

Coed Darcy
Environmental Setting and
Installation Design (ESID) Report
St. Modwen Developments Ltd

June 2013

Notice

This document and its contents have been prepared and are intended solely for St. Modwen Developments Ltd information and use in relation to Crymlyn Tip, Llandarcy.

Atkins Limited assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

This document has 26 pages including the cover.

Document History

Job number: 5092635			Document ref: Environmental Setting and Installation Design (ESID) Report			
Revision	Purpose Description	Originated	Checked	Reviewed	Authorised	Date
Rev 0	Draft	YM/AKA	AKA/YM	RM	RM	June 2013

Client signoff

Client	St. Modwen Developments Ltd
Project	Coed Darcy
Document title	Environmental Setting and Installation Design (ESID) Report
Job No.	5092635
Copy No.	n/a
Document reference	

Table of contents

Chapter	Pages
1. INTRODUCTION	1
1.1. Report Context	1
1.2. Installation Details	1
2. SOURCE TERM CHARACTERISATION	2
2.1. The Development of the Installation	2
2.2. Installation Engineering	4
2.3. Leachate Management and Monitoring Infrastructure	4
2.4. Landfill Gas Management and Monitoring Infrastructure	5
2.5. Surface Water Management System	5
2.6. Post Closure Controls	6
3. PATHWAY AND RECEPTOR TERM CHARACTERISATION	7
3.1. Climate	7
3.2. Geology	7
3.3. Man-made Subsurface Pathways	8
3.4. Permitted Area Hydrology	8
3.5. Hydrogeology	9
3.6. Off-site Landfill Gas Monitoring	12
3.7. Receptors and Compliance Points	13
4. SITE CONDITION REPORT	15
4.1. Introduction and Background Information	15
4.2. Objectives of this Assessment	15
4.3. Site Investigation (Data Collection) Details	15
4.4. Summary of Site Investigation and Analysis Findings	15
4.5. Data Interpretation	16
4.6. Conclusions	16
5. REFERENCES	17

Tables

Table 2–1 – Permitted waste types and volumes as of 1994.....	2
Table 2–2 – Permitted waste types and volumes as of 1998.....	2
Table 3–1 – Local Geology.....	7
Table 3–2 – Water level monitoring results	9
Table 3–3 – Hydraulic Conductivities	10
Table 3–4 – Summary of off-site methane concentrations.....	12
Table 3–5 – Summary of off-site carbon dioxide concentrations	13
Table 3–6 – Distance of proposed receptors from both the landfilled area, and non filled area within the permitted boundary.....	14
Table 3–7 – Landfill Gas Receptors	14

1. INTRODUCTION

1.1. Report Context

Atkins Ltd (Atkins) have been commissioned by St. Modwen Developments Ltd (SMD) to produce an Environmental Setting and Installation Design (ESID), in general compliance with an environmental permit (EPR/AP3990LR) held by SMD for the Crymlyn Tip on the Coed Darcy site, Llandarcy, Port Talbot. This report provides background information which is relevant to the risk assessments required to satisfy the landfill permit's improvement conditions IP1 and IP2 within permit number EPR/AP3990LR/V002.

This report has been prepared in general accordance with the Environment Agency's "Application Form for the Landfill Sector, Environmental Setting and Installation Design Report" template.

1.2. Installation Details

The tip is located in Llandarcy in Neath Port Talbot, Wales at approximate national grid reference (NGR) 270310,195489. The tip, otherwise known as the 'containment area', is located on the western margin of the former BP Llandarcy oil refinery (BPLR); now known as the Coed Darcy Urban Village (CDUV). The site location is shown on Drawing ESID1.

A security Lodge with security gates are present at the main entry to the development, Boiler House Road, which controls access to the Coed Darcy site. Access to the Site is through the existing haul roads from the entrance to Coed Darcy to the north and west edges of the permitted site. Haul roads are also present at the south edge of the Site.

The 'Permitted Area' is 120,784m² of the land defined by the red line within the permit (Drawing ESID2). It is anticipated that just over half of the permitted site will be used for landfilling activities; this area shall be referred to as the "landfill area" for the purpose of this report. The proposed landfill area sits in the eastern half of the site, as outlined in Drawing ESID 2. The remaining areas comprised peripheral lagoons which formed part of the whole site drainage system and open land. These areas are not proposed for infilling and shall be referred to as the "non-operational area".

The permitted area is accessed via a track through the former Railhead Area which borders the tip to the east. The access route runs along the northern boundary of the tip along an underlying ash bund. This ash bund slopes down gently from an approximate elevation of 20m AOD to approximately 8.5m AOD adjacent to the spur (an area of ash bund that extended westwards into the bog and now lies outside of the Llandarcy Refinery fence line). The ash bund then swings to the south, encompassing Crymlyn Bog Lagoon.

There are currently three main water bodies within the Permitted Area, South Bay, Crymlyn Bog Lagoon and West Bay. The Crymlyn Bog lies immediately to the west of the site and is registered as a Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC), Ramsar Site and a National Nature Reserve (NNR). The Permitted Area is thought to be in hydraulic continuity with the Crymlyn Bog.

2. SOURCE TERM CHARACTERISATION

2.1. The Development of the Installation

2.1.1. Historical Development

The Llandarcy refinery was opened in 1921, at which time the now Permitted Area consisted of a series of natural ponds and lagoons that were congruent with Crymlyn Bog. An ash bund was constructed prior to the Second World War to provide a 'containment area' for oily material that may have otherwise flowed directly into Crymlyn Bog from the Southern Tank Farm in the event of potentially catastrophic bombing raids. This ash bund also contained the drainage systems which served the southern half of the Llandarcy refinery site. The ash bund now forms the northern and western boundary of the Permitted Area.

In 1977, the then Local Authority, Neath Borough Council, granted the oil refinery a Waste Disposal Licence (WDL) in line with the Control of Pollution Act 1974. The WDL allowed the deposit of refinery wastes including demolition materials, asbestos, boiler cleanings, oily sludge, bitumen, waxes and pyrophoric materials.

This WDL was modified in 1994 by Neath Borough Council to allow the acceptance of the following wastes and quantities to be deposited at the site;

Table 2–1 – Permitted waste types and volumes as of 1994

Permitted Waste Types	Maximum Permitted Quantity Tonnes/year
Pyrophoric Materials	100
Vanadium Contaminated Materials	200
Asbestos Contaminated Material	100
Oil Sludges	200
Bitumen and Waxes	100
Substantially Oil Free Non-special Waste	1500

The disposal of substances within the Control of Radioactive Substances Act (1960), explosives and other substances with similar effects and any materials capable of producing List 1 Substances (in terms of EC Directives 80/60/EEC and 76/464/EEC) were not permitted.

The WDL underwent a second revision in 1998 (WML/NBWD5) when the Environment Agency converted the WDL to a Waste Management Licence (WML) with the following amendments to the quantities of waste which could be accepted:

Table 2–2 – Permitted waste types and volumes as of 1998

Permitted Waste Types	Maximum Permitted Quantity Tonnes/year
Non Biodegradable Industrial Waste	1500 aggregate
Plastic and Plastic Products	
Timber and Timber Products	

Permitted Waste Types	Maximum Permitted Quantity Tonnes/year
Paper and Paper Products	
Ion Exchange Resins	
Scrap Metal	
Asbestos and Asbestos Products	100

The values contained within the Table 2–2 are in addition to the wastes produced within the curtilage of the BP Llandarcy Refinery (BPLR) however no powdered waste, sludges or liquid waste were to be accepted at the site. Furthermore, wastes capable of leaching or degrading to produce List 1 substances or wastes which have properties which would make them Special Wastes other than asbestos were not permitted.

Following the purchase of the entire site by SMD, the waste management licence was transferred to SMD. At the same time the licence was updated into an environmental permit (EPR/AP3990LR/V002). This permit does not allow acceptance of waste at the site except for restoration purposes. The permit included improvement conditions (IP1 And IP2) requiring updates to the hydrogeological and landfill gas risk assessments.

URS's records (URS, 2006) indicate that following correspondence between the then Environment Agency and site operators at BPLR, the landfill ceased accepting landfill materials in 1999 and the Environment Agency recorded the site as closed in July 2001. Since July 2001, reclamation and remediation works associated with the Coed Darcy development have been carried out within the permitted area (West Bay, South Bay and Crymlyn Bay) and up-gradient. Contamination of these areas is thought to have occurred due to leaks and spills from the tank farm historically located upslope of the Permitted Area and from inflow from the drainage system. Free product historically flowed both over ground and within the underlying strata prior to accumulating within these water features within the permitted area. The works to remove hydrocarbon impacted material and free product has included the following:

- Source removal of hydrocarbon impacted soils and free product to reduce migration of hydrocarbons into the Crymlyn Bog Lagoon from the former Southern Tank Farm area (now the Demonstration Village);
- removal of hydrocarbon impacted sediments from West Bay and South Bay;
- installation of various interception trenches and sumps to intercept residual free phase oil and to protect the remediated water bodies (including the Central Interception Trench);
- removal and offsite disposal of over 400 oil drums from a former drum storage area; and
- ongoing recovery of free phase oil from the landfill area.

Applicable validation and verification reports for completed works within and adjacent to the Permitted Area are attached in the Appendix ESID4 along with the site-wide monitoring report. These documents are:

- West Bay Verification report: 5041216-RAP-RPT-000541, May 2011
- South Bay Verification report: 5041216-RAP-RPT-000545, July 2011
- Development Village: 5041216-DV-RPT-000293, December 2010
- Containment Area Drum Disposal Validation Report R1353/10/3784, April 2010 & Drum Removal Extension Works 5041216-RAP-TN-0373, January 2011
- RAP Interpretive Report 5041216-RAP-RPT-327, Atkins, January 2011

It is proposed under the Coed Darcy Masterplan that the area under consideration will be redeveloped in to a conservation area with a number of raised walkways providing access across the site.

2.1.2. Proposed Development

There currently is no development proposed for the Permitted Area. It is intended that environmental monitoring will be ongoing, until sufficient information is gathered to facilitate surrender of the permit.

2.2. Installation Engineering

2.2.1. Groundwater Management System

No groundwater management is required.

2.2.2. Basal Lining System

There is no basal lining system at the landfill; the waste lies directly on the underlying peat.

2.2.3. Side Slope Lining System

There is no side slope lining system in place.

2.2.4. Capping System

Due to the nature of the waste materials accepted at the site (inert and potentially hazardous) a permanent cap has been proposed for the landfill area. Capping will comprise of suitable topsoil/restoration material, discussed below, to a minimum of 0.5m, to a specification sufficient to support vegetation, as previously agreed between URS and the Environment Agency Wales in 2007. It is not intended that the cap be engineered to limit infiltration but would rather be semi-permeable. For areas designed to be trafficked, i.e. access for machinery and vehicles, the thickness of the capping will be a minimum of 1m.

Potential capping materials have been located within close proximity to the site. These materials are managed and tracked as part of the Coed Darcy Materials and Stockpile management system which forms part of the procedures for wider environmental management agreed as part of the planning requirements for the site. The system allows material provenance to be tracked and verified to ensure material placement complies with 'suitable for use' criteria, discussed in Appendix F of the Construction Quality Assurance Plan for the Capping of Crymlyn Tip (Atkins, June 2012). A monitoring programme for chemical quality, requirements for grading, conformance testing, sampling frequency, compaction and surveys will be developed as part of the site management plan.

