised/approximate site boundary



Report Reference:	Client:	
5603TA	Atkins Limited	BAC TEC
	Project: Swansea Docks to Baglan Burrows	
Source: N. A. Robins, *The Luftwaffe Aerial Photographs of Swansea*, 1993		

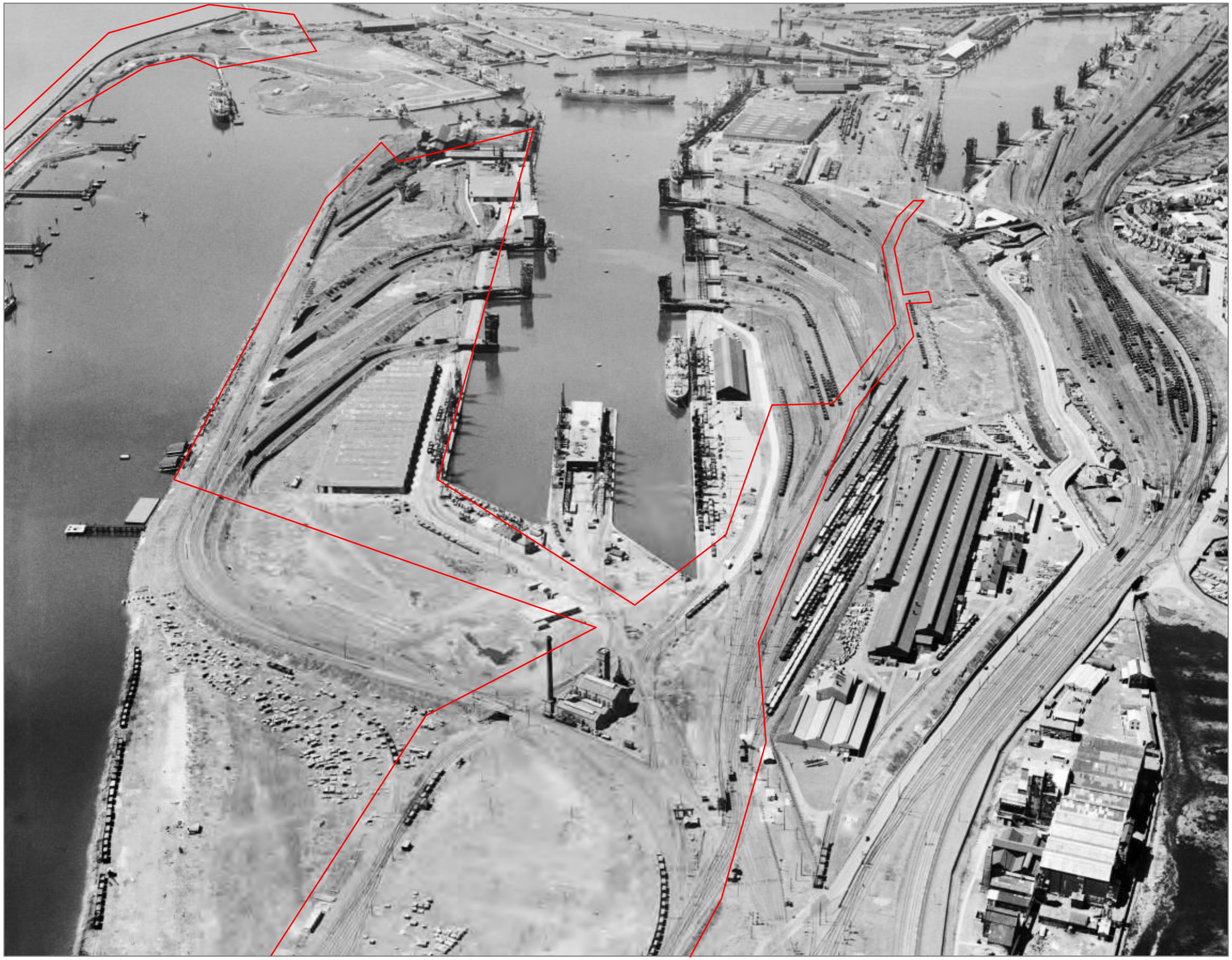


Generalised/approximate site boundary

4 x gun HAA battery

HAA battery accommodation / technical site

Report Reference:	Client:	
5603TA	Atkins Limited	BAC TEC
	Project: Swansea Docks to Baglan Burrows	
Source: The National Monuments Record of Wales		



