



for Global Environmental Site Investigation Services (GENESIS)

COMPREHENSIVE ENVIRONMENTAL SITE ASSESSMENT REPORT

**GB-BU308301 – Shell Fontwell
NP-Site ID-10018981**

FINAL REPORT NO: 310493 – R1 (02)



for Global Environmental Site Investigation Services (GENESIS)

DOCUMENT ISSUE STATUS

Report Issue:	<i>FINAL</i>		
Reference Number:	<i>310493 - R1 (02)</i>		
Title:	Name		
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Quality Reviewer:			

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Executive Summary

RSK Geoconsult Limited was commissioned by Shell (UK) Oil Products Limited to conduct an Environmental Site Assessment (ESA) at Shell Fontwell. During the time of the assessment, the station was in operation.

Site Identification

- Site Name: Shell Fontwell
- Location: Arundel Road, Fontwell, Arundel, West Sussex BN18 0SB
- GB-BU: 308301
- NP-Site ID: 10018981

Project Objectives

- To provide information on the site setting;
- To collect soil samples that will aid the design of future site redevelopment activities; and
- Undertake a site investigation to characterise the extent and severity of any environmental impact.

Scope of Work

- Review all available data / Desktop Phase I study;
- Completion of an ESA including seven boreholes and subsequent installation of five groundwater monitoring wells;
- Collection of 25 soil samples for laboratory analysis (TPH, TAME, TEL, BTEX);
- Collection of 5 groundwater samples for laboratory analysis (TPH, TAME, TEL, BTEX); and
- Submission of this Comprehensive Environmental Site Assessment Report.

Geology and Hydrogeology

Published geological information records the site to be underlain by undifferentiated Head deposits comprising clay, sand, silt and gravel. The bedrock immediately underlying the site is thought to be the Lambeth Group, comprised of clay, silt and sand. The Lambeth Group is published as being up to 27m in thickness. This unit overlies an undifferentiated chalk formation of the White Chalk Subgroup.

The Lambeth Group is classified as a minor aquifer with intermediate leaching soils. The adjacent chalk formation is classified as a major aquifer with intermediate leaching soils.

The site is located within a source protection zone II, close to the boundary with a source protection zone I. One source protection zone borehole, associated with Eastergate pumping station, is located approximately 650m south-west. A second source protection zone borehole associated with Westergate pumping station is located approximately 1.3km west.

Analytical Results

Laboratory analysis of the soil samples and groundwater samples taken from the site did not identify any significant hydrocarbon impact. Detailed analysis of the results indicates that there were no significant risks to human health and Controlled Waters. DQRA was not considered necessary.

Conclusion

Based on the findings of this GQRA no unacceptable risks have been identified. It is the opinion of RSK Geoconsult that the site in its current state may continue to operate without remediation work being undertaken.

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1 Objectives

RSK Geoconsult Limited, as part of the Genesis Alliance, was provided with an Objectives Form on 18 April 2007. This requested that RSK carry out an Environmental Site Assessment (ESA) at Shell Fontwell, Arundel Road, Fontwell, Arundel, West Sussex, to provide data to allow the current environmental status of the site to be assessed and to facilitate possible future construction works. The site to remain a retail filling station.

All works were carried out in accordance with the Shell specification for Global Environmental Site Investigation Services (GENESIS) and in accordance with the Genesis Umbrella Agreement.

Based on these objectives, site-specific conditions and the specification for GENESIS, the following scope of works was determined:

- Phase I Investigation to include: site identification, site location and setting (including geology, hydrogeology and hydrology), site features, comments on previous investigations, chronology of activities and details of Shell site equipment;
- Preliminary Risk Assessment (PRA) including development of an Initial Conceptual Site Model (ICSM);
- Site inspection to include a site walkover with photographs;
- Drilling of seven boreholes to a maximum depth of up to 12.0m below ground level (bgl) for visual inspection and logging of the subsurface strata to BS 5930⁽¹⁾ (NB All references are denoted by a numerical superscript and are listed in [Appendix I](#)) and the retrieval of representative soil samples for laboratory analysis;
- Installation of five monitoring wells to allow groundwater levels beneath the site to be monitored;
- Environmental laboratory analysis;
- Geotechnical soil analysis to determine physical properties of materials and hydrogeological parameters of soils beneath the site;
- Collection of groundwater samples for chemical analysis; and
- Preparation of this Comprehensive Environmental Site Assessment Report.

The above works were based on the RSK proposal, reference number 310493/P01/DEA, 24 May 2007. Purchase order number 4500191979 was issued on 14 June 2007.

The comments given in this report and the opinions expressed are based on the ground conditions encountered during the site work, and on the results of tests made in the field and in the laboratory, and on information provided. However, there may be conditions pertaining at the site that have not been disclosed by the investigation and which therefore could not be taken into account. In particular, it should be noted that there may be areas of hydrocarbon-impacted soil or perched groundwater that have not been identified as a result of the nature of intrusive investigation works.

2 Phase I Investigation

This section provides environmental information on the area within a 500m radius of the site. This information has been collected to assess the environment setting on and off site, and to review the potential risks to receptors on and off site.

The information presented below was derived from a review of documents provided by a Landmark Envirocheck report,⁽²⁾ findings gathered from the site walkover carried out by RSK on 18 June 2007 and information provided by Shell including:

- Site drawings;
- Historic Environmental (GeoDelft) previous reports;
- Shell Environmental database; and
- Engineering data on UK sites.

2.1 Site Identification

The site details are provided in *Table 1*.

Table 1 Site Identification, Shell Fontwell, Comprehensive ESA

Site Name	Shell Retail Global Site ID	Street Address	Site Manager Contact Number	Approximate Site Area ^a	Date of Phase 1 Data Collection
Shell Fontwell	GB-BU308301 NP-Site ID-10018981	Arundel Road, Fontwell, West Sussex BN18 0SB	01243 546000	2440m ²	18 June 2007

^a Estimate from scale drawings

2.2 Site Locality and Environmental Setting

The site is located at Ordnance Survey National Grid reference SU951070 (Latitude 50.855411, Longitude -0.649012) ⁽²⁾.

The site elevation is approximately 32m above Ordnance Datum (AOD) with the immediate surroundings very gently sloping down to the south. Re-grading of the site has meant that the northeast corner is raised approximately 2m above the general level of the site. A site location map is presented as *Figure 1: Site Locality Map*.

The site is located on the corner of London Road and Arundel Road, in the village of Fontwell. Fontwell is located approximately 10km east of Chichester and 13km northwest of Littlehampton. The area surrounding the site is predominantly residential, with woodland and

agricultural land in close vicinity. The south side of the site is bounded by Arundel Road with residential and agricultural land beyond. The east of the site is bounded by London Road with mixed residential and commercial properties beyond. To the west is an electric substation and to the northwest a motel. To the north of the site is Park Cottage.

The information is summarised in *Table 2* below and Figures provided at the rear of the report.

Table 2 Site Locality and Environmental Setting, Shell Fontwell, Comprehensive ESA

Category	Information
Development to the north	Northeast: Park Cottage, commercial property currently used as a stone carvers workshop/studio. (5m NE). Fields lie beyond. Northwest: Motel (Travelodge) (10m NW) ^{a (1)}
Development to the east	London Road bounds the east of the site. Residential and commercial properties are on the other side of London Road (20m E) ^{a (1)}
Development to the south	Arundel Road bounds the south of the site. A field and residential properties are immediately adjacent (15m S) ^{a (1)}
Development to the west	Electrical sub-station, restaurant (Little Chef) and hotel car park. Agricultural land, including orchards (50m W) ^{a (1)}
Regional topography	Flat with a very gentle downward slope to the south ^{a (1)}
Surface water (hydrology)	Two un-named ponds lie 260m west ⁽¹⁾
Geology	The site geology is presented on <i>Figure 6</i> at the rear of the report: - No Made Ground is indicated on the published geological map. It is likely to be present albeit only as backfill around underground storage tanks (USTs) and as engineered fill beneath surface hardstanding ⁽³⁾ - The superficial deposits immediately underlying the site are indicated on the published geological map as being Undifferentiated Head deposits comprising clay, sand, silt and gravel ⁽³⁾ - The bedrock immediately underlying the site is thought to be the Lambeth Group, comprised of clay, silt and sand. The Lambeth Group is published as being up to 27m in thickness. This unit overlies an undifferentiated chalk formation of the White Chalk Subgroup. The location where the boundary between these two units outcrops on the surface is published as being along the western site boundary ⁽³⁾ - A natural sinkhole is thought to be 430m north ⁽¹⁾

Category	Information
Hydrogeology	- The Lambeth Group is classified as a Minor aquifer with intermediate leaching soils; this is shown on the groundwater vulnerability map (<i>Figure 2</i>). The adjacent chalk formation is classified as a Major aquifer with intermediate leaching soils ⁽¹⁾ - The site is located within a Source Protection Zone II, close to the boundary with a Source Protection Zone I. One Source Protection Zone borehole, associated with Eastergate pumping station, is located approximately 650m south-west. A Second Source Protection Zone borehole associated with Westergate pumping station is located approximately 1.3km west ⁽¹⁾ - There are no water abstractions within 500m, the closest water abstractions are as noted above ⁽¹⁾ - Groundwater flow direction is expected to follow topography and flow in a southerly direction - Depth to groundwater is not known
Indicative fluvial flood plain	The site is not located on a fluvial flood plain ⁽¹⁾
Sensitive receptors	Nearby residential and commercial properties. Major aquifer in close proximity to the site
Potentially contaminative land uses in vicinity of the site	- Landfill 240m north (thought to be no longer operational) - Electrical substation west of the site
Environmentally sensitive areas in the vicinity of the site	- Sussex Downs Area of Outstanding Natural Beauty 220m north-east - South Downs environmentally sensitive area and National Park 240m north-east - The site is situated on a nitrate vulnerable zone ⁽¹⁾

^a Information collected from site walkover

^b Information collected from Landmark Envirocheck

2.3 Site Features

At the time of the assessment, the site was an operational service station retailing diesel, unleaded petrol, premium-unleaded petrol (V-Power) and liquefied petroleum gas (LPG). The site comprises a forecourt with four pump islands, heavy goods vehicle (HGV) lane with two pumps, and a shop. Seven of the tanks are situated underground in the west of the site, whilst three above-ground storage tanks (AST) are situated in the east of the site, elevated approximately 2m above the general level of the site. The LPG offset fill is situated to the west of the LPG tanks, and the offset fill points for the USTs are situated in the north of the site next to the HGV lane and air and water facilities. The surface of the service station is constructed of concrete, block paving and tarmac. It was seen to be in good condition, although there was

evidence of staining around the pump islands. The site features as they were at the time of the site walkover are presented on *Figure 5: Site Features Plan*. Photographs of the site were taken during the site walkover and are produced in *Appendix VII*.

2.4 Previous Report Information

One previous report has been published by DG Environmental Ltd (GeoDelft) and a summary of this report is presented below:

GeoDelft Tier 1 Report ⁽⁵⁾

GeoDelft carried out a soil gas survey on 15 April 1998. The report indicated that the site:

- Was surrounded by residential land usage;
- Had a previous line failure, reported by the petroleum officer – the details of which were unknown;
- Was underlain by Head overlying Head Gravel overlying Upper Chalk;
- Was underlain by a Non-aquifer over possible Minor aquifer over Major aquifer. The Non-aquifer aquitard was thought to be >5m but <10m thick;
- Had tanks/lines less than 20 years old;
- Had no surface water within 1km of site; and
- Had two VOC hotspots > 50 ppm identified adjacent to a pump island, and low impact elsewhere.

2.5 Chronology of Activities On and Around the Site

The development of the site and surrounding area has been reviewed with reference to Ordnance Survey (OS) Historical Maps provided in the Landmark Envirocheck report,⁽²⁾ unless otherwise stated. A summary is presented in the table below.

Table 3 Chronology of Activities, Shell Fontwell, Comprehensive ESA

Date / Scale	Site Activity	Surrounding Area	Comment
1876 / 1:2,500	Orchard	Agricultural land, Balls Hut Inn to south. Few residential properties. Gravel pit to north-east	Roads following current location of Arundel and London Roads (latter previously known as Slindon Road). Boulunge Farm 300m west. Slindon Woods approximately 200m north
1897 / 1:2,500	Orchard	Agricultural land, Balls Hut Inn to the south	Gravel pit now disused
1912 / 1:2,500	Orchard	Agricultural land, Balls Hut Inn to south. Small reservoir to south-east	Reservoir (Bognor Water Works Company) located 100m southeast, next to Balls Hut Inn. Area to west of site now named Fontwell
1939 / 1:2,500	Orchard	Agricultural land, predominantly orchards to the east. Residential development to east of site along Arundel and London Roads	
1951 / 1:10,560	Orchard	Agricultural land, predominantly orchards to the east. Residential development to east of site along Arundel and London Road	Horse racing track shown approximately 450m to south-west
1974 / 1:2,500	Orchard	Agricultural land, further residential development to the east. Inn and police house to south	Reservoir indicated as being disused
1989 / 1:2,500	Open land	Motel to northwest. Residential to east, agricultural to south	Roundabout has been built to the west of the site along with the A27 to the north
1990 ^a	Garage		First record of site being used as a retail filling station
1994 / 1:2,500	Garage	Agricultural and residential	Balls Hut Inn demolished. Area approximately as current

^a Information collected from Shell Environmental database

From the above chronology, the following potentially contaminative land use has been identified for the site:

- Garage 1990 to present date.

2.6 Details of Known Shell Site Equipment

Table 4 Details of Site Equipment, Shell Fontwell, Comprehensive ESA

Category	Information
Date when the site was first licensed as a petrol station	Approximately 1990 ^a .
Gauge system currently operating	Veeder-Root model number TLS-350R/E with printer ^{a, b}
Records of pre-existing tanks	No records of pre-existing tanks
Construction of underground fuel lines	Steel ^c
Date underground fuel line(s) last tested	02/02/07 ^c
Repairs to lines	Line from Tank 1 (V Power) to pump 5/6 failed and has been repaired ^c
Interceptor type and capacity	Class 1 interceptor, capacity unknown ^b
Where the interceptor drains to	Unknown ^a

^a Information collected from Site Manager and Petroleum Officer

^b Information collected from Shell Engineering database

^c Information collected from Shell Facilities Manager – JCI.

Table 5 Details of USTs, Shell Fontwell, Comprehensive ESA

Tank or Compartment No. ^b	1	2	3	4	5	6	7
Capacity (litres) ^b	24,700	24,700	24,700	12,350	12,171	24,700	24,700
Product ^b	Unleaded	Diesel	Unleaded	V-Power	Diesel	Unleaded	Diesel
Age (date installed) ^a	1990	1990	1990	1990	1990	1990	1990
Status ^b	Operational	Operational	Operational	Operational	Operational	Operational	Operational
Overfill protection ^a	Present	Present	Present	Present	Present	Present	Present
Fill point ^a	Offset	Offset	Offset	Offset	Offset	Offset	Offset
Construction ^a	Single Walled Steel	Single Walled Steel	Single Walled Steel	Single Walled Steel	Single Walled Steel	Single Walled Steel	Single Walled Steel

^a Information collected from Site Walkover

^b Information collected from Site Manager and Petroleum Officer

3 Preliminary Risk Assessment

3.1 Introduction

As part of a Preliminary Risk Assessment (PRA), an Initial Conceptual Site Model (ICSM) has been produced using the information provided in Section 2.

In order to produce the ICSM, potential sources of hydrocarbons together with receptors that could be impacted and potential pathways connecting the source and receptor were identified. Potential concerns exist when a potentially complete pollutant linkage is present, that is a link between a source, a pathway and a receptor is identified.

The areas of potential concern (areas which may develop into source areas), the chemicals of potential concern (COPC), and the pathways and receptors identified in the Phase I Investigation (see Section 2) are listed in the following section.

3.2 Initial Conceptual Site Model

Areas of Potential Concern

On site:

- Underground storage tanks;
- Above-ground storage tanks;
- Dispensing pumps;
- Associated product piping systems connecting USTs, ASTs (LPG compound) and dispensing pumps;
- Interceptor and site drainage; and
- UST and AST offset fill points.

Off site:

- None have been identified.

Chemicals of Potential Concern

The following chemicals of potential concern (COPC) have been identified as possibly being or having been associated with the site:

- Petroleum hydrocarbon COPC: TPH, BTEX, MTBE, TEL and TAME (associated with diesel and lubrication oils);

Potential Receptors

The following potential receptors have been identified:

- Groundwater;
- Surface water;
- Site workers;

- Site users;
- Site potable water supply;
- Adjacent residents/workers;
- Maintenance workers; and
- Construction workers.

Potential Pathways

Pathways that could connect the potential sources with the receptors resulting in a potentially complete pollutant linkage and therefore concerns are considered to be as follows at the site:

- Inhalation of vapours;
- Migration of vapours along backfill around service pipes and through strata;
- Direct contact including ingestion, inhalation and dermal contact;
- Permeation of plastic utility pipes including water supply;
- Leaching of substances to underlying groundwater; and
- Migration of substances present in groundwater to the wider groundwater body in the Minor aquifer and potentially the off-site surface and groundwater receptors.

Identification of Potentially Complete Pollutant Linkages

Based on the potential sources, pathways and receptors (see above), a number of potentially complete pollutant pathways have been identified for a continued oil end-use. *Table 6* identifies these potential pollutant linkages and assesses the likelihood of each linkage being present at the site.

Table 6 Potentially Complete Pollutant Linkages for Continued Oil End Use, Shell Fontwell, Comprehensive ESA

Source	Pathway	Receptor	Possible Linkage
COPC: TPH, MTBE, BTEX, TAME and TEL in soil	Permeation of plastic pipes	Potable water supply	Unlikely – Surface spillages may have occurred, likely to be localised in nature. Water supply is thought to enter site from south of site and not across the forecourt
	Leaching	Groundwater	Likely – Hardstanding covers 95% of main site and this is expected to remain the case for the commercial end use. However the integrity of the drainage system is unknown and this may exacerbate the leaching process
	Remobilisation	Groundwater	Likely – Groundwater table is likely to fluctuate causing the mobilisation of substances from soil to groundwater
	Direct contact including ingestion,	Site worker Site users Adjacent users	Unlikely – Hardstanding covers 95%, therefore plausible pathway is absent

Source	Pathway	Receptor	Possible Linkage
	inhalation of particulates and dermal contact	Maintenance workers	Unlikely – Routine maintenance unlikely to include removal of hardstanding. Plausible pathway considered absent
		Construction workers	Highly Likely – The site may undergo future construction works
COPC: TPH, MTBE, BTEX, TAME and TEL in groundwater	Permeation of plastic pipes	Plastic pipes inc. water pipes	Unlikely – Depth of groundwater unlikely to be shallow enough for pipes to be directly impacted by substances in groundwater. Plausible pathway considered absent
	Migration	Minor Aquifer	Likely –superficial deposits may impede (but not necessarily stop) downward migration of substances into the underlying minor and major aquifers. Local surface water is thought to be fed from this aquifer, ponds are thought to be down gradient of site
		Major Aquifer (off site)	
		Un-named Ponds 260m west	
Vapours associated with volatile soil and groundwater contaminants	Migration through strata or along backfill around service pipes and subsequent inhalation	Site workers	Likely – Vapours may accumulate in shop, via cable ducting, which is approximately 10m east of the nearest pump island
		Site users	Highly Unlikely – Unlikely to be significantly impacted due to relatively short exposure period
		Adjacent users	Likely – Adjacent residences to the south are hydraulically down-gradient of site. Adjacent motel and other residential and commercial properties to the north and west are down gradient of the site
		Maintenance workers	Unlikely – Tasks likely to be external or of short duration
		Construction workers	Highly Likely – The site may undergo future construction works

3.3 Summary and Conclusion

The following potentially complete pollutant linkages have been identified from the PRA:

- COPC: TPH, MTBE, BTEX, TEL and TAME in soil
 - Direct contact by construction workers;
 - Leaching of substances from soil to the groundwater; and
 - Remobilisation of substances from the soil to the groundwater.
- COPC: TPH, MTBE, BTEX, TEL and TAME in groundwater
 - Potential impact to the Minor/Major aquifers on and off site; and
 - Migration to the un-named ponds, 260m west of the site.
- Vapours associated with volatile soil and groundwater substances
 - Potential migration of vapours to the station kiosk;
 - Adjacent residents; and
 - Risks to construction workers during any future redevelopment activities.

In addition, potential risks to human health off site, and the surrounding environment, may materialise as a consequence of any future construction works on the site. Such potential risks may include, but may not be limited to, issues such as the impact on drains/surface waters (due to surface run off from excavation stockpiles, fugitive dust, and release of volatile compounds into ambient air) and nuisance issues relating to hydrocarbon odours. All such issues can be managed through site-specific method statements within health and safety plans and as a consequence, they are not considered further in this report.

The PRA has established that further investigation of the site would be required in order to assess the potentially complete pollutant linkages identified and to determine the sources, chemicals of potential concern, potential transport mechanisms, pathways and potential receptors.

4 Fieldwork

4.1 Site Works

Site investigation works were carried out by RSK Geoconsult between 31 July and 14 August 2007.

A summary of the fieldwork undertaken is presented in the table below.

Table 7 Summary of Fieldwork, Shell Fontwell, Comprehensive ESA

Date	Activity	Performed by
18/06/07	Health and safety risk assessment completed	RSK Geoconsult
18/06/07	Site walkover	RSK Geoconsult
27/06/07	Utility clearance survey conducted	Site Vision Surveys Ltd
31/07/07	Concrete coring	CC Ground Investigation supervised by RSK Geoconsult
31/07/07-02/08/07	Drilling of boreholes and installation of monitoring wells	CC Ground Investigation supervised by RSK Geoconsult
02/08/07	Well development	RSK Geoconsult
14/08/07	Groundwater monitoring and sampling	RSK Geoconsult
14/08/07	Elevation survey	RSK Geoconsult

Site works comprised a utility clearance survey, intrusive site investigation by using a combination of dynamic and rotary-drilling methods, monitoring well installation and groundwater development purging and sampling.

The works undertaken are described in the following sections.

Health and Safety

In advance of the site works, the site manager, Shell territory manager and relevant petroleum officer for the area were notified of the works, and a site-specific health and safety plan (SSHSP) was prepared.

On site, details of the SSHSP were discussed with fieldwork personnel and, on completion of the briefing, the health and safety plan was signed and dated by site personnel to confirm they had understood and fully accepted the site rules. Daily safety briefings were conducted throughout the duration of the fieldwork.

A Shell Permit To Work was required for the works undertaken by RSK. This was issued on the first day of the site investigation. In addition to this, Shell Daily Work Clearance Forms were also completed, these were signed by the RSK engineer undertaking the work and the site manager at the beginning and end of each day to confirm they had agreed to the works and that the works had been satisfactorily completed.

Fieldworks were supervised by a holder of an SPA contractor's safety passport and fieldwork was conducted in accordance with Shell's safety procedures and requirements.

Utility Clearance Survey

Site Vision Surveys Ltd carried out a utility clearance survey on 27 June 2007. The purpose of the survey was to identify positions of buried services and structures to minimise the risk of injury to field personnel and damage to services or site infrastructure.

Information from the clearance survey is included in *Figure 5: Site Features Plan*.

Site Walkover

A site walkover was carried out on 18 June 2007. The purpose was to confirm information collected as part of the PRA. Photographs of the site were taken and these are produced in *Appendix VII*.

Sampling Strategy

Intrusive investigation locations were determined based on information collected during the PRA and the requirements of GENESIS.

The boreholes were numbered from 1 to 7 inclusive. Where monitoring wells were installed, the location was prefixed with the letters MW (locations MW2, MW4, MW5, MW6 and MW7). The remaining boreholes were prefixed with the letters BH (locations BH3 and BH6).

The rationale for each of the borehole and monitoring well locations is outlined in the table below.

Table 8 *Borehole Location Rationale, Shell Fontwell, Comprehensive ESA*

Borehole/ Monitoring Well ID	Drilling Technique	Anticipated Ground Conditions	Location/Justification/ Purpose
MW1	Dynamic sampling and rotary coring	Undifferentiated Head deposits	Southwest coverage of site boundary and in the vicinity of the forecourt interceptor
MW2	Dynamic sampling and rotary coring	Undifferentiated Head deposits	Northwest coverage of site down gradient of tank farm

Borehole/ Monitoring Well ID	Drilling Technique	Anticipated Ground Conditions	Location/Justification/ Purpose
BH3	Dynamic sampling and rotary coring	Undifferentiated Head deposits	North-eastern coverage of tank farm and HGV lane
MW4	Dynamic sampling and rotary coring	Undifferentiated Head deposits	Northeast coverage of site, up gradient of tank farm
MW5	Dynamic sampling and rotary coring	Undifferentiated Head deposits	Eastern coverage of site and area behind the shop
BH6	Dynamic sampling and rotary coring	Undifferentiated Head deposits	South-eastern coverage of site
MW7	Dynamic sampling and rotary coring	Undifferentiated Head deposits	Coverage in the vicinity of the site shop

Coring

The site was covered predominantly with hardstanding comprised of concrete, tarmac and block paving. Concrete coring was required at each borehole location prior to the commencement of drilling works.