The restoration layer will be a minimum of 500mm in thickness and will be required for the whole of the Permitted Area.

2.2.5. Restoration and Aftercare

On completion of the land filling, the site will be planted with a mixture of broadleaf and coniferous woodland with areas of open oak/birch woodland with glades. A small area of open grassland and arable restoration is also proposed.

2.3. Leachate Management and Monitoring Infrastructure

2.3.1. Leachate Generation

As the landfill is unlined and uncapped, both above the waste, and below, it is expected that leachate will be generated as a result of rainwater infiltrating into the waste mass. Leachate may then be transported to groundwater.

It is anticipated that any free phase hydrocarbon waste contamination within the site will have come from the Llandarcy refinery and is not specific to the Permitted Area. The waste mass is known to contain oil sludge, which may contribute to dissolved phase hydrocarbons within the waste mass.

2.3.2. Leachate Management and Monitoring Infrastructure

There is currently no leachate management system operating onsite.

2.4. Landfill Gas Management and Monitoring Infrastructure

2.4.1. Landfill Gas Generation

The waste historically placed within the landfill, in the eastern half of the Permitted Area, was predominantly non-putrescible (Section 2.1.1); however the landfill accepted oily sludge waste. It is known that the Permitted Area has been subject to contamination by legacy free-phase hydrocarbons emanating from the refinery historically located adjacent to the site. Emissions of landfill gas, namely methane and carbon dioxide, are therefore likely to result from the degradation of the free-phase hydrocarbons both within the waste mass and the historically contaminated land. It is also highly likely that biodegradation processes occurring within the underlying Peat deposits (Section 3.2) will emit ground gases which may have similar composition to landfill gas.

Monitoring carried out in forty-one boreholes between 2010 and 2013, as shown on drawing ESID8, has proven the presence of gas within the subsurface. Trigger level values were used to screen the gas data as discussed in Section 1.2.4 of the LfGRA.

Within the landfilled area in the east of the site, twenty six boreholes were monitored during 2011 and 2013. Exceedances of gas threshold values for carbon dioxide (1.5%v/v) and methane (1.0%v/v) were detected within the waste mass, with a maximum carbon dioxide concentration of 12.1%v/v in MSMW235 on 25/10/2010 and a maximum methane concentration of 84.4%v/v detected in CBH42.

Ten boreholes were monitored for landfill gas concentration within the non-landfilled area in the west of the site between 2010 and 2013. Methane was detected at concentrations in excess of the threshold value in seven boreholes. A maximum of 99.9%v/v was detected in CARW025, located to the north-west of the Permitted Area. Carbon dioxide was found in excess of the threshold value in all boreholes, with a maximum of 14.5%v/v detected in CARW025.

Two boreholes located within the non-landfilled area east of the waste tip were monitored over three months during April and May 2013. The methane and carbon dioxide concentrations were negligible and fell below the trigger level.

Off-site to the east of the containment area, CARW002 was monitored for gas during 2013 over 3 monitoring rounds. Methane concentrations were below the trigger level whilst carbon dioxide was in exceedance of the trigger level, where a maximum concentration of 7.2%v/v was detected.

Off-site to the south of the containment area, MSMW154S and MSMW154D were monitored on seven occasions between 2011 and 2013. Elevated methane and carbon dioxide levels were detected in both boreholes. A maximum methane concentration of 83.7%v/v was detected in MSMW154S and a maximum carbon dioxide concentration of 13.9%v/v was detected in MSMW154D.

The generation potential is discussed and assessed in detail in the Landfill Gas Risk Assessment (LfGRA).

2.4.2. Landfill Gas Management

No landfill gas management system is currently carried out.

2.4.3. Landfill Gas Monitoring Infrastructure

There are forty-one boreholes in the containment area and immediate surroundings that have been monitored since 2010. These are shown on Drawing ESID8. Of these; twenty-six boreholes lie within the eastern landfilled area, ten lie in the non-landfilled area in the west of the site, two boreholes lie east of the landfilled area, one borehole lies outside of the containment area to the east and two borehole lie to the south outside of the containment area.

2.5. Surface Water Management System

There are currently three main water bodies within the Permitted Area, South Bay, Crymlyn Bog Lagoon and West Bay which form part of the surface water management system for the wider site. The location of these water bodies and other pertinent surface water and drainage features are indicated on ESID13.

Discharge from both South Bay and West Bay enters Crymlyn Bog Lagoon before discharging into Crymlyn Bog via the consented discharge points.

Drainage from the Crymlyn Bog Lagoon discharges through an historical oil-water interceptor located within the ash bund and into Crymlyn Bog via a siphon valve. The discharge through this valve is regulated via an Environmental Permit (BP0279201).

2.6. Post Closure Controls

There are currently no post closure controls in place at the permitted site relating to environmental quality. Monitoring requirements to be carried forward will be discussed in the hydrogeological risk assessment (HRA) and landfill gas risk assessment (LfGRA).

Subsidence is not considered likely due to the homogeneous nature of the waste type, and the basement of the site being a consistent material. Any inert fill material under Phase 2 will be compacted to mitigate any potential differential settlement with the natural materials under that part of the site.

The permit completion timing is addressed in the risk assessment reports, but will be subject to review as ongoing monitoring data becomes available.

Onsite maintenance and monitoring of the infrastructure will take place to address any degradation of the accessible engineering precautions such as the surface water and leachate management systems.

3. PATHWAY AND RECEPTOR TERM CHARACTERISATION

3.1. Climate

Climate is not anticipated to influence the pathway from the receptor to the source and therefore has not been assessed.

3.2. Geology

3.2.1. Regional Geology

The British Geological Survey (BGS) Sheet SS79 NW 1:10,560 (Solid and Drift) indicates that the Coed Darcy site as a whole is underlain by the South Wales Upper Coal Measures Formation comprising mudstones, siltstones and sandstones of Carboniferous age with occasional minor coal seams. The Upper Coal Measures are part of the South Wales Coal Measures Group.

The key members noted within the Llandarcy area include the Hughes Sandstone Member, Swansea Member and Llynfi Member, which trend from east to west at the permitted site, see Drawing ESID9. While both the Hughes Member and the Swansea Member are present across the majority of the site, with the Hughes Member to the south of the site and the Swansea Member to the north of the site, the Llynfi Member is only found to the eastern extent of the Permitted Area, where it has been offset by the north-south trending Gardener's Fault.

3.2.2. Site Geology

URS undertook a number of ground investigations between 1998 and 2001 within and around the Permitted Area, which included the installation of up to 100 boreholes of between 3m and 23m depth. A number of boreholes have been selected for use within this report, based on their location in and around the Permitted Area, and the depth at which they have been installed. The majority of boreholes selected are deep wells and provide detailed information on the geology both within the landfill, and made ground, beneath the landfill and around the site. These boreholes are presented in Drawing ESID11, and the associated logs can be found in Appendix ESID1. Details regarding the findings of these investigations are outlined in Table 3-1 below.

Table 3-1 – Local Geology

Geology	Thickness within filled area (m)	Thickness within remaining Permitted Area (m)	Thicknesses in peripheral wells
Made Ground	0 - 15	0 - 9	0 - 4
Till (sands, clays and gravels)	0 - >10	0 - 6.5	0 - 15.4
Mudstone	Bottom of lithology not observed	Bottom of lithology not observed	0 - 2m
Sandstone	Not observed	Not observed	Bottom of lithology not observed
Limestone	Not observed	Not observed	5.6

Made Ground is recorded within the majority of exploratory hole locations, with eight of the boreholes encountering sandstone or mudstone at their base. The eight boreholes recording natural geology from ground level are located within the south and west of the Permitted Area to the west of the main landfilled area.

Made Ground within the Permitted Area can be subdivided into two categories typically comprising landfill material within the east of the Permitted Area where refinery-derived landfilling is known to have historically undertaken and fill material within the west forming the banks of the existing lagoons up to the ash bund. The landfilled Made Ground in the east is significantly deeper compared to the fill material within the south and west of the Permitted Area where it is understood that Made Ground was deposited to provide working areas for compounds and access tracks on otherwise boggy ground.

The landfill material recorded within the east ranges in depth between 0.45m (CARW021) and 15m (MSMW033d). The landfill material includes concrete and brick of varying sizes from gravel to boulders, iron reinforcing bar, wood, plastic and concrete slabs. Many of the logs indicate hydrocarbon staining and odours to varying degrees. Historical records (Tip Closure & Completion Strategy, URS March 2006) indicate that the Permitted Area received a number of types of wastes including refinery wastes, demolition waste, refractory waste, asbestos, pyrophoric waste, vanadium waste and sludge. The Permitted Area is currently largely unrestored with the exception that a number (the exact number is unknown) of small capped vanadium pits and asbestos graves are present within the Permitted Area. In 2008 the restoration of the landfill area was commenced under a previous agreement with the then Environment Agency Wales. The completion of the restoration is now being considered as part of the revised Environmental Permit and is subject to separate documentation.

3.3. Man-made Subsurface Pathways

It is anticipated that no man-made subsurface pathways are present across or beneath the site, with the exception of installed boreholes. The eastern half of the permitted site has been used for the filling of waste materials from Llandarcy Refinery, while the western site contains lagoons that will not be filled. There are no known historical activities at the permitted site area that would have required drains, mine shafts or underground services.

Boreholes have been installed across the site for monitoring purposes, and have been appropriately fitted to prevent the introduction of preferential pathways.

3.4. Permitted Area Hydrology

There are currently three main water bodies within the Permitted Area, South Bay, Crymlyn Bog Lagoon and West Bay. The location of these waterbodies and other pertinent surface water and drainage features are indicated on 5041216-RAP-DWG-0001522 (ESID13). The majority of the surface water drainage from the southern half of the CDUV enters the Permitted Area via overland flow, perched water drainage or flow through existing surface water drainage channels. Discharge from both South Bay and West Bay enters Crymlyn Bog Lagoon before discharging into Crymlyn Bog via the consented discharge points.

Drainage from the Crymlyn Bog Lagoon discharges through an historical oil-water interceptor located within the ash bund and into Crymlyn Bog via a siphon valve. This discharge is subject to an Environmental Permit (number BP0279201).

Other surface water bodies within 2km of the permitted site include the southward flowing Crymlyn Brook, located to the west of the permitted site. It is anticipated that the Crymlyn Bog is in direct continuity with Crymlyn Brook. A number of surface water drains can be found around the permitted site, these are unnamed and are located to the north, south, east and west of the site. The closest of these drains surround the site, and are within 50m of the perimeter.

According the Environment Agency website, Crymlyn Brook currently has good ecological quality, and does not require assessment for chemical quality.

To the west of the Permitted Area, approximately one third of the area lies within a flood risk zone 3 area. A flood zone 3 is described by the Environment Agency as an area that has a 1% (1 in 100) or greater

chance of being flooded by a river each year. The area of site within the flood risk zone has not been landfilled.

3.5. Hydrogeology

3.5.1. Aquifer Characteristics

Two aquifers have been identified beneath the Permitted Area. These comprise the shallow aquifer within made ground, and the deep aquifer (bedrock aquifer) identified in the Till, and bedrock.