Generalised/approximate site boundary

Report Reference:	Client:	
5603TA	Atkins Limited	BAC TEC
	Project: Swansea Docks to Baglan Burrows	
Source: Britain From Above Project		

1kg German Incendiary Bomb next to a 30cm ruler

Pillbox

HAA Battery

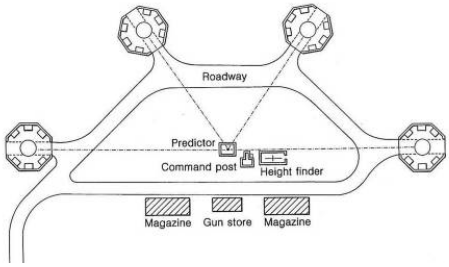
BACTEC on-site risk mitigation works

Report Reference:	Client:	
5603TA	Atkins Limited	BACTEC
	Project: Swansea Docks to Baglan Burrows	
Source: Various Sources		

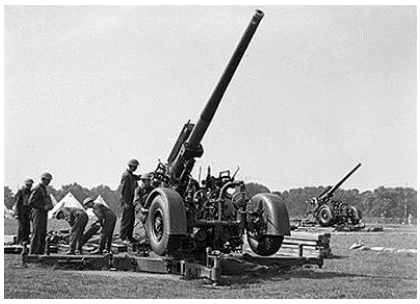
3.7 inch Anti-Aircraft Projectile

Weight:	12.7kg (28lb)
Dimensions:	94 x 360mm (3.7 x 14.7in)
Carriage:	Mobile and Static Versions
Rate of Fire:	10-20 rounds per minute
Ceiling:	9-18,000m (29-59,000ft)
Muzzle Velocity:	792m/s (2,598ft/s)
Remarks:	4.5 inch projectiles were also commonly utilised

This AA shell was uncovered on a construction site in North London in February 2009.



Layout plan for a typical HAA battery site.

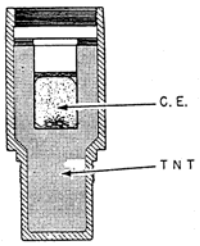


Hyde Park 1939 3.7 Inch QF gun on mobile mounting

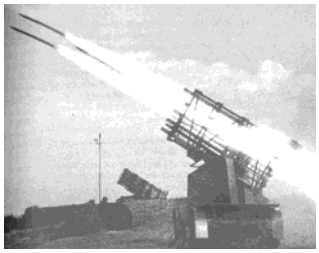
3.7 inch AA Projectile Minus Fuze

Rockets / Unrotated Projectiles

Weight:	Overall: 24.5kg (54lb) Warhead: 1.94kg (4.28lb)
Dimensions:	1930mm x 82.6mm (76 x 3.25in)
Carriage:	Mobile – transported on trailers
Ceiling:	6770m (22,200ft)
Maximum Velocity:	457mps (1,500 fps)

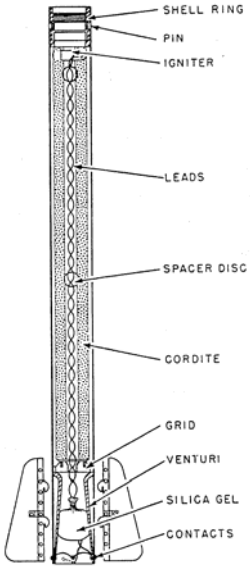


MK II HE Shell (3.5kg)



Rocket Battery in action

Home Guard soldiers load an anti-aircraft rocket at a 'Z' Battery



2" U.P AA Rocket

40mm Bofors Gun Projectile

Weight:	0.86kg (1.96lb)
Dimensions:	40mm x 310mm (1.6in x 12.2in)
Rate of Fire:	120 rounds per minute
Ceiling:	23,000ft (7000m)
Muzzle Velocity:	2,890 ft/s (881m/s)
Remarks:	Mobile batteries – normally few records of where these guns were located

Unexploded 40mm Bofors projectile recovered from a marine environment

40mm Bofors gun and crew at Stanmore in Middlesex, 28 June 1940.