Hand-dug Inspection Pits

Prior to commencement of the drilling works, the upper 1.20m was hand augered as a precaution against the presence of unknown or detected services.

Drilling

A Commachio drill rig was used for the construction of the boreholes. The upper strata was drilled using dynamic probing techniques until refusal. The holes were then advanced using rotary coring methods. Five of the boreholes were installed with monitoring wells. These were constructed of 50mm diameter HDPE casing, and screened across the anticipated groundwater interface. BH3 was not completed due to access restrictions, all site traffic had to pass through this location in order to exit the site (see site features plan). However, the borehole identification numbers were kept in line with the original RSK proposal. Details of the installations are presented on the borehole logs in [Appendix II](#). Borehole locations are shown in [Figure 5: Site Features Plan](#).

A qualified geo-environmental engineer logged the boreholes in accordance with BS 5930.⁽¹⁾ The descriptions of the strata encountered, samples taken, field observations of soil and groundwater, *in situ* testing and details of the monitoring well installations are included in the borehole logs, presented in [Appendix II](#).

Soil Sampling

Representative soil samples were taken from the sample tubes from nine of the boreholes at intervals of approximately 0.5m and placed in plastic bags. Vapour phase hydrocarbons were recorded within the headspace using a MiniRae PID, calibrated using isobutylene gas.

Soil samples were taken at regular intervals and where visual or olfactory evidence indicated possible impact. In addition, several sample field duplicates were retrieved for quality control purposes. These samples were numbered from 1 to 2 inclusive and prefixed with the letter QC. The recovered soil samples, including QC samples, were put in suitable glass jars and placed in a cool box to minimise volatilisation.

Each soil sample was given a unique identifier and entered onto the chain-of-custody documentation. A copy of the chain-of-custody documentation accompanied the samples to the laboratory, with a copy being retained by RSK. All chain-of-custody returns confirmed that samples were analysed within the required laboratory holding time.

Well Development

Water levels were gauged on completion of the monitoring-well installation and prior to development. The monitoring wells were developed using plastic bailers.

Groundwater Gauging

Groundwater was gauged on 14 August 2007. All groundwater levels were measured from the top of casing (TOC). The results of the groundwater gauging are provided within the groundwater data report presented in Appendix VI.

Low-flow Sampling

Wells were allowed to stabilise for approximately one week prior to groundwater sampling, which was undertaken on 14 August 2007.

Groundwater samples were retrieved using the United States Environment Protection Agency (USEPA) approved low-flow purging and sampling methodology. The low-flow method relies on moving groundwater through the well screen at approximately the same rate as it flows through the geological formation. This results in a significant reduction in the volume of water extracted before sampling and significantly reduces the amount of disturbance of the water in the monitoring well during purging and sampling. Drawdown levels in the monitoring well and water quality indicator parameters (pH, temperature, electrical conductivity, redox potential and dissolved oxygen) are monitored during low-flow purging and sampling, with stabilisation indicating that purging is complete and sampling can begin. As the flow rate used for purging is, in most cases, the same or only slightly higher than the flow rate used for sampling, and because purging and sampling are conducted as one continuous operation in the field, the process is referred to as 'low-flow purging and sampling'.

Water-quality measurements undertaken *in situ* during the low-flow sampling process are provided in Appendix VI.

The groundwater samples were collected in a variety of containers appropriate to the anticipated testing suite required. In addition, one sample was retrieved for quality control purposes, i.e. field duplicate. This sample was numbered 1 and prefixed with the letter QC. The containers were filled to capacity and placed in a cool box to minimise volatilisation. Samples were transported under chain-of-custody documentation directly to the testing laboratory by courier.

Elevation Survey

The ground level and TOC of the monitoring well, where relevant, were surveyed and assigned an elevation relative to a Temporary Bench Mark (TBM) of 50.000m. The position of the TBM is shown in [Figure 5](#). Results of the elevation survey are included in the borehole logs, presented in [Appendix II](#).

4.2 Laboratory Analysis

On 2 August 2007, 25 soil samples, plus two QC samples, were submitted to the accredited testing laboratory (Envirolab) under controlled conditions for UKAS and MCERT laboratory chemical analysis, where applicable. Details of the analytical methods and limits of analysis are provided on the certificates of analyses, which are presented in [Appendix III](#). A summary of the key analytical data can be found in [Table 12](#) and is presented within [Figure 7: Soil Analytical Results](#).

Three representative soil samples were submitted for waste acceptance criteria (WAC) testing to assist with any required waste disposal activities. The certificates of analysis are presented in [Appendix III](#) and discussed further in Section 8.

Six geotechnical samples were taken on 1 and 2 August 2007 to assess the physical properties of the soils, to allow determination of hydrogeological parameters and to provide information to support redevelopment activities. The certificates of analysis are presented in [Appendix IV](#). A summary of the key analytical data can be found in [Table 11](#).

On 14 August 2007, four groundwater samples were taken (including one field duplicate). MW1 could not be sampled, it was found to be dry. The groundwater samples together with the QC sample were submitted to the accredited laboratory (Envirolab) under controlled conditions. The certificates of analysis are presented in [Appendix V](#). A summary of the key analytical data can be found in [Table 13](#) and is presented in [Figure 8: Groundwater Analytical Results](#).

4.3 Encountered Ground Conditions

A summary of the encountered ground conditions is presented in [Table 9](#) and geological cross-sections are provided in [Figure 6: Geological Information](#).

Descriptions of the strata encountered, together with comments on tests *in situ*, well design and groundwater conditions are given in borehole logs presented in [Appendix II](#).

Visual/olfactory information was recorded during the site works together with vapour phase head-space (PID) readings taken on disturbed samples from all the boreholes. PID readings and a summary of field observations are presented in the table below.

Table 9 Summary of Encountered Conditions, Shell Fontwell, Comprehensive ESA

Location	Encountered Depth (m)	Thickness (m)	Peak PID reading	Stratum	Description
MW1	0.00	0.10		Made ground	TARMAC
	0.10	0.23			CONCRETE
	0.33	0.17			Comprising orangey brown coarse sand and occasional fragments of red brick and concrete
	0.50	2.00	0.1	Natural	Orangey brown slightly silty SAND with fine to coarse medium subrounded to subangular flint GRAVEL
					Brown to grey slightly clayey coarse SAND
MW2	0.00	0.15		Made ground	TARMAC
	0.15	0.65			Comprising orange brown coarse sand with medium rounded flint gravel and tarmac fragments
	0.80	2.20	0.1	Natural	Orange brown slightly clayey coarse SAND with occasional fine to medium flint gravel
	3.00	>3.00	0.1		Very firm reddish brown slightly sandy CLAY
BH3	Not completed due to access limitations				
MW4	0.00	0.08		Made ground	TARMAC
	0.08	0.12			CONCRETE
	0.20	0.60		Made ground	Comprising orangey brown coarse sands with fragments of concrete
	0.80	>5.20	0.1	Natural	Orangey brown coarse slightly silty SAND with occasional medium to rounded subangular flint gravel
MW5	0.00	0.10		Made ground	TARMAC
	0.10	0.20			CONCRETE
	0.30	0.25			Comprising orangey brown coarse sand with flint gravel and occasional fragments of concrete
	0.55	1.95	0.1	Natural	Orangey brown slightly silty SAND and fine to coarse subangular flint GRAVEL
	2.50	2.50	0.1		Orangey brown fine to coarse slightly clayey SAND
	5.00	>2.00	0.1		Firm red to brown mottled grey sandy CLAY

Location	Encountered Depth (m)	Thickness (m)	Peak PID reading	Stratum	Description
BH6	0.00	0.10		Made ground	TARMAC
	0.10	0.15			CONCRETE
	0.25	0.15			Comprising orangey brown slightly silty sand and fine to medium subangular to angular flint gravel with fragments of concrete
	0.40	2.60	0.1	Natural	Orangey brown slightly silty SAND with fine to medium flint GRAVEL
	3.00	>2.50	0.1	Natural	Orangey brown coarse SAND
MW7	0.00	0.23		Made ground	CONCRETE
	0.23	0.37			Comprising dark brown silty sand with fine fragments of concrete
	0.60	1.90	0.1	Natural	Orangey brown silty to coarse SAND with fine to coarse subangular to angular flint GRAVEL
	2.50	>3.50	0.1		Orangey brown silty SAND

4.4 Hydrogeological Information

The results of the groundwater gauging and levelling exercise are presented in [Appendix VI](#) and summarised in the table below.

Table 10 Results from Gauging Monitoring Wells, Shell Fontwell, Comprehensive ESA

Well ID	Depth to Static Water (m previously used TOC) ^a	LNAPL ^b thickness (mm)
MW1	DRY	
MW2	0.932	0.00
MW4	Flooded	0.00
MW5	1.785	0.00
MW7	Flooded	0.00

^a TOC top of casing

^b LNAPL Light Non Aqueous Phase Liquid (also referred to as Phase Separated Hydrocarbon)

It was not possible to establish the groundwater flow direction due to large quantities of standing water in the vicinity of MW4 and MW7 which meant these wells were fully submerged.

Details of encountered groundwater conditions and monitoring-well design are given in the borehole logs presented in Appendix II.

5 Laboratory Analytical Results

5.1 Soil Analytical Results

Maximum recorded concentrations of the COCs at each borehole location are presented in *Figure 7: Soil Analytical Results*.

Certificates of laboratory analysis along with details of laboratory methods of analysis, limits of detection and UKAS and MCERT accreditation are provided in *Appendix III*.

The physical properties of the soils determined for laboratory testing taken from *Appendix IV* are presented in the table below.

Table 11 Physical Properties of Soil, Shell Fontwell, Comprehensive ESA

Location	Depth (m)	Percentage Soil Types			
		Gravel	Sand	Silt	Clay
MW4	3.00	8	31	37	24
MW4	4.00	9	42	33	16
MW4	6.00	9	43	29	19
MW7	2.00	71	10	8	8
MW7	4.00	0	46	35	19
MW7	6.00	13	51	23	13

The results of laboratory chemical analyses of soil samples are presented in the table overleaf.

Table 12 Laboratory Analysis Results for Soil Samples, Shell Fontwell, Comprehensive ESA

Location	Date Sampled	Depth (m)	Above or Below Static Water Level	Concentration						
				MTBE (mg/kg)	TAME (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethyl Benzene (mg/kg)	Xylene (mg/kg)	TPH (mg/kg)
MW1	01/08/07	2.00	Above	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	92.10
		4.00	Above	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	8.60
		5.70	Above	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	12.80
MW2	01/08/07	2.00	Above	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	9.50
		4.00	Above	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	15.70
		6.00	Above	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	11.60
MW4	02/08/07	2.00	Above	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	6.00
		4.00	Above	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	6.30
		6.00	Above	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	7.50
MW5	31/07/07	2.00	Above	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	11.10
		4.00	Above	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	6.50
		7.00	Above	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	7.80
BH6	31/07/07	2.00	Above	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	11.21
		4.00	Above	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	6.20
		5.50	Above	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	6.40
MW7	02/08/07	2.00	Above	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	11.40
		4.00	Below	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	7.60
		6.00	Below	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	5.30

5.2 Groundwater Analytical Results

A summary of the groundwater concentrations can be found in Figure 8: Groundwater Analytical Results.

Certificates of chemical analysis are presented in Appendix V.

Laboratory groundwater analysis data can be found in the table below. No sample was obtained from MW1, which was found to be dry.

Table 13 *Laboratory Analysis Results for Water Samples, Shell Fontwell, Comprehensive ESA*

Location	Date Sampled	Depth (m)	Concentration						
			MTBE (mg/l)	TAME (mg/l)	Benzene (mg/l)	Toluene (mg/l)	Ethyl Benzene (mg/l)	Xylene (mg/l)	TPH (mg/l)
MW2	14/08/07	1.25	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	0.005
MW4	14/08/07	1.50	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	0.001
MW5	14/08/07	1.50	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.005
MW7	14/08/07	2.50	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	0.006

6 Statistical Data Analysis

6.1 Generic Assessment Criteria

When reviewing analytical results, it is useful to be able to compare the observed concentrations with screening values to indicate whether the concentrations of compounds encountered are likely to represent a risk or not, based on the proposed future use of the site. This is done using a Generic Quantitative Risk Assessment (GQRA). For some compounds, screening values have been published (e.g. Soil Guideline Values from the Environment Agency), but for most organic compounds, a computer-based risk assessment is required to generate the screening value, based on site conditions and the proposed end use (in this case, it is continued petroleum hydrocarbon retail (Continued Oil)).

In accordance with CLR 11,⁽⁵⁾ a set of screening values, or Generic Assessment Criteria (GAC), has been generated for the following compounds in soil and groundwater using the Risk Based Corrective Action (RBCA) model: BTEX, MTBE and the various fractions of aliphatic and aromatic petroleum hydrocarbons (apart from the heaviest fractions). The GAC values along with the justification and supporting information for calculation of the GAC are provided as Appendix VIII.

The GAC are generic and have been generated using a large number of conservative assumptions about the site conditions. As GAC are conservative, exceedance of these values does not necessarily indicate a risk. If the GAC are exceeded, a Detailed Quantitative Risk Assessment (DQRA) is required, which takes account of the site-specific conditions to give a more specific assessment of the risks at that particular site.

6.2 Statistical Data Analysis

Before comparing the analytical results to the GAC using the GQRA, statistical data analysis has been performed on the soil analytical results to assess any inconsistencies and anomalies in the data sets. The statistical data analysis has been carried out in accordance with the guidance set out in CLR 7⁽⁴⁾ and CLR 11.⁽⁵⁾ Calculation sheets for the statistical data analysis can be found in Appendix IX.

6.2.1 Upper 95th Percentile – Soils

For human health risk assessment within CLR 7, the approach is to compare the upper 95th percentile of the mean-measured concentration (i.e. the concentration that is not exceeded by 95 per cent of the samples) of an identified data set (as defined by applying the Mean Value Test) with the appropriate Soil Guideline Value, in this case the Generic Assessment Criteria (GAC). Where the Mean Value Test is applied and the data pass meets the statistical criteria for the test (i.e. 95th percentile is less than the GAC), then the data would indicate there is no risk, and no further action or risk assessment is required.

For Controlled Waters risk assessment, where there are usually insufficient groundwater samples for statistical analysis to be undertaken, the maximum groundwater concentration is compared with the relevant water-quality standards.

6.2.2 *Maximum Value Test – Soils*

The Maximum Value Test has been used to assess whether the highest chemical concentration within the data set can be considered as being part of the data set or is an outlier of those data, i.e. effectively an anomalous result that belongs to a separate data set. If this test highlights a result as being an outlier, this can indicate that a hot spot exists, which may need further investigation.

7 Generic Quantitative Risk Assessment

7.1 GQRA Methodology

In line with CLR 11,⁽⁵⁾ following statistical analysis, the chemical soil and groundwater data were compared with the relevant GAC for the proposed future site usage (continued oil). For human health, the relevant GAC are published Soil Guideline Values or are values derived from the Risk Based Corrective Action (RBCA) model with appropriate generic input parameters. For Controlled Waters, the GAC are the relevant Environmental Quality Standards (EQS) or Drinking Water Standards (DWS) as appropriate for the site location and likely receptors. It should be noted that EQS and DWS are not available for all substances. The relevant GAC for continued oil use and the justification and supporting information for their calculation are provided in [Appendix VIII](#). A summary table of all GAC values for various end uses is also provided in [Appendix VIII](#).

The following potentially relevant pollutant linkages were identified in the ICSM.

- Risk to human health from vapours associated with substances identified in soil and groundwater (to workers in the site shop and neighbour residents);
- Risk to groundwater from leaching and remobilisation of substances identified within soil samples;
- Risk to Minor aquifer within the wider groundwater body; and
- Risk to un-named ponds 260m west.

The statistically analysed (where appropriate) soil and groundwater data were compared to the relevant GAC for the pollutant linkages. Where the analytical data exceed the GAC for any given linkage, a DQRA should be undertaken to examine the linkage in more detail using site-specific input parameters.

7.2 Results of GQRA and Refined CSM

The results of the GQRA are provided in [Appendix IX](#) for human health and [Appendix X](#) for Controlled Waters.

Human Health

The measured site data for substances in soil and groundwater were analysed statistically and compared with the relevant GAC for human health for continued oil use. The results of this comparison are provided in [Appendix IX](#).

For soils, none of the measured compounds exceed the in-house GAC values for human health (continued oil use). For those compounds with no GAC, explanations are provided in [Appendix VIII](#). For TEL and TAME, both compounds were below the Laboratory Method Detection Limits (LMDL) and these were considered not to pose a risk to human health. For the heavier fractions of TPH, the theoretical solubility of the compound is lower than the calculated GAC. The compound could not dissolve into solution with a high enough concentration to

provide a risk via vapour inhalation. Thus, there is no potential risk via vapour inhalation from these heavier hydrocarbon fractions, and no need for further assessment for the vapour inhalation pathway.

GAC values are not provided for the lighter aliphatic fractions C₅–C₆ and C₆–C₈ in soil. Modelling has indicated that these compounds will not pose a risk to human health at any concentration via the pathways considered for impacted soil. The measured concentrations of these fractions were low, and thus are considered not to pose a potential risk to human health at this site.

For groundwater, none of the hydrocarbon compounds were found to fail the derived in-house GAC.

For the TEL and TAME in groundwater, GAC are not provided, however, both of these compounds were below LMDL in all the samples. For many of the heavier fractions of TPH, the solubility of the compound is lower than the calculated GAC as mentioned above for soils. Thus, there is no potential risk via vapour inhalation from these heavier hydrocarbon fractions in groundwater and they need no further assessment for the vapour inhalation pathway.

Controlled Waters

The potential for impacted soil or groundwater at the site to become a source to Controlled Waters was examined via an initial screen of the site data against the published GAC (EQS⁽⁶⁾) values as provided in *Appendix X*). Since the site overlies a Minor aquifer, the GAC considered to be most relevant are the EQS published by the Environment Agency. None of the samples were found to contain substances in exceedance of the EQS values.

Refined CSM

In order to complete the Risk Assessment, a Conceptual Site Model has been produced. An ICSM, produced as part of Section 3, was based on desk study information collected. The ICSM was then refined using field and laboratory data and the assessment using the GAC to produce the Refined CSM, which forms the basis of the Generic and Detailed Quantitative Risk Assessments. A schematic drawing representing the Refined Conceptual Site Model is presented as *Figure 9*.

The following possible site use has been considered:

- **Continued Oil Use:** Site to remain as a petrol filling station

Relevant Pollutant Linkages

Table 14 identifies linkages for continued oil use.

Table 14 Potentially Complete Pollutant Linkages for Continued Oil End Use, Shell Fontwell, Comprehensive ESA

Source	Pathway	Receptor	Possible Linkage
COPC: TPH, MTBE, BTEX, TAME and TEL in soil	Permeation of plastic pipes	Potable water supply	Incomplete – Minimal impact identified within the soil and water main does not cross the refuelling areas or tank farm
	Leaching	Groundwater	Incomplete – Minimal impact identified within the soil
	Remobilisation	Groundwater	Incomplete – Minimal impact identified within the soil
	Direct contact including ingestion, inhalation of particulates and dermal contact	Site workers	Incomplete – Hardstanding covers 95%, therefore plausible pathway is absent
		Site users	
		Adjacent users	
		Maintenance workers	Incomplete – Routine maintenance unlikely to include removal of hardstanding. Plausible pathway considered absent
		Construction workers	Incomplete – Minimal impact identified within the soil
Vapours associated with volatile soil and groundwater contaminants	Migration through strata or along backfill around service pipes and subsequent inhalation	Site workers	Incomplete – Concentrations of substances not high enough to pose a risk
		Site users	Incomplete – Unlikely to be significantly impacted due to relatively short exposure period
		Adjacent users	Incomplete – Concentrations of substances not high enough to pose a risk
		Maintenance workers	Incomplete – Concentrations of substances not high enough to pose a risk
		Construction workers	Potentially Complete – Ongoing use as a service station will potentially involve future construction work. Possible that hydrocarbon impact was not identified within the scope of this investigation i.e. under the tanks and forecourt canopy
COPC: TPH, MTBE, BTEX, TAME and TEL in groundwater	Permeation of plastic pipes	Plastic pipes inc. water pipes	Incomplete – Concentrations of substances not high enough to pose a risk
	Migration	Minor Aquifer and Major Aquifer off site	Incomplete – Concentrations of substances not high enough to pose a risk
	Migration	Unnamed streams 260m west	Incomplete – Concentrations of substances not high enough to pose a risk

The GQRA has identified the following relevant pollutant linkage:

- Vapours associated with volatile soil and groundwater substances
 - Potential Risk to construction workers during proposed activities.

Risks to construction workers from construction activities can be managed through appropriate health and safety measures and the use of suitable personal protective equipment. This should include the monitoring of gas concentrations in excavations and manholes prior to entry. Due to the varying nature of the tasks carried out by maintenance and construction workers, risks have not been assessed further as they would need to be site specific.

The GQRA, therefore, has established that a DQRA is not required to further assess the relevance of the complete linkages identified in Table 14.

8 Waste Disposal

All material proposed for off-site disposal (e.g. during future construction works) should be given a proper description and waste classification (i.e. 'Hazardous' and or 'Non-Hazardous') prior to disposal, as required by the Environmental Protection (Duty of Care) Regulations 1991.

To determine the likely waste classification of the soils beneath the site, the chemical analysis results for soil samples were assessed using the criteria set out in the Environment Agency Technical Guidance WM2.⁽¹²⁾

According to this evaluation, the concentrations of substances in the soil generally observed at the site indicate that it is likely that the majority of the soils at the site would be classified as 'Inert'. It must be noted that this Inert classification is based on maximum concentrations of a limited number of compounds, and a Non-Hazardous classification may not be entirely ruled out if a different set of analytes were tested. Also, although it is considered unlikely, the possible presence of soils that would be classed as Hazardous Waste due to high concentrations of hydrocarbons (e.g. with a Diesel Range Organic (DRO) concentration of more than 10,000mg/kg) cannot be discounted.

The new European Waste Acceptance Criteria (WAC), implemented from 16 July 2005, have amended the Landfill Directive by setting out standards that Hazardous, Inert and Stabilised Non-reactive Hazardous waste materials must meet to be accepted at one of the three classes of landfill site: Hazardous, Non-Hazardous or Inert. The WAC analysis serves to confirm whether waste material would be accepted by the appropriate landfill.

Since the evaluation of the waste material has indicated that the soils at this site would be classified as Inert (for which there are no WAC), the WAC testing results are not relevant.

It should be noted that irrespective of the classification of the waste, landfill site-specific conditions could restrict the types of wastes that sites can accept.

9 Conclusion

All soil and groundwater results were compared with the GAC for human health. There were no exceedances thus there is not considered a risk to human health from hydrocarbon vapours. However, suitable protection should be provided for construction workers in certain areas of the site.

Groundwater results were also compared to the relevant EQS values for a Minor aquifer. In this instance none of the substances were found to be in exceedance.

The risk assessment has not identified any concerns to human health or the nearest surface water feature. It is the opinion of RSK Geoconsult that, in its current environmental state, the site is suitable for continued oil use without remedial action being required.