The bedrock aquifer beneath the Permitted Area, and surrounding area, is classified as a secondary A aquifer. A secondary A aquifer is described by the Environment Agency as an aquifer having permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. There is no superficial aquifer designation available.

The site is not within 2km of a source protection zone.

3.5.2. Groundwater Flow

Water level monitoring undertaken by Atkins between 2008 and 2009 indicates that the dominant groundwater flow is to the east, towards Crymlyn Bog, while some radial flow is noted near the south eastern boundary of the Permitted Area, see Drawing ESID11. Water levels within the landfill area have also been monitored during this time frame, the results of which are outlined in Table 3–2 alongside the findings from groundwater monitoring on and around the Permitted Area.

Table 3–2 – Water level monitoring results

Location	Borehole	Depth To Product (mbgl)	Depth To Water (mbgl)	Water Levels (average) (mAOD)	Range of water level (mAOD)
Landfill Area – Leachate water levels	CARW010	-	0.90	10.94	10.75 – 11.04
	CARW017	-	1.05	10.07	9.57 – 10.53
	CARW022	-	2.27	10.08	-
	CARW029B	-	1.24	8.54	6.94 – 9.36
	MSMW029d	-	0.80	10.73	9.78 – 11.03
	MSMW034d1	-	0.58	12.20	11.97 – 12.46
	MSMW035D1	-	0.96	11.19	11.13 – 11.73
	MSMW152d	-	8.70	8.38	8.17 – 8.51
	MSMW235	7.23*	7.92	7.20	6.22 – 9.17
	MSMW236	5.8*	6.88	7.95	7.26 – 14.83
	MSMW238	5.21*	6.97	7.3	6.75 – 14.25
Permitted non-landfilled Area – Groundwater levels	CARW002	-	0.36	13.59	13.55 – 13.61
	CARW003	-	0.73	12.65	12.38 – 12.78
	CARW007	-	1.01	11.21	11.02 – 12.22

Location	Borehole	Depth To Product (mbgl)	Depth To Water (mbgl)	Water Levels (average) (mAOD)	Range of water level (mAOD)
	CARW008	-	0.85	10.40	10.32 – 10.44
	CARW014	-	1.52	9.37	9.16 – 9.78
	CARW025	-	0.51	9.51	9.14 – 9.78
	CARW032	-	0.97	11.69	-
	CARW033	-	0.30	10.37	10.08 – 10.51
	CARW037	-	2.38	8.98	8.77 – 9.24
	CARW038	-	1.70	9.81	9.54 – 10.07
	CARW041	-	3.11	8.47	8.23 – 8.72
	CARW042	-	2.99	8.41	8.14 – 8.54
	CARW043	-	3.61	8.36	8.13 – 8.6
	CARW044	-	3.85	6.64	6.41 – 6.76
	CARW045	-	3.56	8.40	8.12 – 8.54
	MSMW027d	1.291*	1.80	7.75	7.75 – 9.55
	MSMW155d	-	0.44	7.91	7.72 – 8.01
	MSMW156d	-	0.82	8.20	8.12 – 8.24
Peripheral Wells – Groundwater levels	MSMW115d2	-	1.03	13.47	-

* Data has not been corrected for free product

URS conducted rising head tests between 1998 and 1999 in 13 wells located across the wider Llandarcy site, however tests were not carried out within the Permitted Area. The geology across the greater Llandarcy site is similar to that described above for the permitted site, and as such it is proposed that hydraulic conductivities will also be similar. For the purpose of this report the hydraulic conductivities identified by URS will be used. The results of testing are outlined in Table 3–3.

Table 3–3 – Hydraulic Conductivities

Geology	Minimum	Maximum	Mean
Bedrock	1×10^{-8} m/s	1×10^{-5} m/s	1.4×10^{-6} m/s
Made Ground	2.3×10^{-7} m/s	2.2×10^{-5} m/s	1×10^{-5} m/s

It was noted that the shallow wells were purposely installed within productive units and could therefore provide an overestimation of hydraulic conductivity of the Made Ground. The observation was made that

the glacial acts as a confining layer to fluids within the bedrock, therefore its hydraulic conductivity must be considerably less than that of the bedrock.

3.5.3. Groundwater Quality

Historical investigations of the site have identified petroleum hydrocarbons as being of concern within the permit boundary, due to the presence nearby of an operating refinery, Llandarcy Refinery, between 1921 and 1997. Further to this groundwater, surface water and landfill gas has been monitored for contaminants of concern.

Biannual groundwater monitoring was carried out, by Atkins, between 2008 and 2010, with an interim monitoring round carried out in February 2010 and a final monitoring round undertaken in November/December 2010. Groundwater quality results are outlined in Appendix ESID2 including graphs of TPH concentrations.

Due to the historical activities identified on site, and discussed in 2.1.1 above, the following contaminants have been considered "Contaminants of Concern" (COCs) for the purpose of this report;

- TPH,
- Benzene,
- Ethylbenzene,
- GRO (C4 – C12),
- M&p Xylene,
- MTBE,
- o Xylene,
- Toluene, and
- BTEX.

A total of eight boreholes were monitored, two boreholes were monitored for groundwater quality within the Permitted Area, one within the landfilled area (MSMW035), and the other within the Permitted Area that has not been filled (MSMW156). One borehole was monitored upgradient of the landfilled area (MSMW034), and one downgradient of the Permitted Area. Four other boreholes were monitored outside of the Permitted Area which are not influenced by groundwater flow within the Permitted Area. These boreholes will allow the differentiation of contamination as a result of the landfill from background contamination resulting from historical activity in the Llandarcy area.

3.5.3.1. TPH

At present there is no standard value for which TPH are screened against. For the purpose of this report, TPHs have been screened against the old drinking water standards value of 10µg/l.

Concentrations of TPH of greater than 10µg/l are noted outside of the permit boundary, with the largest number of elevated results to the south of the permit boundary.

Landfilled Area

Concentrations of TPH were not identified within leachate monitoring data (MSMW035) throughout the monitoring period.

Permitted Area, Not Landfilled

Concentrations of over 10µg/l were noted for TPH C10 -C12, TPH C12 – C16, TPH C21 – C40 and C6 – C40 at borehole MSMW156.

Outside Permitted Site

Elevated TPH concentrations, between 32µg/l and 3610µg/l were noted upgradient and downgradient of the site in both boreholes MSMW034 and MSMW155.

Elevated concentrations were noted in boreholes to the south of the site of up to 4310 µg/l.

Concentrations of greater than 10µg/l of all TPHs are noted in all monitoring wells outside of the permitted area throughout the monitoring period. This suggests that elevated TPH concentrations are the result of background contamination in the groundwater.

3.5.3.2. Benzene, Ethylbenzene, GRO (C4 – C12), M&p Xylene, MTBE, o Xylene, Toluene, BTEX

Benzene, Naphthalene, Ethylbenzene, GRO, m&p Xylene, MTBE, o-Xylene, Toluene and BTEX have been compared with their relative EALs as discussed in Section 1.2.3 of the HRA.

Landfilled Area

Concentrations of the above contaminants were not noted within the leachate monitoring data (MSMW035) throughout the monitoring period.

Permitted Area, Not Landfilled

Concentrations of the above contaminants were not noted within the groundwater monitoring data within the permitted area throughout the monitoring period.

Outside Permitted Site

Concentrations of the above contaminants were not noted within the monitoring data, downgradient of the landfill (MSMW155) within the permitted area throughout the monitoring period.

Concentrations of GRO (C4 – C12) were identified in all offsite boreholes monitored ranging from 12µg/l in MSMW163 to 4,100µg/l in MSMW183. No EQS is available for GRO.

Benzene was identified outside of the permitted area, with concentrations ranging from 14µg/l in MSMW034 to 350µg/l in MSMW183. Exceedences of the EQS were noted upgradient of the site at borehole MSMW034, and to the south of the site boundary, MSMW025 and MSMW183.

3.6. Off-site Landfill Gas Monitoring

Due to the age of the site and lack of gas monitoring data prior to the installation of the landfill it is not possible to provide a historical baseline landfill gas analysis. Off-site gas monitoring has been carried out since 2011. CARW002 was monitored east of the permitted area during April and May 2013, whilst MSMW154s and MSMW154d were monitored south of the non-operational area between 2011 and 2013 adjacent to Crymlyn Bog. These installations have been monitored on 3 and 7 occasions respectively. The data has been screened against trigger levels of 1%v/v for methane and 1.5%v/v for carbon dioxide, as outlined in Section 1.2.4 of the LfGRA.

The monitored methane concentrations outside of the permitted area are summarised in Table 3–4 below.

Table 3–4 – Summary of off-site methane concentrations

Borehole	Location in relation to permitted area	Minimum concentration (%v/v)	Maximum concentration (%v/v)	Average concentration (%v/v)
MSMW154D	South	0.2	49.6	9.5
MSMW154S	South	1.3	83.7	21.9
CARW002	East	0	0.6	0.2

The monitored carbon dioxide concentrations outside of the permitted area are summarised in

Table 3–5 below.

Table 3–5 – Summary of off-site carbon dioxide concentrations

Borehole	Location in relation to permitted area	Minimum concentration (%v/v)	Maximum concentration (%v/v)	Average concentration (%v/v)
MSMW154D	South	0.3	5.7	1.8
MSMW154S	South	2.7	13.9	10.5
CARW002	East	0.4	7.2	3.3

The installations at MSMW154 are located adjacent to the refinery and the Crymlyn Bog, it is therefore considered highly likely that the gas concentrations detected at this location are due to a combination of legacy contamination of free-phase hydrocarbons from the refinery and the natural degradation processes within the Crymlyn Bog.

Following the LfGRA, recommendations were made to improve the existing monitoring regime.

3.7. Receptors and Compliance Points

The key receptor with respect to the landfill is considered to be Crymlyn Bog, which is a designated Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC), Ramsar Site and a National Nature Reserve (NNR). Other receptors include the groundwater aquifer beneath the site and surface water receptors, comprising unnamed drains identified to the north, south, east and west of the permitted site. It is anticipated that each of the water bodies within and around the permitted site will be in continuity with Crymlyn Bog, and as such the Bog is considered the key receptor. The locations and distances from the permitted site, of these receptors, are identified in Table 3–6 below.

Table 3–6 – Distance of proposed receptors from both the landfilled area, and non filled area within the permitted boundary

Receptor	Designations	Distance from Permitted site	Distance from Landfilled area
Crymlyn Bog	SSSI, SAC, Ramsar Site, NNR	At western site boundary	200m to the west
Shallow groundwater	None	Beneath the site	Beneath the site
Deep Groundwater	Secondary A	Beneath the site	Beneath the site
Unnamed land drain	None	Along site boundaries	30m to the north and east, 50m to the south, 300m to the west

There are two discharge compliance points adjacent to the site, which are designed to monitor discharges from the containment area into the Crymlyn Bog. These are located to the northern and western boundaries of the permitted site.

Landfill Gas Receptors

Receptors for landfill gas are outlined in Table 3–7 below.