Report Reference: 5603TA	Client: Atkins Limited	BACTEC
	Project: Swansea Docks to Baglan Burrows	

Source: BACTEC International Limited and various historical sources

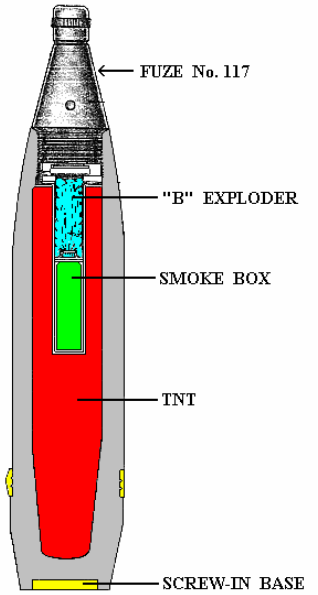
High Explosive Projectile: Fragmentation and Blast

Recognition Features

a) Long, pointed ogival nose and streamlined body.
b) Square or tapered base. Boat tailed/streamlined.
c) One-piece body construction.
d) Base plate screwed or welded to the base, occasionally of one piece construction.
e) Copper driving band near the base of the projectile.
f) Body construction normally thin.
g) Low charge to weight ratio.
h) Fuzed with point-initiating and/or base-detonating fuze.
i) If no driving band is present, it may use two bourrelets.

4in HE Projectile

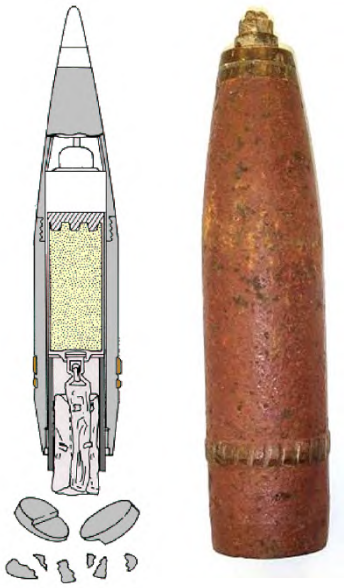
2in HE Projectile

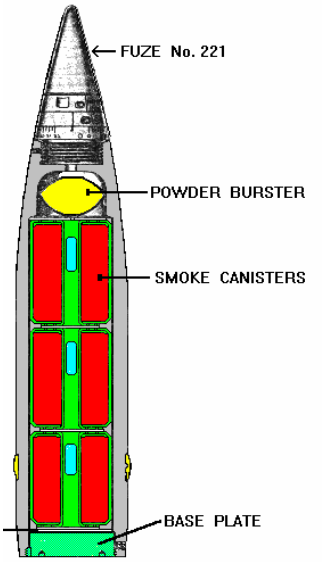


Carrier Projectiles: Base Ejection

Recognition Features

a) Ogival streamlined nose.
b) Nose/Time fuzed.
c) Parallel sides (on older items).
d) Square or tapered base.
e) One or two-piece body construction.
f) Base plate held in place by weakened PVC ring or shear pins.
g) Copper driving band may be fitted.
h) Base plate ejected if the munition has functioned.
i) Contains a small low explosive burster/expulsion charge.



