Attachment 4.8.3 Site Condition Report

Sub Section 4.8
IE Licence Application ID LA003577

Dublin Waste to Energy Limited

Project reference: PR-351653
Project number: 60587300

26 March 2019

Quality information

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	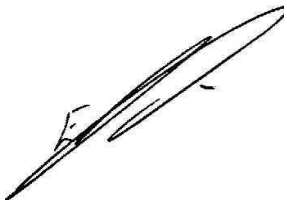	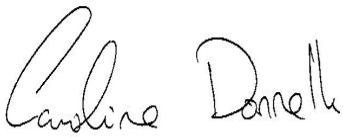	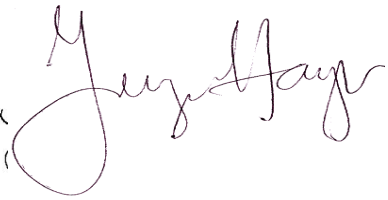
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Revision History

Revision	Revision date	Details	Authorized	Name	Position
1	07th March 2019	Draft for site	Yes	CD	Associate Director
2	26th March 2019	Final	Yes	FH	Director

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1. Introduction

1.1 Project Background

Dublin Waste to Energy Ltd (DWtE) operate a site located on the Poolbeg Peninsula, Ringsend, Dublin (the site) under Industrial Emissions Licence (IEL) W0232-01 granted by the Environmental Protection Agency (EPA).

A proposed increase in the permitted maximum annual quantity of waste accepted at the facility from 600,000 tonnes per year to 690,000 tonnes per year (15% increase) has obliged the site to apply for a revised IEL. As part of the IEL review application DWtE must include a Site Condition Report (SCR). DWtE appointed AECOM Ireland Limited (AECOM) to assist in the preparation of their IEL review application including the production of this SCR.

The site location map and site layout used to support the IEL amendment application are presented in **Appendix A**.

Details on proposed DWtE activities and supporting infrastructure are presented in Attachment 4.8.1: Operational Report that supports the IEL application.

1.2 Objective

The main objective of this report is to complete an SCR for the site in support of DWtE's current IEL amendment application, application reference LA003577.

1.3 Scope of Work

This SCR describes the current condition of the DWtE site by presenting information and detail of ground and groundwater quality, and having regard to relevant environmental quality standards or values.

Within this report are presented those topics which are relevant to the SCR, specifically:

- Site details and site history;
- Environmental setting;
- Permitted activities; and,
- Compliance with requirements of the EC Environmental Objectives (Groundwater) Regulations 2010, S.I. No. 9 of 2010 and as amended by S.I. No. 366 of 2016.

The following documents pertaining to the DWtE site have been consulted in preparing this report:

1. Geotechnical Specialists Limited (2003) Factual Report on Ground Investigation, Dublin Waste to Energy Project;
2. IGSL (2005) Site Investigation at Waste to Energy Project, Ringsend, Dublin City;
3. RPS (2005) Soil and Groundwater Investigation at Ringsend, Dublin;
4. Arup Consulting Engineers (2006) Environmental Impact Assessment, report reference 246840 – Version 2a;
5. Arup Consulting Engineers (2006) Geo-Environmental Engineering Assessment; and,
6. PM Group, Soil Reusability Report (2017) – IE0311183-22-RP-0055, Issue A, Draft for information.

2. Site Details and Site History

2.1 Site Description

The site is located on the Poolbeg Peninsula within the Dublin Docklands and occupies and area of approximately 5.5 ha. Of this, the main process building occupies approximately 2.6 ha. The remaining 2.9 ha consists of soft and hard landscaping and internal road infrastructure.

The site is located in an industrial area. The Ringsend Waste Water Treatment Plant is located to the east of the site; Dublin Bay Power Station (Synergen) is located to the west of the site; Dublin Harbour is located to the north; and, Dublin Bay and Irishtown Nature Park are located to the south.

Four EPA licensed facilities are located within a 1 km radius of the site:

- The Hammond Lane Metal Company Limited (P1002-01);
- ESB Poolbeg Generating Station (P0577-03);
- Synergen Power Limited (P0486-02); and,
- Dublin Port Company (P1022-02).

A detailed description of the site is presented in other documents[1] being provided with IEL application reference LA003577.

2.2 Site Development

The site is built on reclaimed land. The site was infilled between 1970 and 1976. The source of fill material is not recorded.

In 1979, Hibernian Molasses established a plant on the western and central portion of the site. The remainder of the site to the north and south of the molasses plant was used in the 1980s as coal storage areas. Between 1995 and the development of the DWtE site, the northern portion of the site operated as a scrap metal yard.

Potential contaminants in soil associated with the site's historic development include:

- Heavy metals from hydraulic fill and from the weathering of scrap metal;
- Polycyclic aromatic hydrocarbons (PAHs) from coal storage;
- Hydrocarbon contamination from various former site operations; and,
- Molasses from the former molasses plant.

A waste to energy facility in Dublin was first proposed in 1997, following a site selection process the Poolbeg site was chosen. Construction on the DWtE facility began in September 2014. The DWtE facility first became operational on 01st June 2017.

3. Site Investigations

The site investigation reports listed in Section 1.3 were included in the appendix of the 2006 Environmental Impact Assessment (EIA). These reports detail site investigations and/or desk studies for the site and were consulted by AECOM to assess soil and groundwater conditions at the site as summarised below. A figure produced for the 2006 Arup Desk Study showing all of the sampling locations in the following reports is presented as Figure 5 in Appendix D.

[1] Attachment 4.8.1: Operational Report

3.1 2003 GSL Site Investigation

The 2003 Geotech Specialists Limited (GSL) site investigation was completed to obtain geotechnical and geoenvironmental information for the site prior to development of the DWtE facility. Ten boreholes, nine trial pits and five slit trenches were completed as part of the investigation. Boreholes depths ranged between 34 m and 49.5 m below ground level (bgl). Six of the boreholes were installed as groundwater monitoring wells to monitor water levels. Details of the boreholes and trial pits are presented as Table 1 in Appendix B. Available borehole and trial pit logs are presented in Appendix H.

Six soil samples were dispatched to an external laboratory to be tested for a range of parameters including: metals, major ions, total petroleum hydrocarbons (TPH), PAHs and phenols. Two soil samples were analysed for dioxins. Laboratory soil results are presented as Appendix E.

PAHs were detected in all the soil samples from the 2003 investigation, in addition lead, zinc and copper concentrations were detected but below Dutch Intervention Values (DIV).

No groundwater samples were taken as part of this investigation.

3.2 2005 RPS Site Investigation

RPS conducted a geo-environmental site investigation in March 2005. From the report on this investigation, only the tables containing the soil and groundwater analytical results, field sampling sheets and the borehole logs were included in the EIA and have been reviewed. The conclusions of the 2005 RPS report are summarised in the 2006 Arup Desk Study. Seven boreholes were advanced across site and 18 trial pits were completed. All seven boreholes were installed as groundwater monitoring wells. Details of well installations and the trial pits can be found in Table 2 in Appendix B. Borehole and trial pit logs from this investigation can be found in Appendix H.

3.2.1 2005 RPS Soil Sampling

A total of 64 soil samples were collected during the 2005 RPS site investigation and analysed for a range of parameters including: TPH, PAHs, volatile organic compounds (VOCs), metals, asbestos, ammonia, phenols and coliforms.

Soil sampling identified elevated TPH concentrations in many samples. Elevated TPHs were predominately from the C_{16}-C_{35} carbon range which is generally not mobile. There is no DIV for TPHs, however the DIV for mineral oil in soil (5,000 mg/kg) was exceeded at depths of 1 m and 7 m bgl at MW2.

The DIV for PAHs in soil (40 mg/kg) was exceeded in eight of the 64 soil samples analysed in 2005. The 2006 study suggests that these results most likely represent local hotspots.

Lead, zinc and copper were detected above the DIV in samples of fill material from several locations.

Several low concentrations of VOCs were detected in soil samples, including:

- 8 detections of trichloroethene (TCE) up to a concentration of 0.067 mg/kg (TP13);
- 38 detections of tetrachloroethene (PCE) up to 3.2 mg/kg (TP4); and
- 43 detections of BTEX compounds (benzene, toluene, ethyl benzene and xylene), up to 343 mg/kg (TP11).

Laboratory soil results are presented as Appendix F.

3.2.2 2005 RPS Groundwater Sampling

A total of 11 groundwater samples were collected during the 2005 RPS site investigation and analysed for a range of parameters including: TPH, PAHs, VOCs, metals, phenols and coliforms.

During groundwater sampling in March 2005, no separate hydrocarbon layer was noted during the dip round. However, hydrocarbon product was noted in purge water from three wells (MW01, MW04A

and MW06A). A deep orange liquid was recovered from well BH4 within the footprint of the former Hibernian Molasses site of which no further details were provided.

Elevated electrical conductivity (2.3-34.6 mS/cm) and elevated concentrations of boron (up to 3.1 mg/L) were noted. The 2006 Arup desk study states that these indicate saline groundwater conditions beneath the site.

Arsenic, lead, nickel and zinc were also slightly elevated but that was considered by Arup in 2006 to be due to seawater mixing.

TPH concentrations in excess of the IGV (10 µg/L) were noted in groundwater from six wells (MW01, MW02, MW03, MW06A, MW07 and BR8) with concentrations ranging from 12 µg/L (MW02) to 147 µg/L (BR8).

PAHs were detected in groundwater from two wells, MW03 (0.89 µg/L) and BH1 (32.4 µg/L) in excess of the IGV (0.1 µg/L).

VOCs and phenols were below detection limits for the most part, with the exception of a single trace detection of toluene (3 µg/L, BH1).

Analytical results of the groundwater sampling are presented as Appendix G

3.3 2005 IGSL Site Investigation

IGSL conducted a geotechnical site investigation in October 2005, six boreholes were advanced across site and installed as groundwater monitoring wells.

These boreholes were drilled for geotechnical testing only and no soil or groundwater samples were taken for environmental analysis. Details of well installations and the trial pits can be found in Table 3 in Appendix B. Borehole logs from this investigation can be found in Appendix H.

3.4 2006 Arup Desk Study

In 2006 a desk study of existing information and a site walkover was conducted by Arup to assess data collected during previous site investigations to produce a geo-environmental engineering assessment of the site in response to concerns raised regarding the extent of the made ground, beneath site, its depth and the level of contamination present.

The desk study notes that prior to the construction of the DWtE facility a scrap metal company, Clearway Disposal, occupied the northern portion of the site. An unbunded fuel oil tank was noted in the south of the Clearway Disposal site during the site walkover visual evidence of an oil spill was reportedly observed.

Overall, based on results of the earlier site investigations, the 2006 Arup report concluded that there was a high potential for contamination hotspots within excavated materials due to shallow hydrocarbon and PAH contamination in the areas near the Clearway Disposal fuel oil tank and the proposed cooling pipes.

3.5 Soil Reusability Report

A Soil Reusability Report was completed by the PM group in 2017. This is a validation report produced following the completion of construction works on site at the recommendation of the EPA. The report outlines how excavated materials on site was reused and how potential pollutant linkages were broken between contaminated site soils noted in Section 3.4 and identified human health and environmental receptors identified by a risk assessment conducted by Jacobs Engineering[2].

The risk assessment report derived site-specific assessment criteria which could be used to separate site won material into three categories. The site-specific assessment criteria are presented as Table 4 in Appendix B.

[2] Jacobs Engineering (2009) Risk Assessment Report (60556600-05-Rev0), AECOM has not reviewed this report.

- Category A materials were reused under areas of hardstanding or if capped under a 300 mm clean capping layer under soft landscape material.
- Category B materials were used in areas of hardstanding or under a 1 m clean capping layer under soft landscape material.
- Materials in the third category exceed the criteria set for Category A and Category B and were deemed unsuitable for reuse on site.

In general, the top 0.5 m of soil from outside the footprint of the main process building and between 0.5 m and 1.0 m of soil was removed within the main process building to meet design requirements. However, deeper excavations were required in certain areas to meet design requirements. These areas were:

- Waste bunker (4.0 m bgl);
- Bottom Ash Bunker (2.9 m bgl);
- Surface Water Attenuation Tank (4,0 m bgl);
- Cooling Water Pump house (10 m bgl); and,
- Cooling Water Inlet Channel (15 m bgl).

Excavated soil was stockpiled on site and sampled in accordance with ISO 10381-8:2006(E). Composite samples were sent to an external laboratory for quantitative analysis and compared against soil reuse criteria generated in Jacobs' 2009 risk assessment and presented in the Soil Reusability Report. All of the materials excavated on site were found to be within the limits set by the soil reuse criteria with the exception of a small quantity of asbestos tiles located at the southern site boundary.

A total of 80,851 m^3 of soil was excavated from across site, all excavated soils were found to be within the Category B criteria. The majority of soil, 50,031 m^3, was reused on site with the remaining excess, 30,820 m^3, disposed off-site as non-hazardous waste. The asbestos tiles were disposed of to a hazardous waste licenced facility for overseas disposal.

3.6 Groundwater Sampling

Monthly groundwater sampling took place on site during the construction and commissioning phase of the DWtE facility at two monitoring locations (GW1 and GW2). Following the commissioning phase, one well (GW1) continued to be sampled on an annual basis in accordance with the site's IE Licence. The results of the November 2017 and October 2018 groundwater monitoring rounds are presented in Table 5 in Appendix B and summarised below.

Ammonia exceeded the Groundwater Threshold Value (GTV, 0.065 mg/L – 0.175 mg/L) in November 2017 in groundwater from well GW2 (7.1 mg/L)

Arsenic exceeded the GTV (0.0075 mg/L) in groundwater from well GW2 in November 2017 (0.031 mg/L) and in groundwater from well GW1 in October 2018 (0.017 mg/L).

Lead exceeded the GTV (0.075 mg/L) in groundwater from well GW1 in October 2018 (0.082 mg/L).

All other metals (cadmium, chromium, cobalt, copper, manganese, mercury, potassium, thallium, tin and vanadium) were below their corresponding GTVs where defined in 2017 and 2018.

VOCs, semi volatile organic compounds (SVOCs) and pesticides were not detected above their respective GTVs in 2017 and 2018. Although TPHs were not analysed, constituents of diesel such as trimethylbenzene and naphthalene were analysed as part of the VOC analytical suite and were not detected in groundwater in 2017 and 2018.

4. Environmental Setting

4.1 Site Setting and Topography

The site is situated on the Poolbeg Peninsula. It is stated in the 2006 EIS that the site is at an elevation of between 3.5 m and 5.0 m above Ordnance Datum (OD) and land across the site slopes gently from north to south toward Dublin Harbour, see Appendix A Figure 2. As previously noted, the site is built on reclaimed land. The area was infilled between 1970 and 1976.

4.2 Surface Water

The site is located in the Dodder sub catchment (Water Framework Directive (WFD) catchment and sub-catchment codes Dodder_SC_010 and 09_16) which forms part of the Liffey and Dublin Bay Hydrometric Area (HA09) [3].

The Liffey Estuary Lower (WFD code IE_EA_090_0300) is a transitional water body located to the north of the site. Liffey Estuary Lower water quality has been classified as *Moderate* by the EPA and is identified as *At Risk*. The Dublin Bay (WFD code IE_EA_090_0000) costal water body is located to the south. Dublin Bay water quality has been classified as *Good* by the EPA and is *Not at Risk*. As the site is reclaimed, and essentially man-made, there are no known streams or rivers located on site.

DWtE uses cooling water which is abstracted from the River Liffey at Dublin Port. The cooling water is dosed with sodium hypochlorite to prevent biofouling, the cooling water is then discharged back to River Liffey following use. This leads to a slight increase in water temperature (generally 1-2 °C) close to the outfall. The water temperature is continuously monitored to ensure it remains compliant with IEL conditions. No other water is discharged to surface water from the site. Storm water and process water are retained on site for reuse, excess storm water may be discharged to the public sewer when needed.

4.3 Geology

The site and surrounding areas are constructed on reclaimed land. The 2006 EIS states than the area was infilled between 1970 and 1976.

GSI online geological mapping[4] indicates that bedrock underlying the site and surrounding area consists of dark limestone and shale of the Lucan Formation of Dinantian age (early Carboniferous era).

According to reports on site investigations carried out in 2003 and 2005, the subsoil underlying the site is comprised of made ground, clays, silts, sands and gravel. A generalised geological sequence was provided in the 2006 desk study:

- Made Ground: Areas of tarmacadam and concrete hardstanding and topsoil underlain with gravels, sands, silts and clays including fragments of brick, concrete, glass, timber and cinders. Thickness between 1.6 m and 5.6 m.
- Marine Deposits: loose to medium dense, sandy silt and slightly clayey/silty fine sand. Thickness between 0.3 m and 2.5 m.
- Glacial and Fluvioglacial Deposits: medium to dense, sandy gravel with shell fragments and occasional cobbles and boulders, occasional silty material. Thickness between 10.5 m and 13.3 m.
- Outwash/Glacio-Marine Clay Deposits: upper layer of silt with sand laminations with a thickness between 5.5 m and 6.4 m. The lower layer is described as stiff to very stiff dark grey or black slightly sandy clay with layers and laminations of silt and silty sand with a proven thickness between 15.4 m and 16.5 m.

[3] Catchment.ie – accessed 05 February 2019
[4] https://www.gsi.ie/en-ie/data-and-maps/Pages/default.aspx - accessed 05 February 2019

- Limestone Bedrock: dark grey, strong, mostly thinly bedded, fine grained limestones with interbedded shales. Localised weathered zones. Rock head depth between 36 m and 45 m bgl.

4.4 Hydrogeology

As the site is in an area that has been reclaimed from Dublin Bay through in-filling, there is no freshwater aquifer beneath the site and none is mapped on the GSI website. However, on the EPA's mapping website[5] the site is shown as being underlain by the Dublin Groundwater Body (WFD code IE_EA_G_008) which is described by the EPA as a *poorly productive bedrock*[6] aquifer. The Dublin groundwater body quality is classed as *Good* and has been identified as *Not At Risk*.

Approximately 1 km west and south of the site, the GSI has assigned groundwater vulnerability as *Low*. The thick marine clay overlying limestone bedrock acts as an aquitard limiting downward movement of groundwater. As noted in Section 4.3 depth to bedrock beneath the site is >30 m, and bedrock is overlain by a considerable thickness of low permeability glacial, fluvial and marine deposits, on top of which imported infill material was deposited in the 1970s.

Groundwater level gauging conducted as part of site investigations in 2003 and 2005 recorded water levels of approximately 3 m to 4 m bgl in shallow wells, i.e. close to mean sea level. Shallow groundwater resides within the imported infill material and the level of shallow groundwater is thought to remain close to sea level and may exhibit tidal variation.

In 2005, RPS concluded that the local direction of groundwater flow assessed from groundwater elevations in shallow monitoring wells screened within the infill material, as being to the east, toward the coast. However as groundwater levels are likely to be influenced by the tide, the shallow groundwater flow direction may vary.

Wells and Springs

Given the site's coastal location and situation in an area of reclaimed land, a search of the GSI well database did not identify any wells or springs within a 1 km radius of the site. While, there is no permitting system to govern well drilling and no requirement to register abstraction wells in Ireland with yields less than 25 m^3/d, due to the likely brackish conditions of groundwater it is unlikely to be used for potable supply near the site.

4.5 Biodiversity

Special Areas of Conservation (SAC) are habitats and species which must be protected under the Habitats Directive (Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna).

Special Protection Areas (SPA) are designated under the Birds Directive (Council Directive 2009/147/EC on the Conservation of Wild Birds) to protect a range of bird populations.

Together, SAC and SPA form a pan-European network of so-called *European sites* for nature conservation (also known as Natura 2000 sites).

Five European sites have been identified in Dublin Bay downstream of the DWtE site[7]:

- South Dublin Bay and River Tolka Estuary SPA (code 004024);
- North Bull Island SPA (code 004006);
- South Dublin Bay SAC (code 000210);
- North Dublin Bay SAC (code 000206); and,
- Rockabill to Dalkey Island SAC (code 003000).

[5] https://gis.epa.ie/EPAMaps/ - accessed 05 February 2019
[6] www.catchments.ie – accessed 05 February 2019
[7] https://gis.epa.ie/EPAMaps/ - Accessed 05 February 2019

4.6 Storm Water Runoff Drainage Systems

A storm water drainage network serving roofs, roads and parking areas conveys rainwater run-off by gravity from these areas to a 725 m^3 underground attenuation tank where it is stored for reuse on site. All storm water runoff passes through a class 1 hydrocarbon interceptor prior to entering the attenuation tank.

Excess water in the attenuation tank can be discharged to the Ringsend Municipal Waste Water Treatment Plant (MWwTP). Prior to discharging to the MWwTP the discharge is tested as per IEL requirements. If the water in the attenuation tank is found to be unsuitable for the MWwTP it can be sent for disposal to an off-site licensed disposal facility. In the event of a fire and a subsequent requirement for additional fire water retention capacity, water can be pumped from the attenuation tank into the waste bunker.

The main process building is served by an isolated drainage system which acts as tertiary containment in the event of a spill within the building.

The site storm water drainage system was designed in full accordance with the principles of Sustainable Urban Drainage Systems (SUDs).

The OPW flood map[8] for the area indicates that the site is not located in an area of prone to flooding. The Liffey Tidal Flood Extents map, produced for the OPW is presented in Appendix C showing the site to be located outside of 10%, 0.5% and 0.1% Annual Exceedance Probability (AEP) zones.

5. Permitted Activities

The site is licensed for Class 11.1 and 11.3 (a) of listed activities in the First Schedule of the EPA Act 1992 (as amended) defined as requiring an IE Licence:

> *11.3 (a) Disposal or recovery of waste in waste incineration plants or in waste co-incineration plants for non-hazardous waste with a capacity exceeding 3 tonnes per hour*
>
> *11.1 The recovery or disposal of waste in a facility, within the meaning of the Waste Management Act, 1996, which facility is connected or associated with another activity specified in this Schedule in respect of which a licence or revised licence under Part IV is in force or in respect of which a licence under the said part is or will be required*

6. Baseline Assessment and Relevant Hazardous Substances

AECOM completed a Screening for Baseline Assessment[9] in support of the IEL review application for the DWtE site. The assessment was completed at Stage 3 of the eight stage process[10], as it was concluded that the relevant hazardous substances identified in Stages 1 and 2 would be subject to stringent on-site handling procedures and storage facilities, with the result that their release to open ground was highly unlikely.

In total, more than 50 substances currently identified to be used on site were screened out at Stages 1 and 2.

The substances carried through to assessment at Stage 3 were:

- Ammonia Solution;
- Diesel; and

[8] http://www.floodinfo.ie/map/floodmaps/
[9] Attachment 4.8.2 – Screening Baseline Assessment
[10] European Commission Guidance concerning baseline reports under Article 22(2) of Directive 2010/75/EU on industrial emissions (2014)

- Sodium hypochlorite.

Ammonia solution and sodium hypochlorite solution are stored in tanks within the main process building. The ammonia solution and sodium hypochlorite solution are stored in double-skinned tanks providing secondary containment. The isolated internal drainage system provides tertiary containment.

The diesel tank is located below ground level in the main process building. The diesel tank is bunded providing secondary containment. A leak detection system has been fitted to the bund and overfill protection has been installed on the diesel tank.

In the event of a spill or fire from a tanker external to the main process building, the spill or firewater will enter the main surface water drainage system where the diesel would be contained by two Class 1 hydrocarbon interceptor. If the volume of contaminated liquid is too large and it is not contained by the interceptor, it will enter the attenuation tank where it will be contained. Water in the attenuation tank is generally reused on site. Excess water is discharged to the public sewer; however, water is tested to ensure it complies with IEL discharge parameters before discharge.

Any spills of ammonia solution or sodium hypochlorite solution will enter the storm water drainage system and will be contained within the attenuation tank, preventing contaminated material entering the public sewage system. Water in the attenuation tank is generally reused on site. Excess water is discharged to the public sewer; however, water is tested to ensure it complies with IEL discharge parameters before discharge.

The site drainage system is inspected on a five year rotation to ensure its integrity.

Due to the provision of suitable containment and documented procedures on material use and storage, the risk of ammonia solution, diesel or sodium hypochlorite solution entering soil and/or groundwater is considered very low.

7. Site Characterisation

Potential pollutant linkages are considered viable where there is a source of contamination on site which can migrate via a defined pathway to identified receptors. Receptors can be either environmental or human, and located either within or outside the site boundary.

7.1 Sources

As discussed in the preceding sections, historic contamination is present on site associated with fill material imported in the 1970s and previous land uses. As part of construction works, site wide excavations removed at least the top 0.5 m of material from across site. The excavated material was sampled on site and sent to an external laboratory for analysis. With the exception of a small quantity of asbestos tiles, excavated materials were found suitable for reuse beneath areas of hard standing or under capping layers. Excess material and the asbestos tiles were sent for disposal off-site to appropriately licensed facilities.

As part of current and future DWtE operations a total of three relevant hazardous substances have been identified: ammonia solution, diesel and sodium hypochlorite. As discussed in Section 5, these are suitably stored on site and the risk of them entering soil or groundwater is considered very low.

7.2 Pathways

As noted, there is contamination on site associated with historic activities. In the case of relevant hazardous substances, storage facilities have been constructed to contain any losses that may occur and prevent ingress to ground.

The 2017 PM Group Soil Reusability Report states that the risk assessment conducted by Jacobs in 2009 concluded that by capping soft landscaped areas, and the presence of structures and hardstanding across the remainder of the site, potential pollutant linkages between site soils and human health and environmental receptors were broken.

There is a considerable thickness of fine grained, low permeability glacial, fluvial and marine deposits beneath the site (>30 m) that, it is considered, would restrict any losses to ground which may have occurred in the past, or that could potentially occur in the future, from migrating vertically downwards. The main pathway is considered to be lateral with shallow groundwater flow to Dublin Bay and the estuary of the River Liffey.

The likelihood of contemporary contamination impacting receptors is low due to containment safeguards built into the storage and drainage systems on site.

Should contamination enter the on-site drainage system it will be contained in the attenuation tank, excess water from the tank is discharged to the sewage system following testing and not to surface water therefore there is no potential for it migrate off site.

7.3 Receptors

As groundwater beneath site is unsuitable for potable use, the main potential receptors of contamination to ground at the site are identified as on-site workers and environmental receptors in Dublin Bay and the estuary of the River Liffey.

With regard to historic contamination present within fill material, the capping of contaminated material and/or the construction of hardstanding across it has broken potential pathways for controlled waters or on-site human receptors to be exposed. With regard to hazardous substances being stored and used on site, as a result of the relatively small quantities and containment safeguards built into storage and drainage networks on site the overall risk to the receptors is considered to be low.

7.4 Environmental Objectives (Groundwater) Regulations

Compliance with the groundwater regulations is assessed on both the Chemical and Quantitative status of the groundwater body. The bedrock groundwater body beneath the site is currently classified as being of *Good Status* and *Not At Risk*.

The site is not, and has no plans to, abstract from or recharge groundwater to the aquifer; therefore, it will have no likely impact on the Quantitative status of groundwater.

The Chemical status of groundwater is assessed by comparing the results of groundwater samples to the published GTVs, as issued in 2010 and amended in 2016. Available groundwater results for 2017 and 2018 are compared against GTVs in Appendix B Table 5 and summarised in section 3.6.

8. Conclusion

On the basis of the containment safeguards implemented on site, there is considered to be a Low Risk of soil and/or groundwater beneath the site being impacted by contemporary hazardous substances.

Results of previous site investigations indicate that soil and groundwater were contaminated prior to construction of the DWtE facility. Evidence of hydrocarbon and molasses free product has been recorded in groundwater monitoring wells and evidence of heavy metal contamination has been noted in site investigations prior to the development of the site.

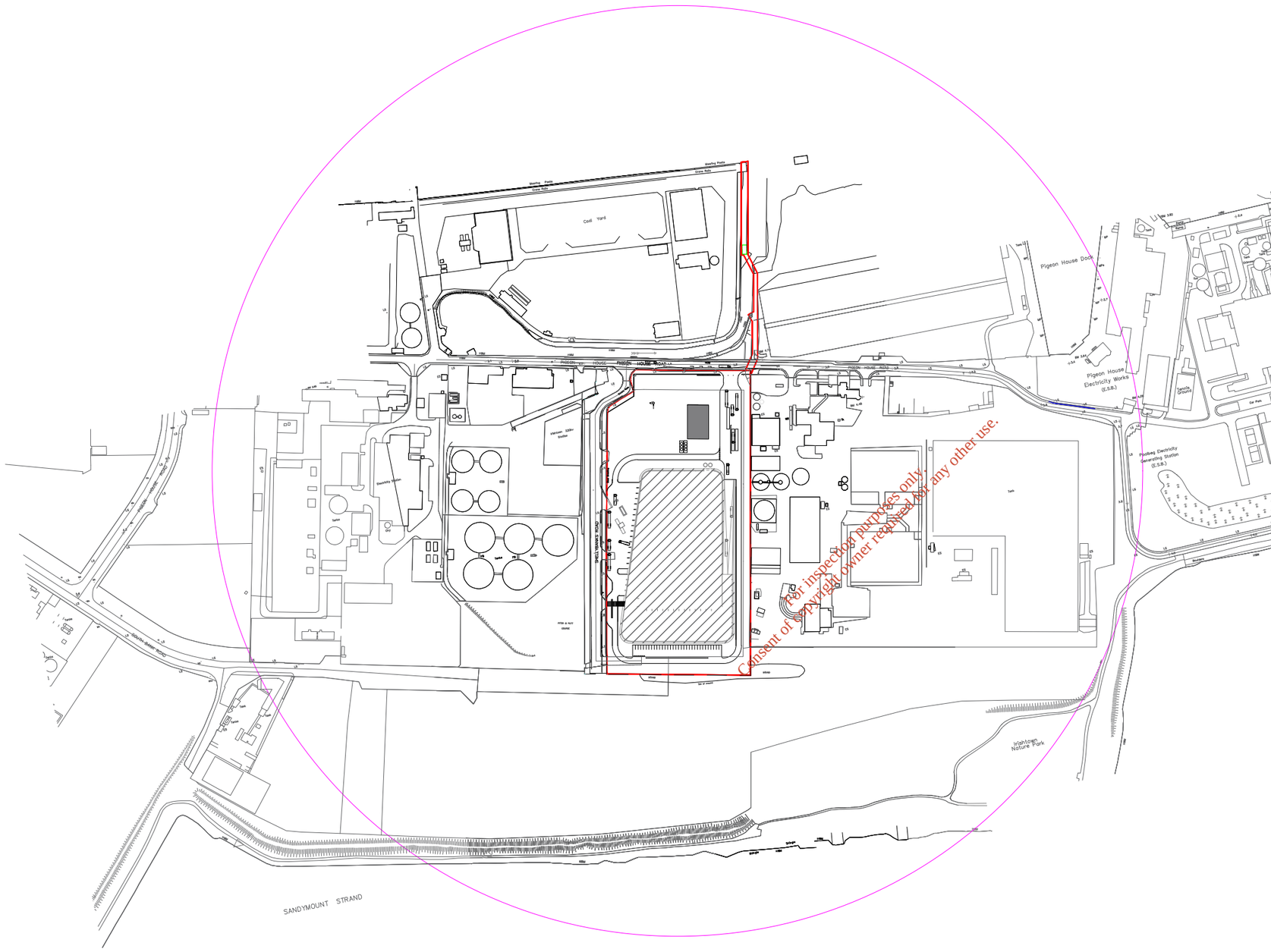
As contaminated soil on site is located under areas of hardstanding or under capped areas there is no pathway from historic contaminated soils to identified receptors.

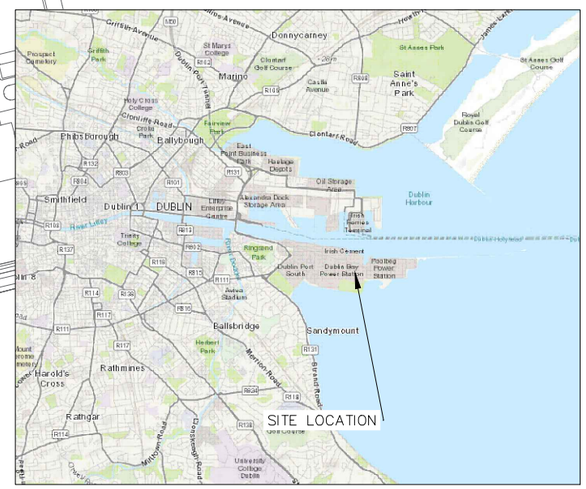
Given the thickness of low permeability, fine grained, glacial, fluvial and marine deposits beneath the site (>30 m) it is considered that this would restrict any losses to ground which have occurred in the past, or that could potentially occur in the future, from migrating vertically downwards. Thus, the thick overburden affords protection to the bedrock aquifer beneath the site.

Safeguards have been included during the site construction to provide secondary and tertiary containment where significant volumes are to be stored and transferred. Therefore, proposed site

operations are also considered to be a Low Risk of soil and/or groundwater beneath the site being impacted by hazardous substances in the future.

Appendix A Figures





LEGEND

- AREA SUBJECT TO IE LICENCE APPLICATION
- 500m BOUNDARY OFFSET

DEF. N

Project Title: W0232-01 IE LICENCE REVIEW APPLICATION Application ID LA003577	Drawing Title: SITE LOCATION PLAN	Purpose of issue: INFORMATION			
Client: DWtE		Designed: RPW	Drawn: SMF	Checked: CD	Approved: CD/DUB	Date: 04.04.19
		AECOM Internal Project No.: PR-351653		Suitability: FOR INFORMATION	
		Scale @ A3: 1:2500		Zone / Mileage: DUBLIN	

Drawing Number	Rev
001	0

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Dublin, Ireland
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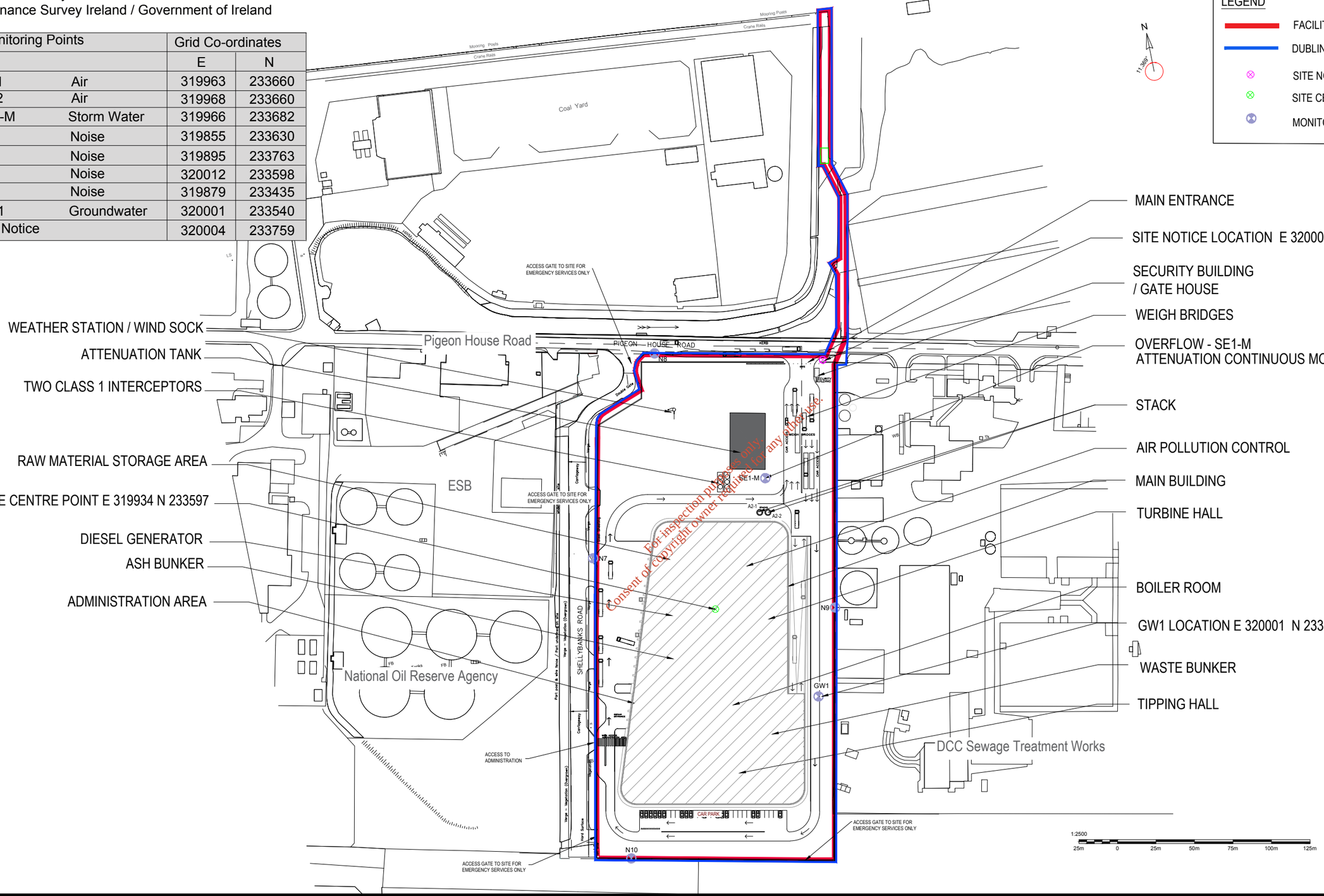
Monitoring Points		Grid Co-ordinates	
		E	N
A2-1	Air	319963	233660
A2-2	Air	319968	233660
SE1-M	Storm Water	319966	233682
N7	Noise	319855	233630
N8	Noise	319895	233763
N9	Noise	320012	233598
N10	Noise	319879	233435
GW1	Groundwater	320001	233540
Site Notice		320004	233759



Project Title: W0232-01 IE LICENCE REVIEW APPLICATION Application ID LA003577	Drawing Title: SITE LAYOUT PLAN	Purpose of issue: FINAL				
Client: DWtE		Designed: RPW	Drawn: SMF/RDH	Checked: CD	Approved: CD/DUB	Date: 04.04.19
		AECOM Internal Project No.: PR-351653		Suitability: FOR INFORMATION		
		Scale @ A3: 1:2500		Zone / Mileage: DUBLIN		

Drawing Number: 002 | Rev: B

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Appendix B Tables

Prepared by: BMC
Checked by: EOH

Appendix B Table 1 2003 GSL Borehle and Trial Pit Details

Location	Depth m bgl	Elevation mAOD	Depth mAOD	Installation	Installation Depth m bgl	Top of Screen m bgl	Base of Screen m bgl
Boreholes							
BH1	65.5	3.64	32.66	Yes	12	2	12
BH2	34	3.99	30.01	No	-	-	-
BH3A	35.5	3.59	31.91	No	-	-	-
BH4	33.5	3.49	30.01	Yes	20	2	20
BH5	34	4.38	29.62	Yes	12	2.5	12
BH6	40.2	3.91	36.29	Yes	40.2	34.2	40.2
BH7A	40.2	3.66	35.54	No	-	-	-
BH8	46.5	3.95	42.55	Yes	46.5	40.5	46.5
BH9	49.5	4.29	45.21	Yes	49.5	44.7	49.5
BH10	43.17	4.3	38.87	No	-	-	-
Trial Pits							
TP1	4	3.81	0.19	-	-	-	-
TP2	4.4	3.72	0.68	-	-	-	-
TP3	3.4	3.67	-0.27	-	-	-	-
TP4	4.2	3.7	0.50	-	-	-	-
TP5	3.1	3.35	-0.25	-	-	-	-
TP6	3.7	3.45	0.25	-	-	-	-
TP7	3.5	3.77	-0.27	-	-	-	-
TP8	4	4.26	-0.26	-	-	-	-
TP9	3.5	4.36	-0.86	-	-	-	-

Notes:
m bgl: metres below ground level
m AOD: metres above ordinance datum
- Not Applicable
Installation: Installed as groundwater monitoring well

Prepared by: BMC
Checked by: EOH

Appendix B Table 2 2005 RPS Borehle and Trial Pit Details

Location	Depth m bgl	Elevation mAOD	Depth mAOD	Installation	Installation Depth m bgl	Top of Screen m bgl	Base of Screen m bgl
Boreholes							
MW01	7	NR	NR	NR	5	2	5
MW02	8	NR	NR	Yes	8	6	8
MW03	7	NR	NR	Yes	5	2	5
MW04	1.5	NR	NR	No	-	-	-
MW04(A)	7	NR	NR	Yes	6	3	6
MW05	12	NR	NR	Yes	12	8.5	12
MW06	2.7	NR	NR	No	-	-	-
MW06(A)	7.3	NR	NR	Yes	7	3.5	7
MW07	6.8	NR	NR	Yes	6.8	3.5	6.8
Trial Pits							
TP01	3.7	NR	NR	-	-	-	-
TP02	3.2	NR	NR	-	-	-	-
TP03	3.4	NR	NR	-	-	-	-
TP04	3.6	NR	NR	-	-	-	-
TP05	3	NR	NR	-	-	-	-
TP06	2.4	NR	NR	-	-	-	-
TP07	3.7	NR	NR	-	-	-	-
TP08	3.4	NR	NR	-	-	-	-
TP09	2.2	NR	NR	-	-	-	-
TP10	2.8	NR	NR	-	-	-	-
TP11	4	NR	NR	-	-	-	-
TP12	4	NR	NR	-	-	-	-
TP13	3.7	NR	NR	-	-	-	-
TP14	3.6	NR	NR	-	-	-	-
TP15	3.6	NR	NR	-	-	-	-
TP16	3.1	NR	NR	-	-	-	-
TP17	2.6	NR	NR	-	-	-	-
TP18	3	NR	NR	-	-	-	-

Notes:
m bgl: metres below ground level
m AOD: metres above ordinance datum
- Not Applicable
Installation: Installed as groundwater monitoring well
NR: Not Recorded

Prepared by: BMC
Checked by: EOH

Appendix B Table 3 2005 IGSL Borehle Details

Location	Depth m bgl	Elevation mAOD	Depth mAOD	Installation	Installation Depth m bgl	Top of Screen m bgl	Base of Screen m bgl
Boreholes							
BH1	39.2	NR	NR	Yes	NR	NR	NR
BH2	37.7	NR	NR	Yes	NR	NR	NR
BH3	16	NR	NR	Yes	NR	NR	NR
BH4	3	NR	NR	Yes	NR	NR	NR
RC1	46	NR	NR	Yes	NR	NR	NR
RC2	52	NR	NR	Yes	NR	NR	NR

Notes:
m bgl: metres below ground level
m AOD: metres above ordinance datum
-
Installation: Installed as groundwater monitoring well
NR: Not Recorded

Prepared by: BMC
Checked by: EOH

Appendix B Table 4 2006 Site Specific Assessment Criteria

Contaminant	Category A	Category B Hardstanding	Category B Landscaping
Units mg/L			
Metals/Metalloids			
Antimony	22	N/A	N/A
Arsenic	55	N/A	N/A
Barium	475	N/A	N/A
Chromium	55	N/A	N/A
Lead	405	N/A	N/A
Nickel	57	N/A	N/A
Copper	127	N/A	N/A
Molybdenum	190	N/A	N/A
Zinc	450	N/A	N/A
Total Petroleum Hydrocarbons (TPH)			
Total TPH	2,500	33,000	5,500
Aliphatics			
C5-C6	288		
C6-C8	1,020		
C8-C10	317		
C10-C12	30,400		
C12-C16	30,400		
C16-C21	627,000		
C21-C35	627,000		
Aromatics			
C6-C7	121		
C7-C8	139		
C8-C10	513		
C10-C12	2,600		
C12-C16	12,400		
C16-C21	9,350		
C21-C35	9,410		
Polyaromatic Hydrocarbons			
Total PAH Duct 10	40		
Benz(a)anthracene	30		
Benzo(a)pyrene	30	130	22
Total PAH (16 USEPA		1,300	220
PCB	10	11,100	11,100
Leachate Metals			
Antimony	N/A	2.90	0.80
Arsenic	N/A	5.80	0.96
Barium	N/A	58.00	9.6
Chromium	N/A	18.00	2.9
Lead	N/A	5.80	0.96
Nickel	N/A	12.00	1
Copper	N/A	18.00	2.88
Molybdenum	N/A	51.00	6.7
Zinc	N/A	58.00	9.60

Notes:

Category A Soils: Suitable for use in all landscaping areas below 300 mm or under buildings or hardstanding areas

Category B Soils: Suitable for use in all landscaping areas below 1 m or under buildings or hardstanding areas

Prepared by: BMC
Checked by: EOH

Appendix B Table 5 Groundwater Results (mg/L)

Analyte	GTV	GW1		GW2
		Nov-17	Oct-18	Nov-17
Ammonia	0.065-0.175	<0.08	<0.013	**7.1**
COD	---	-	131	-
Arsenic	0.0075	0.006	**0.017**	**0.031**
Cadmium	---	<0.001	0.0006	<0.001
Chromium	0.0375	0.009	0.0133	0.027
Cobalt	---	-	0.0045	0.005
Copper	---	0.009	0.045	0.006
Lead	0.0075	0.007	**0.082**	<0.001
Manganese	---	0.04	0.34	4.67
Mercury	0.00075	<0.0001	0.0002	<0.0001
Nickel	---	0.036	0.045	0.015
Potassium	---	34	28	234
Thallium	---	<0.001	<0.003	<0.001
Tin	---	0.002	<0.003	<0.001
Vanadium	---	0.172	-	0.002
VOCs	Varies	ND	ND	ND
SVOCS	Varies	ND	-	ND
Pesticides	Varies	ND	-	ND

Notes:

Indicates result above

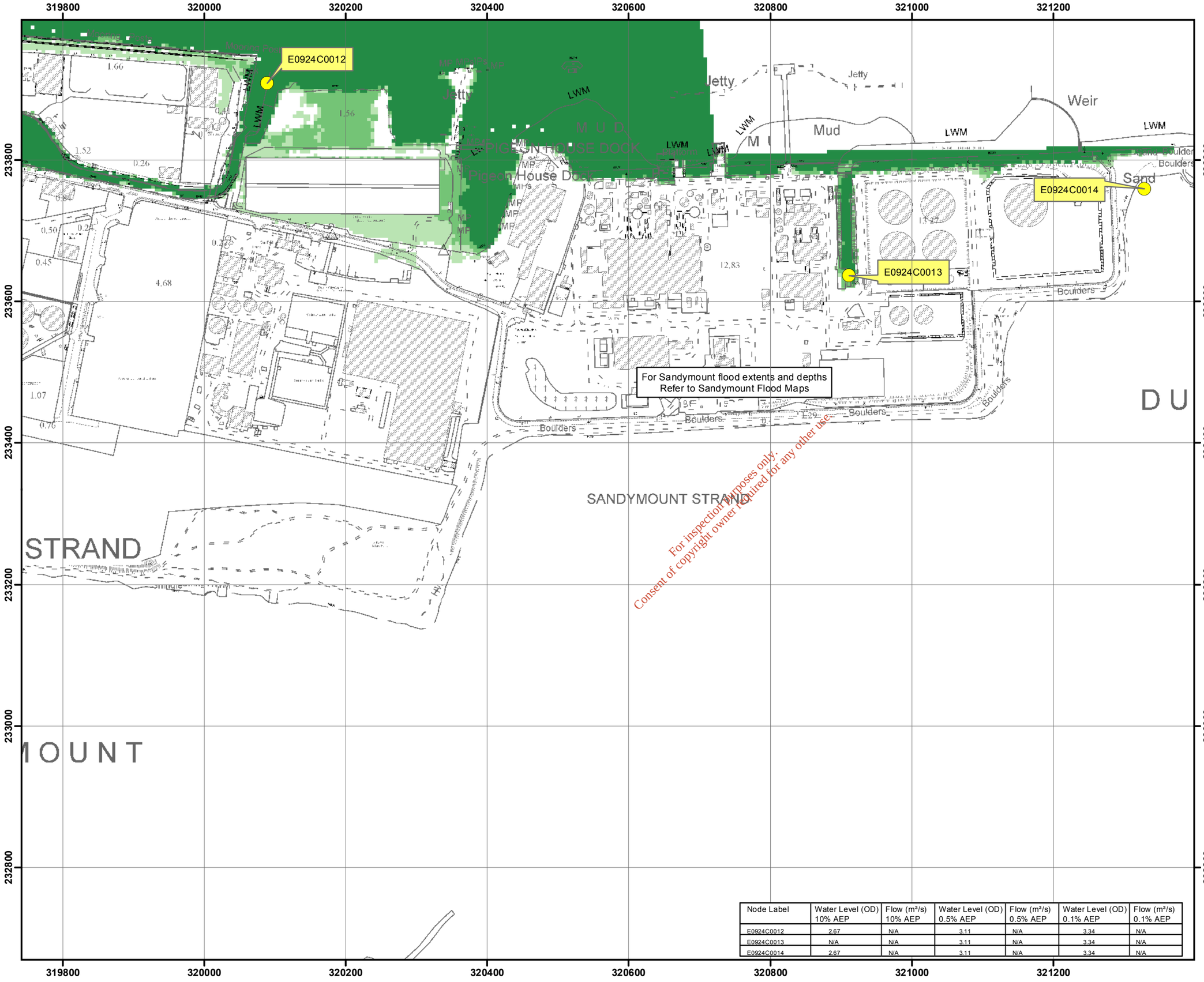
GTV Groundwater Threshold Value

--- GTV not defined

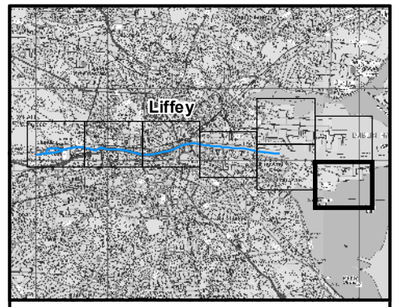
- Not Analysed

ND Not Detected

Appendix C Flood Map



Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 0.5% AEP	Flow (m³/s) 0.5% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
E0924C0012	2.67	N/A	3.11	N/A	3.34	N/A
E0924C0013	N/A	N/A	3.11	N/A	3.34	N/A
E0924C0014	2.67	N/A	3.11	N/A	3.34	N/A



IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

Legend

- 10% Tidal AEP Event
- 0.5% Tidal AEP Event
- 0.1% Tidal AEP Event
- Modelled River Centreline
- AFA Extents
- Node Point
- Node ID Node Label

FINAL

REV:	NOTE:	DATE:
01	Amendments to Flood Extents.	05/12/16

EASTERN CFRAM STUDY
CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT

The Office of Public Works
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Trim
Co Meath

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W www.rpsgroup.com
E ireland@rpsgroup.com

Map:
Liffey Tidal Flood Extents

Map Type: EXTENT
Source: TIDAL
Map Area: COASTAL
Scenario: CURRENT
Drawn By : C.C. **Date :** 9 May 2017
Checked By : A.S. **Date :** 9 May 2017
Approved By : S.P. **Date :** 9 May 2017
Drawing No. :
E09LIF_EXCCD_F1_06
Map Series : Page 6 of 8
Drawing Scale : 1:5,000 @A3

Appendix D 2006 Arup Desk Study

Arup Consulting Engineers

Elsam

Dublin Waste to Energy Project, Ringsend, Dublin

Geo-Environmental Engineering Assessment

June 2006

This report takes into account the particular instructions and requirements of our client.
It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party

Job number D5072/30

Arup Consulting Engineers
10 Wellington Road, Dublin 4 Ireland
Tel +353 1 614 4200 Fax +353 1 668 3169
www.arup.ie

Job title	Dublin Waste to Energy Project, Ringsend, Dublin		Job number D5072/30
Document title	Geo-Environmental Engineering Assessment		File reference
Document ref			

Revision	Date				
Draft 1	31/05/06	Filename			
		Description	First draft		
			Prepared by	Checked by	Approved by
		Name	Malcolm Fitzell/ Craig O'Connor	Michael McGowan	Sean Mason
		Signature			
Issue	07/06/06	Filename	Geo-Environmental Engineering Assessment_07-06-06_D5072-30.doc		
		Description	Issue		
			Prepared by	Checked by	Approved by
		Name	Malcolm Fitzell/ Craig O'Connor	Michael McGowan	Sean Mason
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			

Issue Document Verification with Document ✓

CONTENTS

REFERENCES

Tables

Figures

1. INTRODUCTION

Dublin Waste to Energy Limited are the preferred bidder for the Dublin Waste to Energy Project, in association with Dublin City Council (DCC) as a public private partnership arrangement.

The site for the proposed facility is situated on the Poolbeg Penninsula, Ringsend, Dublin (See Figure 1). A number of previous site investigations had taken place on the site between 2001 and 2005 and these investigations identified a considerable thickness of made ground beneath the site and also noted observations of hydrocarbon contamination.

Arup Consulting Engineers have been appointed by Elsam A/S to complete a desk study of the site including a review of previous intrusive geotechnical and environmental ground investigations in order to produce a geo-environmental engineering assessment of the site as a response to concerns regarding the precise extent of the made ground/ fill material, its depth and the levels of contamination present. No additional site investigation or chemical testing of soil or groundwater from the site was undertaken to complete this assessment.

Section 2 of the report describes the proposed development in relation to the site. A desk study of the site is presented in Section 3. Section 4 describes the site investigations previously carried out on the site. Section 5 presents the ground conditions specific to the site. An appraisal of the available environmental data is presented in Section 6 followed by an appraisal of the geotechnical data in Section 7. Engineering studies undertaken are presented in Section 8 and conclusions and recommendations in Section 9 of the report.

2. PROPOSED DEVELOPMENT

2.1 General Site Description

The proposed facility will comprise a waste to energy facility which will be constructed on a reclaimed site at Pigeon House Road, Ringsend, Dublin (See Figure 1).

2.2 Concept Design

The proposed layout and elevations of the facility are contained on the following drawings produced by Elsam A/S. Relevant drawings include:

Drawing BE002	Layout Permanent Waste Facility
Drawing BE101	Layout Elevation and Distances
Drawing BH001	Layout Longitudinal Section
Drawing BH002	Layout Elevation East
Drawing BH003	Layout Elevation West
Drawing BH004	Layout Elevation North
Drawing BH005	Layout Elevation South

These drawings show the main elements to the facility including the waste bunker, waste reception hall, plant and turbine rooms and flues. External areas comprising roads / parking and landscaped areas are also indicated. A full description of the proposed facility is provided in the EIS.

2.3 Site Formation and Landscaping

The principal areas of cut and fill and land-uses within the site are shown on Figure 2. In the course of construction an amount of material will need to be excavated from portions of the site whilst fill material will be required in other parts of the site. Estimates of the main quantities are given below:

Table 2.1: Approximate Earthworks Quantities

Cut areas	**Un-bulked Volume (m^3)**
Main Building (including Waste Bunker)	16,000
Cooling water pipes	2,000
External Areas	2,000
Fill areas	**Un-bulked Volume (m^3)**
Main Building (incl. Ramp)	6,500
Roads / Hardstanding	7,000
Soft Landscaped Areas	6,000

The principal options of using excavated material onsite will be:

- Filling of soft landscaped area in the northern part of the site;
- Filling beneath the access ramp to the main building.

The implications and viability of retaining the excavated material on site or whether excavated material will be unsuitable for reuse onsite and will require disposal off site are discussed in Section 8 of this report.

3. DESK STUDY

3.1 Site Location

The site is located in an area known as the Poolbeg Penninsula which forms the southern boundary to the entrance to Dublin Port. The principal part of the site itself is situated to the south of Pigeon House Road, east of the Synergen Dublin Bay Power Plant. The Ringsend Wastewater Treatment Plant is located immediately to the west. The auxiliary part of the site which will house the cooling water pipes is located to the north of Pigeon House Road.

3.2 Site Description

The site is rectangular in outline and extends for a distance of approximately 335 metres SSW from Pigeon House Road and is approximately 160 metres from WNW to ESE. The area of the site is approximately 5.5 Ha.

The northern portion of the site, adjoining Pigeon House Road, is currently used as a scrap metal storage and processing yard by the Clearway Disposal. Much of this area is covered by piles of scrap metal. A number of loading bays are present in the west-centre of this area.

A small office building and substantial sheet metal shed are situated in the south-western part of this area. An unbunded fuel oil tank is situated close to the east of this shed; there is evidence of recent fuel oil spillage beside this tank. The ground surface throughout this portion of the site appears to be rubble/gravel/soil with no hard standing evident.

The west-central portion of the site is occupied by Hibernian Molasses Limited and is dominated by one large and three smaller, circular above ground steel storage tanks which contain molasses. These tanks are bunded and there is a concrete surface inside the bunds. Two unbunded rectangular cylindrical steel tanks are present immediately to the northeast, located on a gravel surface – this area is used for loading/unloading. It is understood that these tanks contain blended molasses. Tanker trucks were also seen to be parked in this area. A light fuel oil tank is situated close to the site entrance on a gravel surface.

The east-central portion of the site, separated from the Hibernian Molasses premises by a high steel fence, is understood to be vacant and in the ownership of Dublin City Council and forms part of their waste water treatment facility.

A pipeline runs along the eastern boundary of the scrap yard premises, then along the northern boundary of the east-central portion of the site and continues into the Hibernian Molasses premises. We understand that this is a supply pipeline taking molasses material from ship into the molasses plant (Hibernian Molasses Limited).

The southern part of the site is largely surfaced in tarmac except for portions of the periphery which appear to be gravelled. A number of truck trailers are parked and there are also a considerable number of portable plastic storage tanks in the northern part. There is a substantial prefabricated office/storage building situated near the eastern perimeter and a smaller, similar building in the north-centre.

Pigeon House Road is at an elevation of between about +3.8 and +4.8mOD at the northern margin of the site. In general ground levels on the site itself are between approximately +3.6 and +4.7 mOD, with the scrap metal yard in the northern part of the site being slightly higher than the remainder of the site (see Figure 3). There is no appreciable sloping ground on the site.

3.3 Surrounding Land Use

The surrounding area is currently dominated by industrial utilities and fuel storage facilities including some derelict and disused industrial sites. There is also some public amenity/open space south of the site.

The Synergen Dublin Bay Power Plant is situated to the west of Shellybanks Road which runs along the western boundary of the site. The northern portion of this road is currently used by vehicles accessing Hibernian Molasses' plant.

The Ringsend Wastewater Treatment Plant is situated to the east of the site.

To the north of the site, immediately to the north of Pigeon House Road, there is an open channel which carries cooling water from the power plant into the Liffey Estuary.

The Irishtown Nature Park is situated to the southeast of the site whilst Sean Moore Park, Irishtown Stadium and Ringsend Park are situated to the east.

3.4 Site History

An historical review of the site and surrounding area has been undertaken for Dublin City Council by the RPS Group (ref. RPS 2005) and reported on under a separate cover (See EIS Chapter 16 – Archaeology). This assessment of the site was based on a review of historical maps and aerial photographs.

The study showed the site was largely underwater up to the 1970s except for a small amount of beach shingle in the northern portion of the site adjoining Pigeon House Road. In the late 1930's the old Poolbeg power station was built to the west of the site and was enlarged by subsequent land reclamation towards the east where a number of oil tanks were installed. An outfall from the power station discharged onto the existing site which was described as a lagoon contained by a sand and gravel bund situated to the south.

A sewage works and outfall is described as situated to the north of Pigeon House Road from the 1930s and possibly earlier. The Ringsend Wastewater Treatment Plant east of the site dates from c.1976-78.

The RPS report records that the site was infilled between 1970 and 1976 with a mixture of glass, rubble, concrete, ash waste, bricks, gravel and clay. A Dublin Port and Docks Board map shows the northern and central portions of the site as infilled in September 1972 (Figure 4). A handwritten addition to this drawing notes that this infilled material may possibly have consisted of hydraulic fill.

The RPS report noted that Hibernian Molasses established a plant on the site in 1979 and that the five above ground storage tanks which currently exist were recorded on the 1988 Ordnance Survey 1:1000 scale map for the area. The tanks were described in the RPS report as currently containing molasses except in the case of one smaller tank which contained light fuel oil.

The northern and southern portions of the site were reported to be coal storage sites in 1982. The northern portion of the site is mentioned as having been leased to Coal Distributors Limited prior to 1995 and since then it has been operated as a scrap metal yard.

3.5 Ground Conditions and Geology

General geological information on the study area was obtained from the following sources:

- GSI 1:100,000 scale Bedrock Geology map, Sheet 16 (Kildare-Wicklow)
- The GSI 1:50,000 scale Quaternary map of Dublin
- Nolan, S.C. 1986 *The Carboniferous Geology of the Dublin Area.* Unpubl. PhD thesis, Univ.Dub.
- Naylor, D. 1965 Pleistocene and post-Pleistocene sediments in Dublin Bay, *Sci. Proc. Roy.Dub. Soc.,* Series A, Vol. 2, 175-188
- Farrell, E. R., and Wall D., 1990 The soils of Dublin, *Trans. Instn. Engrs. Ireland*, 115, 78-97

Detailed geological information, data on ground conditions and environmental information was inferred from available ground investigation data for the site and adjoining areas, see Section 4.

4. PREVIOUS GROUND INVESTIGATIONS ON SITE

4.1 General

Previous geotechnical and environmental investigations have been carried out by others to provide data on the ground conditions, the contamination levels of the soil and the hydrogeological conditions relating to the site. These investigations fall into two categories:

- Previous ground investigations on site, see Table 4.1 below and Figure 5;
- Archival ground investigations undertaken in the surrounding areas, see Table 4.2 below. Unless specifically stated otherwise these investigations have not been considered in this appraisal.

Table 4.1: Previous ground investigations on site

Contractor	Description of Investigation	Number of Explorations	Date work carried out
Geotech Specialists Limited	Factual Report on Ground Investigation, Dublin Waste to Energy Project	5 shell & auger 5 rotary core 9 trial pits 5 slit trenches	May-June 2003
RPS	Soil and Groundwater Investigation at Dublin Waste to Energy Site, Ringsend, Dublin	7 shell & auger 18 trial pits	March 2005
IGSL	Site Investigation at Waste to Energy Project, Ringsend, Dublin City	4 shell & auger 2 rotary core 2 CPT	October 2005

Table 4.2: Archival ground investigations in the surrounding area

Contractor	Description of Investigation	Number of Explorations	Issue date
IGSL	Poolbeg Generating Station Site Investigation (Report available but no borehole logs or maps included)	14 shell & auger with rotary coring 4 trial pits	1992
Norwest Holst	Ringsend Wastewater Treatment Works Investigation	125 trial pits, 114 percussive boreholes, 35 rotary cored holes, 59 dynamic and 36 static cone probe holes	1997

4.2 Fieldworks

4.2.1 Cable Percussive Boreholes

In total, 16 no. cable percussive boreholes were undertaken at the site (Figure 5). They typically extended to a depth of up to 34m bgl. Disturbed samples were taken at typically 1-2m intervals from the drill holes undertaken. Standard Penetration Tests (SPT's) were typically undertaken at 1.5-2m intervals from ground level in all of the cable percussive boreholes, except in the RPS 2005 investigations.

4.2.2 Rotary Core Drill-Holes

A total of 7 no. rotary core drill-holes were completed at the site (Figure 5). They generally were drilled to depths of 40-52m bgl. The holes undertaken during the 2003 Geotech investigation were open hole drilled to bedrock; Standard Penetration Tests (SPT's) were typically carried out at 1.5 m intervals between ground level and bedrock in the 2003 drill-holes.

4.2.3 Trial Pits

27 no. trial pits were completed within the site, see Figure 5. Disturbed bulk samples were taken from each pit.

4.2.4 Slit Trenches

5 no. slit trenches were excavated during the Geotech investigation in 2003 (Figure 5). The slit trenches were situated along the perimeter in the western and south-western portions of the site. The trenches were dug to a depth of 1.2m bgl and were 10.0 – 10.5 m in length. The slit trenches where undertaken primarily to locate services.

4.2.5 Cone Penetration Testing

Cone penetrometer (CPT) tests were carried out at two locations in the southern portion of the site during the 2005 IGSL investigation. The tests were subcontracted to the Civil Engineering Department of Trinity College, Dublin.

4.2.6 Groundwater Monitoring

Standpipes were installed in 15 no. of the drillholes, as follows (see Figure 5):

- BH1, BH4, BH5, BR6, BR8, BR9 (2003);
- BH3, BH4 (2005)
- MW01, MW02, MW03, MW04a, MW05, MW06A and MW07 (2005).

Water level monitoring was carried out in 2003 in all of the 2003 installations, and in 2005 for 4 of the 2003 installations (BH1, BH4, BR6 and BR8) and all of the 2005 installations (MW01 - MW07).

4.2.7 Gas Monitoring

Gas barrel headworks were installed on the following drill holes: BH1, BH4, BH5, BR6, BR8 and BR9 (Figure 5). Gases measured included O_2, CO_2 and CH_4 and barometric pressure on one occasion only.

4.3 Environmental Laboratory Testing

Laboratory testing of selected soil and groundwater samples recovered was undertaken as follows:

4.3.1 2003 Geotech Investigations (Environmental Testing)

6 no. soil samples were tested for metals (As, Ba, Cd, Cr, Cu, Hg, Mo, Ni, Pb, Sb, Se, Zn), free/total cyanide, thiocyanate, elemental sulphur, sulphate, sulphide, hexavalent chromium, pH, TPH, PAHs and phenol index. 2 no. samples were tested for dioxins and 28 no. samples for pH/sulphates.

It should be noted that no groundwater samples were tested as part of this investigation.

4.3.2 2005 RPS Investigations (Environmental Testing)

64 no. soil samples were tested for TPH, PAHs, VOCs, metals, asbestos, pH, ammonia, total/faecal coliforms and phenols.