Table 3–7 – Landfill Gas Receptors

Receptor Group	Receptors	Distance from Landfilled Area (m)
Domestic Dwellings	Demonstration village	0m to the south
Sensitive Habitats	Crymlyn Bog	200m to the west

4. SITE CONDITION REPORT

4.1. Introduction and Background Information

The site details are described in full in ESID Sections 1.1 and 1.2.

The proposed development of the permitted site is described in ESID Section 2.1; this section also takes into account the historical development of the site.

The engineering schemes, and proposed monitoring schemes are described in ESID Sections 2.3, 2.4 and 2.5.

The geology, hydrology and hydrogeology for the site is described in detail in ESID Section 3.

The sources of information used to develop this ESID include:

- Environment Agency
- British Geological Survey
- Information provided by URS, and St. Modwens.
- Historical Atkins Reports.

No incidents have been recorded for the site as an operational Landfill.

4.2. Objectives of this Assessment

Historically the site was permitted to operate as a general landfill for the deposition of waste from Llandarcy refinery. Currently activities at the site are restricted to restoration and remediation of the site. The initial site conditions are addressed in Sections 2 and 3 of this document. The contaminants of concern (COCs) are described in the Hydrogeological Risk Assessment (HRA).

The general approach to producing the PPC application is in line with the current Environment Agency documentation including, the Regulatory Guidance Notes on the Landfill Directive, the Agency's "Hydrogeological Risk Assessments for Landfills and the Derivation of Groundwater Control and Trigger Levels", 2003 guidance document and the Environment Agency's "Guidance on Monitoring of Landfill Leachate, Groundwater and Surface Water", 2003. In addition the Groundwater Regulations (1998) and the Landfill Regulations (2002) were referred to in the preparation of the PPC application.

4.3. Site Investigation (Data Collection) Details

The site investigation conducted to support the PPC application are described in Section 3.2.2 of this document, the results of which are referred to throughout Section 3 of the ESID report.

Laboratory analyses of leachate quality and groundwater quality in addition to geotechnical testing data have been provided as a result of the site investigations.

4.4. Summary of Site Investigation and Analysis Findings

The site investigations and associated findings are discussed in detail in ESID Section 3. Where on-site observations are of value they are included. Rising head tests were conducted by URS in between 1998 and 1999, the details of which are outlined in Section 3.5.2. Borehole and trial pit records are presented in Appendix ESID1.

Monitoring data is provided in full in Appendices ESID2 and ESID3 for groundwater and landfill gas. Data summary table and/or graphs are contained variously in the text of the report or the relevant Appendix.

4.5. Data Interpretation

The results of the prior investigation are discussed in the ESID Section 3 and associated appendices. These set out the data obtained and the baseline conditions derived from them. The main constraints on this data are the spatial and temporal extent of the data.

4.6. Conclusions

The landfill area is believed to have a limited impact on the groundwater quality of the unfilled half of the permitted site. There is no evidence from existing monitoring data that the permitted site or surrounding area is impacted by the presence of the landfill, however monitoring data suggests that historical activity (Llandarcy refinery) has had an impact.

Although limited quality data is available for the permitted site, quality trends suggest that downgradient receptors will not be impacted by the landfill area. It is thus proposed that Crymlyn Bog will not be impacted by the presence of the landfill area, although contamination may occur as a result of historic land uses.

5. REFERENCES

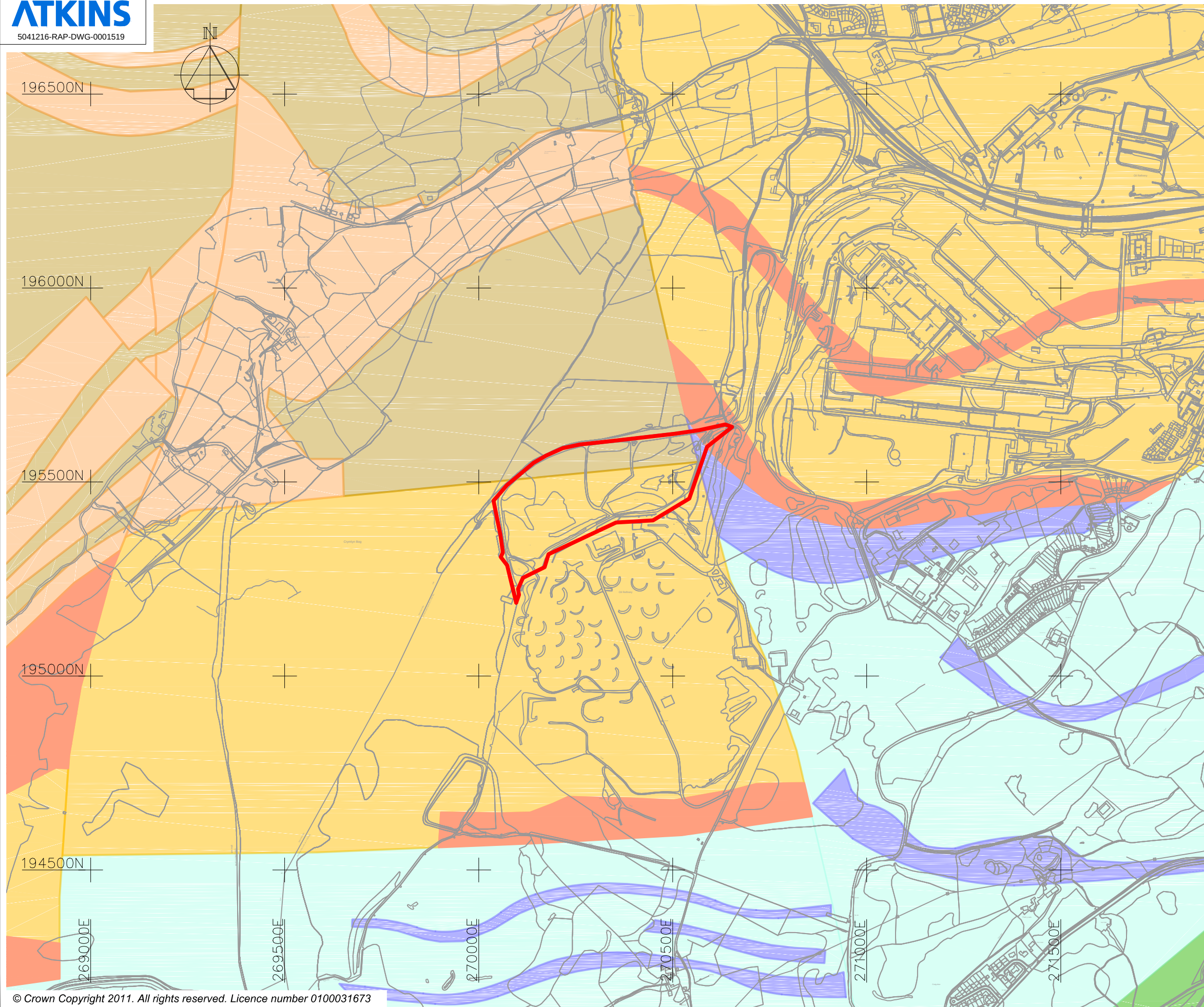
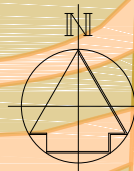
Atkins, June 2012. *Coed Darcy, Capping of Crymlyn Tip, Construction Quality Assurance Plan*, s.l.: s.n.

Environment Agency, 2013. *Environment Agency Website, What's in Your Backyard, Interactive Maps, Groundwater*. [Online]

Available at: <http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=357683.0&y=355134.0&scale=1&layerGroups=default&ep=map&extonly=off&lang=en&topic=groundwater#x=269628&y=193331&lg=1,3,&scale=7>
[Accessed May 2013].

URS, 2006. *BP Llandarcy Remedial Action Plan Tip Closure and Completion Strategy*, s.l.: URS.

DRAWINGS



KEY:

— ENVIRONMENTAL PERMIT BOUNDARY

BEDROCK GEOLOGY

■ HUGHES MEMBER – MUDSTONE, SILTSTONE AND SANDSTONE

■ HUGHES MEMBER – SANDSTONE

■ SWANSEA MEMBER – SANDSTONE

■ LLYNFI MEMBER – MUDSTONE, SILTSTONE AND SANDSTONE

■ SWANSEA MEMBER – MUDSTONE, SILTSTONE AND SANDSTONE

■ RHONDDA MEMBER – SANDSTONE

■ LLYFI MEMBER – SANDSTONE

DRAFT

REVISIONS	Drawn By	Checked By	Date
-----------	----------	------------	------

PURPOSE OF ISSUE	Rev.	Authorised for issue	Date
------------------	------	----------------------	------

Atkins Ltd
Consulting Engineers
The Axis, 10 Holliday Street
Birmingham West Midlands B1 1TF
Tel 0121 483 5000
Fax 0121 483 5252

THIS DRAWING IS NOT TO BE SCALED

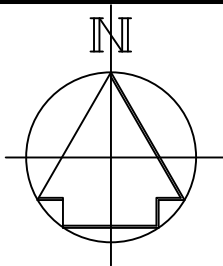
CLIENT **ST.MODWEN**

PROJECT
CRYMLYN TIP

DRAWING TITLE
ESID 9 REGIONAL BEDROCK GEOLOGY

SCALES	DRAWN	CHECKED	CO-ORD CHECK
1:10000	JSD	YMC	
	DATE	DATE	DATE
	13/05/13	13/05/13	
		SHEET A3	PLOT DATE 22.05.13

DRAWING NO	REV
5041216-RAP-DWG-0001519	-



8mAOD

195600N

195400N

195200N

270000E

270200E

270400E

270600E

Oil Refinery

NOTE

- DRAWING DOES NOT SHOW BOREHOLES CONTAINING FREE PRODUCT

KEY

- ENVIRONMENTAL PERMIT BOUNDARY
- LANDFILLED AREA
- GROUNDWATER CONTOURS mAOD
- GROUNDWATER MONITORED WELLS
- MADE GROUND WATER LEVELS