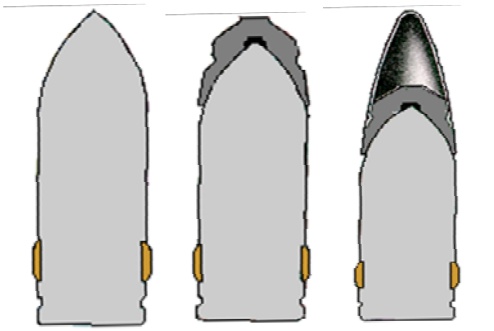


Shot Projectiles

Recognition Features

a) Driving bands (early designs) or obturators (current designs).
b) Tracer pockets common.
c) Ballistic caps and piercing caps (current designs).
d) Early shot projectiles were made of hard high grade steel. Current designs use tungsten carbide or Depleted Uranium (DU) cores or penetrators.
e) Most current shot projectiles now use discarding sabots, either of the post or petal type
f) Proof shot projectiles have flat heads and are used to test guns.
g) No fuzes are present.

4in Solid Shot



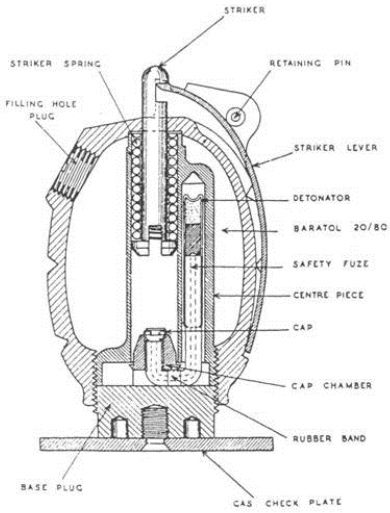
Shot | AP Capped | AP Capped BC

Report Reference:	Client:	
5603TA	Atkins Limited	BACTEC
	Project: Swansea Docks to Baglan Burrows	

Source: BACTEC International Limited and various historical sources

No. 36 'Mills' Grenade

Weight:	0.7kg filled (1lb 6oz)
Type:	Hand or discharger, fragmentation
Dimensions:	95 x 61mm (3.7 x 2.4in)
Filling:	Alumatol, Amatol 2 or TNT
Remarks:	4 second hand-throwing fuse with approximate 30m range. First introduced May 1918.



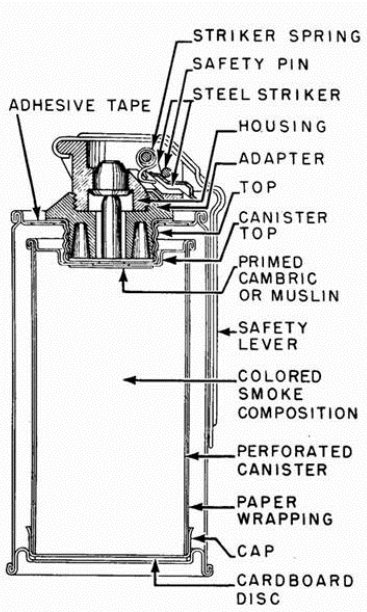
Grenade, .303 inch rifle, No. 36M, Mark I.

No. 69 Grenade

Weight:	0.38kg filled (0.8lb)
Type:	Percussion/Blast
Date Introduced:	December 1940
Remarks:	Black Bakelite body. Blast rather than fragmentation type. After unscrewing the safety cap, a tape is held when throwing the grenade releasing the safety bolt in the throwing motion. Detection is problematic due to its very low metal content.

Typical Smoke Grenade

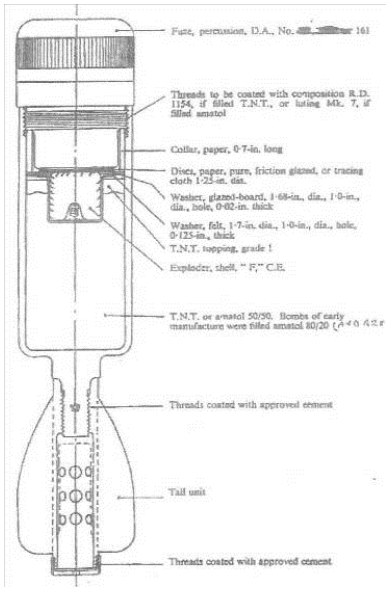
Dimensions:	Approx. 65 x 115mm (2.5 x 4.5in)
Type:	Smoke
Date Introduced:	Current MoD issue
Remarks:	Smoke grenades are used as ground-to-ground or ground-to-air signalling devices, target or landing zone marking devices, and screening devices for unit movement.