11 No. groundwater samples (7 from new installations /4 from 2003 installations) were tested for TPH, PAHs, VOCs, metals, pH, total/faecal coliforms and phenols.

4.4 Geotechnical Laboratory Testing

Particle size distribution and classification tests were carried out on selected disturbed samples of soil recovered from the cable percussive drill holes. Unconsolidated undrained triaxial tests and 1-D consolidation tests were carried out on selected samples recovered. Point load index tests and uniaxial compressive strength tests were carried out on rock cores recovered during rotary coring.

5. GROUND CONDITIONS

5.1 Overview

5.1.1 Geotechnical setting

A detailed geological cross section and layout of the existing boreholes at the site are presented in Figures 5 and 6. The general stratigraphy is summarised in tabular form below:

Table 5.1: Summary of General Stratigraphy

Stratigraphic Divisions		Lithostratigraphy and Genetic Classification	Principal Materials
Quaternary	Recent	Made ground (fill)	Natural earth and man made waste / made ground.
	Recent	Marine (beach, estuarine and seabed) deposits	Generally mixed silts/clays and fine sands with shell fragments
	Pleistocene-Recent	Glacial and Fluvioglacial deposits	Generally well sorted sand and gravels, typically with some cobbles, and boulders in places. Some boulder clay layers reported in places
	Pleistocene	Outwash/ glacio-marine clay deposit	Slightly sandy clays with some silt and sand layers. Thicker sandy silt/clay at top in places
		Lodgement till/ weathered rock	Boulders, cobbles, gravel, clay, silt
Lower Carboniferous		Calp Formation	Dark grey, fine grained limestone with interbedded black shale, and locally common chert

Reviews of site investigation data in the Dublin port area (Naylor, 1965; Farrell and Wall, 1990) indicate local thickening of the Quaternary deposits in a deep channel in the bedrock surface, from -20mOD in the Ringsend/Irishtown area to -40mOD in the in the area of the site. This channel extends north-westwards through the Alexandra Basin on the northern side of the Liffey.

5.2 Geotechnical Materials

5.2.1 Made Ground

During site investigations undertaken on the site the made ground was logged as being between 1.6 m and 5.6 m in thickness across the site. It consists of a mixture of gravels, sands, silts and clays and includes rubble, bricks, concrete, glass, timber and cinder. By its nature the composition of the material is variable as can be seen from the drill-hole logs and photographs taken.

The inferred extent and thickness of the fill material at the site is shown graphically on Figure 6.

5.2.2 Recent Marine Deposits

This material generally consists of loose to medium dense sandy silt and slightly clayey/silty fine sand with shells and, where logged, ranged in thickness from 0.3m to 2.5m in thickness.

5.2.3 Glacial and Fluvioglacial Deposits

This material consists of sands and gravels (generally medium dense to dense sandy gravel with shell fragments and occasional cobbles and boulders). Occasionally the material is silty in nature. Where proven, thicknesses logged varied between 10.5m and 13.3m.

5.2.4 Outwash/Glacio-Marine Clay Deposits

The upper layer of this stratum has been described as a silt with sand laminations. Where logged this material varied between 5.5 m and 6.4 m in thickness. The sand laminations of this material make it susceptible to blowing without good control of groundwater during drilling, as is evident from the low SPT values reported for the IGSL 2005 investigations. This material may be a glacial outwash deposit.

Below this layer a thick, possibly glacio-marine deposit is encountered. This is generally described as stiff to very stiff dark grey or black slightly sandy clay with layers and laminations of silt and silty sand. Where proven, thicknesses ranged between 15.4 m and 16.5m.

5.2.5 Limestone Bedrock

The bedrock underlying the site is described as strong, mostly thinly bedded, fine grained Limestone. Rockhead was confirmed at a number of locations within the site. Depths to rockhead varied between 36 and 45mbgl (-32mOD and –40mOD).

Closely to medium spaced fractures were described as occurring in this limestone. Some weathering of the limestone was recorded, with localised zones of brown clay, and infill along fracture planes.

5.3 Groundwater

The main aquifer beneath the site is the sand/gravel unit below the made ground (i.e. fluvioglacial sands/gravels). The made ground and underlying sands/gravels are expected to be in hydraulic continuity. The clays underlying the sands/gravels act as aquitards, restricting the downward movement of groundwater.

The water table was monitored at a depth of approximately 3-4 m bgl towards the base of the fill material across the site, close to mean sea level. The elevation of the water table at the site is expected to be heavily influenced by tidal effects given the close proximity to Dublin Bay.

7 no. monitoring wells were installed across the site during the RPS site investigation in 2005. The monitoring wells were installed to shallow depths, mostly screened across the fill material/natural ground boundary. Groundwater levels reported by RPS in March 2005 indicate a hydraulic gradient to the east towards Dublin Bay. Deeper groundwater in the limestone bedrock has not been monitored however it would be expected to be brackish to saline, discharging to Dublin Bay.

The sands/gravels although permeable do not represent a potable supply of groundwater given the close proximity to the sea and the recent history of landfilling in the area. The Ringsend area is served by a mains water supply and it is unlikely that there are any private groundwater abstractions in the area. The limestone bedrock (Calp) is classified regionally as a Locally Important Aquifer, moderately productive only in local zones (Ll).

6. APPRAISAL OF ENVIRONMENTAL DATA

6.1 Overview of Legislative Context

6.1.1 Soils

Ireland lacks specific legislation for dealing with contaminated land, however current legislation provides certain powers for dealing with contaminated land such as the Waste Management Acts 1996 – 2003 (and arising Regulations), the Local Government (Water Pollution) Acts 1977-1990, the Building Control Act 1990 (and arising 'Building Regulations'), and the Protection of Environment Act 2003.

In the absence of any national guidelines regulating levels of contamination in soils and groundwater in Ireland, it has been common industry practice to compare contaminant levels with the Dutch guideline values for soil remediation (RIVM 2000). The Dutch guidelines do not have any statutory basis in Ireland however they are widely accepted by the Irish environmental industry and by Irish regulatory authorities. This approach was applied to the sample results to initially assess the levels of possible contamination within the site. This is considered a qualitative assessment as it involves screening the results against guideline values such as the Dutch guideline values.

The Dutch soil remediation guidelines provide "Target" and "Intervention" values for a wide range of soil and groundwater contaminants. "Target" values generally represent clean up levels for soil remediation and are based on the principal of multi-functionality, where remediation must fully recover the functional properties of the soil for humans, plant and animal life. "Intervention" values represent the level of contamination above which there is a serious case of soil contamination. If the Intervention values are exceeded, clean up should be considered (unless a subsequent site specific risk assessment proves otherwise). In Ireland the "suitable for use" principle is adopted for soil remediation, where remedial action is only necessary if there are unacceptable risks to human health or the environment.

If material were to be reused or stored on site, or left in situ, a site-specific risk assessment may be required depending on the level of contamination. Site-specific risk assessment is quantitative, in that a given site (with unique characteristics) is quantitatively assessed as to the potential for hazards to impact on specific receptors, either human or environmental.

However, if soil is excavated and taken offsite it becomes a waste and there are regulations determining the levels of contamination in waste materials. The EU Council Decision of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills, which formed an annex to the Landfill Directive (1999/31/EC), took effect in Ireland on 12 July 2005. This Council Decision sets limit values on waste for each landfill type based on total pollutant contents and leachate concentrations.

The transport of contaminated soils of a hazardous nature for onward disposal/recovery requires compliance with the 'C1' Waste Management (Movement of Hazardous Waste) Regulations 1998 for movement between counties, or the 'TFS' Waste Management (Transfrontier Shipment of Waste) Regulations 1998 for movement between countries in the EU. Where soil has non-hazardous concentrations of contaminants, its movement off-site is subject to the Waste Management (Collection Permit) Regulations 2001, which require the haulier to hold a waste collection permit issued by a Local Authority. The waste collection permit specifies which facilities a haulier is permitted to transport waste to and lists the registration numbers of the vehicles to be used. Hauliers are liable to prosecution if they transfer waste to a site not listed on their waste collection permit.

It is our experience that the Environmental Protection Authority (EPA) will prefer an approach whereby the excavated materials are not moved off site and the material is kept in the proximity of where it is currently situated (i.e. material is retained with the site boundary), unless the level of contamination dictates that the material is causing a significant environmental risk.

6.1.2 Groundwater

The discharge of groundwater off site to sewer or to surface water requires a trade effluent discharge license from Dublin City Council, as per Section 4 of the Water Pollution Act 1977.

Recirculating groundwater within the site is subject to prior investigation and permitting by Dublin City Council under the Protection of Groundwater Regulations, 1999 (S.I. 41 of 1999) which give effect to the Groundwater Directive 80/68/EEC. The purpose of the Regulations is to prevent pollution of groundwater by substances in List I and List II in the Annex to the Directive. The substances listed as either List I or List II are harmful to the environment because of their properties, i.e. toxic, persistent or bioaccumulable. Hydrocarbon compounds are considered List I substances under the Directive.

6.2 Site History – Potential Contaminants

The history of the site has been discussed in detail in Section 3.4 and is summarised below in relation to potential contaminants that may be present in soils and groundwater.

The site was reclaimed in the 1970's possibly with hydraulic fill. Depending on where this hydraulic fill was sourced potential contaminants present in these soils could include heavy metals and hydrocarbon compounds, as well as increased organic matter content.

The northern and southern portions of the site were historically used as a coal storage yards. The principle releases to the environment from coal storage are dust to air/soils and leachate to groundwater. Coal particles in shallow soils may give rise to elevated PAHs and TOC. Leachate from coal is governed by coal composition, in particular the presence of pyrite, and can be acidic containing PAHs and heavy metals.

The northern portion of the site is currently used as a scrap metal storage yard which may lead to elevated metals in shallow soils due to weathering of stockpiled waste metals.

The middle portion of the site is used as a storage facility for Molasses. Spillages during loading operations may lead to shallow soil and groundwater contamination with molasses. Molasses is not hazardous to human health and is naturally biodegradable, therefore is not of concern if present in shallow soils on site. Molasses may lead to reduced groundwater conditions (low dissolved oxygen) if present in groundwater.

The containment of fuels for vehicles and on site machinery across the site may give rise to additional hydrocarbon contamination of shallow soils and groundwater.

6.3 Screening of Data

In the absence of any Irish soil quality standards, the analytical results for soils have been screened against the Dutch Intervention values (RIVM 2000). Dutch Intervention values are only used for guideline purpose in Ireland as they have no statutory basis outside the Netherlands however they are widely accepted by the environmental industry and by Irish regulatory authorities. Therefore it provides an opportunity to assess the levels of possible contamination onsite against an internationally accepted set of assessment criteria. Sulphate concentrations in soil are compared to the Irish concrete standard I.S.EN 206-1:2002.

Groundwater results have been screened against the Environmental Protection Agency (EPA) Interim Guideline Values for groundwater ("Towards Setting Guideline Values for the Protection of Groundwater in Ireland", 2002). Groundwater beneath the site does not represent a drinking water source, given the history of the area and the close proximity to the sea.

Landfill gas results have been screened against guidelines published by the Department of the Environment, "Protection of New Buildings and Occupants from Landfill Gas", 1994.

6.4 Environmental Laboratory Testing

6.4.1 Soils

2003 Geotech Investigations

All soil samples were collected from the fill material and show elevated Polycyclic Aromatic Hydrocarbons (PAHs), ranging from 20-5020mg/kg.

Elevated concentrations of sulphate were detected in the fill material (811-8350mg/kg). A single high concentration (13100mg/kg) was detected in one sample of estuarine sand below the fill material (borehole BH2 at 4m depth). The lowest protective threshold for sulphate for ordinary concrete is 2000mg/kg (Irish Concrete Standard I.S.EN 206-1:2002).

Total concentrations of certain metals in the fill (lead, zinc and copper) are slightly elevated but are below Dutch Intervention Values.

2005 RPS Investigations

Total Petroleum Hydrocarbons (TPH) was elevated in most soil samples analysed, ranging from 0.721-44,374mg/kg, concentrated in the fill material. There is no Dutch Intervention value for TPH however 2 no. of these samples exceed the Dutch Intervention value for Mineral Oil (5000mg/kg) – MW2 at depths of 1 m and 7 m. Speciated TPH analyses show that the elevated TPH results in the soils are predominantly concentrated within the heavier, less mobile C16-C35 carbon ranges. TPH generally decreases with depth through the fill in most locations sampled.

Elevated concentrations of PAHs (Sum of 16 compounds) were detected in the majority of samples, ranging from 0.042-120.6mg/kg. The Dutch Intervention value for PAHs (40mg/kg, based on 10 compounds) is exceeded in 8 no. samples of the fill material, probably representing local hotspots.

Trace concentrations of Benzene, Toluene, Ethylbenzene and Xylene (BTEX compounds) were detected at various depths in the fill material, the concentrations of which are well below Dutch Intervention values. Trace concentrations of Trichloroethene (TCE) up to 0.067mg/kg and Tetrachloroethene (PCE) up to 3.2mg/kg were detected in the fill material at various depths, below the Dutch Intervention values.

Total concentrations of certain metals (lead, zinc and copper) were elevated above Dutch Intervention values in the fill material in a number of samples.

No asbestos fibres were detected in the soil samples analysed.

6.4.2 Groundwater Monitoring

2005 RPS Investigations

Physical evidence of hydrocarbon contamination was noted in the soils across the water table in all 7 No. monitoring wells installed by GES in 2005, suggesting historic free-phase product. No free-phase product was detected floating on the water surface in the monitoring wells, however some hydrocarbon product was observed in purged groundwater from 3 No. monitoring wells (MW01, MW04A, MW06A). In addition, a deep orange odourless liquid was recovered from one monitoring well during purging within the Hibernian Molasses site (BH4).

Groundwater conductivity is elevated, ranging from 2.3-34.6mS/cm indicating a high dissolved load and probable brackish-saline conditions. Groundwater temperatures were elevated up to 17.4 degrees which would suggest that degradation of waste in the fill material is still continuing.

Trace concentrations of hydrocarbons were detected in shallow groundwater from monitoring wells MW1 (TPH 14ug/l), MW2 (TPH 269ug/l), MW6a (TPH 15ug/l) and MW7 (TPH 14ug/l), as well as the deep monitoring well BR8 installed in 2003 (TPH 147ug/l). These concentrations exceed the EPA's interim guideline value for TPH in groundwater of 10ug/l.

PAHs (Sum of 16 compounds) were only detected in 2 no. wells, MW3 (0.89ug/l – lighter, more soluble PAHs) and BH1 (32.4ug/l). These concentrations exceed the EPA's interim guideline value of 0.1ug/l for total PAHs in groundwater.

Boron was the only dissolved metal in groundwater that was significantly elevated above the EPA's interim guideline value of 1mg/l (maximum concentration 3.1mg/l), probably as a result of mixing with seawater, the highest concentrations are found in the samples with the highest electrical conductivities. Detected concentrations of arsenic, lead, nickel and zinc in groundwater are also slightly elevated above their respective interim guideline values, probably as a result of mixing with seawater.

No VOCs/phenols were detected in groundwater, apart from a trace concentration of Toluene (3ug/l) detected in one of the deeper wells (BH1) installed in 2003. This is below the EPA's interim guideline value for Toluene of 10ug/l.

6.4.3 Gas Monitoring

Landfill gases were measured on one occasion only (5 July 2003) for the 6 no. shallow monitoring wells fitted with gas heads. Oxygen was lower than typical atmospheric concentrations in one well (BH1 – 4.1%), suggesting ongoing degradation of organic matter. Carbon dioxide was above the 0.5% long-term exposure limit in 4 no. of the monitoring wells, indicating some continuing gas production within the fill. Methane was not detected. Note: the gas measurements were taken on a day of relatively high barometric pressure (1021mb), therefore higher concentrations/flow rates may be detected on days of lower atmospheric pressure.

Landfill gases were measured in a number of monitoring wells as part of the site investigation of the adjacent Ringsend Wastewater Treatment Plant site in 1997. Three monitoring wells were monitored adjacent to the Waste to Energy Project site: BH63, BH64 and BH67. These wells were monitored for CH_4, CO_2, O_2, and barometric pressure on 8 no. occasions in July 1997.

Carbon dioxide was detected at concentrations above the 0.5% long-term exposure limit in all three wells (maximum 13.2%). Methane was occasionally detected at trace concentrations (0.1%), below the Lower Explosive Limit of 5%. The range of variation in the concentrations detected would suggest that concentrations/flow rates vary with the tidal response of the water table. Higher concentrations of carbon dioxide and methane were detected to the southeast of the waste water treatment plant site (maximum CO_2 21%, maximum CH_4 19%).

Elevated landfill gases were detected to the south/southwest of the Waste to Energy Project site as part of the Ringsend Wastewater Treatment Plant site investigation in 1997. Three monitoring wells were monitored: BH72 (200m southwest of site), BH73 (100m southwest of site), and BH74 (50m south of site). These wells were monitored for CH_4, CO_2, O_2, and barometric pressure on 5 no. occasions in July 1997, and 2 no. occasions in September 1997. Methane was detected at elevated concentrations of between 27-59%, carbon dioxide was detected at concentrations between 22-32% and oxygen was either absent or detected at trace concentrations. A reclamation map by Dublin Port and Docks Board indicates that the area to the south of the site was infilled at an earlier date from 1969-1970 (see Figure 4), and a handwritten addition to this drawing notes that the infilled material consisted predominantly of domestic waste.

6.5 Summary of Results

The fill material across the site generally shows evidence of hydrocarbon contamination however concentrations of TPH and PAHs are mostly below the Dutch Intervention values. Concentrations that exceed Dutch Intervention values are likely to be associated with localised hotspots of contaminated soils. Trace concentrations of BTEX, PCE, and TCE were also detected in the fill material at concentrations below the Dutch Intervention values.

Elevated concentrations of metals (lead, copper and zinc) were detected within the fill material in a number of locations above the Dutch Intervention values, possibly related to the waste included in the fill (waste metals, etc.). Some high sulphate concentrations have also been measured in the fill material above the threshold for the protection of ordinary concrete.

There was evidence of free-product in groundwater during sampling of the monitoring wells in March 2005 (i.e. an oily film), as well as a deep orange liquid in one well within the Hibernian Molasses site. Groundwater results show trace concentrations of TPH and PAHs, which slightly exceed the EPA's interim guideline values for groundwater, as well as elevated Boron probably as a result of mixing with seawater.

Limited landfill gas data for the site shows elevated concentrations of Carbon Dioxide within the fill material above the long-term exposure limit, indicating some continuing gas production. More comprehensive gas monitoring on the adjacent Ringsend Wastewater Treatment Plant site indicates highly variable concentrations of carbon dioxide, probably as a result of tidal variation of the water table. Significantly elevated concentrations of methane and carbon dioxide have been detected further to the southeast of the Ringsend Wastewater Treatment Plant site, as well as 50-100 m south/southwest of the Waste to Energy Project site.

6.6 Conclusions

6.6.1 Option: Disposal of Excavated Soils off site

6.6.1.1 Excavation Areas

For the proposed Plant Area the ground level will be reduced to a formation level of about +3mOD therefore the top 0.5-1 m of the existing ground will be excavated. This area includes the gravel-covered Hibernian Molasses yard, part of a bunded molasses tank, a fuel oil tank in the Clearway site with obvious surface oil contamination, and a storage area to the east of the Hibernian Molasses site.

Therefore the potential for hotspots of soil contamination within this area is high. The existing shallow soil results for this area (<1m) indicate TPH concentrations ranging from 3-386mg/kg and PAHs ranging from 14-100mg/kg (Sum of 16 compounds).

The proposed Waste Bunker location will be reduced to a formation level of approximately -1.5mOD which will involve an excavation of approximately 5.5m. The present ground surface in this area is mostly tarmac-covered and currently used for storage. The fill material is approximately 3.5-4 m thick in this area therefore most of the excavated spoil will be fill material. The existing soil results for this area (<5.5m) indicate TPH concentrations ranging from 4-572mg/kg and PAHs ranging from 0.1-147mg/kg (Sum of 16 compounds).

The proposed route for the cooling pipes will be reduced to a formation level of approximately 2mOD therefore the top 2.5-3m will be excavated. The route of the proposed cooling pipes lies within the Clearway site. The existing soil results for this area (<3m) indicate TPH concentrations ranging from 2-21051mg/kg and PAHs ranging from 0-27mg/kg Sum of 16 compounds).

6.6.1.2 Classification of Excavated Soils

It is not possible to determine the exact classification of the soils for disposal to landfill without carrying out a detailed targeted environmental investigation.

However, based on the existing results the soils in the proposed Plant Area and Waste Bunker area would be considered non-hazardous waste for disposal. The concentrations of metals in these soils are not elevated to hazardous concentrations. Hydrocarbon (TPH) concentrations are below the generic hazardous threshold for oil (0.1% by weight – 1000mg/kg) where the specific nature of the oil contaminating the soil is unknown. Shallow hydrocarbon contamination in the vicinity of the proposed cooling pipes route exceeds this generic threshold and may be considered hazardous for disposal, depending on the nature of the contaminating oil. Note: the probability of local hotspots of contamination within the excavation areas is high based on the nature of the fill and current site usage.

6.6.2 Option: Retention of Excavated Soils on site

6.6.2.1 Retention as Landscaping

It would be possible to retain the excavated soils on site as landscaping, however to do this a detailed quantitative risk assessment will be required for the final retention design to prove that the retention does not pose a risk to human health or the environment.

A detailed quantitative risk assessment would consider all source-pathway-receptor linkages (i.e. pollutant linkages) associated with the retained soils, and estimate the risk associated with each pollutant linkage. Site-specific target levels (SSTLs) could then be calculated for the final retention design which would be protective of all identified human and environmental receptors.

Only soils with contaminant concentrations below the SSTLs would be retained on site; soils that exceed the SSTLs would be disposed off site to an appropriately licenced facility. Hotspots of contaminated soils encountered during excavation would be segregated and sampled; if the concentrations detected were above the SSTLs the soils would be disposed off site.

A key consideration if the soils are re-used as landscaping would be the effect of leaching rainwater on groundwater quality. The landscaped feature could be capped with a low permeability soil cap beneath the topsoil to limit infiltration of rainwater and minimize leaching of the soils to groundwater. Consideration would have to be given in the design to venting any landfill gases that may be produced.

The potential leaching to groundwater would depend on the size, shape and slope of the designed landscaping, as well as the permeability of the soil cap. At the detailed design phase a representative number of soil samples will be collected from the areas to be excavated in order to assess the potential leaching from these soils in a landscaped feature.

There are several precedents in the Dublin area of old local authority landfills being excavated/re-deposited within a development site as landscaping without the need for waste permitting by the local authority or waste licencing by the EPA (e.g. Dublin Port Tunnel, Pfizer Deansgrange, etc.). In these cases, it had to be shown that the proposed re-use would not create a risk to human health or the environment either during construction or in the final development. Hotspots encountered during these excavations were isolated and assessed separately.

6.6.2.2 Retention beneath Main Building

The excavated soils could be re-used as an engineering fill beneath the main building.

The geotechnical properties of the excavated soils would have to be shown to be suitable as a fill material for use beneath the main building (e.g. beneath the access ramp). Such a design would need to incorporate venting for any landfill gases generated by the retained fill material. It is unlikely however that the fill material could be used as an engineering fill without treatment to improve its geotechnical properties.

6.6.3 Disposal of Groundwater off site

6.6.3.1 Option: Discharge directly into Dublin Bay

Laboratory analyses of groundwater carried out to date have only shown trace concentrations of hydrocarbons in the shallow groundwater below levels protective of seawater aquatic life (e.g. UK Saltwater EQSs). The number of parameters analysed are limited however and a number of other parameters would be required to fully assess the potential impact of abstracted groundwater on seawater quality (e.g. BOD, ammonical nitrogen, suspended solids, etc.).

Evidence of free-product was noted during groundwater sampling in March 2005 but is not apparent from the laboratory analyses. If free-product is present on site then Dublin City Council would require groundwater to be treated prior to discharge to Dublin Bay.

An example of such treatment would be an oil/water separator to remove any free-product, a bunded fuel tank for the storage of recovered product, followed by passage through an activated carbon filter to remove any dissolved hydrocarbons. For a flow rate of 80m3/hour 3 no. oil/water separators would be needed in parallel (each handling approximately 30m3/hr.) followed by 4 no. carbon filter units (each handling approximately 20m3/hr.). If there are high suspended solids in groundwater then either sand filters or a settlement unit would be required dependent on loading.

It is unlikely that Dublin City Council would grant a discharge licence to discharge directly to Dublin Bay without treatment based on the existing groundwater information.

6.6.3.2 Option: Discharge into Dublin City Council Sewerage System

Abstracted groundwater from the construction dewatering could be discharged directly to the foul sewer, subject to a trade effluent discharge licence from Dublin City Council. Dublin City Council may accept the existing groundwater results as sufficient for a discharge licence however it is likely that further analyses would be required.

Prior to applying for a discharge licence, it would need to be confirmed with Dublin City Council that the existing foul sewer/treatment facility has the capacity to take the estimated 80m3/hour of water for 6 months and whether or not pre-treatment is required (i.e. removal of any free-product prior to discharge to sewer).

This option is the preferred option and may prove to be the simplest, most cost effective solution if the existing foul sewer/treatment facility has the capacity.

6.6.4 Option: Recirculation of Groundwater within the site

The legislative context of re-circulating groundwater within the site is discussed in Section 6.1.2.

The fact that evidence of free-product was detected during sampling would mean that Dublin City Council may require groundwater to be treated prior to recirculation on site so as not to pollute groundwater in previously uncontaminated areas. The level of treatment required would similar to that required to discharge directly to Dublin Bay. In addition, this option would require an assessment as to how best to recharge 80m3/hour of water to ground and would require the installation of injection wells or infiltration trenches on site prior to excavation.

Recharging the abstracted groundwater within the site would not be as simple as discharging to sewer, or treating groundwater and discharging directly to Dublin Bay. We do not favour this option at this stage.

7. APPRAISAL OF GEOTECHNICAL DATA

7.1 General

This section presents geotechnical information obtained during the site investigations relating to the soil and rock encountered on the site.

7.2 In-situ testing

Standard Penetration tests were typically undertaken at 1.5-2 m intervals from ground level in all of the cable percussive drillholes. The SPT 'N' values obtained in made ground, sands and gravels and glacial tills are shown plotted against depth in Figures 7 to 9 respectively.

7.2.1 Made Ground

Figure 7 shows the SPT values within this material vary between 2 and 50. Values are variable reflecting the uncontrolled nature of the filling.

7.2.2 Marine/Fluvio-Glacial Sands and Gravels

Figure 8 shows the SPT values within these materials vary between 3 and 60, most of the values being between 11 and 50. SPT values of less than 15 occur above 6m bgl indicating that the upper parts may be recent marine deposits.

7.2.3 Glacio-Marine/Glacial Tills

Figure 9 shows the SPT values within this material vary between 1and 57; however most of the values are between 17 and 50. As referred to in Section 5.2.4, low SPT values recorded during the 2005 IGSL investigation for the upper laminated silts have been interpreted as relating to blowing in the sand laminations in this unit.

7.3 Geotechnical Laboratory Soil Testing

Geotechnical testing was carried out on selected samples taken from drillholes and trail pits in all soils. The following tests were performed:

- Atterberg limits;
- Particle Size Distribution testing;
- Undrained unconsolidated triaxial testing;
- Consolidation testing.

7.3.1 Made Ground

Classification testing carried out on the made ground is summarised below.

Material	Moisture Content (%)	Plastic Limit	Liquid Limit	Plasticity Index
Made Ground	13% - 28%	18% - 30%	30% - 39%	7% - 13%

Using Casagrande's Plasticity charts the fill material sampled can be classified as inorganic silts and clays of low to intermediate plasticity.

Bulk densities and dry densities were not measured.

MCV values on selected clayey samples ranged between 5.6 and 14.1.

7.3.2 Fluvio-Glacial Sands and Gravels

No laboratory testing of this material was undertaken.

7.3.3 Glacio-Marine/Glacial Tills

Classification testing carried out on these materials are summarised below.

Material	Moisture Content (%)	Plastic Limit	Liquid Limit	Plasticity Index
Laminated Silts	21% - 30%	NP	22% - 25%	NP
Glacial Tills	16% - 23%	16%- 18%	28% - 36%	12% - 18%

Using Casagrande's Plasticity charts the glacial tills can be classified as inorganic clays of low plasticity.

Bulk densities and dry densities were not measured.

6 no. unconsolidated undrained triaxial tests were undertaken on glacial till samples recovered. The shear strengths recorded in these tests were all less than 100kPa. These results are considered unrealistically low given the SPT's values recorded and information known about this material from elsewhere in Dublin. Sample disturbance and inappropriate test method are considered to be the reasons for the low results recorded.

Consolidation testing was carried out on 6 no. of the glacial till samples recovered. Over the highest stress ranges applied (400kPa) c_v values recorded varied between 6.5m^2/year and 50m^2/year. Published information on tills in Dublin quote c_v values in the range of 20m^2/year and 60m^2/year. Sample disturbance and low stresses applied to the samples could account for the low values recorded.

7.4 Laboratory Rock Testing

The site is underlain by Limestone. The strength of intact bedrock was obtained using two conventional test methods, the unconfined compressive strength (UCS) test; and the point load index test (PLI) expressed in Is50. UCS and PLI tests were carried out on samples recovered. The factor adopted between UCS/Is50 has been assumed to be 20 (IGSL, unpublished).

The adjusted UCS of intact rock samples tested varied from 66MPa to 172MPa.

8. ENGINEERING STUDIES

8.1 General

This section describes some of the key design issues and preliminary engineering studies, undertaken for the substructure works for the proposed facility. Brief descriptions of works are included along with envisaged construction methods. The subsurface profiles used have been based on the ground conditions and groundwater regime inferred from the ground investigations. Geotechnical design parameters have not been selected at this stage.

8.2 Substructure works and envisaged construction methods

8.2.1 Main Building

Within the main building a subsurface waste storage bunker is proposed which will require an excavation to a level of approximately – 1.5mOD (~5mbgl). As this excavation will be carried out to a depth of about 2m below groundwater level it is envisaged that the bunker will be constructed within a sheetpile cofferdam. The sheetpiles will be founded at a depth to ensure stability. Lateral support in the form of internal bracing or possibly anchors will be provided. Spoil and groundwater will be generated during the excavation.

It is proposed to support the main building and venting flues on deep foundations. Where possible it is proposed to support the structure on driven piles founded in soils above bedrock. For heavily loaded areas or areas with sensitive equipment bored piles end bearing on bedrock may be necessary. Spoil will be generated from bored piling works.

8.2.2 Cooling water facilities

The laying of part of the cooling water inlet and outlet pipes will require an excavation to a level of approximately +0.5mOD (~3mbgl).

The excavation will be carried out in open cut where possible although sheet piled support may be necessary close to existing structures or if groundwater levels are higher than expected. Spoil and possibly groundwater will be generated during the excavation.

8.2.3 External areas

External areas will comprise roadways, parking and areas of soft landscaping.

Conventional materials used in road construction will be imported for the construction of the roads and parking areas.

The main area of soft landscaping is in the northern part of the site. Where possible it is intended to re-deposit excavated material from within the site to make up levels for the landscaped areas. Refer to Section 8.3 below.

8.3 Disposal off site/ Retention of excavated soil material

8.3.1 Appraisal of Contamination

The soil results have been discussed in Section 6.4 and summarised in Section 6.5. Conclusions regarding disposal off site/retention on site have been made in Sections 6.6.1 and 6.6.2 respectively.

8.3.2 Engineering Options

Refer to Section 2.3 for approximate un-bulked quantities of excavated material that will be generated. Engineering options for using this material are as follows:

8.3.2.1 Option 1 – Dispose of Material off site

Based on the existing results the soils in the proposed Plant Area and Waste Bunker area would generally be considered non-hazardous waste for disposal. Shallow hydrocarbon contaminated soils in the vicinity of the proposed cooling pipes route may possibly be considered hazardous for disposal. Note: the probability of local hotspots of contamination within the excavation areas is high (See Section 6.6.1).

8.3.2.2 Option 2 – Retain material on site in Landscaped Area

It would be possible to retain the excavated soils on site as landscaping, subject to the findings of a detailed quantitative risk assessment which would be required for the retention design to ensure that the excavated soils do not pose a risk to human health or the environment (See Section 6.6.2.1).

8.3.2.3 Option 3 – Retain material on site beneath Main Building

Excavated soils could only be re-used as an engineering fill beneath the main building (See Section 6.6.2.2), subject to the findings of a risk assessment and the improvement of the soil.

8.3.3 Construction Issues

Not withstanding the above options, procedures will need to be implemented / considered when undertaking the works:

1. Establishment of a materials handling protocol: This should ensure that excavated material is moved around the site in a controlled manner. Excavations would proceed according to a grid system to allow for traceability of all materials. The protocol should also ensure that all health and safety requirements are adhered to. This will include occupational exposure monitoring of site workers and at the perimeter of the site.

2. Since elevated levels of hydrocarbons were found in most soil samples and the potential for finding hotspots of contaminated soils is considered high, any excavation work should be supervised by an environmental engineer to observe for hydrocarbon hot spots within the fill material. If encountered, hotspots of hydrocarbon contamination would have to be segregated and stockpiled in a controlled manner temporarily. Analysis of the materials stockpiled would be required and depending on the results these materials may have to be removed from site for disposal, with the landfill acceptance criteria determining where the material could be disposed.

8.4 Disposal off site/ Retention of groundwater

8.4.1 Appraisal of Groundwater Contamination

The groundwater results have been discussed in Section 6.4 and summarised in Section 6.5. Conclusions regarding disposal off site/recirculation of groundwater on site have been made in Sections 6.6.3 and 6.6.4 respectively.

8.4.2 Engineering Options

During the construction phase the water table will have to be lowered during the construction of the waste bunker and possibly during the laying of the cooling pipelines below ground. For the excavation for the waste bunker we have carried out a seepage analysis and estimated the maximum unfactored steady state seepage generated during this excavation would be approximately 80m3 / hour. Approximate duration of construction has been assumed to be six months.

8.4.2.1 Option 1 – Discharge directly into Dublin Bay

It is unlikely that Dublin City Council would grant a discharge licence to discharge directly to Dublin Bay without treatment based on the existing groundwater information (See Section 6.6.3.1).

8.4.2.2 Option 2 – Discharge into Dublin City Council Sewerage System

Abstracted groundwater from the construction dewatering could be discharged directly to the foul sewer, subject to a trade effluent discharge licence from Dublin City Council. This option is the preferred option and may prove to be the simplest, most cost effective solution (See Section 6.6.3.2).

8.4.2.3 Option 3 – Recharge back into the ground within the site

Abstracted groundwater could be recirculated within the site however this option would not be as simple as discharging to sewer, or treating groundwater and discharging directly to Dublin Bay (See Section 6.6.4).

8.5 Bearing capacity of shallow footings

The bearing capacity for a soil is not a unique value. It depends on the following:

- foundation depth below ground;
- foundation dimensions;
- proximity to the crest of sloping ground;
- presence of groundwater above the foundation base

Ignoring the site topography issues, we have estimated minimum allowable bearing capacity as follows:

Soil Type	Allowable Bearing Capacity (kPa)
Cohesionless Fluvio-Glacial Soils	175
Cohesive Glacial Till	250

Note that the values given above are presumed values. The capacity for each foundation type will need to be reviewed in the content of its depth, dimensions etc. to establish a specific capacity for individual foundation.

8.6 Deep Foundation Design

The design methodology is highly dependent on the pile type adopted and the founding levels of the foundations. This will covered in detail during detailed design.

9. CONCLUSIONS AND RECOMMENDATIONS

The ground investigations carried out at the site indicate the site is covered by up to 5 m of fill below which are extensive deposits of sand and gravels and glacial soils overlying limestone bedrock. Groundwater levels are typically 3m below ground level.

Geotechnical

1. Excavations required to construct the waste bunker within the waste building will extend into the water bearing sands and gravels. It is envisaged that the excavation will be carried out within braced retaining walls founded sufficiently deep to ensure stability of the excavation and groundwater control.
2. Excavated material generated from within the site would not be suitable for use as engineering fill without treatment to improve its geotechnical properties (beneath the main building / ramp).
3. Deep foundations required to support the main facility building will have to be installed through the water bearing sands and gravels and potentially through the underlying laminated silts which can become unstable without control of water pressures.
4. In external areas where roads / parking are proposed the constituents of the hard surfacing and the formation material provided will need to account for the variable composition of the existing fill material beneath.

Environmental

1. Elevated hydrocarbons are the main contaminants detected within the fill material on site. These soils would mostly be considered non-hazardous for disposal purposes however hotspots of contaminated soils are likely given the history of infilling and current site use.

2. The cost of disposing of the excavated soils off-site would be considerable and is the least attractive option. The preferred option would be to retain the excavated soils on site as beneath the soft landscaped areas. This will only be carried out if proven safe to both human health and the environmental through a site specific risk assessment. If the landscaping option is considered we recommend further sampling of the soils to be excavated in order to assess the potential for leaching and associated risk to the receiving environment.
3. Elevated sulphate concentrations were detected within the fill material at a number of locations above the threshold for the protection of ordinary concrete. We recommend that further soil sampling for sulphate is carried out during detailed design to better characterise sulphates in areas where concrete will be placed. The results of these analyses would determine whether a more chemically resistant concrete would need to be specified.
4. Elevated carbon dioxide was detected within the fill material above the long-term exposure limit, indicating some continuing gas production. We recommend that further gas monitoring is carried out on the existing monitoring wells at different atmospheric pressures to determine the range of gas concentrations and flow rates on site. The range of gas concentrations/flow rates with the tidal response of the water table should also be investigated. This information will be necessary to determine if any gas protection measures will be required beneath the buildings and in service trenches.
5. It is unlikely that Dublin City Council would grant a discharge licence to discharge groundwater directly to Dublin Bay without treatment based on the existing groundwater results. Confirmatory groundwater samples should be collected and analysed for the full suite of parameters required to support an application for a discharge licence to discharge groundwater off-site. The preferred option would be to discharge the abstracted groundwater directly to the foul sewer, otherwise costly treatment will most likely be required prior to discharge to Dublin Bay or recirculation within the site.

REFERENCES

GSI 1:100,000 scale Bedrock Geology map, Sheet 16 (Kildare-Wicklow)

GSI 1:50,000 scale Quaternary map of Dublin

Nolan, S.C. 1986 *The Carboniferous Geology of the Dublin Area.* Unpubl. PhD thesis, Univ.Dub.

Naylor, D. 1965 Pleistocene and post-Pleistocene sediments in Dublin Bay, *Sci. Proc. Roy.Dub. Soc., Series A, Vol. 2,* 175-188

Farrell, E. R., and Wall D., 1990 The soils of Dublin, *Trans. Instn. Engrs. Ireland, 115*, 78-9.

GLOSSARY OF TERMS

As	Arsenic
Ba	Barium
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
Cd	Cadmium
Cr	Chromium
Cu	Copper
Hg	Mercury
mb	millibars
mbgl	meters below ground level
Mo	Molybdenum
mOD	meters Ordinance Datum
Ni	Nickel
PAH	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PCE	Perchloroethylene
pH	hydrogen ion concentration (i.e. acidity)
Sb	Antimony
Se	Selenium
TCE	Trichloroethylene
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
VOC	Volatile Organic Compounds
Zn	Zinc

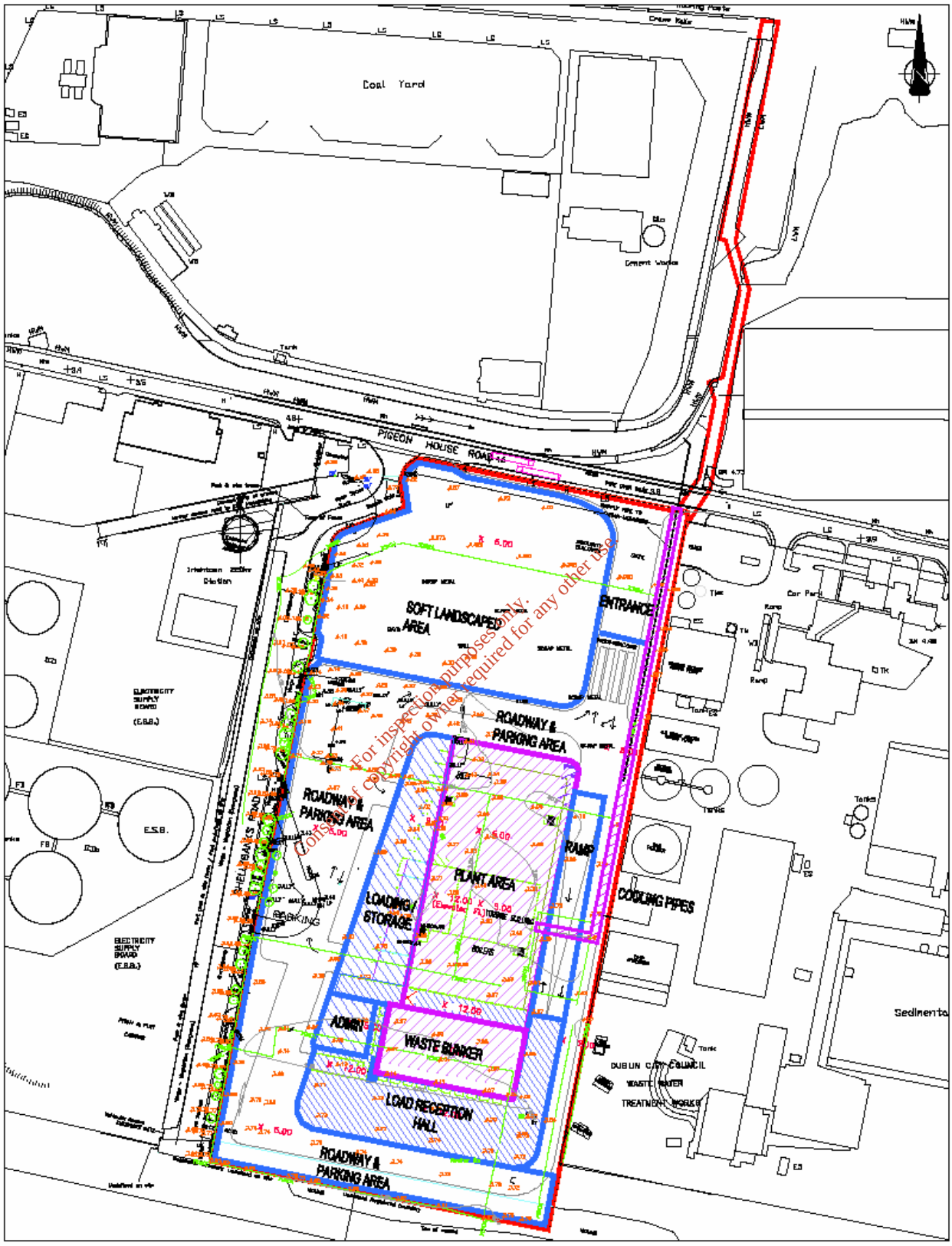
FIGURES

ARUP

Site Location

Dublin Waste to Energy Project

D5072.30 | April 2006 | **Figure 1.0**

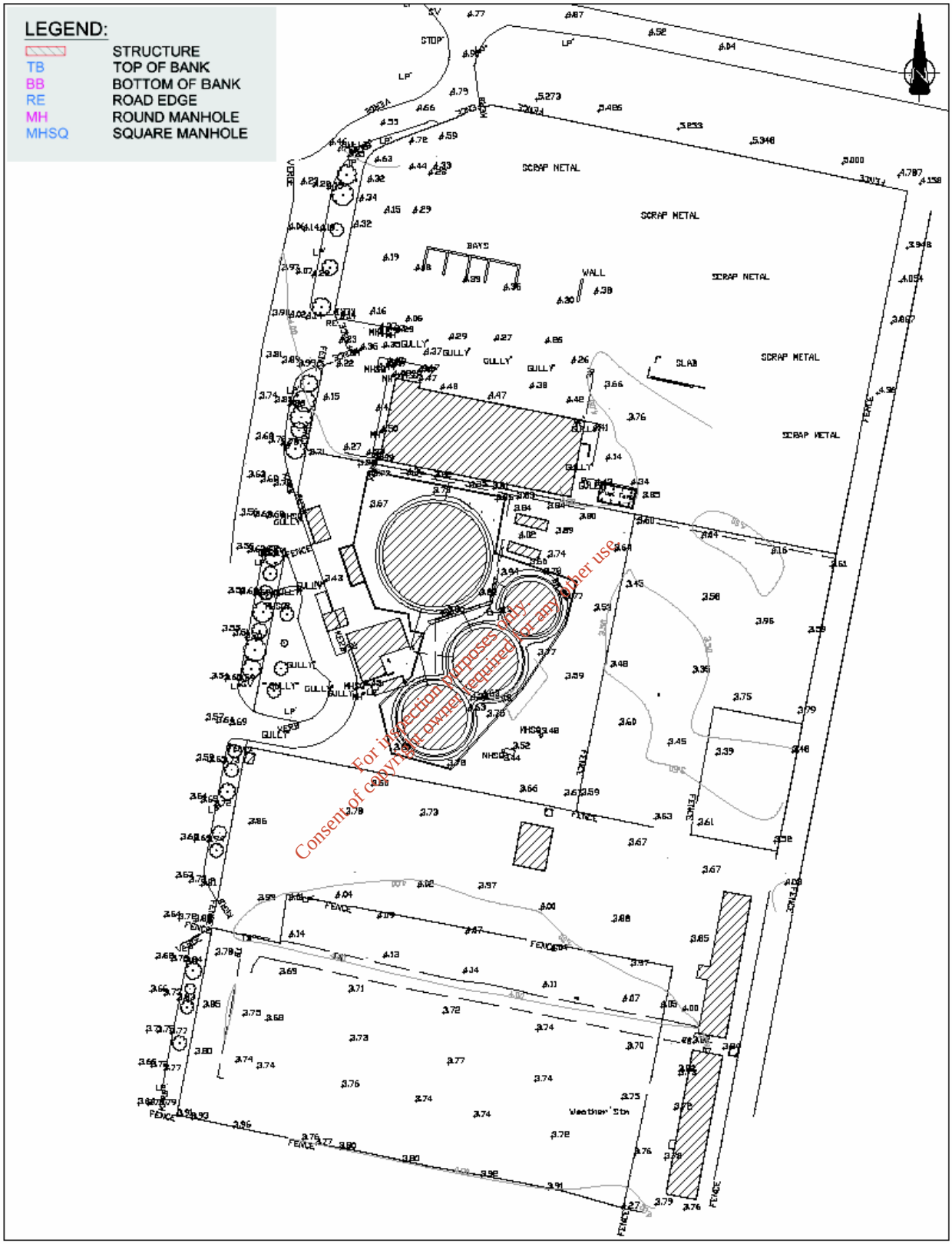


ARUP

Cut & Fill Areas - Landuse

Dublin Waste to Energy Project

D5072.30 | April 2006 | **Figure 2.0**

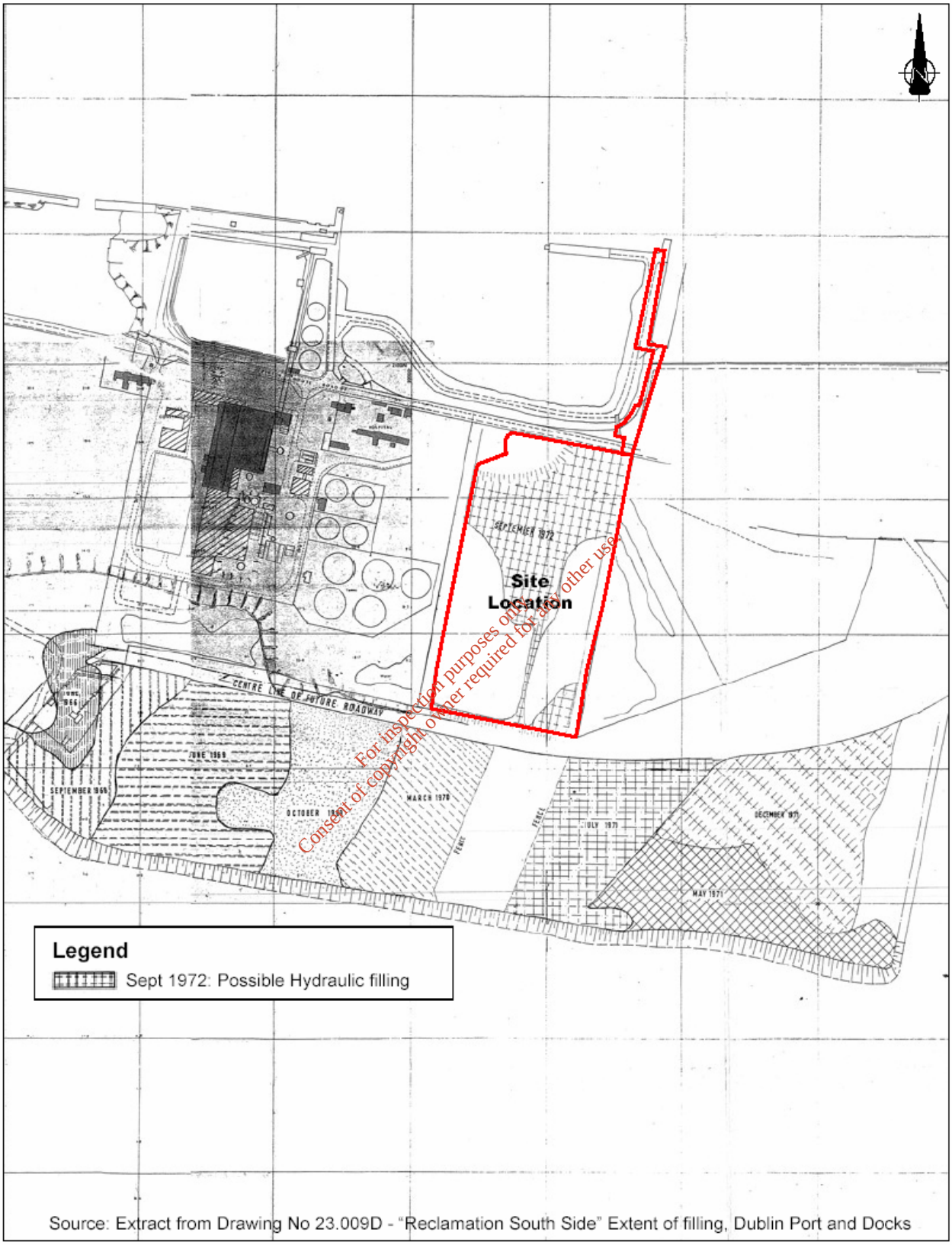


ARUP

Site Topography

Dublin Waste to Energy Project

D5072.30 | April 2006 | Figure 3.0



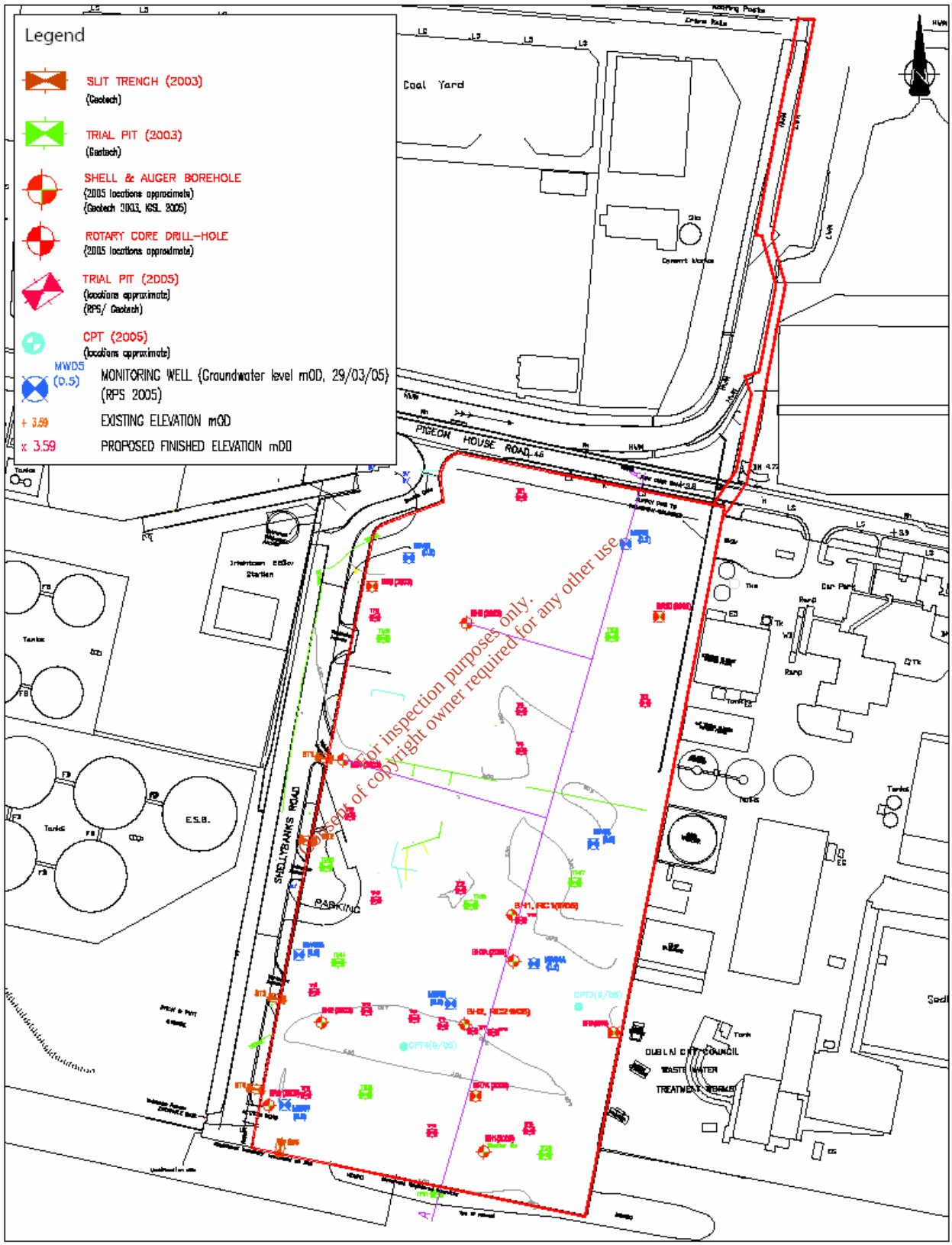
Source: Extract from Drawing No 23.009D - "Reclamation South Side" Extent of filling, Dublin Port and Docks

ARUP

Landfill History

Dublin Waste to Energy Project

D5072.30 | April 2006 | **Figure 4.0**

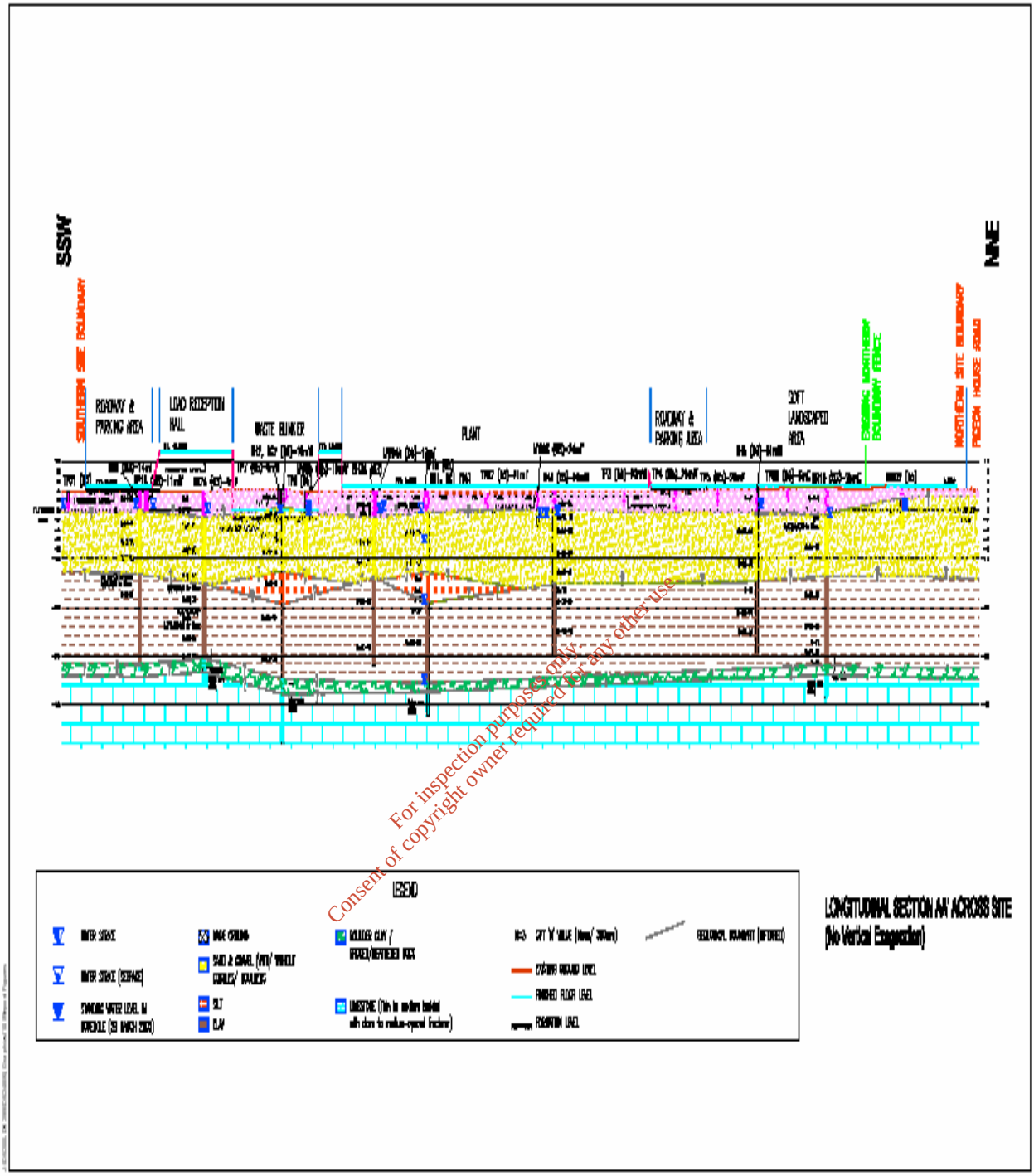


ARUP

Ground Investigation Location Plan

Dublin Waste to Energy Project

D5072.30 | April 2006 | **Figure 5.0**

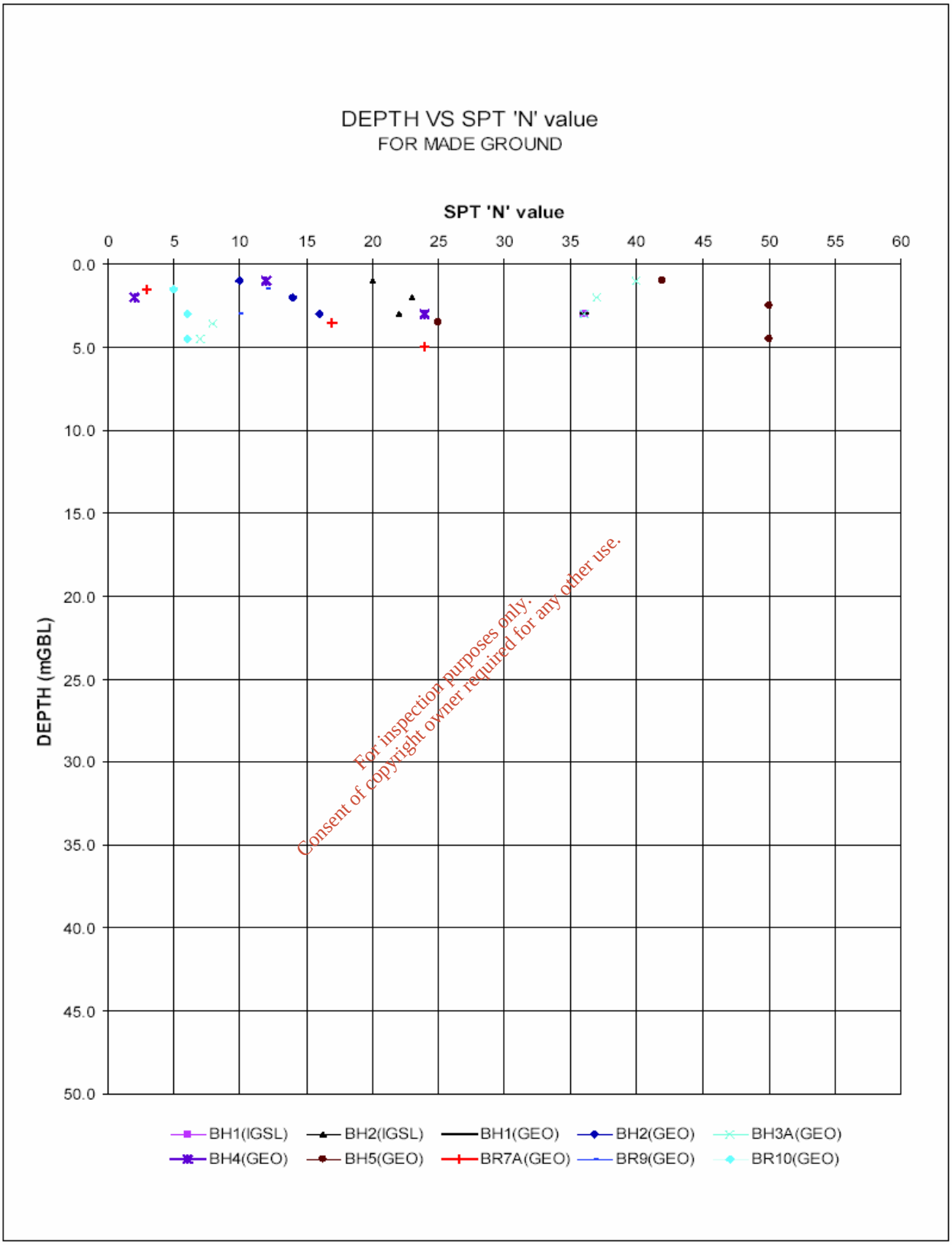


ARUP

Geotechnical Cross Section

Dublin Waste Energy Project

D5072.30 | April 2006 | Figure 6.0

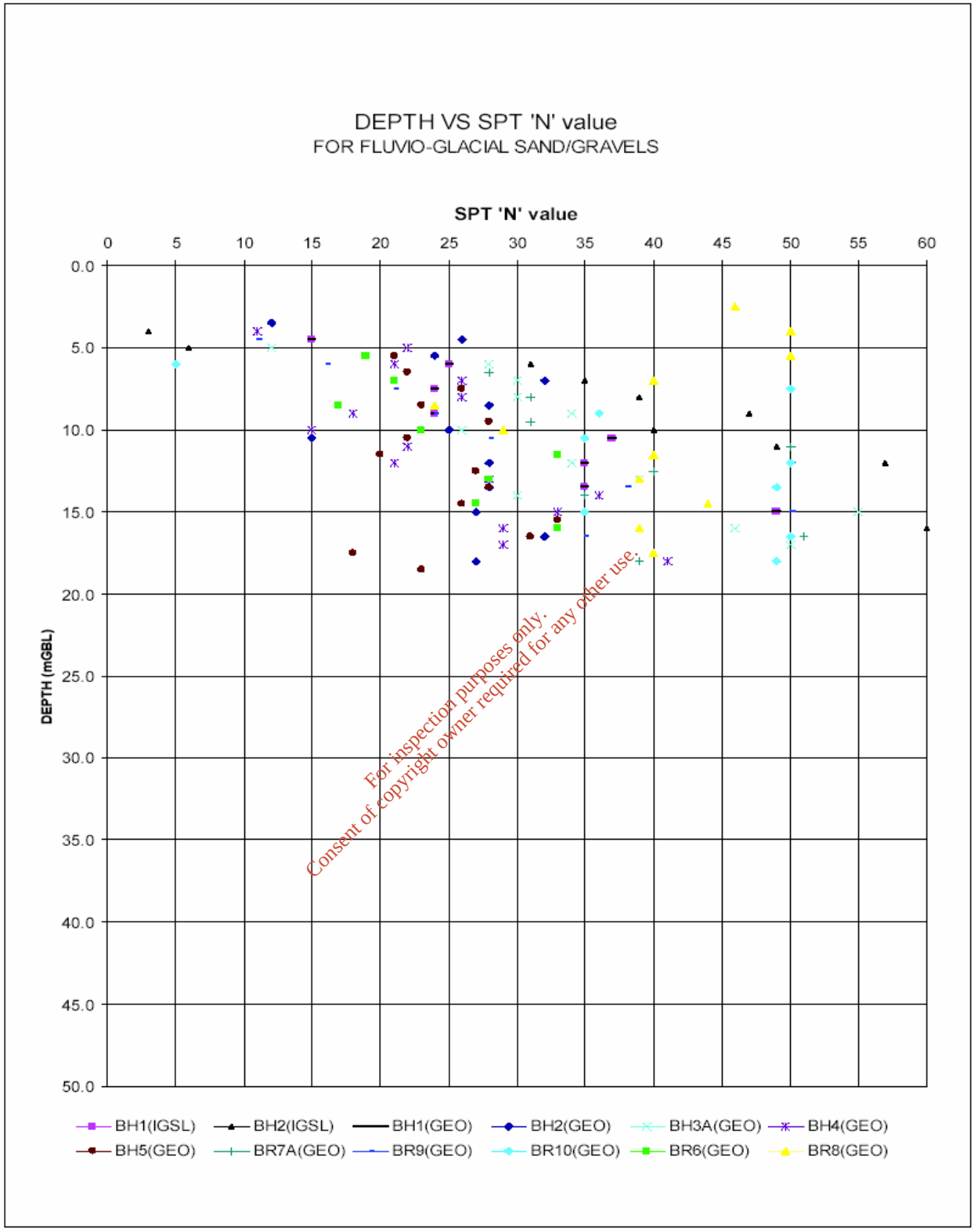


ARUP

SPT | Fill

Dublin Waste to Energy Project

D5072.30 | April 2006 | Figure 7.0

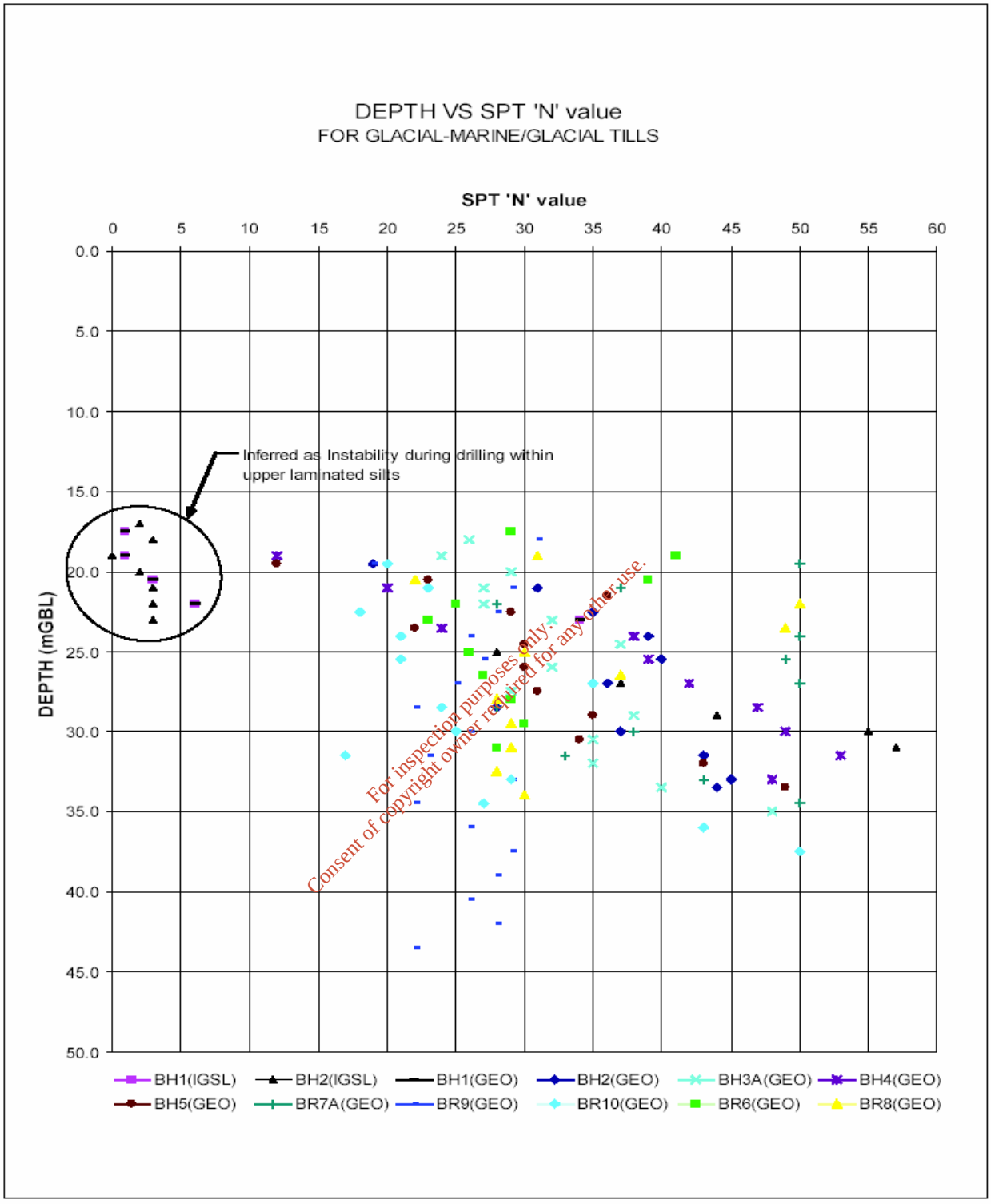


ARUP

SPT | Soils / Gravels

Dublin Waste to Energy Project

D5072.30 | April 2006 | Figure 8.0



ARUP

SPT | Tills

Dublin Waste to Energy Project

D5072.30 | April 2006 | Figure 9.0

Appendix E 2003 GSL Site Investigation Soil Results

GEOTECH

Geotech Specialists Limited

Dublin Waste to Energy

REPORT ON GROUND INVESTIGATION

Factual Report No. KD3116

Engineer: M.C. O'Sullivan & Co. Ltd.