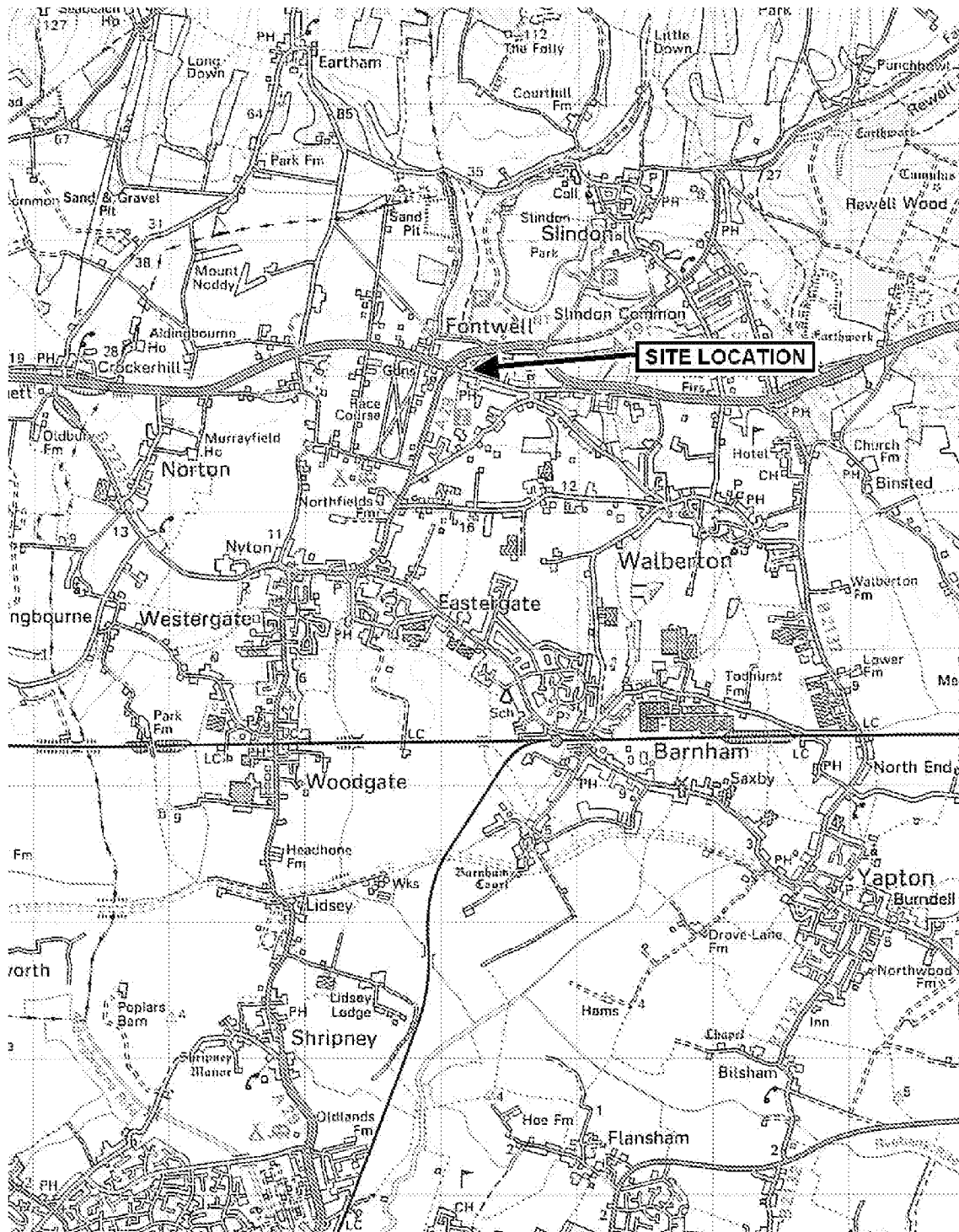
Questions regarding this report should be directed to:

Jack Dobson

Environmental Consultant

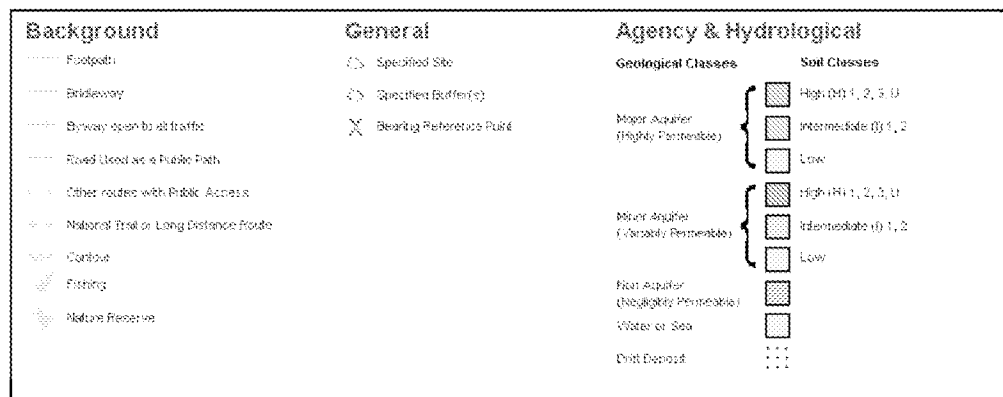
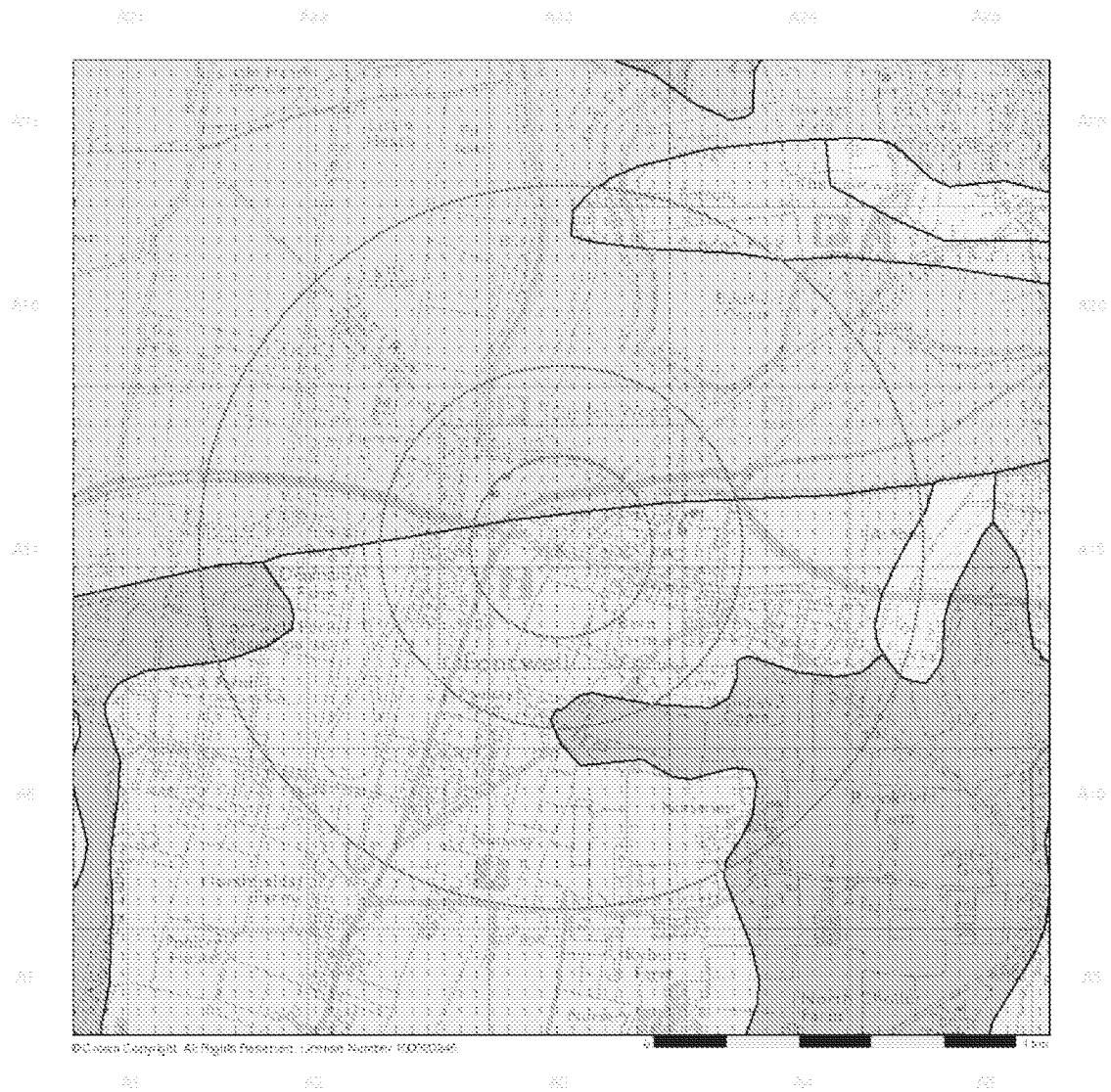
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Bristol BS37 9TS
01454 227564

Figures

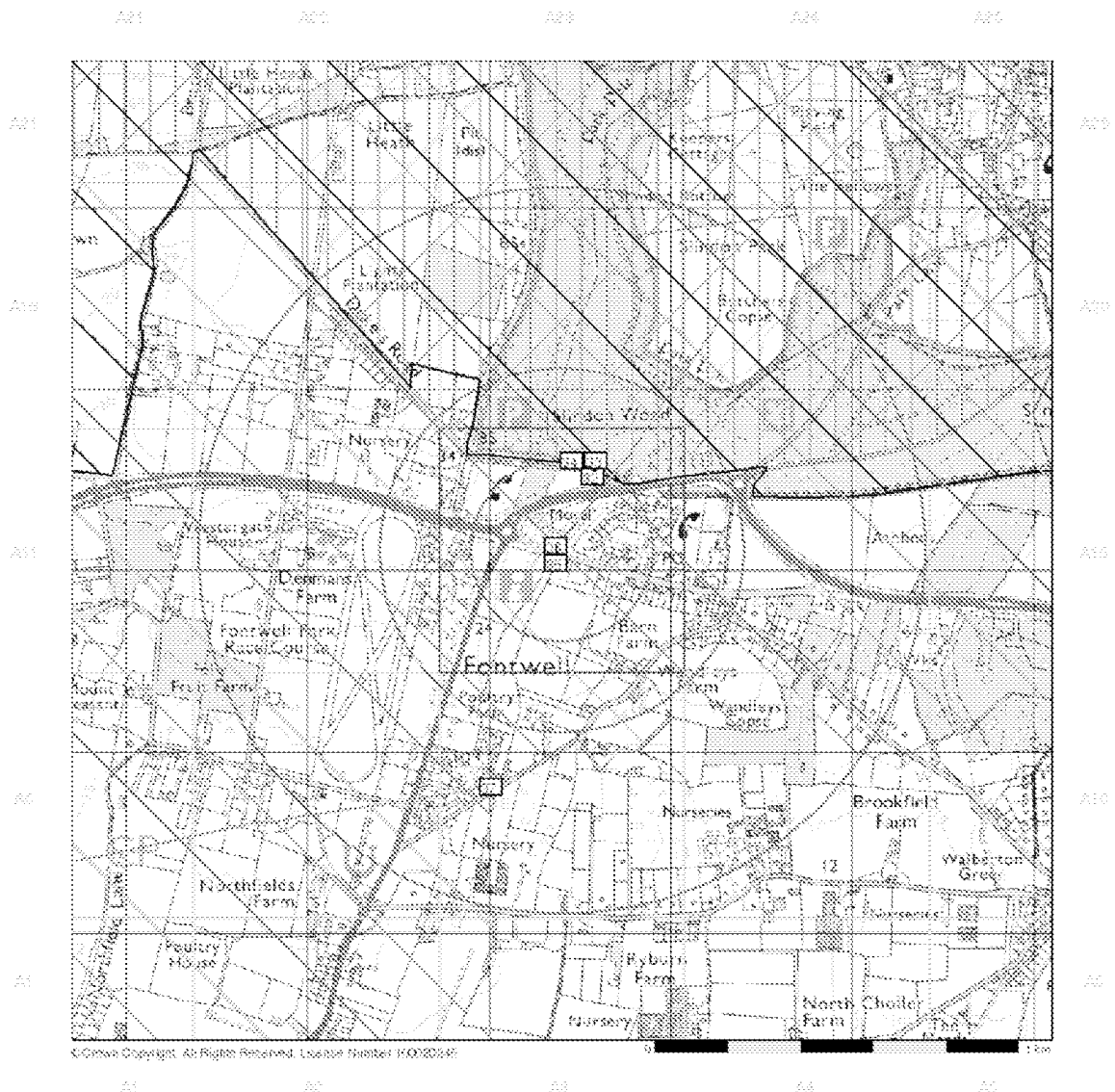


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SITE LOCATION MAP

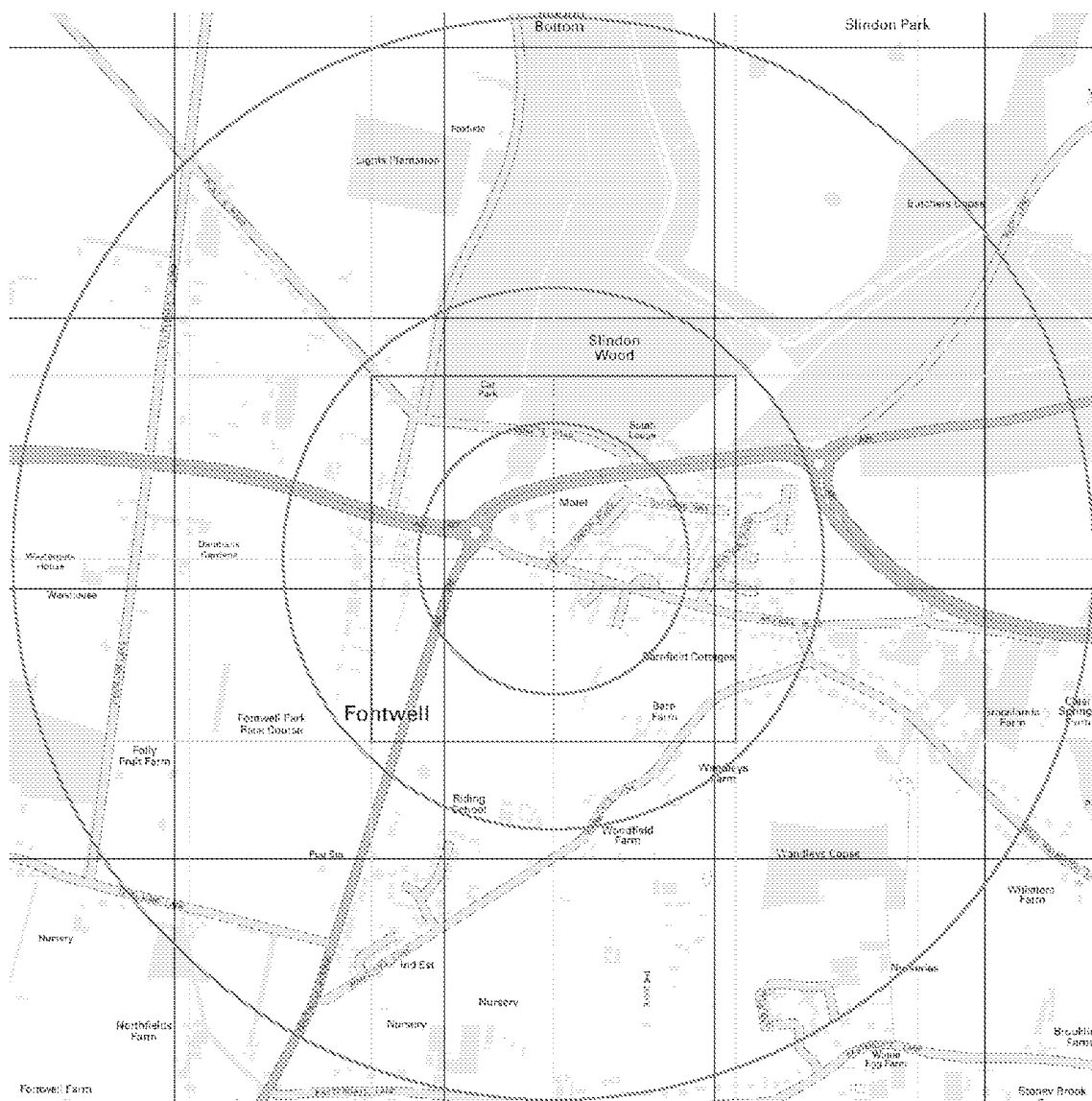


GROUNDWATER VULNERABILITY MAP



Background	General	
Footpath	Specified Site	Local Nature Reserve
Endileway	Specified Buffer(s)	Marine Nature Reserve
Byway open to all traffic	Bearing Reference Point	National Nature Reserve
Road Used as a Public Path	Map E	National Park
Other routes with Public Access		Nature Sensitive Area
National Trail or Long Distance Route	Sensitive Land Uses	Nature Vulnerable Zone
Contour	Area of Adopted Green Belt	Ramsar Site
Fishing	Area of Unadopted Green Belt	Site of Special Scientific Interest
Nature Reserve	Area of Outstanding Natural Beauty	Special Area of Conservation
	Environmentally Sensitive Area	Special Protection Area
	Forest Park	

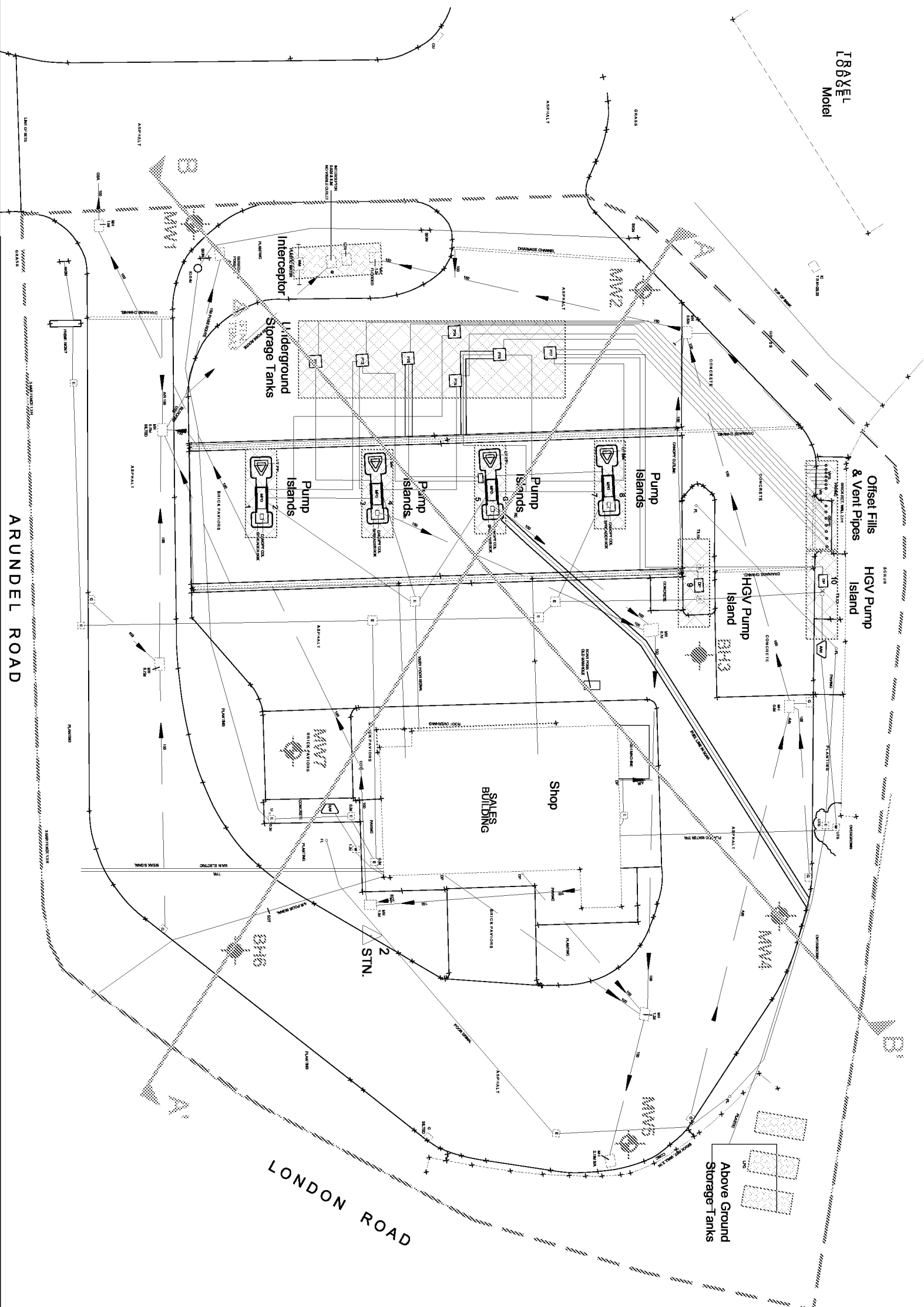
SENSITIVE LAND USES MAP



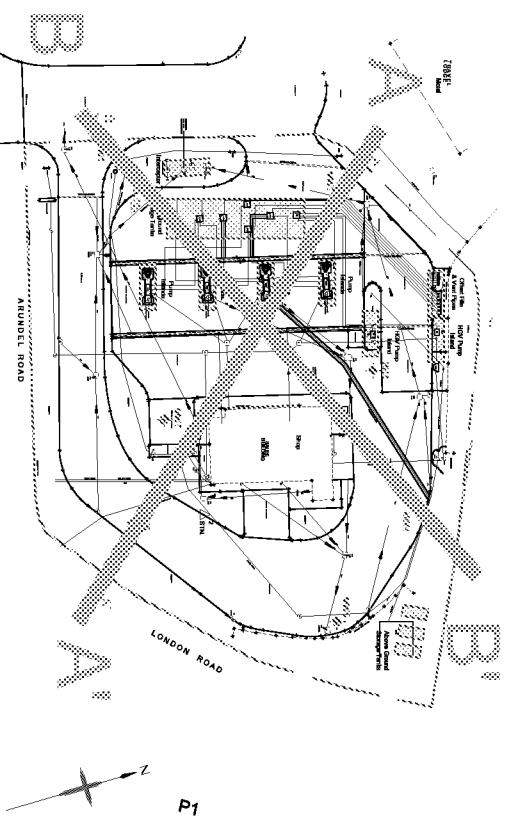
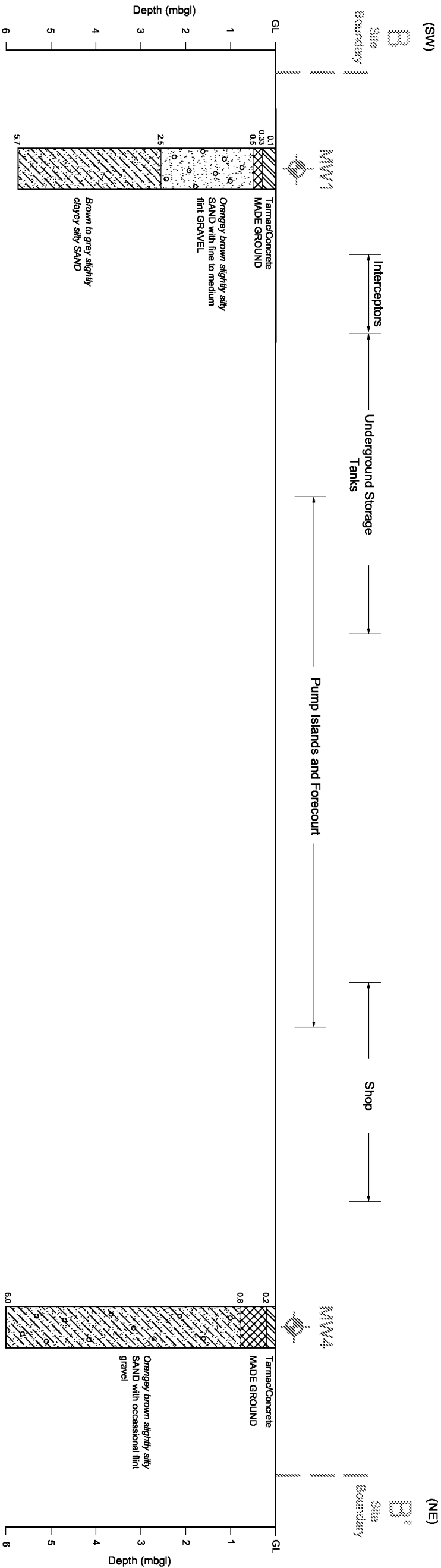
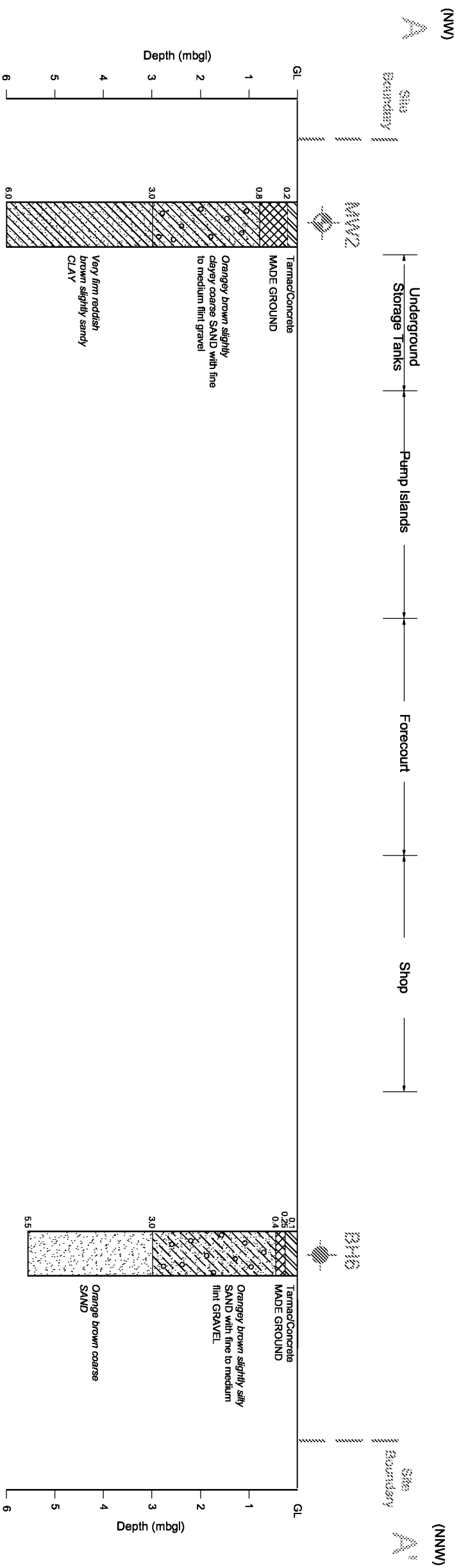
Agency and Hydrological (Flood)

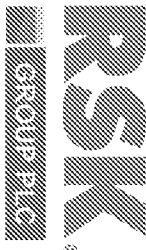
-  Extreme Flooding from Rivers or Sea without Defences (Zone 2)
-  Flooding from Rivers or Sea without Defences (Zone 3)
-  Area Benefiting from Flood Defence
-  Flood Water Storage Areas
-  Flood Defence

FLOOD VULNERABILITY MAP



LEGEND Borehole Location Monitoring Well Location Property Boundary Geological Cross Section Location Possible Sources of Impact Temporary Benchmark P105.10.07FIRST ISSUEGXAJDSTP DrawnDateCheckedDateApprovedDate GXA05.10.07JD05.10.07STP05.10.07 ScaleOrig SizeDimensions 1:250A3m PSK GROUP PLC Sheep Farm Business Park, Loughbeg, Stranmillis, County Wick, Wick Road, 814804, 8537 1713. Tel: +44 (0)1454 227933 Fax: +44 (0)1454 227932 Email: info@psk.co.uk Web: www.psk.co.uk ClientSHELL (UK) OIL PRODUCTS LTD Project TitleSHELL FONTWELL FONTWELL, WEST SUSSEX Drawing TitleSITE FEATURES PLAN COMPREHENSIVE ESA Project No.310493-R1 (02) Drawing File310493 (esa01-02).DWG Drawing No.FIGURE 5 Rev.P1					
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LEGEND  Borehole Location  Monitoring Well Location  Concrete  Made Ground  Clay  Tarmac  Sand  Gravel										 Sheep Farm Business Park, Lutteridge, Warwick, CV34 6JN. Tel: +44 (0)1456 227532 Fax: +44 (0)1456 227533 Email: info@psk.co.uk Web: www.psk.co.uk									
Rev.	Date	Amendment	Drawn	Chkd.	Appd.	Scale	1:250	Orig Size	A3	Dimensions	m								
05.10.07	FIRST ISSUE		GXA	JD	STP	Drawn	Date	05.10.07	Checked	Date	05.10.07	Approved	Date	05.10.07					
Client SHELL (UK) OIL PRODUCTS LTD																			
Project Title SHELL FONTWELL FONTWELL, WEST SUSSEX																			
Drawing Title GEOLOGICAL INFORMATION COMPREHENSIVE ESA																			
Project No. 310493-R1 (02)																			
Drawing File 310493 (essa01-02).DWG																			
Drawing No. FIGURE 6																			
Rev. P1																			



Appendix I

References

References

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11. DEFRA and the Environment Agency, Review of the Fate and Transport of Selected Contaminants in the Soil Environment, Draft Technical Report P5-079/TR1.
12. The Environment Agency, Contaminants in Soils; Collation of Toxicological Data and Intake Values for Humans, R&D TOX 11,14,17 and 19, 2002 to 2004.