REVISIONS

Rev.	Checked By	Date

PURPOSE OF ISSUE

Rev.	Authorised for issue	Date

Atkins Limited

Birmingham Office
The Axis, 10 Holiday Street
Birmingham
West Midlands B1 1TF



Tel 0121 483 5000
Fax 0121 483 5252

THIS DRAWING IS NOT TO BE SCALED

CLIENT

ST.MODWEN

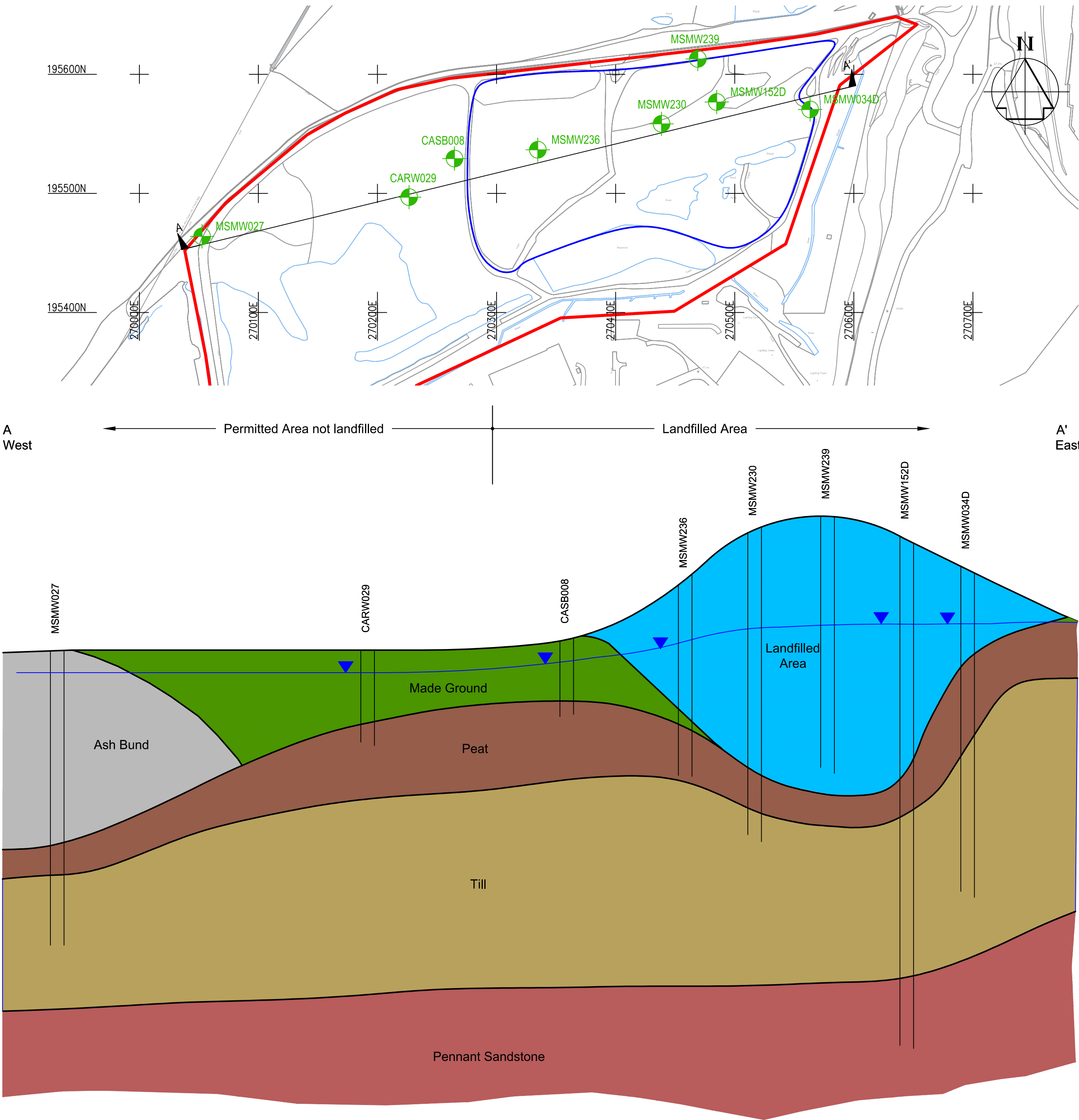
PROJECT

CRYMLYN TIP

DRAWING TITLE

ESID 11 LOCAL HYDROGEOLOGY & HYDROLOGY

SCALES	DRAWN	CHECKED	CO-ORD CHECK
1:2500	JSD	YMC	
	DATE	DATE	DATE
	07/05/13	07/05/13	
DRAWING NO		SHEET	PLOT DATE
5401216-RAP-DWG-0001520a		A3	24.05.13
		REV	
		-	



NOTES:
1. SECTION & GROUND WATER LEVELS ARE SCHEMATIC & INDICATIVE ONLY.

KEY:
ENVIRONMENTAL PERMIT BOUNDARY
LANDFILLED AREA
MONITORING WELLS
GROUND WATER LEVEL

REVISIONS	Drawn By	Checked By	Date

PURPOSE OF ISSUE	Rev.	Authorised for Issue	Date

Atkins Ltd
Consulting Engineers
The Axis, 10 Holliday Street
Birmingham West Midlands B1 1TF
Tel 0121 483 5000
Fax 0121 483 5252

THIS DRAWING IS NOT TO BE SCALED

CLIENT
ST.MODWEN

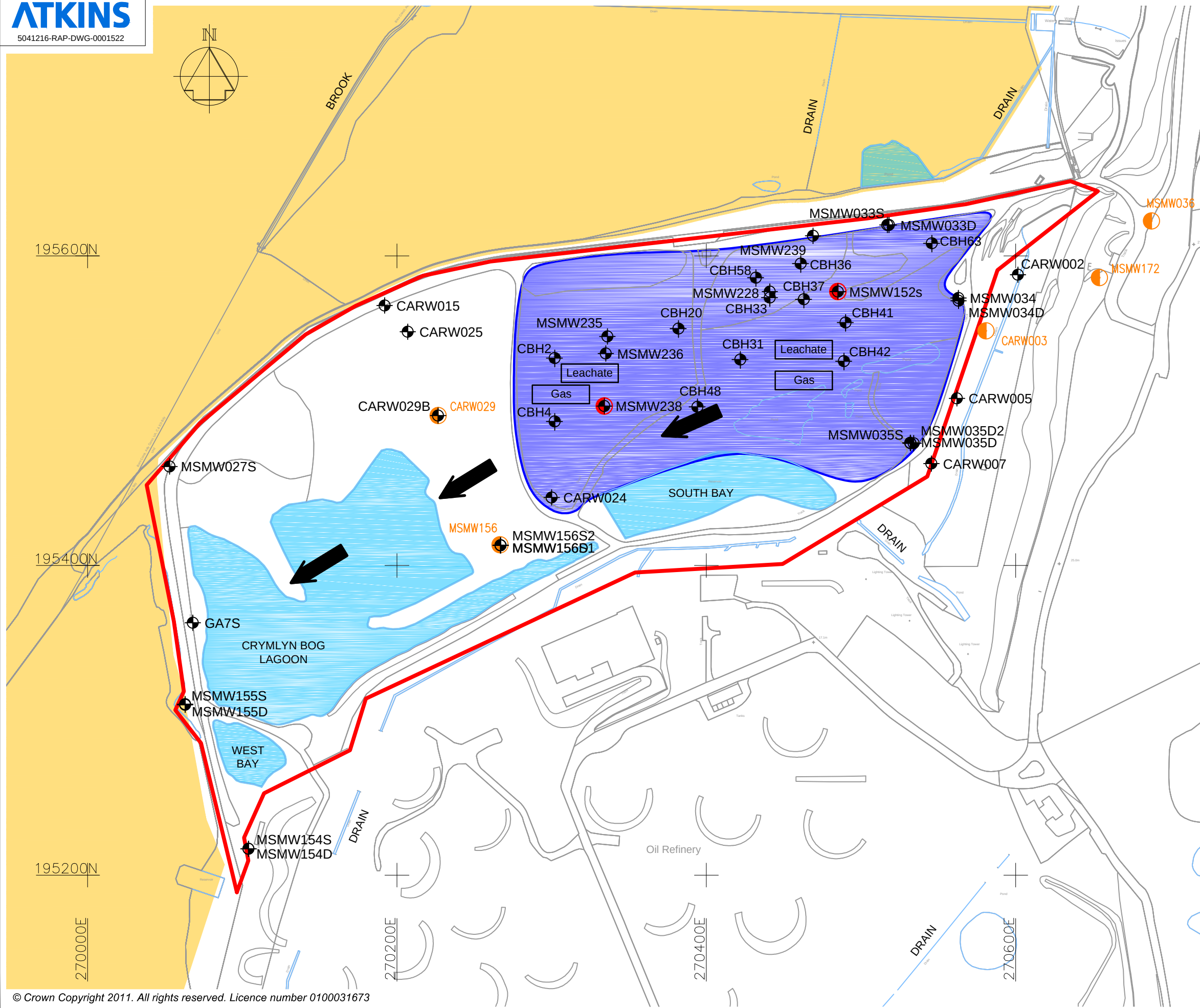
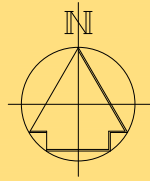
PROJECT
CRYMLYN TIP

DRAWING TITLE
ESID 12 HYDROGEOLOGICAL CROSS SECTION

SCALES	DRAWN	CHECKED	CO-ORD CHECK
N:T.S.	JH	YM	—
DATE	14/05/13	DATE	DATE
		14/05/13	—

0 1 2 3 4 5 6 7 8 9 10

DRAWING NO	SHEET	PLOT DATE	REV
5041216-RAP-DWG-0001521	A2	28/05/13	-



KEY:

- ENVIRONMENTAL PERMIT BOUNDARY
- LANDFILLED AREA
- GAS MONITORING POINTS
- GROUNDWATER MONITORING WELLS
- LECHATE MONITORING WELLS

SOURCE

- Leachate
- Gas

PATHWAY

- GROUNDWATER FLOW DIRECTION

RECEPTORS

- CRYMLYN BOG
- SURFACE WATER
- WATER FEATURES

REVISED	Drawn By	Checked By	Date

PURPOSE OF ISSUE	Rev.	Authorised for issue	Date

Atkins Ltd
Consulting Engineers
The Axis, 10 Holliday Street
Birmingham West Midlands B1 1TF

Tel 0121 483 5000
Fax 0121 483 5252

THIS DRAWING IS NOT TO BE SCALED

CLIENT
ST.MODWEN

PROJECT
CRYMLYN TIP

DRAWING TITLE
ESID 13 - SOURCE, PATHWAYS AND RECEPTORS

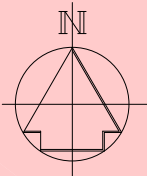
SCALE	DRAWN	CHECKED	CO-ORD CHECK
1:2500	JSD	YMC	
	DATE	DATE	DATE
	07/05/13	07/05/13	

DRAWING NO 5041216-RAP-DWG-0001522

SHEET A3

PLOT DATE 24.05.13

REV -



196500N

196000N

195500N

195000N

194500N

194000N

268500E

269000E

269500E

270000E

270500E

271000E

271500E

272000E

KEY:

- ENVIRONMENTAL PERMIT BOUNDARY
- LANDFILLED AREA
- SECONDARY A AQUIFER

DRAFT

REVISIONS	Drawn By	Checked By	Date
-----------	----------	------------	------

PURPOSE OF ISSUE	Rev.	Authorised for issue	Date
------------------	------	----------------------	------

Atkins Ltd
Consulting Engineers
The Axis, 10 Holliday Street
Birmingham West Midlands B1 1TF
Tel 0121 483 5000
Fax 0121 483 5252