Client: Dublin City Council

Carewswood
Castlemartyr
Co. Cork
Ireland

Tel: (021) 4667164
Fax: (021) 4667630

Our Ref: EFS/034319
Your Ref:
7 November, 2003

Mr M Kelly
Geotech Specialists Ltd
Hartwell Upper
Kill
County Kildare
Eire

TES Bretby

PO Box 100
Ashby Road
Burton-upon-Trent
Staffordshire
DE15 0XD

Telephone: 01283 554400
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E-mail: enquiries@tes-bretby.co.uk

Dear Mr Kelly

Soil Sample Analysis – Dublin Waste

Please find attached an amended Table 1 for the samples from the above site with the Elemental Sulphur results that were missing from the original report.

The work was carried out in accordance with Mowlem Environmental Sciences Group Standard Terms and Conditions of Contract.

Please contact me if you require any further information.

Yours sincerely

J Hannah

J Hannah
Project Co-ordinator
01283 554403

TEST REPORT
SOIL SAMPLE ANALYSIS

UKAS TESTING
1252

Amended Report
TES Report No. EFS/034319

Site: Dublin Waste

Geotech Specialists Ltd
Hartwell Upper
Kill
County Kildare
Eire

The 2 samples described in this report were scheduled for analysis by TES Bretby on Friday, 17 October 2003. This is an amended report that replaces the report issued on 31 October 2003. The analysis was completed by Friday, 7 November 2003.

Tests marked as 'not UKAS accredited' and any opinions or interpretations expressed herein are outside the scope of any UKAS accreditation held by TES Bretby laboratories.

The following tables are contained in this report:

Table 1 Main Analysis Results
Table of Report Notes (1 Page)

behalf of
Bretby :
annah

J Hannah
Project Co-ordinator

Date of Issue: 07/11/03

rked 'not UKAS accredited' in this report are not included in the UKAS Accreditation Schedule for our laboratory.

Bretby accepts no responsibility for the sampling related to the above results

TES Bretby = Report 034319 Control Page Sheet 1/ 1

Units :		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Method Codes :		BGCN22	ELESULP	ICPACIDS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICTSCN28	ICTSCN28	PAHSCUV	SCNCRI
Detection Limits :		1	20	10	0.5	0.1	0.5	0.5	0.5	0.10	0.5	0.5	3.0	1	5	10	0.1
UKAS Accredited :		yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
TES ID Number CL/	Client Sample Description	Cyanide (Free)	Elemental Sulphur	SO4-- (acid sol)	Arsenic (MS)	Cadmium (MS)	Chromium (MS)	Copper (MS)	Lead (MS)	Mercury (MS)	Nickel (MS)	Selenium (MS)	Zinc (MS)	CN- (total)	Sulphide	PAH (screening)	Chromium VI.
0330243	BH001 3.6																
0330244	BH002 4.0	<1	29	13100	12.80	0.97	19.2	27.5	178.6	0.34	24.9	1.10	320.9	<1	14	68	<0.1

TES Bretby
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Client Name: Geotech Specialists

Contact: Mr M Kelley

Dublin Waste

Soils Sample Analysis

Amended Report

Date Printed	7 November 2003
Report Number	EFS/034319
Table Number	1
Page Number	1 of 2

UKAS TESTING 1252

GEOTECH SPECIALISTS LIMITED
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Dublin Waste to Energy

REPORT ON GROUND INVESTIGATION

Factual Report No. KD3116

Engineer: M.C. O'Sullivan & Co. Ltd.

Client: Dublin City Council

Client:

Dublin City Council
Waste Management Services Dept.
68/70 Marrowbone Lane
Dublin 8

Engineer:

M.C. O'Sullivan & Co. Ltd.
Consulting Engineers
Ashurst
Mount Merrion Avenue
Blackrock
Co. Dublin

GEOTECH

CONTENTS

1 INTRODUCTION

In May 2003 Geotech Specialists Limited (GSL) were commissioned by M.C. O'Sullivan & Co. Ltd., (MCOS), on behalf of Dublin City Council (DCC), to carry out a ground investigation at a site in the Ringsend area of Dublin. The investigation was required to obtain geotechnical and geoenvironmental information for the proposed Waste to Energy plant.

The scope of the investigation, which was specified by MCOS, comprised cable percussion and rotary drilled boreholes, excavation of trial pits and slit trenches, and laboratory testing. The investigation was carried out in accordance with the contract specification and relevant standards (see References). The fieldwork was carried out between 14 May and 27 June 2003. This report presents the factual records of the fieldwork and laboratory testing.

2 THE SITE AND GEOLOGY

2.1 The Site

The proposed site is situated to the south of Dublin Harbour and to the west of the of the existing Poolbeg Power Station. The site is at Irish National Grid reference O 196 335, see Site Location Plan in Enclosure F.

The proposed site covers approximately 7 hectares and is generally rectangular in shape with hardstanding surfaces. The site comprises three relatively flat sections including a scrap yard, an area with above ground storage tanks and a car park. The site is bounded by Pigeon House Road to the north, Shellybanks Road and an electrical station to the west and the Ringsend Sewage Treatment Plant to the east. As indicated in the tender documents, the site may have been used as a municipal waste disposal site in the past.

2.2 Published Geology

The published geological map covering the site, GSI Sheet 16 (1995), shows the solid geology in the areas comprises dark grey to black limestone and shale of the Calp Formation (Carboniferous Age)

As reported in the project tender documents (Dublin Waste to Energy, Ground Investigation Contract, October 2002) previous investigations in the vicinity of the site indicate that the area is underlain by made ground overlying a sequence of sands and gravels, soft estuarine clays and silts, laminated clays, glacial till and dense coarse to very coarse granular soils, overlying Lower Carboniferous deposits of limestone.

3 FIELDWORK

3.1 General

The fieldwork was carried out in general accordance with BS 5930 (1999) and Part 9 of BS 1377 (1990). The exploratory hole locations were selected by MCOS as shown on the Exploratory Hole Location Plan in Enclosure F. The locations were set out by taping from local features. The final co-ordinates and reduced levels were surveyed by GSL to Irish National Grid and Ordnance Datum (Malin Head) and are shown on the logs in Enclosure A.

3.2 Exploratory Holes

The exploratory holes are listed in the following table.

SUMMARY OF EXPLORATORY HOLES

Type	Quantity	Maximum Depth (m)	Remarks
Cable Percussion Boring	5	36.50	BH1, 2, 3A, 4 & 5
Rotary Open Hole / Core Drilling	4	49.50	BR6, 7A, 8, 9 & 10
Trial Pits	9	4.40	machine dug, TP1 to TP9
Slit Trenches	5	1.20	machine and hand dug, ST1 to ST5

The exploratory hole records are presented in Enclosure A and should be read in conjunction with the Key included therein. The records provide descriptions, in accordance with BS 5930 (1999), of the materials encountered and details of the samples taken, together with observations made during boring, drilling, pitting and trenching. Slit trench sketches and logs are shown in Enclosure C. Photographs of the trial pits and recovered cores are presented separately.

3.3 Instrumentation and Monitoring

Standpipe piezometers were installed in borings BH1, BH4, BH5, BR6, BR8 and BR9 as shown on the logs in Enclosure A and detailed in Enclosure B. Records of groundwater and gas monitoring carried out by GSL during and after the fieldwork period are also presented in Enclosure B.

3.4 In-Situ Testing

In-situ testing was carried in accordance with BS5930 (1999) and Part 9 of BS1377 (1990) unless otherwise stated. The testing is summarised below and the results are presented on the logs in Enclosure A.

SUMMARY OF IN-SITU TESTING

Type	Quantity	Remarks
Standard Penetration Tests	269	conducted during boring and drilling

Standard Penetration Test (SPT) N-values ranged from less than 10 to greater than 50 (blows per 0.30 m). Tests conducted in made ground where the N-values are greater than approximately 35 is likely due to the presence of cobbles, boulders and obstructions. These values are not regarded as representative of the relative density, consistency or strength of the soil at that depth. The visual description of the consistency or density of the recovered soil samples in these layers is reported on the logs.

4 LABORATORY TESTING

4.1 Geotechnical Testing

On completion of the fieldwork all samples were transported to the Castlemartyr, Co. Cork laboratory of GSL for temporary retention and testing. The laboratory testing was scheduled by MCOS. The geotechnical testing was carried out in accordance with BS 1377 (1990) and ISRM (1981) and ISRM (1985). The testing is summarised below and the results are presented in Enclosure D.

SUMMARY OF GEOTECHNICAL LABORATORY TESTING

Type	Remarks
Moisture Content Determination	20no., conducted on sealed jar (D) samples
Atterberg Limit Determination	18no.
Particle Size Distribution Analysis	32no. including 5no. hydrometer tests
pH Level and Sulphate Content of Soils	28no.
Moisture Condition Value (MCV) Tests	12no. conducted on bulk (B) samples
California Bearing Ratio (CBR) Tests	3no. conducted on bulk (B) samples
Determination of Point Load Index Values	10no., conducted on selected rock core samples
Unconfined Compressive Strength (UCS) Tests	1no., conducted on a selected rock core sample from BR8

4.2 Geoenvironmental Testing

On completion of the fieldwork, samples for geoenvironmental testing were transported to the TES Bretby laboratory in Burton-on-Trent, UK and the ALControl Geochem laboratory in Dublin. The laboratory testing was scheduled by MCOS. The testing is summarised below and the results are presented in Enclosure E.

SUMMARY OF GEOTECHNICAL LABORATORY TESTING

Type	Remarks
ICRCL Full Suite (common contaminants)	6no., conducted on samples from BH2, BH5 & BH8 and TP1, TP4 & TP7.
Total Petroleum Hydrocarbons (by GCFID)	6no., conducted on samples from BH1, BH3A, & BH5 and TP8
Dioxins	2no., conducted on samples from TP2 & TP9

REFERENCES

British Standards and Codes of Practice

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

BS 5930 : 1999 : Code of practice for site investigations. British Standards Institution.

Maps

GSI Sheet 16 : 1995 : "Kildare-Wicklow". 1:100000 geological map (solid). Geological Survey of Ireland.

Ordnance Survey Landranger Series. Sheet 50 : 2001 : Dublin Kildare Meath Wicklow. 1:50000. Ordnance Survey of Ireland.

Publications and Reports

Dublin Waste to Energy Project, Ground Investigation Contract, October 2002.

ISRM : 1981 : Rock Characterisation, Testing and Monitoring - ISRM Suggested Methods (Ed E T Brown). Commission on Testing Methods, International Society for Rock Mechanics, Pergamon Press.

ISRM : 1985 : Suggested method for determining point load strength. Commission on Testing Methods, International Society for Rock Mechanics, International Journal of Rock Mechanics, Mining Sciences and Geomechanics Abstracts, Vol 22.

ICRCL 59/83 : 1987: Guidance on the assessment and redevelopment of contaminated land, Department of Environment.

Prepared By	**Mike Kelley, B.Sc., M.Sc.**
Approved for Issue By	**Mike Kelley, B.Sc., M.Sc.**

TES Bretby

TEST REPORT
SOIL SAMPLE ANALYSIS

UKAS TESTING

1252

TES Report No. EFS/033223

Site: Dublin Waste

Geotech Specialists Ltd
Carewswood
Castlemartyr
County Cork
Ireland

The 7 samples described in this report were scheduled for analysis by TES Bretby on Wednesday, 6 August 2003. The analysis was completed by Monday, 18 August 2003.

Tests marked as 'not UKAS accredited' and any opinions or interpretations expressed herein are outside the scope of any UKAS accreditation held by TES Bretby laboratories.

The following tables are contained in this report:

Table 1 Main Analysis Results
Tables of TPH Chromatograms (5 Pages)
Table of Report Notes (1 Page)

On behalf of
TES Bretby : J Hannah
J Hannah Project Co-ordinator

Date of Issue: 18/08/03

Tests marked 'not UKAS accredited' in this report are not included in the UKAS Accreditation Schedule for our laboratory.

TES Bretby accepts no responsibility for the sampling related to the above results

Units :		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Method Codes :		BGCN22	ELESULP	ICPACIDS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICTSCN28	ICTSCN28	PAHSCUV	SCNCR6
Detection Limits :		1	20	10	0.5	0.1	0.5	0.5	0.5	0.10	0.5	0.5	3.0	1	5	10	0.1
UKAS Accredited :		yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
TES ID Number CU	Client Sample Description	Cyanide (Free)	Elemental Sulphur	SO4– (acid sol)	Arsenic (MS)	Cadmium (MS)	Chromium (MS)	Copper (MS)	Lead (MS)	Mercury (MS)	Nickel (MS)	Selenium (MS)	Zinc (MS)	CN- (total)	Sulphide	PAH (screening)	Chromium vi.
0322922	BH003A 4.0																
0322923	BH003A 6.0																
0322924	BH005 0.5																
0322925	BH005 1.2	<1	<20	1850	10.40	0.44	23.6	32.6	104.2	0.12	18.6	1.34	107.4	<1	6	5020	0.3
0322926	BH005 5.5																
0322920	TP008 0.8	<1	69	811	13.60	0.24	15.8	99.0	51.5	0.26	41.6	1.23	448.8	<1	<5	29	<0.1

TES Bretby
PO Box 100, Bretby Business Park,
Burton-on-Trent, Staffordshire, DE15 0XD
Tel +44 (0) 1283 554400
Fax +44 (0) 1283 554422

Client Name: Geotech Specialists

Contact: Mr A Game

Dublin Waste

Soils Sample Analysis

Date Printed	18 August 2003
Report Number	EFS/033223
Table Number	1
Page Number	1 of 2

UKAS TESTING 1252

Units :		mg/kg	mg/kg	pH Units	mg/kg	mg/kg												
Method Codes :		SCNCR6	TPHFID	WSLM3	WSLM4	ICPBOR												
Detection Limits :		0.5	10.0		0.5	0.5												
UKAS Accredited :		yes	yes	yes	yes	no												
TES ID Number CL/	Client Sample Description	Thiocyanate.	TPH GCFID (AR)	pH units	Phenol Index	Boron.												
0322922	BH003A 4.0		47															
0322923	BH003A 6.0		<10.0															
0322924	BH005 0.5		815															
0322925	BH005 1.2	1.0		10.6	7.6	0.8												
0322926	BH005 5.5		132															
0322920	TP008 0.8	<0.5		8.5	<0.5	1.7												
0322921	TP008 1.8		149															

TES Bretby
TES Bretby
PO Box 100, Bretby Business Park,
Burton-on-Trent, Staffordshire, DE15 0XD
Tel +44 (0) 1283 554400
Fax +44 (0) 1283 554422

Client Name: Geotech Specialists
Contact: Mr A Garne

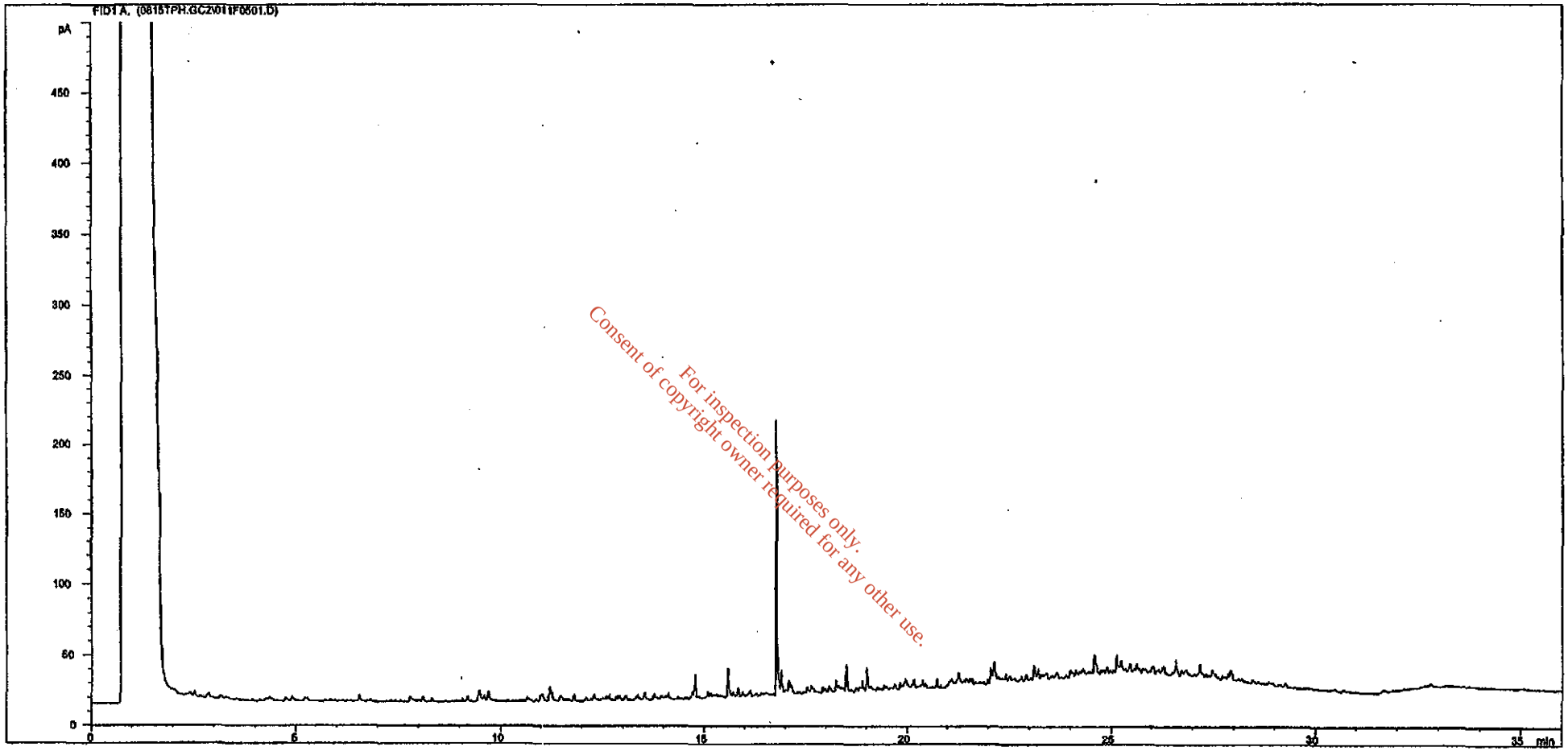
Dublin Waste

Soils Sample Analysis

Date Printed	18 August 2003
Report Number	EFS/033223
Table Number	1
Page Number	2 of 2

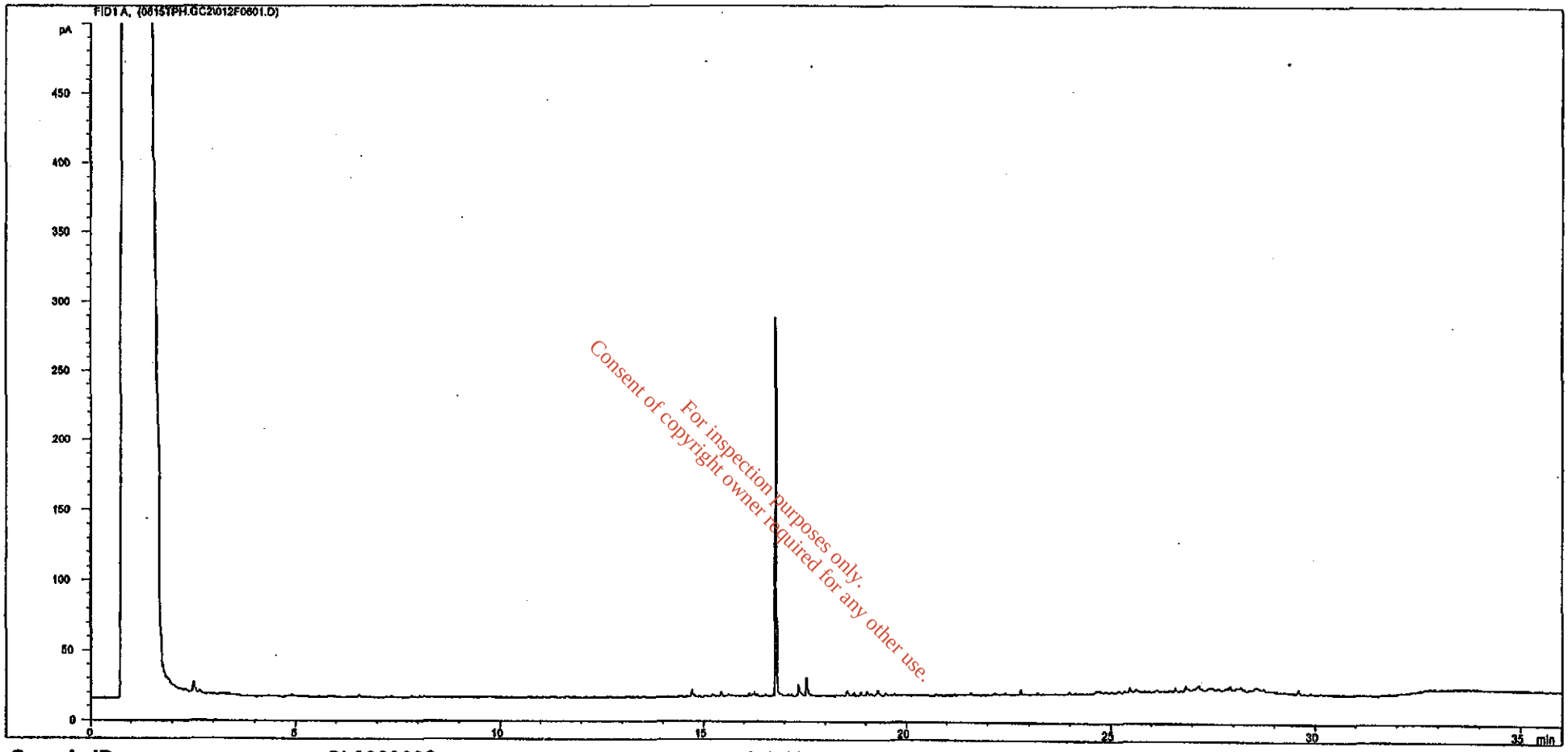
UKAS TESTING
1252

Petroleum Hydrocarbons (C8 to C37) by GC/FID



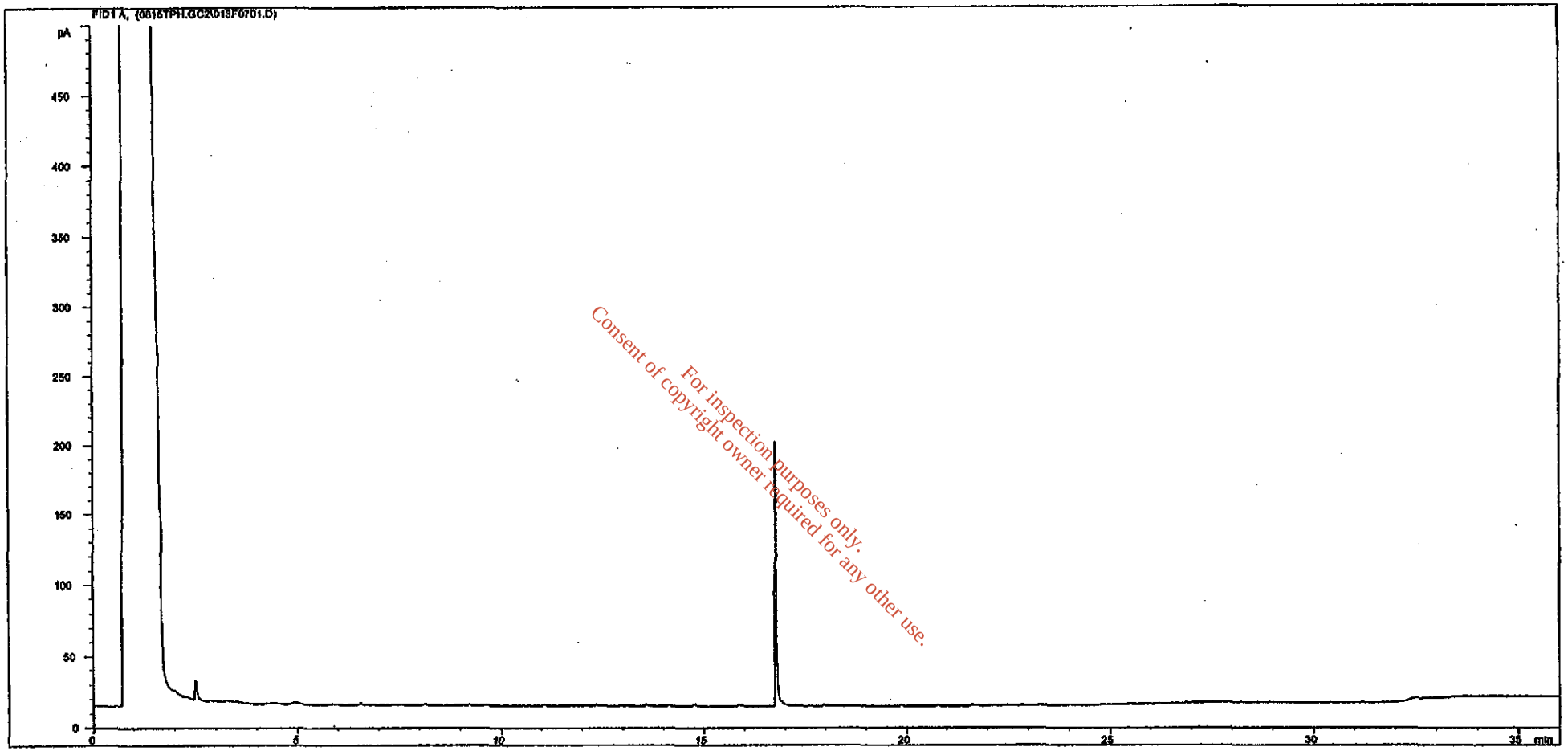
Sample ID:	CL0322921	**Job Number:**	S03_3223
Multiplier:	0.1	**Client:**	Geotech Specialists
Dilution:	1	**Site:**	Dublin Waste
Acquisition Method:	WMF_RUNF.M	**Client Sample Ref:**	TP008 1.8
Acquisition Date/Time:	15/08/2003 19:02		
Datafile:	L:\DATA\0815TPH.GC2\011F0501.D		

Petroleum Hydrocarbons (C8 to C37) by GC/FID



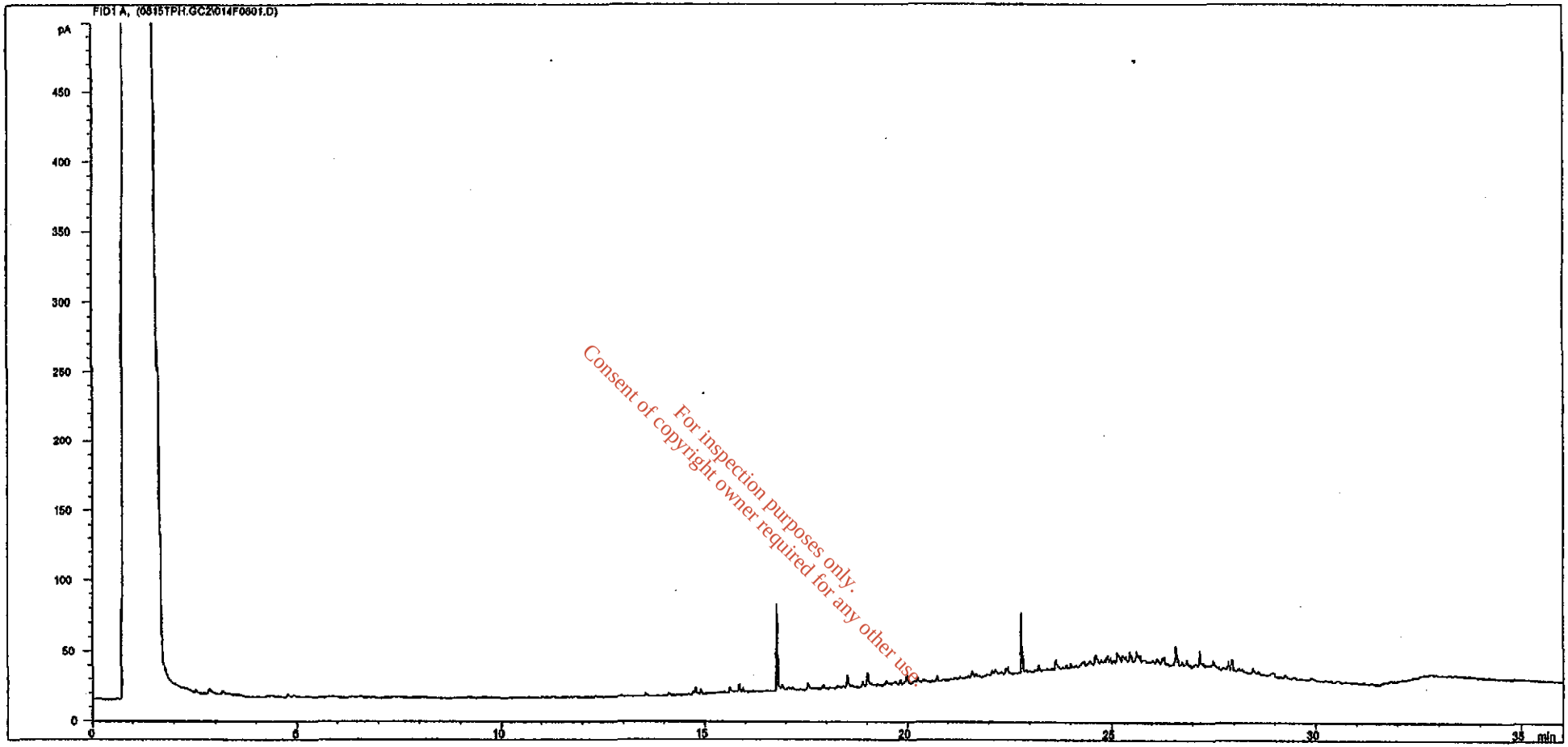
Sample ID:	CL0322922	**Job Number:**	S03_3223
Multiplier:	0.1	**Client:**	Geotech Specialists
Dilution:	1	**Site:**	Dublin Waste
Acquisition Method:	WMF_RUNF.M	**Client Sample Ref:**	BH003A 4.0
Acquisition Date/Time:	15/08/2003 19:49		
Datafile:	L:\DATA\0815TPH.GC2\012F0601.D		

Petroleum Hydrocarbons (C8 to C37) by GC/FID



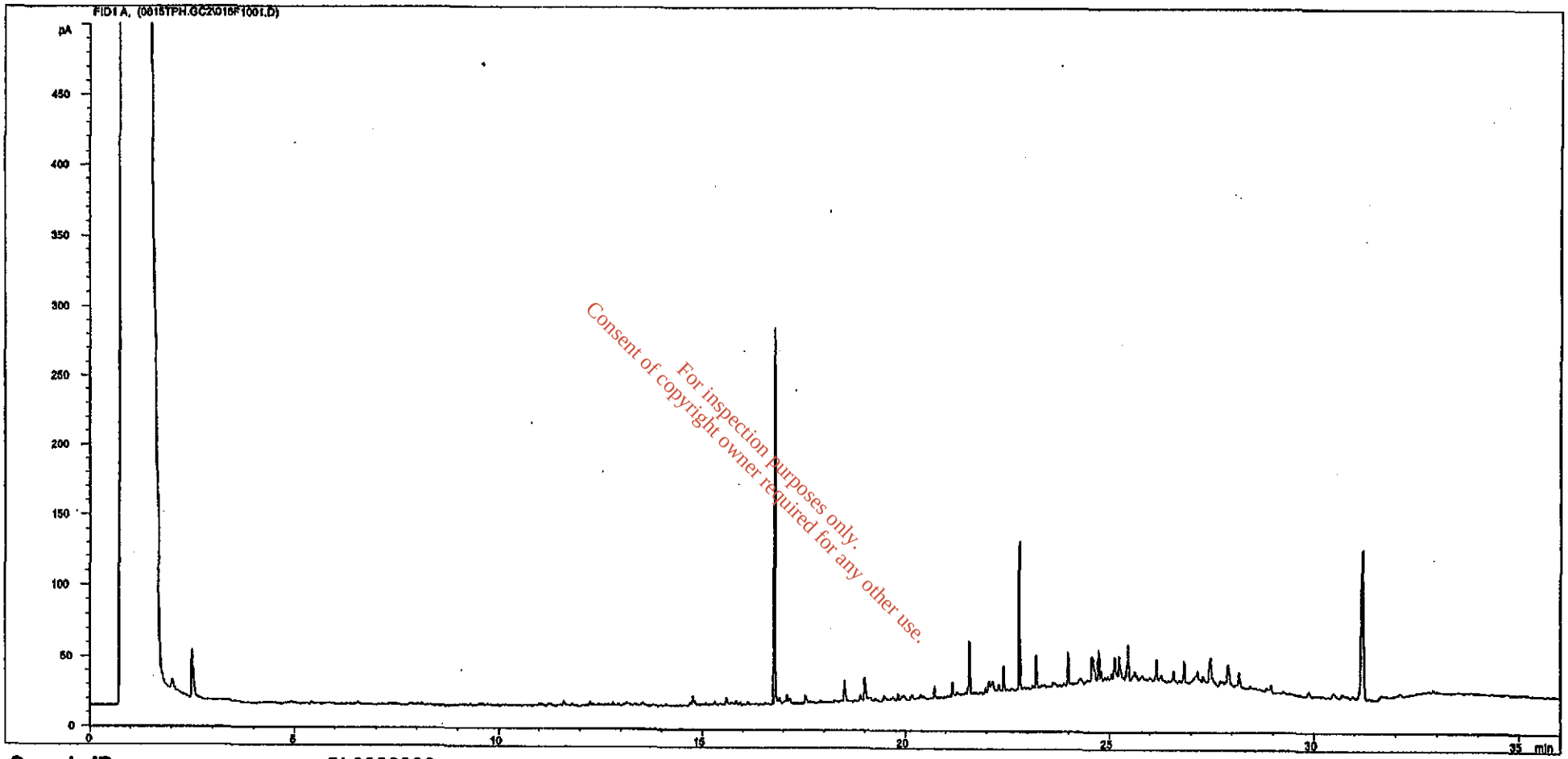
Sample ID:	CL0322923	**Job Number:**	S03_3223
Multiplier:	0.1	**Client:**	Geotech Specialists
Dilution:	1	**Site:**	Dublin Waste
Acquisition Method:	WMF_RUNF.M	**Client Sample Ref:**	BH003A 6.0
Acquisition Date/Time:	15/08/2003 20:36		
Datafile:	L:\DATA\0815TPH.GC2\013F0701.D		

Petroleum Hydrocarbons (C8 to C37) by GC/FID



Sample ID:	CL0322924	**Job Number:**	S03_3223
Multiplier:	0.1	**Client:**	Geotech Specialists
Dilution:	5	**Site:**	Dublin Waste
Acquisition Method:	WMF_RUNF.M	**Client Sample Ref:**	BH005 0.5
Acquisition Date/Time:	15/08/2003 21:23		
Datafile:	L:\DATA\0815TPH.GC2\014F0801.D		

Petroleum Hydrocarbons (C8 to C37) by GC/FID



Sample ID:	CL0322926	**Job Number:**	S03_3223
Multiplier:	0.1	**Client:**	Geotech Specialists
Dilution:	1	**Site:**	Dublin Waste
Acquisition Method:	WMF_RUNF.M	**Client Sample Ref:**	BH005 5.5
Acquisition Date/Time:	15/08/2003 22:56		
Datafile:	L:\DATA\0815TPH.GC2\016F1001.D		

Report Notes

Soil/Solid analysis specific:
Results expressed as mg/kg unless stated otherwise
S04 analysis not conducted in accordance with BS1377
Water Soluble Sulphate on 2:1 water:soil extract
AR denotes analysis conducted on the As Received sample
co-eluted with benzo(b)fluoranthene
co-eluted with Indeno(123-cd)pyrene
BTEX analysis expressed as ug/kg As Received
Phenol HPLC results expressed as mg/kg As Received

Water analysis specific:
Results expressed as mg/l unless stated otherwise

Oil analysis specific:
Results expressed as mg/kg unless stated otherwise
S.G. expressed as g/cm^3@ 15°C

Filter analysis specific:
Results expressed as mg on filter unless stated otherwise

VOC analysis specific:
Explanatory notes for data flagging
U = undetected above reporting limit
J = concentration at instrument was below lowest calibration standard
E = concentration at instrument was above top calibration standard
B = compound was detected in method blank

Gas (Tedlar bag) analysis specific:
Results expressed as ug/l unless stated otherwise

Air (Carbon tube) analysis specific:
Results expressed as ug on tube unless stated otherwise

Asbestos analysis specific:
CH denotes Chrysotile
CR denotes Crocidolite
AM denotes Amosite
NADIS denotes No Asbestos Detected in Sample
NBFO denotes No Bulk fibres Observed
T Trace
L Low (2-15%)
M Medium (15-50%)
H High (>50%)

General notes:
^ this analysis was subcontracted to another laboratory
$ Within laboratory tolerances
$$ unable to analyse due to nature of sample
¥ Results for guidance only, possible interference
& Blank corrected
I.S insufficient sample for analysis
Intf Unable to analyse due to interferences
N.D Not determined
N.R Not recorded
N.Det Not detected
Req Analysis Requested, see attached sheets for results
***** denotes this result not UKAS accredited on this sample
Þ Raised detection limit due to nature of sample

TES
Bretby

Our Ref : EFS/032527
Your Ref:
9 July 2003

Geotech Specialists Limited
14 JUL 2003

TES Bretby

PO Box 100
Ashby Road
Burton-upon-Trent
Staffordshire
DE15 0XD

Telephone: 01283 554400
Facsimile: 01283 554422
E-mail: enquiries@tes-bretby.co.uk

Mr A Garne
Geotech Specialists Ltd
Carewswood
Castlemartyr
County Cork
Ireland

Dear Mr Garne

SOILS ANALYSIS - Dublin Waste

Please find attached analytical results for the samples from the above site.

An invoice for this work will follow under separate cover.

If appropriate, samples covered by this report will be saved until approximately 06/08/03 when they will be discarded. Please call 01283 554403 for an extension of this date.
Please be aware that from 1 January 2003 our policy for the retention of paper based laboratory records and analysis reports will be 3 year

The work was carried out in accordance with Mowlem Environmental Sciences Group Standard Terms and Conditions of Contract.

Please contact me if you require any further information.

Yours sincerely

J Hannah

J Hannah
Project Co-ordinator
01283-554403

TES Bretby

TEST REPORT
SOIL SAMPLE ANALYSIS

UKAS TESTING

1252

TES Report No. EFS/032527

Site: Dublin Waste

Geotech Specialists Ltd
Carewswood
Castlemartyr
County Cork
Ireland

The 3 samples described in this report were scheduled for analysis by TES Bretby on Wednesday, 25 June 2003. The analysis was completed by Wednesday, 9 July 2003.

Tests marked as 'not UKAS accredited' and any opinions or interpretations expressed herein are outside the scope of any UKAS accreditation held by TES Bretby laboratories.

The following tables are contained in this report:

Table 1 Main Analysis Results
Table of Report Notes (1 Page)

On behalf of
TES Bretby : J Hannah
J Hannah Project Co-ordinator

Date of Issue: 09/07/03

Tests marked 'not UKAS accredited' in this report are not included in the UKAS Accreditation Schedule for our laboratory.

TES Bretby accepts no responsibility for the sampling related to the above results

Units :	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Method Codes :	BGCN22	ELESULP	ICPACIDS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICTSCN28	ICTSCN28	PAHSCUV	SCNCR6
Detection Limits :	1	20	10	0.5	0.1	0.5	0.5	0.5	0.10	0.5	0.5	3.0	1	5	10	0.1
UKAS Accredited :	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

TES ID Number CLJ	Client Sample Description	Cyanide (Free)	Elemental Sulphur	SO4-- (acid sol)	Arsenic (MS)	Cadmium (MS)	Chromium (MS)	Copper (MS)	Lead (MS)	Mercury (MS)	Nickel (MS)	Selenium (MS)	Zinc (MS)	CN- (total)	Sulphide	PAH (screening)	Chromium vi.
0318336	TP001 1.2-1.6	<1	48	839	12.10	0.13	20.5	65.3	30.6	0.21	29	1.04	66.1	<1	16	20	<0.1
0318337	TP004 1.2-1.4	<1	21	8350	13.50	1.25	17.5	42.4	479.2	0.69	23.8	1.82	292.6	<1	<5	108	<0.1
0318338	TP007 0.7-0.8	<1	<20	7180	23.2	1.57	58.3	189.5	822.6	0.49	52.4	1.70	381.4	<1	16	125	<0.1

TES Bretby
PO Box 100, Bretby Business Park,
Burton-on-Trent, Staffordshire, DE15 0XD
Tel +44 (0) 1283 554400
Fax +44 (0) 1283 554422

Client Name: Geotech Specialists
Contact: Mr A Game

Dublin Waste

Soils Sample Analysis

Date Printed	9 July 2003
Report Number	EFS/032527
Table Number	1
Page Number	1 of 2

UKAS TESTING
1252

Units :		mg/kg	pH Units	mg/kg	mg/kg													
Method Codes :		SCNCR6	WSLM3	WSLM4	ICPBOR													
Detection Limits :		0.5		0.5	0.5													
UKAS Accredited :		yes	yes	yes	no													
TES ID Number CL/	Client Sample Description	Thiocyanate.	pH units	Phenol Index	Boron.													
0318336	TP001 1.2-1.6	<0.5	9.5	<0.5	0.9													
0318337	TP004 1.2-1.4	<0.5	8.4	<0.5	1.1													
0318338	TP007 0.7-0.8	<0.5	9.0	<0.5	1.1													

TES Bretby
PO Box 100, Bretby Business Park,
Burton-on-Trent, Staffordshire, DE15 0XD
Tel +44 (0) 1283 554400
Fax +44 (0) 1283 554422

Client Name	Geotech Specialists
Contact	Mr A Garne

Dublin Waste

Soils Sample Analysis

Date Printed	9 July 2003
Report Number	EFS/032527
Table Number	1
Page Number	2 of 2

UKAS TESTING
1252

Report Notes

Soil/Solid analysis specific:
Results expressed as mg/kg unless stated otherwise
S04 analysis not conducted in accordance with BS1377
Water Soluble Sulphate on 2:1 water:soil extract
AR denotes analysis conducted on the As Received sample
co-eluted with benzo(b)fluoranthene
co-eluted with Indeno(123-cd)pyrene
BTEX analysis expressed as ug/kg As Received
Phenol HPLC results expressed as mg/kg As Received

Water analysis specific:
Results expressed as mg/l unless stated otherwise

Oil analysis specific:
Results expressed as mg/kg unless stated otherwise
S.G. expressed as g/cm³ @ 15°C

Filter analysis specific:
Results expressed as mg on filter unless stated otherwise

VOC analysis specific:
Explanatory notes for data flagging
U = undetected above reporting limit
J = concentration at instrument was below lowest calibration standard
E = concentration at instrument was above top calibration standard
B = compound was detected in method blank

Gas (Tedlar bag) analysis specific:
Results expressed as ug/l unless stated otherwise

Air (Carbon tube) analysis specific:
Results expressed as ug on tube unless stated otherwise

Asbestos analysis specific:
CH denotes Chrysotile
CR denotes Crocidolite
AM denotes Amosite
NADIS denotes No Asbestos Detected in Sample
NBFO denotes No Bulk fibres Observed
T Trace
L Low (2-15%)
M Medium (15-50%)
H High (>50%)

General notes:
^ this analysis was subcontracted to another laboratory
$ Within laboratory tolerances
$$ unable to analyse due to nature of sample
¥ Results for guidance only, possible interference
& Blank corrected
LS insufficient sample for analysis
Intf Unable to analyse due to interferences
N.D Not determined
N.R Not recorded
N.Det Not detected
Req Analysis Requested, see attached sheets for results
* denotes this result not UKAS accredited on this sample
Þ Raised detection limit due to nature of sample

Our Ref : EFS/034319
Your Ref: 21964
31 October 2003

TES Bretby

PO Box 100
Ashby Road
Burton-upon-Trent
Staffordshire
DE15 0XD

Telephone: 01283 554400
Facsimile: 01283 554422
E-mail: enquiries@tes-bretby.co.uk

Mr M Kelley
Geotech Specialists Ltd
Hartwell Upper
Kill
County Kildare
Eire

Dear Mr Kelley

SOILS ANALYSIS - Dublin Waste

Please find attached analytical results for the samples from the above site.

An invoice for this work will follow under separate cover.

If appropriate, samples covered by this report will be saved until approximately 28/11/03 when they will be discarded. Please call 01283 554403 for an extension of this date.
Please be aware that from 1 January 2003 our policy for the retention of paper based laboratory records and analysis reports will be 3 years

The work was carried out in accordance with Mowlem Environmental Sciences Group Standard Terms and Conditions of Contract.

Please contact me if you require any further information.

Yours sincerely

J Elstub
Project Co-ordinator
01283-554403

TEST REPORT
SOIL SAMPLE ANALYSIS

1252

TES Report No. EFS/034319

Site: Dublin Waste

Geotech Specialists Ltd
Hartwell Upper
Kill
County Kildare
Eire

The 2 samples described in this report were scheduled for analysis by TES Bretby on Friday, 17 October 2003. The analysis was completed by Friday, 31 October 2003.

Tests marked as 'not UKAS accredited' and any opinions or interpretations expressed herein are outside the scope of any UKAS accreditation held by TES Bretby laboratories.

The following tables are contained in this report:

Table 1 Main Analysis Results
Table of TPH Chromatogram (1 Page)
Table of Report Notes (1 Page)

On behalf of
TES Bretby :
J Elstub Project Co-ordinator

Date of Issue: 31/10/03

Tests marked 'not UKAS accredited' in this report are not included in the UKAS Accreditation Schedule for our laboratory.

TES Bretby accepts no responsibility for the sampling related to the above results

TES Bretby, P.O. Box 100, Burton-on-trent, DE15 0XD Tel: 01283 554400 Fax: 01283 554422

Units :		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
Method Codes :		BGCN22	ICPACIDS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICPMSS	ICTSCN28	ICTSCN28	PAHSCUV	SCNCR6	SCNCR6
Detection Limits :		1	10	0.5	0.1	0.5	0.5	0.5	0.10	0.5	0.5	3.0	1	5	10	0.1	0.5
UKAS Accredited :		yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
TES ID Number CU	Client Sample Description	Cyanide (Free)	SO4-- (acid sol)	Arsenic (MS)	Cadmium (MS)	Chromium (MS)	Copper (MS)	Lead (MS)	Mercury (MS)	Nickel (MS)	Selenium (MS)	Zinc (MS)	CN- (total)	Sulphide	PAH (screening)	Chromium vi.	Thiocyanate.
0330243	BH001 3.6																
0330244	BH002 4.0	<1	13100	12.80	0.91	19.2	27.5	178.6	0.34	24.9	1.10	320.9	<1	14	68	<0.1	<0.5

TES Bretby
PO Box 100, Bretby Business Park,
Burton-on-Trent, Staffordshire, DE15 0XD
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Fax +44 (0) 1283 554422

Client Name	Geotech Specialists
Contact	Mr M Kelley

Dublin Waste

Soils Sample Analysis

Date Printed	31 October 2003
Report Number	EFS/034319
Table Number	1
Page Number	1 of 2

UKAS TESTING
1252

Units :		mg/kg	pH Units	mg/kg	mg/kg													
Method Codes :		TPHFID	WSLM3	WSLM4	ICPBOR													
Detection Limits :		10.0		0.5	0.5													
UKAS Accredited :		yes	yes	yes	no													
TES ID Number CU	Client Sample Description	TPH GCFID (AR)	pH units	Phenol Index	Boron.													
0330243	BH001 3.6	72																
0330244	BH002 4.0		9.6	<0.5	1.3													

TES Bretby
PO Box 100, Bretby Business Park,
Burton-on-Trent, Staffordshire, DE15 0XD
Tel +44 (0) 1283 554400
Fax +44 (0) 1283 554422

Client Name	Geotech Specialists
Contact	Mr M Kelley

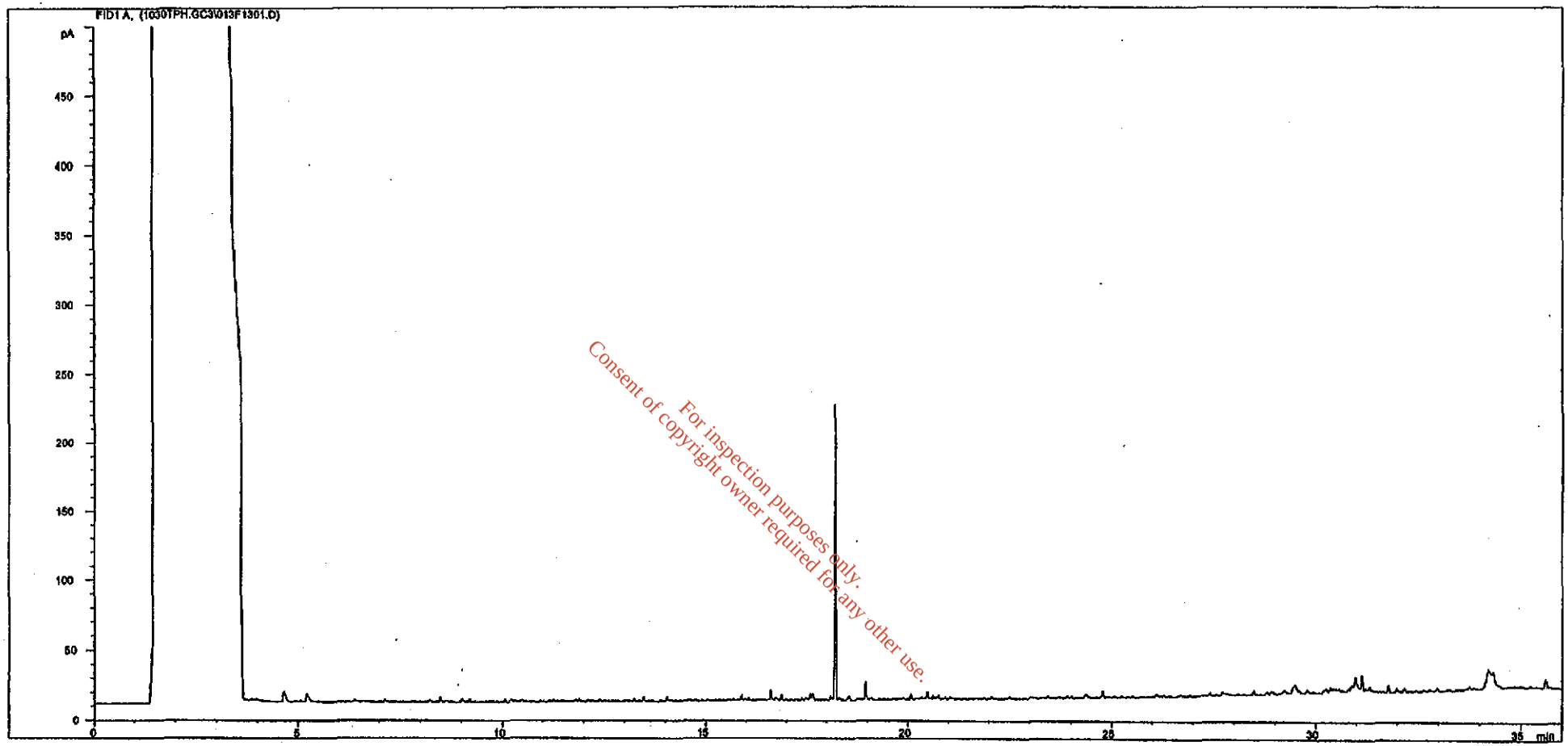
Dublin Waste

Soils Sample Analysis

Date Printed	31 October 2003
Report Number	EFS/034319
Table Number	1
Page Number	2 of 2

UKAS TESTING 1252

Petroleum Hydrocarbons (C8 to C37) by GC/FID



Sample ID:	CL0330243	**Job Number:**	S03_4319
Multiplier:	0.1	**Client:**	Geotech Specialists
Dilution:	1	**Site:**	Dublin Waste
Acquisition Method:	WMF_RUNF.M	**Client Sample Ref:**	BH001 3.6
Acquisition Date/Time:	31/10/03 02:30:17		
Datafile:	C:\TES\DATA\1030TPH.GC3\013F1301.D		

Report Notes

Soil/Solid analysis specific:
Results expressed as mg/kg unless stated otherwise
S04 analysis not conducted in accordance with BS1377
Water Soluble Sulphate on 2:1 water:soil extract
AR denotes analysis conducted on the As Received sample
co-eluted with benzo(b)fluoranthene
co-eluted with Indeno(123-cd)pyrene
BTEX analysis expressed as ug/kg As Received
Phenol HPLC results expressed as mg/kg As Received

Water analysis specific:
Results expressed as mg/l unless stated otherwise

Oil analysis specific:
Results expressed as mg/kg unless stated otherwise
S.G. expressed as g/cm^3 @ 15°C

Filter analysis specific:
Results expressed as mg on-filter unless stated otherwise

VOC analysis specific:
Explanatory notes for data flagging
U = undetected above reporting limit
J = concentration at instrument was below lowest calibration standard
E = concentration at instrument was above top calibration standard
B = compound was detected in method blank

Gas (Tedlar bag) analysis specific:
Results expressed as ug/l unless stated otherwise

Air (Carbon tube) analysis specific:
Results expressed as ug on tube unless stated otherwise

Asbestos analysis specific:
CH denotes Chrysotile
CR denotes Crocidolite
AM denotes Amosite
NADIS denotes No Asbestos Detected in Sample
NBFO denotes No Bulk fibres Observed
T Trace
L Low (2-15%)
M Medium (15-50%)
H High (>50%)

General notes:
^ this analysis was subcontracted to another laboratory
$ Within laboratory tolerances
$$ unable to analyse due to nature of sample
¥ Results for guidance only, possible interference
& Blank corrected
I.S insufficient sample for analysis
Intf Unable to analyse due to interferences
N.D Not determined
N.R Not recorded
N.Det Not detected
Req Analysis Requested, see attached sheets for results
* denotes this result not UKAS accredited on this sample
Þ Raised detection limit due to nature of sample

ALcontrol Laboratories (Dublin)

18a Rosemount Business Park,
Ballycoolin,
Dublin 11
Ireland
Tel: + 353 (0) 1 8829893
Fax: + 353 (0) 1 8829895

CERTIFICATE OF ANALYSIS

Client: Geotech Specialists Ltd

Carewswood
Castlemartyr
Co. Cork

Attention: Ronan Lynam

Date: 15 August, 2003

Our Reference: 03-B02557

Your Reference: DUBLIN WASTE KD3116

Location:

A total of 2 samples was received for analysis on Wednesday, 30 July 2003. We are pleased to enclose our final report, it was a pleasure to be of service to you, and we look forward to our continuing association.

Signed

Ken Scally
Site Manager

Compiled By *Natalie Duncan*

ALcontrol Laboratories Ireland

Test Schedule

Ref Number: 03-B02557

Client: Geotech Specialists Ltd

Date of Receipt: 30/07/2003

Turnaround: 7 days

Sample Type: SOIL

Location:

Client Contact: Ronan Lynam

Client Ref: DUBLIN WASTE KD3116

Detection Method				GCMS	GRAVIMETRIC													
UKAS Accredited																		
ALcontrol Reference	Sample Identity	Other ID	P / V	Dioxins*	Natural Moisture Content													
03-B02557-S0004-A01	TP9 (0.7-0.9m)	UNKNOWN	Plastic tub	X	X													
03-B02557-S0005-A01	TP2 (1.0-1.1m)	UNKNOWN	Plastic tub	X	X													

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

Checked By _____

☐ Interim

☑ Validated

ALcontrol Laboratories Ireland

Table Of Results

Ref Number: 03-B02557

Client: Geotech Specialists Ltd

Date of Receipt: 30/07/03

(of first sample)

Sample Type: SOIL

Location:

Client Contact: Ronan Lynam

Client Ref: DUBLIN WASTE KD3116

	Detection Method		GCMS	GRAVIMETRIC
	Method Detection Limit		n/a	<0.1%
	UKAS Accredited			
ALcontrol Reference	Sample Identity	Other ID	Dioxins*	Natural Moisture Content
				%
03-B02557-S0004	TP9 (0.7-0.9m)	UNKNOWN	Done	14.6
03-B02557-S0005	TP2 (1.0-1.1m)	UNKNOWN	Done	23.4

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

NFP = NO FIBRES PRESENT

Checked By Natalie Duncan

Printed at 16:32 on 18/08/03

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

Appendix

APPENDIX

1. Results are expressed as mg/kg dry weight unless otherwise stated, excluding analyses in (2) below .

2. Leach tests, cyanide, phenols by MS, hexavalent chrome, flash point, acid soluble sulphides, TPH by IR and volatiles are performed on wet soil as received, and results are expressed as mg/kg of wet soil or mg/I of Leachate of specified leach test . Ammoniacal nitrogen and total phenols by HPLC are performed on wet sample but are then re-calculated and expressed as mg/kg of dry soil .

3. ICP metals results are analysed using a screening program and the data is accurate to within 20%

4. The Majority of analyses are run to an accuracy of 10%, but this may be improved upon if legally defensible data is required .

5. A sub sample of all samples received will be retained free of charge for two months for soils and one month for waters (sample size permitting), but may then be discarded unless we are instructed to the contrary . Once the initial period has expired, a storage charge will be applied for each month or thereof until the client cancels the request for sample storage.

6. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but the turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

7. Please note that we take no responsibility for any test performed by sub-contractor's (marked with an asterisk) .

8. Asbestos screen is done in-house on soils and if no fibres are found will be reported as NFD-no fibres present . If asbestos is detected then identification & quantifications is carried out by sub-contractor . If a sample is suspected of containing asbestos then drying & crushing will be suspended on the sample until the asbestos result is known . If asbestos is present then no analysis requiring dry sampling will be undertaken .

9. NDP-No determination possible due to insufficient / unsuitable sample.

SCIENTIFIC ANALYSIS LABORATORIES LTD.
Medlock House,
New Elm Road,
Manchester M3 4JH
Telephone: 0161-827 1400
Fax: 0161-827 1414

Job 37310E/Dioxins

Dioxin and Furan Analysis

For

ALcontrol Geochem Ireland

Unit 18a

Rosemount Business Park,

Ballycoolin, Dublin 11

Ireland

Date of Sample Receipt: 31/07/03

Date(s) of Sample Testing: 31/07/03 - 11/08/03

Date of Issue of Report: 11/08/03

UKAS TESTING
1549

Scientific Analysis Laboratories Ltd.

Certificate of Analysis

All analytical results contained within have been obtained in accordance with the Laboratory's standard operating procedures contained in SAL SOP #1

Any deviations from these standard operating procedures are described in the following text.

Report written by D. Hood Signature/date 11/08/03
Laboratory Director

Report checked by V.C. Pam Signature/date 11/8/03
Director

Scientific Analysis Laboratories Ltd.

Report Checking Form

CHECK	SIGNED/DATE
CLIENT ID vs LAB ID CHECKED	11/8/07
DETECTION LIMITS CHECKED	11/8/07
QUALITY CONTROL DATA CHECKED	11/8/07
SAMPLE TEQs TRANSPOSED TO SUMMARY CORRECTLY	11/8/07
SAMPLE NARRATIVES CHECKED	11/8/07
ID OF TARGET COMPOUNDS	11/8/07
SELECTED ANALYTE CONCNS. CHECKED FROM RAW DATA	11/8/07
TRACKING FORMS CHECKED	11/8/07

Sample Data Pack, JOB # 37310E

Table of Contents

1.5 Summary of Objectives

Two soil samples were analysed for the seventeen 2,3,7,8 containing chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans. The concentrations of total tetra- through heptachlorinated dioxin and furan homologues were also determined.

Please note that the data reported here are based on the samples on a 'dried and ground' basis. Analysis and quantitation was performed at SAL via isotope dilution high resolution gas chromatography/ high resolution mass spectrometry according to SAL SOP #1. Tests covered by this report are within the scope of our UKAS accreditation.

The detection limits for these samples were between 0.2 and 0.4 ng/kg per congener, depending upon the specific sample and congeners involved.

Raw data from calibration and sample analyses are archived indefinitely on magnetic tape.

2.5 Sample data and results presentation

This is a brief explanation of the way in which the results are presented for this sample. The sample data pack commences with a sample narrative, this contains any comments upon the data, or any peculiarities observed in the sample's pathway through the laboratory.