Appendix II

Borehole Logs

Client: SHELL (UK) OIL PRODUCTS LTD

Site: SHELL FONTWELL

Project No: 310493



Boring Method: CP+RC

Date: 31/07/2007 - 31/07/2007

Driller: CC Ground Investigation Ltd

Logged By: Jack Dobson

Ground Level (mASD):

49.777m

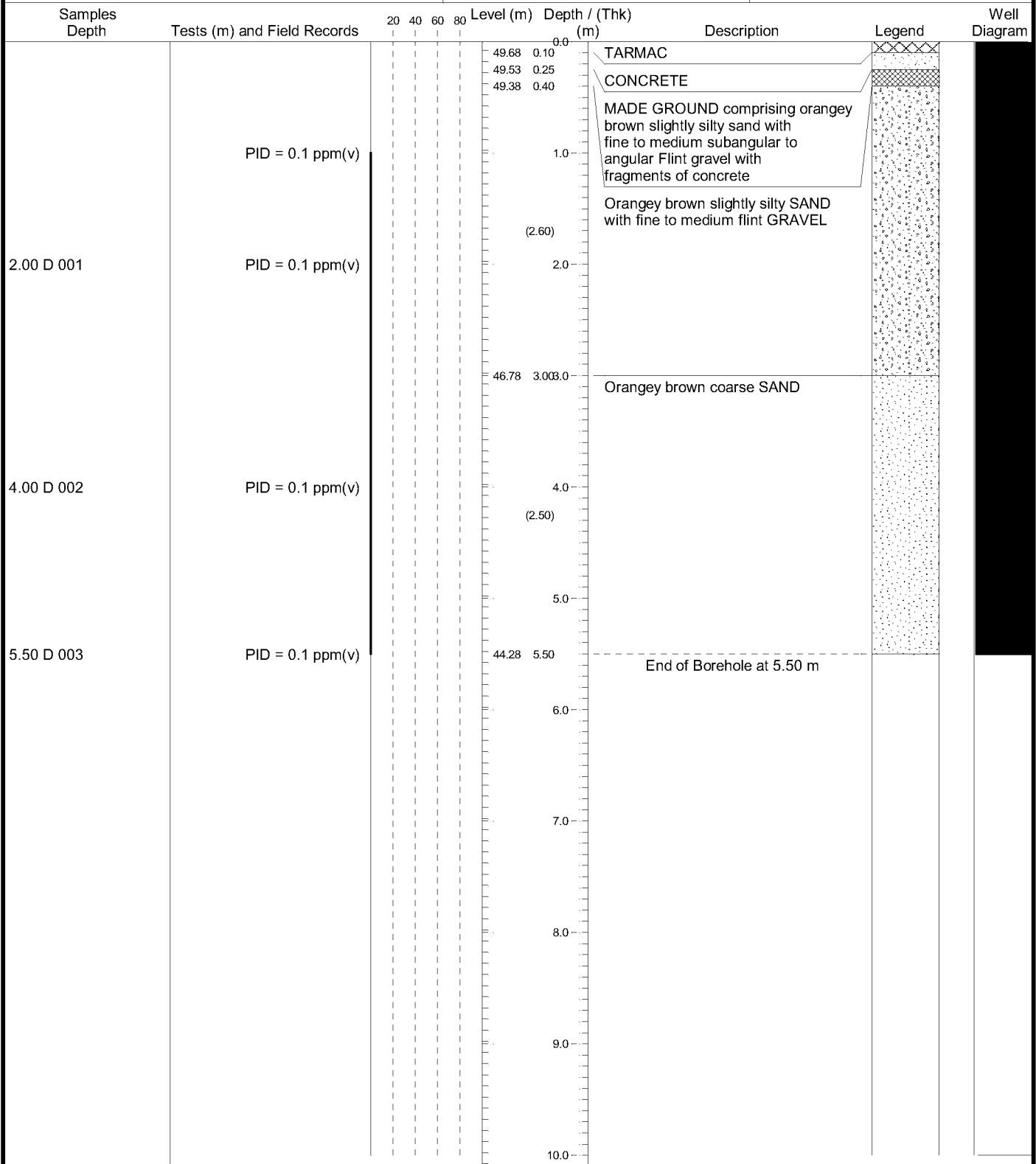
Top of Casing Elevation (mASD):

NOT DETERMINED

Record of : BH6

1 of 1

Scale, 1:50

**General Remarks:**

Borehole backfilled with bentonite and surface reinstated with concrete

Water Strikes**Chiselling****Borehole and Casing Details****Borehole****Casing**Strike
☒Level
☒From:
(m)To:
(m)Time:
(hr's)Depth
(m)Diam.
(mm)Depth
(m)Diam.
(mm)RSK GROUP PLC.
Green Farm Business Park, Latteridge Green.
Folly Road, Bristol. BS37 9TS.

15:27:46 - 26/10/2007

Client: SHELL (UK) OIL PRODUCTS LTD

Site: SHELL FONTWELL

Project No: 310493



Boring Method: CP+RC

Date: 01/08/2007 - 01/08/2007

Driller: CC Ground Investigation Ltd

Logged By: Jack Dobson

Ground Level (mASD):

49.693m

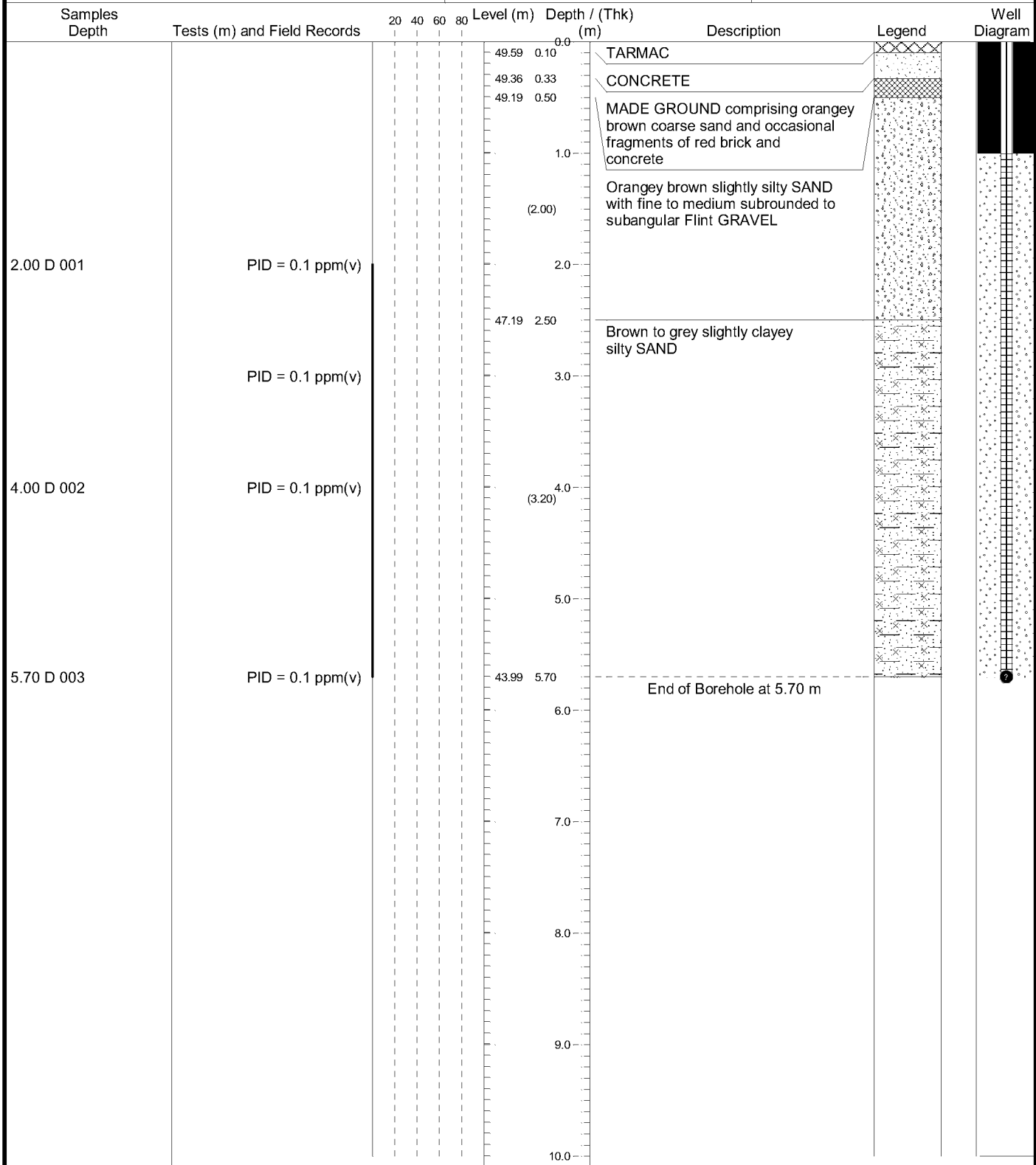
Top of Casing Elevation (mASD):

49.880

Record of : MW1

1 of 1

Scale, 1:50

**General Remarks:**

Installation details: Fitted with 50mm HDPE monitoring well.
 Screened from 5.7m bgl to 1.0m bgl, casing from 1.0m bgl to GL.
 Gravel filter pack from 5.7m bgl to 0.75m bgl. Bentonite seal from 0.75 to 0.10. Fitted with a traffic rated cover and two end caps.

RSK GROUP PLC.
 Green Farm Business Park, Latteridge Green.
 Folly Road, Bristol. BS37 9TS.

15:27:57 - 26/10/2007

Water StrikesStrike
☒

No Groundwater Encountered

Level
☒**Chiselling**From:
(m)To:
(m)Time:
(hr's)**Borehole and Casing Details****Borehole**Depth
(m)Diam.
(mm)**Casing**Depth
(m)Diam.
(mm)

Client: SHELL (UK) OIL PRODUCTS LTD

Site: SHELL FONTWELL

Project No: 310493



Boring Method: CP+RC

Date: 01/08/2007 - 01/08/2007

Driller: CC Ground Investigation Ltd

Logged By: Jack Dobson

Ground Level (mASD):

49.867m

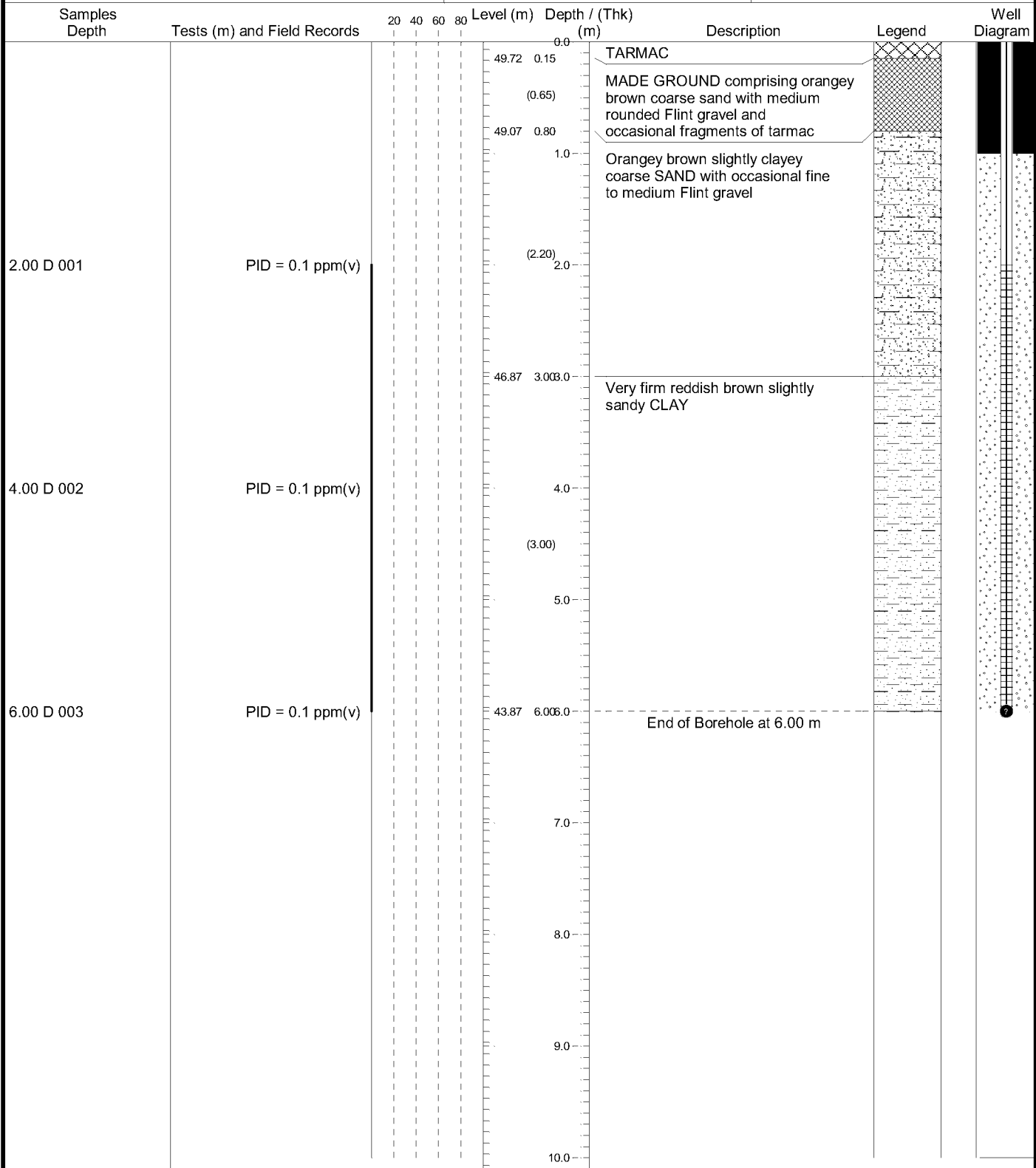
Top of Casing Elevation (mASD):

49.873

Record of : MW2

1 of 1

Scale, 1:50

**General Remarks:**

Installation details: Fitted with 50mm HDPE monitoring well.
 Screened from 6.0m bgl to 2.0m bgl, casing from 2.0m bgl to GL.
 Gravel filter pack from 6.0m bgl to 1.0m bgl. Bentonite seal from 1.0 to 0.10. Fitted with a traffic rated cover and two end caps.

RSK GROUP PLC.
 Green Farm Business Park, Latteridge Green.
 Folly Road, Bristol. BS37 9TS.

15:28:08 - 26/10/2007

Water Strikes

Strike

No Groundwater Encountered

Level

ChisellingFrom:
(m)To:
(m)Time:
(hr's)**Borehole and Casing Details****Borehole**Depth
(m)Diam.
(mm)**Casing**Depth
(m)Diam.
(mm)

Client: SHELL (UK) OIL PRODUCTS LTD

Site: SHELL FONTWELL

Project No: 310493



Boring Method: CP+RC

Date: 02/08/2007 - 02/08/2007

Driller: CC Ground Investigation Ltd

Logged By: Jack Dobson

Ground Level (mASD):

50.000m

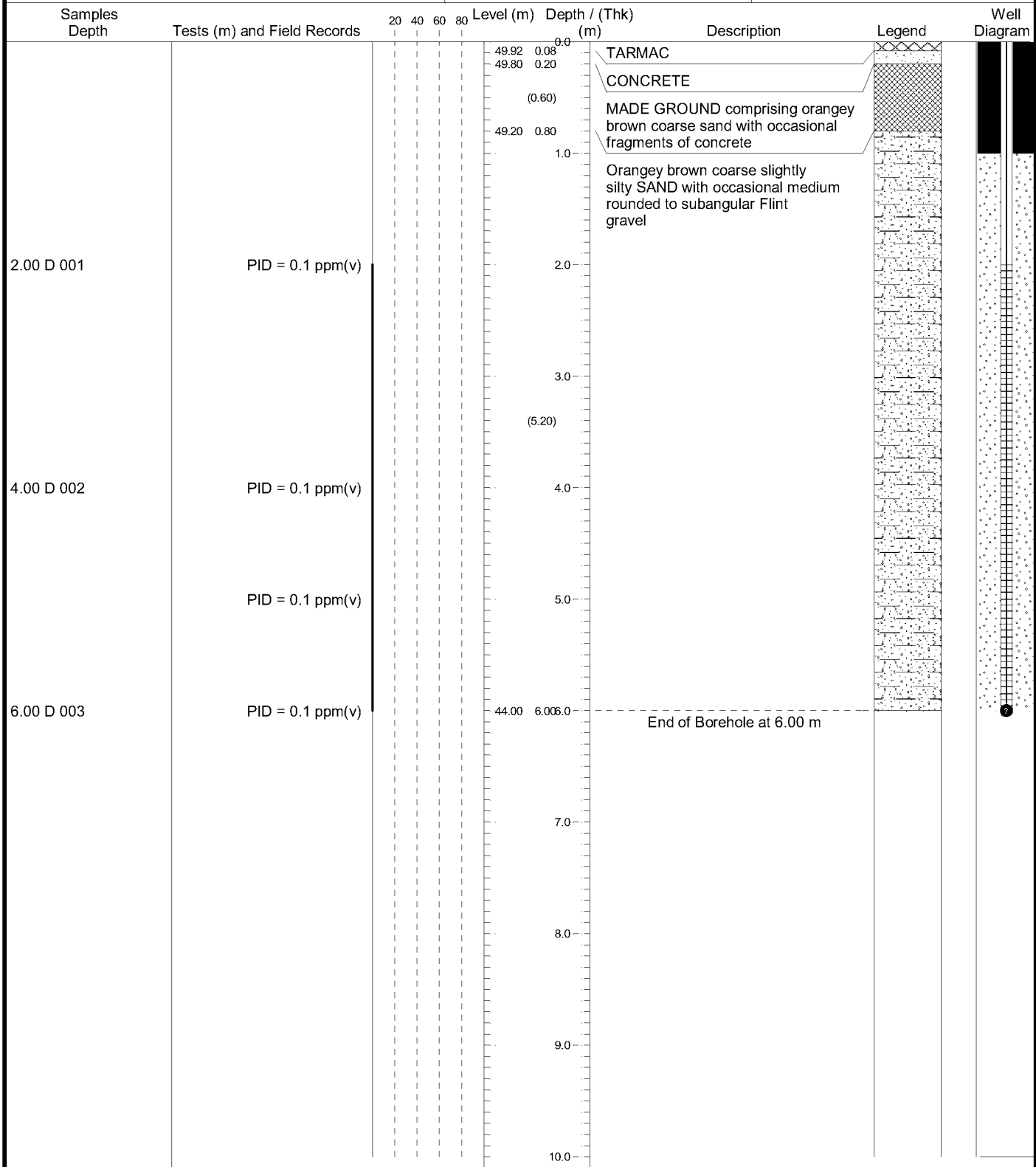
Top of Casing Elevation (mASD):

49.967

Record of : MW4

1 of 1

Scale, 1:50

**General Remarks:**

Installation details: Fitted with 50mm HDPE monitoring well.
 Screened from 6.0m bgl to 2.0m bgl, casing from 2.0m bgl to GL.
 Gravel filter pack from 6.0m bgl to 1.0m bgl. Bentonite seal from 1.0 to 0.10. Fitted with a traffic rated cover and two end caps.

RSK GROUP PLC.
 Green Farm Business Park, Latteridge Green.
 Folly Road, Bristol. BS37 9TS.

15:28:19 - 26/10/2007

Water StrikesStrike
☒

No Groundwater Encountered

Level
☒**Chiselling**From:
(m)To:
(m)Time:
(hr's)**Borehole and Casing Details****Borehole**Depth
(m)Diam.
(mm)**Casing**Depth
(m)Diam.
(mm)

Client: SHELL (UK) OIL PRODUCTS LTD

Site: SHELL FONTWELL

Project No: 310493



Boring Method: CP+RC

Date: 31/07/2007 - 31/07/2007

Driller: CC Ground Investigation Ltd

Logged By: Jack Dobson

Ground Level (mASD):

50.001m

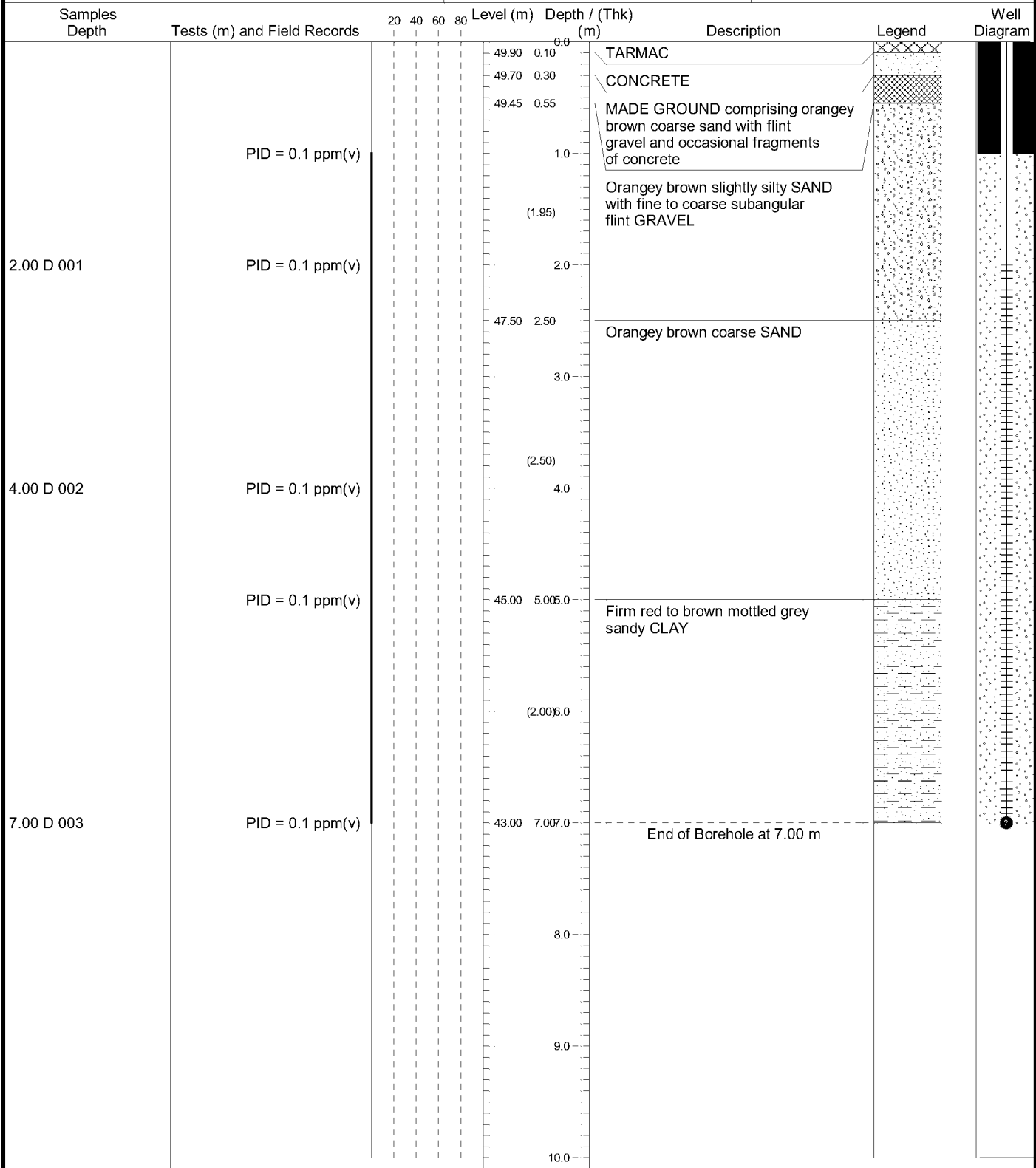
Top of Casing Elevation (mASD):

49.890

Record of : MW5

1 of 1

Scale, 1:50

**General Remarks:**

Installation details: Fitted with 50mm HDPE monitoring well.
 Screened from 7.0m bgl to 2.0m bgl, casing from 2.0m bgl to GL.
 Gravel filter pack from 7.0m bgl to 1.0m bgl. Bentonite seal from 1.0 to 0.10. Fitted with a traffic rated cover and two end caps.