Source: BACTEC International Limited and various historical sources

Typical 2 inch High Explosive Mortar

Bomb Weight: 1.02kg (2.25lb)
Type: High Explosive
Dimensions: 51 x 290mm (2in x 11.4in)
Filling: 200g RDX/TNT
Maximum Range: 457m (500yds)
Remarks: Fitted with an impact fuze which detonates the fuze booster charge (exploder) and, in turn, the high explosive charge. The main charge shatters the mortar bomb body, producing near optimum fragmentation and blast effect at the target.

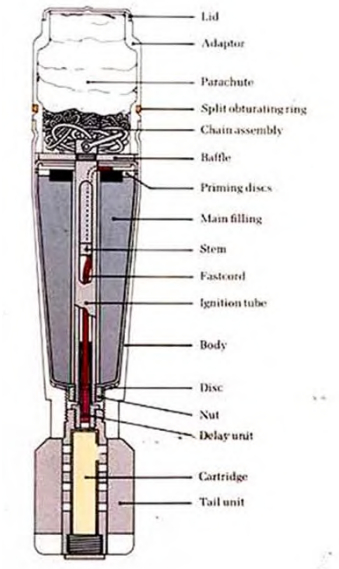


Typical 3 inch Smoke Mortar

Type: Smoke
Dimensions: c490 x 76mm (19.3in x 3in)
Filling: Typically white phosphorous
Maximum Range: 2515m (2,750yds)
Remarks: On impact, the fuze functions and initiates the bursting charge. The bursting charge ruptures the mortar bomb body and disperses the white phosphorous filler. The white phosphorous produces smoke upon exposure to the air.

Typical 2 inch Illuminating Mortar

Type: Illum.
Dimensions: 51 x 290mm
Filling: Various
Remarks: The expulsion charge ignites and ejects the candle assembly. A spring ejects the parachute from the tail cone. The parachute opens, slowing the descent of the burning candle which illuminates the target.



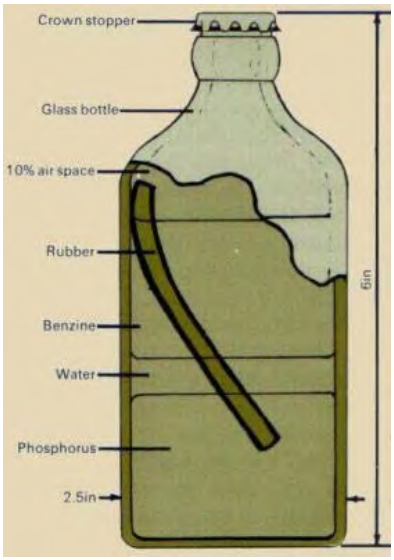
Report Reference:	Client:	
5603TA	Atkins Limited	BACTEC
	Project: Swansea Docks to Baglan Burrows	

Source: BACTEC International Limited and various historical sources

Self Igniting Phosphorous (SIP) Grenades

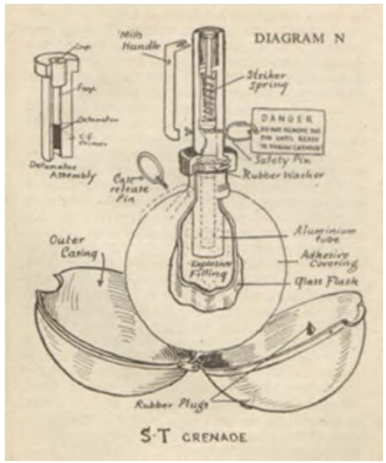
Filling: White Phosphorous and Benzene

Remarks: The grenade comprised a glass bottle with a total volume of approximately one pint. It was filled with White Phosphorus, benzene, a piece of rubber and water. Over time the rubber dissolved to create a sticky fluid which would self ignite when the bottle broke. Fired by hand or Northover Projector. Sometimes called the "A & W" (Albright & Wilson) grenade.