Following this is a data summary sheet, this contains the results obtained for the targeted 2378 containing congeners and the "totals" for other chlorinated dioxin and furan isomers present in the sample.

The next page consists of the recovery information for the isotope labelled standards relative to the $^{13}C_6$-1,2,3,4-TCDD standard added prior to injection. Any comments thought appropriate will appear in the sample narrative.

Finally the sample tracking sheet is included.

"Totals" Determinations

In the case of quantitation of isomers other than the 2378 containing ones the RRFs of the first eluting 2378 isomer of the same degree of chlorination (or homologue group) are used.

Note that the current Toxic Equivalent Factors (TEFs) for the German BGA/UBA, US EPA and European Community/NATO (also known as i-TEF) are listed on the next page and are used to produce a total Dioxin and Furan equivalent amount for all congeners.

3.6 Toxic Equivalent Factors

Dioxin 2,3,7,8-Isomer	TEF		
	BGA/UBA	USEPA	EC
2,3,7,8-TCDD	1.0	1.0	1.0
1,2,3,7,8-PeCDD	0.1	0.5	0.5
1,2,3,4,7,8-HxCDD	0.1	0.1	0.1
1,2,3,6,7,8-HxCDD	0.1	0.1	0.1
1,2,3,7,8,9-HxCDD	0.1	0.1	0.1
1,2,3,4,6,7,8-HpCDD	0.01	0.01	0.01
OCDD	0.001	0.001	0.001

Total Dioxin Non-2,3,7,8-Isomer	
Summed TCDD	0.01
Summed PeCDD	0.01
Summed HxCDD	0.01
Summed HpCDD	0.001

Furan 2,3,7,8-Isomer			
2,3,7,8-TCDF	0.1	0.1	0.1
1,2,3,7,8-PeCDF	0.1	0.05	0.05
2,3,4,7,8-PeCDF	0.1	0.5	0.5
1,2,3,4,7,8-HxCDF	0.1	0.1	0.1
1,2,3,6,7,8-HxCDF	0.1	0.1	0.1
1,2,3,7,8,9-HxCDF	0.1	0.1	0.1
2,3,4,6,7,8-HxCDF	0.1	0.1	0.1
1,2,3,4,6,7,8-HpCDF	0.01	0.01	0.01
1,2,3,4,7,8,9-HpCDF	0.01	0.01	0.01
OCDF	0.001	0.001	0.001

Total Furan Non-2,3,7,8-Isomer	
Summed TCDF	0.01
Summed PeCDF	0.01
Summed HxCDF	0.01
Summed HpCDF	0.001

Please note that the USEPA TEFs now employed correspond exactly with those promulgated by NATO/CCMS and the EC.

4.7 Data Summary

The EC/NATO/CCMS/i-TE total toxic equivalent amounts for each of the samples are given in the table below. Note that the results are reported in ng/kg for the soil samples.

SAL Reference	Your Reference	Amount ng/kg I-TE
37310E001	03-B02557-50004-AD1 TP9 (0.7-0.9m)	2.2
37310E002	03-B02557-50005-AD1 TP2 (1.0-1.1m)	19
37310EBL	Method Blank	<0.5

5.8 Sample Narrative, Sample Number 37310E001

Extraction/ Clean up :- No Comments.

Data Acquisition :- No Comments.

Data Analysis :- A number of the toxic PCDD/Fs were detected in this sample together with some non-toxic ones.

The internal standard recoveries are acceptable.

RESULTS SUMMARY REPORT (Sally Version 6.7)

Job Number : 37310E Sample Number : 37310E001 Client Id :-
Date Acquired : 08-Aug-03 Acquired File : A:D0808
Operator : D. Wood Instrument : Ultima Column :DB5-ms
PC File : R:\DIOXINV\D0808\sample.005\D0808.DAT
File Text : 03-B02557-50004-AD1 TP9 (0.7-0.9m)
Sample Employed : 10.0 g

Compound Name	Quantity ng/kg	Toxic Equivalents BGA	USEPA	EC
Dioxins				
2,3,7,8-TCDD	N.D.			
1,2,3,7,8-PeCDD	N.D.			
1,2,3,6,7,8-HxCDD	1.6	0.16	0.16	0.16
1,2,3,4,7,8-HxCDD	N.D.			
1,2,3,7,8,9-HxCDD	0.72	0.072	0.072	0.072
1,2,3,4,6,7,8-HpCDD	58	0.58	0.58	0.58
OCDD	440	0.44	0.44	0.44
Total non-targeted isomers				
TCDD	4.9	0.049	0.0	0.0
PeCDD	1.7	0.017	0.0	0.0
HxCDD	9.4	0.094	0.0	0.0
HpCDD	71	0.071	0.0	0.0
Total Dioxins TEQ		1.5	1.3	1.3
Furans				
2,3,7,8-TCDF	0.76	0.076	0.076	0.076
1,2,3,7,8-PeCDF	0.82	0.082	0.041	0.041
2,3,4,7,8-PeCDF	0.64	0.064	0.32	0.32
1,2,3,4,7,8-HxCDF	1.1	0.11	0.11	0.11
1,2,3,6,7,8-HxCDF	0.73	0.073	0.073	0.073
2,3,4,6,7,8-HxCDF	0.75	0.075	0.075	0.075
1,2,3,7,8,9-HxCDF	N.D.			
1,2,3,4,6,7,8-HpCDF	16	0.16	0.16	0.16
1,2,3,4,7,8,9-HpCDF	0.94	0.0094	0.0094	0.0094
OCDF	45	0.045	0.045	0.045
Total non-targeted isomers				
TCDF	2.6	0.026	0.0	0.0
PeCDF	3.7	0.037	0.0	0.0
HxCDF	12	0.12	0.0	0.0
HpCDF	27	0.027	0.0	0.0
Total Furans TEQ		0.90	0.91	0.91
Grand Total TEQ		2.4	2.2	2.2

TARGETING REPORT (Sally Version 6.7)

Job Number : 37310E Sample Number : 37310E001 Client Id :-
Date Acquired : 08-Aug-03 Acquired File : A:D0808
Operator : D. Wood Instrument : Ultima Column :DB5-ms
PC File : R:\DIOXINV\D0808\sample.005\D0808.DAT
File Text : 03-B02557-50004-AD1 TP4 (0.7-0.9m)
Sample Employed : 10.0 g

Compound Name	M1	M2	M1/M2 thry	M1/M2 actl	Ok	Retention Time theory	Retention Time found	Area	RRF	Amount
Dioxins										
13C 1,2,3,4-TCDD	326	328	0.78	0.83	Y	00:30:06	00:29:37	111369	1.00	300.0
13C 2,3,7,8-TCDD	332	334	0.78	0.80	Y	00:30:38	00:30:09	25508	1.00	69.0
13C 1,2,3,7,8-PeCDD	368	370	1.55	1.56	Y	00:35:52	00:35:26	25205	0.94	72.4
13C 1,2,3,6,7,8-HxCDD	402	404	1.24	1.19	Y	00:40:20	00:40:01	17345	0.63	74.0
1,2,3,6,7,8-HxCDD	390	392	1.24	1.31	Y	00:40:21	00:40:01	288	1.03	1.6
1,2,3,7,8,9-HxCDD	390	392	1.24	1.28	Y	00:40:44	00:40:26	114	0.91	0.7
13C 1,2,3,4,6,7,8-HpCDD	436	438	1.05	1.08	Y	00:44:34	00:44:10	12982	0.56	63.0
1,2,3,4,6,7,8-HpCDD	424	426	1.05	1.03	Y	00:44:35	00:44:11	7007	0.93	57.8
13C OCDD	470	472	0.89	0.87	Y	00:49:16	00:48:50	6939	0.33	56.3
OCDD	458	460	0.89	0.91	Y	00:49:17	00:48:52	31458	1.03	439.5
Furans										
13C 1,2,3,4-TCDD	326	328	0.78	0.83	Y	00:30:06	00:29:37	111369	1.00	300.0
13C 2,3,7,8-TCDF	316	318	0.78	0.77	Y	00:29:56	00:29:26	35363	1.36	70.1
2,3,7,8-TCDF	304	306	0.78	0.75	Y	00:29:57	00:29:27	283	1.06	0.8
13C 1,2,3,7,8-PeCDF	352	354	1.55	1.52	Y	00:34:27	00:34:00	31982	1.19	72.7
1,2,3,7,8-PeCDF	340	342	1.55	1.53	Y	00:34:28	00:33:58	249	0.95	0.8
2,3,4,7,8-PeCDF	340	342	1.55	1.60	Y	00:35:34	00:35:08	188	0.92	0.6
13C 1,2,3,4,7,8-HxCDF	384	386	0.51	0.50	Y	00:39:12	00:38:48	24763	0.84	79.3
1,2,3,4,7,8-HxCDF	374	376	1.24	1.35	Y	00:39:12	00:38:48	283	1.07	1.1
1,2,3,6,7,8-HxCDF	374	376	1.24	1.26	Y	00:39:21	00:38:59	204	1.13	0.7
2,3,4,6,7,8-HxCDF	374	376	1.24	1.29	Y	00:40:04	00:39:44	170	0.91	0.8
13C 1,2,3,4,6,7,8-HpCDF	418	420	0.46	0.42	Y	00:43:06	00:42:45	10222	0.57	47.9
1,2,3,4,6,7,8-HpCDF	408	410	1.05	1.00	Y	00:43:07	00:42:46	2029	1.27	15.7
1,2,3,4,7,8,9-HpCDF	408	410	1.05	1.00	Y	00:45:28	00:45:02	70	0.73	0.9
13C OCDD	470	472	0.89	0.87	Y	00:49:16	00:48:50	6939	0.33	56.3
OCDF	442	444	0.89	0.90	Y	00:49:42	00:49:15	2926	0.93	45.4

RECOVERY REPORT (Sally Version 6.7)

Job Number : 37310E Sample Number : 37310E001 Client Id :-
Date Acquired : 08-Aug-03 Acquired File : A:D0808
Operator : D. Wood Instrument : Ultima Column :DB5-ms
PC File : R:\DIOXINV\D0808\sample.005\D0808.DAT
File Text : 03-B02557-50004-AD1 TP9 (0.7-0.9m)
Sample Employed : 10.0 g

Compound Name	Recovery %	Standard Addition / ng
Dioxins		
13C 1,2,3,4-TCDD		
13C 2,3,7,8-TCDD	69	1.00
13C 1,2,3,7,8-PeCDD	72	1.00
13C 1,2,3,6,7,8-HxCDD	74	1.00
13C 1,2,3,4,6,7,8-HpCDD	63	1.00
13C OCDD	56	1.00
Furans		
13C 1,2,3,4-TCDD		
13C 2,3,7,8-TCDF	70	1.00
13C 1,2,3,7,8-PeCDF	73	1.00
13C 1,2,3,4,7,8-HxCDF	79	1.00
13C 1,2,3,4,6,7,8-HpCDF	48	1.00
13C OCDD	56	1.00

SAL Sample Tracking Form : Issue 6

PLEASE INITIAL AND DATE ALL ENTRIES

Job Number 37310 **Sample Number** 001 **Analysis** PCDD/F

Sample Extraction

Weight/Volume Extracted 10.00g — 05.08.03 PSM

PCCD/F Internal Standard id/Lot #/Volume EDF957/32461-83/ 46 3µl — 05.08.03 PSM

PCB Internal Standard id/Lot #/Volume

Extraction Method/Solvent/Volume SOXHLET TOLUENE 300ml — 05.08.03 PSM

Extraction Start 16:00 05.08.03 PSM **End** 09:00 — 06.08.03 PSM

Additional Comments

Extract Clean-up

Clean-up 1 COMBINATION COLUMN — 06.08.03 PSM

Clean-up 2 FLORISIL COLUMN — 06.08.03 PSM

Clean-up 3

Additional Comments

GC/MS Analysis

Instrument ULTIMA **Analyte** PCDD/F **Injection** 47585 — 08/08/03 JCL

Instrument **Analyte** **Injection**

Instrument **Analyte** **Injection**

Quantitation

Method SALLY (DIOXIN) — 10/08/03 JCL

Additional Comments

6.13 Sample Narrative, Sample Number 37310E002

Extraction/ Clean up :- No Comments.

Data Acquisition :- No Comments.

Data Analysis :- All bar one of the toxic PCDD/Fs were detected in this sample together with some non-toxic ones.

The internal standard recoveries are acceptable.

RESULTS SUMMARY REPORT (Sally Version 6.7)

Job Number : 37310E Sample Number : 37310E002 Client Id :-
Date Acquired : 08-Aug-03 Acquired File : A:D0808
Operator : D. Wood Instrument : Ultima Column :DB5-ms
PC File : R:\DIOXINV\D0808\sample.006\D0808.DAT
File Text : 03-B02557-50005-AD1 TP2 (1.0-1.1m)
Sample Employed : 10.0 g

Compound Name	Quantity ng/kg	Toxic Equivalents BGA	USEPA	EC
Dioxins				
2,3,7,8-TCDD	N.D.			
1,2,3,7,8-PeCDD	1.3	0.13	0.64	0.64
1,2,3,6,7,8-HxCDD	13	1.3	1.3	1.3
1,2,3,4,7,8-HxCDD	3.3	0.33	0.33	0.33
1,2,3,7,8,9-HxCDD	5.3	0.53	0.53	0.53
1,2,3,4,6,7,8-HpCDD	380	3.8	3.8	3.8
OCDD	3600	3.6	3.6	3.6
Total non-targeted isomers				
TCDD	23	0.23	0.0	0.0
PeCDD	28	0.28	0.0	0.0
HxCDD	190	1.9	0.0	0.0
HpCDD	450	0.45	0.0	0.0
Total Dioxins TEQ		13	10	10
Furans				
2,3,7,8-TCDF	5.9	0.59	0.59	0.59
1,2,3,7,8-PeCDF	17	1.7	0.86	0.86
2,3,4,7,8-PeCDF	6.9	0.69	3.5	3.5
1,2,3,4,7,8-HxCDF	13	1.3	1.3	1.3
1,2,3,6,7,8-HxCDF	6.6	0.66	0.66	0.66
2,3,4,6,7,8-HxCDF	7.6	0.76	0.76	0.76
1,2,3,7,8,9-HxCDF	N.D.			
1,2,3,4,6,7,8-HpCDF	89	0.89	0.89	0.89
1,2,3,4,7,8,9-HpCDF	16	0.16	0.16	0.16
OCDF	330	0.33	0.33	0.33
Total non-targeted isomers				
TCDF	58	0.58	0.0	0.0
PeCDF	53	0.53	0.0	0.0
HxCDF	110	1.1	0.0	0.0
HpCDF	13	0.013	0.0	0.0
Total Furans TEQ		9.2	9.0	9.0
Grand Total TEQ		22	19	19

TARGETING REPORT (Sally Version 6.7)

Job Number : 37310E Sample Number : 37310E002 Client Id :-
Date Acquired : 08-Aug-03 Acquired File : A:D0808
Operator : D. Wood Instrument : Ultima Column :DB5-ms
PC File : R:\DIOXINV\D0808\sample.006\D0808.DAT
File Text : 03-B02557-50005-AD1 TP2 (1.0-1.1m)
Sample Employed : 10.0 g

Compound Name	M1	M2	M1/M2 thry	M1/M2 actl	Ok	Retention Time theory	Retention Time found	Area	RRF	Amount
Dioxins										
13C 1,2,3,4-TCDD	326	328	0.78	0.86	Y	00:30:06	00:29:43	35168	1.00	300.0
13C 2,3,7,8-TCDD	332	334	0.78	0.83	Y	00:30:38	00:30:12	8670	1.00	74.3
13C 1,2,3,7,8-PeCDD	368	370	1.55	1.57	Y	00:35:52	00:35:30	8016	0.94	72.9
1,2,3,7,8-PeCDD	356	358	1.55	1.40	Y	00:35:53	00:35:31	90	0.88	1.3
13C 1,2,3,6,7,8-HxCDD	402	404	1.24	1.28	Y	00:40:20	00:40:04	4289	0.63	58.0
1,2,3,6,7,8-HxCDD	390	392	1.24	1.23	Y	00:40:21	00:40:05	586	1.03	13.2
1,2,3,4,7,8-HxCDD	390	392	1.24	1.39	Y	00:40:13	00:39:58	124	0.88	3.3
1,2,3,7,8,9-HxCDD	390	392	1.24	1.29	Y	00:40:44	00:40:30	206	0.91	5.3
13C 1,2,3,4,6,7,8-HpCDD	436	438	1.05	1.10	Y	00:44:34	00:44:14	2551	0.56	39.2
1,2,3,4,6,7,8-HpCDD	424	426	1.05	1.04	Y	00:44:35	00:44:15	8988	0.93	377.3
13C OCDD	470	472	0.89	0.85	Y	00:49:16	00:48:54	1092	0.33	28.1
OCDD	458	460	0.89	0.91	Y	00:49:17	00:48:55	40980	1.03	3636.6
Furans										
13C 1,2,3,4-TCDD	326	328	0.78	0.86	Y	00:30:06	00:29:43	35168	1.00	300.0
13C 2,3,7,8-TCDF	316	318	0.78	0.69	Y	00:29:56	00:29:32	12655	1.36	79.5
2,3,7,8-TCDF	304	306	0.78	0.67	Y	00:29:57	00:29:33	791	1.06	5.9
13C 1,2,3,7,8-PeCDF	352	354	1.55	1.44	Y	00:34:27	00:34:04	11402	1.19	82.1
1,2,3,7,8-PeCDF	340	342	1.55	1.51	Y	00:34:28	00:34:02	1851	0.95	17.2
2,3,4,7,8-PeCDF	340	342	1.55	1.58	Y	00:35:34	00:35:12	725	0.92	6.9
13C 1,2,3,4,7,8-HxCDF	384	386	0.51	0.55	Y	00:39:12	00:38:52	6859	0.84	69.6
1,2,3,4,7,8-HxCDF	374	376	1.24	1.28	Y	00:39:12	00:38:53	920	1.07	12.5
1,2,3,6,7,8-HxCDF	374	376	1.24	1.32	Y	00:39:21	00:39:03	509	1.13	6.6
2,3,4,6,7,8-HxCDF	374	376	1.24	1.22	Y	00:40:04	00:39:48	475	0.91	7.6
13C 1,2,3,4,6,7,8-HpCDF	418	420	0.46	0.45	Y	00:43:06	00:42:50	2328	0.57	34.5
1,2,3,4,6,7,8-HpCDF	408	410	1.05	1.03	Y	00:43:07	00:42:51	2636	1.27	89.4
1,2,3,4,7,8,9-HpCDF	408	410	1.05	1.08	Y	00:45:28	00:45:06	267	0.73	15.8
13C OCDD	470	472	0.89	0.85	Y	00:49:16	00:48:54	1092	0.33	28.1
OCDF	442	444	0.89	0.87	Y	00:49:42	00:49:20	3378	0.93	333.1

RECOVERY REPORT (Sally Version 6.7)

Job Number : 37310E Sample Number : 37310E002 Client Id :-
Date Acquired : 08-Aug-03 Acquired File : A:D0808
Operator : D. Wood Instrument : Ultima Column :DB5-ms
PC File : R:\DIOXINV\D0808\sample.006\D0808.DAT
File Text : 03-B02557-50005-AD1 TP2 (1.0-1.1m)
Sample Employed : 10.0 g

Compound Name	Recovery %	Standard Addition / ng
Dioxins		
13C 1,2,3,4-TCDD		
13C 2,3,7,8-TCDD	74	1.00
13C 1,2,3,7,8-PeCDD	73	1.00
13C 1,2,3,6,7,8-HxCDD	58	1.00
13C 1,2,3,4,6,7,8-HpCDD	39	1.00
13C OCDD	28	1.00
Furans		
13C 1,2,3,4-TCDD		
13C 2,3,7,8-TCDF	79	1.00
13C 1,2,3,7,8-PeCDF	82	1.00
13C 1,2,3,4,7,8-HxCDF	70	1.00
13C 1,2,3,4,6,7,8-HpCDF	35	1.00
13C OCDD	28	1.00

SAL Sample Tracking Form : Issue 6

PLEASE INITIAL AND DATE ALL ENTRIES

Job Number 37310 **Sample Number** 002 **Analysis** PCDDF

Sample Extraction

Weight/Volume Extracted 10.00g — 05.08.03 PSM

PCCD/F Internal Standard id/Lot #/Volume EDF957/32461-83/46 3mL — 05.08.03 PSM

PCB Internal Standard id/Lot #/Volume — 05.08.03 PSM

Extraction Method/Solvent/Volume SOXHLET TOLUENE 300mL — 05.08.03 PSM

Extraction Start 16:00 05.08.03 PSM **End** 09:00 — 06.08.03 PSM

Additional Comments

Extract Clean-up

Clean-up 1 COMBINATION COLUMN — 06.08.03 PSM

Clean-up 2 FLORISIL COLUMN — 06.08.03 PSM

Clean-up 3

Additional Comments

GC/MS Analysis

Instrument ULTIMA **Analyte** DIOXINS **Injection** 4758 — 08/08/0330

Instrument **Analyte** **Injection**

Instrument **Analyte** **Injection**

Quantitation

Method — 10/8/3 1005

Additional Comments

7.18 Reagent Blank Narrative

Extraction/ Clean up :- No Comments.

Data Acquisition :- No Comments.

Data Analysis :- This reagent blank contains a limited number of the target congeners. It is reported as <0.5 ng/kg I-TEQ in the data summary.

The internal standard recoveries are acceptable.

RESULTS SUMMARY REPORT (Sally Version 6.7)

Job Number : 37310E Sample Number : 37310EBL Client Id :-
Date Acquired : 08-Aug-03 Acquired File : A:D0808
Operator : D. Wood Instrument : Ultima Column :DB5-ms
PC File : R:\DIOXINV\D0808\sample.004\D0808.DAT
File Text : Method Blank
Sample Employed : 10.0 g

Compound Name	Quantity ng/kg	Toxic Equivalents BGA	USEPA	EC
Dioxins				
2,3,7,8-TCDD	N.D.			
1,2,3,7,8-PeCDD	N.D.			
1,2,3,6,7,8-HxCDD	0.16	0.016	0.016	0.016
1,2,3,4,7,8-HxCDD	N.D.			
1,2,3,7,8,9-HxCDD	N.D.			
1,2,3,4,6,7,8-HpCDD	1.6	0.016	0.016	0.016
OCDD	4.2	0.0042	0.0042	0.0042
Total non-targeted isomers				
TCDD	N.D.			
PeCDD	1.2	0.012	0.0	0.0
HxCDD	0.56	0.0056	0.0	0.0
HpCDD	N.D.			
Total Dioxins TEQ		0.054	0.036	0.036
Furans				
2,3,7,8-TCDF	N.D.			
1,2,3,7,8-PeCDF	N.D.			
2,3,4,7,8-PeCDF	N.D.			
1,2,3,4,7,8-HxCDF	N.D.			
1,2,3,6,7,8-HxCDF	N.D.			
2,3,4,6,7,8-HxCDF	N.D.			
1,2,3,7,8,9-HxCDF	N.D.			
1,2,3,4,6,7,8-HpCDF	1.3	0.013	0.013	0.013
1,2,3,4,7,8,9-HpCDF	N.D.			
OCDF	1.9	0.0019	0.0019	0.0019
Total non-targeted isomers				
TCDF	1.6	0.016	0.0	0.0
PeCDF	0.62	0.0062	0.0	0.0
HxCDF	2.5	0.025	0.0	0.0
HpCDF	N.D.			
Total Furans TEQ		0.062	0.015	0.015
Grand Total TEQ		0.12	0.051	0.051

TARGETING REPORT (Sally Version 6.7)

Job Number : 37310E Sample Number : 37310EBL Client Id :-
Date Acquired : 08-Aug-03 Acquired File : A:D0808
Operator : D. Wood Instrument : Ultima Column :DB5-ms
PC File : R:\DIOXINV\D0808\sample.004\D0808.DAT
File Text : Method Blank
Sample Employed : 10.0 g

Compound Name	M1	M2	M1/M2 thry	M1/M2 actl	Ok	Retention Time theory	Retention Time found	Area	RRF	Amount
Dioxins										
13C 1,2,3,4-TCDD	326	328	0.78	0.85	Y	00:30:06	00:29:34	148320	1.00	300.0
13C 2,3,7,8-TCDD	332	334	0.78	0.84	Y	00:30:38	00:30:04	34908	1.00	70.9
13C 1,2,3,7,8-PeCDD	368	370	1.55	1.50	Y	00:35:52	00:35:23	34363	0.94	74.1
13C 1,2,3,6,7,8-HxCDD	402	404	1.24	1.21	Y	00:40:20	00:39:51	24700	0.63	79.2
1,2,3,6,7,8-HxCDD	390	392	1.24	1.07	Y	00:40:21	00:39:52	40	1.03	0.2
13C 1,2,3,4,6,7,8-HpCDD	436	438	1.05	1.11	Y	00:44:34	00:44:04	17824	0.56	65.0
1,2,3,4,6,7,8-HpCDD	424	426	1.05	1.11	Y	00:44:35	00:44:06	270	0.93	1.6
13C OCDD	470	472	0.89	0.88	Y	00:49:16	00:48:40	11071	0.33	67.4
OCDD	458	460	0.89	0.80	Y	00:49:17	00:48:43	479	1.03	4.2
Furans										
13C 1,2,3,4-TCDD	326	328	0.78	0.85	Y	00:30:06	00:29:34	148320	1.00	300.0
13C 2,3,7,8-TCDF	316	318	0.78	0.68	Y	00:29:56	00:29:23	49340	1.36	73.5
13C 1,2,3,7,8-PeCDF	352	354	1.55	1.54	Y	00:34:27	00:33:57	31591	1.19	53.9
13C 1,2,3,4,7,8-HxCDF	384	386	0.51	0.51	Y	00:39:12	00:38:42	34139	0.84	82.1
13C 1,2,3,4,6,7,8-HpCDF	418	420	0.46	0.45	Y	00:43:06	00:42:37	22390	0.57	78.8
1,2,3,4,6,7,8-HpCDF	408	410	1.05	0.90	Y	00:43:07	00:42:38	359	1.27	1.3
13C OCDD	470	472	0.89	0.88	Y	00:49:16	00:48:40	11071	0.33	67.4
OCDF	442	444	0.89	0.89	Y	00:49:42	00:49:05	199	0.93	1.9

RECOVERY REPORT (Sally Version 6.7)

Job Number : 37310E Sample Number : 37310EBL Client Id :-
Date Acquired : 08-Aug-03 Acquired File : A:D0808
Operator : D. Wood Instrument : Ultima Column :DB5-ms
PC File : R:\DIOXINV\D0808\sample.004\D0808.DAT
File Text : Method Blank
Sample Employed : 10.0 g

Compound Name	Recovery %	Standard Addition / ng
Dioxins		
13C 1,2,3,4-TCDD		
13C 2,3,7,8-TCDD	71	1.00
13C 1,2,3,7,8-PeCDD	74	1.00
13C 1,2,3,6,7,8-HxCDD	79	1.00
13C 1,2,3,4,6,7,8-HpCDD	65	1.00
13C OCDD	67	1.00
Furans		
13C 1,2,3,4-TCDD		
13C 2,3,7,8-TCDF	73	1.00
13C 1,2,3,7,8-PeCDF	54	1.00
13C 1,2,3,4,7,8-HxCDF	82	1.00
13C 1,2,3,4,6,7,8-HpCDF	79	1.00
13C OCDD	67	1.00

SAL Sample Tracking Form : Issue 6

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Job Number 37309/310/336/419 273 **Sample Number** BLK **Analysis** PCDD/F + PCB (WHO12)

Sample Extraction

Weight/Volume Extracted THIMBLE — 05-08-03 PSH

PCCD/F Internal Standard id/Lot #/Volume EDF957/32461-83/46 — 3µL — 05-08-03 PSH

PCB Internal Standard id/Lot #/Volume PCBWH012 070703/A — 20µL — 05-08-03 PSH

Extraction Method/Solvent/Volume SOXHLET DCM : Hexane — 800ml — 05-08-03 PSH

Extraction Start 16:00 05-08-03 PSH **End** 09:00 — 06-08-03 PSH

Additional Comments

Extract Clean-up

Clean-up 1 COMBINATION COLUMN — 06-08-03 PSH

Clean-up 2 FLORISIL COLUMN — 06-08-03 PSH

Clean-up 3

Additional Comments

GC/MS Analysis

Instrument ULTIMA **Analyte** PCDD/F **Injection** 14582 — 08/08/03

Instrument **Analyte** **Injection**

Instrument **Analyte** **Injection**

Quantitation

Method SALLY (DIOXIN) — 10/08/03

Additional Comments

8.23 Extraction and Clean Up Procedures

Each sample was processed in accordance with the procedures defined in SAL SOP #1. In summary an accurately weighed 10g aliquot of the 'dried and ground' soil sample was placed into a Soxhlet thimble that was then spiked with labelled internal standards. The samples were extracted with 300 mls of toluene for in excess of sixteen hours.

A method blank was prepared in the same way.

Following extraction, the toluene was reduced to incipient dryness *in vacuo*, prior to reconstitution in *ca* 5 ml hexane and purification by elution through a column combining sulphuric acid impregnated silica, potassium hydroxide impregnated silica and anhydrous sodium sulphate. The entire eluate from this column was further purified via activated Florisil column chromatography and then concentrated to near-dryness prior to GC/MS analysis.

Immediately prior to analysis by GC/MS nonane spiked with recovery standard $^{13}C_6$-1,2,3,4-TCDD and nonane were added to the samples and the blank (see the sample tracking form for the respective amounts). An aliquot of this solution was then injected onto the GC/MS system.

9.23 Analytical Procedures

The analytical methods may be summarised as follows,

Stable isotopically labelled internal standards are added at known concentration to the samples prior to extraction and clean up.

A standard solution containing the known first and last eluting isomers of the tetra, penta, hexa and hepta furans is injected onto the GC/MS system with ions monitored for all the homologues. This allows the setting up of appropriate acquisition windows for the more specific multi-group data acquisition for the sample analysis. The resulting elution windows are incorporated into the multi group acquisition tables.

Following this, another standard solution containing the 2378 TCDD native compound and the known close eluting isomers is injected. This permits the ability of the column to identify 2378-TCDD to be evaluated.

Two masses each are monitored for each native and isotopically labelled congener, this allows the isotope ratio to be checked with the theoretical value as additional confirmation of the compound's identity. Note that although the mass spectrometer is operated at 10,000 resolving power there are still other compounds which may survive the clean up and may be close enough in mass to yield a response in the dioxin or furan channels. To aid in identification of these interferences two other QA masses are monitored, firstly the molecular ion species for polychlorinated diphenyl ethers which yield fragments in their mass spectra of exactly the same mass as the furans, if a response is observed in this channel coincident with the furan masses then the peaks are discarded if appropriate. Secondly, as part of the system's performance checks, a "lock mass" from perfluorokerosene (present in the batch inlet throughout the entire GC run) is monitored and scanned to compensate for any mass drift during the run. Use is made of this feature to monitor the lock mass before it has been used to correct for drift. This trace would, if no large components were present, appear as a continuous line, however, if a large (many nanograms/micrograms) peak elutes from the GC column the ion source sensitivity is suppressed and a negative going "peak" will be seen. If such a peak coelutes with possible interferences they may also be discarded, (see each sample's narrative).

Standards of both the isotopically labelled and native 2378 containing congeners of interest are injected sequentially, starting with the least concentrated. The composition of these are given later. The resulting target results and relative response factors are given.

All 2378 containing native congeners are quantitated by isotope dilution methods relative to their carbon-13 labelled internal standards. For quantitation of the "totals" of all non-2378 containing congeners, the relative response factor is assumed to be the same as for the first eluting native 2378 congener of the same homologue group. For example, non-2,3,7,8-chlorinated PeCDFs are quantified using the RRF derived for 1,2,3,7,8-PeCDF.

As a check upon the efficiency of the extraction/clean up, $^{13}C_6$-1,2,3,4-TCDD was added to the samples immediately prior to injection onto the GC/MS system. This is also used to help evaluate the method detection limit in the case where no peak is detected for one of the targeted analytes. A recovery table is printed in each sample's report.

A nonane blank is injected prior to sample analysis. This blank must contain no target isomers above noise before the analysis of samples can continue.

The sample log sheet for the job is given at the end of the report.

10.24 (a) GC Conditions for the Analysis, Acquisition System Used for Window Standard.

Column 60m J&W DB5-ms, 0.25u film thickness, 0.25mm i.d., head pressure 30 p.s.i.

Program 140° C for 4 minutes, then 15 C°/min to 220 ° C, then 1.5 C°/min to 240 ° C, hold for 2 minutes, then 4 C°/min to 310 ° C, which is held for 10 minutes.

Injection Conditions Temperature 300 ° C, Splitless mode, valve time 2 minutes.

(b) GC/MS Acquisition System, Window Standard

Group Time, 0:01:0 to 0:50:0

Masses Monitored

Component	Mass	Sample Time(ms)	Delay Time(ms)
TCDF	305.8987	40	10
PeCDF	339.8597	40	10
HxCDF	373.8208	40	10
HpCDF	407.7818	40	10

This test is performed at 1000 resolving power (10% valley definition).

11.25 Mass Spectrometer Conditions and Instrumentation Used

The operating parameters for the mass spectrometer used during sample analysis are listed below.

Resolving Power	10,000 (10% valley definition).
Source Conditions	Electron Energy 30 eV. Trap Current 700 μA. Source Temperature 250 °C.
Interface Temperatures	280 °C.
Detector Conditions	Amplifier Range 10^{-6} Amps Full Scale. Amplifier Response Time 0.01 ms. Multiplier Voltage 320 volts.

GC/MS system VG Autospec Ultima Mass Spectrometer equipped with HP 5890A Gas Chromatograph. Data system is a VG OPUS. Samples were injected with an HP7673B autosampler.

12.25 Compounds Present in the Window Determination Standard.

	First eluting isomer	Last eluting isomer
Tetra Furan	1368	1289
Penta Furan	13468	12389
Hexa Furan	123468	123489
Hepta Furan	1234678	1234789

Only one isomer exists for the octachlorinated furan and so no standard is necessary to define the acquisition window.

Please note that 1,2,8,9-TCDF elutes after 1,3,4,6,8-PeCDF on the DB-5ms column. On the basis of operator experience, it has been decided that the acquisition windows be set to permit measurement of 1,3,4,6,8-PeCDF, which is far more prevalent in samples than 1,2,8,9-TCDF. The data reported here for "total non-targeted TCDFs" therefore, omits 1,2,8,9-TCDF.

Compounds in Column Performance Standard

The following TCDD isomers:

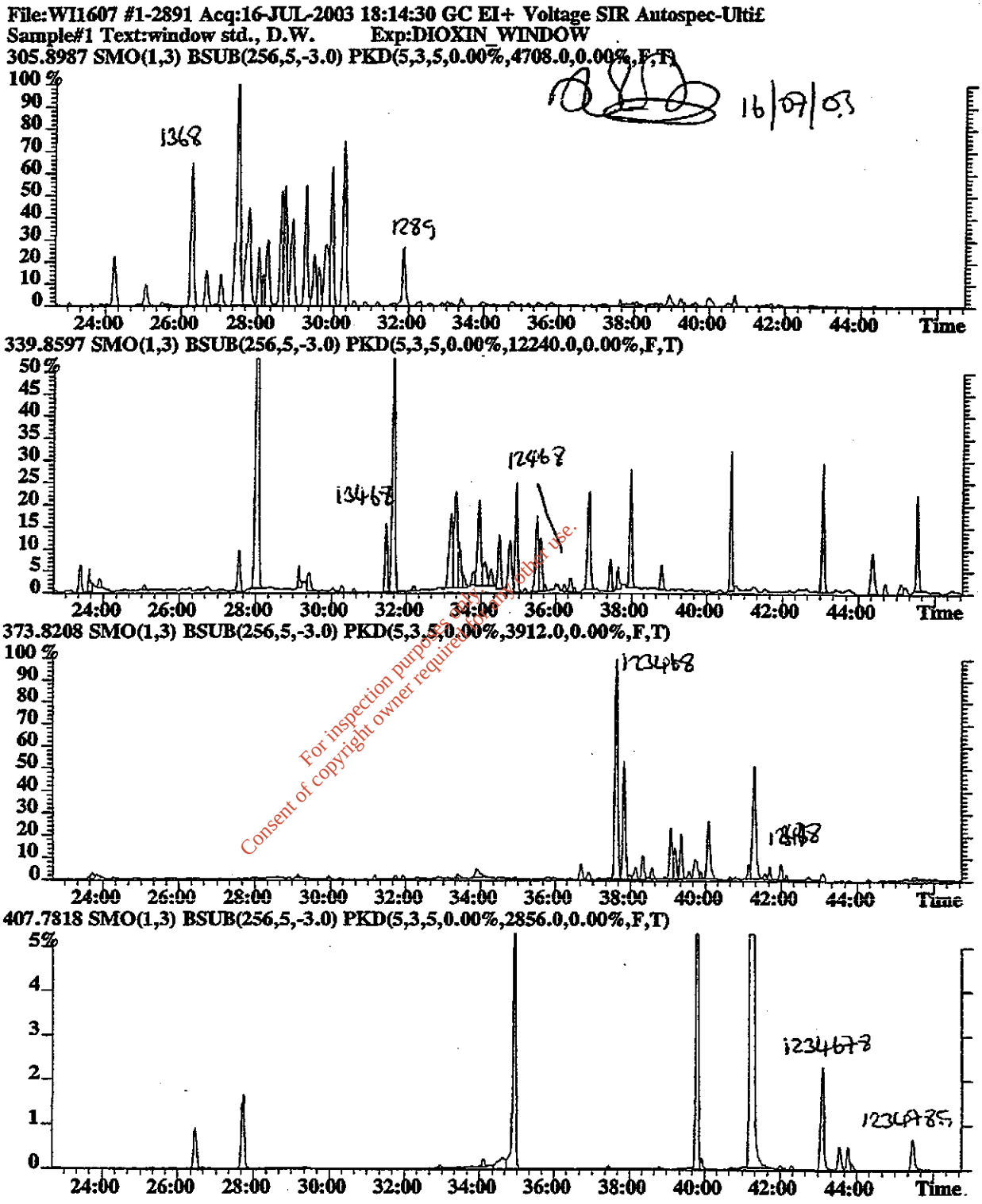
1478, 1234, 1237/1238, 2378, 1278, 1267

Note :- The DB5-ms column chosen achieves satisfactory resolution of 2378 TCDF from its close eluting isomers.

EPA protocols require that the separation between 1237/1238 and 2378 TCDD be better than 25% valley, clearly easily achieved on the DB5-ms column used.

Please note that the DB5-ms column employed does not effect satisfactory resolution of 2,3,4,7,8-PeCDF and 1,2,3,7,8,9-HxCDF from their close-eluting isomers. The amount reported for these isomers are therefore the *maximum possible*. The amount of the 2,3,4,7,8-PeCDF may be over reported by as much as 25%, based upon the analysis of five extracts chosen at random that were then confirmed on a polar column.

13.26 Raw Data from the Window Determination Standard, Including Peak Identifications.



14.27 Acquisition Systems Used for Sample Analysis.

Group 1

Component	Mass	Sample Time(ms)	Delay Time(ms)	
PFK	292.9825	10	5	Lock Mass Check
PFK	292.9825	50	10	Lock Mass
TCDF	303.9015	100	10	
TCDF	305.8987	100	10	
^{13}C TCDF	315.9419	30	10	
^{13}C TCDF	317.9389	30	10	
TCDD	319.8965	100	10	
TCDD	321.8936	100	10	
^{13}C6 1234 TCDD	325.9166	30	10	Recovery Std.
^{13}C6 1234 TCDD	327.9137	30	10	Recovery Std.
^{13}C 2378 TCDD	331.9368	30	10	
^{13}C 2378 TCDD	333.9339	30	10	
CDPE	375.8364	30	50	Furan Interference

Group 2

Component	Mass	Sample Time(ms)	Delay Time(ms)	
PeCDF	339.8597	100	10	
PeCDF	341.8567	100	10	
^{13}C PeCDF	351.9000	30	10	
^{13}C PeCDF	353.8970	30	10	
PeCDD	355.8546	100	10	
PeCDD	357.8516	100	10	
PFK	366.9792	10	5	Lock Mass Check
PFK	366.9792	50	10	Lock Mass
^{13}C PeCDD	367.8949	30	10	
^{13}C PeCDD	369.8919	30	10	
CDPE	409.7974	30	50	Furan Interference

Group 3

Component	Mass	Sample Time(ms)	Delay Time(ms)	
HxCDF	373.8208	100	10	
HxCDF	375.8358	100	10	
^{13}C HxCDF	383.8639	30	10	
^{13}C HxCDF	385.8610	30	10	
HxCDD	389.8157	100	10	
HxCDD	391.8127	100	10	
PFK	392.9760	10	5	Lock Mass Check
PFK	392.9760	50	10	Lock Mass
^{13}C HxCDD	401.8559	30	10	
^{13}C HxCDD	403.8529	30	10	
CDPE	445.7555	30	50	Furan Interference

Group 4

Component	Mass	Sample Time(ms)	Delay Time(ms)	
HpCDF	407.7818	100	10	
HpCDF	409.7789	100	10	
^{13}C HpCDF	417.8253	30	10	
^{13}C HpCDF	419.8220	30	10	
HpCDD	423.7766	100	10	
HpCDD	425.7737	100	10	
PFK	430.9729	10	5	Lock Mass Check
PFK	430.9729	50	10	Lock Mass
^{13}C HpCDD	435.8169	30	10	
^{13}C HpCDD	437.8140	30	10	
CDPE	479.7165	30	50	Furan Interference

Group 5

Component	Mass	Sample Time(ms)	Delay Time(ms)	
OCDF	441.7428	100	10	
PFK	442.9728	10	5	Lock Mass Check
PFK	442.9728	50	10	Lock Mass
OCDF	443.7399	100	10	
^{13}C OCDF	453.7830	30	10	
^{13}C OCDF	455.7800	30	10	
OCDD	457.7377	100	10	
OCDD	459.7348	100	10	
^{13}C OCDD	469.7835	30	10	
^{13}C OCDD	471.7750	30	10	
CDPE	513.6775	30	50	Furan Interference

15.29 Dioxin and Furan Calibration Standards Preparation Certificate.

Dioxin/Furan Calibration Standards Preparation Certificate

This certifies that a set of five dioxin/furan calibration standards were prepared in accordance with SAL SOP 2, issue 3.

The batch numbers of the stock dioxin and furan reference standards used in the preparation of the calibrations standards were:

$^{13}C_6$-1,2,3,4-TCDD (080299)

Mixed labelled/native standards CS1-CS5 (EDF-4947), batch numbers 34752-77A, 33384-42B, 35005-04, 3384-42D and 34752-77E respectively.

All the above standards are traceable to certified reference standards purchased from Cambridge Isotope Laboratories.

	Signature	Name	Position
Standards prepared by	[signature]	**P.Harrington**	**Dioxin Analyst**

Date of Preparation :- CS2: 26/11/01, CS3: 28/06/02, CS1,4,5: 14/08/02 .

Standard Codes :- CS1/140802, CS2/261101, CS3/280602, CS4/140802, CS5/140802

Please note that these standards contain $^{13}C_{12}$-OCDF and are suitable for use in method EN1948 analysis (SAL SOP1c).

The continuing calibration solution, CS3, is in constant use and is exhausted regularly. This standard is prepared on an as needed basis, the current standard being CS3/~~280602.~~

~~C41002~~ P.
~~C30103~~ P.
170503 PSL

16.30 Initial Calibration Results Table (IC1707)

CALIBRATION RESULTS (Sally Version 6.7)

File Number	Date (d:m:year)	File Name
1	17-Jul-03	R:\DIOXINV\IC1707\SAMPLE.001\IC1707.DAT
2	17-Jul-03	R:\DIOXINV\IC1707\SAMPLE.003\IC1707.DAT
3	17-Jul-03	R:\DIOXINV\IC1707\SAMPLE.002\IC1707.DAT
4	17-Jul-03	R:\DIOXINV\IC1707\SAMPLE.004\IC1707.DAT
5	17-Jul-03	R:\DIOXINV\IC1707\SAMPLE.005\IC1707.DAT

File	1	2	3	4	5	Average	%s.d.
13C 1,2,3,4-TCDD-R						Retention Time Standard	
13C 1,2,3,4-TCDD							
Recovery Standard							
Amount	91.0	91.0	91.0	91.0	91.0		
RF	1.00	1.00	1.00	1.00	1.00	1.00	
RRF	1.00	1.00	1.00	1.00	1.00	1.00	0
13C 2,3,7,8-TCDD							
Internal Standard							
Amount	91.0	91.0	91.0	91.0	91.0		
RF	0.847	0.718	0.784	0.848	0.920	0.00	
RRF	0.847	0.718	0.784	0.848	0.920	0.949	0.00
2,3,7,8-TCDD							
Analyte							
Amount	0.5	9.1	1.8	36.0	182.0		
RF	0.005	0.103	0.023	0.472	2.16	0.553	
RRF	1.04	1.03	1.14	1.19	1.08	1.10	6
13C 1,2,3,7,8-PeCDD							
Internal Standard							
Amount	91.0	91.0	91.0	91.0	91.0		
RF	0.649	0.574	0.653	0.712	0.800	0.00	
RRF	0.649	0.574	0.653	0.712	0.800	0.690	0.00
1,2,3,7,8-PeCDD							
Analyte							
Amount	2.3	45.4	9.1	182.0	910.0		
RF	0.020	0.435	0.090	1.84	8.84	2.25	
RRF	0.808	0.872	0.903	0.922	0.884	0.878	5
13C 1,2,3,4,7,8-HxCDF-T						Retention Time Standard	
13C 1,2,3,6,7,8-HxCDD							
Internal Standard							
Amount	91.0	91.0	91.0	91.0	91.0		
RF	0.458	0.412	0.456	0.501	0.582	0.00	
RRF	0.458	0.412	0.456	0.501	0.582	0.505	0.00

1,2,3,6,7,8-HxCDD

Analyte							
Amount	2.3	45.4	9.1	182.0	910.0		
RF	0.024	0.541	0.099	2.08	10.8	2.70	
RRF	0.971	1.08	0.987	1.04	1.08	1.03	5

1,2,3,4,7,8-HxCDD

Analyte							
Amount	2.3	45.4	9.1	182.0	910.0		
RF	0.021	0.411	0.099	1.82	8.50	2.17	
RRF	0.845	0.824	0.986	0.911	0.850	0.883	7

1,2,3,7,8,9-HxCDD

Analyte							
Amount	2.3	45.4	9.1	182.0	910.0		
RF	0.021	0.455	0.093	1.91	9.10	2.32	
RRF	0.849	0.913	0.929	0.955	0.910	0.911	4

13C 1,2,3,4,6,7,8-HpCDD-R Retention Time Standard

13C 1,2,3,4,6,7,8-HpCDD

Internal	Standard						
Amount	91.0	91.0	91.0	91.0	91.0		
RF	0.323	0.272	0.307	0.336	0.401	0.00	
RRF	0.323	0.272	0.307	0.336	0.401	0.394	0.00

1,2,3,4,6,7,8-HpCDD

Analyte							
Amount	2.3	45.4	9.1	182.0	910.0		
RF	0.022	0.465	0.093	1.96	9.32	2.37	
RRF	0.899	0.932	0.927	0.978	0.932	0.934	3

13C OCDD

Internal	Standard						
Amount	182.0	182.0	182.0	182.0	182.0		
RF	0.394	0.349	0.375	0.403	0.504	0.00	
RRF	0.197	0.175	0.187	0.201	0.252	0.234	0.00

OCDD

Analyte							
Amount	4.5	91.0	18.0	360.0	1820.0		
RF	0.024	0.499	0.103	2.12	10.6	2.68	
RRF	0.980	0.999	1.04	1.07	1.06	1.03	4

13C 1,2,3,4-TCDD-R Retention Time Standard

13C 1,2,3,4-TCDD

Recovery	Standard						
Amount	91.0	91.0	91.0	91.0	91.0		
RF	1.00	1.00	1.00	1.00	1.00	1.00	
RRF	1.00	1.00	1.00	1.00	1.00	1.00	0

13C 2,3,7,8-TCDF

Internal	Standard						
Amount	91.0	91.0	91.0	91.0	91.0		
RF	1.07	0.904	1.03	1.07	1.15	0.00	
RRF	1.07	0.904	1.03	1.07	1.15	1.05	0.00

2,3,7,8-TCDF

Analyte							
Amount	0.5	9.1	1.8	36.0	182.0		
RF	0.005	0.102	0.022	0.448	2.09	0.534	
RRF	1.00	1.02	1.09	1.13	1.05	1.06	5

13C 1,2,3,7,8-PeCDF

Internal	Standard						
Amount	91.0	91.0	91.0	91.0	91.0		
RF	0.750	0.673	0.849	0.890	0.934	0.00	
RRF	0.750	0.673	0.849	0.890	0.934	0.941	0.00

1,2,3,7,8-PeCDF

Analyte							
Amount	2.3	45.4	9.1	182.0	910.0		
RF	0.024	0.480	0.094	1.83	9.38	2.36	
RRF	0.973	0.962	0.938	0.914	0.938	0.945	2

2,3,4,7,8-PeCDF

Analyte							
Amount	2.3	45.4	9.1	182.0	910.0		
RF	0.023	0.467	0.090	1.80	9.12	2.30	
RRF	0.930	0.936	0.897	0.900	0.912	0.915	2

13C 1,2,3,4,7,8-HxCDF-T Retention Time Standard

13C 1,2,3,4,7,8-HxCDF

Internal	Standard						
Amount	91.0	91.0	91.0	91.0	91.0		
RF	0.539	0.468	0.557	0.580	0.668	0.00	
RRF	0.539	0.468	0.557	0.580	0.668	0.619	0.00

1,2,3,4,7,8-HxCDF

Analyte							
Amount	2.3	45.4	9.1	182.0	910.0		
RF	0.027	0.520	0.112	2.19	10.4	2.64	
RRF	1.07	1.04	1.12	1.09	1.04	1.07	3

1,2,3,6,7,8-HxCDF

Analyte							
Amount	2.3	45.4	9.1	182.0	910.0		
RF	0.026	0.566	0.118	2.31	11.1	2.81	
RRF	1.05	1.13	1.18	1.15	1.11	1.13	4

2,3,4,6,7,8-HxCDF

Analyte							
Amount	2.3	45.4	9.1	182.0	910.0		
RF	0.021	0.474	0.092	1.90	8.87	2.27	
RRF	0.858	0.950	0.923	0.950	0.887	0.914	4

1,2,3,7,8,9-HxCDF

Analyte							
Amount	2.3	45.4	9.1	182.0	910.0		
RF	0.015	0.336	0.066	1.31	6.59	1.66	
RRF	0.603	0.673	0.660	0.654	0.659	0.650	4

13C 1,2,3,4,6,7,8-HpCDD-R					Retention Time Standard		
13C 1,2,3,4,6,7,8-HpCDF							
Internal	Standard						
Amount	91.0	91.0	91.0	91.0	91.0		
RF	0.322	0.300	0.343	0.345	0.411	0.00	
RRF	0.322	0.300	0.343	0.345	0.411	0.405	0.00

1,2,3,4,6,7,8-HpCDF							
Analyte							
Amount	2.3	45.4	9.1	182.0	910.0		
RF	0.032	0.615	0.128	2.62	12.4	3.16	
RRF	1.27	1.23	1.28	1.31	1.24	1.27	2

1,2,3,4,7,8,9-HpCDF							
Analyte							
Amount	2.3	45.4	9.1	182.0	910.0		
RF	0.018	0.368	0.070	1.46	7.46	1.87	
RRF	0.723	0.737	0.704	0.728	0.746	0.728	2

13C OCDD							
Internal	Standard						
Amount	182.0	182.0	182.0	182.0	182.0		
RF	0.394	0.349	0.375	0.403	0.504	0.00	
RRF	0.197	0.175	0.187	0.201	0.252	0.234	0.00

OCDF							
Analyte							
Amount	4.5	91.0	18.0	360.0	1820.0		
RF	0.021	0.462	0.098	1.83	9.49	2.38	
RRF	0.856	0.925	0.988	0.924	0.949	0.928	5

17.34 Continuing Calibration Check, 8th August 2003

Standard 'CS3/170503' is injected onto the 60m DB5-ms column prior to sample analysis. The relative response factors are determined for all analytes and must not have changed by more than 25% from the initial values for analysis to proceed.

The differences are reported in the table below and are acceptable.

Compound Name	Mean RRF	%SD	RRFcc	%Delta
2,3,7,8-TCDD	1.10	6	1.13	-3
1,2,3,7,8-PeCDD	0.878	5	0.870	1
1,2,3,6,7,8-HxCDD	1.03	5	1.10	-6
1,2,3,4,7,8-HxCDD	0.883	7	0.847	4
1,2,3,7,8,9-HxCDD	0.911	4	1.06	-16
1,2,3,4,6,7,8-HpCDD	0.934	3	0.974	-4
OCDD	1.03	4	1.03	0
2,3,7,8-TCDF	1.06	5	1.06	0
1,2,3,7,8-PeCDF	0.945	2	1.03	-9
2,3,4,7,8-PeCDF	0.915	2	1.07	-17
1,2,3,4,7,8-HxCDF	1.07	3	1.04	3
1,2,3,6,7,8-HxCDF	1.13	4	1.24	-10
2,3,4,6,7,8-HxCDF	0.914	4	1.00	-10
1,2,3,7,8,9-HxCDF	0.650	4	0.744	-14
1,2,3,4,6,7,8-HpCDF	1.27	2	1.31	-3
1,2,3,4,7,8,9-HpCDF	0.728	2	0.800	-10
OCDF	0.928	5	1.06	-14

TARGETING REPORT (Sally Version 6.7)

Date Acquired : 08-Aug-03 Acquired File : A:D0808
Operator : D. Wood Instrument : Ultima Column :DB5-ms
PC File : R:\DIOXINV\D0808\sample.001\D0808.DAT

Compound Name	M1	M2	M1/M2 thry	M1/M2 actl	Ok	Retention Time theory	Retention Time found	Area
Dioxins								
13C 1,2,3,4-TCDD	326	328	0.78	0.84	Y	00:30:06	00:29:30	227274
13C 2,3,7,8-TCDD	332	334	0.78	0.83	Y	00:30:38	00:30:01	165886
2,3,7,8-TCDD	320	322	0.78	0.77	Y	00:30:39	00:30:03	18743
13C 1,2,3,7,8-PeCDD	368	370	1.55	1.58	Y	00:35:52	00:35:19	162041
1,2,3,7,8-PeCDD	356	358	1.55	1.56	Y	00:35:53	00:35:21	70308
13C 1,2,3,6,7,8-HxCDD	402	404	1.24	1.21	Y	00:40:20	00:39:49	119228
1,2,3,6,7,8-HxCDD	390	392	1.24	1.28	Y	00:40:21	00:39:50	65284
1,2,3,4,7,8-HxCDD	390	392	1.24	1.27	Y	00:40:13	00:39:42	50393
1,2,3,7,8,9-HxCDD	390	392	1.24	1.27	Y	00:40:44	00:40:12	62893
13C 1,2,3,4,6,7,8-HpCDD	436	438	1.05	1.05	Y	00:44:34	00:44:02	87537
1,2,3,4,6,7,8-HpCDD	424	426	1.05	1.02	Y	00:44:35	00:44:03	42555
13C OCDD	470	472	0.89	0.86	Y	00:49:16	00:48:38	115785
OCDD	458	460	0.89	0.84	Y	00:49:17	00:48:39	59486
Furans								
13C 1,2,3,4-TCDD	326	328	0.78	0.84	Y	00:30:06	00:29:30	227274
13C 2,3,7,8-TCDF	316	318	0.78	0.68	Y	00:29:56	00:29:19	226840
2,3,7,8-TCDF	304	306	0.78	0.74	Y	00:29:57	00:29:20	23969
13C 1,2,3,7,8-PeCDF	352	354	1.55	1.46	Y	00:34:27	00:33:53	182700
1,2,3,7,8-PeCDF	340	342	1.55	1.54	Y	00:34:28	00:33:55	94232
2,3,4,7,8-PeCDF	340	342	1.55	1.59	Y	00:35:34	00:35:01	97661
13C 1,2,3,4,7,8-HxCDF	384	386	0.51	0.53	Y	00:39:12	00:38:39	146104
1,2,3,4,7,8-HxCDF	374	376	1.24	1.22	Y	00:39:12	00:38:40	75858
1,2,3,6,7,8-HxCDF	374	376	1.24	1.23	Y	00:39:21	00:38:50	90434
2,3,4,6,7,8-HxCDF	374	376	1.24	1.19	Y	00:40:04	00:39:33	73153
1,2,3,7,8,9-HxCDF	374	376	1.24	1.21	Y	00:41:15	00:40:44	54197
13C 1,2,3,4,6,7,8-HpCDF	418	420	0.46	0.44	Y	00:43:06	00:42:35	99240
1,2,3,4,6,7,8-HpCDF	408	410	1.05	1.01	Y	00:43:07	00:42:36	64700
1,2,3,4,7,8,9-HpCDF	408	410	1.05	1.00	Y	00:45:28	00:44:53	39628
13C OCDD	470	472	0.89	0.86	Y	00:49:16	00:48:38	115785
OCDF	442	444	0.89	0.90	Y	00:49:42	00:49:03	61476

18.36 Estimation of Method Detection Limits

The 'CS3' continuing calibration standard responses for the day when this sample was run (using standard CS3/170503) were used to estimate the method detection limits for the targeted analytes. The criteria is a minimum S/N of 2.5:1 for both isotope peaks.

Analyte	Std Amount(pg)	S/N	Detection Limit(pg)
Dioxins			
2,3,7,8-TCDD	10	500:1	0.05
1,2,3,7,8-PeCDD	50	2000:1	0.05
1,2,3,4,7,8-HxCDD	50	2000:1	0.05
1,2,3,6,7,8-HxCDD	50	2000:1	0.05
1,2,3,7,8,9-HxCDD	50	2000:1	0.05
1,2,3,4,6,7,8-HpCDD	50	1500:1	0.08
OCDD	100	2000:1	0.1
Furans			
2,3,7,8-TCDF	10	500:1	0.05
1,2,3,7,8-PeCDF	50	2000:1	0.05
2,3,4,7,8-PeCDF	50	2000:1	0.05
1,2,3,4,7,8-HxCDF	50	2000:1	0.05
1,2,3,6,7,8-HxCDF	50	2000:1	0.05
2,3,4,6,7,8-HxCDF	50	2000:1	0.05
1,2,3,7,8,9-HxCDF	50	1000:1	0.1
1,2,3,4,6,7,8-HpCDF	50	2000:1	0.05
1,2,3,4,7,8,9-HpCDF	50	1000:1	0.1
OCDF	100	2000:1	0.1

Note that these detection limits are given in **pg injected** , so the sample detection limits are obtained by using the following equation. The proportion of the sample injected may be determined from the sample tracking form included with each sample report.

$$\text{Analyte detection limit} = \frac{\text{Injection detection limit (above)}}{\text{(portion of sample injected) x (amount sample)}}$$

In the case of poor recoveries of the internal standards this amount should be further increased by multiplying by 100/(recovery %).

The detection limits for these samples, where *ca* 1/30th was injected and recoveries were *ca* 70% were between 0.2 and 0.4 ng/kg per congener in the soil samples, depending upon the specific sample.

19.37 GC Performance Check

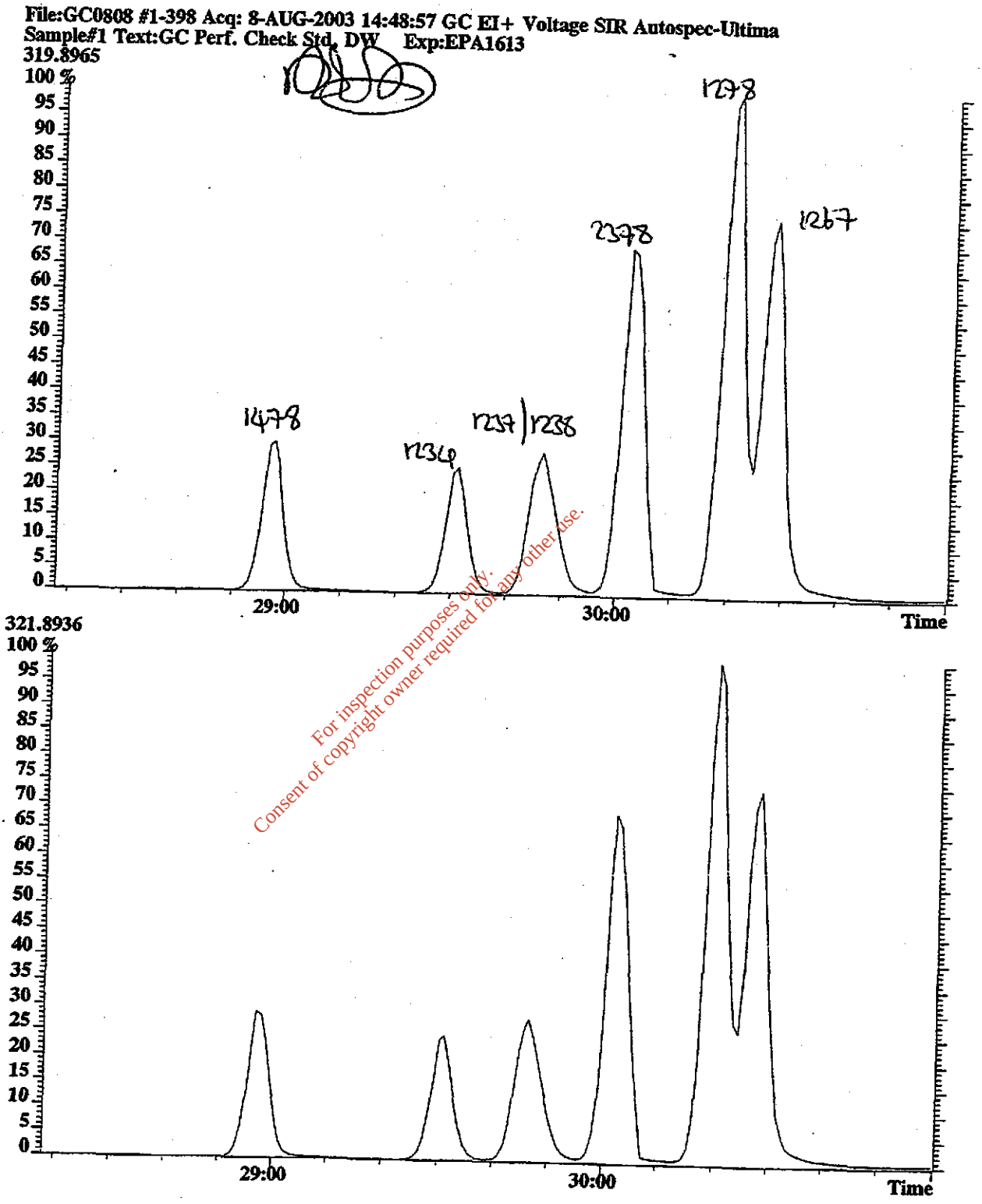
The ability of the GC column used to resolve the known close eluting isomers of the Tetra Dioxins was tested prior to analysis. A performance check standard containing the following isomers is injected. The TCDD traces are given on the following pages.

TCDD isomers contained in the GC Performance Check Standard in elution order.

1,4,7,8
1,2,3,4
1,2,3,7/1,2,3,8
2,3,7,8
1,2,7,8
1,2,6,7

The criterion for acceptance of this test is that the 2,3,7,8 TCDD must be separated by a valley of at least 25% from its nearest neighbours.