THIS DRAWING IS NOT TO BE SCALED

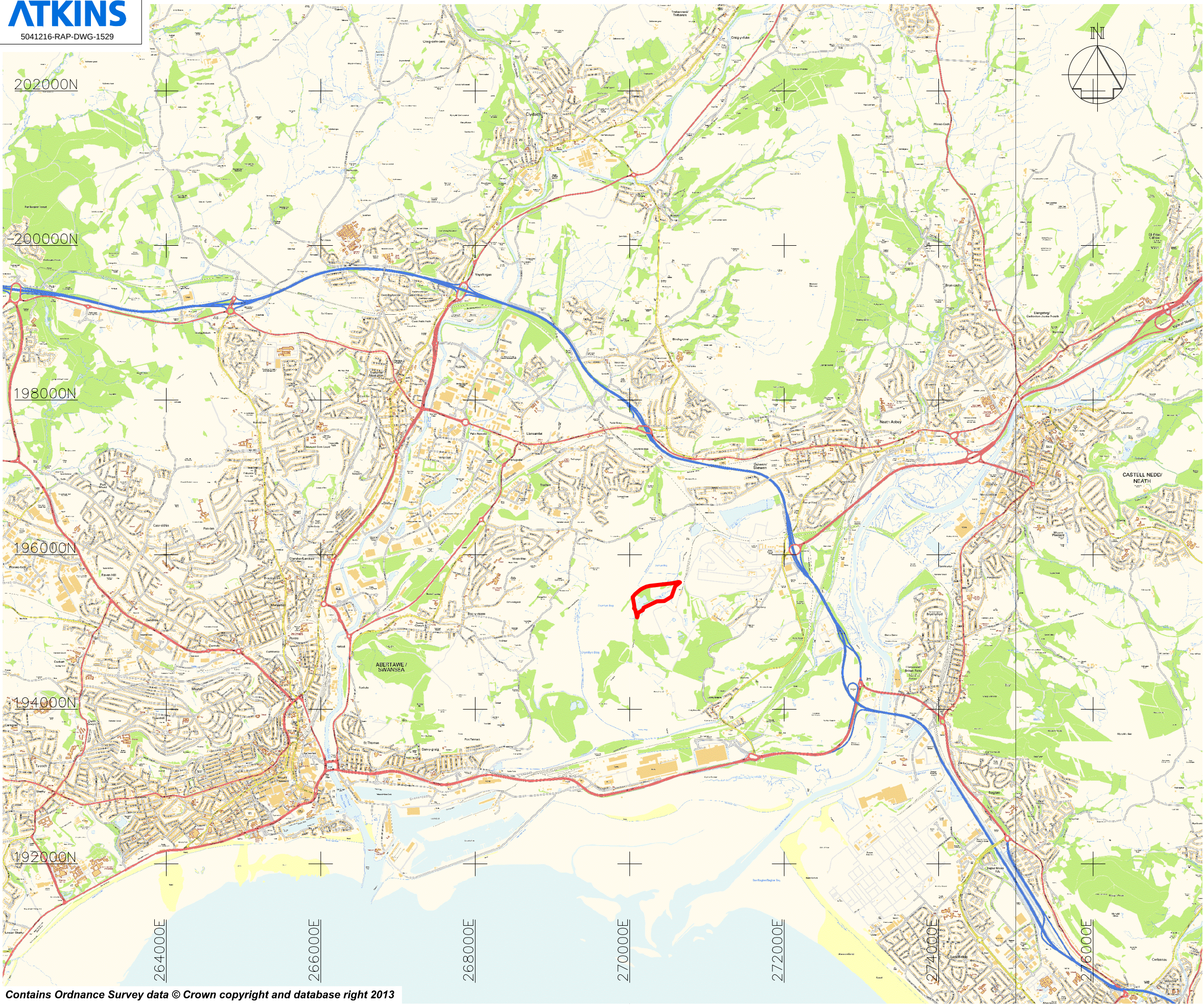
CLIENT **ST.MODWEN**

PROJECT **CRYMLYN TIP**

DRAWING TITLE **ESID 10 REGIONAL HYDROGEOLOGY**

SCALES	DRAWN	CHECKED	CO-ORD CHECK
1:12500	JSD	YMC	
	DATE	DATE	DATE
	14/05/13	14/05/13	
		SHEET A3	PLOT DATE 24.05.13

DRAWING NO	REV
5041216-RAP-DWG-0001527	-



Contains Ordnance Survey data © Crown copyright and database right 2013

KEY:

— ENVIRONMENTAL PERMIT BOUNDARY

REVISIONS			
Rev.	Drawn By	Checked By	Date

PURPOSE OF ISSUE
Atkins Ltd
Consulting Engineers
The Axis, 10 Holliday Street
Birmingham West Midlands B1 1TF
Tel 0121 483 5000
Fax 0121 483 5252
©
THIS DRAWING IS NOT TO BE SCALED

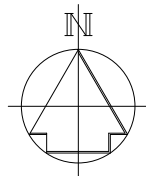
CLIENT
ST.MODWEN

PROJECT
CRYMLYN TIP

DRAWING TITLE
ESID1 LOCATION

SCALES	DRAWN	CHECKED	CO-ORD
1:50000	JSD	YMC	CHECK
	DATE	DATE	DATE
	22/05/13	22/05/13	

DRAWING NO
5041216-RAP-DWG-1529



196500N

196000N

195500N

195000N

194500N

270000E

270500E

271000E

271500E

KEY:

- ENVIRONMENTAL PERMIT BOUNDARY
- LANDFILLED AREA
- CRYMLYN BOG (SSSI, SAC, NNR, Ramsar Site)

DRAFT

REVISIONS	Drawn By	Checked By	Date
-----------	----------	------------	------

PURPOSE OF ISSUE	Rev.	Authorised for issue	Date
------------------	------	----------------------	------

Atkins Ltd
Consulting Engineers
The Axis, 10 Holliday Street
Birmingham West Midlands B1 1TF
Tel 0121 483 5000
Fax 0121 483 5252

THIS DRAWING IS NOT TO BE SCALED

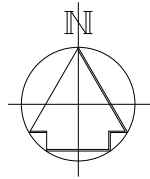
CLIENT **ST.MODWEN**

PROJECT
CRYMLYN TIP

DRAWING TITLE
ESID 3 CULTURAL AND NATURAL HERITAGE

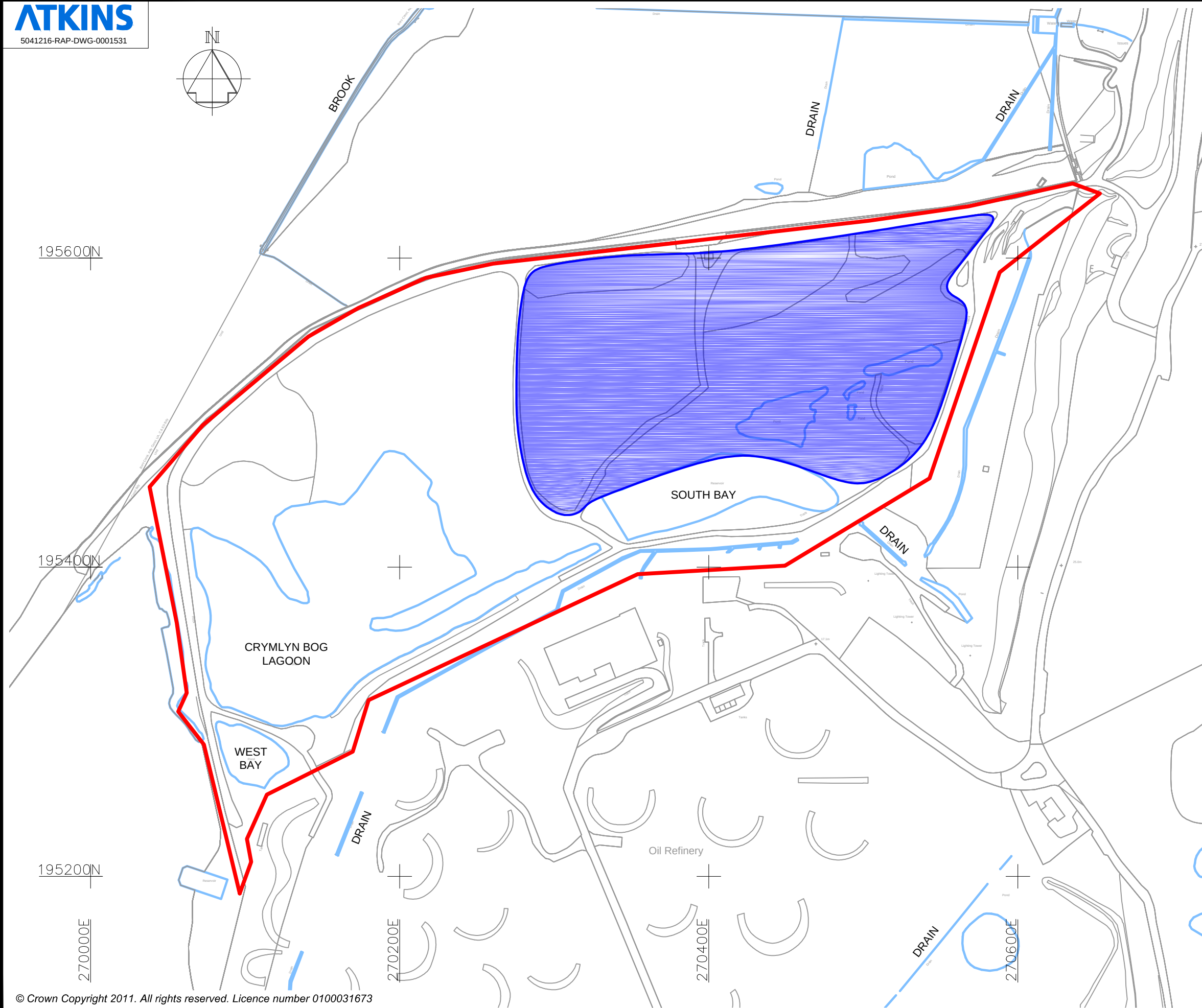
SCALES	DRAWN	CHECKED	CO-ORD CHECK
1:10000	JSD	YMC	
	DATE	DATE	DATE
	22/05/13	22/05/13	

DRAWING NO	SHEET	PLOT DATE	REV
5041216-RAP-DWG-0001530	A3	24.05.13	-



KEY:

- ENVIRONMENTAL PERMIT BOUNDARY
- LANDFILLED AREA



DRAFT

REVISIONS	Drawn By	Checked By	Date

PURPOSE OF ISSUE	Rev.	Authorised for issue	Date

Atkins Ltd
 Consulting Engineers
 The Axis, 10 Holliday Street
 Birmingham West Midlands B1 1TF
 Tel 0121 483 5000
 Fax 0121 483 5252

THIS DRAWING IS NOT TO BE SCALED

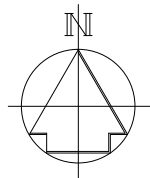
CLIENT **ST.MODWEN**

PROJECT **CRYMLYN TIP**

DRAWING TITLE **ESID 4 SITE LAYOUT AND WASTE**

SCALES	DRAWN	CHECKED	CO-ORD CHECK
1:2500	JSD	YMC	
	DATE	DATE	DATE
	22/05/13	22/05/13	

DRAWING NO	SHEET	PLOT DATE	REV
5041216-RAP-DWG-0001531	A3	24.05.13	-



KEY:

- ENVIRONMENTAL PERMIT BOUNDARY
- LANDFILLED AREA
- LEACHATE MONITORING WELLS

195600N

195400N

195200N

270000E

270200E

270400E

270600E

Oil Refinery

© Crown Copyright 2011. All rights reserved. Licence number 0100031673

REVISIONS	Drawn By	Checked By	Date
-----------	----------	------------	------

PURPOSE OF ISSUE	Rev.	Authorised for issue	Date
------------------	------	----------------------	------