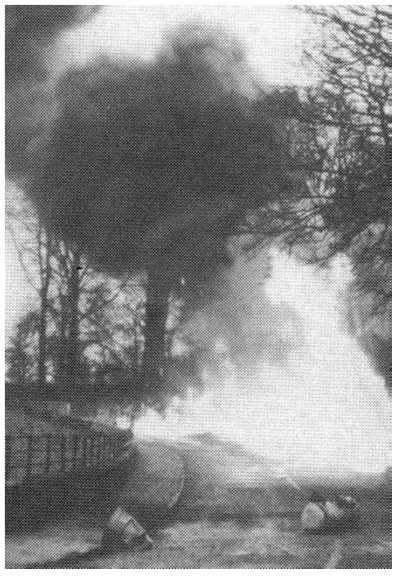
No 74 Grenade (Sticky Bomb)

Remarks: Designed as an anti-tank grenade and used by the Home Guard. The grenade consisted of a glass ball on the end of a Bakelite (plastic) handle. Inside the glass ball was an explosive filling whilst on the outside was a very sticky adhesive covering. Until used, this adhesive covering was encased in a metal outer casing.



Flame Fougasse Bomb

Remarks: A Flame Fougasse was a weapon in which the projectile was a flammable liquid, typically a mixture of petrol and oil. It was usually constructed from a 40-gallon drum dug into the roadside and camouflaged. Ammonal provided the propellant charge which, when triggered, caused the weapon to shoot a flame 3m (10ft) wide and 27m (30 yards) long. Initially a mixture of 40% petrol and 60% gas oil was used, this was later replaced by an adhesive gel of tar, lime and petrol known as 5B.



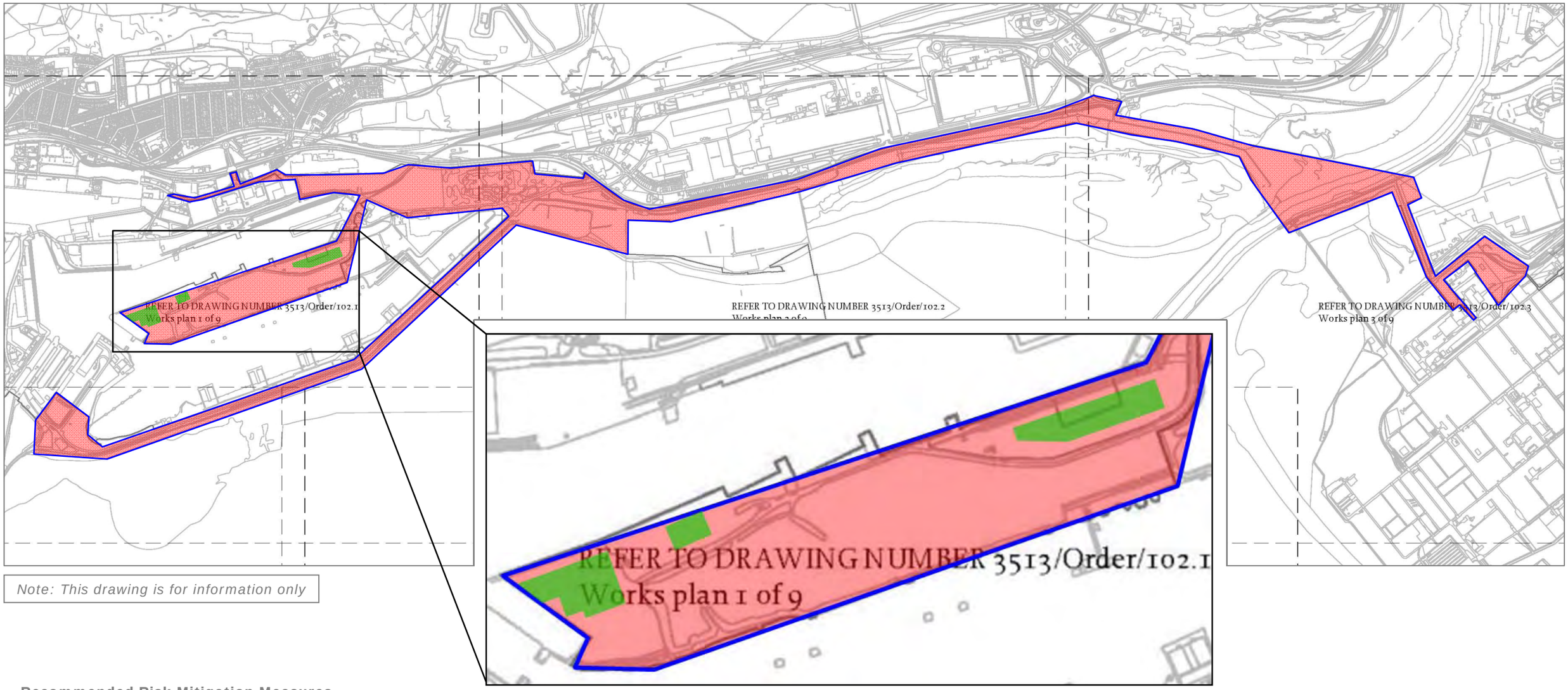
Source: BACTEC International Limited and various historical sources