20.38 GC Performance Check Data, DB5-ms Column, 8th August 2003



21.39 Sample Log Sheet

Job 37310-1

ALCONTROL B2557 ... [illegible]

for Quotation Ref Q10093-1

Customer Mr Paul Burton at Alcontrol Laboratories Ltd, Brunel Science Park, Kingston Lane, Uxbridge, Middlesex UB8 3PQ

Tel 01895 271271, Fax 01895 271272

Logged in: 31 July 2003 , Report due: 11 August 2003

Date	SAL Contact	Contact	Subject	Action
01-AUG-03	MILESW		TURNAROUND INVOICING	WILL NEED SURCHARGE ADDED FOR 7 DAY TURNAROUND
01-AUG-03	MILESW		PURCHASE ORDER & SAMPLE REFERENCES	PO NUMBER IS 08737. PLEASE PUT FULL ALCONTROL REFERENCE IN THANKS (03-BO2557-S0004-A01 AND 03-BO2557-S0005-A01)

Sample Information

Soil

SAL	Customer Reference	Condition	Logged in By	Location
001	03-B02557-S0004-A01 TP9(0.7-0.9)	OK	LTAYLOR	B5
002	03-B02557-S00005-A01 TP2(1.0-1.1)	OK	LTAYLOR	B5

Tests	Technique	Accreditation
Dioxins and Furans (Based on US EPA 1613)	GCMS (HR)	UKAS

Audit Trail

State	Set By	When	Why
Unfinished	LTAYLOR	31-Jul-2003 11:36:04	
Analyst Review Required	LTAYLOR	31-Jul-2003 11:37:59	
Analyst Review Underway	VHIGHAM	01-Aug-2003 10:27:40	
Sales Review Required	VHIGHAM	01-Aug-2003 10:29:12	
Sales Review Underway	MILESW	01-Aug-2003 12:12:08	
Failed Sales Review	MILESW	01-Aug-2003 13:42:52	
Analyst Review Required	LTAYLOR	01-Aug-2003 13:48:22	
Analyst Review Underway	VHIGHAM	01-Aug-2003 14:58:43	
Sales Review Required	VHIGHAM	01-Aug-2003 14:58:51	
Sales Review Underway	NSUMMERS	01-Aug-2003 18:16:55	
Analysis Underway	NSUMMERS	01-Aug-2003 18:17:48	

22.40 SAL Authorised Signatories Register

SAL AUTHORISED SIGNATORIES SPECIMEN SIGNATURES
CURRENT AS OF 14-APR-2003. ISSUE: 32
MASTER COPY

Name	Signature	Initials
Sarah Bannister		
Saber Chaudhry		
Bill Cohen		
Lindsay Collins		
Steve Coulam		
Will Crossley		
Sebastian Dahl		
Chris Field		
Jane Fletcher		
Jane Fox		
Subhash Gadher		
Phillip George		
Paul Harrington		
Iain Haslock		
Ian Hayes		
Vanessa Higham		
Eifion Hollywell		
Pam Knott		

Name	Signature	Initials
Himanshu Lad		
Helen Mason		
Mike Maxwell		
Vic Parr		
Thi Pham		
Jane Pilot		
Mercy Prak		
Lee Quibell		
Suzanne Quick		
Gary Quirk		
Clifford Rodger		
Charlotte Riley		
Graham Small		
Robert Smith		
Nicola Summers		
Keith Thompson		
Leanne Taylor		
Peter Verrechia		
David Wood		

Appendix F 2005 RPS Site Investigation Soil Results

A2. RPS (2005)

Results Tables For Soil

Table 1: pH, Asbestos and Soil Moisture Content results for soil (taken during well drilling)

Sample	Date	Mar-05		
	Depth (mbgl)	pH	Natural Moisure Content (%)	Asbestos Screening
Method Detection Limit / Units		pH units	0.01	n/a
MW01	1m	8.61	16.5	None detected
MW01	4m	-	-	None detected
MW01	5m	7.7	46.5	None detected
MW01	6m	-	-	None detected
MW01	7m	8	11.3	None detected
MW02	1m	6.94	20.7	None detected
MW02	5m	7.64	16.1	None detected
MW02	7m	7.82	18	None detected
MW03	1m	8.04	11.3	None detected
MW03	2m	-	-	None detected
MW03	3m	8	20.2	None detected
MW03	4m	9.7	35.4	None detected
MW03	5m	8.16	44.8	None detected
MW03	6m	-	-	None detected
MW03	7m	-	-	None detected
MW04A	1m	7.94	16.7	None detected
MW04A	5m	8.4	28	None detected
MW04A	7m	8.44	15.7	None detected
MW05	1m	8.15	5.7	None detected
MW05	2m	8.73	11	None detected
MW05	5m	8.51	18.3	None detected
MW05	10m	8.51	7.8	None detected
MW06A	1m	8.19	14.1	None detected
MW06A	4m	9.05	53.2	None detected
MW06A	7.3m	8.63	10.3	None detected
MW07	1m	7.9	12.3	None detected
MW07	4m	8.12	38.3	None detected
MW07	6m	7.89	20.8	None detected

Notes:

'- Below Detection Limits

Tsble 2: pH, Asbestos and Soil Moisture Content results for soil (taken during trial pitting)

Sample	Date	Mar-05		
	Depth (mbgl)	pH	Phenols Total Monohydric	Ammonical Nitrogen as N
Method Detection Limit / Units		napH units	< 0.01 mg/kg	<0.3 mg/kg
TP1	0.5	7.64	0.02	◊
TP1	3.5	7.67	-	◊
TP2	0.3	7.37	-	◊
TP2	3.0	7.8	-	◊
TP3	0.5	7.65	-	◊
TP3	3.2	7.95	0.01	◊
TP4	0.5	7.67	-	◊
TP4	2.0	7.69	0.02	◊
TP4	3.0	7.74	-	◊
TP5	0.5	7.63	0.04	◊
TP5	3.0	7.83	-	◊
TP6	0.5	7.78	-	◊
TP6	2.4	8.8	0.4	◊
TP7	0.5	8.05	0.05	◊
TP7	3.0	7.86	-	◊
TP8	0.5	7.73	-	◊
TP8	3.1	8.59	0.03	◊
TP9	0.5	7.91	-	◊
TP9	2.0	7.85	-	◊
TP10	0.5	7.9	0.01	◊
TP10	2.0	8.17	-	◊
TP11	0.5	8.06	0.12	◊
TP11	3.3	8.1	-	◊
TP12	0.5	8.11	-	◊
TP12	3.2	7.62	-	◊
TP13	0.5	8.15	-	◊
TP13	3.5	6.74	0.01	◊
TP14	0.5	6.58	-	◊
TP14	3.0	6.32	-	◊
TP15	0.5	6.75	-	◊
TP15	3.0	6.29	-	◊
TP16	0.5	6.92	0.01	0.9
TP16	3.0	9.89	-	1.5
TP17	0.5	8.64	0.01	◊
TP18	0.5	8.66	-	◊
TP18	3.0	7.65	-	◊

◊ Parameter not analysed

'- Below Detection Limits

Table 3: Soil Volatile Organic Compound Results (taken during well drilling)

Compound	Method Detection Limit / Units	Mar-05																								
		MW01	MW01	MW01	MW01	MW02	MW02	MW02	MW03	MW03	MW03	MW03	MW03	MW04A	MW04A	MW04A	MW05	MW05	MW05	MW05	MW06	MW06	MW06	MW07	MW07	MW07
Depth (bgl) (m)	ug/kg	1m	4m	5m	7m	1m	5m	7m	1m	2m	3m	4m	5m	1m	5m	7m	1m	2m	5m	10m	1m	4m	7.3m	1m	4m	6m
Dichlorodifluoromethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloromethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl chloride	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromomethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
trans-1,2-Dichloroethene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloromethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon disulphide	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tert-butyl methyl ether	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
cis-1,2-Dichloroethene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromochloromethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroform	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,2-Dichloropropane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbontetrachloride	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibromomethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloropropane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
cis-1,3-Dichloropropene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
trans-1,3-Dichloropropene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	1	-	-	6	-	-	-	-	16	-	-	7	-	8	2	10	3	-	-	-	16	-	-	-	-	-
1,3-Dichloropropane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethene	1	-	-	15	-	-	-	-	18	-	18	-	136	2	-	-	133	-	-	-	18	75	-	-	-	-
1,1,1,2-Tetrachloroethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	1	-	-	-	-	-	-	-	15	-	3	-	3	-	-	-	2	-	-	-	15	-	-	-	-	-
p/m-Xylene	1	-	-	8	-	-	-	-	37	-	9	-	7	-	-	-	4	-	-	-	37	-	-	-	-	-
Bromoform	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o-Xylene	1	-	-	-	-	-	-	-	16	-	-	-	-	-	-	-	-	-	-	-	16	-	-	-	-	-
1,2,3-Trichloropropane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromobenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Propylbenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

- Below Detection Limits

Table 4: Soil Volatile Organic Compound Results (taken during trial pitting)

Compound	Method Detection Limit / Units	Mar-05																	
		TP1	TP1	TP2	TP2	TP3	TP3	TP4	TP4	TP4	TP5	TP5	TP6	TP6	TP7	TP7	TP8	TP8	TP9	TP9
Depth (bgl) (m)	ug/kg	0.6	3.5	0.3	3.0	0.5	3.2	0.5	2.0	3.0	0.5	3.0	0.5	2.4	0.5	3.0	0.5	3.1	0.5	2.0
Dichlorodifluoromethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloromethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl chloride	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromomethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
trans-1,2-Dichloroethene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloromethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon disulphide	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tert-butyl methyl ether	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
cis-1,2-Dichloroethene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromochloromethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroform	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,2-Dichloropropane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
Carbontetrachloride	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibromomethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloropropane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethene	1	-	-	-	-	-	-	-	-	-	-	-	3	-	-	45	-	13	-	-
cis-1,3-Dichloropropene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
trans-1,3-Dichloropropene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	1	15	5	8	13	5	8	51	29	8	-	9	14	24	15	8	44	10	14	6
1,3-Dichloropropane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethene	1	9	69	244	135	5	129	3201	552	98	65	86	-	15	14	21	-	65	17	24
1,1,1,2-Tetrachloroethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	1	15	-	-	7	2	-	55	-	4	-	8	16	8	21	6	48	8	21	7
p/m-Xylene	1	52	-	-	23	5	-	102	-	9	6	13	29	22	41	6	120	18	34	9
Bromoform	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o-Xylene	1	-	-	-	8	-	-	48	-	3	-	6	-	10	18	7	51	4	-	7
1,2,3-Trichloropropane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	20	-	-	-	-	-	-
Bromobenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Propylbenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	1	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	1	-	-	-	-	-	-	-	-	-	-	-	-	1905	-	-	-	-	-	-
1,2,3-Trichlorobenzene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

- Below Detection Limits

Table 4: Soil Volatile Organic Compound Results (taken during trial pitting)

Compound	TP10	TP10	TP11	TP11	TP12	TP12	TP13	TP13	TP14	TP14	TP15	TP15	TP16	TP16	TP17	TP18	TP18
Depth (bgl) (m)	0.5	2.0	0.5	3.3	0.5	3.2	0.5	3.5	0.5	3.0	0.5	3.0	0.5	3.0	0.5	0.5	3.0
Dichlorodifluoromethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloromethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vinyl chloride	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromomethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichlorofluoromethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
trans-1,2-Dichloroethene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dichloromethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbon disulphide	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tert-butyl methyl ether	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
cis-1,2-Dichloroethene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromochloromethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloroform	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,2-Dichloropropane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1,1-Trichloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1-Dichloropropene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbontetrachloride	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibromomethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichloropropane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromodichloromethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Trichloroethene	-	7	-	8	19	-	61	-	9	-	-	-	-	-	-	-	-
cis-1,3-Dichloropropene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
trans-1,3-Dichloropropene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1,2-Trichloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	27	6	43	-	13	72	24	4	27	5	11	-	48	-	4	22	7
1,3-Dichloropropane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibromochloromethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromoethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tetrachloroethene	-	52	23	-	43	-	27	2	39	29	12	-	9	6	9	16	52
1,1,1,2-Tetrachloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethylbenzene	21	3	78	-	7	-	35	-	44	5	8	-	38	5	-	16	7
p/m-Xylene	52	8	165	-	19	84	58	-	72	7	13	-	81	5	5	31	7
Bromoform	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Styrene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o-Xylene	23	2	57	-	6	-	26	-	39	6			31	4		11	10
1,2,3-Trichloropropane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Isopropylbenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Chlorotoluene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Propylbenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Chlorotoluene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4-Isopropyltoluene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dichlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,4-Dichlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
sec-Butylbenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
tert-Butylbenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,3-Dichlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
n-Butylbenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hexachlorobutadiene	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

- Below Detection Limits

Table 5: PAH Results for soil (taken during well drilling)

Sample		PAHs																					
	Date	Mar-05																					
	Method Detection Limit	MW01	MW01	MW01	MW02	MW02	MW02	MW03	MW03	MW03	MW03	MW04	MW04	MW04	MW05	MW05	MW05	MW06	MW06	MW06	MW07	MW07	MW07
	Depth (mbgl)	1m	5m	7m	1m	5m	7m	1m	3m	4m	5m	3m	5m	7m	1m	5m	10m	1m	4m	7.3m	1m	4m	6m
Naphthalene	<1ug/kg	301	1021	-	-	60	42	461	126	94	278	-	-	-	117	-	-	169	-	-	351	357	-
Acenaphthylene	<1ug/kg	51	992	-	-	-	-	77	53	41	35	-	-	-	7	-	-	21	-	-	243	289	-
Acenaphthene	<1ug/kg	378	2012	-	-	-	-	517	40	43	49	-	-	-	38	10	-	71	-	-	339	754	-
Fluorene	<1ug/kg	344	2277	-	-	-	-	624	48	63	64	-	-	-	39	10	-	67	-	-	424	718	-
Phenanthrene	<1ug/kg	3139	12509	-	-	-	-	3175	573	387	343	-	-	-	380	73	-	427	42	-	2819	7357	34
Anthracene	<1ug/kg	1531	3134	-	-	-	-	672	119	86	100	-	-	-	63	14	-	89	10	-	882	1757	13
Fluoranthene	<1ug/kg	3693	25444	-	-	-	-	4569	930	679	456	-	-	-	488	44	-	540	35	-	3575	11476	44
Pyrene	<1ug/kg	3607	28769	-	-	-	-	4043	891	608	425	-	-	-	436	36	-	488	30	-	3078	10325	34
Benz(a)anthracene	<1ug/kg	1848	11253	-	-	-	-	2387	415	420	431	-	-	-	340	-	-	380	-	-	2237	5567	58
Chrysene	<1ug/kg	1847	9642	-	-	-	-	2097	550	377	512	-	-	-	356	-	-	337	-	-	1982	6147	51
Benzo(b)+Benzo(k)fluoranthene	<1ug/kg	1804	10794	-	-	-	-	2214	597	282	168	-	-	-	253	-	-	275	-	-	1629	6163	67
Benzo(a)pyrene	<1ug/kg	1023	6791	-	-	-	-	1252	248	74	-	-	-	-	141	-	-	161	-	-	951	3100	36
ıdeno(1,2,3-cd)pyren	<1ug/kg	308	2011	-	-	-	-	447	108	37	-	-	-	-	50	-	-	62	-	-	432	1375	157
ibenzo(a,h)anthracer	<1ug/kg	168	1466	-	-	-	-	265	54	33	-	-	-	-	30	-	-	37	-	-	267	865	122
Benzo(ghi)perylene	<1ug/kg	364	2441	-	-	-	-	509	130	62	-	-	-	-	62	-	-	76	-	-	502	1576	145
Total EPA 16	<1ug/kg	20406	120556	-	-	60	42	23310	4882	3286	2863	-	-	-	2800	186	-	3200	117	-	19711	57828	760
Shaded area: Results not available																							
- Below Detection Limits																							

Table 8:
PAH Results for soil (taken during trial pitting)

Sample		PAHs																																		
	Date	Mar-05																																				
	Method Detection Limit	TP1	TP1	TP2	TP2	TP3	TP3	TP4	TP4	TP4	TP5	TP5	TP6	TP6	TP7	TP7	TP8	TP8	TP9	TP9	TP10	TP10	TP11	TP11	TP12	TP12	TP13	TP13	TP14	TP14	TP15	TP15	TP16	TP16	TP17	TP18	TP18
	Depth (mbgl)	0.5	3.5	0.3	3.0	0.5	3.2	0.5	2.0	3.0	0.5	3.0	0.5	2.4	0.5	3.0	0.5	3.1	0.5	2.0	0.5	2.0	0.5	3.3	0.5	3.2	0.5	3.5	0.5	3.0	0.5	3.0	0.5	3.0	0.5	0.5	3.0
Naphthalene	<1ug/kg	226	129	4294	250	288	2697	1174	369	288	288	391	3284	4739	4031	190	2448	3181	544	668	1741	536	12036	186	310	1094	416	219	1534	158	841	217	278	445	293	141	162
Acenaphthylene	<1ug/kg	90	42	57	15	550	292	241	135	106	106	21	202	479	109	51	69	84	36	178	88	26	680	13	52	259	40	14	47	28	719	26	83	218	54	10	11
Acenaphthene	<1ug/kg	104	32	178	73	<70	1397	<140	763	168	230	61	417	3116	391	74	155	201	304	210	103	40	348	21	580	351	222	50	261	51	633	105	164	542	114	90	43
Fluorene	<1ug/kg	105	34	231	70	134	1261	138	733	158	170	55	768	2510	903	82	510	487	305	220	129	50	1556	21	549	269	178	59	457	48	823	94	156	468	79	87	29
Phenanthrene	<1ug/kg	1129	368	2408	519	4032	13943	1483	8361	1737	2105	845	5638	19936	6579	852	4535	3616	1788	1804	1007	644	8926	219	5810	1846	1766	507	3856	441	7077	806	1411	5040	835	800	184
Anthracene	<1ug/kg	278	73	291	91	1863	2971	276	1628	339	436	130	791	4567	689	193	698	564	350	486	164	84	744	40	1480	433	339	89	619	81	2028	156	294	1402	181	89	27
Fluoranthene	<1ug/kg	2045	606	1552	457	10661	17617	1133	13740	2834	3928	908	4453	26632	2863	1288	1513	1684	1760	2230	402	602	1670	197	10046	624	2799	331	2841	561	15934	1332	1643	15668	865	840	164
Pyrene	<1ug/kg	1878	530	1371	370	9465	14950	997	12108	2551	3872	799	3829	21432	2523	1070	1416	1599	1505	2002	507	479	1677	161	7397	482	2338	280	2422	503	13500	1029	1395	13111	820	528	142
Benz(a)anthracene	<1ug/kg	1242	340	1001	245	6048	8525	811	8747	1540	2141	697	1856	10211	2330	612	1138	1051	999	1112	326	352	1433	114	5196	1954	1777	279	1806	400	8650	856	1008	8003	343	365	155
Chrysene	<1ug/kg	1430	401	1168	306	5548	9401	828	7390	1779	2545	863	2164	11711	3291	706	1504	1432	1116	1463	406	513	2353	155	5270	3292	2053	320	2161	438	9301	1268	1782	9386	583	468	342
Benzo(b)fluoranthene	<1ug/kg	1640	335	883	297	7775	7852	739	6922	1709	3730	947	1344	10883	1856	818	806	873	1349	1361	149	445	1171	140	6312	3442	1836	200	1977	596	12630	1517	1422	10892	433	416	196
Benzo(k)fluoranthene	<1ug/kg	829	158	377	132	2307	3783	<250	3591	738	1105	322	630	4098	995	279	399	378	470	642	147	281	390	59	2706	1798	612	87	583	202	4951	422	588	3194	219	129	76
Benzo(a)pyrene	<1ug/kg	1445	303	752	186	5560	7227	416	6240	1517	2591	571	1422	10464	1623	593	574	710	910	1225	197	288	858	99	4842	4403	1632	151	1223	276	10611	738	981	8449	349	137	78
Indeno(1,2,3-cd)pyrene	<1ug/kg	792	197	518	118	3835	5038	408	4003	1006	1779	390	936	6517	826	369	522	532	542	862	183	411	783	77	3102	,11	1442	113	912	393	7072	867	1288	5250	314	788	521
Dibenzo(a,h)anthracene	<1ug/kg	475	90	322	84	1558	2468	191	1953	483	787	213	231	2876	581	162	391	283	290	391	123	183	711	40	1579	<8	766	55	594	194	3377	579	703	2596	156	462	241
Benzo(ghi)perylene	<1ug/kg	852	239	730	142	3894	5443	617	4010	1078	2117	566	897	7442	1081	432	778	909	649	977	269	530	1227	98	3111	<10	1627	134	1078	494	7345	857	1659	5826	497	1142	616
Total EPA 16	<1ug/kg	14560	3877	16133	3335	63504	104665	9251	76793	18029	27930	7783	28862	147513	30673	7771	17458	17552	12897	15831	5939	5424	36943	1630	57942	20265	19743	2868	22171	4564	1E+05	10869	14755	90591	6138	6072	2967
- Below Detection Limits																																					

Table 7: Metal Results for Soils (taken during well drilling)

Compound	Method Detection Limit / Units	Sample Number																								
		MW01	MW01	MW01	MW01	MW02	MW02	MW02	MW02	MW03	MW03	MW03	MW03	MW03	MW04A	MW04A	MW04A	MW05	MW05	MW05	MW05	MW06A	MW06A	MW06A	MW07	MW07	MW07
Depth (bgl) (m)	mg/kg	1m	4m	5m	7m	1m	5m	7m	8m	1m	2m	3m	4m	5m	1m	5m	7m	1m	2m	5m	10m	1m	4m	7.3m	1m	4m	6m
Arsenic Low Level	0.5	15	-	16	-	10	-	-	-	11	-	13	17	14	22	14	7	11	10	10	-	-	20	-	14.0	23.0	-
Cadmium Low Level	0.5	1	-	-	-	-	-	-	-	3	-	1	1	-	1	-	-		2	-	-	-	-	-	1.0	4.0	-
Chromium	1	35	-	18	10	33	10	10	-	17	-	26	27	13	21	9	9	15	16	12	9	12	20	9	25.0	49.0	8.0
Copper	1	35	-	85	6	60	5	5	-	36	-	74	46	18	68	8	5	23	30	21	6	22	35	8	38.0	181.0	9.0
Lead	1	963	-	105	6	38	7	5	-	156	-	259	193	35	706	2545	111	64	265	38	13	60	46	5	158.0	716.0	7.0
Mercury Low Level	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.0	-
Nickel	1	43	-	32	12	47	14	11	-	29	-	30	112	27	35	11	9	30	28	43	8	16	33	8	25.0	162.0	11.0
Selenium Low Level	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	4	-	-	-	-	-	-
Zinc	1	258	-	134	30	74	30	29	-	317	-	167	128	57	408	42	29	112	399	47	23	85	59	24	240.0	1929.0	32.0
Water Soluble Boron	1	2	-	-	-	2	4	-	-	1	-	-	2	-	-	-	-	-	6	3	1	-	-	-	3.0	5.0	7.0

- Below Detection Limits
Shaded area: Results unavailable

Table 8: Metal Results for Soils (taken during trial pitting)

Compound	Method Detection Limit / Units	Sample Number																																	
		TP1	TP1	TP2	TP2	TP3	TP3	TP4	TP4	TP4	TP5	TP5	TP6	TP6	TP7	TP7	TP8	TP8	TP9	TP9	TP10	TP10	TP11	TP11	TP12	TP12	TP13	TP13	TP14	TP14	TP15	TP15	TP16	TP16	TP17	TP18	TP18
Depth (bgl) (m)	mg/kg	0.5	3.5	0.3	3.0	0.5	3.2	0.5	2.0	3.0	0.5	3.0	0.5	2.4	0.5	3.0	0.5	3.1	0.5	2.0	0.5	2.0	0.5	3.3	0.5	3.2	0.5	3.5	0.5	3.0	0.5	3.0	0.5	3.0	0.5	0.5	3.0
Arsenic Low Level	0.5	11	12	17	11	13	11	8	38	18	26	12	9	12	8	9	19	19	12	25	4	9	4	17	9	26	9	10	11	10	31	8	23	9	9	10	13
Cadmium Low Level	0.5	1	1	1	2	1	5	-	2	1	7	2	1	2	-	1	-	-	1	1	-	2	-	-	2	-	1	2	-	2	2	2	1	1	-	2	-
Chromium	1	103	25	36	17	26	25	18	17	13	37	24	12	35	13	16	14	14	17	23	8	16	6	18	18	39	16	20	19	16	40	14	25	28	31	15	17
Copper	1	176	60	193	53	49	179	57	101	49	308	125	45	78	28	37	30	30	63	72	4	40	17	41	18	88	52	48	34	51	82	31	87	34	22	46	36
Lead	1	447	228	-	652	246	155	190	1977	140	516	133	70	160	65	181	44	44	197	306	25	144	28	17	115	40	119	99	127	410	558	88	273	116	230	43	361
Mercury Low Level	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Nickel	1	47	29	47	29	32	30	22	30	18	34	41	18	36	22	21	23	19	27	34	16	36	10	34	29	433	24	40	19	36	51	27	23	32	16	36	35
Selenium Low Level	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	-	1	-	-	-	2	2	-	-	-	-	-	-
Zinc	1	555	191	293	215	217	177	218	205	264	1708	487	147	182	87	209	81	107	170	206	76	107	37	49	140	73	150	115	139	163	767	142	360	124	157	106	68

- Below Detection Limits

Table 9: Soil Speciated Total Petroleum Hydrocarbon Results (taken during well drilling)

Compound	Method Detection Limit	MW01			MW02			MW03		MW04A				MW05				MW06A			MW07					
Sample Depth	ug/kg	1m	5m	7m	1m	5m	7m	1m	5m	1m	3m	5m	7m	1m	2m	5m	10m	1m	4m	7.3m	1m	2m	3m	4m	5m	6m
GRO (C4-C12)	10	-	-	-	-	-	-	-	-	49	-	-	-	12	110	-	-	-	-	-	-	14	-	-	-	-
MTBE	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	10	-	-	-	-	-	-	-	-	23	-	-	-	12	-	-	-	-	-	-	-	14	-	-	-	-
Ethyl benzene	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m & p Xylene	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o Xylene	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics C5-C6	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C6-C8	10	-	-	-	-	-	-	-	-	26	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C8-C10	10	-		-	-	-	-	-	-	-	-	-	-	-	30	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C10-C12	10	-	-	-	-	-	-	-	-	-	-	-	-	-	14	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C12-C16	10	3581	1101	283	1054018	563	564345	13219	1035	3073	11002	569	114	5169	2799	2802	2192	51063	5157	873	5089	882	5157	36193	51063	696
Aliphatics >C16-C21	10	14708	2093	635	9795468	1991	33501394	174233	1392	15218	9005	115	128	7059	3614	284	2224	34157	788	1282	57818	1394	788	290444	34157	243
Aliphatics >C21-C35	10	55305	1421	164	9051029	931	8923521	63932	2058	45847	55283	1507	112	8084	13390	899	1719	84791	2443	2907	73597	11023	2443	931398	84791	1912
Total Aliphatics C5-C35	10	73594	4615	1082	19900515	3485	42989280	251384	4485	64186	75290	2191	354	18312	19847	3985	6135	170011	8388	8388	136504	13299	8388	1258035	170011	2851
Aromatics C6-C7	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics >C7-C8	10	-	-	-	-	-	-	-	-	23	-	-	-	12	-	-	-	-	-	-	-	14	-	-	-	-
Aromatics >EC8-EC10	10	-	-	-	-	-	-	-	-	-	-	-	-	-	45	-	-	-	-	-	-	-	-	-	-	-
Aromatics >EC10-EC12	10	-	-	-	-	-	-	-	-	-	-	-	-	-	21	-	-	-	-	-	-	-	-	-	-	-
Aromatics >EC12-EC16	10	1381	471	189	6298	186	4414	2664	688	1131	1023	<100	<100	2047	1239	201	<100	60163	128	<100	2979	125	128	4231	60163	471
Aromatics >EC16-EC21	10	3996	652	283	166791	761	205826	18126	11215	3638	2344	117	<100	10817	2028	182	192	252183	112	131	8598	102	112	66854	252183	858
Aromatics >EC21-EC35	10	20683	1024	234	977458	381	1175215	114751	162968	42627	58174	116	367	40024	5415	120	245	443330	368	<100	38833	912	368	399379	443330	663
Total Aromatics C6-C35	10	26060	2147	706	1150547	1308	1385454	135541	174871	47419	59541	287	367	52900	8748	503	437	755676	608	131	50410	1153	608	470464	755676	1992
TPH (Aliphatics and Aromatics C5-C35)	10	99654	6762	1788	21051062	4793	44374714	386925	179356	111583	134831	2478	721	71212	28595	4488	6572	925687	8996	5193	186914	14452	8996	1728496	925687	4843

- Below Detection Limits

Table 10: Soil Speciated Total Petroleum Hydrocarbon Results (taken during trial pitting)

Compound	Method Detection Limit	TP1	TP1	TP2	TP2	TP3	TP3	TP4	TP4	TP4	TP5	TP5	TP6	TP6	TP7	TP7	TP8	TP8	TP9	TP9
Sample Depth	**ug/kg**	0.5	3.5	0.3	3.0	0.5	3.2	0.5	2.0	3.0	0.5	3.0	0.5	2.4	0.5	3.0	0.5	3.1	0.5	2.0
GRO (C4-C12)	10	-	-	-	-	-	-	332	561	-	-	-	-	660	-	-	-	-	-	-
MTBE	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ethyl benzene	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m & p Xylene	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
o Xylene	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics C5-C8	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C8-C8	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C8-C10	10	-	-	-	-	-	-	133	220	-	-	-	-	147	-	-	-	-	-	-
Aliphatics >C10-C12	10	-	-	-	-	-	-	-	-	-	-	-	-	197	-	-	-	-	-	-
Aliphatics >C12-C16	100	4173	834	6824	1780	198	5799	2821	843	<100	998	371	250	3994	6997	105	13916	31265	4845	1116
Aliphatics >C16-C21	100	107332	974	2969	3464	483	13947	5026	8133	249	1478	477	155	8024	4396	364	7792	71248	14474	4100
Aliphatics >C21-C35	100	1340290	3233	337727	32047	1157	38621	26231	1005265	548	15868	629	342	32796	9027	310	30575	233676	39971	8060
Total Aliphatics C5-C35	100	1451735	5041	347620	37291	1838	58367	34311	1014461	797	18344	1477	747	45158	20420	789	52283	336190	59290	13276
Aromatics C6-C7	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics >C7-C8	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics >EC8-EC10	10	-	-	-	-	-	-	198	331	-	-	-	-	221	-	-	-	-	-	-
Aromatics >EC10-EC12	10	-	-	-	-	-	-	-	-	-	-	-	-	295	-	-	-	-	-	-
Aromatics >EC12-EC16	100	213	-	9179	175	795	8811	3044	833	264	397	197	136	7647	11346	<100	9036	21053	257	389
Aromatics >EC16-EC21	100	581	-	17416	177	8737	40397	5613	7719	105	548	377	115	36582	14827	185	18618	41565	676	4785
Aromatics >EC21-EC35	100	37754	284	216291	1060	89888	210070	22388	48913	108	42661	598	245	205397	32390	6275	49963	173393	10372	27730
Total Aromatics C6-C35	100	38548	284	242888	1412	99360	259218	31244	57796	477	43606	1112	496	250142	58363	6460	75617	236011	11345	32904
TPH (Aliphatics and Aromatics C5-C35)	100	1490263	5325	590506	38703	#####	317585	65555	1072257	1274	61950	2589	1243	295300	78783	7229	127900	572201	70635	46180

- Below Detection Limits

Table 10: Soil Speciated Total Petroleum Hydrocarbon Results (taken during trial pitting)

Compound	Method Detection Limit	TP10	TP10	TP11	TP11	TP12	TP12	TP13	TP13	TP14	TP14	TP15	TP15	TP16	TP16	TP17	TP18	TP18
Sample Depth	ug/kg	0.5	2.0	0.5	3.3	0.5	3.2	0.5	3.5	0.5	3.0	0.5	3.0	0.5	3.0	0.5	0.5	3.0
GRO (C4-C12)	10	-	-	-	-	-	-	-	-	-	-	-	-	212	-	-	-	-
MTBE	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzene	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Toluene	10	-	-	-	-	-	-	-	-	-	-	-	-	91	-	-	-	-
Ethyl benzene	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
m & p Xylene	10	-	-	-	-	-	-	-	-	-	-	-	-	121	-	-	-	-
o Xylene	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics C5-C6	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C6-C8	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C8-C10	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C10-C12	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aliphatics >C12-C16	100	8003	297	101720	395	253	124980	389	581	907	463	3000	143	405	332	2637	523	450
Aliphatics >C16-C21	100	3624	319	120568	254	197	515683	488	1605	923	339	9960	<100	179	208	16025	468	235
Aliphatics >C21-C35	100	36895	191	252700	594	497	982211	294	2305	3447	297	20872	339	939	723	17598	337	492
Total Aliphatics C5-C35	100	48522	807	474988	1243	947	1622874	1171	4491	5277	1099	33832	482	1523	1263	36260	1328	1177
Aromatics C6-C7	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics >C7-C8	10	-	-	-	-	-	-	-	-	-	-	-	-	91	-	-	-	-
Aromatics >EC8-EC10	10	-	-	-	-	-	-	-	-	-	-	-	-	121	-	-	-	-
Aromatics >EC10-EC12	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aromatics >EC12-EC16	100	2631	-	29466	-	1636	209	342	<100	4040	137	2217	107	-	921	203	-	-
Aromatics >EC16-EC21	100	5547	496	115606	-	9543	864	363	252	7184	183	15103	305	377	9988	271	159	140
Aromatics >EC21-EC35	100	36764	476	252237	129	65930	309	25364	252	14906	154	149163	9266	1868	80999	6674	163	150
Total Aromatics C6-C35	100	44942	972	397311	129	77109	1382	26069	504	26130	474	166483	9678	2457	91908	7148	322	290
TPH (Aliphatics and Aromatics C5-C35)	100	93464	1779	872299	1372	78056	1624256	27240	4995	31407	1573	200315	10160	3980	93171	43408	1650	1467

- Below Detection Limits

Table 11: Microbacterial Results for Soils

Compound	Method Detection Limit / Units	Sample Number	
		TP16	TP16
Depth (bgl) (m)		0.5m	3m
Faecal Coliforms	cfu/100ml	0	0
Salmonella	n/a	Positive	Negative

Table 12: Soil Phenol Results (taken during well drilling)

Compound	Method Detection Limit / Units	Sample Number																				
		MW01	MW01	MW01	MW02	MW02	MW02	MW03	MW03	MW03	MW03	MW03	MW04A	MW04A	MW04A	MW05	MW05	MW05	MW05	MW06A	MW07	MW07	MW07
Depth (bgl) (m)	mg/kg	1m	5m	7m	1m	5m	7m	1m	2m	3m	4m	5m	1m	5m	7m	1m	2m	5m	10m	1m	1m	4m	6m
Resorcinol	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Catechol	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenol	0.01	-	-	-	-	-	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.05	-
Total Cresols	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-	-	0.04	-
Total Xylenols	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.57	-	-
Napthol	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2,3,5 -Trimethyl Phenol	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2-Isopropyl Phenol	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Phenols	0.01	-	-	-	-	-	0.6	-	-	-	-	-	-	-	-	0.03	-	-	-	-	4.58	0.09	-

- Below Detection Limits

Appendix G 2005 RPS Site Investigation Groundwater Results

Results Tables For Groundwater

Table 1: pH, Temperature, Dissolved Oxygen Results for all wells

Sample		Conductivity (at 25 deg C) Ms/cm	Dissolved Oxygen (mg/l)	pH
Method Detection Limit	Date	<0.014	<0.1	pH units
MW01	Mar-05	2.330	8.6	8.25
MW02	Mar-05	2.900	7.5	7.67
MW03	Mar-05	2.430	8.8	7.84
MW04A	Mar-05	3.260	5.7	7.60
MW5	Mar-05	4.180	6.1	7.97
MW06A	Mar-05	22.500	7.5	7.71
MW07	Mar-05	5.600	4.3	7.70
BR6	Mar-05	33.900	7.2	8.01
BR8	Mar-05	34.600	8.8	8.04
BH1	Mar-05	10.00	6.6	7.80
BH4	Mar-05	19.420	6.5	8.23

Table 2: VOC Results for Shallow Groundwater Wells

Compound	Method Detection Limit / Units	Sample Number						
		MW01	MW02	MW03	MW04A	MW5	MW06A	MW07
Date	ug/l	Mar-05	Mar-05	Mar-05	Mar-05	Mar-05	Mar-05	Mar-05
Dichlorodifluoromethane	1	-	-	-	-	-	-	-
Chloromethane	1	-	-	-	-	-	-	-
Vinyl chloride	1	-	-	-	-	-	-	-
Bromomethane	1	-	-	-	-	-	-	-
Chloroethane	1	-	-	-	-	-	-	-
Trichlorofluoromethane	1	-	-	-	-	-	-	-
trans-1,2-Dichloroethene	1	-	-	-	-	-	-	-
Dichloromethane	1	-	-	-	-	-	-	-
Carbon disulphide	1	-	-	-	-	-	-	-
1,1-Dichloroethene	1	-	-	-	-	-	-	-
1,1-Dichloroethane	1	-	-	-	-	-	-	-
tert-butyl methyl ether	1	-	-	-	-	-	-	-
cis-1,2-Dichloroethene	1	-	-	-	-	-	-	-
Bromochloromethane	1	-	-	-	-	-	-	-
Chloroform	1	-	-	-	-	-	-	-
2,2-Dichloropropane	1	-	-	-	-	-	-	-
1,2-Dichloroethane	1	-	-	-	-	-	-	-
1,1,1-Trichloroethane	1	-	-	-	-	-	-	-
1,1-Dichloropropene	1	-	-	-	-	-	-	-
Benzene	1	-	-	-	-	-	-	-
Carbontetrachloride	1	-	-	-	-	-	-	-
Dibromomethane	1	-	-	-	-	-	-	-

Table 2: VOC Results for Shallow Groundwater Wells

Compound	Method Detection Limit / Units	Sample Number						
		MW01	MW02	MW03	MW04A	MW5	MW06A	MW07
Date	ug/l	Mar-05	Mar-05	Mar-05	Mar-05	Mar-05	Mar-05	Mar-05
Bromodichloromethane	1	-	-	-	-	-	-	-
Trichloroethene	1	-	-	-	-	-	-	-
cis-1,3-Dichloropropene	1	-	-	-	-	-	-	-
trans-1,3-Dichloropropene	1	-	-	-	-	-	-	-
1,1,2-Trichloroethane	1	-	-	-	-	-	-	-
Toluene	1	-	-	-	-	-	-	-
1,3-Dichloropropane	1	-	-	-	-	-	-	-
Dibromochloromethane	1	-	-	-	-	-	-	-
1,2-Dibromoethane	1	-	-	-	-	-	-	-
Tetrachloroethene	1	-	-	-	-	-	-	-
1,1,1,2-Tetrachloroethane	1	-	-	-	-	-	-	-
Chlorobenzene	1	-	-	-	-	-	-	-
Ethylbenzene	1	-	-	-	-	-	-	-
p/m-Xylene	1	-	-	-	-	-	-	-
Bromoform	1	-	-	-	-	-	-	-
Styrene	1	-	-	-	-	-	-	-
1,1,2,2-Tetrachloroethane	1	-	-	-	-	-	-	-
o-Xylene	1	-	-	-	-	-	-	-
1,2,3-Trichloropropane	1	-	-	-	-	-	-	-
Isopropylbenzene	1	-	-	-	-	-	-	-
Bromobenzene	1	-	-	-	-	-	-	-
2-Chlorotoluene	1	-	-	-	-	-	-	-

Table 2: VOC Results for Shallow Groundwater Wells

Compound	Method Detection Limit / Units	Sample Number						
		MW01	MW02	MW03	MW04A	MW5	MW06A	MW07
Date	ug/l	Mar-05	Mar-05	Mar-05	Mar-05	Mar-05	Mar-05	Mar-05
Propylbenzene	1	-	-	-	-	-	-	-
4-Chlorotoluene	1	-	-	-	-	-	-	-
1,2,4-Trimethylbenzene	1	-	-	-	-	-	-	-
4-Isopropyltoluene	1	-	-	-	-	-	-	-
1,3,5-Trimethylbenzene	1	-	-	-	-	-	-	-
1,2-Dichlorobenzene	1	-	-	-	-	-	-	-
1,4-Dichlorobenzene	1	-	-	-	-	-	-	-
sec-Butylbenzene	1	-	-	-	-	-	-	-
tert-Butylbenzene	1	-	-	-	-	-	-	-
1,3-Dichlorobenzene	1	-	-	-	-	-	-	-
n-Butylbenzene	1	-	-	-	-	-	-	-
1,2-Dibromo-3-chloropropane	1	-	-	-	-	-	-	-
1,2,4-Trichlorobenzene	1	-	-	-	-	-	-	-
Naphthalene	1	-	-	-	-	-	-	-
1,2,3-Trichlorobenzene	1	-	-	-	-	-	-	-
Hexachlorobutadiene	1	-	-	-	-	-	-	-
- Below Detection Limits								

Table 3: VOC Results for Deep Groundwater Wells

Compound	Method Detection Limit / Units	BR6	BR8	BH1	BH4
Date	ug/l	Mar-05	Mar-05	Mar-05	Mar-05
Dichlorodifluoromethane	1	-	-	-	-
Chloromethane	1	-	-	-	-
Vinyl chloride	1	-	-	-	-
Bromomethane	1	-	-	-	-
Chloroethane	1	-	-	-	-
Trichlorofluoromethane	1	-	-	-	-
trans-1,2-Dichloroethene	1	-	-	-	-
Dichloromethane	1	-	-	-	-
Carbon disulphide	1	-	-	-	-
1,1-Dichloroethene	1	-	-	-	-
1,1-Dichloroethane	1	-	-	-	-
tert-butyl methyl ether	1	-	-	-	-
cis-1,2-Dichloroethene	1	-	-	-	-
Bromochloromethane	1	-	-	-	-
Chloroform	1	-	-	-	-
2,2-Dichloropropane	1	-	-	-	-
1,2-Dichloroethane	1	-	-	-	-
1,1,1-Trichloroethane	1	-	-	-	-
1,1-Dichloropropene	1	-	-	-	-
Benzene	1	-	-	-	-
Carbontetrachloride	1	-	-	-	-
Dibromomethane	1	-	-	-	-

Table 3: VOC Results for Deep Groundwater Wells

Compound	Method Detection Limit / Units				
		BR6	BR8	BH1	BH4
Date	ug/l	Mar-05	Mar-05	Mar-05	Mar-05
1,2-Dichloropropane	1	-	-	-	-
Bromodichloromethane	1	-	-	-	-
Trichloroethene	1	-	-	-	-
cis-1,3-Dichloropropene	1	-	-	-	-
trans-1,3-Dichloropropene	1	-	-	-	-
1,1,2-Trichloroethane	1	-	-	-	-
Toluene	1	-	-	3	-
1,3-Dichloropropane	1	-	-	-	-
Dibromochloromethane	1	-	-	-	-
1,2-Dibromoethane	1	-	-	-	-
Tetrachloroethene	1	-	-	-	-
1,1,1,2-Tetrachloroethane	1	-	-	-	-
Chlorobenzene	1	-	-	-	-
Ethylbenzene	1	-	-	-	-
p/m-Xylene	1	-	-	-	-
Bromoform	1	-	-	-	-
Styrene	1	-	-	-	-
1,1,2,2-Tetrachloroethane	1	-	-	-	-
o-Xylene	1	-	-	-	-
1,2,3-Trichloropropane	1	-	-	-	-
Isopropylbenzene	1	-	-	-	-
Bromobenzene	1	-	-	-	-

Table 3: VOC Results for Deep Groundwater Wells

Compound	Method Detection Limit / Units	BR6	BR8	BH1	BH4
Date	ug/l	Mar-05	Mar-05	Mar-05	Mar-05
2-Chlorotoluene	1	-	-	-	-
Propylbenzene	1	-	-	-	-
4-Chlorotoluene	1	-	-	-	-
1,2,4-Trimethylbenzene	1	-	-	-	-
4-Isopropyltoluene	1	-	-	-	-
1,3,5-Trimethylbenzene	1	-	-	-	-
1,2-Dichlorobenzene	1	-	-	-	-
1,4-Dichlorobenzene		-	-	-	-
sec-Butylbenzene	1	-	-	-	-
tert-Butylbenzene	1	-	-	-	-
1,3-Dichlorobenzene	1	-	-	-	-
n-Butylbenzene	1	-	-	-	-
1,2-Dibromo-3-chloropropane	1	-	-	-	-
1,2,4-Trichlorobenzene	1	-	-	-	-
Naphthalene	1	-	-	-	-
1,2,3-Trichlorobenzene	1	-	-	-	-
Hexachlorobutadiene	1	-	-	-	-
- Below Detection Limits					
Shaded: Results unavailable					

Table 4: TPH Results for Shallow Groundwater Wells

Compound	Method Detection Limit	Sample Number						
		MW01	MW02	MW03	MW04A	MW5	MW06A	MW07
Sample Date	ug/l	Mar-05	Mar-05	Mar-05	Mar-05	Mar-05	Mar-05	Mar-05
GRO (C4-C12)	10	14	11	-	-	-	-	-
MTBE (Methyl Tertiary Butyl Ether)	10	-	-	-	-	-	-	-
Benzene	10	-	-	-	-	-	-	-
Toluene	10	-	-	-	-	-	-	-
Ethyl benzene	10	-	-	-	-	-	-	-
m & p Xylene	10	-	-	-	-	-	-	-
o Xylene	10	-	-	-	-	-	-	-
Aliphatics C5-C6	10	-	-	-	-	-	-	-
Aliphatics >C6-C8	10	-	-	-	-	-	-	-
Aliphatics >C8-C10	10	-	-	-	-	-	-	-
Aliphatics >C10-C12	10	-	-	-	-	-	-	-
Aliphatics >C12-C16	10	-	29	-	-	-	-	-
Aliphatics >C16-C21	10	-	211	12	-	-	15	14
Aliphatics >C21-C35	10	-	18	-	-	-	-	-
Total Aliphatics C5-C35	10	-	258	12	-	-	15	14
Aromatics C6-C7	10	-	-	-	-	-	-	-
Aromatics >C7-C8	10	-	-	-	-	-	-	-
Aromatics >EC8-EC10	10	14	11	-	-	-	-	-
Aromatics >EC10-EC12	10	-	-	-	-	-	-	-
Aromatics >EC12-EC16	10	-	-	-	-	-	-	-
Aromatics >EC16-EC21	10	-	-	-	-	-	-	-
Aromatics >EC21-EC35	10	-	-	-	-	-	-	-
Total Aromatics C6-C35	10	14	11	-	-	-	-	-
TPH (Aliphatics and Aromatics C5-C35)	10	14	269	12	-	-	15	14

'- Below Detection Limits

Table 5: TPH Results for Deep Groundwater Wells

Compound	Method Detection Limit	BR6	BR8	BH1	BH4
Sample Date	ug/l	**Mar-05**	**Mar-05**	**Mar-05**	**Mar-05**
GRO (C4-C12)	10	-	147	-	-
MTBE (Methyl Tertiary Butyl Ether)	10	-	11	-	-
Benzene	10	-	-	-	-
Toluene	10	-	-	-	-
Ethyl benzene	10	-	-	-	-
m & p Xylene	10	-	-	-	-
o Xylene	10	-	-	-	-
Aliphatics C5-C6	10	-	-	-	-
Aliphatics >C6-C8	10	-	-	-	-
Aliphatics >C8-C10	10	-	54	-	-
Aliphatics >C10-C12	10	-	-	-	-
Aliphatics >C12-C16	10	-	-	-	-
Aliphatics >C16-C21	10	-	11	-	-
Aliphatics >C21-C35	10	-	-	-	-
Total Aliphatics C5-C35	10	-	65	-	-
Aromatics C6-C7	10	-	-	-	-
Aromatics >C7-C8	10	-	-	-	-
Aromatics >EC8-EC10	10	-	82	-	-
Aromatics >EC10-EC12	10	-	-	-	-
Aromatics >EC12-EC16	10	-	-	-	-
Aromatics >EC16-EC21	10	-	-	-	-
Aromatics >EC21-EC35	10	-	-	-	-
Total Aromatics C6-C35	10	-	82	-	-
TPH (Aliphatics and Aromatics C5-C35)	10	-	147	-	-

'- Below Detection Limits

Table 6: Heavy Metals Results for Shallow Groundwater Wells

Sample								
	Date	Mar-05						
	Method Detection Limit	MW01	MW02	MW03	MW04A	MW5	MW06A	MW07
Arsenic Dissolved (ICP-MS)	<1 ug/l	7	2	10	5	8	19	6
Boron Dissolved (ICP-MS)	<10 ug/l	626	913	761	1619	723	1673	1206
Cadmium Dissolved (ICP-MS)	<0.4 ug/l	0.4	-	-	0.7	-	-	-
Chromium Dissolved (ICP-MS)	<1 ug/l	6	10	5	5	5	5	7
Copper Dissolved (ICP-MS)	<1 ug/l	9	4	4	3	1	4	2
Lead Dissolved (ICP-MS)	<1 ug/l	2	-	-	18	-	-	2
Nickel Dissolved (ICP-MS)	<1 ug/l	15	16	19	33	9	12	31
Selenium Dissolved (ICP-MS)	<1 ug/l	13	5	7	5	7	40	7
Zinc Dissolved (ICP-MS)	<3 ug/l	87	94	43	72	77	49	49
Mercury Dissolved (CVAA)	<0.05 ug/l	-	-	-	-	-	-	-

- Below Detection Limits

Table 7: Heavy Metals results for Deep Groundwater Wells

Sample	Date	Mar-05			
	Method Detection Limit (ug/l)	BR6	BR8	BH1	BH4
Arsenic Dissolved (ICP-MS)	<1	16	23	5	17
Boron Dissolved (ICP-MS)	<10	2495	3130	0.81	1.44
Cadmium Dissolved (ICP-MS)	<0.4	0.7	4.2	-	-
Chromium Dissolved (ICP-MS)	<1	7	11	18	7
Copper Dissolved (ICP-MS)	<1	4	6	1	1
Lead Dissolved (ICP-MS)	<1	-	70	1	-
Nickel Dissolved (ICP-MS)	<1	18	18	10	11
Selenium Dissolved (ICP-MS)	<1	62	82	11	25
Zinc Dissolved (ICP-MS)	<3	79	200	126	49
Mercury Dissolved (CVAA)	<0.05	-	-	-	-

- Below Detection Limits

Table 8: PAH Results for Shallow Groundwater Wells

Sample		PAHs						
	Date	Mar-05						
	Method Detection Limit (ng/l)	MW01	MW02	MW03	MW04A	MW5	MW06A	MW07
Naphthalene	10	-	-	558	-	-	-	-
Acenaphthylene	10	-	-	42	-	-	-	-
Acenaphthene	10	-	-	17	-	-	-	-
Fluorene	10	-	-	47	-	-	-	-
Phenanthrene	10	-	-	99	-	-	-	-
Anthracene	10	-	-	14	-	-	-	-
Fluoranthene	10	-	-	61	-	-	-	-
Pyrene	10	-	-	52	-	-	-	-
Benz(a)anthracene	10	-	-	-	-	-	-	-
Chrysene	10	-	-	-	-	-	-	-
Benzo(b)fluoranthene	10	-	-	-	-	-	-	-
Benzo(k)fluoranthene	10	-	-	-	-	-	-	-
Benzo(a)pyrene	10	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	10	-	-	-	-	-	-	-
Dibenzo(a,h)anthracene	10	-	-	-	-	-	-	-
Benzo(ghi)perylene	10	-	-	-	-	-	-	-
Total EPA 16	10	-	-	890	-	-	-	-

- Below Detection Limits

Table 9: PAH Results for Deep Groundwater Wells

Sample		PAHs			
	Date	Mar-05			
	Method Detection Limit (ng/l)	BR6	BR8	BH1	BH4
Naphthalene	10	-	-	786	-
Acenaphthylene	10	-	-	549	-
Acenaphthene	10	-	-	2885	-
Fluorene	10	-	-	1200	-
Phenanthrene	10	-	-	4001	-
Anthracene	10	-	-	2495	-
Fluoranthene	10	-	-	6667	-
Pyrene	10	-	-	5751	-
Benz(a)anthracene	10	-	-	1927	-
Chrysene	10	-	-	2824	-
Benzo(b)fluoranthene	10	-	-	1509	-
Benzo(k)fluoranthene	10	-	-		
Benzo(a)pyrene	10	-	-	674	-
Indeno(1,2,3-cd)pyrene	10	-	-	427	-
Dibenzo(a,h)anthracene	10	-	-	242	-
Benzo(ghi)perylene	10	-	-	473	-
Total EPA 16	10	-	-	32411	-

- Below Detection Limits

Table 10: Phenol Results for all wells

Sample	Phenols
Date	**Mar-05**
Method Detection Limit	**<0.01**
MW01	-
MW02	0.01
MW03	-
MW04A	-
MW5	-
MW06A	-
MW07	-
BR6	-
BR8	-
BH1	-
BH4	-

- Below Detection Limits

Appendix H Borehole and Trial Pit Logs

Borehole Log

GEOTECH

Drilled by MD Logged by PG Checked by MK	Start 20/05/2003 End 26/05/2003	Equipment, Methods and Remarks Dando 175 cable tool drill rig Hand dug inspection pit to 1.20m Cable percussive boring to 36.50m Installed 50mm dia. standpipe	Depth from / to / Diameter / Casing Depth 0.00m / 13.50m / 250mm / 13.50m 13.50m / 36.50m / 200mm / 36.50m	Ground Level +3.64 mOD Coordinates E 319923.03 National Grid N 233437.37	

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
0.00-0.50	B 1			
0.50-1.00	B 2			
1.00-1.50	B 3			
1.20-1.65	SPT C	N=48 (4,4/6,10,14,18)	1.20	dry
2.00-2.50	B 4			
3.00-3.45	SPT C	N=16 (2,3/3,4,4,5)	3.00	dry
3.00-3.50	B 5			
3.00	W 9			
3.50	D 6			
3.60-4.05	SPT S	N=11 (1,2/2,3,2,4)	3.60	dry
3.60-4.00	B 7			
4.00-4.45	SPT C	N=23 (3,4/4,5,6,8)	4.00	dry
4.00-4.50	B 8			
4.50	W 48			
5.00-5.45	SPT C	N=41 (6,8/9,10,11,11)	5.00	3.00
5.00-5.50	B 10		20/05/2003 5.00	3.00
6.00-6.45	SPT C	N=33 (4,6/6,8,8,11)	6.00	3.00
6.00-6.50	B 11			
7.00-7.45	SPT C	N=35 (4,4/7,8,10,10)	7.00	3.00
7.00-7.50	B 12			
8.00-8.45	SPT C	N=[illegible]	[illegible]	3.00
8.00-8.50	B 13			
9.00-9.45	SPT C	N=46 (6,8/9,11,12,14)	9.00	3.00
9.00-9.50	B 14			

Strata

Description	Depth, Level (Thickness)	Legend	Backfill / Instrumentation
Soft brown to black sandy gravelly CLAY and sandy GRAVEL FILL with subangular cobbles and fragments of brick, concrete, wood and plastic. Gravel is subangular to subrounded fine to coarse. (MADE GROUND) 1.00-2.50 m Occasional boulder-sized concrete fragment.	(4.00)		
Medium dense to dense grey sandy GRAVEL with shell fragments and occasional subrounded cobbles. Sand is fine to medium, gravel is subangular to rounded fine to coarse. (ESTUARINE DEPOSIT). 4.00-4.50 m some brown cemented sand clods	4.00 -0.37		
Stratum continued next sheet			

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.50	Rose to 3.00 m after 20 minutes. Strong inflow	-

Depth Related Remarks
From to (m)

Chiselling

Depths (m)	Time	Tools used
1.50 -2.50	330 mins	Chisel
7.60 -7.80	30 mins	Chisel
9.85 -10.00	45 mins	Chisel

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

Scale 1:50

(c) MESG NBR (281), 30/10/2003 12:44:51

Project: Dublin Waste to Energy
Project No.: KD3116
Carried out for: Dublin City Council

Borehole
BH1
Sheet 1 of 4

Borehole Log

GEOTECH

Drilled by MD Logged by PG Checked by MK	Start 20/05/2003 End 26/05/2003	Equipment, Methods and Remarks	Depth from / to / Diameter / Casing Depth 0.00m 13.50m 250mm 13.50m 13.50m 38.50m 200mm 36.50m	Ground Level +3.64 mOD Coordinates E 319923.03 National Grid N 233437.37

Samples and Tests / Strata

Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)	Legend	Backfill/Instruments
10.00-10.29 10.00-10.50	SPT C B 15	50 (6,11/25,25 for 65mm)	10.00	3.00	Medium dense to dense grey sandy GRAVEL with shell fragments and occasional subrounded cobbles. Sand is fine to medium, gravel is subangular to rounded fine to coarse. (ESTUARINE DEPOSIT).	(13.00)		
11.00-11.45 11.00-11.50	SPT C B 16	N=42 (7,7/8,8,14,12)	11.00	3.00				
			22/05/2003 11.00	3.00				
12.00-12.45 12.00-12.50	SPT C B 17	N=17 (1,2/4,4,4,5)	12.00	3.20				SP
13.00-13.45 13.00-13.50	SPT C B 18	N=28 (4,4/6,6,7,9)	13.00	3.20				
14.00-14.45 14.00-14.50	SPT C B 19	N=27 (5,5/6,7,6,8)	14.00	3.20	14.00 m becoming clayey			
15.00-15.45 15.00-15.50	SPT C B 20	N=32 (4,4/6,6,9,11)	15.00	3.20				
16.00-16.45 16.00-16.50	SPT C B 21	N=35 (5,5/5,8,10,12)	16.00	3.20				
17.00-17.10 17.10-17.53 17.10-17.60	D 22 SPT S B 23	60 (3,8/10,14,11 for 55mm)	17.10	3.20	Stiff to very stiff dark grey brown slightly sandy CLAY with rare fine sand lenses. (ESTUARINE DEPOSIT).	17.00 -13.36		
18.00-18.44 18.00-18.50	SPT S B 24	55 (5,9/9,13,12 for 60mm)	18.00	3.20				
			23/05/2003 18.00	3.20				
19.50-19.95 19.50-19.95	SPT S D 25	N=30 (4,4/5,7,9,9)	19.50	3.20				
Depth	Type & No	Records	Date Casing	Time Water	Stratum continued next sheet			

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.50	Rose to 3.00 m after 20 minutes. Strong inflow	-

Depth Related Remarks
From to (m)

Chiselling

Depths (m)	Time	Tools used
10.80 -10.95	45 mins	Chisel
12.80 -12.90	30 mins	Chisel
13.70 -13.95	45 mins	Chisel

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

Scale 1:50   (4 M[illegible] (281), 30/10/2003 12:44:56) AGS

Project: Dublin Waste to Energy
Project No.: KD3116
Carried out for: Dublin City Council

Borehole **BH1**

Borehole Log

GEOTECH

Drilled by	MD
Logged by	PG
Checked by	MK

Start 20/05/2003
End 26/05/2003

Equipment, Methods and Remarks

Depth from	to	Diameter	Casing Depth
0.00m	13.50m	250mm	13.50m
13.50m	36.50m	200mm	36.50m

Ground Level +3.64 mOD
Coordinates E 319923.03
National Grid N 233437.37

Samples and Tests

Strata

Depth	Type & No	Records	Date Casing	Time Water	Description	Depth,Level (Thickness)	Legend	Backfill Instrumen
20.00-20.50	B 26				Stiff to very stiff dark grey brown slightly sandy CLAY with rare fine sand lenses. (ESTUARINE DEPOSIT).			
21.00-21.45	SPT S	N=29 (3,4/4,8,8,9)	21.00	3.20				
21.00-21.45	D 27							
22.00-22.50	B 28							
22.50-22.95	SPT S	N=30 (4,4/6,8,8,10)	22.50	3.20				
22.50-22.95	D 29							
23.00-23.50	B 30							
24.00-24.45	SPT S	N=28 (5,5/5,7,7,9)	24.00	3.20				
24.00-24.45	D 31							
24.50-25.00	B 32							
25.50-25.95	SPT S	N=31 (4,4/6,8,8,9)	25.50	3.20				
25.50-25.95	D 33							
			24/05/2003 25.50	3.20				
26.00-26.50	B 34					(18.50)		
27.00-27.45	SPT S	N=29 (3,4/4,8,8,9)	27.00	3.20				
27.00-27.45	D 35							
28.00-28.50	B 36							
28.50-28.95	SPT S	N=28 (5,5/6,8,8,6)	28.50	3.20				
28.50-28.95	D 37							
29.00-29.50	B 38							
					Stratum continued next sheet			

Depth	Type & No	Records	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.50	Rose to 3.00 m after 20 minutes. Strong inflow	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50

Project Dublin Waste to Energy
Project No. KD3116
Carried out for Dublin City Council

Borehole
BH1
Sheet 3 of 4

Borehole Log

GEOTECH

Drilled by	MD
Logged by	PG
Checked by	MK

Start 20/05/2003
End 26/05/2003

Equipment, Methods and Remarks

Depth from	to	Diameter	Casing Depth
0.00m	13.50m	250mm	13.50m
13.50m	36.50m	200mm	36.50m

Ground Level	+3.64 mOD
Coordinates	E 319923.03
National Grid	N 233437.37

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
30.00-30.45	SPT S	N=24 (3,3/5,5,6,8)	30.00	3.20
30.00-30.45	D 39			
31.00-31.50	B 40			
31.50-31.95	SPT S	N=27 (3,4/5,6,8,8)	31.50	3.20
31.50-31.95	D 41			
			25/05/2003	
			33.50	3.20
33.00-33.45	SPT S	N=29 (4,4/6,6,8,9)	33.00	3.20
33.00-33.50	B 42			
34.00-34.50	B 43			
34.50-34.95	SPT S	N=27 (3,4/5,6,8,6)	34.50	3.20
34.50-34.95	D 44			
35.00-35.50	B 45			
35.50-35.95	SPT S	N=31 (3,5/5,6,9,11)	35.50	3.20
35.50-35.95	D 46			
36.00-36.39	SPT C	47 (4,6/10,12,18,7 for 10mm)	36.00	3.20
36.00-36.50	B 47			
			26/05/2003	
			36.00	3.20

Depth	Type & No	Records	Date Casing	Time Water

Strata

Description	Depth, Level (Thickness)
Stiff to very stiff dark grey brown slightly sandy CLAY with rare fine sand lenses. (ESTUARINE DEPOSIT).	
Recovered as brown slightly silty GRAVEL with occasional subangular to subrounded cobbles. Gravel is angular to subrounded fine to coarse. (possible weathered rockhead)	35.50 -31.86 (1.00)
EXPLORATORY HOLE ENDS AT 36.50 m	36.50 -32.86

Legend

Backfill/ Instruments

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.50	Rose to 3.00 m after 20 minutes. Strong inflow	-

Depth Related Remarks

From to (m)

Chiselling

Depths (m)	Time	Tools used
36.40 -36.50	45 mins	Chisel

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

Scale 1:50

(c) MEXO HBM (2011), 30/10/2003 12:45:01

AGS

Project: Dublin Waste to Energy

Project No.: KD3116

Carried out for: Dublin City Council

Borehole

BH1

Sheet 4 of 4

Borehole Log

GEOTECH

Drilled by MD Logged by PG Checked by MK	Start 27/05/2003 End 06/06/2003	Equipment, Methods and Remarks Dando 175 cable tool drill rig Hand dug inspection pit to 1.20m Cable percussive boring to 34.00m. Borehole backfilled with grout.	Depth from / to / Diameter / Casing Depth 0.00m 13.60m 250mm 13.60m 13.60m 34.00m 200mm 34.00m	Ground Level +3.99 mOD Coordinates E 319847.27 National Grid N 233497.54

Samples and Tests / Strata

Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)
0.00-0.50	B 1				TARMAC pavement overlying grey angular to subangular cobbles (MADE GROUND).	(0.50)
0.50-1.00	B 2					0.50 +3.49
1.00-1.45 1.00-1.50	SPT C B 3	N=10 (2,3/3,2,3,2)	1.00	dry	Soft grey brown to black slightly sandy CLAY and GRAVEL FILL with concrete, wood, ceramics and brick fragments. Gravel is angular to subrounded fine to coarse. (MADE GROUND)	
1.50-2.00	B 4					
2.00-2.45 2.00-2.50	SPT C B 5	N=14 (2,3/3,4,4,3)	2.00	dry		(3.10)
2.50-3.00	B 6					
3.00-3.45 3.00-3.50	SPT C B 7	N=16 (2,2/4,3,4,5)	3.00	dry		
3.60-3.70 3.70-4.15 3.70-4.15	D 8 SPT S D 9	N=12 (1,1/2,2,3,5)	3.70	dry	Medium dense grey slightly clayey fine SAND with rare shell fragments. Gravel is subangular to subrounded fine to medium. (ESTUARINE DEPOSIT).	3.60 +0.39
4.00-4.50	B 10					
4.50-4.95 4.50 4.50-5.00	SPT C W 11 B 12	N=26 (3,4/4,6,7,9)	4.50	3.20		(2.00)
5.00-5.50	B 13					
5.50-5.95 5.50-6.00	SPT C B 14	N=24 (4,4/4,6,6,8)	5.50	3.20	Medium dense dark grey to multi-coloured sandy GRAVEL with shell fragments. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse. (ESTUARINE DEPOSIT).	5.60 -1.62
6.50-7.00	B 15					
7.00-7.45 7.00-7.50	SPT C B 16	N=32 (3,6/8,8,7,9)	7.00	3.20		
8.50-8.95 8.50-9.00	SPT C B 17	N=28 (4,4/6,7,7,8)	8.50	3.20		
			27/05/2003 10.00	3.20	Stratum continued next sheet	

Stratum continued next sheet

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.70	Rose to 4.50 m after 20 minutes. Slow ingress	-

Depth Related Remarks
From to (m)

Chiselling

Depths (m)	Time	Tools used
1.80 -1.95	45 mins	Chisel

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

Scale 1:50

(c) MESG HBM (281), 30/10/2003 12:45:16 AGS

Project: Dublin Waste to Energy
Project No. KD3116
Carried out for: Dublin City Council

Borehole **BH2**
Sheet 1 of 4

Borehole Log

GEOTECH

Drilled by MD	Start 27/05/2003	Equipment, Methods and Remarks	Depth from	to	Diameter	Casing Depth	Ground Level	+3.99 mOD
Logged by PG	End 06/06/2003		0.00m	13.60m	250mm	13.60m	Coordinates	E 319847.27
Checked by MK			13.60m	34.00m	200mm	34.00m	National Grid	N 233497.54