Atkins Ltd
Consulting Engineers
The Axis, 10 Holliday Street
Birmingham West Midlands B1 1TF
Tel 0121 483 5000
Fax 0121 483 5252

THIS DRAWING IS NOT TO BE SCALED

CLIENT



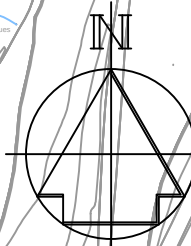
PROJECT
CRYMLYN TIP

DRAWING TITLE
ESID 7 LEACHATE MANAGEMENT

SCALES	DRAWN	CHECKED	CO-ORD CHECK
1:2500	JSD	YMC	
	DATE	DATE	DATE
	22/05/13	22/05/13	

DRAWING NO	SHEET	PLOT DATE	REV
5041216-RAP-DWG-0001532	A3	28.05.13	-

- KEY
- ENVIRONMENTAL PERMIT BOUNDARY
 - LANDFILLED AREA
 - GAS MONITORING LOCATIONS



195600N

195400N

195200N

270000E

270200E

270400E

270600E

REVISIONS	Drawn By	Checked By	Date
-----------	----------	------------	------

PURPOSE OF ISSUE	Rev.	Authorised for Issue	Date
------------------	------	----------------------	------

Atkins Ltd
Consulting Engineers
The Axis, 10 Holiday Street
Birmingham West Midlands B1 1TF

Tel 0121 483 5000
Fax 0121 483 5252

THIS DRAWING IS NOT TO BE SCALED

CLIENT

ST.MODWEN

PROJECT
CRYMLYN TIP

DRAWING TITLE
ESID 8 GAS MONITORING LOCATIONS

SCALES	DRAWN	CHECKED	CO-ORD CHECK
1:2500	AJ	AM	—
	DATE	DATE	DATE
	01/05/13	01/05/13	—
	SHEET A3		PLOT DATE 24/05/13

DRAWING NO 5041216/RAP/DWG/1513

196500N

196000N

195500N

195000N

194500N

269000E

269500E

270000E

270500E

271000E

271500E

© Crown Copyright 2011. All rights reserved. Licence number 0100031673

KEY:

- ENVIRONMENTAL PERMIT BOUNDARY
- ▨ PERMITTED AREA NOT LANDFILLED
- LANDFILLED AREA
- FLOODING FROM RIVERS OR SEA WITHOUT DEFENCES
- EXTENT OF EXTREME FLOOD

REVISIONS	Drawn By	Checked By	Date

--	--	--	--

PURPOSE OF ISSUE	Rev.	Authorised for issue	Date
------------------	------	----------------------	------

Atkins Ltd
 Consulting Engineers
 The Axis, 10 Holliday Street
 Birmingham West Midlands B1 1TF
 Tel 0121 483 5000
 Fax 0121 483 5252

THIS DRAWING IS NOT TO BE SCALED

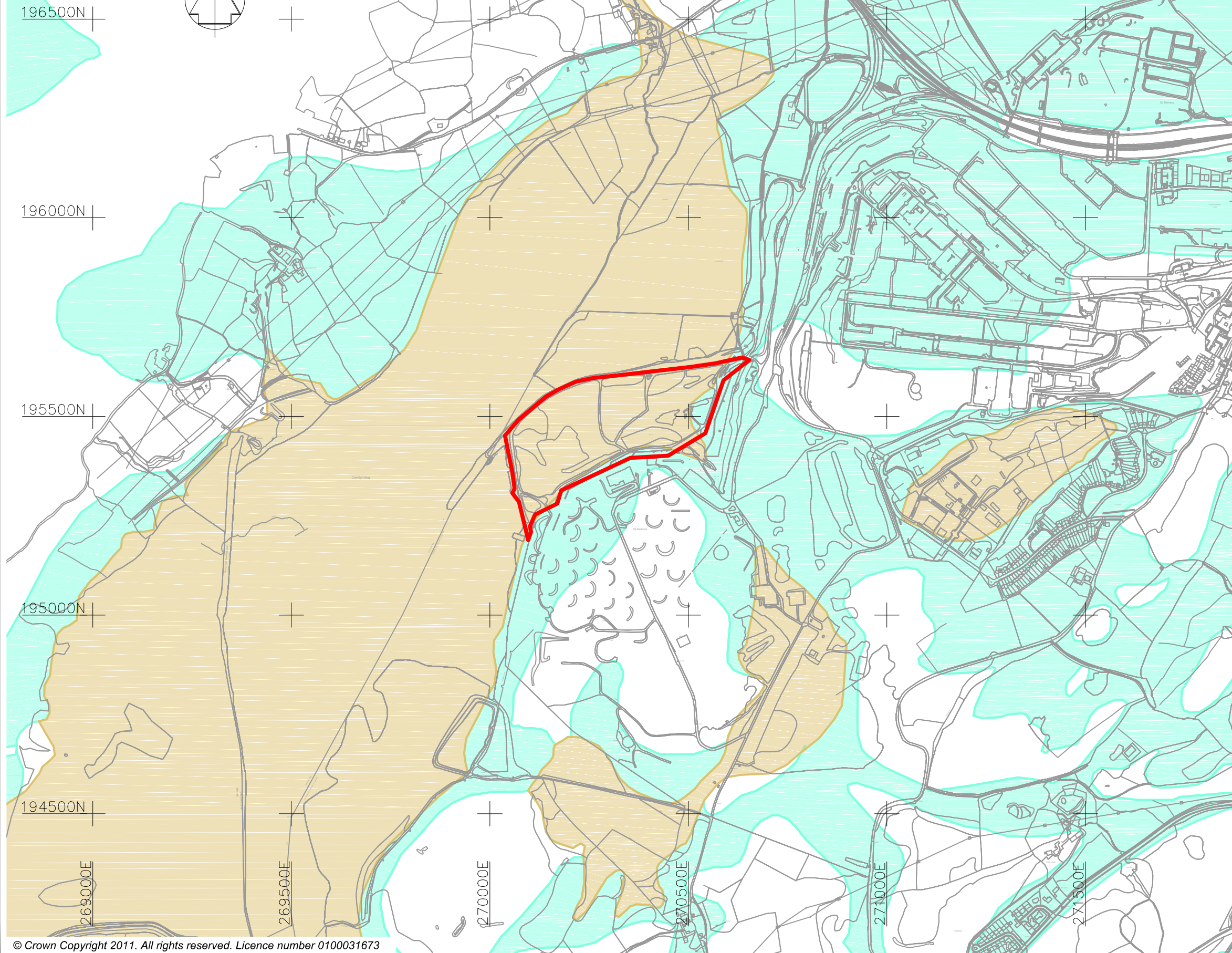
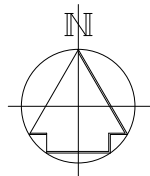
CLIENT **ST.MODWEN**

PROJECT **CRYMLYN TIP**

DRAWING TITLE **ESID 2 ENVIRONMENTAL SITE SETTING**

SCALES	DRAWN	CHECKED	CO-ORD CHECK
1:10000	JSD	YMC	—
	DATE	DATE	DATE
	07/05/13	07/05/13	—

DRAWING NO	SHEET	PLOT DATE
5041216-RAP-DWG-1517	A3	22.05.13



KEY:

— ENVIRONMENTAL PERMIT BOUNDARY

SUPERFICIAL DEPOSITS

■ TILL DEVENSIAN – DIAMICTON
■ PEAT – PEAT

DRAFT

REVISIONS	Drawn By	Checked By	Date
-----------	----------	------------	------

PURPOSE OF ISSUE	Rev.	Authorised for issue	Date
------------------	------	----------------------	------

Atkins Ltd
 Consulting Engineers
 The Axis, 10 Holliday Street
 Birmingham West Midlands B1 1TF
 Tel 0121 483 5000
 Fax 0121 483 5252

THIS DRAWING IS NOT TO BE SCALED

CLIENT
ST.MODWEN

PROJECT
 CRYMLYN TIP

DRAWING TITLE
 ESID 9 SUPERFICIAL GEOLOGY

SCALES	DRAWN	CHECKED	CO-ORD CHECK
1:10000	JSD	YMC	
	DATE	DATE	DATE
	13/05/13	13/05/13	

DRAWING NO	SHEET	PLOT DATE	REV
5041216-RAP-DWG-0001518	A3	22.05.13	-

APPENDIX ESID1

BOREHOLE LOGS FOR GROUNDWATER/LANDFILL GAS MONITORING BOREHOLES

BOREHOLE CONSTRUCTION		SAMPLE NUMBER TYPE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW27s		PAGE 1 of 1
								START DATE: 05/06/98		DRILLING METHOD: Cable Percussion
								FINISH DATE: 05/06/98		BOREHOLE DIAMETER: 150mm
								DRILLER: CP1		SCREEN TYPE & DIAMETER: HDPE 50mm
								LOGGED BY: SG		APPROD BY:
										SCREEN SLOT SIZE: 0.5mm
								DESCRIPTION	COMMENTS	
								Loose red-brown and grey COBBLES with sand and fine to coarse gravel with some concrete (MADE GROUND)		
								Loose black / dark brown coarse SAND with ash, clinker, burnt coal and brick l (MADE GROUND)	Poor returns from 1-3 m	
									Moderate to strong hydrocarbon odour	
								becoming coarse sand and gravel at 2.5m		
								Spongy light yellow-brown PEAT		
								Borehole terminated at 9.0 mbgl	Slight hydrocarbon odour	

LOCATION / NOTES:

- All measurements in m below ground level (mbgl)
- Water strike at 2.0m

LEGEND

- Disturbed Sample
- Undisturbed Sample
- Headspace Analysis
- Down Borehole Analysis
- Groundwater Table
- Perched Water Table

BOREHOLE LOG

Job Title **SOIL & GROUNDWATER INVESTIGATION**

Location **LLANDARCY REFINERY**

Client **BP LLANDARCY**

Appd DRAFT
Ref. MC/CR/BRS
Date JUL 98
Job No. 39991-001-401

DAMES & MOORE

BOREHOLE CONSTRUCTION		SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW034D1/D2		PAGE 1 of 2	
								NUMBER	TYPE	START DATE: 21/4/99	
		FINISH DATE: 21/4/99								BOREHOLE DIAMETER: 165 mm	
		DRILLER: R1						SCREEN TYPE & DIAMETER: 50/19 mm ID UPVC			
LOGGED BY: MC		APPR'D BY:		SCREEN SLOT SIZE: 0.5/1 mm							
D2	D1							DESCRIPTION	COMMENTS		
						0		Grey-dark grey sandy gravelly CLAY with sandstone and brick fragments (MADE GROUND)	Strong hydrocarbon odour	0	
						1.0			Moist	1.0	
						2.0				2.0	
						3.0		Dark brown-black peaty, gravelly CLAY with wood fragments (MADE GROUND)	Strong hydrocarbon odour	3.0	
								Grey clayey GRAVEL	Damp - wet		
						4.0			No odour	4.0	
						5.0		Dense brown gravelly, silty CLAY (BOULDER CLAY)	Dry	5.0	
						6.0			No hydrocarbon odour	6.0	
						7.0		Dense brown clayey GRAVEL	Productive at 8.2 m but cased out at 9.6 m	7.0	
						8.0				8.0	
						9.0				9.0	
						10			Moist	10	