Small arms ammunition and cannon rounds up to 30mm

Recovered British WWII-era SAA

Live WWII-era 4.5” British Naval Shell

North



Note: This drawing is for information only

Recommended Risk Mitigation Measures

Both Risk Zones - Prior to All Works

Explosive Ordnance Safety and Awareness Briefings to all personnel conducting intrusive works.

The Provision of Unexploded Ordnance Site Safety Instructions.

High Risk Zone only – Shallow Intrusive Works

Non-Intrusive Magnetometer Survey and target investigation ahead of any intrusive works – where appropriate.

Explosive Ordnance Disposal (EOD) Engineer Presence on site to supervise all open excavations.

High Risk Zone – Deep Intrusive Works

Intrusive Magnetometer Survey of any pile/borehole locations and Target Investigation, if necessary. Investigation of Suspect Anomalies, if required.

- High Risk Zone
- Low Risk Zone
- Generalised/approximate site boundary

Report Reference:	Client:	
5603TA	Atkins Limited	BACTEC
	Project: Swansea Docks to Baglan Burrows	

Source: Atkins Ltd/BACTEC International Limited

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THE QUEEN'S AWARDS FOR ENTERPRISE 2008

Appendix E. Risk Assessment Matrix

Classification of Consequences and Probability

Classification of Consequences		Classification of Probability	
Classification	**Definition**	**Classification**	**Definition**
Severe	Acute risk to human health. Short-term risk of pollution of controlled waters or significant impact on controlled waters, for example, large scale pollution of very high levels of contamination equivalent to EA Category 1 pollution incident including persistent and/or extensive effects on water quality, for example, leading to closure of a major abstraction point, major impact on operational effectiveness and/or amenity value or major damage to agriculture or commerce. Catastrophic damage to buildings or property, for example, explosion causing building collapse. Ecological system effects- immediate risk of major damage which is likely to result in: irreversible substantial adverse change in the functioning of the ecosystem or harm to a species of special interest that endangers the long-term maintenance of the population.	High Likelihood	There is a contaminant linkage and an event is High Likelihood to occur in the short term and is almost inevitable over the long term OR there is evidence at the receptor of harm or pollution. >95% Likelihood of Consequence occurring.
Medium	Chronic risk to human health. Pollution of sensitive water resources, for example, leaching of contaminants into controlled water that is equivalent to an EA category 2 pollution incident including significant effect on water quality, notification required to abstractors, reduction in amenity value or significant damage to site operations, agriculture or commerce. Ecological system effects – immediate risk of significant damage which may result in substantial, adverse changes to the ecosystem's functioning or harm to a species of special interest that may endanger the long-term maintenance of the population. Significant damage to buildings, structures and services, for example, damage rendering a building unsafe to occupy, such as foundation damage.	Likely	There is a contaminant linkage and it is probable that the event will occur. It is not inevitable, but possible in the short term and likely over the long term. 50-95% likelihood of consequence occurring.