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
10.00-10.45 10.00-10.50	SPT C B 18	N=25 (3,4/4,7,7,7)	10.00	3.20
10.50-10.95 10.50-11.00	SPT C B 19	N=15 (2,3/2,3,3,7)	10.50	3.00
12.00-12.45 12.00-12.50	SPT C B 20	N=26 (3,4/4,7,7,10)	12.00	3.00
13.50-13.95 13.50-14.00	SPT C B 21	N=28 (4,4/4,6,6,12)	13.50	3.00
15.00-15.45 15.00-15.50	SPT C B 22	N=27 (3,5/5,6,8,8)	15.00	3.00
16.50-16.95 16.50-17.00	SPT C B 23	N=32 (4,4/7,7,8,10)	16.50	3.00
18.00-18.45 18.00-18.50	SPT C B 24	N=27 (6,6/4,8,8,7)	18.00	3.00
19.50-19.95 19.50-19.95	SPT S D 25	N=19 (3,3/4,4,4,7)	19.50	3.00
			28/05/2003 19.50	3.00

Depth | Type & No | Records | Date Casing | Time Water

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instrument
Medium dense dark grey to multi-coloured sandy GRAVEL with shell fragments. Sand is fine to coarse. Gravel is subangular to rounded fine to coarse. (ESTUARINE DEPOSIT).	(12.90)		
18.00-18.50 m becoming clayey			
Stiff to very stiff dark grey brown slightly sandy CLAY. Sand is fine. (ESTUARINE DEPOSIT).	18.50 -14.51		
Stratum continued next sheet			

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.70	Rose to 4.50 m after 20 minutes. Slow ingress	-

Depth Related Remarks

From to (m)

Chiselling

Depths (m)	Time	Tools used
14.30 -14.45	30 mins	Chisel
17.50 -17.80	45 mins	Chisel

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

Scale 1:50

Project: Dublin Waste to Energy
Project No.: KD3116
Carried out for: Dublin City Council

Borehole
BH2
Sheet 2 of 4

Borehole Log

GEOTECH

Drilled by MD	Start 27/05/2003	Equipment, Methods and Remarks	Depth from	to	Diameter	Casing Depth	Ground Level	+3.99 mOD
Logged by PG	End 06/06/2003		0.00m	13.60m	250mm	13.60m	Coordinates	E 319647.27
Checked by MK			13.60m	34.00m	200mm	34.00m	National Grid	N 233497.54

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
20.00-20.50	B 26			
21.00-21.45 21.00-21.45	SPT S D 27	N=31 (3,5/5,8,8,10)	21.00	3.80
22.00-22.50	B 28			
22.50-22.95 22.50-22.95	SPT S D 29	N=35 (4,4/6,9,10,10)	22.50	3.80
23.50-24.00	B 30			
24.00-24.45 24.00-24.45	SPT S D 31	N=39 (3,5/7,10,10,12)	24.00	3.80
25.00-25.50	B 32			
25.50-25.95 25.50-25.95	SPT S D 33	N=40 (4,4/8,11,10,11)	25.50	3.80
26.00-26.50	B 34			
			04/06/2003 26.00	3.60
27.00-27.45 27.00-27.45	SPT S D 35	N=36 (4,6/6,8,10,12)	27.00	3.60
28.00-28.50	B 36			
28.50-28.95 28.50-28.95	SPT S D 37	N=28 (3,4/4,7,7,10)	28.50	3.60
29.50-30.00	B 38			

Strata

Description	Depth,Level/ (Thickness)	Legend	Backfill/ Instrumen
Stiff to very stiff dark grey brown slightly sandy CLAY. Sand is fine. (ESTUARINE DEPOSIT).	(15.50)		
Stratum continued next sheet			

Depth	Type & No	Records	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.70	Rose to 4.50 m after 20 minutes. Slow ingress	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50

Project: Dublin Waste to Energy
Project No.: KD3116
Carried out for: Dublin City Council

Borehole
BH2
Sheet 3 of 4

Borehole Log

GEOTECH

Drilled by MD Logged by PG Checked by MK	Start 27/05/2003 End 06/06/2003	Equipment, Methods and Remarks	Depth from	to	Diameter	Casing Depth	Ground Level +3.99 mOD Coordinates E 319847.27 National Grid N 233497.54
			0.00m	13.60m	250mm	13.60m	
			13.60m	34.00m	200mm	34.00m	

Samples and Tests / Strata

Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
30.00-30.45 30.00-30.45	SPT S D 39	N=37 (4,4/7,8,11,11)	30.00	3.60	Stiff to very stiff dark grey brown slightly sandy CLAY. Sand is fine. (ESTUARINE DEPOSIT).			
31.00-31.50	B 40							
31.50-31.95 31.50-31.95	SPT S D 41	N=43 (5,7/8,10,11,14)	31.50	3.60				
32.50-33.00	B 42							
33.00-33.44 33.00-33.45	SPT S D 43	45 (8,7/10,10,13,12 for 65mm)	33.00	3.60				
			05/06/2003 33.00	3.60				
33.50-33.95 33.50-33.95	SPT S D 44	N=42 (5,5/8,8,10,16)						
			06/06/2003 33.50	3.40				
					EXPLORATORY HOLE ENDS AT 34.00 m	34.00 -30.01		

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.70	Rose to 4.50 m after 20 minutes. Slow ingress	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50

(c) MESG HBB (281), 30/10/2003 12:45:34 AGS

Project: Dublin Waste to Energy
Project No. KD3116
Carried out for: Dublin City Council

Borehole **BH2**
Sheet 4 of 4

Borehole Log

GEOTECH

Drilled by MD Logged by JL Checked by MK	Start 07/06/2003 End 13/06/2003	Equipment, Methods and Remarks Dando 175 cable tool drill rig Relocated from BH3 due to obstruction. Hand dug inspection pit to 1.20m. Cable percussive boring to 35.50m. Borehole backfilled with grout.	Depth from / to / Diameter / Casing Depth 0.00m 16.00m 250mm 16.00m 16.00m 35.50m 200mm 35.50m	Ground Level +3.59 mOD Coordinates E 319938.91 National Grid N 233526.20

Samples and Tests / Strata

Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)	Legend	Backfill Instrument
0.00								
0.00-0.50	B 1				TARMAC pavement over roadstone (MADE GROUND)	0.30 +3.29		
0.50-1.00	B 2				Soft dark brown sandy gravelly CLAY and ASH FILL with occasional subrounded cobbles and fragments of brick, concrete and plastic. (MADE GROUND)			
1.20-1.65 1.20-1.70	SPT C B 3	N=40 (3,4/4,8,10,18)	1.20		1.20-1.70 m concrete cobbles and boulders			
2.00-2.45 2.00-2.50	SPT C B 4	N=37 (6,6/7,8,12,10)	2.00			(3.30)		
3.00-3.45 3.00-3.50	SPT C B 5	N=36 (5,7/7,8,9,12)	3.00					
3.60-4.05 3.60-4.00	SPT S B 6	N=8 (2,1/1,2,3,2)	3.60 07/06/2003 4.00	1800 3.30	Soft black sandy slightly gravelly CLAY FILL with fragments of concrete and ceramics and rare pockets of silty sand. (MADE GROUND).	3.60 -0.01		
4.00-4.50	B 7		08/06/2003 35.00	0800 3.20				
4.50-4.95 4.50-5.00	SPT S D 8	N=7 (2,2/2,2,1,2)	4.50			(1.60)		
5.20-5.65 5.20-5.70	SPT C B 9	N=12 (2,3/3,2,3,4)	5.20		Medium dense to dense dark grey sandy GRAVEL with occasional subrounded cobbles and shell fragments. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse. (ESTUARINE DEPOSIT).	5.20 -1.61		
6.00-6.45 6.00-6.50	SPT C B 10	N=26 (4,4/7,7,6,6)	6.00					
7.00-7.45 7.00-7.50	SPT C B 11	N=30 (3,3/6,6,8,10)	7.00					
8.00-8.45 8.00-8.50	SPT C B 12	N=30 (4,4/7,7,7,9)	8.00					
9.00-9.45 9.00-9.50	SPT C B 13	N=34 (6,6/7,8,8,11)	9.00					

Stratum continued next sheet

Depth	Type & No	Records	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.10	Rose to 3.30 m after 20 minutes. Slow ingress	-

Depth Related Remarks

From / to (m)

Chiselling

Depths (m)	Time	Tools used
1.80-2.10	90 mins	Chisel

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

Scale 1:50 (c) MESG HBM (G81), 30/10/2003 12:45:44 AGS

Project: Dublin Waste to Energy
Project No.: K03116
Carried out for: Dublin City Council

Borehole **BH3A**
Sheet 1 of 4

Borehole Log

GEOTECH

Drilled by	MD
Logged by	JL
Checked by	MK

Start 07/06/2003
End 13/06/2003

Equipment, Methods and Remarks

Depth from	to	Diameter	Casing Depth
0.00m	16.00m	250mm	16.00m
16.00m	35.50m	200mm	35.50m

Ground Level +3.59 mOD
Coordinates E 319936.91
National Grid N 233526.20

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
10.00-10.45 10.00-10.50	SPT C B 14	N=26 (4,4/8,5,5,8)	10.00	
11.00-11.45 11.00-11.50	SPT C B 15	N=22 (3,4/4,7,2,9)	11.00	
12.00-12.45 12.00-12.50	SPT C B 16	N=34 (4,4/4,8,8,14)	12.00	
			08/06/2003 13.00	1600 3.30
13.00-13.45 13.00-13.50	SPT C B 17	N=39 (6,6/8,8,10,13)	09/06/2003 13.00	0800 3.20
14.00-14.45 14.00-14.50	SPT C B 18	N=30 (5,4/5,6,8,11)	14.00	
			09/06/2003 14.00	1600 3.20
			10/06/2003 14.00	0800 3.20
15.00-15.33 15.00-15.50	SPT C B 19	55 (4,8/10,20,25 for 25mm)	15.00	
15.50-16.00	B 20			
16.00-16.40	SPT S	45 (5,6/9,12,17,8 for 25mm)	16.00	
			10/06/2003 17.00	1600 3.20
17.00-17.45 17.00-17.50	SPT S B 21	N=50 (6,8/8,10,14,18)	11/06/2003 17.00	0800 3.30
17.60-18.00	D 22			
18.00-18.45 18.00-18.50	SPT S B 23	N=28 (4,4/4,6,8,8)	18.00	
19.00-19.45 19.00-19.45	SPT S D 24	N=24 (3,3/4,6,7,7)	19.00	

Strata

Description	Depth,Level (Thickness)	Legend	Backfill/ Instrument
Medium dense to dense dark grey sandy GRAVEL with occasional subrounded cobbles and shell fragments. Sand is fine to medium. Gravel is subangular to subrounded fine to coarse. (ESTUARINE DEPOSIT).	(12.40)		
Stiff to very stiff grey brown slightly sandy CLAY. Sand is fine. (ESTUARINE DEPOSIT).	17.60 -14.01		
Stratum continued next sheet			

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.10	Rose to 3.30 m after 20 minutes. Slow ingress	-

Depth Related Remarks
From to (m)

Chiselling

Depths (m)	Time	Tools used
11.80 -11.95	30 mins	Chisel
12.60 -12.85	45 mins	Chisel

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

Scale 1:50

Project Dublin Waste to Energy
Project No. KD3116
Carried out for Dublin City Council

Borehole
BH3A
Sheet 2 of 4

Borehole Log

GEOTECH

Drilled by MD	Start 07/06/2003	Equipment, Methods and Remarks	Depth from	to	Diameter	Casing Depth	Ground Level	+3.59 mOD
Logged by JL	End 13/06/2003		0.00m	16.00m	250mm	16.00m	Coordinates	E 319936.91
Checked by MK			16.00m	35.50m	200mm	35.50m	National Grid	N 233526.20

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
20.00-20.45	SPT S	N=29 (2,3/8,6,7,8)	20.00	
20.00-20.45	D 25			
20.50-21.00	B 26			
21.00-21.45	SPT S	N=27 (4,4/6,6,7,8)	21.00	
21.00-21.45	D 27			
21.50-22.00	B 28			
22.00-22.45	SPT S	N=27 (3,4/4,7,7,9)	22.00	
22.00-22.45	D 29			
22.50-23.00	B 30			
23.00-23.45	SPT S	N=32 (4,4/4,6,9,11)	23.00	
23.00-23.45	D 31			
24.00-24.50	B 32			
24.50-24.95	SPT S	N=37 (4,3/7,9,9,12)	24.50	
24.50-24.95	D 33			
			11/06/2003	1800
			25.00	3.30
			12/06/2003	0800
			25.00	3.30
25.50-26.00	B 34			
26.00-26.45	SPT S	N=32 (3,4/4,6,8,12)	26.00	
26.00-26.45	D 35			
27.00-27.50	B 36			
27.50-27.95	SPT S	N=29 (4,4/6,6,7,10)	27.50	
27.50-27.95	D 37			
28.00-28.50	B 38			
29.00-29.45	SPT S	N=38 (3,7/7,8,10,13)	29.00	
29.00-29.45	D 39			

Strata

Description	Depth, Level (Thickness)	Legend	Backfill / Instrument
Stiff to very stiff grey brown slightly sandy CLAY. Sand is fine. (ESTUARINE DEPOSIT).	(17.90)		
Stratum continued next sheet			

Depth	Type & No	Records	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.10	Rose to 3.30 m after 20 minutes. Slow ingress	-

Depth Related Remarks

From to (m)

Chiselling

Depths (m) Time Tools used

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

Scale 1:50

Project: Dublin Waste to Energy
Project No.: KD3116
Carried out for: Dublin City Council

Borehole

BH3A

Sheet 3 of 4

Borehole Log

GEOTECH

Drilled by MD	Start 07/06/2003	Equipment, Methods and Remarks	Depth from	to	Diameter	Casing Depth	Ground Level	+3.59 mOD
Logged by JL	End 13/06/2003		0.00m	16.00m	250mm	16.00m	Coordinates	E 319936.91
Checked by MK			16.00m	35.50m	200mm	35.50m	National Grid	N 233526.20

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
30.00-30.50	B 40			
30.50-30.95 30.50-30.95	SPT S D 41	N=35 (4,4/6,8,11,12)	30.50	
32.00-32.45 32.00-32.45	SPT S D 42	N=35 (4,5/5,8,10,14)	32.00	
33.50-33.95 33.50-33.95	SPT S D 43	N=40 (3,6/6,10,12,12)	33.50	
34.50-35.00	B 44			
			12/06/2003 35.00	1800 3.30
35.00-35.45 35.00-35.45	SPT S D 45	N=48 (4,8/8,12,14,14)		
			13/06/2003 35.00 13/06/2003 35.50	0800 3.30 1200 3.30

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instrument
Stiff to very stiff grey brown slightly sandy CLAY. Sand is fine. (ESTUARINE DEPOSIT).			
EXPLORATORY HOLE ENDS AT 35.50 m	35.50 -31.91		

Depth	Type & No	Records	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.10	Rose to 3.30 m after 20 minutes. Slow ingress	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50

Project Dublin Waste to Energy
Project No. KD3116
Carried out for Dublin City Council

Borehole
BH3A
Sheet 4 of 4

Borehole Log

GEOTECH

Drilled by MD Logged by PG Checked by MK	Start 13/06/2003 End 17/06/2003	Equipment, Methods and Remarks Dando 175 cable tool drill rig. Hand dug inspection pit to 1.20m. Cable percussive drilling to 33.50m Installed 50mm diameter standpipe.	Depth from / to / Diameter / Casing Depth 0.00m 14.50m 250mm 14.50m 14.50m 33.50m 200mm 33.50m	Ground Level +3.49 mOD Coordinates E 319857.30 National Grid N 233620.06

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
0.00-0.50	B 1			
0.50-1.00	B 2			
1.00-1.45 1.00-1.50	SPT C B 3	N=12 (3,2/4,3,2,3)	1.00	
1.50-2.00	B 4			
2.00-2.45 2.00-2.50	SPT C B 5	N=26 (4,4/6,4,9,7)	2.00	
2.50-3.00	B 6			
3.00-3.45 3.00-3.50	SPT C B 7	N=24 (3,4/4,6,6,8)	3.00	
3.30	W 42			
4.00-4.45 4.00-4.50	SPT C B 8	N=11 (3,3/2,3,3,3)	4.00	
5.00-5.45 5.00-5.50	SPT C B 9	N=22 (4,4/4,5,5,8)	5.00	
6.00-6.45 6.00-6.50	SPT C B 10	N=21 (4,3/3,4,7,7)	6.00	
7.00-7.45 7.00-7.50	SPT C B 11	N=26 (3,4/4,6,8,8)	7.00	
8.00-8.45 8.00-8.50	SPT C B 12	N=26 (3,5/5,5,7,9)	8.00	
9.00-9.45 9.00-9.50	SPT C B 13	N=18 (3,3/4,4,4,6)	9.00	

Strata

Description	Depth, Level (Thickness)	Legend	Backfill Instrument
Hard standing GRAVEL (MADE GROUND)	0.10 +3.39		
Soft brown slightly sandy CLAY and GRAVEL FILL with fragments of brick, concrete and wood.(MADE GROUND)	(3.50)		
Medium to dense grey brown clayey sandy GRAVEL with abundant shell fragments. Gravel is angular to subrounded fine to coarse. (ESTUARINE DEPOSIT). 3.60-3.90 m Driller reports pushing boulder. 5.00-5.50 m Occassional tabular cobbles.	3.60 -0.12 (1.90)		
Medium dense grey sandy GRAVEL with some shell fragments. Sand is fine to medium. Gravel is subangular fine to medium. (ESTUARINE DEPOSIT).	5.50 -2.02		

Stratum continued next sheet

Depth	Type & No	Records	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	3.60	Rose to 3.30 m after 20 minutes. Slow inflow	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50 (c) MESG HBM (2.1), 30/10/2003 12:46:08 AGS

Project: Dublin Waste to Energy
Project No.: KD3116
Carried out for: Dublin City Council

Borehole **BH4**
Sheet 1 of 4

Borehole Log

GEOTECH

Drilled by MD Logged by PG Checked by MK	Start 13/06/2003 End 17/06/2003	Equipment, Methods and Remarks	Depth from / to / Diameter / Casing Depth 0.00m 14.50m 250mm 14.50m 14.50m 33.50m 200mm 33.50m	Ground Level +3.49 mOD Coordinates E 319857.30 National Grid N 233620.06

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
10.00-10.38 *10.00-10.50*	SPT C *B 14*	N=15 (3 for 60mm/3,3,4,5)	10.00	
			14/06/2003 11.00	1800 3.30
11.00-11.45 11.00-11.50	SPT C B 15	N=22 (3,4/4,6,5,7)	15/06/2003 11.00	0800 3.30
12.00-12.45 12.00-12.50	SPT C B 16	N=21 (4,4/4,6,5,6)	12.00	
13.00-13.45 13.00-13.50	SPT C B 17	N=28 (3,5/5,7,7,9)	13.00	
14.00-14.45 14.00-14.50	SPT C B 18	N=36 (4,4/6,8,10,12)	14.00	
15.00-15.45 15.00-15.50	SPT C B 19	N=33 (4,6/6,8,8,11)	15.00	
16.00-16.45 16.00-16.50	SPT C B 20	N=29 (5,5/6,7,7,9)	16.00	
17.00-17.45 17.00-17.50	SPT C B 21	N=29 (6,6/5,4,8,12)	17.00	
18.00-18.45 18.00-18.50	SPT C B 22	N=41 (4,4/8,9,10,14)	18.00	
18.85-18.90	D 23			
19.00-19.45	*SPT S*	N=12 (2,3/3,2,3,4)	19.00	
19.50-20.00	*B 24*			
			15/06/2003 20.00	1800 3.30

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
Medium dense grey sandy GRAVEL with some shell fragments. Sand is fine to medium. Gravel is subangular fine to medium. (ESTUARINE DEPOSIT).	(13.35)		
Firm to very stiff dark grey brown slightly sandy CLAY. Sand is fine. (ESTUARINE DEPOSIT).	18.85 *-15.36*		

Stratum continued next sheet

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Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	3.60	Rose to 3.30 m after 20 minutes. Slow inflow	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50 (c) MESC HSR (201). 30/10/2003 12:46:11 AGS

Project: Dublin Waste to Energy
Project No.: KD3116
Carried out for: Dublin City Council

Borehole **BH4**

Borehole Log

GEOTECH

Drilled by MD Logged by PG Checked by MK	Start 13/06/2003 End 17/06/2003	Equipment, Methods and Remarks	Depth from / to / Diameter / Casing Depth 0.00m / 14.50m / 250mm / 14.50m 14.50m / 33.50m / 200mm / 33.50m	Ground Level +3.49 mOD Coordinates E 319857.30 National Grid N 233620.06

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
20.00-20.20 20.00-20.50	SPT S B 25	25 (12,25/25 for 50mm)	16/06/2003 20.00	0800 3.00
21.00-21.45 21.00-21.45	SPT S D 26	N=20 (3,3/4,4,6,6)	21.00	
22.00-22.50	B 27			
23.50-23.95 23.50-23.95 23.50-24.00	SPT S D 28 B 29	N=24 (4,4/4,6,8,6)	23.50	
24.00-24.45 24.00-24.45	SPT S D 30	N=38 (5,7/7,9,10,12)	24.00	
25.00-25.50	B 31			
25.50-25.95 25.50-25.95	SPT S D 32	N=39 (6,8/8,8,10,13)	25.50	
26.50-27.00	B 33			
27.00-27.45 27.00-27.45	SPT S D 34	N=42 (5,7/7,10,11,14)	27.00	
28.00-28.50	B 35			
28.50-28.95 28.50-28.95	SPT S D 36	N=47 (6,8/9,9,14,15)	28.50	
			16/06/2003 30.00	1800 3.00

Depth	Type & No	Records	Date Casing	Time Water

Strata

Description	Depth, Level (Thickness)	Legend	Backfill / Instrumen
Firm to very stiff dark grey brown slightly sandy CLAY. Sand is fine. (ESTUARINE DEPOSIT).	(14.62)		
Stratum continued next sheet			

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	3.60	Rose to 3.30 m after 20 minutes. Slow inflow	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50

Project: Dublin Waste to Energy
Project No.: KD3116
Carried out for: Dublin City Council

Borehole
BH4
Sheet 3 of 4

Borehole Log

GEOTECH

Drilled by	MD
Logged by	PG
Checked by	MK

Start 13/06/2003
End 17/06/2003

Equipment, Methods and Remarks

Depth from	to	Diameter	Casing Depth
0.00m	14.50m	250mm	14.50m
14.50m	33.50m	200mm	33.50m

Ground Level	+3.49 mOD
Coordinates	E 319857.30
National Grid	N 239620.06

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
30.00-30.45	SPT S	N=49 (5,8/10,10,13,15)	17/06/2003	0800
30.00-30.45	D 37		30.00	3.00
31.00-31.50	B 38			
31.50-31.95	SPT S	N=53 (6,8/11,13,14,15)	31.50	
31.50-31.95	D 39			
32.50-33.00	B 40			
33.00-33.45	SPT S	N=48 (7,7/10,12,12,14)	33.00	
33.00-33.45	D 41			
			17/06/2003	1800
			33.50	3.00

Strata

Description	Depth,Level/ (Thickness)	Legend	Backfill/ Instrument
Firm to very stiff dark grey brown slightly sandy CLAY. Sand is fine. (ESTUARINE DEPOSIT).			
EXPLORATORY HOLE ENDS AT 33.50 m	33.50 -30.01		

Depth	Type & No	Records	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	3.60	Rose to 3.30 m after 20 minutes. Slow inflow	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50

Project	Dublin Waste to Energy
Project No.	KD3116
Carried out for	Dublin City Council

Borehole
BH4
Sheet 4 of 4

Borehole Log

GEOTECH

Drilled by MD Logged by PG Checked by MK	Start 18/06/2003 End 27/06/2003	Equipment, Methods and Remarks Dando 175 cable tool drill rig. Hand dug inspection pit to 1.20m Cable percussive boring to 34.50m Installed 50mm standpipe	Depth from / to / Diameter / Casing Depth 0.00m 14.50m 250mm 14.50m 14.50m 34.50m 200mm 34.50m	Ground Level +4.38 mOD Coordinates E 319914.98 National Grid N 233683.89	

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
0.00 0.00-0.50	B 1			
0.50-1.00	B 2			
1.20-1.65 1.20-1.70	SPT C B 3	N=42 (3,6/6,8,10,18)	1.20	
2.00-2.50	B 4			
2.50-2.78 2.50-3.00	SPT C B 5	50 (6,18/25,25 for 55mm)	2.50	
3.50-3.71 3.50-4.00	SPT C B 6	25 (10,25/25 for 60mm)	3.50	
			18/06/2003 4.00	1800
3.90 4.00-4.50	W 39 B 7			
			24/06/2003 4.00	0800 3.90
4.50-4.75 4.50-5.00	SPT C B 8	50 (3,20/25,25 for 20mm)	4.50	
5.00-5.50	B 9			
5.50-5.95 5.50-6.00	SPT C B 10	N=21 (4,4/4,6,5,6)	5.50	
6.00-6.50	B 11			
6.50-6.95 6.50-7.00	SPT C B 12	N=22 (3,4/4,4,7,7)	6.50	
7.50-7.95 7.50-8.00	SPT C B 13	N=26 (3,4/4,7,7,8)	7.50	
8.50-8.95 8.50-9.00	SPT C B 14	N=23 (3,4/5,5,5,8)	8.50	
9.50-9.95 9.50-10.00	SPT C B 15	N=28 (4,4/6,6,6,10)	9.50	
			24/06/2003 10.00	1800 5.60

Strata

Description	Depth, Level (Thickness)	Legend	Backfill / Instrumentation
Soft brown sandy CLAY and GRAVEL FILL with occasional cobbles and abundant fragments of metal, brick, wood, concrete. Slight hydrocarbon odour detected. (MADE GROUND)	(5.00)		
Medium dense grey sandy GRAVEL with abundant shell fragments and occasional subrounded cobbles. Sand is fine to medium. Gravel is angular to rounded fine to coarse. (ESTUARINE DEPOSIT).	5.00 -0.62		
Stratum continued next sheet			

Depth	Type & No	Records	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.10	Rose to 3.90 m after 15 minutes. slow inflow	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50 (c) MESC HBM (281), 30/10/2003 12:46:32 AGS

Project Dublin Waste to Energy
Project No. KD3116
Carried out for Dublin City Council

Borehole
BH5
Sheet 1 of 4

Borehole Log

GEOTECH

Drilled by MD	Start 18/06/2003	Equipment, Methods and Remarks	Depth from	to	Diameter	Casing Depth	Ground Level	+4.38 mOD
Logged by PG	End 27/06/2003		0.00m	14.50m	250mm	14.50m	Coordinates	E 319914.98
Checked by MK			14.50m	34.50m	200mm	34.50m	National Grid	N 233683.89

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
			25/06/2003	0800
			10.00	3.90
10.50-10.95	SPT C	N=22 (2,3/4,4,7,7)	10.50	
10.50-11.00	B 16			
11.50-11.95	SPT C	N=20 (1,2/4,4,6,6)	11.50	
11.50-12.00	B 17			
12.50-12.95	SPT C	N=27 (3,3/4,7,8,8)	12.50	
12.50-13.00	B 18			
13.50-13.95	SPT C	N=26 (4,4/4,7,7,10)	13.50	
13.50-14.00	B 19			
14.50-14.95	SPT C	N=26 (4,5/5,6,6,9)	14.50	
14.50-15.00	B 20			
15.50-15.95	SPT C	N=33 (4,4/8,7,8,10)	15.50	
15.50-16.00	B 21			
16.50-16.95	SPT C	N=31 (5,4/4,8,8,11)	16.50	
16.50-17.00	B 22			
			25/06/2003	1800
			17.00	3.90
			26/06/2003	0800
			17.00	4.00
17.50-17.95	SPT C	N=18 (3,4/4,4,5,5)	17.50	
17.50-18.00	B 23			
18.50-18.95	SPT C	N=23 (4,4/5,6,6,6)	18.50	
18.50-19.00	B 24			
19.10	D 25			
19.50-19.95	SPT S	N=12 (1,2/2,3,3,4)	19.50	
19.50-20.00	B 26			

Strata

Description	Depth,Level/ (Thickness)	Legend	Backfill/ Instruments
Medium dense grey sandy GRAVEL with abundant shell fragments and occasional subrounded cobbles. Sand is fine to medium. Gravel is angular to rounded fine to coarse. (ESTUARINE DEPOSIT).	(14.10)	SP	
Firm to very stiff dark grey brown slightly sandy CLAY. Sand is fine. (ESTUARINE DEPOSIT). 19.10-20.00 m slightly gravelly	19.10 -14.72		
Stratum continued next sheet			

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.10	Rose to 3.90 m after 15 minutes. slow inflow	-

Depth Related Remarks

From to (m)

Chiselling

Depths (m) Time Tools used

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

Scale 1:50

Project: Dublin Waste to Energy
Project No.: KD3116
Carried out for: Dublin City Council

Borehole

BH5

Sheet 2 of 4

Borehole Log

GEOTECH

Drilled by MD Logged by PG Checked by MK	Start 18/06/2003 End 27/06/2003	Equipment, Methods and Remarks	Depth from / to / Diameter / Casing Depth 0.00m / 14.50m / 250mm / 14.50m 14.50m / 34.50m / 200mm / 34.50m	Ground Level +4.38 mOD Coordinates E 319914.96 National Grid N 233683.89

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
20.00	D 27			
20.50-20.95 20.50-20.95	SPT S D 28	N=23 (3,4/4,6,6,7)	20.50	
21.50-21.95 21.50-22.00	SPT S B 29	N=36 (4,5/8,8,10,10)	21.50	
22.50-22.95 22.50-23.00	SPT S B 30	N=29 (4,4/6,7,7,9)	22.50	
23.50-23.95 23.50-24.00	SPT S B 31	N=22 (3,3/4,4,6,8)	23.50	
24.50-24.95 24.50-25.00	SPT S B 32	N=30 (4,4/7,7,7,9)	24.50	
			26/06/2003 25.00	1600 8.00
			27/06/2003 25.00	0600 3.90
26.00-26.45 26.00-26.50	SPT S B 33	N=30 (3,4/5,7,7,11)	26.00	
27.50-27.95 27.50-28.00	SPT S B 34	N=31 (3,4/4,8,7,12)	27.50	
29.00-29.45 29.00-29.50	SPT S B 35	N=35 (4,4/7,7,10,11)	29.50	

Strata

Description	Depth, Level (Thickness)	Legend	Backfill / Instrumer
Firm to very stiff dark grey brown slightly sandy CLAY. Sand is fine. (ESTUARINE DEPOSIT).	(14.90)		
22.10-23.00 m slightly gravelly			
Stratum continued next sheet			

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.10	Rose to 3.90 m after 15 minutes. slow inflow	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50

Project: Dublin Waste to Energy
Project No.: KD3116
Carried out for: Dublin City Council

Borehole
BH5
Sheet 3 of 4

Borehole Log

GEOTECH

Drilled by MD	Start 18/06/2003	Equipment, Methods and Remarks	Depth from	to	Diameter	Casing Depth	Ground Level	+4.38 mOD
Logged by PG	End 27/06/2003		0.00m	14.50m	250mm	14.50m	Coordinates	E 319914.98
Checked by MK			14.50m	34.50m	200mm	34.50m	National Grid	N 233683.89

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
30.50-30.95 30.50-31.00	SPT S B 36	N=34 (4,5/6,8,8,12)	30.50	
32.00-32.45 32.00-32.50	SPT S B 37	N=43 (6,6/8,9,12,14)	32.00	
33.50-33.95 33.50-34.00	SPT S B 38	N=49 (7,8/8,13,14,14)	33.50	
			27/06/2003 34.00	1800 3.90

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instrument
Firm to very stiff dark grey brown slightly sandy CLAY. Sand is fine. (ESTUARINE DEPOSIT).			
EXPLORATORY HOLE ENDS AT 34.00 m	34.00 -29.62		

Depth	Type & No	Records	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.10	Rose to 3.90 m after 15 minutes. slow inflow	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50

Project: Dublin Waste to Energy
Project No.: KD3116
Carried out for: Dublin City Council

Borehole
BH5
Sheet 4 of 4

Borehole Log

GEOTECH

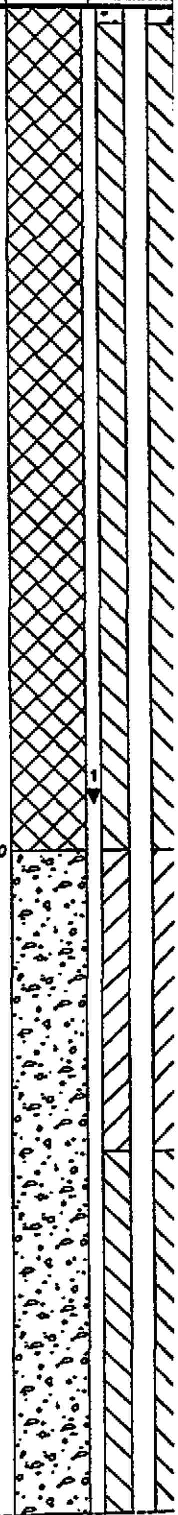
Drilled by MN Logged by PG Checked by MK	Start 16/05/2003 End 20/05/2003	**Equipment, Methods and Remarks** Casagrande C6 rotary drill rig Hand dug inspection pit to 1.20m. Rotary open hole drilling to 33.00m Rotary coring to 40.20m. Installed 50mm standpipe.	Ground Level +3.91 mOD Coordinates E 319822.62 National Grid N 233458.92

Depth from	to	Diameter	Casing Depth
0.00m	26.70m	131mm	26.70m
26.70m	33.00m	120mm	33.00m
33.00m	40.20m	76mm	35.90m

Samples and Tests / Strata

Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)
					Driller reports black waste FILL with strong hydrocarbon (oily) odour.	(5.60)
5.70-6.15	SPT C	N=19 (2,3/5,4,4,6)	5.70		Driller reports SAND and GRAVEL.	5.60 -1.70
7.20-7.65	SPT C	N=21 (4,3/4,5,5,7)	7.20			
8.70-9.15	SPT C	N=17 (2,2/3,2,5,7)	8.70			

Stratum continued next sheet



Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	5.20	-	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50 (c) MESG HBM (BR1), 30/10/2003 12:47:24 AGS

Project: Dublin Waste to Energy
Project No. KD3116
Carried out for: Dublin City Council

Borehole **BR6**
Sheet 1 of 5

Borehole Log

GEOTECH

Drilled by	MN
Logged by	PG
Checked by	MK

Start	16/05/2003
End	20/05/2003

Equipment, Methods and Remarks

Depth from	to	Diameter	Casing Depth
0.00m	26.70m	131mm	26.70m
26.70m	33.00m	120mm	33.00m
33.00m	40.20m	76mm	35.90m

Ground Level	+3.91 mOD
Coordinates	E 319822.62
National Grid	N 233458.92

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
10.20-10.65	SPT C	N=23 (3,4/5,5,7,6)	10.20	
11.70-12.15	SPT C	N=33 (5,7/7,8,9,9)	11.70	
13.20-13.59	SPT C	28 (4,5/6,7,8,7 for 13mm) Flush: 0.00-26.70 Air (foam, 100 %	13.20	
14.70-15.15	SPT C	N=27 (2,2/3,7,7,10)	14.70	
16.20-16.65	SPT C	N=33 (6,7/7,8,9,9)	16.20	
			16/05/2003	1815
17.70-18.15	SPT C	N=29 (9,9/8,7,7,7)	17.70	7.80
			17/05/2003	0800
			17.70	4.70
19.20-19.65	SPT C	N=41 (6,7/9,10,11,11)	19.20	

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instrument
Driller reports SAND and GRAVEL.	(10.70)		
Driller reports sandy SILT	16.30 -12.39		
Stratum continued next sheet			

Depth	Type & No	Records	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	5.20	-	-

Depth Related Remarks

From to (m)

Chiselling

Depths (m) Time Tools used

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

Scale 1:50

Project	Dublin Waste to Energy
Project No.	KD3116
Carried out for	Dublin City Council

Borehole

BR6

Sheet 2 of 5

Borehole Log

GEOTECH

Drilled by MN Logged by PG Checked by MK	Start 16/05/2003 End 20/05/2003	Equipment, Methods and Remarks	Depth from / to / Diameter / Casing Depth 0.00m 26.70m 131mm 26.70m 26.70m 33.00m 120mm 33.00m 33.00m 40.20m 76mm 35.90m	Ground Level +3.91 mOD Coordinates E 319822.62 National Grid N 233458.92

Samples and Tests / Strata

Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)
					Driller reports sandy SILT	
20.70-21.15	SPT C	N=39 (10,7/9,9,10,11)	20.70			
						(10.40)
22.20-22.65	SPT S	N=25 (4,4/5,6,7,7)	22.20			
23.70-24.15	SPT S	N=23 (4,5/5,6,5,7)	23.70			
25.20-25.65	SPT S	N=26 (5,5/6,6,7,7)	25.20			
			17/05/2003 26.70	1800 22.00		
26.70-27.15	SPT S	N=27 (4,5/7,7,6,7)	18/05/2003 26.70	0800 4.75	Driller reports SILT/CLAY	26.70 -22.79
28.20-28.65	SPT S	N=29 (4,6/7,7,8,7)	26.70			
29.70-30.15	SPT S	N=30 (4,7/7,7,8,8)	26.70			(6.00)

Stratum continued next sheet

Depth	Type & No	Records	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	5.20	-	-

Depth Related Remarks From to (m)

Chiselling Depths (m) Time Tools used

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

Scale 1:50 (c) MESG NBW (28T), 30/10/2003 12:47:30 AGS

Project: Dublin Waste to Energy
Project No.: KD3116
Carried out for: Dublin City Council

Borehole **BR6**

Borehole Log

GEOTECH

Drilled by MN Logged by PG Checked by MK	Start 16/05/2003 End 20/05/2003	Equipment, Methods and Remarks	Depth from / to / Diameter / Casing Depth 0.00m 26.70m 131mm 26.70m 26.70m 33.00m 120mm 33.00m 33.00m 40.20m 76mm 35.90m	Ground Level +3.91 mOD Coordinates E 319822.62 National Grid N 233458.92

Samples and Tests

Depth	Type & No	Records	Date	Casing	Time	Water
31.20-31.65	SPT C	N=28 (5,6/6,7,7,8)		26.70		
32.70-32.88	SPT C	50 (20,5 for 0mm/ 25,22 for 25mm)	18/05/2003	32.70 33.00	1730	0.00
			19/05/2003	33.00	0740	4.90
33.00-33.75 m	67 / 0 / 0	Flush: 26.70-40.20 Water, 100 %				
33.75-34.05 m		TCR 60, SCR 0, RQD 0				
34.05-34.60 m	64 / 0 / 0					
34.60-34.70 m	NI	TCR 100, SCR 0, RQD 0				
34.70-34.74 m	NI / NI	TCR 100, SCR 0, RQD 0				
34.74-35.40 m	100 / 0 / 0					
35.40-35.90 m	26 / 0 / 0					
35.90-36.34 m	136 / 0 / 0					
36.34-37.40 m	100 / 69 / 63	NI 110 340				
37.40-37.88 m	100 / 65 / 0	NI 95 120				
37.88-38.70 m	100 / 65 / 50	NI 85 320				
38.70-39.63 m	100 / 59 / 32	If NI/100/100	19/05/2003	35.90	1830	8.60
39.63-40.20 m	100 / 75 / 40	NI 50 250	20/05/2003	35.90	0730	4.35
Depth	TCR SCR RQD	If	Records/Samples	Date Casing	Time	Water

Strata

Description	Depth, Level (Thickness)
Driller reports SILT/CLAY	
Driller reports clayey GRAVEL (possible weathered rockhead) Core recovered as dark grey angular to subrounded GRAVEL and COBBLES of limestone with some dark brown silt/clay.	32.70 -28.79 (3.34)
Core recovered as very stiff dark grey to black slightly sandy gravelly CLAY. Gravel is angular to subangular, fine to medium.	36.04 -32.13 (0.30)
Strong to very strong grey fine-grained LIMESTONE with rare calcite veins. Joints are closely spaced, 20 to 45° dip, and planar rough. Weathering includes slight clay infill along fracture planes and zones of non-intact core reduced to angular to subangular gravel.	36.34 -32.43 (1.16)
Moderately strong to strong dark grey to black fine-grained MUDSTONE. Joints are closely spaced, 45 to 60° dip, and planar rough. Weathering includes zones of weak core.	37.50 -33.59 (0.38)
Strong grey fine-grained LIMESTONE. Joints are closely to very closely spaced, 30 to 45° dip, and planar rough. Weathering includes zones of weak core and slight orange discoloration along fracture planes.	37.88 -33.97 (1.42)
	39.30 -35.39
	39.53 -35.62 (0.67)
Stratum continued next sheet	

- 35.40-35.77 m AZCL
- 37.24-37.34 m non-intact
- 38.00-38.15 m very weak core
- 39.05-39.30 m very weak core
- 39.30-39.43 m non-intact
- 39.63-39.73 m non-intact

Legend | Backfill/Instruments

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	5.20	-	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50 (c) MESG HBB (28/1) 30/10/2003 12:47:33 AGS

Project: Dublin Waste to Energy
Project No. KD3116
Carried out for: Dublin City Council

Borehole **BR6**
Sheet 4 of 5

Borehole Log

GEOTECH

Drilled by MN Logged by PG Checked by MK	Start 16/05/2003 End 20/05/2003	Equipment, Methods and Remarks	Depth from / to / Diameter / Casing Depth 0.00m 26.70m 131mm 26.70m 26.70m 33.00m 120mm 33.00m 33.00m 40.20m 76mm 35.90m	Ground Level +3.91 mOD Coordinates E 319822.62 National Grid N 233458.92

Samples and Tests / Strata

Depth	TCR SCR RQD	If	Records/Samples	Date Casing	Time Water	Description	Depth, Level (Thickness)	Legend	Backfill Instrument
				20/05/2003 35.90		39.30m - 39.53m : Moderately weak to moderatley strong dark grey to black fine-grained MUDSTONE. Joints are subhorizontal. Weathering includes core reduced to gravel and core wall and fracture planes coated in stiff black slightly gravelly clay.			
						39.53m - 40.20m : Strong to very strong grey fine-grained LIMESTONE. Joints are very closely to closely spaced, 20 to 30° dip, and undulating rough. No visible weathering.	40.20 -36.29		SP
						EXPLORATORY HOLE ENDS AT 40.20 m			

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

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	5.20	-	-

Depth Related Remarks

From to (m)

Chiselling

Depths (m) Time Tools used

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

Scale 1:50

(c) MESG HBM (261), 30/10/2003 12:47:39 AGS

Project	Dublin Waste to Energy
Project No.	KD3116
Carried out for	Dublin City Council

Borehole **BR6**

Borehole Log

GEOTECH

Drilled by MN Logged by PG Checked by MK	Start 20/05/2003 End 23/05/2003	Equipment, Methods and Remarks Casagrande C6 rotary rig Relocated 1.00m from BH7 due to mechanical failure. Hand dug inspection pit to 1.20m. Rotary open hole drilling to 36.40m. Rotary coring to 40.20m	Depth from / to / Diameter / Casing Depth 0.00m 22.20m 131mm 22.20m 22.00m 36.40m 120mm 36.40m 36.40m 40.20m 76mm	Ground Level +3.66 mOD Coordinates E 319919.19 National Grid N 233463.25

Samples and Tests / Strata

Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)
					TARMAC pavement over GRAVEL FILL (MADE GROUND)	(1.20)
						1.20 +2.46
1.50-1.95	SPT S	N=3 (1,1/0,1,1,1)	1.50	dry	Driller reports black CLAY FILL and waste material with hydrocarbon (oil) odors. (MADE GROUND)	
3.60-4.05	SPT C	N=17 (2,3/3,4,5,5)	1.80	dry		(4.10)
5.10-5.55	SPT C	N=24 (3,6/6,5,6,7)	3.60			
						5.30 -1.64
					Driller reports silty sandy GRAVEL.	
6.60-7.05	SPT C	N=28 (4,4/7,7,6,8)	5.10			
8.10-8.55	SPT C	N=31 (7,7/6,8,8,9)	7.00			
9.60-10.05	SPT C	N=31 (7,7/6,8,8,9)	7.00		Stratum continued next sheet	

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.30	-	-

Depth Related Remarks: From / to (m)

Chiselling: Depths (m) / Time / Tools used

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

Scale 1:50

(c) MESG HBW (261), 30/10/2003 12:47:58 AGS

Project: Dublin Waste to Energy
Project No. KD3116
Carried out for: Dublin City Council

Borehole **BR7A**
Sheet 1 of 5

Borehole Log

GEOTECH

Drilled by	MN
Logged by	PG
Checked by	MK

Start 20/05/2003
End 23/05/2003

Equipment, Methods and Remarks

Depth from	to	Diameter	Casing Depth
0.00m	22.20m	131mm	22.20m
22.00m	36.40m	120mm	36.40m
36.40m	40.20m	76mm	

Ground Level +3.65 mOD
Coordinates E 319919.19
National Grid N 233463.25

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
11.10-11.55	SPT C	N=50 (12,11/15,10,11,14)	10.00	
12.60-13.05	SPT C	N=40 (6,9/9,10,10,11)	12.60	
14.10-14.55	SPT C	N=35 (7,8/7,8,10,10)	14.10	
16.60-17.05	SPT C	N=51 (4,8/11,12,14,14)	20/05/2003 16.60	1840 3.20
			21/05/0200 16.60	0730 4.00
18.20-18.65 18.20	SPT S D 1	N=39 (7,6/8,10,10,11)	18.20	
19.60-19.91 19.60	SPT S D 2	50 (3,9/14,21,15 for 10mm)	19.60	

Strata

Description	Depth,Level (Thickness)	Legend	Backfill Instrume
Driller reports silty sandy GRAVEL.	(11.30)		
Dense grey fine SAND. Driller reports SAND and GRAVEL	16.60 -12.94 (2.60)		
Very stiff dark grey brown slightly sandy CLAY.	19.20 -15.54		
Stratum continued next sheet			

Depth	Type & No	Records	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.30	-	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50

Project Dublin Waste to Energy
Project No. KD3116
Carried out for Dublin City Council

Borehole
BR7A
Sheet 2 of 5

Borehole Log

GEOTECH

Drilled by MN	Start 20/05/2003	Equipment, Methods and Remarks	Depth from	to	Diameter	Casing Depth	Ground Level	+3.66 mOD
Logged by PG	End 23/05/2003		0.00m	22.20m	131mm	22.20m	Coordinates	E 319919.19
Checked by MK			22.00m	36.40m	120mm	36.40m	National Grid	N 233463.25
			36.40m	40.20m	76mm			

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
21.20-21.65	SPT C	N=37 (4,7/8,8,9,12)	21.20	
22.60-23.05 22.60	SPT S D 3	N=28 (9,8/6,7,7,8)	22.20	
24.20-24.58 24.20	SPT S D 4	50 (14,11/14,18,18,- for 0mm)	24.20	
25.60-26.05 25.60	SPT S D 5	N=49 (7,8/11,12,13,13)	25.60	
27.20-27.60 27.20	SPT S D 6	50 (5,7/11,12,16,11 for 20mm)	27.20	
		Flush: 22.20-33.20 Water, 100 %		
28.60-29.05 28.60	SPT S D 7	N=28 (5,5/7,8,7,8)	28.60	

Strata

Description	Depth,Level/ (Thickness)	Legend	Backfill/ Instruments
Very stiff dark grey brown slightly sandy CLAY.	(15.20)		
Stratum continued next sheet			

Depth	Type & No	Records	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.30	-	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50

Project: Dublin Waste to Energy
Project No.: KD3116
Carried out for: Dublin City Council

Borehole: **BR7A**
Sheet 3 of 5

Borehole Log

GEOTECH

Drilled by	MN
Logged by	PG
Checked by	MK

Start 20/05/2003
End 23/05/2003

Equipment, Methods and Remarks

Depth from	to	Diameter	Casing Depth
0.00m	22.20m	131mm	22.20m
22.00m	36.40m	120mm	36.40m
36.40m	40.20m	76mm	

Ground Level +3.66 mOD
Coordinates E 319919.19
National Grid N 233463.25

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
30.20-30.65	SPT S	N=38 (5,6/8,8,11,11)	30.20	
31.60-32.05 31.60	SPT C D 8	N=33 (5,6/7,8,9,9)	31.60	
33.20-33.65	SPT C	N=43 (7,8/10,10,11,12)	21/05/2003 33.20 ~~33.20~~ 22/05/2003 33.20	1600 6.25 0730 3.85
34.60-34.78	SPT C	50 (18,7/50 for 25mm)	34.60	
36.40-36.66 m		TCR 100, SCR 35, RQD 0		
36.66-36.76 m	NI 70 112	TCR 100, SCR 0, RQD 0 TCR 100, SCR 68, RQD 39		
36.76-37.04 m			22/05/2003 36.40	1800 1.60
37.04-37.08 m		TCR 100, SCR 0, RQD 0		
37.08-37.25 m		TCR 100, SCR 47, RQD 9	23/05/2003 36.40	0745 4.00
37.25-37.35 m		TCR 100, SCR 40, RQD 0		
37.35-38.10 m	100 71 59			
38.10-38.90 m	100 81 56 NI 130 250			
38.90-40.20 m	100 92 82			

Strata

Description	Depth, Level (Thickness)	Legend	Backfill / Instrumentation
Very stiff dark grey brown slightly sandy CLAY.			
Driller reports gravel, boulders and clay bands. (possible weathered rockhead).	34.40 -30.74 (2.00)		
Recovered core is predominantly non-intact: strong to very strong gravel and cobbles of LIMESTONE. Weathering includes rock mass reduced to subangular medium gravel with soft brown binding clay at NI zones. Clay coating rock surfaces 0 to 45° and sub-horizontal 30° dip; undulating and rough.	36.40 -32.74 (0.85)		
Strong to very strong grey to dark grey LIMESTONE with occasional calcite veins (thickness varying from 1mm to 15mm).	37.25 -33.59 (2.95)		
Joints are closely to medium spaced, 30 to 40° dip, planar and rough. Weathering includes zones of rock mass reduced to soft to firm brown clay, with stiff brown slightly gravelly clay infill along fracture planes at 37.80m to 37.90m. Rare subvertical fractures at calcite veins between 38.39 to 38.49m.			

36.40-36.45 m Stiff brown slightly gravelly clay bands

37.75-37.90 m NI

38.46-38.56 m non-intact

39.04-40.04 m very weak rock with calcite veins

Stratum continued next sheet

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

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.30	-	-

Depth Related Remarks

From to (m)

Chiselling

Depths (m) Time Tools used

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

Scale 1:50

AGS

Project Dublin Waste to Energy
Project No. KD3116
Carried out for Dublin City Council

Borehole
BR7A
Sheet 4 of 5

Borehole Log

GEOTECH

Drilled by MN Logged by PG Checked by MK	Start 20/05/2003 End 23/05/2003	Equipment, Methods and Remarks	Ground Level +3.66 mOD Coordinates E 319919.19 National Grid N 233463.25

Depth from	to	Diameter	Casing Depth
0.00m	22.20m	131mm	22.20m
22.00m	36.40m	120mm	36.40m
36.40m	40.20m	76mm	

Samples and Tests

Depth	TCR SCR RQD	If	Records/Samples	Date Casing	Time Water
				23/05/2003 36.40	1800 8.36

Strata

Description	Depth, *Level* (Thickness)	Legend	Backfill/ Instruments
Strong to very strong grey to dark grey LIMESTONE with occasional calcite veins (thickness varying from 1mm to 15mm). Joints are closely to medium spaced, 30 to 40° dip, planar and rough. Weathering includes zones of rock mass reduced to soft to firm brown clay, with stiff brown slightly gravelly clay infill along fracture planes at 37.80m to 37.90m. Rare subvertical fractures at calcite veins between 38.39 to 38.49m.	40.20 *-36.54*		

EXPLORATORY HOLE ENDS AT 40.20 m

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

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.30	-	-

Depth Related Remarks

From	to (m)

Chiselling

Depths (m)	Time	Tools used

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

Scale 1:50 (c) MESG HBG (281), 30/10/2003 12:48:08 AGS

Project	Dublin Waste to Energy
Project No.	KD3116
Carried out for	Dublin City Council

Borehole

BR7A

Borehole Log

GEOTECH

Drilled by	MN
Logged by	PG
Checked by	MK

Start 24/05/2003
End 28/05/2003

Equipment, Methods and Remarks
Casagrande C8 rotary drill rig
Hand dug inspection pit to 1.20m
Rotary open hole drilling to 39.0m
Rotary coring to 46.50m
Installed 50mm diameter standpipe with stand up cover

Depth from	to	Diameter	Casing Depth
0.00m	20.70m	131mm	20.70m
20.70m	39.80m	120mm	39.80m
39.80m	46.50m	76mm	41.20m

Ground Level +3.95 mOD
Coordinates E 319963.53
National Grid N 233492.81

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
1.50-1.61	SPT C	(25,50 for 35mm)	1.50	dry
2.60-3.05	SPT C	N=46 (5,1/1,4,2,39)	2.60	dry
4.20-4.60	SPT C	50 (7,7/14,13,13,10 for 20mm)	4.20	3.80
5.70-5.99	SPT C	50 (5,7/25,25 for 65mm)	5.70	
7.20-7.65	SPT C	N=40 (5,6/9,10,10,11)	7.20	
8.70-9.15	SPT C	N=24 (2,3/4,5,5,9)	8.70	

Strata

Description	Depth, Level (Thickness)	Legend	Backfill / Instrumentation
Driller reports FILL material with concrete, rubble and bricks. (MADE GROUND)	(2.30)		
Driller reports clayey GRAVEL.	2.30 +1.65		
	(1.40)		
Driller reports light grey SAND and GRAVEL.	3.70 +0.25		1
	(0.50)		
Driller reports grey blue CLAY/SILT	4.20 -0.25		
	(2.50)		
Driller reports grey SAND.	6.70 -2.75		
	(0.50)		
Driller reports coarse GRAVEL.	7.20 -3.25		
	(1.50)		
Driller reports GRAVEL with clay bands.	8.70 -4.75		
Stratum continued next sheet			

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	3.80	-	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50

Project Dublin Waste to Energy
Project No. KD3116
Carried out for Dublin City Council

Borehole
BR8
Sheet 1 of 5

Borehole Log

GEOTECH

Drilled by	MN
Logged by	PG
Checked by	MK

Start 24/05/2003
End 28/05/2003

Equipment, Methods and Remarks

Depth from	to	Diameter	Casing Depth
0.00m	20.70m	131mm	20.70m
20.70m	39.80m	120mm	39.80m
39.80m	46.50m	76mm	41.20m

Ground Level +3.95 mOD
Coordinates E 319983.53
National Grid N 233492.81

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
10.20-10.65	SPT C	N=29 (4,5/7,7,7,8) Flush: 0.00-20.70 Air, 100 %	10.20	
11.70-12.15	SPT C	N=40 (6,9/9,10,10,11)	11.70	
13.20-13.65	SPT C	N=39 (6,7/10,10,9,10)	13.20	
14.70-15.15	SPT C	N=44 (9,7/11,11,10,12)	24/05/2003 14.70	1845 4.30
			25/05/2003 14.70	0730 9.83
16.20-16.65	SPT C	N=39 (5,7/8,9,11,11)	16.20	
17.70-18.15	SPT C	N=40 (6,8/9,10,10,11)	17.70	
19.20-19.65	SPT C	N=31 (4,6/6,7,9,9)	19.20	

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
Driller reports GRAVEL with clay bands.	(4.50)		
Driller reports brown clayey GRAVEL.	13.20 -9.25		
	(3.00)		
Driller reports black sandy SILT with gravel bands.	16.20 -12.25		
	(2.90)		
Firm to very stiff dark grey brown slightly sandy CLAY. Sand is fine.	19.10 -15.15		
Stratum continued next sheet			

Depth	Type & No	Records	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	3.80	-	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50

(c) MESG Hdbk (281), 30/10/2003 12:48:28 AGS

Project Dublin Waste to Energy
Project No. KD3116
Carried out for Dublin City Council

Borehole
BR8
Sheet 2 of 5

Borehole Log

GEOTECH

Drilled by	MN
Logged by	PG
Checked by	MK

Start 24/05/2003
End 28/05/2003

Equipment, Methods and Remarks

Depth from	to	Diameter	Casing Depth
0.00m	20.70m	131mm	20.70m
20.70m	39.80m	120mm	39.80m
39.80m	46.50m	76mm	41.20m

Ground Level +3.95 mOD
Coordinates E 319983.53
National Grid N 233492.81

Samples and Tests

Strata

Depth	Type & No	Records	Date Casing	Time Water	Description	Depth,Level/ (Thickness)	Legend	Backfill/ Instrument
					Firm to very stiff dark grey brown slightly sandy CLAY. Sand is fine.			
20.70-21.15 20.70	SPT S D 1	N=22 (2,3/3,5,8,8)	20.70					
22.20-23.15 22.20	SPT S D 2	N=50 (11,12/10,12,15,13)	22.20					
23.70-24.15 23.70	SPT S D 3	49 (9,11/12,13,14,10 for 70mm)	23.70					
25.20-25.65 25.20	SPT S D 4	N=30 (4,6/6,7,8,9)	25.20					
26.70-27.15 26.70	SPT S D 5	N=37 (5,10/5,10,10,12)	26.70			(17.10)		
28.20-28.65 28.20	SPT S D 6	N=28 (6,7/7,8,6,7)	28.20					
29.70-30.15 29.70	SPT S D 7	N=29 (7,7/7,8,6,8)	29.70					
					Stratum continued next sheet			
Depth	Type & No	Records	Date Casing	Time Water				

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	3.80	-	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50

Project Dublin Waste to Energy
Project No. KD3116
Carried out for Dublin City Council

Borehole
BR8
Sheet 3 of 5

Borehole Log

GEOTECH

Drilled by MN Logged by PG Checked by MK	Start 24/05/2003 End 28/05/2003	Equipment, Methods and Remarks	Depth from / to / Diameter / Casing Depth 0.00m 20.70m 131mm 20.70m 20.70m 39.80m 120mm 39.80m 39.80m 46.50m 76mm 41.20m	Ground Level +3.95 mOD Coordinates E 319983.53 National Grid N 233492.81

Samples and Tests / Strata

Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)
					Firm to very stiff dark grey brown slightly sandy CLAY. Sand is fine.	
			25/05/2003 20.70	1730 3.60		
31.20-31.65 31.20	SPT S D 8	N=29 (5,6/7,7,8,7)	26/05/2003 20.70	0730 3.60		
32.70-33.15 32.70	SPT S D 9	N=28 (5,6/8,6,6,10)	32.70			
		Flush: 20.70-46.50 Mud drilling, 100 %				
34.20-34.65	SPT C	N=30 (6,7/7,8,8,7)	34.20			
35.70-35.74	SPT C	(75 for 35mm)	35.70			
					Drillers reports gravel, boulders and clay bands.	36.20 -32.25
37.20	SPT C	(50 for 0mm)	37.20			
						(2.80)
39.00-39.10 m		TCR 100, SCR 60, RQD 0				
39.10-39.30 m		TCR 50, SCR 0, RQD 0			Recovered as grey sandy GRAVEL with compact dark brown clay bands. Gravel is subangular to subrounded fine to coarse, sand is fine to coarse. (possible weathered rockhead). 39.00-39.10 m clay bands	39.00 -35.05
39.30-39.70 m	50 0 0		28/05/2003 39.80	1800 5.20		
39.70-39.80 m		TCR 0, SCR 0, RQD 0				
39.80-40.00 m		TCR 25, SCR 0, RQD 0	27/05/2003	0730	Stratum continued next sheet	

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

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	3.80	-	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50

(c) MESG HEM (261). 30/10/2003 12:48:33 AGS

Project: Dublin Waste to Energy
Project No.: KD3116
Carried out for: Dublin City Council

Borehole **BR8**
Sheet 4 of 5

Borehole Log

GEOTECH

Drilled by	MN
Logged by	PG
Checked by	MK

Start 24/05/2003
End 28/05/2003

Equipment, Methods and Remarks

Depth from	to	Diameter	Casing Depth
0.00m	20.70m	131mm	20.70m
20.70m	39.80m	120mm	39.80m
39.80m	46.50m	76mm	41.20m

Ground Level +3.95 mOD
Coordinates E 319963.53
National Grid N 233492.81

Samples and Tests

Depth	TCR SCR RQD	If	Records/Samples	Date Casing	Time Water
40.00-40.30 m		NI	TCR 17, SCR 0, RQD 0	39.80	8.25
		NI			
	29	70			
40.30-40.65 m	0				
	0				
	18				
40.65-41.20 m	0				
	0				
41.20-41.30 m			TCR 100, SCR 0, RQD 0		
	100				
41.30-42.00 m	80				
	70				
	100				
42.00-43.50 m	77				
	61				
		NI			
	100	200			
43.50-45.00 m	91	800			
	85				
	100				
45.00-46.50 m	99				
	99			27/05/2003	1800
				41.20	6.35

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instrument
Recovered as grey sandy GRAVEL with compact dark brown clay bands. Gravel is subangular to subrounded fine to coarse, sand is fine to coarse. (possible weathered rockhead).	(2.30)		
	41.30 -37.35		
Moderately weak to strong fine to coarse grained LIMESTONE with high calcite content (irregular matrix).			
Joints are closely spaced, 10 to 30° dip, smooth and stepped. Weathering includes slight weakening of rock strength at joints; moderately weak crystalline calcite - platy habit (80 to 90% calcite content)			
42.00-42.30 m zone of weak rock			
43.85-44.20 m zone of weak rock	(5.20)		
44.55-44.70 m subvertical fracture, undulating and rough			
45.45-45.60 m subvertical fracture, undulating and rough			
45.50-45.55 m Pyrite veins			
46.15-46.50 m subvertical fracture, undulating and rough			
EXPLORATORY HOLE ENDS AT 46.50 m	46.50 -42.55		SP

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

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	3.80	-	-

Depth Related Remarks

From to (m)

Chiselling

Depths (m) Time Tools used

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

Scale 1:50

Project: Dublin Waste to Energy
Project No.: KD3116
Carried out for: Dublin City Council

Borehole
BR8
Sheet 5 of 5

Borehole Log

GEOTECH

Drilled by MN Logged by PG Checked by MK	Start 09/06/2003 End 12/06/2003	Equipment, Methods and Remarks Casagrande C8 rotary rig Hand dug inspection pit to 1.20m Rotary open hole drilling to 44.70m Rotary coring to 49.50m Installed 50mm standpipe with stand up cover	Depth from / to / Diameter / Casing Depth 0.00m / 39.00m / 131mm / 39.00m 39.00m / 44.70m / 120mm / 44.70m 44.70m / 49.50m / 76mm /	Ground Level +4.29 mOD Coordinates E 319670.84 National Grid N 233701.08

Samples and Tests / Strata

Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)
					Driller reports soft light grey gravelly CLAY.	(3.00)
1.50-1.95	SPT C	N=12 (3,2/3,3,2,4)	1.50	dry		
3.00-3.45	SPT C	N=10 (1,1/2,2,3,3)	3.00	dry		3.00 +1.29
					Driller reports soft sandy CLAY.	(1.20)
						4.20 +0.09
4.50-4.95	SPT C	N=11 (2,2/2,3,3,3)	4.50	4.10	Driller reports black shale GRAVEL.	(1.80)
6.00-6.45	SPT C	N=16 (1,1/3,4,4,5)	6.00			6.00 -1.72
					Driller reports sandy GRAVEL with shells.	(2.70)
7.50-7.95	SPT C	N=21 (3,4/5,6,5,5)	7.50			
						8.70 -4.42
9.00-9.45	SPT C	N=24 (4,5/6,6,5,7)	9.00		Driller reports GRAVEL with silt and sand bands.	