RSK GROUP PLC.
 Green Farm Business Park, Latteridge Green.
 Folly Road, Bristol. BS37 9TS.

15:28:30 - 26/10/2007

Water StrikesStrike
☒

No Groundwater Encountered

Level
☒**Chiselling**From:
(m)To:
(m)Time:
(hr's)**Borehole and Casing Details****Borehole**Depth
(m)Diam.
(mm)**Casing**Depth
(m)Diam.
(mm)

Client: SHELL (UK) OIL PRODUCTS LTD

Site: SHELL FONTWELL

Project No: 310493



Boring Method: CP+RC

Date: 02/08/2007 - 02/08/2007

Driller: CC Ground Investigation Ltd

Logged By: Jack Dobson

Ground Level (mASD):

49.232m

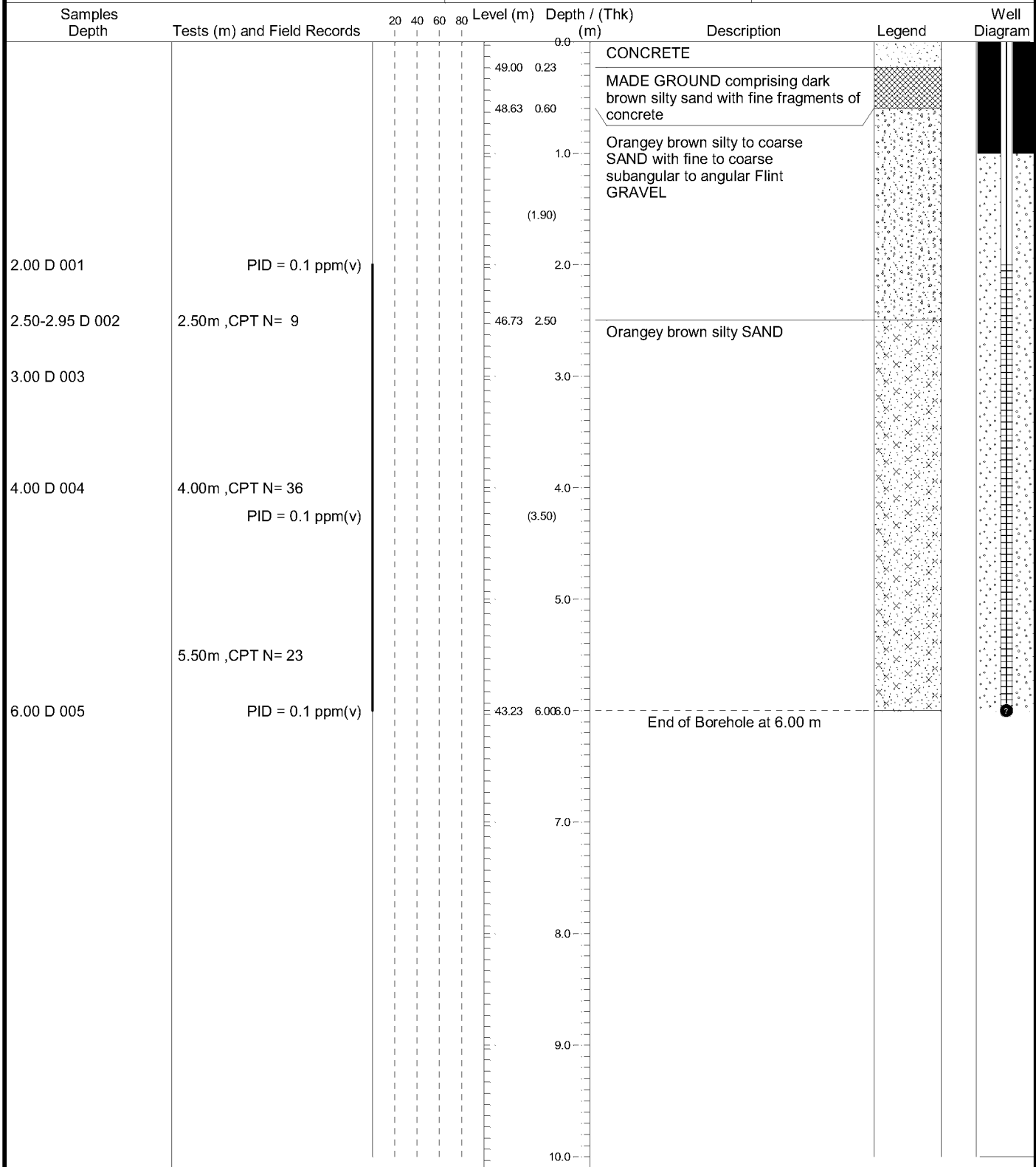
Top of Casing Elevation (mASD):

49.214

Record of : MW7

1 of 1

Scale, 1:50

**General Remarks:**

Installation details: Fitted with 50mm HDPE monitoring well.
Screened from 6.0m bgl to 2.0m bgl, casing from 2.0m bgl to GL.
Gravel filter pack from 6.0m bgl to 1.0m bgl. Bentonite seal from 1.0 to 0.10. Fitted with a traffic rated cover and two end caps.

RSK GROUP PLC.
Green Farm Business Park, Latteridge Green.
Folly Road, Bristol. BS37 9TS.

15:28:41 - 26/10/2007

Water StrikesStrike
☒

No Groundwater Encountered

Level
☒**Chiselling**From:
(m)To:
(m)Time:
(hr's)**Borehole and Casing Details****Borehole**Depth
(m)Diam.
(mm)**Casing**Depth
(m)Diam.
(mm)

Appendix III

Certificates of Chemical Soil Analysis

Date: 21 August 2007
Your Ref: 310493
Our Ref: 310493-(2506)-011
Project Manager: Jack Dobson
Report to: Jack Dobson

Envirolab
Units 7 & 8
Sandpits Business Park
Mottram Road
Hyde
Cheshire
SK14 3AR

Final Test Report

Sample(s) of Soil from Shell UK Ltd, Fontwell.
Received from RSK Group plc
Green Farm Business Park, Latteridge Green, Iron Acton, Bristol, BS37 9TS

Date of receipt 08 August 2007
Date of analysis 08 August 2007

Method Statement

Speciated TPH, TAME and TEL analysis is performed in accordance with procedures A-T-022 using GC-MS with Head Space & A-T-023 using GC-FID.

Subcontract analysis was submitted to a laboratory on Envirolab's approved vendors list.
A copy of the report is attached, UKAS/MCERTS status is detailed on the report.

Prepared by:

Approved by:

Melanie Marshall
Lab Coordinator

Louise Adams
Associate Director - Operations



Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.
Tests marked "***" in this report are not included in the UKAS Accreditation Schedule for Envirolab.
Analytical results reflect the quality of the sample at the time of analysis only.

Envirolab Ref.	PROCEDURE	ISO17025	67044	67045	67046	67047	67048	67049	67050	67051	67052	67053
Location			MW1	MW1	MW1	MW2	MW2	MW2	MW4	MW5	MW5	MW5
Depth (m)			2.0	4.0	5.7	2.0	4.0	6.0	4.0	2.0	4.0	7.0
TAME _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
TEL _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
MTBE _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzene _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Toluene _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ethyl Benzene _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
m & p Xylene _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
o Xylene _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aliphatics C5-C6 _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aliphatics >C6-C8 _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aliphatics >C8-C10 _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aliphatics >C10-C12 _R	A-T-023	Y	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aliphatics >C12-C16 _R	A-T-023	Y	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aliphatics >C16-C21 _R	A-T-023	Y	15.9	3.0	3.5	3.8	3.9	4.0	3.5	3.7	2.9	3.9
Aliphatics >C21-C36 _R	A-T-023	Y	74.0	0.9	3.9	<0.1	4.8	<0.1	<0.1	<0.1	<0.1	<0.1
Total Aliphatics		Y	89.90	3.90	7.40	3.80	8.70	4.00	3.50	3.70	2.90	3.90
Aromatics >C5-C6 _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aromatics >C6-C8 _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aromatics >C8-C10 _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aromatics >C10-C12 _R	A-T-023	Y	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aromatics >C12-C16 _R	A-T-023	Y	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aromatics >C16-C21 _R	A-T-023	Y	2.2	3.0	3.1	3.4	4.4	4.0	2.8	3.7	3.2	3.9
Aromatics >C21-C36 _R	A-T-023	Y	<0.1	1.7	2.3	2.3	2.6	3.6	<0.1	3.7	0.4	<0.1
Total Aromatics		Y	2.20	4.70	5.40	5.70	7.00	7.60	2.80	7.40	3.60	3.90
TPH (Aliphatics & Aromatics)		Y	92.10	8.60	12.80	9.50	15.70	11.60	6.30	11.10	6.50	7.80

Table 1 - Soil Speciated TPH Results (mg/kg)

Envirolab Ref.	PROCEDURE	ISO17025	67054	67055	67056	67057	67058	67059	67253	67254	67255	
Location			MW7	MW7	Duplicate	BH6	BH6	BH6	MW7	MW4	MW4	
Depth (m)			2.0	4.0	-	2.0	4.0	5.5	6.0	2.0	6.0	
TAME _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
TEL _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
MTBE _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Benzene _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Toluene _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Ethyl Benzene _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
m & p Xylene _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
o Xylene _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Aliphatics C5-C6 _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Aliphatics >C6-C8 _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Aliphatics >C8-C10 _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Aliphatics >C10-C12 _R	A-T-023	Y	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Aliphatics >C12-C16 _R	A-T-023	Y	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Aliphatics >C16-C21 _R	A-T-023	Y	3.8	3.6	3.9	3.9	3.3	3.0	3.0	3.0	2.4	
Aliphatics >C21-C36 _R	A-T-023	Y	<0.1	1.1	<0.1	<0.1	<0.1	0.8	<0.1	<0.1	<0.1	
Total Aliphatics		Y	3.80	4.70	3.90	3.90	3.30	3.80	3.00	3.00	2.40	
Aromatics >C5-C6 _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Aromatics >C6-C8 _R	A-T-022	Y	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Aromatics >C8-C10 _R	A-T-022	Y	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Aromatics >C10-C12 _R	A-T-023	Y	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Aromatics >C12-C16 _R	A-T-023	Y	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
Aromatics >C16-C21 _R	A-T-023	Y	3.8	2.9	3.5	3.4	2.9	2.6	2.3	3.0	2.4	
Aromatics >C21-C36 _R	A-T-023	Y	3.8	<0.1	1.2	3.9	<0.1	<0.1	<0.1	<0.1	2.7	
Total Aromatics		Y	7.60	2.90	4.70	7.31	2.90	2.60	2.30	3.00	5.10	
TPH (Aliphatics & Aromatics)		Y	11.40	7.60	8.60	11.21	6.20	6.40	5.30	6.00	7.50	

Table 2 - Soil Speciated TPH Results (mg/kg)

Notes

1. For detailed matrix description please see attached sheet.
2. Analysis suffixed "D" were performed on the sample air dried at <30°C
3. Analysis suffixed "R" were performed on the sample as received. Where results are expressed on a dry weight basis, the samples were oven dried at 95°C.
4. Natural stones and debris are excluded from analyses.

Envirolab Ref.	67044	67045	67046	67047	67048	67049	67050	67051	67052	67053
Location	MW1	MW1	MW1	MW2	MW2	MW2	MW4	MW5	MW5	MW5
Depth (m)	2.0	4.0	5.7	2.0	4.0	6.0	4.0	2.0	4.0	7.0
Consistency	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Colour	Green/ Brown	Brown	Light Brown	Light Brown	Brown/ Grey	Brown/ Red	Light Brown	Light Brown	Light Brown	Brown/ Red
Soil Type	Sandy	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay
Comments	-	-	-	-	-	-	-	-	-	-

Table 3 - Soil Matrix Table

Envirolab Ref.	67054	67055	67056	67057	67058	67059	67253	67254	67255	
Location	MW7	MW7	Duplicate	BH6	BH6	BH6	MW7	MW4	MW4	
Depth (m)	2.0	4.0	-	2.0	4.0	5.5	6.0	2.0	6.0	
Consistency	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	
Colour	Brown	Light Brown	Light Brown	Light Brown	Light Brown	Brown/ Red	Red/ Brown	Light Brown	Light Brown	
Soil Type	Clay	Sandy	Sandy	Clay	Clay	Sandy	Clay	Clay	Clay	
Comments	-	-	-	-	-	-	-	-	-	

Table 4 - Soil Matrix Table

Gill Scott
Envirolab
7 & 8 Sandpits Business Park
Mottram Road
Hyde
Cheshire
SK14 3AR

17 August 2007

TEST REPORT

Our Report Number: 07-36578

Your Order Reference: 24542

13 soil samples submitted for analysis on 09/08/2007

Project Name: Fontwell

Project Code: 310493 - 2506

Laboratory analysis started on 09/08/2007

All laboratory analysis completed by 17 August 2007

Rhys Ashton
Project Co-Ordinator
ALCONTROL TECHNICHEM

Sharon Googh
Project Co-Ordinator
ALCONTROL TECHNICHEM

Test methods are documented in house procedures or where appropriate standard methods. Non accredited tests (if applicable) are identified on each page. Procedures for sampling are outside the scope of the laboratory UKAS accreditation. Opinions and interpretations expressed herein are outside the scope of our UKAS accreditation. All samples connected with this report, including any 'on hold', will be stored and disposed of according to company policy. A copy of this policy is available on request.

ALcontrol Technichem Sample Description

Job Number: 07-36578
Client: Envirolab
Project Code: 310493 - 2506

Matrix: Soil
Project Name: Fontwell

Laboratory Reference No	Sample Reference	Sample Depth (m)	Date Sampled	Sample Description
251947	67051 MW5	2	-	Light brown clay with gravel
251948	67052 MW5	4	-	Light brown sand
251949	67057 BH6	2	-	Light brown sand
251950	67058 BH6	4	-	Light brown sand
251951	67045 MW1	4	-	Light grey sand
251952	67048 MW2	4	-	Dark grey sandy clay
251953	67252 MW7	3	-	Light brown sand
251954	67054 MW7	2	-	Brown sandy clay with gravel
251955	67055 MW7	4	-	Light brown sand
251956	67253 MW7	6	-	Light brown sand with gravel
251957	67254 MW4	2	-	Light brown sand with gravel
251958	67050 MW4	4	-	Light brown clay
251959	67255 MW4	6	-	Light brown sandy clay

ALcontrol Technichem Table Of Results

Job Number : 07-36578
Matrix : Soil
Project Code: 310493 - 2506

Project Name: Fontwell
Client : Envirolab

[illegible]

[†] ISO 17025 accredited.

^M MCERTS accredited for sand, loam and clay.

ALcontrol Technichem Table Of Results

Job Number : 07-36578
Matrix : Soil
Project Code: 310493 - 2506

Project Name: Fontwell
Client : Envirolab

[illegible]

[‡] ISO 17025 accredited.

^M MCERTS accredited for sand, loam and clay.

ALcontrol Technichem Table Of Results

Job Number : 07-36578
Matrix : Soil
Project Code: 310493 - 2506

Project Name: Fontwell
Client : Envirolab

[illegible]

[‡] ISO 17025 accredited.

^M MCERTS accredited for sand, loam and clay.

ALcontrol Technichem

Table Of Results - Appendix

Job Number : 07-36578

Project Name: Fontwell

Client : Envirolab

Project Code: 310493 - 2506

Summary of methods contained within report :

Method No.	Reference	Description	Wet/Dry Analysis
074	In-house method based on BS1377 Part 3, "Chemical and Electrochemical Tests", 1990	Determination of 2:1 water soluble sulphate in soil samples by Inductively Coupled Plasma - Optical Emission Spectrometry (ICP-OES)	D
069S	In-house method based on MEWAM "Methods for the Determination of Metals in Soil", HMSO, 1986	Determination of metals in soil samples by aqua-regia digestion followed by ICP-OES detection	D
009S	In-house method based on BS1377: Part 3: 1990	Determination of pH by addition of water followed by electrometric measurement	D
092	In-house method	Determination of organic matter in soil samples by combustion analyser	D

Gill Scott
Envirolab
7 & 8 Sandpits Business Park
Mottram Road
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Cheshire
SK14 3AR

17 August 2007

TEST REPORT

Our Report Number: 07-36578a

Your Order Reference: 24542

2 soil samples submitted for analysis on 09/08/2007

Project Name: Fontwell

Project Code: 310493 - 2506

Laboratory analysis started on 09/08/2007

All laboratory analysis completed by 17 August 2007

Rhys Ashton
Project Co-Ordinator
ALCONTROL TECHNICHEM

Sharon Googh
Project Co-Ordinator
ALCONTROL TECHNICHEM

Test methods are documented in house procedures or where appropriate standard methods. Non accredited tests are identified in the appendix. Procedures for sampling are outside the scope of the laboratory UKAS accreditation. Opinions and interpretations expressed herein are outside the scope of our UKAS accreditation. All samples connected with this report , including any 'on hold', will be stored and disposed of according to company policy. A copy of this policy is available on request.

TEST REPORT

WAC ANALYTICAL RESULTS

Our Report No: 07-36578a

Your Order No: 24542

CLIENT: Envirolab

2 soil samples submitted for analysis on 09 August 2007

DATE OF ISSUE: 17 August 2007

Project Name: Fontwell

Project Code: 310493 - 2506

Lab Reference	251953				Landfill Waste Acceptance Criteria Limits		
Sampling Date	-				Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sample ID	67252 MW7						
Sample Depth (m)	3.0						
Solid Waste Analysis							
092 Total Organic Carbon (%)	< 0.1				3	5	6
019 Loss on Ignition (%)	< 1				-	-	10
071 Sum of BTEX (mg/kg)	<0.15				6	-	-
039 Sum of 7 PCBs (mg/kg)	<0.014				1	-	-
065 Mineral Oil (mg/kg)	< 25				500	-	-
022 PAH Sum of 17 (mg/kg)	<1.7				100	-	-
009 pH (pH Units)	8.3				-	>6	-
085 ANC to pH 6 (mol/kg)	< 0.10				-	to be evaluated	to be evaluated
085 ANC to pH 4 (mol/kg)	< 0.10				-	to be evaluated	to be evaluated
Eluate Analysis	2:1	8:1	2:1	Cumulative 10:1	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)		
	mg/l		mg/kg				
080 Arsenic	< 0.005	< 0.005	< 0.010	< 0.050	0.5	2	25
080 Barium	< 0.005	< 0.005	< 0.010	< 0.050	20	100	300
080 Cadmium	< 0.001	< 0.001	< 0.002	< 0.010	0.04	1	5
080 Chromium	< 0.005	< 0.005	< 0.010	< 0.050	0.5	10	70
080 Copper	< 0.005	< 0.005	< 0.010	< 0.050	2	50	100
080 Mercury	< 0.00005	< 0.00005	< 0.00010	< 0.00050	0.01	0.2	2
080 Molybdenum	< 0.005	< 0.005	< 0.010	< 0.050	0.5	10	30
080 Nickel	< 0.005	< 0.005	< 0.010	< 0.050	0.4	10	40
080 Lead	< 0.005	< 0.005	< 0.010	< 0.050	0.5	10	50
080 Antimony	< 0.001	< 0.001	< 0.002	< 0.010	0.06	0.7	5
080 Selenium	< 0.005	< 0.005	< 0.010	< 0.050	0.1	0.5	7
080 Zinc	< 0.005	< 0.005	< 0.010	< 0.050	4	50	200
086 Chloride	< 10	< 10	< 20	< 100	800	15000	25000
086 Fluoride	0.15	0.15	0.29	1.5	10	150	500
086 Sulphate as SO ₄	< 10	< 10	< 10	< 100	1000	20000	50000
029 Total Dissolved Solids	-	-	-	-	4000	60000	100000
020 Phenol Index	< 0.01	< 0.01	< 0.02	< 0.1	1	-	-
010 Dissolved Organic Carbon	< 5	< 5	< 10	< 50	500	800	1000
Leach Test Information							
084 pH (pH Units)	7.1	6.8					
084 Conductivity (µS/cm)	76	39					
078 Temperature (°C)	22.0	22.0					
021 Mass Sample (kg)	0.150						
021 Dry Matter (kg)	0.12						
021 Moisture (% Dry Weight)	21.6						
Stage 1							
078 Volume Leachant, L ₂ (l)	0.220						
078 Filtered Eluate Volume, VE ₁ (l)	0.084						
Stage 2							
078 Volume Leachant, L ₈ (l)	0.987						

Results are expressed on a dry weight basis, after correction for moisture content where applicable

Stated limits are for guidance only and ALcontrol cannot be held responsible for any discrepancies with current legislation

TEST REPORT

WAC ANALYTICAL RESULTS

Our Report No: 07-36578a

Your Order No: 24542

CLIENT: Envirolab

2 soil samples submitted for analysis on 09 August 2007

DATE OF ISSUE: 17 August 2007

Project Name: Fontwell

Project Code: 310493 - 2506

Lab Reference	251957				Landfill Waste Acceptance Criteria Limits		
Sampling Date	-				Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
Sample ID	67254 MW4						
Sample Depth (m)	2.0						
Solid Waste Analysis							
092 Total Organic Carbon (%)	< 0.1				3	5	6
019 Loss on Ignition (%)	< 1				-	-	10
071 Sum of BTEX (mg/kg)	<0.15				6	-	-
039 Sum of 7 PCBs (mg/kg)	<0.014				1	-	-
065 Mineral Oil (mg/kg)	< 25				500	-	-
022 PAH Sum of 17 (mg/kg)	<1.7				100	-	-
009 pH (pH Units)	7.3				-	>6	-
085 ANC to pH 6 (mol/kg)	< 0.10				-	to be evaluated	to be evaluated
085 ANC to pH 4 (mol/kg)	< 0.10				-	to be evaluated	to be evaluated
Eluate Analysis	2:1	8:1	2:1	Cumulative 10:1	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)		
	mg/l		mg/kg				
080 Arsenic	< 0.005	< 0.005	< 0.010	< 0.050	0.5	2	25
080 Barium	< 0.005	< 0.005	< 0.010	< 0.050	20	100	300
080 Cadmium	< 0.001	< 0.001	< 0.002	< 0.010	0.04	1	5
080 Chromium	< 0.005	< 0.005	< 0.010	< 0.050	0.5	10	70
080 Copper	< 0.005	< 0.005	< 0.010	< 0.050	2	50	100
080 Mercury	< 0.00005	< 0.00005	< 0.00010	< 0.00050	0.01	0.2	2
080 Molybdenum	< 0.005	< 0.005	< 0.010	< 0.050	0.5	10	30
080 Nickel	< 0.005	< 0.005	< 0.010	< 0.050	0.4	10	40
080 Lead	< 0.005	< 0.005	< 0.010	< 0.050	0.5	10	50
080 Antimony	< 0.001	< 0.001	< 0.002	< 0.010	0.06	0.7	5
080 Selenium	< 0.005	< 0.005	< 0.010	< 0.050	0.1	0.5	7
080 Zinc	< 0.005	< 0.005	< 0.010	< 0.050	4	50	200
086 Chloride	< 10	< 10	< 20	< 100	800	15000	25000
086 Fluoride	0.18	0.16	0.36	1.7	10	150	500
086 Sulphate as SO ₄	< 10	< 10	< 10	< 100	1000	20000	50000
029 Total Dissolved Solids	-	-	-	-	4000	60000	100000
020 Phenol Index	< 0.01	< 0.01	< 0.02	< 0.1	1	-	-
010 Dissolved Organic Carbon	< 5	< 5	< 10	< 50	500	800	1000
Leach Test Information							
084 pH (pH Units)	7.0	6.6					
084 Conductivity (µS/cm)	76	39					
078 Temperature (°C)	22.0	22.0					
021 Mass Sample (kg)	0.150						
021 Dry Matter (kg)	0.13						
021 Moisture (% Dry Weight)	19.7						
Stage 1							
078 Volume Leachant, L ₂ (l)	0.226						
078 Filtered Eluate Volume, VE ₁ (l)	0.120						
Stage 2							
078 Volume Leachant, L ₈ (l)	1.000						