Mild	Non-permanent health effects to humans (exposure unlikely to lead to 'significant' harm). Pollution of controlled waters or non-sensitive water resources, for example, pollution of non-classified groundwater that is equivalent to an EA Category 3 pollution incident or short lived effect on water quality, marginal effect on operational capability, amenity value, agriculture or commerce. Minor damage to buildings, structures and services, for example, damage rendering a building unsafe to occupy, such as foundation damage. Ecological system effects – minor or short term damage which is unlikely to result in substantial adverse changes to the ecosystem's functioning or harm to a species of special interest that may endanger the long-term maintenance of the population. Substantial damage to non-sensitive environments, such as unprotected ecosystems, for example, crops.	Low Likelihood	There is a contaminant linkage and circumstances are possible under which an event could occur. It is by no means certain that even over a longer period such an event would take place and less likely in the short term. 5-49% likelihood of consequence occurring.
Minor/Negligible	No measurable effects on human health including non-permanent health effects to humans that is easily preventable by appropriate use of personnel protective equipment. Minor pollution of controlled waters including non-sensitive water resource with no discernible effect on water quality or ecosystems. Minor damage to non-sensitive environments, such as unprotected ecosystems, for example, crops. Easily repairable effects of damage to buildings/structures/services/environment, for example, discolouration of concrete, loss of plants in a landscaping scheme.	Unlikely	There is a contaminant linkage and it is improbable that an event would occur even in the very long term. <5% likelihood of consequence occurring.

Definitions of Classified Risks/Risk Terms

Classification	Definition
Very High Risk	Severe harm to a receptor may already be occurring OR there is a high likelihood that severe harm will arise to a receptor unless immediate remediation works/mitigation measures are undertaken. Realisation of that risk is likely to present a substantial liability to the MoD
High Risk	Harm is likely to arise to a receptor and it is likely to be severe unless appropriate remediation works/mitigation measures are undertaken. Remediation works may be required in the short term and are likely to be required in the long term. Realisation of that risk is likely to present a substantial liability to the MoD
Moderate Risk	It is possible that harm could arise to a receptor, but there is low likelihood that such harm would be severe. Harm is likely to be mild. Some remediation works may be required in the long term. Realisation of that risk is unlikely to present a substantial liability to the MoD but further work may be required to determine whether this is the case.
Moderate/Low Risk	It is possible that harm could arise to a receptor, but where a combination of likelihood and consequence results in a risk that is above low, but is not of sufficient concern to be classed as mild. It can be driven by cases where there is an acute risk which carries severe consequences, but where the exposure is unlikely. Such harm would at worse normally be mild. Unlikely to present a substantial liability to the MoD. Limited further investigation may be required to clarify the risk and liability. If necessary remediation works are likely to be limited in extent.
Low Risk	It is possible that harm could arise to a receptor. Such harm would at worst, normally be mild.
Negligible Risk	There is low likelihood that harm could arise to receptor. Such harm is unlikely to be any worse than mild. No liability.
No Potential risk	There is no potential risk where no contaminant linkage has been established. No liability.

Classification of Risk

		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**High Likelihood**	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk
	Likely	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate/Low Risk	Low Risk	Negligible Risk
	Unlikely	Moderate/Low Risk	Low Risk	Negligible Risk	Negligible Risk

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