Stratum continued next sheet

Depth	Type & No	Records	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.10	-	

Depth Related Remarks

From	to (m)	
0.00	1.20	Inspection pit

Chiselling

Depths (m)	Time	Tools used

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

Scale 1:50 (c) MESG KBM (2K1), 30/10/2003 12:46:56 AGS

Project: Dublin Waste to Energy
Project No. KD3116
Carried out for: Dublin City Council

Borehole **BR9**
Sheet 1 of 5

Borehole Log

GEOTECH

Drilled by MN	Start 09/06/2003	Equipment, Methods and Remarks
Logged by PG	End 12/06/2003	
Checked by MK		

Depth from	to	Diameter	Casing Depth
0.00m	39.00m	131mm	39.00m
39.00m	44.70m	120mm	44.70m
44.70m	49.50m	76mm	

Ground Level +4.29 mOD
Coordinates E 319870.84
National Grid N 233701.08

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
10.50-10.95	SPT C	N=28 (6,6/7,6,7,8)	10.50	
12.00-12.40	SPT C	50 (8,10/10,11,12,17 for 20mm)	12.00	
13.50-13.95	SPT C	N=38 (8,8/7,9,11,11)	13.50	
15.00-15.38	SPT C	50 (10,10/12,14,17,7 for 0mm)	15.00	
16.50-16.95	SPT C	N=35 (8,8/7,8,9,11)	16.50	
18.00-18.45 18.00	SPT S D 1	N=31 (4,6/8,7,9,7)	18.00	
19.50-19.95 19.50	SPT S D 2	N=19 (4,5/4,4,5,6)	19.50	

Strata

Description	Depth,Level/ (Thickness)	Legend	Backfill Instrumen
Driller reports GRAVEL with silt and sand bands.	(8.10)		
Firm to stiff grey brown slightly sandy CLAY..Sand is fine.	16.80 -12.51		
Stratum continued next sheet			

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.10	-	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50

Project Dublin Waste to Energy
Project No. KD3116
Carried out for Dublin City Council

Borehole
BR9
Sheet 2 of 5

Borehole Log

GEOTECH

Drilled by	MN
Logged by	PG
Checked by	MK

Start 09/06/2003
End 12/06/2003

Equipment, Methods and Remarks

Depth from	to	Diameter	Casing Depth
0.00m	39.00m	131mm	39.00m
39.00m	44.70m	120mm	44.70m
44.70m	49.50m	76mm	

Ground Level +4.29 mOD
Coordinates E 319870.84
National Grid N 233701.08

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
21.00-21.45 21.00	SPT S D 3	N=29 (4,4/6,7,8,8)	09/06/2003 21.00	1830 12.47
			10/06/2003 21.00	0730 6.30
22.50-22.95 22.50	SPT S D 4	N=28 (5,4/5,7,7,9)	22.50	
24.00-24.45 24.00	SPT S D 5	N=26 (5,5/6,5,7,8)	24.00	
25.50-25.95 25.50	SPT S D 6	N=27 (5,6/6,7,7,7)	25.50	
27.00-27.45 27.00	SPT S D 7	N=25 (4,4/6,5,6,8)	27.00	
28.50-28.95 28.50	SPT S D 8	N=22 (5,4/6,5,5,6)	28.50	

Strata

Description	Depth,Level/ (Thickness)	Legend	Backfill/ Instrument
Firm to stiff grey brown slightly sandy CLAY. Sand is fine.	(22.20)		

Stratum continued next sheet

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.10	-	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50

(c) MESG HBR (281), 30/10/2003 12:48:01

Project Dublin Waste to Energy
Project No. KD3116
Carried out for Dublin City Council

Borehole
BR9
Sheet 3 of 5

Borehole Log

GEOTECH

Drilled by	MN
Logged by	PG
Checked by	MK

Start 09/06/2003
End 12/06/2003

Equipment, Methods and Remarks

Depth from	to	Diameter	Casing Depth
0.00m	39.00m	131mm	39.00m
39.00m	44.70m	120mm	44.70m
44.70m	49.50m	76mm	

Ground Level +4.29 mOD
Coordinates E 319870.84
National Grid N 233701.08

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
30.00-30.45 30.00	SPT S D 9	N=26 (4,4/6,7,7,6)	30.00	
31.50-31.95 31.50	SPT S D 10	N=23 (4,5/4,5,6,7)	31.50	
33.00-33.45 33.00	SPT S D 11	N=29 (4,6/7,7,7,8)	33.00	
		Flush: 21.00-46.30 Water, 95 %		
34.50-34.95 34.50	SPT S D 12	N=22 (5,7/6,5,5,5)	34.50	
36.00-36.45 36.00	SPT S D 13	N=26 (4,5/5,6,7,8)	36.00	
37.50-37.95 37.50	SPT S D 14	N=29 (5,6/6,7,8,8)	37.50	
39.00-39.45 39.00	SPT S D 15	N=28 (6,7/6,7,7,8)	10/06/2003 1745 39.00 8.65 ~~39.00~~ 11/06/2003 0730 39.00 5.86	

Strata

Description	Depth,Level (Thickness)	Legend	Backfill Instrumen
Firm to stiff grey brown slightly sandy CLAY. Sand is fine.			
Driller reports gravelly SILT.	39.00 -34.71		
Stratum continued next sheet			

Depth	Type & No	Records	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.10	-	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50

Project Dublin Waste to Energy
Project No. KD3116
Carried out for Dublin City Council

Borehole
BR9
Sheet 4 of 5

Borehole Log

GEOTECH

Drilled by MN Logged by PG Checked by MK	Start 09/06/2003 End 12/06/2003	Equipment, Methods and Remarks	Depth from	to	Diameter	Casing Depth	Ground Level +4.29 mOD Coordinates E 319870.84 National Grid N 233701.08
			0.00m	39.00m	131mm	39.00m	
			39.00m	44.70m	120mm	44.70m	
			44.70m	49.50m	76mm		

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
40.50-40.95	SPT C	N=26 (6,7/7,7,6,6)	40.50	
42.00-42.45	SPT C	N=28 (5,5/6,7,7,8)	42.00	
43.50-43.67	SPT C	22 (25,28/22 for 15mm)	43.50	
44.70-44.80 m		TCR 100, SCR 50, RQD 0		
44.80-46.30 m	100 91 85 / NI 70 290		11/06/2003 44.70	1630 18.60
46.30-47.00 m	100 86 86			
47.00-48.15 m	100 89 59 / NI 150 350	Flush: 46.30-49.50 Water, 0 %		
48.15-49.50 m	100 96 79		12/06/2003 44.70	0730 16.30

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

Strata

Description	Depth, Level (Thickness)
Driller reports gravelly SILT.	(4.50) 43.50 -39.21
Driller reports gravel, boulders and clay bands.	(1.20) 44.70 -40.41
Strong to very strong dark grey fine to coarse-grained LIMESTONE with occasional calcite veins. Joints are closely to medium spaced, 30 to 40° dip, undulating and smooth. Weathering includes uncompact grey brown silt infill along fracture planes. 44.70-44.80 m NI 45.60 m 60° fracture along 10mm thick calcite vein 46.30-46.45 m NI 46.70 m 20° fracture along 5mm thick calcite vein 46.85-46.90 m occasional vugs in calcite veins 47.00-47.05 m NI 47.40-49.05 m silt coating at joint surfaces 48.20-48.50 m subvertical fracture along pre-existing calcite vein, smooth and planar	(4.80) 49.50 -45.21
EXPLORATORY HOLE ENDS AT 49.50 m	

Legend | Backfill/Instruments: SP

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	4.10	-	-

Depth Related Remarks From to (m)

Chiselling Depths (m) Time Tools used

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

Scale 1:50 (c) MESG HBM (2S1), 30/10/2003 12:46:07 AGS

Project: Dublin Waste to Energy
Project No.: KD3116
Carried out for: Dublin City Council

Borehole **BR9** Sheet 5 of 5

Borehole Log

GEOTECH

Drilled by MN Logged by JL Checked by MK	Start 03/06/2003 End 06/06/2003	Equipment, Methods and Remarks Casagrande C6 rotary drill rig Hand dug inspection pit to 1.20m. Rotary open hole drilling to 38.55m. Rotary coring to 43.17m. Borehole backfilled with grout	Depth from / to / Diameter / Casing Depth 0.00m / 20.70m / 131mm / 20.70m 20.70m / 38.55m / 120mm / 38.55m 38.55m / 43.17m / 76mm	Ground Level +4.30 mOD Coordinates E 320004.82 National Grid N 233686.92	

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
1.50-1.95	SPT C	N=5 (2,1/1,2,1,1)	1.50	dry
3.00-3.45	SPT C	N=6 (1,2/1,1,2,2)	3.00	dry
4.50-4.95	SPT C	N=6 (2,1/1,2,2,1)	4.50	dry
6.00-6.45	SPT C	N=5 (2,1/1,1,1,2)	6.00	5.80
7.50-7.91	SPT C	50 (2,4/7,14,17,12 for 35mm)	7.50	
9.00-9.45	SPT C	Flush: 0.00-17.70 Air, 100 % N=36 (2,3/5,9,10,12)	9.00	

Strata

Description	Depth, Level (Thickness)	Legend	Backfill / Instrumen
Driller reports ASH and GRAVEL FILL with metal fragments (MADE GROUND)	(5.40)		
Driller reports SAND and GRAVEL with shells.	5.40 -1.10		
Stratum continued next sheet			

Depth	Type & No	Records	Date Casing	Time Water

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	5.80	-	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50

Project Dublin Waste to Energy
Project No. KD3116
Carried out for Dublin City Council

Borehole
BR10
Sheet 1 of 5

Borehole Log

GEOTECH

Drilled by MN Logged by JL Checked by MK	Start 03/06/2003 End 06/06/2003	Equipment, Methods and Remarks	Depth from / to / Diameter / Casing Depth	Ground Level / Coordinates / National Grid
			0.00m – 20.70m, 131mm, 20.70m 20.70m – 38.55m, 120mm, 38.55m 38.55m – 43.17m, 76mm	+4.30 mOD E 320004.82 N 233686.92

Samples and Tests / Strata

Depth	Type & No	Records	Date Casing	Time Water	Description	Depth, Level (Thickness)
					Driller reports SAND and GRAVEL with shells.	
10.50-10.95	SPT C	N=35 (3,6/7,8,9,11)	10.50			
12.00-12.33	SPT C	50 (8,10/12,24,14 for 25mm)	12.00			(12.80)
13.50-13.95	SPT C	N=49 (9,10/9,9,11,20)	13.50			
15.00-15.45	SPT C	N=35 (6,5/6,7,10,12)	15.00			
16.50-16.90	SPT C	50 (7,6/8,9,9,24 for 20mm)	16.50			
			03/06/2003 17.70	1630 14.10		
			04/06/2003 17.70	0730 6.20		
18.00-18.40	SPT C	49 (8,8/11,10,11,17 for 25mm)	18.00			
					Firm to stiff grey brown slightly sandy CLAY. Sand is fine to medium.	18.20 -13.90
19.50-19.95 19.50	SPT S D 1	N=20 (3,2/4,5,5,6)	19.50			

Stratum continued next sheet

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	5.80	-	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50

(c) MESO HBM (2/1), 30/10/2003 12:46:58 AGS

Project	Dublin Waste to Energy
Project No.	KD3116
Carried out for	Dublin City Council

Borehole **BR10**

Borehole Log

GEOTECH

Drilled by MN Logged by JL Checked by MK	Start 03/06/2003 End 06/06/2003	Equipment, Methods and Remarks	Depth from / to / Diameter / Casing Depth: 0.00m / 20.70m / 131mm / 20.70m 20.70m / 38.55m / 120mm / 38.55m 38.55m / 43.17m / 76mm	Ground Level +4.30 mOD Coordinates E 320004.82 National Grid N 233686.92

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
21.00-21.45 21.00	SPT S D 2	N=23 (2,3/4,4,7,8)	21.00	
22.50-22.95 22.50	SPT S D 3	N=18 (2,3/5,4,4,5)	22.50	
24.00-24.45 24.00	SPT S D 4	N=21 (3,2/4,6,5,6)	24.00	
25.50-25.95 25.50	SPT S D 5	N=21 (3,3/5,4,6,6)	25.50	
27.00-27.45 27.00	SPT S D 6	N=35 (3,6/7,8,10,10)	27.00	
28.50-28.95 28.50	SPT S D 7	Flush: 20.70-36.00 Water, 100 % N=24 (4,4/6,6,7,5)	28.50	

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
Firm to stiff grey brown slightly sandy CLAY. Sand is fine to medium.	(18.30)		
Stratum continued next sheet			

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	5.80	-	-

Depth Related Remarks From to (m)

Chiselling Depths (m) Time Tools used

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

Scale 1:50 (c) MESG HBM (28?), 30/10/2003 12:47:01 AGS

Project: Dublin Waste to Energy
Project No.: KD3116
Carried out for: Dublin City Council

Borehole **BR10**
Sheet 3 of 5

Borehole Log

GEOTECH

Drilled by MN	Start 03/06/2003	Equipment, Methods and Remarks	Depth from	to	Diameter	Casing Depth	Ground Level	+4.30 mOD
Logged by JL	End 05/06/2003		0.00m	20.70m	131mm	20.70m	Coordinates	E 320004.82
Checked by MK			20.70m	38.55m	120mm	38.55m	National Grid	N 233688.92
			38.55m	43.17m	76mm			

Samples and Tests

Depth	Type & No	Records	Date Casing	Time Water
30.00-30.45 30.00	SPT S D 8	N=25 (5,5/5,7,7,6)	30.00	
31.50-31.95 31.50	SPT S D 9	N=17 (3,3/4,3,5,5)	31.50	
33.00-33.45 33.00	SPT S D 10	N=29 (7,6/6,8,7,8)	33.00	
34.50-34.95 34.50	SPT S D 11	N=27 (6,5/6,7,8,6)	34.50	
36.00-36.45 36.00	SPT S D 12	N=43 (9,11/8,11,9,15)	04/06/2003 36.00 ~~36.96~~ 05/06/2003 36.00	1630 1.20 0730 4.35
37.50-37.56	SPT C	50 (25 for 35mm/50 for 20mm)	37.50	
38.55	SPT C	(25 for 0mm/50 for 0mm)	38.50	
38.55-39.15 m	100 42 42	NI NI 150		
39.15-39.66 m	100 71 53		Flush: 36.00-43.17 Mud, 100 %	
39.66-40.17 m	100 88 78			

Depth	Type & RQD	If	Records/Samples	Date Casing	Time Water

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instrument
Firm to stiff grey brown slightly sandy CLAY. Sand is fine to medium.			
Driller reports clayey SAND and GRAVEL and boulders with clay.	36.50 -32.20 (2.05)		
Moderately strong to strong dark and light grey slightly fossiliferous medium to coarse-grained LIMESTONE with rare calcite veins. 38.55-38.70 m non-intact, recoved as gravel Joints are closely to medium spaced, 45 to 60° dip, and rough undulating. Weathering includes soft grey sandy clay infill along fracture planes. 39.40-39.60 m subvertical fracture along calcite vein Stratum continued next sheet	38.55 -34.25 (2.45)		

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	5.80	-	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1:50

Project: Dublin Waste to Energy
Project No.: KD3116
Carried out for: Dublin City Council

Borehole
BR10
Sheet 4 of 5

Borehole Log

GEOTECH

Drilled by MN Logged by JL Checked by MK	Start 03/06/2003 End 06/06/2003	Equipment, Methods and Remarks	Depth from / to / Diameter / Casing Depth 0.00m / 20.70m / 131mm / 20.70m 20.70m / 38.55m / 120mm / 38.55m 38.55m / 43.17m / 76mm /	Ground Level +4.30 mOD Coordinates E 320004.82 National Grid N 233686.92

Samples and Tests

Depth	TCR SCR RQD	If	Records/Samples	Date Casing	Time Water
		NI 70 270			
40.17-41.67 m	105 93 71				
				05/06/2003 38.55	1630 11.30
				06/06/2003 38.55	0730 6.25
		40 150 300			
41.67-43.17 m	93 93 90				
				06/06/2003 38.55	1500

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
Moderately strong to strong dark and light grey slightly fossiliferous medium to coarse-grained LIMESTONE with rare calcite veins. Joints are closely to medium spaced, 45 to 60° dip, and rough undulating. Weathering includes soft grey sandy clay infill along fracture planes.	41.00 -36.70		
Strong dark to light grey medium to coarse-grained thickly laminated to thinly bedded LIMESTONE. Joints are medium spaced, 35 to 45° dip, smooth and planar, predominantly along bedding planes. No visible weathering, slight discolouration along fracture planes. 41.30 m 40° fracture along calcite vein 42.50-42.58 m subvertical rough fracture	(2.17) 43.17 -38.87		
EXPLORATORY HOLE ENDS AT 43.17 m			

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

Groundwater Entries

No.	Struck (m)	Post strike behaviour	Depth sealed (m)
1	5.80	-	-

Depth Related Remarks
From to (m)

Chiselling
Depths (m) Time Tools used

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

Scale 1:50 (c) MESG HBR (281), 30/10/2003 12:47:08 AGS

Project	Dublin Waste to Energy
Project No.	KD3116
Carried out for	Dublin City Council

Borehole **BR10**
Sheet 5 of 5

Trial Pit Log

GEOTECH

Logged by PG Checked by MK	Start 14/05/2003 End 14/05/2003	Equipment, Methods and Remarks Excavated by JCB 3CX Trial pit terminated at required depth. Pit backfilled with arisings.	Dimensions and Orientation Width 0.75 m Length 3.20 m 110 (Deg)	Ground Level +3.81 mOD Coordinates E 319901.10 National Grid N 233417.70

Samples and Tests			Strata			
Depth	Type & No.	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instrument
			1 Soft, brown slightly sandy slightly gravelly CLAY FILL with rare brick fragments metal and plastic. Gravel is subangular to subrounded fine to medium (MADE GROUND)	(0.50)		
0.50-0.60 0.50-0.60	B 1 D 2		2 Grey slightly clayey gravelly SAND with ASH FILL. Gravel is subangular to subrounded fine to medium (MADE GROUND)	0.50 +3.31		
			3 Soft dark brown sandy slightly gravelly CLAY and ASH FILL with occasional brick fragments. Gravel is subangular to subrounded fine to medium. (MADE GROUND).	0.70 +3.11		
1.20-1.60 1.20-1.60	B 3 D 4					
			2.00 m Rare shells and some ceramic fragments			
2.40-2.60 2.40-2.60	B 5 D 6			(3.30)		
3.40 3.40 3.50-3.70 3.50-3.70	W 7 W 8 D 10 B 9					
			EXPLORATORY HOLE ENDS AT 4.00 m	4.00 -0.19		
Depth	Type & No.	Records Date				

Groundwater Entries			Depth Related Remarks	Stability Moderate
No.	Struck (m)	Post Strike Behaviour	From to (m)	Shoring None
140	3.40	Very Fast Inflow		Weather

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

Scale 1:25

Project Dublin Waste to Energy
Project No. KD3116
Carried out for Dublin City Council

Trial Pit
TP01
Sheet 1 of 1

Trial Pit Log

GEOTECH

Logged by PG Checked by MK	Start 14/05/2003 End 14/05/2003	Equipment, Methods and Remarks Excavated by JCB3CX Trial pit terminated at required depth. Pit backfilled with arisings.	Dimensions and Orientation Width 0.75 m Length 3.42 m 285 (Deg)	Ground Level +3.72 mOD Coordinates E 319867.74 National Grid N 233463.92

Samples and Tests

Depth	Type & No.	Date Records
1.00-1.10	B 1	
1.00-1.10	D 2	
2.00-2.20	B 3	
2.00-2.20	D 4	
3.20-3.40	B 5	
3.20-3.40	D 6	

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instrumen
1 TARMAC pavement (MADE GROUND)	0.08 +3.64		
2 Grey slightly clayey sandy GRAVEL (subbase) with frequent angular to subangular cobbles. Sand is fine to coarse gravel is angular fine to coarse (MADE GROUND)	(0.30)		
3 Soft dark brown slightly sandy gravelly CLAY and ASH FILL with many pockets of gravel and occasional cobble and boulder-sized fragments of red brick, glass concrete, wood, slate and plastic (MADE GROUND)	0.38 +3.34		
3.10 m becoming damp	(3.22)		
4 Dark grey fine to medium SAND with some medium spaced dark grey laminae of SILT. (ESTUARINE DEPOSIT)	3.60 +0.12		
	(0.80)		
EXPLORATORY HOLE ENDS AT 4.40 m	4.40 -0.68		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike (m)	Behaviour
1	3.45		Strong Inflow

Depth Related Remarks
From to (m)

Stability Moderate
Shoring None
Weather

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

Scale 1:25

Project Dublin Waste to Energy
Project No. KD3116
Carried out for Dublin City Council

Trial Pit
TP02
Sheet 1 of 1

Trial Pit Log

GEOTECH

Logged by PG Checked by MK	Start 15/05/2003 End 15/05/2003	Equipment, Methods and Remarks Excavated by JCB 3CX Trial Pit terminated due to poor stability. Pit backfilled with arisings.	Dimensions and Orientation Width 0.60 m Length 3.00 m 20 (Deg)	Ground Level +3.67 mOD Coordinates E 319951.50 National Grid N 233435.75

Samples and Tests			Strata			
Depth	Type & No.	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instrument
			1 TARMAC pavement overlying crushed stone subbase (MADE GROUND).	(0.30)		
			2 Soft brown sandy CLAY and GRAVEL FILL with many pockets of coarse gravel and occasional boulder-sized (50 x 25 x 20cms) fragments of red/yellow brick, plastic metal, concrete. Sand is fine to coarse, gravel is subangular to subrounded fine to coarse. (MADE GROUND)	0.30 +3.37		
0.60-0.80 0.60-0.80	B 1 D 2					
1.80-2.00 1.80-2.00	B 3 D 4			(3.10)		
2.80-3.20 2.80-3.20	B 5 D 6		3.20-3.40 m sidewall collapse			
			EXPLORATORY HOLE ENDS AT 3.40 m	3.40 +0.27		
Depth	Type & No.	Records Date				

Groundwater Entries			Depth Related Remarks	Stability poor below 3.20 m.
No.	Struck (m)	Post Strike Behaviour	From to (m)	Shoring None
1	3.20	Moderate Inflow		Weather

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

Scale 1:25

Project Dublin Waste to Energy
Project No. KD3116
Carried out for Dublin City Council

Trial Pit
TP03
Sheet 1 of 1

Trial Pit Log

GEOTECH

Logged by PG Checked by MK	Start 14/05/2003 End 14/05/2003	Equipment, Methods and Remarks Excavated by JCB3CX Trial Pit terminated at required depth. Pit backfilled with arisings.	Dimensions and Orientation Width 0.75 m Length 3.10 m 286 (Deg)

Ground Level +3.70 mOD
Coordinates E 319855.15
National Grid N 233525.52

Samples and Tests / Strata

Depth	Type & No.	Date Records	Description	Depth, Level (Thickness)
			1 TARMAC pavement over dark grey gravel subbase. (MADE GROUND).	(0.47)
0.50-0.60 0.50-0.60	B 1 D 2		3 Dark brown sandy CLAY and GRAVEL FILL with pockets of ash and coarse gravel to cobble-sized fragments of red/yellow bricks, concrete, slate , wood, steel bars and plastics (MADE GROUND)	0.47 +3.23
1.20-1.40 1.20-1.40	B 3 D 4			(2.33)
2.40-2.50 2.40-2.50	B 5 D 6			
2.80-3.00 2.80-3.00	B 7 D 8		4 Grey clayey gravelly SAND. Gravel is subangular to subrounded fine to medium (ESTUARINE DEPOSIT)	2.80 +0.90
3.90-4.10 3.90-4.10	D 10 B 9			(1.40)
			EXPLORATORY HOLE ENDS AT 4.20 m	4.20 -0.50

Depth	Type & No.	Records Date

Groundwater Entries
No. Struck Post Strike Behaviour (m)
None observed (see Key Sheet)

Depth Related Remarks
From to (m)

Stability poor
Shoring none
Weather

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

Scale 1:25 (c) MESG HBM (2?1), 30/10/2003 12:51:01 AGS

Project Dublin Waste to Energy
Project No. KD3116
Carried out for Dublin City Council

Trial Pit
TP04
Sheet 1 of 1

Trial Pit Log

GEOTECH

Logged by PG Checked by MK	Start 15/05/2003 End 15/05/2003	Equipment, Methods and Remarks Excavated by JCB 3CX Trial pit terminated at 3.10 m due to obstruction. Pit backfilled with arisings.	Dimensions and Orientation Width 0.90 m Length 2.90 m 270 (Deg)	Ground Level +3.35 mOD Coordinates E 319849.51 National Grid N 233570.09

Samples and Tests

Depth	Type & No.	Date Records
0.70-0.80	B 1	
0.70-0.80	D 2	
1.80-2.00	B 3	
1.80-2.00	D 4	
2.80-3.00	B 5	
2.80-3.00	D 6	

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instrument
1 TOPSOIL: soft sandy gravelly CLAY with roots. Sand is fine to medium. Gravel is subangular to subrounded fine to medium 2 Soft dark brown sandy CLAY and GRAVEL FILL with abundant pockets of coarse gravel and occasional boulder-sized (up to 160cm) fragments of brick and concrete, some wood, glass, wire and slate. (MADE GROUND)	0.15 +3.20		
2.80 m concrete blocks	(2.95)		
EXPLORATORY HOLE ENDS AT 3.10 m	3.10 +0.25		

Depth	Type & No.	Records Date

Groundwater Entries
No. Struck Post Strike Behaviour (m)
None observed (see Key Sheet)

Depth Related Remarks
From to (m)

Stability poor
Shoring none
Weather

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

Project Dublin Waste to Energy
Project No. KD3116
Carried out for Dublin City Council

Trial Pit
TP05
Sheet 1 of 1

Trial Pit Log

GEOTECH

Logged by PG Checked by MK	Start 15/05/2003 End 15/05/2003	Equipment, Methods and Remarks Excavated by JCB3CX Trial pit terminated due to poor stability. Pit backfilled with arisings.	Dimensions and Orientation Width 0.90 m Length 3.10 m 15 (Deg)	Ground Level +3.45 mOD Coordinates E 319916.98 National Grid N 233552.27

Samples and Tests

Depth	Type & No.	Date Records
0.80-1.00	B 1	
0.80-1.00	D 2	
1.80-2.00	B 3	
1.80-2.00	D 4	
2.80-3.00	B 5	
2.80-3.00	D 6	
3.20	W 7	
3.20	W 8	
3.50-3.70	D 10	
3.50-3.70	B 9	

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instrument
1 Gravel - Hard Standing (MADE GROUND).	(0.40)		
2 Soft brown slightly sandy CLAY and GRAVEL FILL with many pockets of coarse gravel to boulder-sized fragments of yellow/red brick, concrete, concrete blocks, limestone and granite, abundant glass, cloth and wood fragments. Sand is fine to coarse, gravel is subangular to subrounded fine to coarse. (MADE GROUND)	0.40 +3.05		
2.50 m limestone boulder	(3.00)		1
3 Dark grey to black fine to medium SAND (ESTUARINE DEPOSIT)	3.40 +0.05 (0.30)		
EXPLORATORY HOLE ENDS AT 3.70 m	3.70 -0.25		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
1	3.20	Very fast inflow

Depth Related Remarks
From to (m)

Stability poor
Shoring none
Weather

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

Scale 1:25

Project Dublin Waste to Energy
Project No. KD3116
Carried out for Dublin City Council

Trial Pit
TP06
Sheet 1 of 1

Trial Pit Log

GEOTECH

Logged by PG Checked by MK	Start 15/05/2003 End 15/05/2003	Equipment, Methods and Remarks Excavated by JCBSCX Trial pit terminated due to poor stability. Pit backfilled with arisings.	Dimensions and Orientation Width 0.80 m Length 3.20 m 197 (Deg)	Ground Level +3.77 mOD Coordinates E 319965.50 National Grid N 233562.82

Samples and Tests			Strata			
Depth	Type & No.	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instrument
			1 GRAVEL - Hard Standing (MADE GROUND)	0.10 +3.67		
0.70-0.80 0.70-0.80	B 1 D 2		2 Soft brown slightly sandy CLAY and GRAVEL FILL with many cobbles and boulders, abundant fragments of red brick, wood, plastic, metal, glass, concrete blocks and rubble. (MADE GROUND).			
1.80-2.00 1.80-2.00	B 3 D 4		2.00 m boulder sized fragments of concrete (40cm wide) slow progress.	(3.40)		
2.80-3.00 2.80-3.00	B 5 D 6					
3.40 3.40	W 7 B 8					1
			EXPLORATORY HOLE ENDS AT 3.50 m	3.50 +0.27		
Depth	Type & No.	Records Date				

Groundwater Entries

No.	Struck (m)	Post Strike (m)	Behaviour
1	3.40		Slow inflow

Depth Related Remarks
From to (m)

Stability poor below 2.00 m.
Shoring none
Weather

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

Scale 1:25 (c) IESG HBR (281), 30/10/2003 12:51:17

Project Dublin Waste to Energy
Project No. KD3116
Carried out for Dublin City Council

Trial Pit
TP07
Sheet 1 of 1

Trial Pit Log

GEOTECH

Logged by PG Checked by MK	Start 27/06/2003 End 27/06/2003	Equipment, Methods and Remarks Excavated by JCB 3CX Trial pit terminated due to poor stability. Pit backfilled with arisings	Dimensions and Orientation Width 0.60 m Length 3.20 m 230 (Deg)	Ground Level +4.26 mOD Coordinates E 319982.73 National Grid N 233677.34

Samples and Tests			Strata				
Depth	Type & No.	Date Records	Description	Depth, Level (Thickness)		Legend	Backfill/ Instrumer
			1 Soft brown sandy gravelly CLAY FILL with rare cobbles and fragments of brick, metal and plastic.	(0.70)			
0.80-1.00 0.80-1.00	B 1 D 2		2 Loose orange grey clayey sandy GRAVEL and ASH FILL with fragments of charcoal and burnt wood. Gravel is subangular to subrounded fine to medium.	0.70	+3.56		
1.80-2.00 1.80-2.00	B 3 D 4			(3.30)			
2.80-3.10 2.80-3.10	B 5 D 6		3.60 m rare subangular boulders				
~~4.00~~ 4.00	~~B 7~~ D 8		EXPLORATORY HOLE ENDS AT 4.00 m	4.00	+0.26		
Depth	Type & No.	Records Date					

Groundwater Entries No. Struck Post Strike Behaviour (m) None observed (see Key Sheet)	Depth Related Remarks From to (m)	Stability poor Shoring none Weather

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column. Scale 1:25 (c) MESC HBR (28n), 30/10/2003 12:51:22 AGS	Project Dublin Waste to Energy Project No. KD3116 Carried out for Dublin City Council	Trial Pit TP08 Sheet 1 of 1

Trial Pit Log

GEOTECH

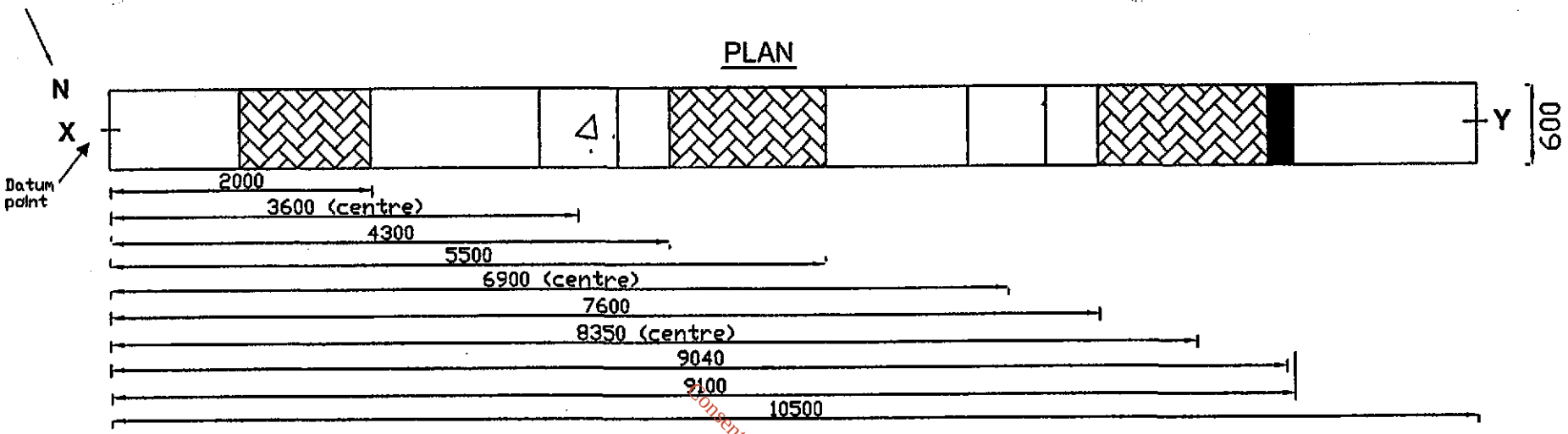
Logged by PG Checked by MK	Start 27/06/2003 End 27/06/2003	Equipment, Methods and Remarks Excavated by JCB 3CX Trial pit terminated due to poor stability. Pit backfilled with arisings	Dimensions and Orientation Width 0.70 m Length 3.20 m 195 (Deg)	Ground Level +4.36 mOD Coordinates E 319876.08 National Grid N 233676.72

Samples and Tests			Strata			
Depth	Type & No.	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instrument
			1 Soft brown sandy CLAY and GRAVEL FILL with occasional subangular cobbles and fragments of brick, concrete, wood, plastic, metal etc. (MADE GROUND).			
0.70-0.90 0.70-0.90	B 1 D 2					
1.70-1.80 1.70-1.80	B 3 D 4		1.80 m many subangular boulders 2.00-3.40 m concrete blocks	(3.50)		
2.80-3.10 2.80-3.10	B 5 D 6					
3.50	B 7		EXPLORATORY HOLE ENDS AT 3.50 m	3.50 +0.86		
Depth	Type & No.	Records Date				

Groundwater Entries	Depth Related Remarks	
No. Struck Post Strike Behaviour (m)	From to (m)	Stability poor
None observed (see Key Sheet)		Shoring none
		Weather

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.	Project Dublin Waste to Energy	Trial Pit
Scale 1:25 (c) MESG HBBI (.28T), 30/10/2003 12:51:27 AGS	Project No. KD3116 Carried out for Dublin City Council	TP09 Sheet 1 of 1

PLAN



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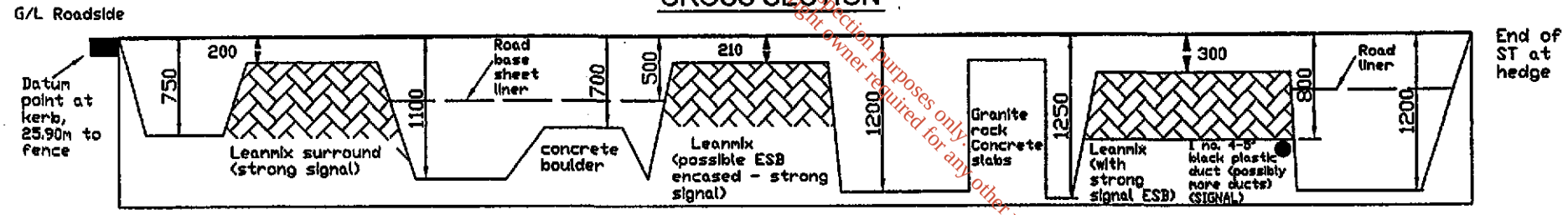


KEY

- Dimensions (in millimetres)
- Pipes
- Ground level

LOG OF TRENCH (m)

0.00 - 0.14	DENSE BITUMEN MACADAM
0.14 - 0.43	Roadstone
0.43 - 1.20	MADE GROUND - sandy gravelly CLAY

CO-ORDINATES / **ELEVATION**

X: E 319845 N 233634 3.83m
Y: E 319835 N 233636 3.65m

Orientation - 290°

SLIT TRENCH DETAILS

Date	14.5.03
Depth	1.20m
Width	0.60m
Length	10.50m

Dublin Waste to Energy
M. C. O'Sullivan & Co. Ltd.
Ground Investigation Slit Trench Details

DRAWN BY	DATE	SCALE
TL	18/6/03	1:50
CHECKED	APPRD	STATUS
PG	MK	
SLIT TRENCH NO.		REV:
ST01		

GEOTECH

Trial Pit Log

GEOTECH

Logged by PG	Start 14/05/2003	Equipment, Methods and Remarks	Dimensions and Orientation	Ground Level -
Checked by MK	End 14/05/2003	Excavated by JCB and Komatsu Mini-digger ESB representative on site for dig. Backfilled with gravel, reinstated surface.	Width 0.60 m Length 10.50 m A B C 290 (Deg)	Coordinates - National Grid -

Samples and Tests

Depth	Type & No.	Date Records

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instrument
1 Dense Bitumen Macadam	0.14		
2 Compacted black ROADSTONE subbase (Leanmix over ducts)	(0.29)		
3 Firm brown fine to coarse sandy gravelly CLAY FILL with brick and block fragments. Gravel is subangular to subrounded fine to coarse. (MADE GROUND).	0.43		
0.80-1.20 m Rare stiff dark brown slightly gravelly clay clods. Irregular	(0.77)		
EXPLORATORY HOLE ENDS AT 1.20 m	1.20		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike (m)	Behaviour
None observed (see Key Sheet)			

Depth Related Remarks

From to (m)

Stability Poor from 0.43m bgl

Shoring N/A

Weather -

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

Scale 1:25

AGS

Project Dublin Waste to Energy

Project No. KD3116

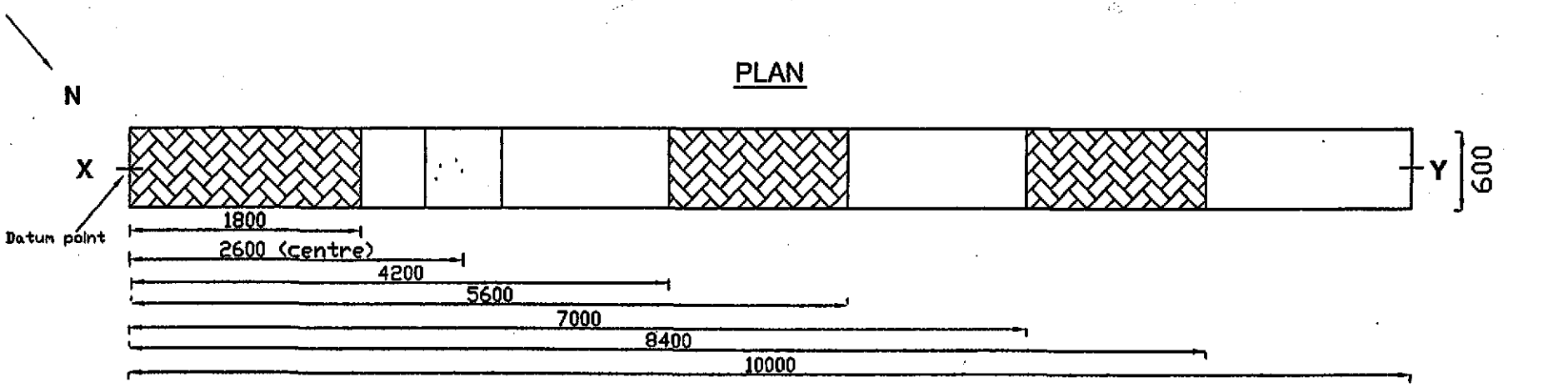
Carried out for Dublin City Council

Trial Pit

ST01

Sheet 1 of 1

PLAN



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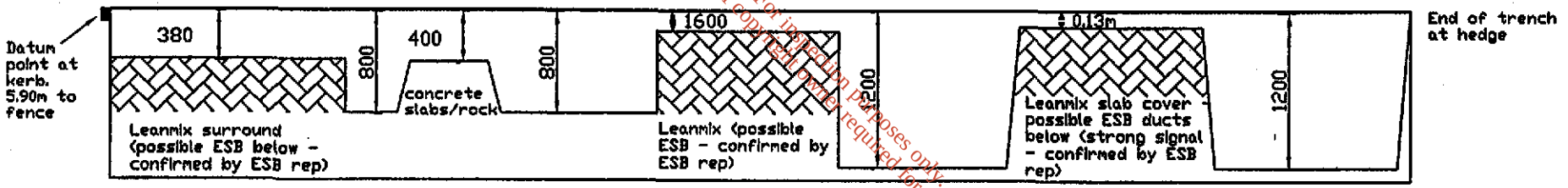


KEY

- Dimensions (in millimetres)
- Pipes
- Ground level

LOG OF TRENCH (m)

0.00 - 0.31	DENSE BITUMEN MACADAM
0.31 - 1.20	MADE GROUND - sandy CLAY

CO-ORDINATES / **ELEVATION**

X:	E 319835	N 233582	3.64m
Y:	E 319826	N 233584	3.45m

Orientation - 287°

SLIT TRENCH DETAILS

Date	14.5.03
Depth	1.20m
Width	0.60m
Length	10.00m

Dublin Waste to Energy
M. C. O'Sullivan & Co. Ltd.
Ground Investigation Slit Trench Details

DRAWN BY	DATE	SCALE
TL	18.6.03	1:50
CHECKED: MK	APPRD: MK	STATUS
SLIT TRENCH NO.: ST02		REV.

GEOTECH

Trial Pit Log

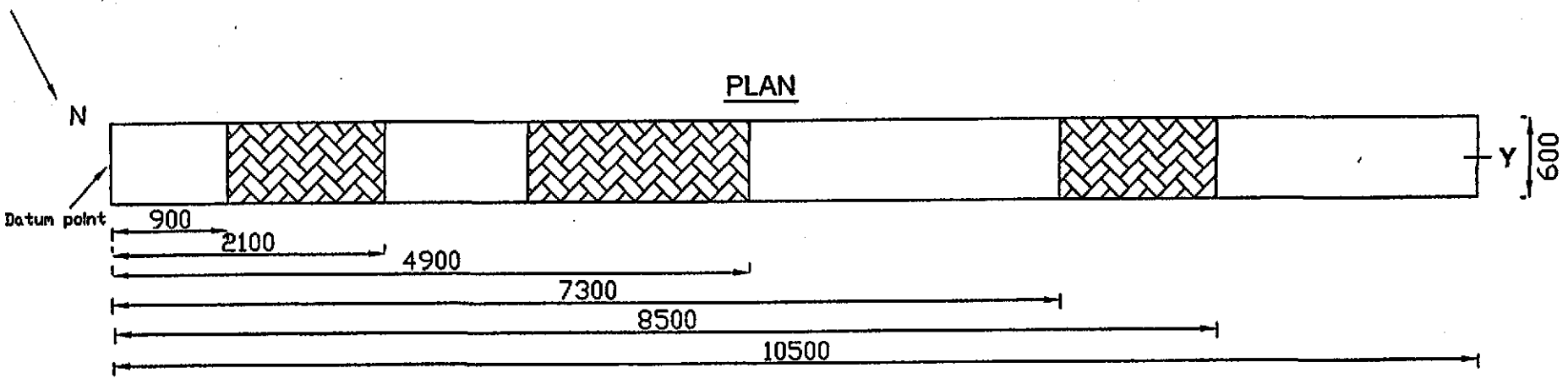
GEOTECH

Logged by PG Checked by MK	Start 14/05/2003 End 14/05/2003	Equipment, Methods and Remarks Excavated by JCB and Komatsu Mini-digger ESB representative on site for dig. Backfilled with gravel, reinstated surface.	Dimensions and Orientation Width 0.60 m Length 10.00 m 287 (Deg)	Ground Level - Coordinates - National Grid -

Samples and Tests			Strata			
Depth	Type & No.	Date Records	Description	Depth, Level/ (Thickness)	Legend	Backfill/ Instrument
			1 Dense bitumen macadam	(0.31)		
			2 Soft brown fine to medium sandy gravelly CLAY FILL with many granite boulders, brick and metal fragments, rare copper pipe, plastic, rubber and iron strips. Gravel is subangular to subrounded, fine to coarse. (MADE GROUND).	0.31 (0.89)		
			EXPLORATORY HOLE ENDS AT 1.20 m	1.20		
Depth	Type & No.	Records Date				

Groundwater Entries No. Struck Post Strike Behaviour (m) None observed (see Key Sheet)	Depth Related Remarks From to (m)	Stability Poor at hedge side Shoring N/A Weather -
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column. Scale 1:25	Project Dublin Waste to Energy Project No. KD3116 Carried out for Dublin City Council	Trial Pit ST02 Sheet 1 of 1

PLAN



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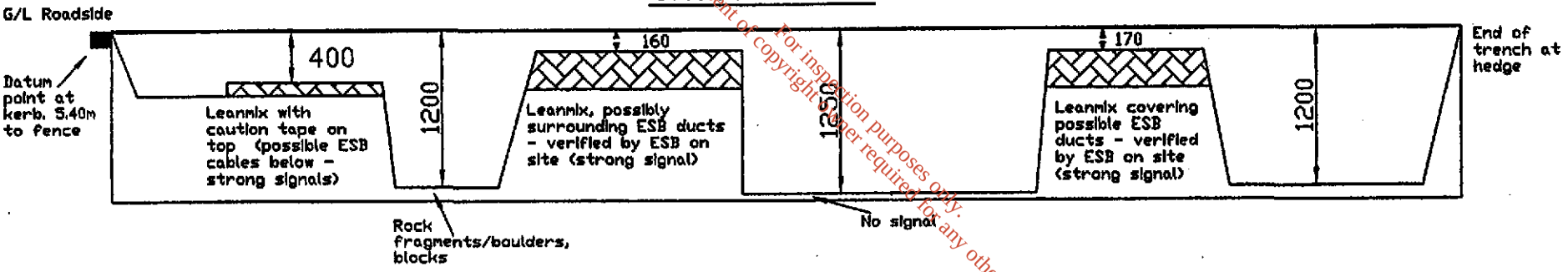


KEY

- Dimensions (in millimetres)
- Pipes
- Ground level

LOG OF TRENCH (m)

0.00 - 0.10	DENSE BITUMEN MACADAM
0.10 - 0.41	Roadstone
0.41 - 1.20	MADE GROUND - sandy gravelly CLAY

CO-ORDINATES **ELEVATION**

X: E 319824 N 233525 3.66m
Y: E 319815 N 233527 3.56m

Orientation - 287°

SLIT TRENCH DETAILS

Date 14.6.03
Depth 1.20m
Width 0.60m
Length 10.50m

Dublin Waste to Energy
M. C. O'Sullivan & Co. Ltd.
Ground Investigation Slit Trench Details

DRAWN BY TL	DATE 18.6.03	SCALE 1:50
CHECKED PG	APPRD MK	STATUS
SLIT TRENCH NO. ST03		REV.

GEOTECH

Trial Pit Log

GEOTECH

Logged by PG Checked by MK	Start 14/05/2003 End 14/05/2003	Equipment, Methods and Remarks Excavated by JCB and Komatsu mini-digger ESB representative on site for dig. Backfilled with gravel, reinstated surface.	Dimensions and Orientation Width 0.60 m Length 10.50 m 287 (Deg)	Ground Level - Coordinates - National Grid -

Samples and Tests

Depth	Type & No.	Date Records

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instrument
1 Dense bitumen macadam	0.10		
2 Grey slightly clayey ROADSTONE subbase.	(0.31)		
	0.41		
3 Soft mottled grey brown fine to medium sandy gravelly CLAY FILL with many concrete, granite and brick fragments, wiring, cables, metal and wood fragments, rare re-inforcing bars (not local to trench) and plastic. Rare yellow sandstone blocks. Gravel is angular to subrounded fine to coarse. (MADE GROUND).	(0.79)		
	1.20		
EXPLORATORY HOLE ENDS AT 1.20 m			

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike	Behaviour
None observed (see Key Sheet)			

Depth Related Remarks

From to (m)

Stability poor from 0.41m bgl.

Shoring N/A

Weather -

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

Scale 1:25 (c) MESC HBR (281), 30/10/2003 12:50:30

Project Dublin Waste to Energy

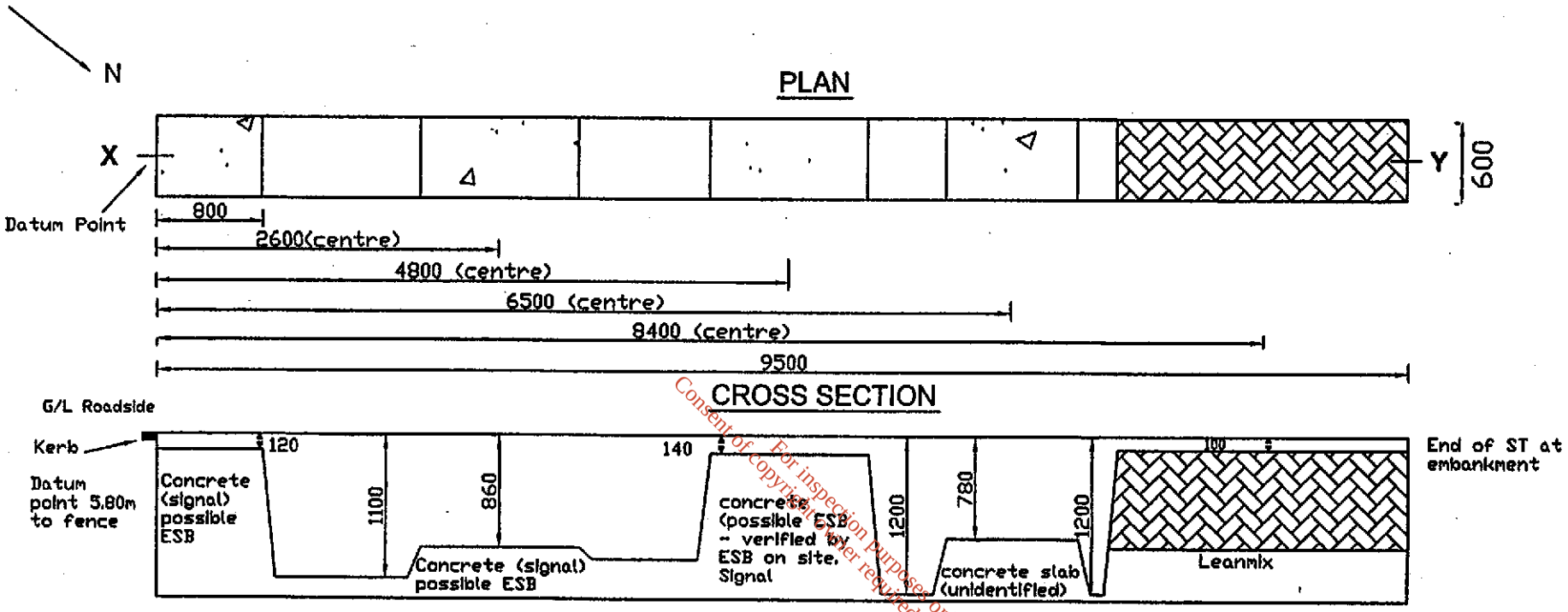
Project No. KD3116

Carried out for Dublin City Council

Trial Pit

ST03

Sheet 1 of 1



KEY

- Dimensions (in millimetres)
- Pipes
- Ground level

LOG OF TRENCH

0.00 - 0.10	DENSE BITUMEN MACADAM
0.10 - 0.33	ROADSTONE sub base
0.33 - 1.20	MADE GROUND - sandy gravelly CLAY

CO-ORDINATES **ELEVATION**

X: E 319810 N 233452 3.74m
Y: E 319801 N 233454 3.56m

Orientation - 277°

SLIT TRENCH DETAILS

Date	14.5.03
Depth	1.20m
Width	0.60m
Length	9.50m

Dublin Waste to Energy
M. C. O'Sullivan & Co. Ltd.
Ground Investigation Slit Trench Details

DRAWN BY	DATE	SCALE
TL	26.6.03	1:50
CHECKED	APPRD	STATUS
PG	MK	
SLIT TRENCH NO.		REV.
ST04		

GEOTECH

Trial Pit Log

PRELIMINARY

GEOTECH

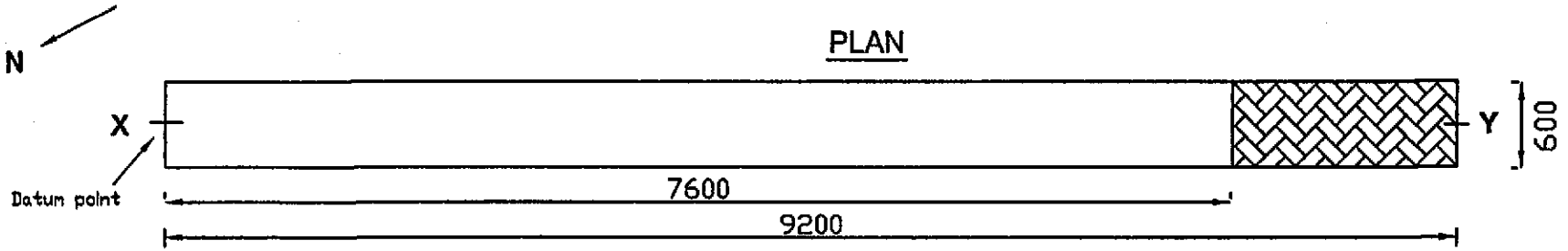
Logged by PG	Start 14/05/2003	Equipment, Methods and Remarks	Dimensions and Orientation	Ground Level -
Checked by	End 14/05/2003	Excavated by JCB and Komatsu mini-digger ESB representative on site for dig. Backfilled with gravel, reinstated surface.	Width 0.60 m Length 9.50 m 277 (Deg)	Coordinates - National Grid -

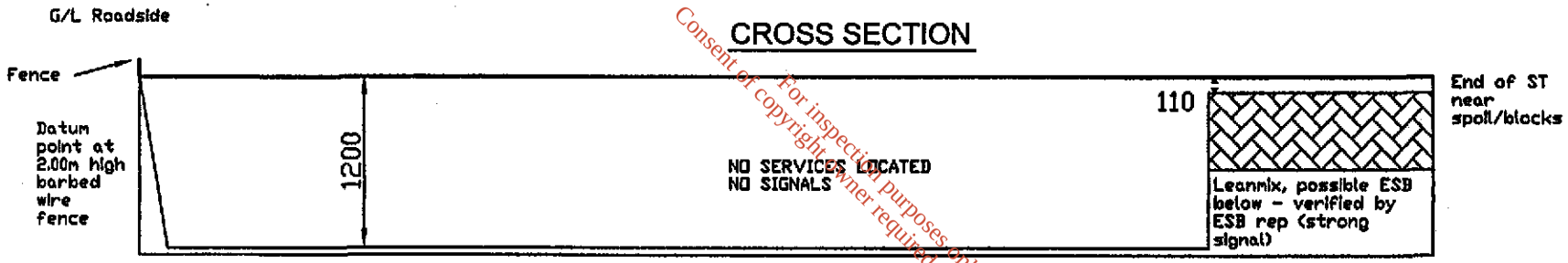
Samples and Tests			Strata			
Depth	Type & No.	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instrument
			1 Dense bitumen macadam	0.10		
			2 Grey ROADSTONE subbase.	0.33		
			3 Soft to firm dark brown fine to coarse sandy gravelly CLAY FILL with many red brick and concrete fragments, wood chips, metal bars and plastic. Gravel is subangular to subrounded fine to coarse. (MADE GROUND).	(0.87)		
			EXPLORATORY HOLE ENDS AT 1.20 m	1.20		

Depth	Type & No.	Records Date

Groundwater Entries	Depth Related Remarks	Stability Poor from 0.33m bgl.
No. Struck Post Strike Behaviour (m)	From to (m)	Shoring N/A
None observed (see Key Sheet)		Weather -

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.	Project Dublin Waste to Energy	Trial Pit
Scale 1:25	Project No. KD3116	ST04
	Carried out for Dublin City Council	Sheet 1 of 1





KEY

- Dimensions (in millimetres)
- Pipes
- Ground level

LOG OF TRENCH

0.00 - 0.10	DENSE BITUMEN MACADAM
0.10 - 0.40	Gravelly CLAY
0.40 - 1.20	MADE GROUND - sandy gravelly CLAY

CO-ORDINATES **ELEVATION**

X: E 319827	N 233436	3.88m
Y: E 319825	N 233428	3.89m

ORIENTATION - 200°

SLIT TRENCH DETAILS

Date	14.5.03
Depth	1.20m
Width	0.60m
Length	9.20m

Dublin Waste to Energy
M. C. O'Sullivan & Co. Ltd.
Ground Investigation Slit Trench Details

DRAWN BY: TL	DATE: 16.5.03	SCALE: 1:50
CHECKED: PG	APPRD: MK	STATUS:
SLIT TRENCH NO.: ST05		REV.:

GEOTECH

Trial Pit Log

GEOTECH

Logged by PG Checked by MK	Start 14/05/2003 End 14/05/2003	Equipment, Methods and Remarks Excavated by JCB and Komatsu mini-digger ESB representative on site for dig. Backfilled with gravel, reinstated surface.	Dimensions and Orientation Width 0.60 m Length 9.20 m 200 (Deg)	Ground Level - Coordinates - National Grid -

Samples and Tests

Depth	Type & No.	Date Records

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instrument
1 Dense bitumen macadam	0.10		
2 Stiff brown gravelly CLAY (possible subbase). Gravel is subangular to subrounded fine to coarse.	(0.30)		
3 Soft brown slightly fine to coarse sandy gravelly CLAY FILL with many red and yellow brick fragments, blocks, wood chips, plastic, cloth, glass, metal strips and re-inforcing bars (not local to trench). Gravel is subangular to subrounded fine to coarse. (MADE GROUND).	0.40 (0.80)		
EXPLORATORY HOLE ENDS AT 1.20 m	1.20		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike	Behaviour
None observed (see Key Sheet)			

Depth Related Remarks

From to (m)

Stability Poor along entire length of trench to 1.20m bgl.

Shoring N/A

Weather -

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

Scale 1:25

Project Dublin Waste to Energy

Project No. KD3116

Carried out for Dublin City Council

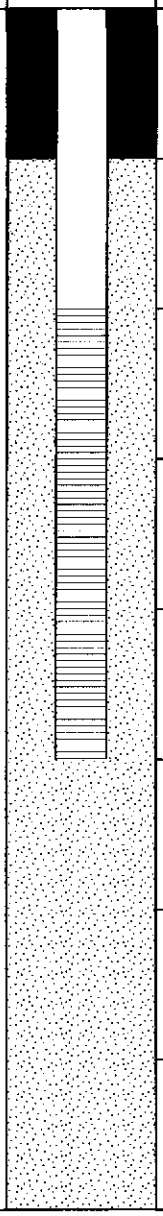
Trial Pit

ST05

Sheet 1 of 1

BORING LOG

Drill Rig: Cable Percussion	Date Drilled: 03/03/05	Logged By:
Boring Dia: 8 Inches	Boring Number: MW01	Y.C.

Sample	Blow Counts	Completion	Depth Meters	Lithology	Description
			5		FILL comprising concrete, rubble FILL comprising brown sandy CLAY with silt and cobbles. Fill also contains red brick fragments FILL comprising sand with cobbles. Fill also contains red brick fragments and tree bark. FILL comprising sand with occasional gravels and small cobbles. Fill also contains red brick fragments Natural Ground - Sand and Gravel

Completion Notes:

Inspection pit dug to 1.2m. Struck water during drilling at 4.6mbg. Struck hydrocarbon contamination at 4.5mbg. Hydrocarbon contamination extended from 4.5mbg to 7.0mbg. Samples taken at 1m intervals.

Site:

DWTE

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Project No.:

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BORING LOG

Drill Rig: Cable Percussion	Date Drilled: 02/03/05	Logged By:
Boring Dia: 8 Inches	Boring Number: MW02	Y.C.

Sample	Blow Counts	Completion	Depth Meters	Lithology	Description
			1		MADE GROUND comprising concrete, rubble
					FILL comprising dark brown to black SAND and GRAVEL with cobbles. Fill also contains red brick fragments.
			2		Very black silty SAND.
			3		
			4		

Completion Notes:

Inspection pit dug to 1.2m. Struck water during drilling at 4.5mbg. Observed hydrocarbon contamination at 4.0mbg. Hydrocarbon contaminaition extended from 4.0mbg to 5.0mbg. Also possible contamination at 2m due to odour. Samples taken at 1m intervals during drilling. Samples from 1m, 5m and 7m submitted to lab for analysis.

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Project No.:

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BORING LOG

Drill Rig: Cable Percussion	Date Drilled: 02/03/05	Logged By:
Boring Dia: 8 Inches	Boring Number: MW02	Y.C.

Sample	Blow Counts	Completion	Depth Meters	Lithology	Description
			6		SAND and GRAVEL with cobbles
			7		
			8		
			9		

Completion Notes:

Inspection pit dug to 1.2m. Struck water during drilling at 4.5mbg. Observed hydrocarbon contamination at 4.0mbg. Hydrocarbon contaminaition extended from 4.0mbg to 5.0mbg. Also possible contamination at 2m due to odour. Samples taken at 1m intervals during drilling. Samples from 1m, 5m and 7m submitted to lab for analysis.

Site:

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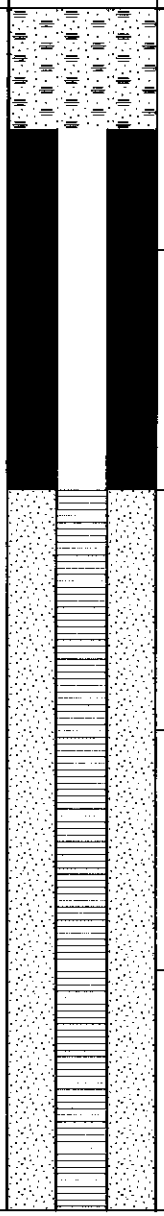
Project No.:

BORING LOG

Drill Rig: Cable Percussion	Date Drilled: 04/03/05	Logged By:
Boring Dia: 8 Inches	Boring Number: MW03	Y.C.

Sample	Blow Counts	Completion	Depth Meters	Lithology	Description
			1 2 3 4		MADE GROUND comprising concrete, rubble FILL comprising dark brown SAND with cobbles. Fill also contains red brick fragments, metal, glass FILL comprising dark brown sandy SILT with clay and cobbles. Fill also contains red brick fragments FILL comprising dark brown sandy SILT with clay and cobbles. Fill also contains red brick fragments FILL comprising dark brown sandy SILT with clay. Fill contains red brick fragments Sandy SILT with clay

Completion Notes:

Inspection pit dug to 1.2m. Struck water during drilling at 4.7mbg. Struck hydrocarbon contamination at 4.5mbg. Hydrocarbon contaminaition extended from 4.5mbg to 6.5mbg. Samples taken at 1m intervals during drilling. Samples from 1m, 5m and 7m submitted to lab for analysis.

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BORING LOG

Drill Rig: Cable Percussion	Date Drilled: 04/03/05	Logged By:
Boring Dia: 8 Inches	Boring Number: MW03	Y.C.

Sample	Blow Counts	Completion	Depth Meters	Lithology	Description
					SAND with occasional gravels
			6		
			7		
			8		
			9		

Completion Notes:

Inspection pit dug to 1.2m. Struck water during drilling at 4.7mbg. Struck hydrocarbon contamination at 4.5mbg. Hydrocarbon contaminaition extended from 4.5mbg to 6.5mbg. Samples taken at 1m intervals during drilling. Samples from 1m, 5m and 7m submitted to lab for analysis.

Site:

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Project No.:

BORING LOG

Drill Rig: Cable Percussion	Date Drilled: 05/03/05	Logged By:
Boring Dia: 8 Inches	Boring Number: MW04	Y.C.

Sample	Blow Counts	Completion	Depth Meters	Lithology	Description
			1		MADE GROUND including concrete, rubble
			2		FILL comprising brown silty SAND with occasional gravels and red brick fragments
			3		
			4		

Completion Notes:

Inspection pit dug to 1.2m. Terminated borehole having struck pipe at 1.5m

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DWTE

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BORING LOG

Drill Rig: Cable Percussion	Date Drilled: 08/03/05	Logged By:
Boring Dia: 8 Inches	Boring Number: MW04(A)	Y.C.

Sample	Blow Counts	Completion	Depth Meters	Lithology	Description
					MADE GROUND comprising concrete, rubble
			1		FILL comprising dark brown silty SAND with gravels and red brick fragments
					FILL comprising dark brown SILTY with red brick fragments
			2		FILL comprising dark brown sandy CLAY with silt. Fill also contains red brick fragments, car battery, glass
			3		FILL comprising light brown SAND. Fill contains glass, red brick, metal, car battery
			4		FILL comprising SAND. Fill also contains wood, glass, tiling

Completion Notes:

Inspection pit dug to 1.2m. Struck water during drilling at 4.0mbg. Struck hydrocarbon contamination at 4.0mbg. Hydrocarbon contaminaition extended from 4.0mbg to 6.0mbg. Samples taken at 1m intervals during drilling. Samples from 3m, 5m and 7m submitted to lab for analysis.

Site:

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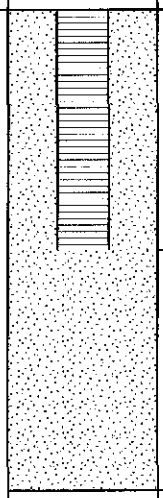
Project No.:

BORING LOG

Drill Rig: Cable Percussion	Date Drilled: 08/03/05	Logged By:
Boring Dia: 8 Inches	Boring Number: MW04(A)	Y.C.

Sample	Blow Counts	Completion	Depth Meters	Lithology	Description
			6 7 8 9		Natural Ground. SAND and GRAVEL with cobbles

Completion Notes:

Inspection pit dug to 1.2m. Struck water during drilling at 4.0mbg. Struck hydrocarbon contamination at 4.0mbg. Hydrocarbon contaminaition extended from 4.0mbg to 6.0mbg. Samples taken at 1m intervals during drilling. Samples from 3m, 5m and 7m submitted to lab for analysis.

Site:

DWTE

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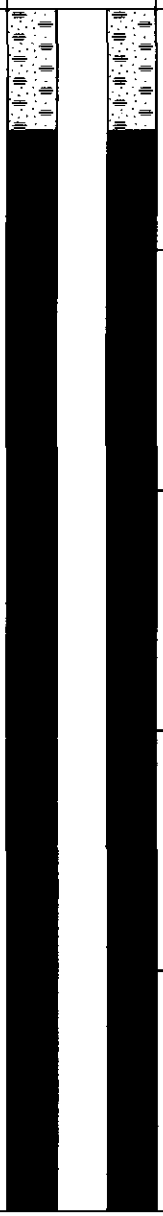
Project No.:

BORING LOG

Drill Rig: Cable Percussion	Date Drilled: 10/03/05	Logged By:
Boring Dia: 8 Inches	Boring Number: MW05	Y.C.

Sample	Blow Counts	Completion	Depth Meters	Lithology	Description
			1		MADE GROUND comprising concrete, rubble.
					FILL comprising silty SAND with occasional gravels and red brick fragments
			2		FILL comprising sandy CLAY with silt and cobbles and red brick fragments
					FILL comprising sandy SILT with clay and cobbles. Fill also contains red brick and wood
			3		FILL comprising sandy CLAY with silt and cobbles. Fill also contains red brick, glass, plastic and wood
			4		Natural ground. SAND with cobbles.

Completion Notes:

Inspection pit dug to 1.2m. Struck water during drilling at 4.5mbg. Struck hydrocarbon contamination at 4.5mbg. Hydrocarbon contaminaition extended from 4.5mbg to 6.5mbg. Samples taken at 1m intervals during drilling. Samples from 1m, 5m and 10m submitted to lab for analysis.