Results are expressed on a dry weight basis, after correction for moisture content where applicable

Stated limits are for guidance only and ALcontrol cannot be held responsible for any discrepancies with current legislation

Waste Acceptance Method Appendix

Our Report No: 07-36578a

Your Order No: 24542

CLIENT: Envirolab

DATE OF ISSUE: 17 August 2007

Project Name: Fontwell

Project Code: 310493 - 2506

Method Reference / Parameter	Extraction Summary	Detection Technique	ISO17025 Accredited?
Solid Waste Analysis			
092 Total Organic Carbon		Carbon Analyser	✓
019 Loss on Ignition	Oven heated at 450°C	Gravimetry	✓
071 Sum of BTEX	Headspace	GC-MS	
Benzene			✓
Toluene			✓
Ethylbenzene			✓
m,p-Xylenes			✓
o-Xylene			✓
039 Sum of 7 PCBs	Hexane / acetone	GC-MS	
PCB Congener 28			✓
PCB Congener 52			✓
PCB Congener 101			✓
PCB Congener 118			✓
PCB Congener 138			✓
PCB Congener 153			✓
PCB Congener 180			✓
065 Mineral Oil (C ₈ -C ₄₀)	Hexane / acetone with silica / alumina clean-up	GC-FID	✗
022 PAH (Sum of 17 listed)	Hexane / acetone	GC-MS	
Naphthalene			✓
Acenaphthylene			✓
Acenaphthene			✓
Fluorene			✓
Phenanthrene			✓
Anthracene			✓
Fluoranthene			✓
Pyrene			✓
Benzo (a) anthracene			✓
Chrysene			✓
Benzo (b) fluoranthene			✓
Benzo (k) fluoranthene			✓
Benzo (a) pyrene			✓
Indeno (1,2,3-cd) pyrene			✓
Dibenzo (a,h) anthracene			✓
Benzo (g,h,i) perylene			✓
Coronene			✓
009 pH	Water addition	Potentiometric	✓
085 Acid Neutralisation Capacity (ANC)	Water addition	Titration	✗
021 Moisture Content	Dried at 105 (+/-5) °C	Gravimetry	✓
Leachate Analysis†			
078 Leachate Preparation	In accordance with BS EN 12457-3	-	✗
080 Metals	Nitric acidification	ICP-MS	✓
086 Chloride	-	Ion chromatography	✓
086 Fluoride	-	Ion chromatography	✓
086 Sulphate	-	Ion chromatography	✓
029 Total Dissolved Solids	Evaporation	Gravimetry	✓
020 Monohydric Phenols (Phenol Index)	-	HPLC - electrochemical detection	✓
010 Dissolved Organic Carbon	Persulphate oxidation	Infra-red detection	✓
084 pH	-	pH meter	✓
084 Conductivity	-	Conductivity meter	✓

†Note: ISO17025 accreditation does not cover leachate analysis as the preparation stage is not accredited

Appendix IV

Certificates of Geotechnical Soil Analysis

SUMMARY OF CHEMICAL ANALYSES

In accordance with clauses 5, 9 of BS1377:Part 3:1990.

Hole Reference	Sample No	Sample Type	Depth m	Sulphate (SO ₄) Content #			Chloride Content		pH Value	Percent Passing 2 mm %	Description
				Acid Soluble Sulphate as % SO ₄	Aqueous Extract as g/l SO ₄ ⁺	Ground-water as g/l SO ₄	Soluble Chloride as % Cl	Ground-water as g/l Cl			
MW4		D	3.00		0.02				5.5	92	Brown mottled orange and grey slightly gravelly slightly sandy CLAY
MW4		D	4.00		0.01				8.3	91	Brown mottled orange slightly gravelly sandy SILT
MW4		D	6.00		0.01				8.3	91	Orangish brown slightly gravelly sandy CLAY
MW7		D	2.00		0.03				8.2	29	Brown sandy clayey/silty GRAVEL
MW7		D	4.00		0.01				8.2	100	Brown mottled orange sandy SILT
MW7		D	6.00		0.01				8.3	87	Pale grey mottled orangish brown slightly gravelly sandy CLAY

NOTES : + In 2:1 water:soil extract

Calculated as SO₃ to BS1377:Part 3:1990, reported as SO₄ (SO₄ = SO₃ x 1.2)

All chemical tests were undertaken by an external laboratory.

SO₄ results for soil are for material <2mm

Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON A. LENNON

 STRUCTURAL SOILS The Old School Stillhouse Lane Bedminster Bristol BS3 4EB	Compiled By	Date	Checked By	Date	Job No
		13.09.07			740197
	Contract Shell Fontwell				Page of



PARTICLE SIZE DISTRIBUTION TEST

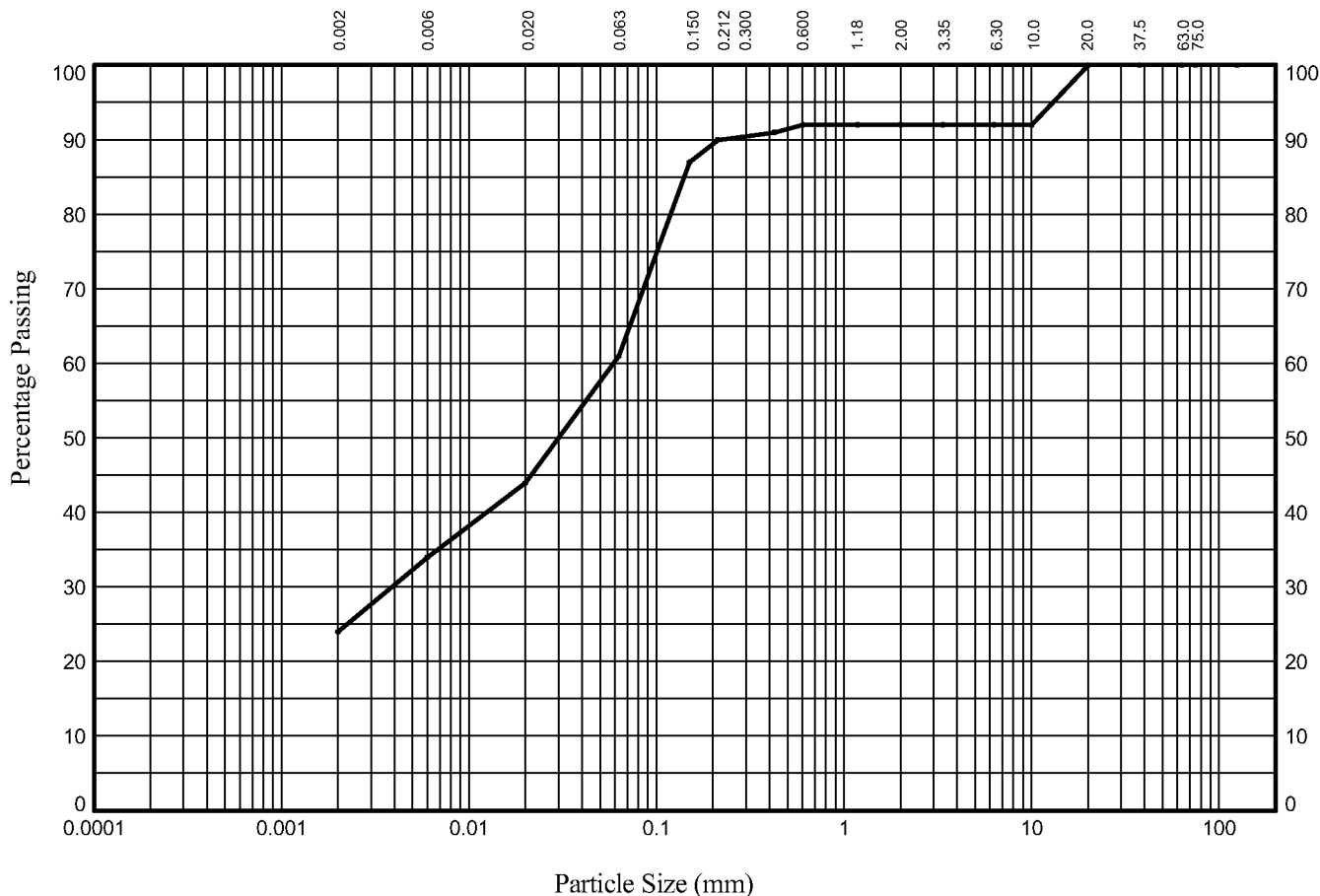
In accordance with clauses 9.2,9.3 of BS1377:Part 2:1990

Hole ID : **MW4**

Sample Ref :

Sample Type : **D**

Depth (m) : **3.00**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	SILT			SAND			GRAVEL			

BS Test Sieve (mm)	Percentage Passing
125.0	100
75.0	100
63.0	100
37.5	100
20.0	100
10.0	92
6.30	92
5.00	92
3.35	92
2.00	92
1.18	92
0.600	92
0.425	91
0.300	90
0.212	87
0.150	87
0.063	61

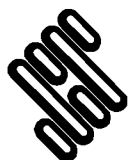
Particle Diameter	Percentage Passing
0.02	44
0.006	34
0.002	24

Soil Fraction	Sieve Percentage
GRAVEL	8
SAND	31
SILT	37
CLAY	24

Soil Description:

Brown mottled orange and grey slightly gravelly slightly sandy CLAY

Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON A. LENNON



STRUCTURAL SOILS

The Old School
Stillhouse Lane
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			AGS

PARTICLE SIZE DISTRIBUTION TEST

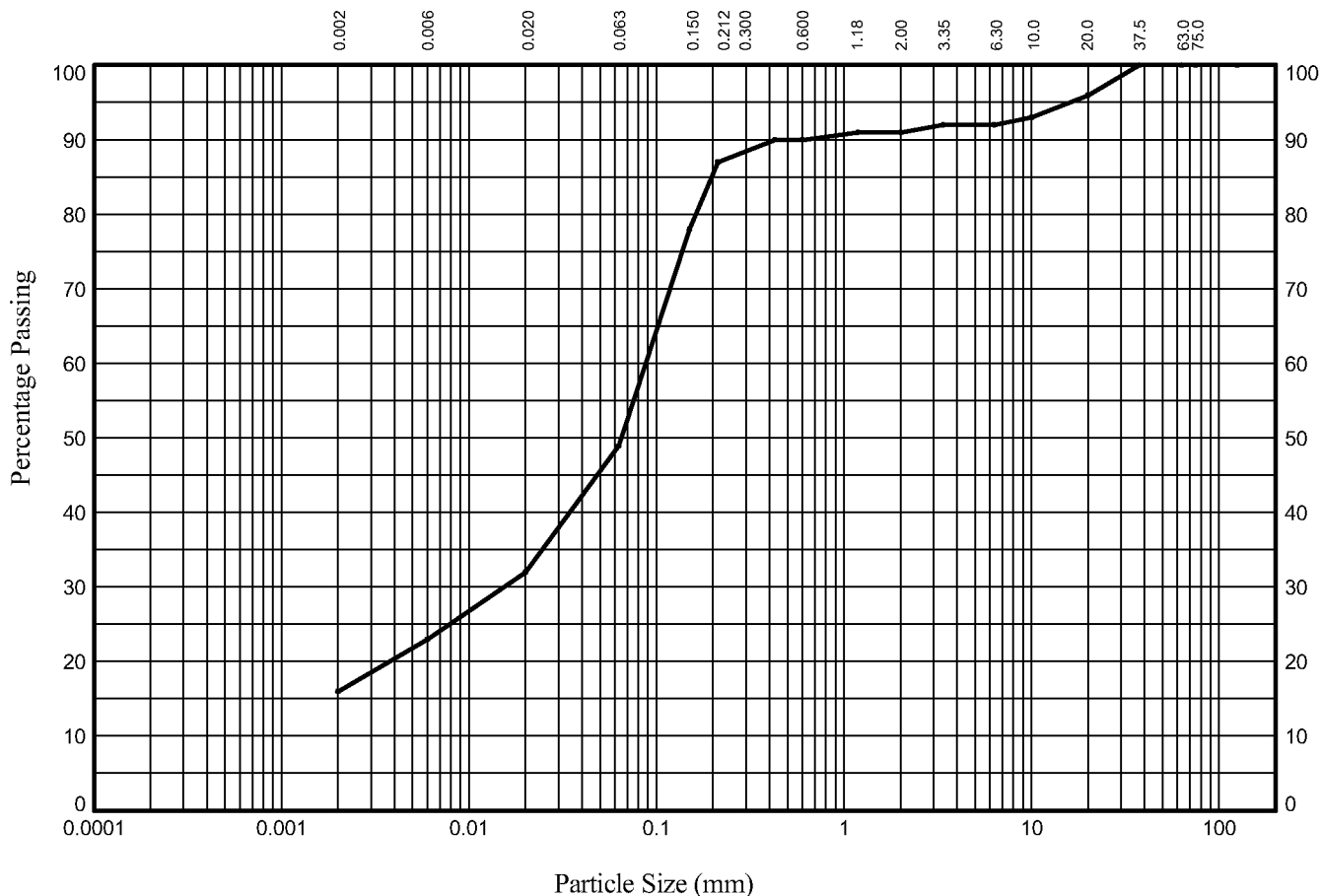
In accordance with clauses 9.2,9.3 of BS1377:Part 2:1990

Hole ID : **MW4**

Sample Ref :

Sample Type : **D**

Depth (m) : **4.00**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	SILT			SAND			GRAVEL			

BS Test Sieve (mm)	Percentage Passing
125.0	100
75.0	100
63.0	100
37.5	100
20.0	96
10.0	93
6.30	92
5.00	92
3.35	92
2.00	91
1.18	91
0.600	90
0.425	90
0.300	87
0.212	87
0.150	78
0.063	49

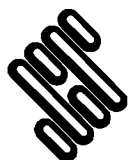
Particle Diameter	Percentage Passing
0.02	32
0.006	23
0.002	16

Soil Fraction	Sieve Percentage
GRAVEL	9
SAND	42
SILT	33
CLAY	16

Soil Description:

Brown mottled orange slightly gravelly sandy SILT

Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON A. LENNON



STRUCTURAL SOILS

The Old School
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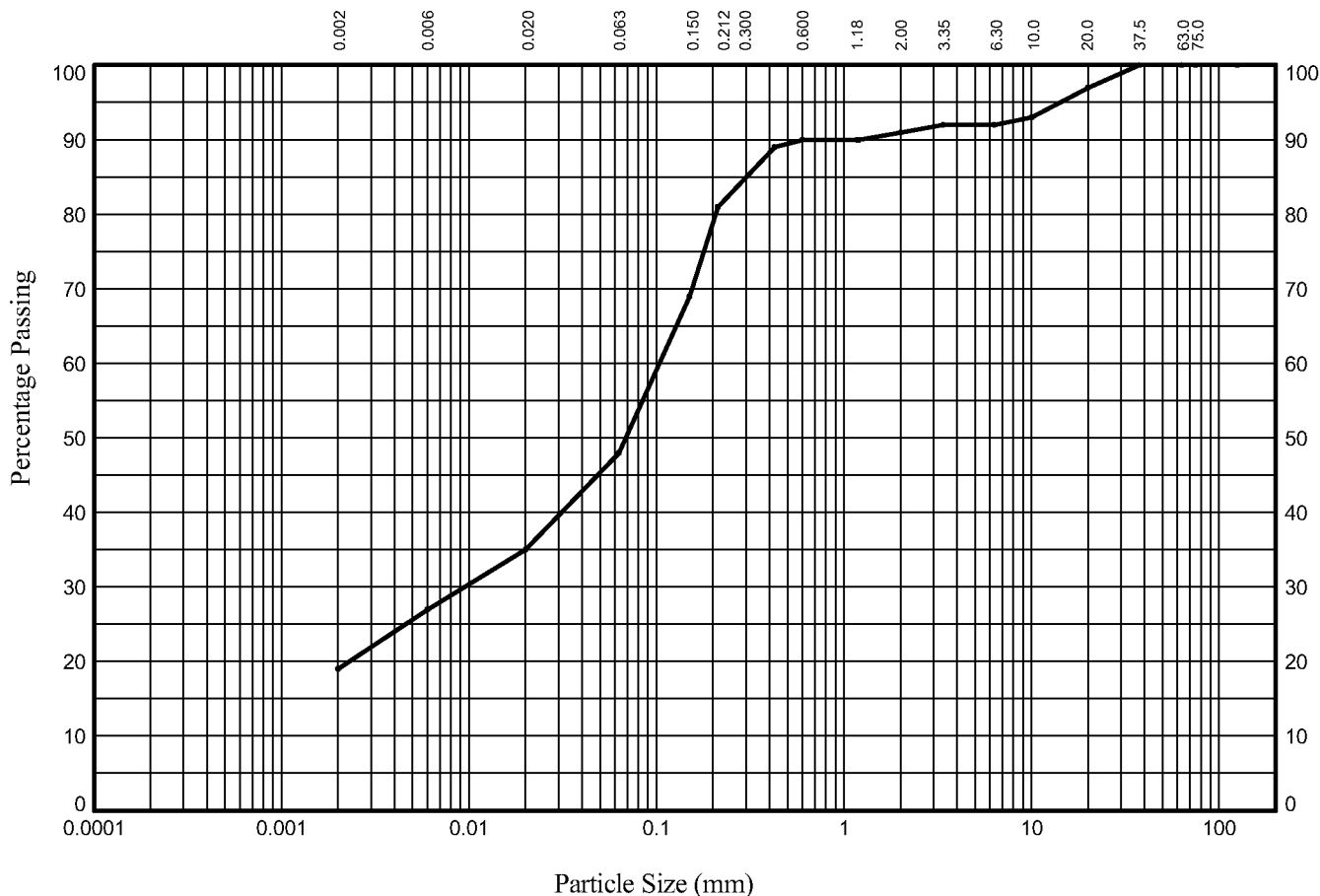
In accordance with clauses 9.2,9.3 of BS1377:Part 2:1990

Hole ID : **MW4**

Sample Ref :

Sample Type : **D**

Depth (m) : **6.00**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	SILT			SAND			GRAVEL			

BS Test Sieve (mm)	Percentage Passing
125.0	100
75.0	100
63.0	100
37.5	100
20.0	97
10.0	93
6.30	92
5.00	92
3.35	92
2.00	91
1.18	90
0.600	90
0.425	89
0.300	81
0.212	69
0.150	48
0.063	19

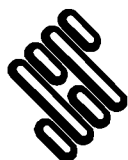
Particle Diameter	Percentage Passing
0.02	35
0.006	27
0.002	19

Soil Fraction	Sieve Percentage
GRAVEL	9
SAND	43
SILT	29
CLAY	19

Soil Description:

Orangish brown slightly gravelly sandy CLAY

Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON A. LENNON



STRUCTURAL SOILS

The Old School
Stillhouse Lane
Bedminster
Bristol BS3 4EB

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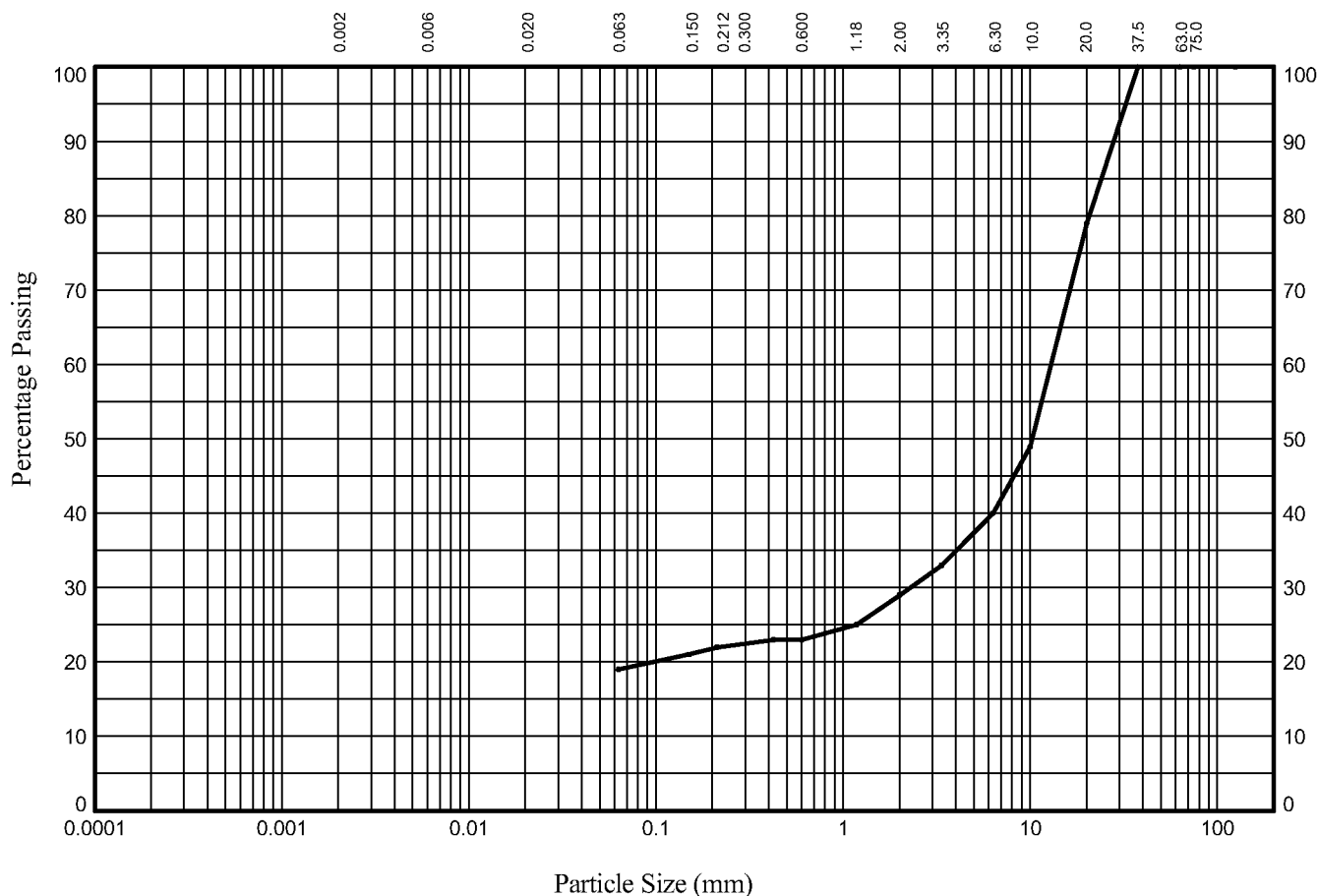
In accordance with clauses 9.2,9.3 of BS1377:Part 2:1990
NON STANDARD TEST

Hole ID : MW7

Sample Ref :

Sample Type : D

Depth (m) : **2.00**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	SILT			SAND			GRAVEL			

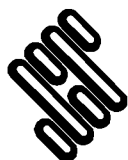
BS Test Sieve (mm)	Percentage Passing
125.0	100
75.0	100
63.0	100
37.5	100
20.0	79
10.0	49
6.30	40
5.00	
3.35	33
2.00	29
1.18	25
0.600	23
0.425	23
0.300	
0.212	22
0.150	21
0.063	19

Particle Diameter	Percentage Passing

Soil Fraction	Sieve Percentage
GRAVEL	71
SAND	10
SILT/CLAY	19

Soil Description:
Brown sandy clayey/silty GRAVEL

Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON A. LENNON



STRUCTURAL SOILS

The Old School
Stillhouse Lane
Bedminster
Bristol BS3 4EB

Compiled By	Date	Checked By	Date
	13/09/07		
Contract Shell Fontwell		Job No	740197
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PARTICLE SIZE DISTRIBUTION TEST