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Project No.:

BORING LOG

Drill Rig: Cable Percussion	Date Drilled: 10/03/05	Logged By:
Boring Dia: 8 Inches	Boring Number: MW05	Y.C.

Sample	Blow Counts	Completion	Depth Meters	Lithology	Description
			6		Natural ground. SAND and GRAVEL
			7		
			8		Natural ground. SAND and GRAVEL with cobbles.
			9		

Completion Notes:

Inspection pit dug to 1.2m. Struck water during drilling at 4.5mbg. Struck hydrocarbon contamination at 4.5mbg. Hydrocarbon contaminaition extended from 4.5mbg to 6.5mbg. Samples taken at 1m intervals during drilling. Samples from 1m, 5m and 10m submitted to lab for analysis.

Site:

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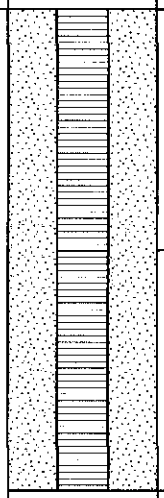
Project No.:

BORING LOG

Drill Rig: Cable Percussion	Date Drilled: 10/03/05	Logged By:
Boring Dia: 8 Inches	Boring Number: MW05	Y.C.

Sample	Blow Counts	Completion	Depth Meters	Lithology	Description
			11 12 13 14		

Completion Notes:

Inspection pit dug to 1.2m. Struck water during drilling at 4.5mbg. Struck hydrocarbon contamination at 4.5mbg. Hydrocarbon contaminaition extended from 4.5mbg to 6.5mbg. Samples taken at 1m intervals during drilling. Samples from 1m, 5m and 10m submitted to lab for analysis.

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Project No.:

BORING LOG

Drill Rig: Cable Percussion	Date Drilled: 05/03/05	Logged By:
Boring Dia: 8 Inches	Boring Number: MW06	Y.C.

Sample	Blow Counts	Completion	Depth Meters	Lithology	Description
					MADE GROUND, concrete and rubble
			1		FILL comprising very dark brown sandy SILT with some clay and occasional gravels. Fill also contains red brick fragments.
					FILL comprising very black silty SAND with occasional gravels. Fill also contains red brick fragments
			2		FILL comprising brown sandy SILT with cobbles. Fill also contains red brick fragments
			3		
			4		

Completion Notes:

Inspection pit dug to 1.2m. Drilling abandoned at 2.7m after 1hr of chiselling due to large boulder. Water not encountered

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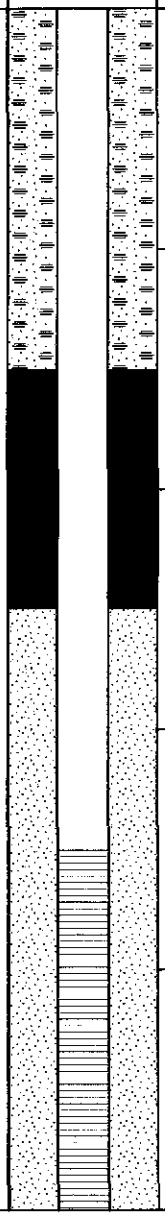
BORING LOG

Drill Rig: Cable Percussion	Date Drilled: 08/03/05	Logged By:
Boring Dia: 8 Inches	Boring Number: MW06(A)	Y.C.

Sample	Blow Counts	Completion	Depth Meters	Lithology	Description
			1 2 3 4		MADE GROUND comprising concrete, rubble. FILL comprising very dark brown to black SILT with red brick fragments FILL comprising sandy CLAY with silt. Fill also contains red brick fragments and concrete FILL comprising silty SAND with very occasional gravels. Fill also contains red brick fragments and concrete. Natural Ground - SAND

Completion Notes:

Inspection pit dug to 1.2m. Struck water during drilling at 4.5mbg. Struck hydrocarbon contamination at 4.0mbg. Hydrocarbon contaminaition observed extended from 4.0mbg to 7.0mbg. Hole terminated at 7.3. Samples taken at 1m intervals during drilling. Samples from 1m, 4m and 7.3m submitted to lab for analysis.

Site:

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Project No.:

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BORING LOG

Drill Rig: Cable Percussion	Date Drilled: 08/03/05	Logged By:
Boring Dia: 8 Inches	Boring Number: MW06(A)	Y.C.

Sample	Blow Counts	Completion	Depth Meters	Lithology	Description
			6		Natural Ground- SAND and GRAVEL
			7		Natural Ground - SAND and GRAVEL with cobbles
			8		
			9		

Completion Notes:

Inspection pit dug to 1.2m. Struck water during drilling at 4.5mbg. Struck hydrocarbon contamination at 4.0mbg. Hydrocarbon contaminaition observed extended from 4.0mbg to 7.0mbg. Hole terminated at 7.3. Samples taken at 1m intervals during drilling. Samples from 1m, 4m and 7.3m submitted to lab for analysis.

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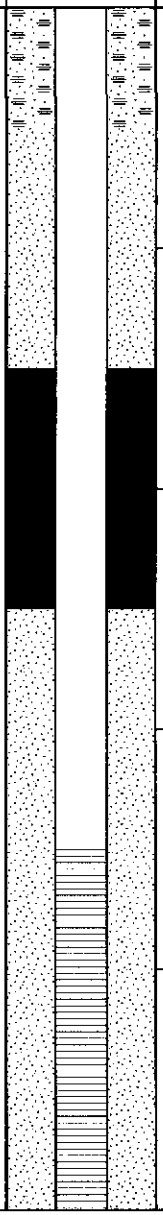
Project No.:

BORING LOG

Drill Rig: Cable Percussion	Date Drilled: 07/03/05	Logged By:
Boring Dia: 8 Inches	Boring Number: MW07	Y.C.

Sample	Blow Counts	Completion	Depth Meters	Lithology	Description
			1 2 3 4		MADE GROUND comprising concrete, rubble FILL comprising SILT with cobbles. Fill also contains red brick and plastic FILL comprising sandy CLAY with silt and cobbles. Fill also contains red brick fragments and glass FILL comprising SILT with cobbles and red brick fragments FILL comprising clayey SAND with cobbles. Fill also contains red brick and computer film FILL comprising sandy CLAY with silt and cobbles. Fill also contains red brick fragments and plastic material

Completion Notes:

Inspection pit dug to 1.2m. Struck water during drilling at 4.5mbg. Hydrocarbon contamination observed at 4.0mbg. Hydrocarbon contaminaition extended from 4.0mbg to 5.5mbg. Hole terminated at 6.9m. Samples taken at 1m intervals during drilling. Samples from 1m, 4m and 6m submitted to lab for analysis.

Site:

DWTE

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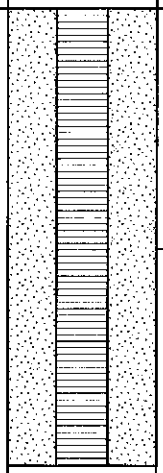
Project No.:

BORING LOG

Drill Rig: Cable Percussion	Date Drilled: 07/03/05	Logged By:
Boring Dia: 8 Inches	Boring Number: MW07	Y.C.

Sample	Blow Counts	Completion	Depth Meters	Lithology	Description
					Natural ground - SAND with shells
			6		Sandy GRAVEL
			7		
			8		
			9		

Completion Notes:

Inspection pit dug to 1.2m. Struck water during drilling at 4.5mbg. Hydrocarbon contamination observed at 4.0mbg. Hydrocarbon contaminaition extended from 4.0mbg to 5.5mbg. Hole terminated at 6.9m. Samples taken at 1m intervals during drilling. Samples from 1m, 4m and 6m submitted to lab for analysis.

Site:

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Project No.:

Trial Pit Log

GEOTECH

Logged AB Checked MK	Start 22/03/2005 End 22/03/2005	Equipment, Methods and Remarks Excavated by JBC 3CX. Pit terminated due to instability. Trial pit backfilled with arisings.	Dimensions and Orientation Width 0.60 m Length 3.80 m A B C D 350 (Deg)	Ground Level - Coordinates - National Grid -

Samples and Tests			Strata			
Depth	Type & No.	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
			1 Grey angular GRAVEL FILL with concrete and brick fragments. (MADE GROUND)			
0.50	ES 1			(1.00)		
			2 Dark grey brown slightly clayey gravelly fine to coarse SAND with rare coobbles. Gravel is subangular to rounded fine to coarse. (MADE GROUND)	1.00		
				(1.30)		
			3 Brown clayey SAND and GRAVEL FILL with concrete, bricks and metal fragments. (MADE GROUND)	2.30		
2.80	ES 2			(1.40)		
3.50	ES 3					
			EXPLORATORY HOLE ENDS AT 3.70 m	3.70		
Depth	Type & No.	Records Date				

Groundwater Entries No. Struck Post Strike Behaviour (m) None observed (see Key Sheet)	Depth Related Remarks * From to (m)	Stability poor Shoring none Weather
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column. Scale 1:25 (c) MESG 358 v1.20a20/04/2005 17:03:45 AGS	Project Ringsend Project No. KD5032 Carried out for	Trial Pit TP01 Sheet 1 of 1

Trial Pit Log

GEOTECH

Logged AB Checked MK	Start 22/03/2005 End 22/03/2005	Equipment, Methods and Remarks Excavated by JBC 3CX. Pit terminated due to instability. Trial pit backfilled with arisings.	Dimensions and Orientation Width 0.60 m Length 3.90 m A B C D → 045 (Deg)	Ground Level - Coordinates - National Grid -

Samples and Tests			Strata			
Depth	Type & No.	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
			1 Grey yellow slightly clayey sandy GRAVEL. Gravel is angular fine to coarse. (MADE GROUND)	(0.35)		
0.30	ES 1		0.30-0.35 m possible oil contamination (<5cm)	0.35		
			2 Brown clayey SAND and GRAVEL FILL with some cobbles and rare boulders and fragments of bricks, concrete, tin and pipes. (MADE GROUND)	(2.85)		
2.00	ES 2					
3.00	ES 3					
			EXPLORATORY HOLE ENDS AT 3.20 m	3.20		
Depth	Type & No.	Records Date				

Groundwater Entries No. Struck (m) Post Strike Behaviour None observed (see Key Sheet)	Depth Related Remarks * From to (m)	Stability poor Shoring none Weather
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column. Scale 1:25 (c) MESG 358 v1.20a20/04/2005 17:03:50 AGS	Project Ringsend Project No. KD5032 Carried out for	Trial Pit TP02 Sheet 1 of 1

Trial Pit Log

GEOTECH

Logged AB Checked MK	Start 22/03/2005 End 22/03/2005	Equipment, Methods and Remarks Excavated by JBC 3CX. Pit terminated on obstruction. Trial pit backfilled with arisings.	Dimensions and Orientation Width 0.60 m Length 4.00 m A B C D → 090 (Deg)	Ground Level - Coordinates - National Grid -

Samples and Tests

Depth	Type & No.	Date Records
0.50	ES 1	
2.20	ES 2	
3.20	ES 3	

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
1 Dark grey brown clayey sandy GRAVEL with some pockets of silt and some cobbles and boulders (up to 800mm) and some fragments of brick, concrete, cable, plastic, etc. Gravel is angular to rounded fine to coarse. (MADE GROUND)			
0.45 m lense of tar			
	(3.40)		
EXPLORATORY HOLE ENDS AT 3.40 m 3.40 m boulder obstruction	3.40		

Depth	Type & No.	Records Date

Groundwater Entries

No. Struck (m)	Post Strike Behaviour
None observed (see Key Sheet)	

Depth Related Remarks *

From to (m)

Stability good

Shoring none

Weather

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

Scale 1:25 (c) MESC 358 v1.20a20/04/2005 17:03:54 AGS

Project Ringsend

Project No. KD5032

Carried out for

Trial Pit TP03

Sheet 1 of 1

Trial Pit Log

GEOTECH

Logged AB Checked MK	Start 24/03/2005 End 24/03/2005	Equipment, Methods and Remarks Excavated by JBC 3CX. Pit terminated due to instability. Trial pit backfilled with arisings.	Dimensions and Orientation Width 0.70 m Length 4.50 m 090 (Deg)	Ground Level - Coordinates - National Grid -

Samples and Tests			Strata			
Depth	Type & No.	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
			1 Dark brown slightly clayey SAND and GRAVEL FILL with rare subrounded cobbles and some fragments of brick, reinforced concrete, plastic, etc. Gravel is subangular to rounded fine to coarse. (MADE GROUND)			
0.50	ES 1					
			1.20 m struck old pipe, some unknown fluid			
				(3.60)		
2.00	ES 2					
3.00	ES 3					
			EXPLORATORY HOLE ENDS AT 3.60 m	3.60		
Depth	Type & No.	Records Date				

Groundwater Entries No. Struck (m) Post Strike Behaviour	Depth Related Remarks * From to (m)	Stability poor to moderate Shoring none Weather
None observed (see Key Sheet)		

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column. Scale 1:25 (c) MESG 358 v1.20a20/04/2006 17:03:53 AGS	Project Ringsend Project No. KD5032 Carried out for	Trial Pit TP04 Sheet 1 of 1

Trial Pit Log

GEOTECH

Logged AB Checked MK	Start 22/03/2005 End 22/03/2005	Equipment, Methods and Remarks Excavated by JBC 3CX. Pit terminated due to instability. Trial pit backfilled with arisings.	Dimensions and Orientation Width 0.80 m Length 4.10 m A B C D → 010 (Deg)	Ground Level - Coordinates - National Grid -

Samples and Tests

Depth	Type & No.	Date Records
0.50	ES 1	
2.00	ES 2	
3.00	ES 3	

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
1 Dark brown slightly clayey SAND and GRAVEL FILL with some fragments of brick, concrete, steel and plastic. Gravel is angular to rounded fine to coarse. Sand is fine to coarse. (MADE GROUND)	(3.00)		
EXPLORATORY HOLE ENDS AT 3.00 m	3.00		

Depth	Type & No.	Records Date

Groundwater Entries
No. Struck Post Strike Behaviour (m)
None observed (see Key Sheet)

Depth Related Remarks *
From to (m)

Stability poor
Shoring none
Weather

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1:25 (c) MESG 358 v1.20a20/04/2005 17:04:02 AGS

Project Ringsend
Project No. KD5032
Carried out for

Trial Pit TP05
Sheet 1 of 1

Trial Pit Log

GEOTECH

Logged	AB	Start	23/03/2005	Equipment, Methods and Remarks	Dimensions and Orientation	Ground Level	-
Checked	MK	End	23/03/2005	Excavated by JBC 3CX. Pit terminated on obstruction. Trial pit backfilled with arisings.	Width 1.10 m, Length 4.20 m, 045 (Deg)	Coordinates	-
						National Grid	-

Samples and Tests			Strata			
Depth	Type & No.	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
			1 TARMAC over gravel subbase	0.05		
			2 Medium dense grey SAND and GRAVEL FILL. (MADE GROUND)	(0.35)		
			3 TARMAC	0.40		
0.50	ES 1		4 Soft to firm grey brown sandy gravelly CLAY with rare cobbles and boulders and some fragments of brick, concrete, metal, plastic, etc. Gravel is angular to rounded fine to coarse. (MADE GROUND)	0.45		
				(1.95)		
2.40	ES 2		EXPLORATORY HOLE ENDS AT 2.40 m. 2.40 m driller reports pushing boulders	2.40		
Depth	Type & No.	Records Date				

Groundwater Entries	Depth Related Remarks *	Stability good
No. Struck (m) Post Strike Behaviour	From to (m)	Shoring none
None observed (see Key Sheet)		Weather

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.	Project Ringsend	Trial Pit TP06
Scale 1:25 (c) MESG 366 v1.20a20/04/2005 17:04:05 AGS	Project No. KD5032	Sheet 1 of 1
	Carried out for	

Trial Pit Log

GEOTECH

Logged AB Checked MK	Start 23/03/2005 End 23/03/2005	Equipment, Methods and Remarks Excavated by JBC 3CX. Pit terminated due to ground water inflow / instability. Trial pit backfilled with arisings.	Dimensions and Orientation Width 1.00 m Length 4.00 m A B C D → 045 (Deg)	Ground Level - Coordinates - National Grid -

Samples and Tests			Strata			
Depth	Type & No.	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
			1 TARMAC over gravel subbase.	0.05		
			2 Medium dense grey SAND and GRAVEL. Gravel is angular to rounded fine to coarse. (MADE GROUND)	(0.35)		
			3 TARMAC	0.40		
0.50	ES 1		4 Soft to firm grey brown slightly sandy gravelly CLAY with rare cobbles and some fragments of brick, concrete, metal, etc. Gravel is angular to rounded fine to coarse. (MADE GROUND)	0.45		
2.00	ES 2			(3.25)		
3.00	ES 3					
			EXPLORATORY HOLE ENDS AT 3.70 m	3.70		
Depth	Type & No.	Records Date				

Groundwater Entries			Depth Related Remarks *	Stability poor
No.	Struck (m)	Post Strike Behaviour	From to (m)	Shoring none
1	3.50	slow seepage		Weather

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.	Project Ringsend Project No. KD5032 Carried out for	Trial Pit TP07 Sheet 1 of 1
Scale 1:25 (c) MESG 358 v1.20a20/04/2005 17:04:09 AGS		

Trial Pit Log

GEOTECH

Logged	AB	Start	23/03/2005	Equipment, Methods and Remarks	Dimensions and Orientation	Ground Level	-
Checked	MK	End	23/03/2005	Excavated by JBC 3CX. Pit terminated due to obstruction. Trial pit backfilled with arisings.	Width 1.00 m Length 4.00 m 045 (Deg)	Coordinates National Grid	- -

Samples and Tests

Depth	Type & No.	Date Records
0.50	ES 1	
2.00	ES 2	
3.10	ES 3	

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
1 TARMAC over gravel subbase	0.05		
2 Medium dense grey SAND and GRAVEL FILL. (MADE GROUND)	(0.40)		
3 TARMAC	0.45		
4 Firm grey brown slightly sandy gravelly CLAY with rare cobbles and some fragments of brick, concrete, metal, etc. Gravel is angular to subrounded fine to coarse. (MADE GROUND)	0.55		
	(2.55)		
EXPLORATORY HOLE ENDS AT 3.10 m — 3.10 m boulder obstruction	3.10		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
1	2.20	slow seepage

Depth Related Remarks *

From to (m)

Stability poor

Shoring none

Weather

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

Scale 1:25 (c) MESG 358 v1.20a20/04/2005 17:04:14

Project Ringsend

Project No. KD5032

Carried out for

Trial Pit TP08

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Trial Pit Log

GEOTECH

Logged AB Checked MK	Start 23/03/2005 End 23/03/2005	Equipment, Methods and Remarks Excavated by JBC 3CX. Pit terminated on obstruction. Trial pit backfilled with arisings.	Dimensions and Orientation Width 1.00 m Length 4.00 m A B C D → 045 (Deg)	Ground Level - Coordinates - National Grid -

Samples and Tests

Depth	Type & No.	Date Records
0.50	ES 1	
2.00	ES 2	

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
1 TARMAC over gravel subbase	0.05		
2 Medium dense grey SAND and GRAVEL FILL. (MADE GROUND)	(0.35)		
3 TARMAC	0.40		
4 Soft to firm dark grey brown slightly sandy gravelly CLAY with rare subangular cobbles and some fragments of brick, concrete, metal, wood, etc. Gravel is angular to rounded fine to coarse. (MADE GROUND) 0.60-0.70 m some orange staining	0.45 (1.75)		1
EXPLORATORY HOLE ENDS AT 2.20 m 2.20 m boulder obstruction	2.20		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
1	0.70	slight seepage

Depth Related Remarks *
From to (m)

Stability moderate
Shoring none
Weather

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.
Scale 1:25 (c) MEBG 368 v1.20a20/04/2005 17:04:18 AGS

Project Ringsend
Project No. KD5032
Carried out for

Trial Pit
TP09
Sheet 1 of 1

Trial Pit Log

GEOTECH

Logged AB Checked MK	Start 23/03/2005 End 23/03/2005	Equipment, Methods and Remarks Excavated by JBC 3CX. Pit terminated on obstruction. Trial pit backfilled with arisings.	Dimensions and Orientation Width 1.00 m Length 4.00 m A B C D → 045 (Deg)	Ground Level - Coordinates - National Grid -

Samples and Tests			Strata			
Depth	Type & No.	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
			1 TARMAC over gravel subbase	0.05		
			2 Medium dense SAND and GRAVEL FILL. (MADE GROUND)	(0.35)		
			3 TARMAC	0.40		
0.50	ES 1		4 Soft to firm grey brown sandy gravelly CLAY with some fragments of brick, concrete, glass, metal, plastic, etc. Gravel is is angular to subrounded fine to coarse. (MADE GROUND)	0.45		
				(2.35)		
2.00	ES 2					
			EXPLORATORY HOLE ENDS AT 2.80 m 2.80 m boulder obstruction	2.80		
Depth	Type & No.	Records Date				

Groundwater Entries No. Struck Post Strike Behaviour (m) None observed (see Key Sheet)	Depth Related Remarks * From to (m)	Stability moderate Shoring none Weather
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column. Scale 1:25 (c) MEBG 368 v1.20a20/04/2005 17:04:22 AGS	Project Ringsend Project No. KD5032 Carried out for	Trial Pit TP10 Sheet 1 of 1

Trial Pit Log

GEOTECH

Logged AB Checked MK	Start 23/03/2005 End 23/03/2005	Equipment, Methods and Remarks Excavated by JBC 3CX. Pit terminated due to instability. Trial pit backfilled with arisings.	Dimensions and Orientation Width 1.00 m Length 4.00 m D A B C → 045 (Deg)	Ground Level - Coordinates - National Grid -

Samples and Tests			Strata			
Depth	Type & No.	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instrument
			1 TARMAC over gravel subbase.	0.05		
			2 Grey SAND and GRAVEL FILL with bricks, concrete, bottles and pipes. (MADE GROUND)	(0.45)		
0.50	ES 1		3 TARMAC over gravel fill.	0.50		
				(0.40)		
			4 Grey brown slightly sandy gravelly CLAY with some fragments of brick, concrete, glass, plastic, etc. Gravel is subangular to rounded fine to coarse. (MADE GROUND) 1.10 m driller reports some orange staining	0.90		
2.00	ES 2			(2.40)		
3.00	ES 3					
			5 Loose grey gravelly fine to coarse SAND. Gravel is subrounded to rounded fine to coarse. (possible MADE GROUND)	3.30		
				(0.70)		
			EXPLORATORY HOLE ENDS AT 4.00 m	4.00		
Depth	Type & No.	Records Date				

Groundwater Entries	Depth Related Remarks *	Stability moderate
No. Struck Post Strike Behaviour (m)	From to (m)	Shoring none
None observed (see Key Sheet)		Weather

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.	Project Ringsend	Trial Pit TP11
Scale 1:25 (c) MESG 356 v1.20a20/04/2005 17:04:26 AGS	Project No. KD5032 Carried out for	Sheet 1 of 1

Trial Pit Log

GEOTECH

Logged AB Checked MK	Start 23/03/2005 End 23/03/2005	Equipment, Methods and Remarks Excavated by JBC 3CX. Pit terminated due to instability. Trial pit backfilled with arisings.	Dimensions and Orientation Width 1.10 m Length 4.20 m A B C D → 135 (Deg)	Ground Level - Coordinates - National Grid -

Samples and Tests			Strata			
Depth	Type & No.	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
			1 TARMAC over gravel subbase.	0.05		
			2 Soft to firm brown slightly sandy gravelly CLAY with some fragments of concrete, brick, metal, glass, etc. Gravel is angular to rounded fine to coarse. (MADE GROUND)	(2.65)		
0.50	ES 1					
2.00	ES 2					
			3 Loose grey slightly gravelly SAND. Gravel is subrounded fine to medium. Strong hydrocarbon odour detected, some oil seepage at 3.20m. (possible MADE GROUND)	2.70		
3.20	ES 3			(1.30)		
			EXPLORATORY HOLE ENDS AT 4.00 m	4.00		
Depth	Type & No.	Records Date				

Groundwater Entries No. Struck (m) Post Strike Behaviour None observed (see Key Sheet)	Depth Related Remarks * From to (m)	Stability moderate Shoring poor Weather
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column. Scale 1:25 (c) MESG 356 v1.20a 23/04/2005 17:04:30 AGS	Project Ringsend Project No. KD5032 Carried out for	Trial Pit TP12 Sheet 1 of 1

Trial Pit Log

GEOTECH

Logged AB Checked MK	Start 23/03/2005 End 23/03/2005	Equipment, Methods and Remarks Excavated by JBC 3CX. Pit terminated due to instability. Trial pit backfilled with arisings.	Dimensions and Orientation Width 1.00 m Length 4.00 m A B C D 135 (Deg)	Ground Level - Coordinates - National Grid -

Samples and Tests

Depth	Type & No.	Date Records
0.50	ES 1	
2.00	ES 2	
3.50	ES 3	

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
1 TARMAC over gravel subbase	0.05		
2 Soft grey brown sandy gravelly CLAY with some fragments of brick, concrete, metal, etc. Gravel is subangular to rounded fine to coarse. (MADE GROUND)	(3.65)		1
3.50 m possible oil contamination in water sample			
EXPLORATORY HOLE ENDS AT 3.70 m	3.70		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
1	1.90	slight seepage

Depth Related Remarks *

From to (m)

Stability moderate

Shoring none

Weather

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

Scale 1:25 (c) MESG 368 v1.20a20/04/2005 17:04:34

Project Ringsend

Project No. KD5032

Carried out for

Trial Pit

TP13

Sheet 1 of 1

Trial Pit Log

GEOTECH

Logged AB Checked MK	Start 24/03/2005 End 24/03/2005	Equipment, Methods and Remarks Excavated by JBC 3CX. Pit terminated due to instability / ground water inflow. Trial pit backfilled with arisings.	Dimensions and Orientation Width 1.10 m Length 4.00 m A B C D → 045 (Deg)	Ground Level - Coordinates - National Grid -

Samples and Tests

Depth	Type & No.	Date Records
0.50	ES 1	
2.00	ES 2	
3.00	ES 3	

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
1 TARMAC over gravel subbase.	0.05		
2 Soft to firm grey brown sandy gravelly CLAY with some fragments of brick, concrete, glass, wood, etc. Gravel is angular to rounded fine to coarse. (MADE GROUND)	(3.55)		
EXPLORATORY HOLE ENDS AT 3.60 m	3.60		

Depth	Type & No.	Records Date

Groundwater Entries

No.	Struck (m)	Post Strike Behaviour
1	3.30	moderate seepage

Depth Related Remarks
From to (m)

Stability poor below 3.00m
Shoring none
Weather

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

Scale 1:25 (c) MEBG 359 v1.20a20/04/2006 17:04:38 AGS

Project Ringsend
Project No. KD5032
Carried out for

Trial Pit
TP14
Sheet 1 of 1

Trial Pit Log

GEOTECH

Logged AB Checked MK	Start 24/03/2005 End 24/03/2005	Equipment, Methods and Remarks Excavated by JBC 3CX. Pit terminated due to instability. Trial pit backfilled with arisings.	Dimensions and Orientation Width 0.70 m Length 6.00 m A B C D → 080 (Deg)	Ground Level - Coordinates - National Grid -

Samples and Tests

Depth	Type & No.	Date Records
0.50	ES 1	
2.00	ES 2	
3.00	ES 3	

Strata

Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
1 Grass over sandy gravelly CLAY with roots. (TOPSOIL)	0.05		
2 Soft to firm brown slightly sandy gravelly CLAY some fragments of brick, concrete, metal, etc. Gravel is subangular to rounded fine to coarse. (MADE GROUND)	(1.45)		
3 Light brown clayey SAND with rare brick, metal and glass fragments. (MADE GROUND)	1.50 (2.10)		
EXPLORATORY HOLE ENDS AT 3.60 m	3.60		

Depth	Type & No.	Records Date

Groundwater Entries

No. Struck (m)	Post Strike Behaviour
None observed (see Key Sheet)	

Depth Related Remarks *

From to (m)

Stability poor

Shoring none

Weather

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

Scale 1:25 (c) MESG 358 v1.20a20/04/2005 17:04:42 AGS

Project Ringsend

Project No. KD5032

Carried out for

Trial Pit

TP15

Sheet 1 of 1

Trial Pit Log

GEOTECH

Logged AB Checked MK	Start 24/03/2005 End 24/03/2005	Equipment, Methods and Remarks Excavated by JBC 3CX. Pit terminated due to instability. Trial pit backfilled with arisings.	Dimensions and Orientation Width 0.70 m Length 4.10 m A B C D → 270 (Deg)	Ground Level - Coordinates - National Grid -

Samples and Tests			Strata			
Depth	Type & No.	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
			1 Grey sandy GRAVEL hard standing. (MADE GROUND)	(0.35)		
0.50	ES 1		2 Grey brown slightly clayey SAND and GRAVEL with rare cobbles and some fragments of brick, concrete, metal, plastic, etc. Gravel is subangular to rounded fine to coarse. Sand is fine to coarse. (MADE GROUND)	0.35		
2.00	ES 2			(2.75)		
3.00	ES 3					
			EXPLORATORY HOLE ENDS AT 3.10 m	3.10		
Depth	Type & No.	Records Date				

Groundwater Entries			Depth Related Remarks *	Stability poor
No.	Struck (m)	Post Strike Behaviour	From to (m)	Shoring none
1	3.00	moderate seepage		Weather

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column.	Project Ringsend Project No. KD5032 Carried out for	Trial Pit TP16 Sheet 1 of 1
Scale 1:25 (c) MESG 356 v1.20a20/04/2005 17:04:46 AGS		

Trial Pit Log

Logged AB Checked MK	Start 24/03/2005 End 24/03/2005	Equipment, Methods and Remarks Excavated by JBC 3CX. Pit terminated due to instability / obstruction. Trial pit backfilled with arisings.	Dimensions and Orientation Width 0.70 m Length 5.00 m A B C D 060 (Deg)	Ground Level - Coordinates - National Grid -

Samples and Tests			Strata			
Depth	Type & No.	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
			1 Grey sandy GRAVEL hard standing. (MADE GROUND)	(0.40)		
0.50	ES 1		2 Grey brown slightly clayey SAND and GRAVEL with some fragments of brick, concrete, pottery, metal, etc. Gravel is subangular to rounded fine to coarse. Sand is fine to coarse. (MADE GROUND)	0.40 (2.20)		
2.00	ES 2					
			EXPLORATORY HOLE ENDS AT 2.60 m 2.60 m driller reports boulder	2.60		
Depth	Type & No.	Records Date				

Groundwater Entries No. Struck Post Strike Behaviour (m) None observed (see Key Sheet)	Depth Related Remarks * From to (m)	Stability poor Shoring none Weather
Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column. Scale 1:25 (c) MESG 358 v1.20a20/04/2005 17:04:57	Project Ringsend Project No. KD5032 Carried out for	Trial Pit TP17 Sheet 1 of 1

Trial Pit Log

Logged AB Checked MK	Start 24/03/2005 End 24/03/2005	Equipment, Methods and Remarks Excavated by JBC 3CX. Pit terminated due to instability. Trial pit backfilled with arisings.	Dimensions and Orientation Width 0.80 m Length 5.00 m A B C D 240 (Deg)	Ground Level - Coordinates - National Grid -

Samples and Tests			Strata			
Depth	Type & No.	Date Records	Description	Depth, Level (Thickness)	Legend	Backfill/ Instruments
			1 Compacted grey sandy GRAVEL hard standing. (MADE GROUND)	(0.30)		
				0.30		
0.50	ES 1		2 Grey slightly clayey SAND and GRAVEL with fragments of brick, concrete, glass, metal, etc. Gravel is subangular to rounded fine to coarse. Sand is fine to coarse. (MADE GROUND)	(2.70)		
2.00	ES 2					
3.00	ES 3		EXPLORATORY HOLE ENDS AT 3.00 m	3.00		
Depth	Type & No.	Records Date				

Groundwater Entries No. Struck (m) Post Strike Behaviour	Depth Related Remarks * From to (m)	Stability poor Shoring none Weather
None observed (see Key Sheet)		

Notes: For explanation of symbols and abbreviations see key sheet. All depths and reduced levels in metres. Stratum thickness given in brackets in depth column. Scale 1:25 (c) MESG 368 v1 20a20/04/2005 17:04:56	Project Ringsend Project No. KD5032 Carried out for	Trial Pit TP18 Sheet 1 of 1

REPORT NO: 11183	GEOTECHNICAL BORING RECORD	IGSL Ltd.
CONTRACT : Elsam Waste to Energy		BOREHOLE NO: BH1 Sheet 1 of 4
CLIENT : Elsam Engineering ENGINEER :	GROUND LEVEL (mOD) - BOREHOLE DIAMETER (mm) BOREHOLE DEPTH (m) CASING DEPTH (m) 39.20	DATE STARTED: 06/10/2005 DATE COMPLETED: 12/10/2005
CO-ORDINATES : E - N -		BORED BY: J. O'Hara

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES REF. NUMBER	SAMPLE TYPE	SAMPLES DEPTH (m)	SPT TYPE	FIELD TEST RESULTS	STAND PIPE DETAILS
0	MADE GROUND consisting of compacted coarse gravel with cobbles and boulders, fragments of concrete, bricks, glass, timber				6031	B	1.00	C	N=R	
1										
2					6032	B	2.00			
3					6033	B	3.00	C	N=36	
	Soft grey/brown SILT with shell fragments			3.60						
4	Medium dense coarse sandy GRAVEL with cobbles			3.90	6034	B	4.00	C	N=15	
5					6035	B	5.00			
6					6036	B	6.00	C	N=25	
7					6037	B	7.00	C	N=24	
8					6038	B	8.00			
9					6039	B	9.00	C	N=24	
10	Continued next sheet				6040	B	10.00			

Hard Strata Boring / Chiselling

From (m)	To (m)	Hours	Comments
0.00	2.00	2.00	
2.00	3.60	1.00	
11.50	16.30	2.00	

Water Strike Details

Water Strike	Casing Depth	Sealed At	Rise To	Time	Comments
3.90	3.90	-	-	-	Seepage
10.30	10.30	-	7.20	20	Fast
22.70	22.70	22.70	-	20	Water sealed
39.20	39.20	-	3.00	20	Water strike

Standpipe Installation Details

Date	Tip Depth	RZ Top	RZ Base	Type

Groundwater Observations

Date	Hole Depth	Casing Depth	Depth to Water	Comments
12/10/2005	39.20	39.20	39.20	

Remarks: Some blowing from 11.5m to 16.3m

REPORT NO: 11183	GEOTECHNICAL BORING RECORD	IGSL Ltd.
CONTRACT : Elsam Waste to Energy		BOREHOLE NO: BH1 Sheet 2 of 4
CLIENT : Elsam Engineering ENGINEER :	GROUND LEVEL (mOD) - BOREHOLE DIAMETER (mm) BOREHOLE DEPTH (m)	DATE STARTED: 06/10/2005 DATE COMPLETED: 12/10/2005
CO-ORDINATES : E - N -	CASING DEPTH (m) 39.20	BORED BY: J. O'Hara

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES REF. NUMBER	SAMPLE TYPE	SAMPLES DEPTH (m)	SPT TYPE	FIELD TEST RESULTS	STAND PIPE DETAILS
10	Medium dense coarse sandy GRAVEL with cobbles							C	N=37	
11					6041	B	11.00			
12					6042	B	12.00	C	N=35	
13					6043	B	13.00			
								C	N=35	
14					6044	B	14.00			
15					6045	B	15.00	C	N=49	
16					6046	B	16.00			
	Grey black silty SAND/sandy SILT			16.30	6047	U	16.50			
17										
	Grey black very sandy SILT with thin layers of SAND			17.40				C	N=1	
18					6048	B	18.00			
19					6049	B	19.00	C	N=1	
20	Continued next sheet				6050	B	20.00			

Hard Strata Boring / Chiselling

From (m)	To (m)	Hours	Comments
0.00	2.00	2.00	
2.00	3.60	1.00	
11.50	16.30	2.00	

Water Strike Details

Water Strike	Casing Depth	Sealed At	Rise To	Time	Comments
3.90	3.90	-	-	-	Seepage
10.30	10.30	-	7.20	20	Fast
22.70	22.70	22.70	-	20	Water sealed
39.20	39.20	-	3.00	20	Water strike

Standpipe Installation Details

Date	Tip Depth	RZ Top	RZ Base	Type

Groundwater Observations

Date	Hole Depth	Casing Depth	Depth to Water	Comments
12/10/2005	39.20	39.20	39.20	

Remarks: Some blowing from 11.5m to 16.3m

REPORT NO: 11183	GEOTECHNICAL BORING RECORD	IGSL Ltd.
CONTRACT : Elsam Waste to Energy		BOREHOLE NO: BH1 Sheet 3 of 4
CLIENT : Elsam Engineering ENGINEER :	GROUND LEVEL (mOD) - BOREHOLE DIAMETER (mm) BOREHOLE DEPTH (m) CASING DEPTH (m) 39.20	DATE STARTED: 06/10/2005 DATE COMPLETED: 12/10/2005
CO-ORDINATES : E - N -		BORED BY: J. O'Hara

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES REF. NUMBER	SAMPLE TYPE	SAMPLES DEPTH (m)	SPT TYPE	FIELD TEST RESULTS	STAND PIPE DETAILS
20	Grey black very sandy SILT with thin layers of SAND							C	N=3	
21					6051	B	21.00			
22					6052	B	22.00	C	N=6	
23	Stiff to very stiff black slightly sandy CLAY laminated and fissured (Port Clay)			22.70	6053	B	23.00	C	N=34	
24					6054	U	24.00			
25					6055	B	25.00	C	N=49/ 150mm	
26					6056	B	26.00	C	N=82	
27					6057	B	27.00			
28					6058	B	28.00	C	N=70	
29					6059	U	29.00			
30	Continued next sheet				6060	B	30.00	C	N=68	

Hard Strata Boring / Chiselling

From (m)	To (m)	Hours	Comments
0.00	2.00	2.00	
2.00	3.60	1.00	
11.50	16.30	2.00	

Standpipe Installation Details

Date	Tip Depth	RZ Top	RZ Base	Type

Water Strike Details

Water Strike	Casing Depth	Sealed At	Rise To	Time	Comments
3.90	3.90	-	-	-	Seepage
10.30	10.30	-	7.20	20	Fast
22.70	22.70	22.70	-	20	Water sealed
39.20	39.20	-	3.00	20	Water strike

Groundwater Observations

Date	Hole Depth	Casing Depth	Depth to Water	Comments
12/10/2005	39.20	39.20	39.20	

Remarks: Some blowing from 11.5m to 16.3m

REPORT NO: 11183	GEOTECHNICAL BORING RECORD	IGSL Ltd.
CONTRACT : Elsam Waste to Energy		BOREHOLE NO: BH1 Sheet 4 of 4
CLIENT : Elsam Engineering ENGINEER :	GROUND LEVEL (mOD) - BOREHOLE DIAMETER (mm) BOREHOLE DEPTH (m) CASING DEPTH (m) 39.20	DATE STARTED: 06/10/2005 DATE COMPLETED: 12/10/2005
CO-ORDINATES : E - N -		BORED BY: J. O'Hara

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES REF. NUMBER	SAMPLE TYPE	SAMPLES DEPTH (m)	SPT TYPE	FIELD TEST RESULTS	STAND PIPE DETAILS
30	Stiff to very stiff black slightly sandy CLAY laminated and fissured (Port Clay)									
31					6061	B	31.00			
								C	N=64	
32					6062	B	32.00			
33	Stiff to very stiff grey CLAY, laminated and fissured			33.00	6063	U	33.00			
34					6064	B	34.00	C	N=74	
35					6065	B	35.00			
								C	N=63	
36										
					6066	B	36.50			
37								C	N=77	
38					6067	B	38.00			
39										
	End of Borehole at 39.20 m			39.20						
								C	N=49/ 225mm	
40										

Hard Strata Boring / Chiselling

From (m)	To (m)	Hours	Comments
0.00	2.00	2.00	
2.00	3.60	1.00	
11.50	16.30	2.00	

Standpipe Installation Details

Date	Tip Depth	RZ Top	RZ Base	Type

Water Strike Details

Water Strike	Casing Depth	Sealed At	Rise To	Time	Comments
3.90	3.90	-	-	-	Seepage
10.30	10.30	-	7.20	20	Fast
22.70	22.70	22.70	-	20	Water sealed
39.20	39.20	-	3.00	20	Water strike

Groundwater Observations

Date	Hole Depth	Casing Depth	Depth to Water	Comments
12/10/2005	39.20	39.20	39.20	

Remarks: Some blowing from 11.5m to 16.3m

REPORT NO: 11183	GEOTECHNICAL BORING RECORD	IGSL Ltd.
CONTRACT : Elsam Waste to Energy		BOREHOLE NO: BH2 Sheet 1 of 4
CLIENT : Elsam Engineering ENGINEER :	GROUND LEVEL (mOD) - BOREHOLE DIAMETER (mm) BOREHOLE DEPTH (m) CASING DEPTH (m) 39.70	DATE STARTED: 10/10/2005 DATE COMPLETED: 17/10/2005
CO-ORDINATES : E - N -		BORED BY: J. McDonnell

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES REF. NUMBER	SAMPLE TYPE	SAMPLES DEPTH (m)	SPT TYPE	FIELD TEST RESULTS	STAND PIPE DETAILS
0	MADE GROUND consisting of tarmac and gravel									
	MADE GROUND consisting of gravelly clay with some brick, concrete, rubble, ash, cinders			0.40						
1					3824	B	1.00	C	N=20	
2					3825	B	2.00	C	N=23	
3					3826	B	3.00	C	N=22	
	Loose fine black silty gravelly SAND with shell fragments			3.50						
4					3827	B	4.00	C	N=3	
5	Loose fine very gravelly SAND with some shells (strong organic odour)			5.00	3828	B	5.10	C	N=6	
6	Dense medium to coarse GRAVEL with occasional cobbles and boulders			6.00	3829	B	6.10	C	N=31	
7					3830	B	7.00	C	N=35	
8					3831	B	8.00	C	N=39	
9					3832	B	9.00	C	N=47	
10	Continued next sheet				3833	B	10.00	C	N=40	

Hard Strata Boring / Chiselling

From (m)	To (m)	Hours	Comments
0.00	0.40	1.00	
15.40	15.60	2.00	
38.90	39.70	2.50	

Water Strike Details

Water Strike	Casing Depth	Sealed At	Rise To	Time	Comments
3.50	3.50	-	2.50	5	Moderate
22.00	22.00	22.00	-	5	Water sealed
38.90	38.90	-	3.00	5	Lower gravel

Standpipe Installation Details

Date	Tip Depth	RZ Top	RZ Base	Type

Groundwater Observations

Date	Hole Depth	Casing Depth	Depth to Water	Comments
17/10/2005	38.90	38.90	3.00	End of borehole

Remarks: Blowing from 5.0 to 12.0m and 16.5 to 23.5m

REPORT NO: 11183	GEOTECHNICAL BORING RECORD	IGSL Ltd.
CONTRACT : Elsam Waste to Energy		BOREHOLE NO: BH2 Sheet 2 of 4
CLIENT : Elsam Engineering ENGINEER :	GROUND LEVEL (mOD) - BOREHOLE DIAMETER (mm)	DATE STARTED: 10/10/2005 DATE COMPLETED: 17/10/2005
CO-ORDINATES : E - N -	BOREHOLE DEPTH (m) CASING DEPTH (m) 39.70	BORED BY: J. McDonnell

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES REF. NUMBER	SAMPLE TYPE	SAMPLES DEPTH (m)	SPT TYPE	FIELD TEST RESULTS	STAND PIPE DETAILS
10	Dense medium to coarse GRAVEL with occasional cobbles and boulders									
11					3834	B	11.00	C	N=49	
12					3835	B	12.00	C	N=57	
13					3836	B	13.00	C	N=67	
14					3837	B	14.00	C	N=61	
15					3838	B	15.00	C	N=44/ 150mm	
16					3839	B	16.00	C	N=60	
	Grey black sandy slightly gravelly SILT/CLAY with bands of grey silty SAND			16.50						
17					3840	B	17.00	C	N=2	
18					3841	B	18.00	C	N=3	
19					3842	B	19.00	C	N=0	
20	Continued next sheet				3843	B	20.00	C	N=2	

Hard Strata Boring / Chiselling

From (m)	To (m)	Hours	Comments
0.00	0.40	1.00	
15.40	15.60	2.00	
38.90	39.70	2.50	

Water Strike Details

Water Strike	Casing Depth	Sealed At	Rise To	Time	Comments
3.50	3.50	-	2.50	5	Moderate
22.00	22.00	22.00	-	5	Water sealed
38.90	38.90	-	3.00	5	Lower gravel

Standpipe Installation Details

Date	Tip Depth	RZ Top	RZ Base	Type

Groundwater Observations

Date	Hole Depth	Casing Depth	Depth to Water	Comments
17/10/2005	38.90	38.90	3.00	End of borehole

Remarks: Blowing from 5.0 to 12.0m and 16.5 to 23.5m

REPORT NO: 11183	GEOTECHNICAL BORING RECORD	IGSL Ltd.
CONTRACT : Elsam Waste to Energy		BOREHOLE NO: BH2 Sheet 3 of 4
CLIENT : Elsam Engineering ENGINEER :	GROUND LEVEL (mOD) - BOREHOLE DIAMETER (mm) BOREHOLE DEPTH (m)	DATE STARTED: 10/10/2005 DATE COMPLETED: 17/10/2005
CO-ORDINATES : E - N -	CASING DEPTH (m) 39.70	BORED BY: J. McDonnell

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES REF. NUMBER	SAMPLE TYPE	SAMPLES DEPTH (m)	SPT TYPE	FIELD TEST RESULTS	STAND PIPE DETAILS
20	Grey black sandy slightly gravelly SILT/CLAY with bands of grey silty SAND									
					3844	B	21.00	C	N=3	
22	Grey black sandy CLAY with some grey sandy SILT			22.00	3845	B	22.00	C	N=3	
					3846	B	23.00	C	N=3	
	Stiff to very stiff black CLAY, laminated and fissured (Port Clay)			23.50						
24					3847	U	24.00			
25					3848	B	25.00	C	N=28	
26					3849	U	26.00			
27					3850	B	27.00	C	N=37	
28					3851	U	28.00			
29					3852	B	29.00	C	N=44	
30	Continued next sheet				3853	B	30.00	C	N=55	

Hard Strata Boring / Chiselling

From (m)	To (m)	Hours	Comments
0.00	0.40	1.00	
15.40	15.60	2.00	
38.90	39.70	2.50	

Standpipe Installation Details

Date	Tip Depth	RZ Top	RZ Base	Type

Water Strike Details

Water Strike	Casing Depth	Sealed At	Rise To	Time	Comments
3.50	3.50	-	2.50	5	Moderate
22.00	22.00	22.00	-	5	Water sealed
38.90	38.90	-	3.00	5	Lower gravel

Groundwater Observations

Date	Hole Depth	Casing Depth	Depth to Water	Comments
17/10/2005	38.90	38.90	3.00	End of borehole

Remarks: Blowing from 5.0 to 12.0m and 16.5 to 23.5m

REPORT NO: 11183	GEOTECHNICAL BORING RECORD	IGSL Ltd.
CONTRACT : Elsam Waste to Energy		BOREHOLE NO: BH2 Sheet 4 of 4
CLIENT : Elsam Engineering ENGINEER :	GROUND LEVEL (mOD) - BOREHOLE DIAMETER (mm) BOREHOLE DEPTH (m) CASING DEPTH (m) 39.70	DATE STARTED: 10/10/2005 DATE COMPLETED: 17/10/2005
CO-ORDINATES : E - N -		BORED BY: J. McDonnell

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES REF. NUMBER	SAMPLE TYPE	SAMPLES DEPTH (m)	SPT TYPE	FIELD TEST RESULTS	STAND PIPE DETAILS
30	Stiff to very stiff black CLAY, laminated and fissured (Port Clay)									
31					3854	B	31.00	C	N=57	
32					3855	B	32.00			
33					3856	U	33.00			
34										
35					3857	B	35.00	C	N=61	
36										
37					3858	B	37.00	C	N=73	
38					3859	B	38.00			
39	Dense grey angular GRAVEL with fragments of limestone			38.90	3860	B	39.00	C	N=67	
	End of Borehole at 39.70 m			39.70						
40										

Hard Strata Boring / Chiselling

From (m)	To (m)	Hours	Comments
0.00	0.40	1.00	
15.40	15.60	2.00	
38.90	39.70	2.50	

Water Strike Details

Water Strike	Casing Depth	Sealed At	Rise To	Time	Comments
3.50	3.50	-	2.50	5	Moderate
22.00	22.00	22.00	-	5	Water sealed
38.90	38.90	-	3.00	5	Lower gravel

Standpipe Installation Details

Date	Tip Depth	RZ Top	RZ Base	Type

Groundwater Observations

Date	Hole Depth	Casing Depth	Depth to Water	Comments
17/10/2005	38.90	38.90	3.00	End of borehole

Remarks: Blowing from 5.0 to 12.0m and 16.5 to 23.5m

REPORT NO: 11183	GEOTECHNICAL BORING RECORD	IGSL Ltd.
CONTRACT : Elsam Waste to Energy		BOREHOLE NO: BH3 Sheet 1 of 2
CLIENT : Elsam Engineering ENGINEER :	GROUND LEVEL (mOD) - BOREHOLE DIAMETER (mm) BOREHOLE DEPTH (m) CASING DEPTH (m) 16.00	DATE STARTED: 17/10/2005 DATE COMPLETED: 20/10/2005
CO-ORDINATES : E - N -		BORED BY: J. O'Hara

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES REF. NUMBER	SAMPLES SAMPLE TYPE	SAMPLES DEPTH (m)	SPT TYPE	FIELD TEST RESULTS	STAND PIPE DETAILS
0	MADE GROUND consisting of compacted coarse gravel with cobbles and boulders				Samples		0.00			
	Grey/black sandy SILT (wet)			3.70						
	Grey silty sandy fine to coarse GRAVEL (wet)			5.00						
	Grey coarse GRAVEL (wet)			6.30						
10	Continued next sheet									

Hard Strata Boring / Chiselling

From (m)	To (m)	Hours	Comments
0.00	3.70	2.00	

Water Strike Details

Water Strike	Casing Depth	Sealed At	Rise To	Time	Comments
No Groundwater					

Standpipe Installation Details

Date	Tip Depth	RZ Top	RZ Base	Type
20/10/2005	16.00	0.00	16.00	SP

Groundwater Observations

Date	Hole Depth	Casing Depth	Depth to Water	Comments

Remarks:

REPORT NO: 11183	GEOTECHNICAL BORING RECORD	IGSL Ltd.

CONTRACT : Elsam Waste to Energy

BOREHOLE NO: BH3
Sheet 2 of 2

CLIENT : Elsam Engineering
ENGINEER :

GROUND LEVEL (mOD) -
BOREHOLE DIAMETER (mm)
BOREHOLE DEPTH (m)
CASING DEPTH (m) 16.00

DATE STARTED: 17/10/2005
DATE COMPLETED: 20/10/2005

CO-ORDINATES : E -
N -

BORED BY: J. O'Hara

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES: REF. NUMBER	SAMPLES: SAMPLE TYPE	SAMPLES: DEPTH (m)	SPT TYPE	FIELD TEST RESULTS	STAND PIPE DETAILS
10	Grey coarse GRAVEL (wet)									
11										
12										
13										
14										
15										
	Grey/black silty SAND			15.40						
16	End of Borehole at 16.00 m			16.00						
17										
18										
19										
20										

Hard Strata Boring / Chiselling

From (m)	To (m)	Hours	Comments
0.00	3.70	2.00	

Water Strike Details

Water Strike	Casing Depth	Sealed At	Rise To	Time	Comments
No Groundwater Encountered					

Standpipe Installation Details

Date	Tip Depth	RZ Top	RZ Base	Type
20/10/2005	16.00	0.00	16.00	SP

Groundwater Observations

Date	Hole Depth	Casing Depth	Depth to Water	Comments

Remarks:

REPORT NO: 11183	GEOTECHNICAL BORING RECORD	IGSL Ltd.

CONTRACT : Elsam Waste to Energy

BOREHOLE NO: BH4
Sheet 1 of 1

CLIENT : Elsam Engineering
ENGINEER :

GROUND LEVEL (mOD) -
BOREHOLE DIAMETER (mm)
BOREHOLE DEPTH (m)
CASING DEPTH (m) 3.00

DATE STARTED: 21/10/2005
DATE COMPLETED: 22/10/2005

CO-ORDINATES : E -
N -

BORED BY:

DEPTH (M)	DESCRIPTION	LEGEND	ELEVATION (mOD)	DEPTH (m)	SAMPLES REF. NUMBER	SAMPLES SAMPLE TYPE	SAMPLES DEPTH (m)	SPT TYPE	FIELD TEST RESULTS	STAND PIPE DETAILS
0	MADE GROUND consisting of rubble, brick, cinders				Samples		0.00			
3	End of Borehole at 3.00 m			3.00						

Hard Strata Boring / Chiselling

From (m)	To (m)	Hours	Comments
0.00	3.00	2.50	

Water Strike Details

Water Strike	Casing Depth	Sealed At	Rise To	Time	Comments
No Groundwater Encountered					

Standpipe Installation Details

Date	Tip Depth	RZ Top	RZ Base	Type
22/10/2005	3.00	0.00	3.00	SP

Groundwater Observations

Date	Hole Depth	Casing Depth	Depth to Water	Comments

Remarks:

REPORT NO.	11183	GEOTECHNICAL CORE LOG RECORD	IGSL Ltd.

CONTRACT: 11183		DRILLHOLE NO : RC1 SHEET: Sheet 1 of 6
CLIENT: ENGINEER: Elsam Engineering	CORE DIAMETER (mm): 72 GROUND LEVEL (mOD):	DATE STARTED: 19/10/2008 DATE COMPLETED:21/10/2008
CO-ORDINATES:	INCLINATION (Degrees): 90 FLUSH: Air/Mist	DRILLED BY: Millennium LOGGED BY: IGSL

DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION
													Hole opened by Shell & Auger

Continued next sheet

REMARKS:

INSTALLATION DETAILS
Installation Type :
Depth to Response Zone top (m) :
Depth to Response Zone bottom (m) :
Comments :

REPORT NO.	11183	GEOTECHNICAL CORE LOG RECORD	IGSL Ltd.

CONTRACT: 11183		DRILLHOLE NO : RC1 SHEET: Sheet 2 of 6
CLIENT: ENGINEER: Elsam Engineering	CORE DIAMETER (mm): 72 GROUND LEVEL (mOD):	DATE STARTED: 19/10/2008 DATE COMPLETED:21/10/2008
CO-ORDINATES:	INCLINATION (Degrees): 90 FLUSH: Air/Mist	DRILLED BY: Millennium LOGGED BY: IGSL

DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION
9													Hole opened by Shell & Auger
10													
11													
12													
13													
14													
15													
16													Continued next sheet

REMARKS:

INSTALLATION DETAILS
Installation Type :
Depth to Response Zone top (m) :
Depth to Response Zone bottom (m) :
Comments :

REPORT NO.	11183	GEOTECHNICAL CORE LOG RECORD	IGSL Ltd.

CONTRACT: 11183		DRILLHOLE NO : RC1 SHEET: Sheet 3 of 6
CLIENT: ENGINEER: Elsam Engineering	CORE DIAMETER (mm): 72 GROUND LEVEL (mOD):	DATE STARTED: 19/10/2008 DATE COMPLETED:21/10/2008
CO-ORDINATES:	INCLINATION (Degrees): 90 FLUSH: Air/Mist	DRILLED BY: Millennium LOGGED BY: IGSL

DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION
18													Hole opened by Shell & Auger
19													
20													
21													
22													
23													
24													
25													Continued next sheet

REMARKS:

INSTALLATION DETAILS
Installation Type :
Depth to Response Zone top (m) :
Depth to Response Zone bottom (m) :
Comments :

REPORT NO.	11183	GEOTECHNICAL CORE LOG RECORD	IGSL Ltd.

CONTRACT: 11183		DRILLHOLE NO : RC1 SHEET: Sheet 4 of 6
CLIENT: ENGINEER: Elsam Engineering	CORE DIAMETER (mm): 72 GROUND LEVEL (mOD):	DATE STARTED: 19/10/2008 DATE COMPLETED:21/10/2008
CO-ORDINATES:	INCLINATION (Degrees): 90 FLUSH: Air/Mist	DRILLED BY: Millennium LOGGED BY: IGSL

DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION
27													Hole opened by Shell & Auger
28													
29													
30													
31													
32													
33													
34													Continued next sheet

REMARKS:

INSTALLATION DETAILS
Installation Type :
Depth to Response Zone top (m) :
Depth to Response Zone bottom (m) :
Comments :

REPORT NO.	11183	GEOTECHNICAL CORE LOG RECORD	IGSL Ltd.

CONTRACT: 11183

DRILLHOLE NO : RC1
SHEET: Sheet 5 of 6

CLIENT:
ENGINEER: Elsam Engineering

CORE DIAMETER (mm): 72
GROUND LEVEL (mOD):

DATE STARTED: 19/10/2008
DATE COMPLETED: 21/10/2008

CO-ORDINATES:

INCLINATION (Degrees): 90
FLUSH: Air/Mist

DRILLED BY: Millennium
LOGGED BY: IGSL

DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION
36													Hole opened by Shell & Auger
37													
38													
39										39.20			SYMETREX: OPEN HOLE DRILLING: Observed by driller as angular gravel size returns of limestone
40													
41	41.00									41.00			Moderately strong to strong, thin to medium bedded, grey, fine grained LIMESTONE, fresh to locally moderately weathered, intersected by rough, planar, tight to open fractures of sub-horizontal dip
42		100	45	33									
	42.50												
43		100	65	11									
	44.00												Continued next sheet

REMARKS:

INSTALLATION DETAILS
Installation Type :
Depth to Response Zone top (m) :
Depth to Response Zone bottom (m) :
Comments :

REPORT NO.	11183	GEOTECHNICAL CORE LOG RECORD	IGSL Ltd.

CONTRACT: 11183		DRILLHOLE NO : RC1 SHEET: Sheet 6 of 6
CLIENT: ENGINEER: Elsam Engineering	CORE DIAMETER (mm): 72 GROUND LEVEL (mOD):	DATE STARTED: 19/10/2008 DATE COMPLETED:21/10/2008
CO-ORDINATES:	INCLINATION (Degrees): 90 FLUSH: Air/Mist	DRILLED BY: Millennium LOGGED BY: IGSL

DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION
45		100	37	9									Moderately strong to strong, thin to medium bedded, grey, fine grained LIMESTONE, fresh to locally moderately weathered, intersected by rough, planar, tight to open fractures of sub-horizontal dip
	45.50												
46		83	67	67						46.00			End of Borehole at 46.00 m
	46.10												
47													
48													
49													
50													
51													
52													

REMARKS:

INSTALLATION DETAILS
Installation Type :
Depth to Response Zone top (m) :
Depth to Response Zone bottom (m) :
Comments :

REPORT NO.	11183	GEOTECHNICAL CORE LOG RECORD	IGSL Ltd.

CONTRACT: 11183		DRILLHOLE NO : RC2 SHEET: Sheet 1 of 6
CLIENT: ENGINEER: Elsam Engineering	CORE DIAMETER (mm): 72 GROUND LEVEL (mOD):	DATE STARTED: 24/10/2005 DATE COMPLETED:27/10/2005
CO-ORDINATES:	INCLINATION (Degrees): 90 FLUSH: Air/Mist	DRILLED BY: Millennium LOGGED BY: IGSL

DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION
													Hole opened by Shell & Auger
1													
2													
3													
4													
5													
6													
7													
8													Continued next sheet

REMARKS:

INSTALLATION DETAILS
Installation Type :
Depth to Response Zone top (m) :
Depth to Response Zone bottom (m) :
Comments :

REPORT NO.	11183	GEOTECHNICAL CORE LOG RECORD	IGSL Ltd.

CONTRACT: 11183		DRILLHOLE NO : RC2 SHEET: Sheet 2 of 6
CLIENT: ENGINEER: Elsam Engineering	CORE DIAMETER (mm): 72 GROUND LEVEL (mOD):	DATE STARTED: 24/10/2005 DATE COMPLETED:27/10/2005
CO-ORDINATES:	INCLINATION (Degrees): 90 FLUSH: Air/Mist	DRILLED BY: Millennium LOGGED BY: IGSL

DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION
9													Hole opened by Shell & Auger
10													
11													
12													
13													
14													
15													
16													Continued next sheet

REMARKS:

INSTALLATION DETAILS
Installation Type :
Depth to Response Zone top (m) :
Depth to Response Zone bottom (m) :
Comments :

REPORT NO.	11183	GEOTECHNICAL CORE LOG RECORD	IGSL Ltd.

CONTRACT: 11183		DRILLHOLE NO : RC2 SHEET: Sheet 3 of 6
CLIENT: ENGINEER: Elsam Engineering	CORE DIAMETER (mm): 72 GROUND LEVEL (mOD):	DATE STARTED: 24/10/2005 DATE COMPLETED:27/10/2005
CO-ORDINATES:	INCLINATION (Degrees): 90 FLUSH: Air/Mist	DRILLED BY: Millennium LOGGED BY: IGSL

DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION
18													Hole opened by Shell & Auger
19													
20													
21													
22													
23													
24													
25													

Continued next sheet

REMARKS:

INSTALLATION DETAILS
Installation Type :
Depth to Response Zone top (m) :
Depth to Response Zone bottom (m) :
Comments :

REPORT NO.	11183	GEOTECHNICAL CORE LOG RECORD	IGSL Ltd.

CONTRACT: 11183		DRILLHOLE NO : RC2 SHEET: Sheet 4 of 6
CLIENT: ENGINEER: Elsam Engineering	CORE DIAMETER (mm): 72 GROUND LEVEL (mOD):	DATE STARTED: 24/10/2005 DATE COMPLETED:27/10/2005
CO-ORDINATES:	INCLINATION (Degrees): 90 FLUSH: Air/Mist	DRILLED BY: Millennium LOGGED BY: IGSL

DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION
27													Hole opened by Shell & Auger
28													
29													
30													
31													
32													
33													
34													Continued next sheet

REMARKS:

INSTALLATION DETAILS
Installation Type :
Depth to Response Zone top (m) :
Depth to Response Zone bottom (m) :
Comments :

REPORT NO.	11183	GEOTECHNICAL CORE LOG RECORD	IGSL Ltd.

CONTRACT: 11183		DRILLHOLE NO : RC2 SHEET: Sheet 5 of 6
CLIENT: ENGINEER: Elsam Engineering	CORE DIAMETER (mm): 72 GROUND LEVEL (mOD):	DATE STARTED: 24/10/2005 DATE COMPLETED:27/10/2005
CO-ORDINATES:	INCLINATION (Degrees): 90 FLUSH: Air/Mist	DRILLED BY: Millennium LOGGED BY: IGSL

DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION
36													Hole opened by Shell & Auger
37													
38													
39													
40										39.70			SYMETREX: OPEN HOLE DRILLING: Observed by driller as angular gravel size returns of limestone
41													
42	42.00									42.00			Strong, thin to thickly bedded, grey, fine grained LIMESTONE, locally fossiliferous (48.0m-50.0m), fresh to locally moderately weathered, intersected by smooth, planar, tight to open, clay/gravel infilled (at 46.5m-46.9m) fractures of sub-horizontal & locally 90° (51.4m-52.0m) dip
43		100	55	38									
	43.50												
		100	37	11									Continued next sheet

REMARKS:

INSTALLATION DETAILS
Installation Type :
Depth to Response Zone top (m) :
Depth to Response Zone bottom (m) :
Comments :

REPORT NO.	11183	GEOTECHNICAL CORE LOG RECORD	IGSL Ltd.

CONTRACT: 11183		DRILLHOLE NO : RC2 SHEET: Sheet 6 of 6
CLIENT: ENGINEER: Elsam Engineering	CORE DIAMETER (mm): 72 GROUND LEVEL (mOD):	DATE STARTED: 24/10/2005 DATE COMPLETED:27/10/2005
CO-ORDINATES:	INCLINATION (Degrees): 90 FLUSH: Air/Mist	DRILLED BY: Millennium LOGGED BY: IGSL

DOWNHOLE DEPTH (m)	CORE RUN DEPTH (m)	T.C.R.%	S.C.R.%	R.Q.D.%	Fracture Spacing (mm) 0 250 500	UCS (MPa)	POINT LOAD Is(50) MPa	SYMBOLIC LOG	ELEVATION (mOD)	DEPTH (m)	SPT (N value)	STANDPIPE DETAILS	GEOTECHNICAL DESCRIPTION
45	45.00												
		100	43	19									Strong, thin to thickly bedded, grey, fine grained LIMESTONE, locally fossiliferous (48.0m-50.0m), fresh to locally moderately weathered, intersected by smooth, planar, tight to open, clay/gravel infilled (at 46.5m-46.9m) fractures of sub-horizontal & locally 90° (51.4m-52.0m) dip
46	46.50												
		100	37	29									
47													
48	48.00												
		100	66	55									
49													
	49.50												
50		100	43	35									
51	51.00												
		100	70	0									
	51.40												
		83	38	0									
52	52.00									52.00			End of Borehole at 52.00 m

REMARKS:

INSTALLATION DETAILS
Installation Type :
Depth to Response Zone top (m) :
Depth to Response Zone bottom (m) :
Comments :

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