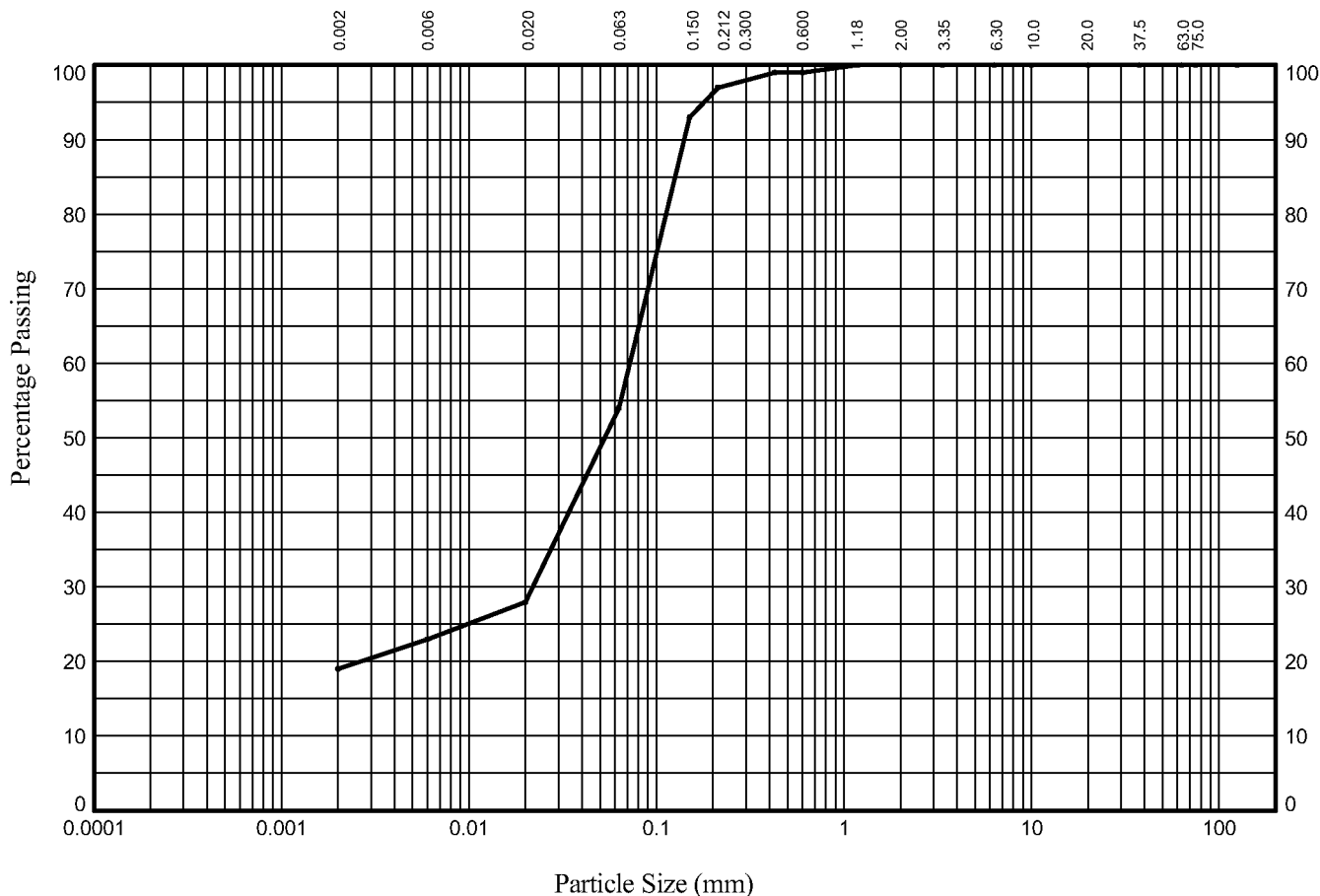
In accordance with clauses 9.2,9.3 of BS1377:Part 2:1990

Hole ID : **MW7**

Sample Ref :

Sample Type : **D**

Depth (m) : **4.00**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	SILT			SAND			GRAVEL			

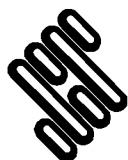
BS Test Sieve (mm)	Percentage Passing
125.0	100
75.0	100
63.0	100
37.5	100
20.0	100
10.0	100
6.30	100
5.00	100
3.35	100
2.00	100
1.18	100
0.600	99
0.425	99
0.300	97
0.212	93
0.150	93
0.063	54

Particle Diameter	Percentage Passing
0.02	28
0.006	23
0.002	19

Soil Fraction	Sieve Percentage
GRAVEL	0
SAND	46
SILT	35
CLAY	19

Soil Description:
Brown mottled orange sandy SILT

Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON A. LENNON



STRUCTURAL SOILS

The Old School
Stillhouse Lane
Bedminster
Bristol BS3 4EB

Compiled By	Date	Checked By	Date
	13/09/07		
Contract		Job No	
Shell Fontwell		740197	
		Page	of
			AGS

PARTICLE SIZE DISTRIBUTION TEST

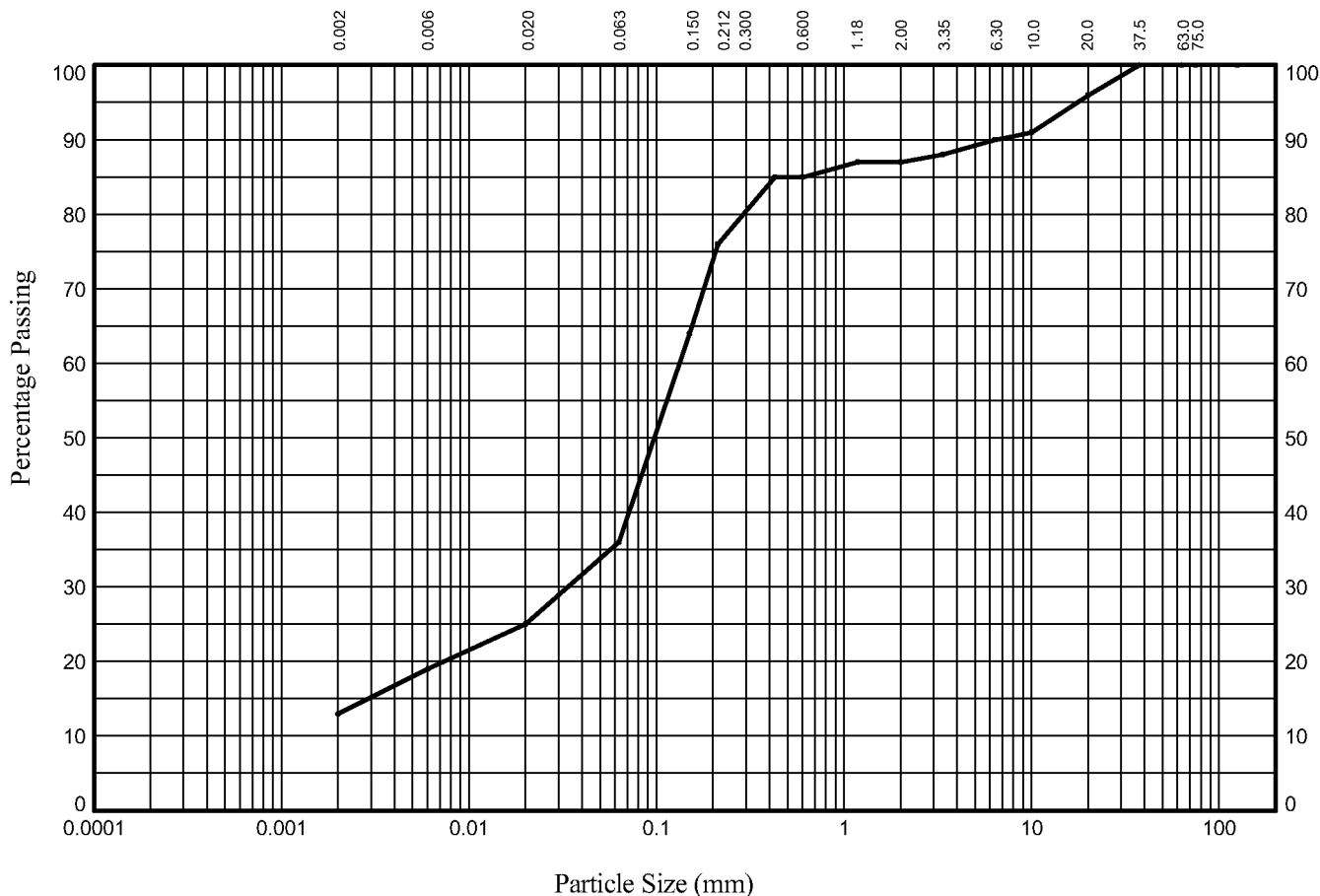
In accordance with clauses 9.2,9.3 of BS1377:Part 2:1990

Hole ID : **MW7**

Sample Ref :

Sample Type : **D**

Depth (m) : **6.00**



CLAY	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	COBBLES
	SILT			SAND			GRAVEL			

BS Test Sieve (mm)	Percentage Passing
125.0	100
75.0	100
63.0	100
37.5	100
20.0	96
10.0	91
6.30	90
5.00	
3.35	88
2.00	87
1.18	87
0.600	85
0.425	85
0.300	
0.212	76
0.150	64
0.063	36

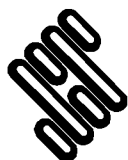
Particle Diameter	Percentage Passing
0.02	25
0.006	19
0.002	13

Soil Fraction	Sieve Percentage
GRAVEL	13
SAND	51
SILT	23
CLAY	13

Soil Description:

Pale grey mottled orangish brown slightly gravelly sandy CLAY

Approved Signatories: D. TROWBRIDGE A. FROST F. HAMILTON A. LENNON



STRUCTURAL SOILS

The Old School
Stillhouse Lane
Bedminster
Bristol BS3 4EB

Compiled By		Date	Checked By		Date
		13/09/07			
Contract			Job No		
Shell Fontwell			740197		
			Page		
			of		



Appendix V

Certificates of Chemical Groundwater Analysis

Date: 23 August 2007
Your Ref: 310493
Our Ref: 310493-(2589)-020
Project Manager: Jack Dobson
Report to: Jack Dobson

Envirolab
Units 7 & 8
Sandpits Business Park
Mottram Road
Hyde
Cheshire
SK14 3AR

Final Test Report

Sample(s) of Water from Shell UK Ltd, Fontwell.
Received from RSK Group plc
Green Farm Business Park, Latteridge Green, Iron Acton, Bristol, BS37 9TS

Date of receipt 16 August 2007
Date of analysis 16 August 2007

Method Statement

Speciated TPH, TAME and TEL analysis is performed in accordance with procedures A-T-022 using GC-MS with Head Space & A-T-023 using GC-FID.

Prepared by:

Approved by:

Thi Pham
Analytical Chemist

Louise Adams
Associate Director - Operations



Opinions and interpretations expressed herein are outside the scope of UKAS accreditation.
Tests marked "***" in this report are not included in the UKAS Accreditation Schedule for Envirolab.
Analytical results reflect the quality of the sample at the time of analysis only.

Envirolab Ref.	PROCEDURE	ISO17025	67978	67979	67980	67981	67982					
Location			MW2	MW7	MW4	MW5	Duplicate					
Depth (m)			1.25	2.50	1.50	1.50	-					
TAME _R	A-T-022	Y	<1	<1	<1	<1	<1					
TEL _R	A-T-022	Y	<1	<1	<1	<1	<1					
MTBE _R	A-T-022	Y	<1	<1	<1	<1	<1					
Benzene _R	A-T-022	Y	<1	<1	<1	<1	<1					
Toluene _R	A-T-022	Y	<1	<1	<1	<1	<1					
Ethyl Benzene _R	A-T-022	Y	<1	<1	<1	<1	<1					
m & p Xylene _R	A-T-022	Y	1	<1	<1	<1	1					
o Xylene _R	A-T-022	Y	<1	<1	<1	<1	<1					
Aliphatics C5-C6 _R	A-T-022	Y	1	1	1	<1	1					
Aliphatics >C6-C8 _R	A-T-022	Y	<1	<1	<1	<1	<1					
Aliphatics >C8-C10 _R	A-T-022	Y	3	5	<1	<1	2					
Aliphatics >C10-C12 _R	A-T-023	Y	<5	<5	<5	<5	<5					
Aliphatics >C12-C16 _R	A-T-023	Y	<5	<5	<5	<5	<5					
Aliphatics >C16-C21 _R	A-T-023	Y	<5	<5	<5	<5	<5					
Aliphatics >C21-C36 _R	A-T-023	Y	<5	<5	<5	<5	<5					
Total Aliphatics		Y	3	6	1	<5	3					
Aromatics >C5-C6 _R	A-T-022	Y	<1	<1	<1	<1	<1					
Aromatics >C6-C8 _R	A-T-022	Y	<1	<1	<1	<1	<1					
Aromatics >C8-C10 _R	A-T-022	Y	1	1	<1	<1	1					
Aromatics >C10-C12 _R	A-T-023	Y	<5	<5	<5	<5	<5					
Aromatics >C12-C16 _R	A-T-023	Y	<5	<5	<5	<5	<5					
Aromatics >C16-C21 _R	A-T-023	Y	<5	<5	<5	<5	<5					
Aromatics >C21-C36 _R	A-T-023	Y	<5	<5	<5	<5	<5					
Total Aromatics		Y	1	1	<5	<5	1					
TPH (Aliphatics & Aromatics)		Y	5	6	1	<5	4					

Table 1 - Water Speciated TPH Results (µg/l)

Notes

1. Analyses suffixed "R" were performed on the sample 'as received'.

Appendix VI

Groundwater Data Report

	RSK Geoconsult Ltd 18 Frogmore Road, Hemel Hempstead, Herts, HP3 9RT Tel: +44 (0)1442 437500 Fax: +44 (0)1442 437550 www.rsk.co.uk

Site Name:	Shell Fontwell
File Number:	310493
Date:	14.08.07
Well ID:	MW2

1. Water Level Data: (Measured to the top of casing)

Total Well Length: 5.456m	Length of Water Column: 4.524m	Free Product: None
Water table depth: 0.932m	Calculated System Volume: 9.95 litres	Casing Diameter and Material: 5mm HDPE

2. Well Purging Methods:

Field Testing Equipment	Make	Model	Serial Number
	YSI	556 MPS	05F2447AE
	Geotechnical Instruments	IM1.1-30	75991-05
	Eijkelpamp	Peristaltic Pump 12VDC	26061117

Time (24Hr)	Volume Removed (Litres)	Temp (°C)	pH	Spec. Cond (us/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Flow Rate (ml/min)	Drawdown (Feet)	Colour/Odour
09.30			19.54	688	9.97	7.08		200		Clear, no odour
09.31			19.52	687	9.97	6.98		200		Clear
09.32			19.48	685	9.97	6.72		200		Clear
09.33			19.38	681	9.97	5.68		200		Clear
09.34			19.16	678	9.92	5.56		200		Clear
09.35			18.95	684	9.83	5.02		200		Clear
09.40			18.92	684	9.83	4.98		200		Clear
09.45			18.89	684	9.84	4.92		200		Clear
09.50			18.88	684	9.85	4.90		200		Clear

Acceptance criteria pass/fail	Yes	No	N/A
Has required volume been removed	/		
Have parameters stabilized	/		

3. Sample Collection

Sample ID	Container Type	No. Containers	Preservation	Analysis Req.	Time
MW1	40ml Vial	2	Cool box		09.58
MW2	1 litre bottle	1	Cool box		09.58

Signature E Gould

Date 13.08.07

	RSK Geoconsult Ltd 18 Frogmore Road, Hemel Hempstead, Herts, HP3 9RT Tel: +44 (0)1442 437500 Fax: +44 (0)1442 437550 www.rsk.co.uk		

Site Name:	Shell Fontwell	DUPLICATE TAKEN
File Number:	310493	
Date:	14.08.07	
Well ID:	MW4	

1. Water Level Data: (Measured to the top of casing)

Total Well Length:	Length of Water Column:	Free Product: None
Water table depth:	Calculated System Volume:	Casing Diameter and Material: 5mm HDPE

2. Well Purging Methods:

Field Testing Equipment	Make	Model	Serial Number
	YSI	556 MPS	05F2447AE
	Geotechnical Instruments	IM1.1-30	75991-05
	Eijkelkamp	Peristaltic Pump 12VDC	26061117

Time (24Hr)	Volume Removed (Litres)	Temp (°C)	pH	Spec. Cond (us/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Flow Rate (ml/min)	Drawdown (Feet)	Colour/Odour
11.56		19.23	11.76	989	8.54	-164.9		200		Clear, slight odour
11.57		19.24	11.87	989	7.34	-151.2		200		Clear, slight odour
11.58		19.25	12.45	984	6.21	-152.9		200		Clear, slight odour
11.59		19.26	12.50	979	4.05	-150.4		200		Clear, slight odour
12:00		19.26	12.58	978	3.78	-143.4		200		Clear
12:05		19.27	12.62	964	3.24	-144.5		200		Clear
12:10		19.27	12.69	952	2.95	-140.1		200		Clear
12:15		19.27	12.69	946	2.52	-145.5		200		Clear
12:20		19.27	12.69	946	2.31	-144.7		200		Clear

Acceptance criteria pass/fail	Yes	No	N/A
Has required volume been removed	/		
Has required turbidity been reached			/
Have parameters stabilized	/		

3. Sample Collection

Sample ID	Container Type	No. Containers	Preservation	Analysis Req.	Time
MW2	40ml Vial	2	Cool box		12:30
MW2	1 litre bottle	1	Cool box		12:30

Signature E Gould

Date 13.08.07

	RSK Geoconsult Ltd 18 Frogmore Road, Hemel Hempstead, Herts, HP3 9RT Tel: +44 (0)1442 437500 Fax: +44 (0)1442 437550 www.rsk.co.uk

Site Name:	Shell Fontwell
File Number:	310493
Date:	13.08.07
Well ID:	MW5

1. Water Level Data: (Measured to the top of casing)

Total Well Length: 5.783m	Length of Water Column: 3.998m	Free Product: None
Water table depth: 1.785m	Calculated System Volume: 8.79 litres	Casing Diameter and Material: 5mm HDPE

2. Well Purging Methods:

Field Testing Equipment	Make	Model	Serial Number
	YSI	556 MPS	05F2447AE
	Geotechnical Instruments	IM1.1-30	75991-05
	Eijkelkamp	Peristaltic Pump 12VDC	26061117

Time (24Hr)	Volume Removed (Litres)	Temp (°C)	pH	Spec. Cond (us/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Flow Rate (ml/min)	Drawdown (Feet)	Colour/Odour
12:50		19.54	11.62	989	9.97	-184.6		200		Clear, slight odour
12:51		19.54	11.85	989	7.64	-181.1		200		Clear, slight odour
12:52		19.54	12.00	984	6.72	-172.7		200		Clear, slight odour
12:53		19.52	12.42	979	4.58	-170.3		200		Clear, slight odour
12:54		19.52	12.49	978	3.49	-173.4		200		Clear
12:55		19.52	12.53	964	3.17	-174.4		200		Clear
13:00		19.52	12.62	952	2.97	-170.1		200		Clear
13:05		19.52	12.61	946	2.78	-165.7		200		Clear
13:10		19.52	12.61	946	2.76	-164.3		200		Clear

Acceptance criteria pass/fail	Yes	No	N/A
Has required volume been removed	/		
Has required turbidity been reached			/
Have parameters stabilized	/		

3. Sample Collection

Sample ID	Container Type	No. Containers	Preservation	Analysis Req.	Time
MW3	40ml Vial	2	Cool box		13:20
MW3	1 litre bottle	1	Cool box		13:20

Signature E Gould

Date 13.08.07

	RSK Geoconsult Ltd 18 Frogmore Road, Hemel Hempstead, Herts, HP3 9RT Tel: +44 (0)1442 437500 Fax: +44 (0)1442 437550 www.rsk.co.uk		

Site Name:	Shell Fontwell	DUPLICATE TAKEN
File Number:	310493	
Date:	13.08.07	
Well ID:	MW7	

1. Water Level Data: (Measured to the top of casing)

Total Well Length:	Length of Water Column:	Free Product:
Water table depth:	Calculated System Volume:	Casing Diameter and Material:

2. Well Purging Methods:

Field Equipment	Testing	Make	Model	Serial Number
	YSI		556 MPS	05F2447AE
	Geotechnical Instruments		IM1.1-30	75991-05
	Eijkelpomp		Peristaltic Pump 12VDC	26061117

Time (24Hr)	Volume Removed (Litres)	Temp (°C)	pH	Spec. Cond (us/cm)	DO (mg/L)	ORP (mV)	Turbidity (NTU)	Flow Rate (ml/min)	Drawdown (Feet)	Colour/Odour
13:30		19.48	11.62	1343	9.02			175		Clear, odorous
13:31		19.48	11.85	1247	8.67			175		Clear, HC sheen noted
13:32		19.48	12.00	1276	8.47			175		Clear
13:33		19.49	12.42	1246	8.31			175		Clear
13:34		19.49	12.49	1246	7.49			175		Clear
13:35		19.50	12.53	1238	6.25			175		Clear
13:40		19.50	12.62	1237	4.85			175		Clear
13:45		19.50	12.61	1253	3.99			175		Clear
13:50		19.50	12.61	1254	3.96			175		Clear

Acceptance criteria pass/fail	Yes	No	N/A
Has required volume been removed	/		
Has required turbidity been reached			/
Have parameters stabilized	/		

3. Sample Collection

Sample ID	Container Type	No. Containers	Preservation	Analysis Req.	Time
MW4	40ml Vial	2	Cool box		14:00
MW4	1 litre bottle	1	Cool box		14:00

Signature	E Gould	Date	13.08.07
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RSK Geoconsult Ltd
18 Frogmore Road, Hemel Hempstead, Herts, HP3 9RT
Tel: +44 (0)1442 437500 Fax: +44 (0)1442 437550
www.rsk.co.uk

Levelling Data Sheet

Well ID	TOC	GL
MW4	49.967 (1.276)	50.000 (1.309)
MW5	49.890 (1.242)	50.001 (1.419)
BH6		49.777 (1.532)
MW7	49.214 (1.413)	49.232 (1.575)
MW2	49.867 (1.376)	49.873 (1.436)
MOVE		
MW2	49.876 (1.265)	49.873 (1.329)
MW1	49.693 (1.633)	49.680 (1.730)
MW7	49.214 (1.900)	49.232 (1.988)

Appendix VII

Photographs



Photograph A – View across the forecourt, tank farm to the west of the site



Photograph B – HGV Lane



Photograph C –Tank vent stack and above ground off-set fill points



Photograph D – LPG installation on bank to the northeast of the site



Photograph E – Area immediately adjacent to the west, Little Chef and associated parking



Photograph F – Travel Lodge to the north of the site



Photograph G – Construction of MW4

Appendix VIII

Generic Risk Assessment Criteria

Generic Assessment Criteria for Human Health
Continued Oil

1. Model Selection

The Generic Assessment Criteria (GAC) were calculated using the Risk-Based Corrective Action (RBCA) model for two reasons. First, RBCA uses the Johnson and Ettinger (J&E) model, as incorporated into the current beta version of the UK Contaminated Land Exposure Assessment (CLEA) model (which was not appropriate due to the necessity of assessing risks from groundwater). The second reason is that RBCA accounts for differential pressure in the inhalation of indoor air pathway from both soil and groundwater. Another available model, the Risk-Integrated Software for Clean-ups (RISC), only accounts for differential pressure for the inhalation of indoor air from soil. One disadvantage to the model used is that it only accounts for dissolved-phase hydrocarbons and cannot assess free-phase.

2. Pathway Selection

Pathways considered in the Continued Oil end use include inhalation of indoor air vapours from soil, inhalation of indoor air vapours from groundwater, ingestion of soil/indoor dust and dermal contact with soil. The inhalation of outdoor air pathway was not modelled, as the indoor air pathway is typically more conservative and thus protective of this route of exposure. In addition, the majority of the worker's time is spent indoors, which limits the relevance of modelling outdoor air exposure. Of the pathways modelled, it is important to note that hardstanding will act as a barrier to direct contact with soil. Therefore, inhalation of indoor air is typically the most relevant and conservative pathway for this end use. A conceptual model illustrating the linkages modelled is presented in Figure 1.

Within the model, solubility limits volatilisation, which in turn drives the inhalation of indoor air pathway. In cases where the contaminant solubility is exceeded, a reliable method to derive GAC has not been determined. Under these circumstances, the values calculated for the soil ingestion and dermal contact pathways are selected as the GAC. It should be noted that these values might not be relevant if there is 100% hardstanding on-site. This selection process is presented in Table 3.

3. Input Selection

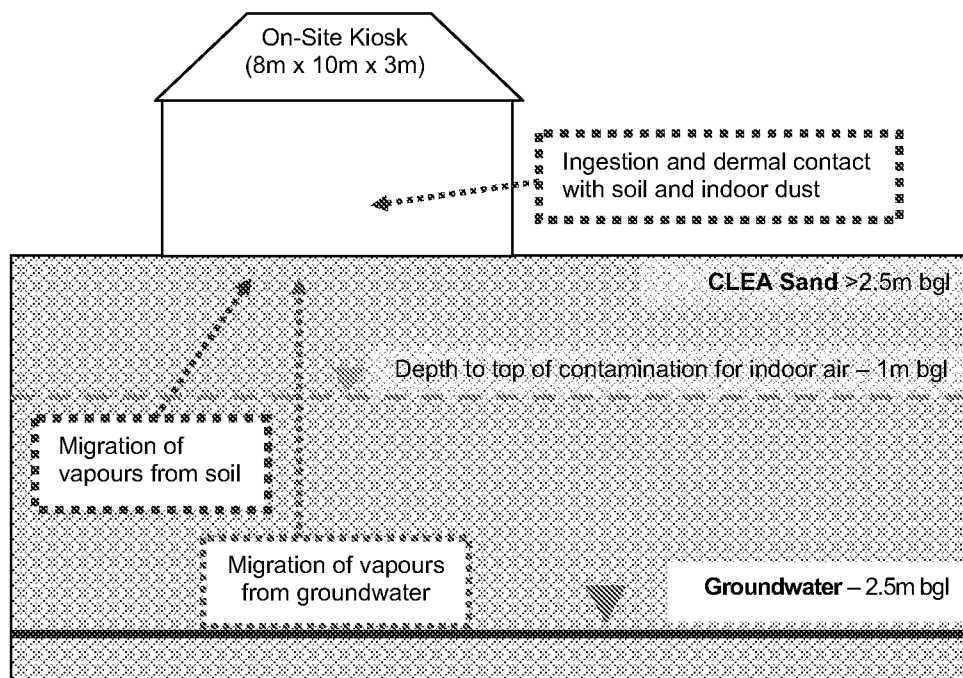
Where available, the published UK toxicity data has been used. For compounds where tolerable daily soil intakes (TDSI) for both a child and an adult are published, the value for the adult has been used. For total petroleum hydrocarbons (TPH), toxicity and chemical specific parameters from the TPH Criteria Working Group (TPHCWG) were used. Due to the lack of UK-specific data, default information in the RBCA model was used to evaluate MTBE.

For the Continued Oil end use, building parameters were selected to fit a typical service station kiosk, assumed approximately 8m x 10m x 3m. The typical kiosk is smaller than the CLEA office (24.5m x 24.5m x 9.6m) or CLEA warehouse (45m x 45m x 4.6m). Therefore, there is less room in the kiosk for dilution when considering the indoor inhalation pathway. No basement was assumed present in line with typical service stations. An average groundwater depth of 2.5m was assumed based on typical UK conditions. This is a particularly sensitive parameter for the indoor air pathway.

4. GAC

The model was run considering a Continued Oil end use using the input parameters in Tables 1 and 2. The GAC produced for the Continued Oil end use are presented by pathway in Table 3. The final selected GAC are presented in Table 4.

Figure 1
Conceptual Model for Continued Oil End Use



Note: Exposure parameters shown on Table 1.

Table 1
Exposure Assessment Parameters for Continued Oil –
Inputs for RBCA Model

Parameter	Value	Justification
Averaging time	43 years	Equal to exposure duration - CLR 10 for commercial end use.
Body weight	68.5kg	Adult female in line with CLR10 for commercial end use.
Exposure frequency	230 days	In line with CLR10 for a commercial end use, Table 6.1.
Exposure duration	43 years	Equal to exposure duration - CLR 10 for commercial end use.
Ingestion rate for soil	40mg/day	In line with CLR10 for a commercial end use, Table 6.1.
Total exposed skin surface area	5,808cm ²	Equation: Total skin area (17,600cm ²) x Fraction skin exposed (0.33). 17,600cm ² = Value for a 16–59 year old adult. Appendix 1, Briefing Note 1. 0.33 [-] = Mean value for a 16–59 year old adult for maximum fraction skin for indoor exposure. CLEA Briefing Note 1, Table 2. Most conservative fraction.
Soil/Skin adherence factor	0.14mg/cm ²	In line with recommendations for a commercial/industrial worker. CLEA Briefing Note 1, Table 3.

Note: Briefing Notes (BN) are CLEA publications. BN1, Version 1.1, (March 2005). BN2, Version 1.1 (July 2004), BN3, Version 1.1 (July 2004).

Table 2
Additional Parameters for Continued Oil - Inputs for RBCA Model

Parameter	Value	Justification
Depth to water bearing unit	2.5m	Assumed typical depth to groundwater in UK based on RSK experience.
Depth to top of affected soil	1.0m	Default from Briefing Note 2 for the depth to impacted soil.
Depth to base of affected soil	2.5m	Taken equal to depth to water-bearing unit to reflect unsaturated zone thickness.
Affected soil area	80m ²	Taken equal to estimated foundation area of a kiosk, estimated as 8m x 10m on the basis of RSK experience.
Soil type – Sand in line with CLEA		
Total porosity	0.46 [-]	CLEA sand from Briefing Note 2 as this is the most permeable CLEA soil.
Volumetric water content	0.15 [-]	
Dry bulk density	1.6	
Vertical hydraulic conductivity	5.6m/d	
Vapour permeability	7.20E-12m ²	Calculated for a CLEA sand using equations in Briefing Note 2.
Capillary zone thickness	0.05m	Default value for sand from RBCA as RBCA sand is similar to CLEA sand and value is not included in Briefing Note 2.
Fraction of organic carbon	0.0058	Modelling used 1% SOM (0.58% TOC) in line with the published CLEA SGVs.
Soil/water pH	6.8	Taken as model default as hydrocarbons are not sensitive to pH.
Groundwater plume width at source	10m	Longest length of typical kiosk (8m x 10m), estimated based on RSK experience.
Foundation area	80m ²	Typical kiosk estimated as 8m x 10m based on RSK experience.
Foundation perimeter	36m	
Building volume/area ratio	3m	Considered reasonable for petrol filling station kiosk
Building air exchange rate	24 No./day	CLEA Briefing Note 3 for a commercial property, considered reasonable for a petrol filling station.
Depth to slab base	0.15m	Briefing Note 3 for a commercial property, considered reasonable for a petrol filling station.
Foundation crack fraction	0.0009 [-]	Calculated using building perimeter and foundation area in line with Briefing Note 3 (0.002m x perimeter/area).
Volumetric air content of cracks	0.31 [-]	Assumed equal to underlying soil type in assumption that cracks become filled with soil over time. Discussion for Equation 6 - Briefing Note 2. Underlying soil is assumed to be CLEA sand.
Volumetric water content of cracks	0.15 [-]	
Indoor/outdoor differential pressure	30g/cm/s ²	There is no specific information available for a kiosk, the CLEA warehouse is considered more appropriate than the CLEA office due to the layout.

Note: Briefing Notes (BN) are CLEA publications. BN1, Version 1.1, (March 2005). BN2, Version 1.1 (July 2004), BN3, Version 1.1 (July 2004).

SHELL (UK) OIL PRODUCTS LIMITED
Continued Oil



Table 3
Human Health Generic Assessment Criteria for Continued Oil End Use by Pathway

Compound	GAC for Groundwater (a,b) (mg/l)	SSV Appropriate to Pathway		Selected GAC for Soil (a,c) (mg/kg)
		Soil/Dust Ingestion and Dermal Contact (mg/kg)	Inhalation of Indoor Air (mg/kg)	
Benzene (d)	1.62E-01	2.60E+02	2.38E+00	2.38E+00
Toluene (d,e)	1.14E+01	1.79E+05	1.88E+02	1.88E+02
Ethylbenzene (d,e)	2.51E+01	8.96E+04	4.45E+02	4.45E+02
Xylene (d,e)	7.78E+00	1.60E+05	1.60E+02	1.60E+02
Methyl t-Butyl ether (f)	7.95E+02	1.98E+03	2.24E+03	1.98E+03
Aliphatic Hydrocarbons EC ₅ -EC ₆ (f)	3.07E+00	NA	ND	NA
Aliphatic Hydrocarbons >EC ₆ -EC ₈ (f)	2.07E+00	NA	ND	NA
Aliphatic Hydrocarbons >EC ₈ -EC ₁₀ (f)	6.90E-02	8.96E+04	ND	8.96E+04
Aliphatic Hydrocarbons >EC ₁₀ -EC ₁₂ (f)	ND	8.96E+04	ND	8.96E+04
Aliphatic Hydrocarbons >EC ₁₂ -EC ₁₆ (f)	ND	8.96E+04	ND	8.96E+04
Aliphatic Hydrocarbons >EC ₁₆ -EC ₂₁ (f)	-	NA	-	NA
Aliphatic Hydrocarbons >EC ₂₁ -EC ₃₅ (f)	-	NA	-	NA
Aromatic Hydrocarbons EC ₅ -EC ₇ (f)	1.39E-01	2.69E+03	4.45E+00	4.45E+00
Aromatic Hydrocarbons >EC ₇ -EC ₈ (f)	7.82E+00	1.79E+05	2.99E+02	2.99E+02
Aromatic Hydrocarbons >EC ₈ -EC ₁₀ (f)	2.26E+00	3.58E+04	1.49E+02	1.49E+02
Aromatic Hydrocarbons >EC ₁₀ -EC ₁₂ (f)	8.02E+00	3.58E+04	1.49E+02	1.49E+02
Aromatic Hydrocarbons >EC ₁₂ -EC ₁₆ (f)	ND	3.58E+04	ND	3.58E+04
Aromatic Hydrocarbons >EC ₁₆ -EC ₂₁ (f)	-	2.69E+04	-	2.69E+04
Aromatic Hydrocarbons >EC ₂₁ -EC ₃₅ (f)	-	2.69E+04	-	2.69E+04
Benzo(a)pyrene (d)	ND	1.79E+01	ND	1.79E+01
Naphthalene (d,e)	3.71E+00	1.79E+04	1.55E+01	1.55E+01

Notes:

"-" - GAC or SSV not calculated owing to low volatility of substance and therefore no vapour source.

EC - Equivalent Carbons.

GAC - Generic Assessment Criteria.

NA - Modelling indicates that the compound will not pose a risk to human health at any concentration below 1.0E+06 mg/kg.

ND - Not determined. Calculated screening value exceeded the solubility limit used in RBCA. Theoretically, these compounds could not dissolve into a solution with high enough concentrations to pose a risk. The potential pathway is incomplete, as the solubility limit is exceeded and the RBCA model cannot consider free phase.

RBCA - Risk-Based Corrective Action model, Version 1.3b (2000), (ASTM, 1998).

SSV - Soil Screening Values.

TPH - Total Petroleum Hydrocarbons.

(a) Unless otherwise noted values were calculated by the RBCA model using default values shown in Table 1 and 2 of this Appendix.

(b) Values based on the inhalation of indoor air pathway.

(c) Value selected is the lowest calculated from the direct contact pathways and indoor inhalation pathways.

(d) Toxicity information and chemical parameters obtained from Environment Agency publications.

(e) Adult values for Total Daily Soil Intake were used for both the oral and inhalation pathways (oral values substituted for dermal pathway in absence of dermal values).

(f) RBCA default values used for MTBE and hydrocarbon fractions. Hydrocarbons consistent with TPH Criteria Working Group (TPHCWG).

SHELL (UK) OIL PRODUCTS LIMITED
Continued Oil



Table 4
Selected Human Health Generic Assessment Criteria for Continued Oil End Use

Compound	GAC for Groundwater (a) (mg/l)	GAC for Soil (a) (mg/kg)
Benzene	0.16	2.4
Toluene	11	190
Ethylbenzene	25	450
Xylene	7.8	160
Methyl t-Butyl ether	800	2,000
Aliphatic Hydrocarbons EC ₅ -EC ₆	3.1	NA
Aliphatic Hydrocarbons >EC ₆ -EC ₈	2.1	NA
Aliphatic Hydrocarbons >EC ₈ -EC ₁₀	0.069	90,000
Aliphatic Hydrocarbons >EC ₁₀ -EC ₁₂	ND	90,000
Aliphatic Hydrocarbons >EC ₁₂ -EC ₁₆	ND	90,000
Aliphatic Hydrocarbons >EC ₁₆ -EC ₂₁	-	NA
Aliphatic Hydrocarbons >EC ₂₁ -EC ₃₅	-	NA
Aromatic Hydrocarbons EC ₅ -EC ₇	0.14	4.5
Aromatic Hydrocarbons >EC ₇ -EC ₈	7.8	300
Aromatic Hydrocarbons >EC ₈ -EC ₁₀	2.3	150
Aromatic Hydrocarbons >EC ₁₀ -EC ₁₂	8.0	150
Aromatic Hydrocarbons >EC ₁₂ -EC ₁₆	ND	36,000
Aromatic Hydrocarbons >EC ₁₆ -EC ₂₁	-	27,000
Aromatic Hydrocarbons >EC ₂₁ -EC ₃₅	-	27,000
Benzo(a)pyrene	ND	18
Naphthalene	3.7	16

Notes:

"-" - Value not applicable due to low volatility of substance, ingestion of groundwater not considered a plausible pathway.

GAC - Generic Assessment Criteria.

NA - Modelling indicates that the compound will not pose a risk to human health at any concentration below 1.0E+06 mg/kg.

ND - Not determined. Calculated screening value exceeded the solubility limit used in RBCA. Theoretically, these compounds could not dissolve into a solution with high enough concentrations to pose a risk. The potential pathway is incomplete, as the solubility limit is exceeded and the RBCA model cannot consider free phase.

RBCA - Risk-Based Corrective Action model, Version 1.3b (2000), (ASTM, 1998).

(a) See Table 3 for calculation notes, values shown rounded to two significant figures.

GENERIC ASSESSMENT CRITERIA FOR SHELL PROJECTS

	Pipes	Human Health						Controlled Waters	
	Permeation of Plastic Pipes	Generic Assessment Criteria for Soil			Generic Assessment Criteria for Groundwater			Major Aquifer/abstraction	Minor Aquifer/surface water
	All end uses (mg/kg)	Continued Oil Use (mg/kg)	Non-Oil Non-Sensitive (mg/kg)	Non-Oil Sensitive (mg/kg)	Continued Oil Use (mg/l)	Non-Oil Non-Sensitive (mg/l)	Non-Oil Sensitive (mg/l)	UK DWS/MRV (mg/l)	UK EQS/MRV (mg/l)
TPH	50	-	-	-	-	-	-	-	-
Benzene	-	2.4	3.7	0.084	0.16	0.40	0.043	0.001 ^B	0.03 ^A
Toluene	-	190	150 ^G	3.0 ^G	11	28	3.0	0.004 ^C	0.05 ^A
Ethylbenzene	-	450	48000 ^G	9.0 ^G	25	59	6.6	0.001 ^C	0.02 ^F
Xylene	-	160	245	5.5	7.8	19	2.0	0.003 ^C	0.03 ^A
MTBE	-	2000	2000	79	800	1900	210	0.01 ^D	0.015 ^E
TAME	-	2000	2000	79	800	1900	210	0.01 ^D	0.015 ^E
TEL	-	LMDL	LMDL	LMDL	LMDL	LMDL	LMDL	-	-
Aliphatic C5-C6	-	-	-	280000	3.1	7.8	0.81	0.01 ^D	0.01 ^D
Aliphatic C6-C8	-	-	-	280000	2.1	5.3	0.55	0.01 ^D	0.01 ^D
Aliphatic C8-C10	-	90000	90000	26	0.069	0.18	0.018	0.01 ^D	0.01 ^D
Aliphatic C10-C12	-	90000	90000	26	-	-	0.012	0.01 ^D	0.01 ^D
Aliphatic C12-C16	-	90000	90000	5500	-	-	-	0.01 ^D	0.01 ^D
Aliphatic C16-C21	-	-	-	110000	-	-	-	0.01 ^D	0.01 ^D
Aliphatic C21-C35	-	-	-	110000	-	-	-	-	-
Aromatic C5-C7	-	4.5	6.8	0.156	0.14	0.35	0.037	0.01 ^D	0.01 ^D
Aromatic C7-C8	-	300	460	10.5	7.8	20	2.1	0.01 ^D	0.01 ^D
Aromatic C8-C10	-	150	230	5.3	2.3	5.7	0.60	0.01 ^D	0.01 ^D
Aromatic C10-C12	-	150	230	19.8	8.0	20	2.1	0.01 ^D	0.01 ^D
Aromatic C12-C16	-	36000	36000	100	-	-	5.6	0.01 ^D	0.01 ^D
Aromatic C16-C21	-	27000	27000	1700	-	-	-	0.01 ^D	0.01 ^D
Aromatic C21-C35	-	27000	27000	1700	-	-	-	0.01 ^D	0.01 ^D
Benzo(a)pyrene	-	18	18	1.1	-	-	-	0.00001 ^C	0.00001 ^C
Naphthalene	-	16	43	4.0	3.7	8.3	0.93	0.00001 ^C	0.01 ^A

Note: For human health calculation notes, see respective receptor appendicies. Values shown are rounded to two significant figures.

- A EQS
 B UK DWS
 C MRV - LFTGN01
 D MRV Working Group Criteria Method
 E Environment Agency Guidance regarding MTBE
 F Proposed EQS
 G Published SGV for 1% SOM (0.58% TOC). Altering the TOC to 0.1% did not alter the calculated ethylbenzene or toluene GACs, thus the SGV is considered appropriate.

Appendix IX

Risk Assessment Calculation Sheets for Generic Assessment Criteria

MEAN VALUE TEST FOR SHELL

SITE DETAILS

PROJECT TITLE

Shell Fontwell

PROJECT NUMBER

310493

SAMPLING DATE

23-Jun-07

DATA ENTERED BY

Jack Dobson

DATE

28-Aug-07

SOIL RESULTS (mg/kg)

End use for site

Continued oil end use

Soil Organic Matter (Fraction Organic Carbon)

1% SOM (0.58% TOC)

BTEX, PAH & Additives											
Sample ID	Sample Depth	Static Water	Benzene	Toluene	Ethylbenzene	Xylene	Naphthalene	Benzo(a)pyrene	MTBE	TAME	TEL
MW1	2		0.01	0.01	0.01	0.02			0.01	0.01	0.01
MW1	4		0.01	0.01	0.01	0.02			0.01	0.01	0.01
MW1	5.7		0.01	0.01	0.01	0.02			0.01	0.01	0.01
MW2	2		0.01	0.01	0.01	0.02			0.01	0.01	0.01
MW2	4		0.01	0.01	0.01	0.02			0.01	0.01	0.01
MW2	6		0.01	0.01	0.01	0.02			0.01	0.01	0.01
MW4	4		0.01	0.01	0.01	0.02			0.01	0.01	0.01
MW5	2		0.01	0.01	0.01	0.02			0.01	0.01	0.01
MW5	4		0.01	0.01	0.01	0.02			0.01	0.01	0.01
MW5	7		0.01	0.01	0.01	0.02			0.01	0.01	0.01
MW7	2		0.01	0.01	0.01	0.02			0.01	0.01	0.01
MW7	4		0.01	0.01	0.01	0.02			0.01	0.01	0.01
BH6	2		0.01	0.01	0.01	0.02			0.01	0.01	0.01
BH6	4		0.01	0.01	0.01	0.02			0.01	0.01	0.01
BH6	5.5		0.01	0.01	0.01	0.02			0.01	0.01	0.01
MW7	6		0.01	0.01	0.01	0.02			0.01	0.01	0.01
MW4	2		0.01	0.01	0.01	0.02			0.01	0.01	0.01
MW4	6		0.01	0.01	0.01	0.02			0.01	0.01	0.01

MAXIMUM VALUE SCREEN FOR SHELL

SITE DETAILS

PROJECT TITLE: Shell Fontwell

PROJECT NUMBER: 310493

SAMPLING DATE: 23-Jun-07

DATA ENTERED BY: Jack Dobson

DATE: 28-Aug-07

GROUNDWATER RESULTS (mg/l)

End use for site:

Continued oil end use

BTEX, PAH & Additives

Sample ID	Benzene	Toluene	Ethylbenzene	Xylene	Napthalene	Benzo(a)pyrene	MTBE	TAME	TEL
MW2	0.001	0.001	0.001	0.002			0.001	0.001	0.001
MW7	0.001	0.001	0.001	0.002			0.001	0.001	0.005
MW4	0.001	0.001	0.001	0.002			0.001	0.001	0.001
MW5	0.001	0.001	0.001	0.002			0.001	0.001	
Maximum value	1.0E-03	1.0E-03	1.0E-03	2.0E-03	0.0E+00	0.0E+00	1.0E-03	1.0E-03	5.0E-03
Continued oil end use	1.6E-01	1.1E+01	2.5E+01	7.8E+00	3.7E+00	ND	8.0E+02	8.0E+02	LMDL
Comparison with GAC	Result: pass	Result: pass	Result: pass	Result: pass	Result: pass	Result: pass	Result: pass	Result: pass	MANUAL CHECK
Source of GAC	In-house GAC	In-house GAC	In-house GAC	In-house GAC	In-house GAC	In-house GAC	In-house GAC	MTBE In-house GAC	In-house GAC - LMDL

TPH Aliphatic Groups

Sample ID	Aliphatic C ₆₋₈	Aliphatic C ₉₋₁₀	Aliphatic C ₁₁₋₁₂	Aliphatic C ₁₃₋₁₄	Aliphatic C ₁₅₋₁₆	Aliphatic C ₁₇₋₁₈	Aliphatic C ₁₉₋₂₀
MW2	0.001	0.001	0.003	0.005	0.005	0.005	0.005
MW7	0.001	0.001	0.005	0.005	0.005	0.005	0.005
MW4	0.001	0.001	0.001	0.005	0.005	0.005	0.005
MW5	0.001	0.001	0.001	0.005	0.005	0.005	0.005
Maximum value	1.0E-03	1.0E-03	5.0E-03	5.0E-03	5.0E-03	5.0E-03	5.0E-03
Continued oil end use	3.1E+00	2.1E+00	6.9E-02	ND	ND	--	--
Comparison with GAC	Result: pass	Result: pass	Result: pass	Result: pass	Result: pass	Result: pass	Result: pass
Source of GAC	In-house GAC	In-house GAC	In-house GAC	In-house GAC	In-house GAC	In-house GAC	In-house GAC

TPH Aromatic Groups

Sample ID	Aromatic C ₆₋₇	Aromatic C ₇₋₈	Aromatic C ₉₋₁₀	Aromatic C ₁₁₋₁₂	Aromatic C ₁₃₋₁₄	Aromatic C ₁₅₋₁₆	Aromatic C ₁₇₋₁₈
MW2	0.001	0.001	0.001	0.005	0.005	0.005	0.005
MW7	0.001	0.001	0.001	0.005	0.005	0.005	0.005
MW4	0.001	0.001	0.001	0.005	0.005	0.005	0.005
MW5	0.001	0.001	0.001	0.005	0.005	0.005	0.005
Maximum value	1.0E-03	1.0E-03	1.0E-03	5.0E-03	5.0E-03	5.0E-03	5.0E-03
Continued oil end use	1.4E-01	7.8E+00	2.3E+00	8.0E+00	ND	--	--
Comparison with GAC	Result: pass	Result: pass	Result: pass	Result: pass	Result: pass	Result: pass	Result: pass
Source of GAC	In-house GAC	In-house GAC	In-house GAC	In-house GAC	In-house GAC	In-house GAC	In-house GAC

Appendix X

Generic Assessment Results for Controlled Waters

Shell Fontwell: 310493
Groundwater comparison with EQS values

	Minor Aquifer/surface water	Monitoring well ID			
	UK EQS/MRV (mg/l)	MW2	MW4	MW5	MW7
TPH	-				
Benzene	0.03	<0.001	<0.001	<0.001	<0.001
Toluene	0.05	<0.001	<0.001	<0.001	<0.001
Ethylbenzene	0.02	<0.001	<0.001	<0.001	<0.001
Xylene	0.03	0.001	<0.001	<0.001	<0.001
MTBE	0.015	<0.001	<0.001	<0.001	<0.001
TAME	0.015	<0.001	<0.001	<0.001	<0.001
TEL	-				
Aliphatic C5-C6	0.01	0.001	0.001	<0.001	0.001
Aliphatic C6-C8	0.01	<0.001	<0.001	<0.001	<0.001
Aliphatic C8-C10	0.01	0.003	<0.001	<0.001	0.005
Aliphatic C10-C12	0.01	<0.005	<0.005	<0.005	<0.005
Aliphatic C12-C16	0.01	<0.005	<0.005	<0.005	<0.005
Aliphatic C16-C21	0.01	<0.005	<0.005	<0.005	<0.005
Aliphatic C21-C35					
Aromatic C5-C7	0.01	<0.001	<0.001	<0.001	<0.001
Aromatic C7-C8	0.01	<0.001	<0.001	<0.001	<0.001
Aromatic C8-C10	0.01	0.001	<0.001	<0.001	0.001
Aromatic C10-C12	0.01	<0.005	<0.005	<0.005	<0.005
Aromatic C12-C16	0.01	<0.005	<0.005	<0.005	<0.005
Aromatic C16-C21	0.01	<0.005	<0.005	<0.005	<0.005
Aromatic C21-C35	0.01	<0.005	<0.005	<0.005	<0.005