LOCATION / NOTES: 1. All measurements in m below ground level		LEGEND ☒ Disturbed Sample ■ Undisturbed Sample * Headspace Analysis † Down Borehole Analysis ▼ Groundwater Table ▽ Perched Water Table	BOREHOLE LOG Job Title SOIL & GROUNDWATER INVESTIGATION Location LLANDARCY REFINERY Client BP LLANDARCY LTD App'd DRAFT Ref. CR/MC/BRS Date MAY 99 Job No. 39991-004-401	 DAMES & MOORE GROUP
---	--	---	---	---

BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW034D1/D2		PAGE 2 of 2		
	NUMBER	TYPE					START DATE: 21/4/99		DRILLING METHOD: ROTARY AIR FLUSH		
							FINISH DATE: 21/4/99		BOREHOLE DIAMETER: 165 mm		
							DRILLER: R1		SCREEN TYPE & DIAMETER: 50/19 mm ID UPVC		
							LOGGED BY: MC APPR'D BY:		SCREEN SLOT SIZE: 0.5/1 mm		
						DESCRIPTION		COMMENTS			
						Gravelly CLAY (BOULDER CLAY)		Moist			
						Dense coarse grey silty, sandy GRAVEL becoming more clayey at 11 m		No water in hole			
						ROCKHEAD - Dark grey MUDSTONE with occasional silty and sandy layers.					
LOCATION / NOTES: 1. All measurements in m below ground level						LEGEND ☒ Disturbed Sample ☐ Undisturbed Sample * Headspace Analysis † Down Borehole Analysis Groundwater Table Perched Water Table		BOREHOLE LOG Job Title SOIL & GROUNDWATER INVESTIGATION Location LLANDARCY REFINERY Client BP LLANDARCY LTD App'd DRAFT Ref. CR/MC/BR5 Date MAY 99 Job No. 39991-004-401			
								DAMES & MOORE GROUP			

BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW035D2		PAGE 1 of 2	
	NUMBER	TYPE					START DATE: 21/4/99		DRILLING METHOD: ROTARY AIR FLUSH	
							FINISH DATE: 21/4/99		BOREHOLE DIAMETER: 165 mm	
							DRILLER: R1		SCREEN TYPE & DIAMETER: 50 mm ID UPVC	
				LOGGED BY: MC APPRD BY:		SCREEN SLOT SIZE: 0.5 mm				
							DESCRIPTION	COMMENTS		
						0	ASH with gravel and brick fragments (MADE GROUND)			0
						1.0	Silty and sandy GRAVEL with some black ash (MADE GROUND)	Strong "farry" hydrocarbon odour Wet		1.0
						2.0	Grey plastic CLAY with silt and sand	Moist Moderate hydrocarbon odour		2.0
						3.0				3.0
						4.0	Very soft grey-brown very sandy CLAY becoming gravelly and brown-grey	Easy drilling Faint hydrocarbon odour		4.0
						5.0		Wet at 5.0m After pipe connection; faint hydrocarbon odour		5.0
						6.0		Cased out at 6.0m		6.0
						7.0	Soft grey silty, sandy and gravelly CLAY	Dry Very easy drilling - "powdery" returns		7.0
						8.0	gravel content increasing at 7.7m becoming firmer and more stiff at 8.7m	Wet at 7.7m Dry at 8.7m		8.0
						9.0	Dense grey coarse mudstone GRAVEL	Wet		9.0
							ROCKHEAD - Dark grey MUDSTONE (BEDROCK)	Productive		
						10	Hard grey crystalline SANDSTONE (BEDROCK)			10

LOCATION / NOTES:		LEGEND		BOREHOLE LOG	
1. All measurements in m below ground level (mbgl)		Disturbed Sample Undisturbed Sample Headspace Analysis Down Borehole Analysis Groundwater Table Perched Water Table		Job Title SOIL & GROUNDWATER INVESTIGATION Location LLANDARCY REFINERY Client BP LLANDARCY LTD	
2. Bedrock addition to 2 existing shallow				Appd Ref. CR/MC/BRS Date MAY 99 Job No. 39991-004-401	
				DAMES & MOORE	

[illegible]

BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW35s&d		PAGE 1 of 1		
	NUMBER	TYPE					START DATE: 10/06/98	DRILLING METHOD: Cable Percussion	FINISH DATE: 11/06/98	BOREHOLE DIAMETER: 200mm	DRILLER: CP1
							DESCRIPTION	COMMENTS			
						0	Dense to very dense brown slightly silty and sandy COBBLES with occasional boulders and some brick (MADE GROUND)	Slight hydrocarbon odour			
						1.0	Firm to stiff light brown-grey, slightly silty CLAY with occasional gravel	Slight to moderate hydrocarbon odour with some oil droplets visible, black staining and oily odours at 1.5m, Damp			
						2.0	Soft to firm brown, slightly gravelly and silty CLAY - becoming black with depth	Black staining in clay at 2.1m			
						3.0	Soft to firm yellow-brown mottled grey, slightly silty CLAY	Slight hydrocarbon odour at 2.2m			
						4.0	Soft orange-brown slightly silty CLAY with lenses of fine orange sand	No odour at 2.7m			
						5.0	Soft orange-brown silty CLAY with occasional sand, gravel and light grey silt lenses	No odour at 3.2m			
							Dense blue-grey medium to coarse sub-rounded GRAVEL becoming cobbly at 4.0m	No odour			
							Borehole terminated at 5.0 mbgl				
						6.0					
						7.0					
						8.0					
						9.0					
						10					

LOCATION / NOTES: 1. All measurements in m below ground level (mbgl) 2. Water strike at 3.2m rising to 2.4m after 10 minutes		LEGEND ☒ Disturbed Sample ■ Undisturbed Sample * Headspace Analysis † Down Borehole Analysis ▼ Groundwater Table ▽ Perched Water Table	BOREHOLE LOG Job Title SOIL & GROUNDWATER INVESTIGATION Location LLANDARCY REFINERY Client BP LLANDARCY App'd DRAFT Ref. MC/CR/BRS Date JUL 98 Job No. 39991-001-401
---	--	---	---


DAMES & MOORE

BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW152		PAGE 1 of 3	
	NUMBER	TYPE					START DATE: 1/4/99	DRILLING METHOD: Cable Percussion / Rotary	FINISH DATE: 1/4/99	BOREHOLE DIAMETER: 200/165 mm
D	S				0		DESCRIPTION		COMMENTS	
					0		Dark grey CLAY with ash and boulders (MADE GROUND)			
			*18.4		1.0		Soft firm grey buff CLAY (MADE GROUND)		Strong hydrocarbon odour	
			*20.6		2.0				Heavy oil staining in clay fill	
			*7.5		3.0					
			*2.9		4.0					
			*17.9		5.0					
			*0.0		6.0					
					7.0		Large wooden timbers (MADE GROUND)			
			*0.0		7.0		Dark grey CLAY with black ash (MADE GROUND)			
			*0.0		8.0		Black ASH and clay (MADE GROUND)		Water strike at 8m	
					9.0					
					10					

LOCATION / NOTES:	LEGEND	BOREHOLE LOG	
1. All measurements in m below ground level (mbgl)	Disturbed Sample	Job Title SOIL & GROUNDWATER INVESTIGATION	
2. Cable Percussion to 15.0m, Rotary to	Undisturbed Sample	Location LLANDARCY REFINERY	
	* Headspace Analysis	Client BP LLANDARCY LTD	
	+ Down Borehole Analysis	App'd DRAFT	
	Groundwater Table	Ref. CR/MC/BRs	
	Perched Water Table	Date MAY 99	
		Job No. 39991-004-401	
		DAMES & MOORE	

BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW152		PAGE 2 of 3	
	NUMBER	TYPE					START DATE: 1/4/99	DRILLING METHOD: Cable Percussion / Rotary		
							FINISH DATE: 1/4/99		BOREHOLE DIAMETER: 200/165 mm	
							DRILLER: CP2/R1		SCREEN TYPE & DIAMETER: 50 mm	
							LOGGED BY: DB APPR'D BY:		SCREEN SLOT SIZE: 0.5 mm	
							DESCRIPTION		COMMENTS	
						10	Black ASH with clay (MADE GROUND)			10
						11			Water at 11m	11
						12				12
						13			Free product in water returns	13
						14	Dark brown to black PEAT		Very strong hydrocarbon odour (sulphurous)	14
						15	Soft dark brown CLAY			15
						16	Soft grey CLAY with frequent gravel		Moderate to strong sweet odour	16
						17	Dark grey silty GRAVEL		Moderate to strong sweet odour from gravel and water	17
						18				18
						19			No odour Water at 19.7m	19
						20				20

LOCATION / NOTES: 1. All measurements in m below ground level (mbgl) 2. Cable Percussion to 15.0m, Rotary to		LEGEND Disturbed Sample Undisturbed Sample Headspace Analysis Down Borehole Analysis Groundwater Table Perched Water Table	BOREHOLE LOG Job Title SOIL & GROUNDWATER INVESTIGATION Location LLANDARCY REFINERY Client BP LLANDARCY LTD App'd DRAFT Ref. CR/MC/BRS Date MAY 99 Job No. 39991-004-401	DAMES & MOORE
---	--	---	---	--------------------------

BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW152		PAGE 3 of 3	
	NUMBER	TYPE					START DATE: 1/4/99	DRILLING METHOD: Cable Percussion / Rotary	FINISH DATE: 1/4/99	BOREHOLE DIAMETER: 200/165 mm
							DESCRIPTION	COMMENTS		
						20	Dark grey silty GRAVEL	No odour to	20	
						21			21	
						22	Mudstone boulder from 21.6 to 22.0 m		22	
						23	Mudstone GRAVEL (WEATHERED BEDROCK)		23	
						24	ROCKHEAD - Soft dark brown MUDSTONE (BEDROCK)		24	
						25	Borehole terminated at 22.7 mbgl		25	
						26			26	
						27			27	
						28			28	
						29			29	
						30			30	

LOCATION / NOTES: 1. All measurements in m below ground level (mbgl) 2. Cable Percussion to 15.0m, Rotary to 22.7m with ODEX throughout. 3. 200mm casing bentonited in place at 15m		LEGEND ☒ Disturbed Sample ■ Undisturbed Sample * Headspace Analysis † Down Borehole Analysis ▼ Groundwater Table ▽ Perched Water Table		BOREHOLE LOG Job Title SOIL & GROUNDWATER INVESTIGATION Location LLANDARCY REFINERY Client BP LLANDARCY LTD App'd DRAFT Ref. CR/MC/BRS Date MAY 99 Job No. 39991-004-401	
				 DAMES & MOORE	

BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW154S&D		PAGE 1 of 2	
	NUMBER	TYPE					START DATE: 13/4/99		DRILLING METHOD: ROTARY AIR FLUSH	
							FINISH DATE: 13/4/99		BOREHOLE DIAMETER: 165 mm	
							DRILLER: R1		SCREEN TYPE & DIAMETER: 50 mm ID UPVC 19 mm ID HDPE	
LOGGED BY: DB		APPR'D BY:		SCREEN SLOT SIZE: 0.5 mm						
						DESCRIPTION		COMMENTS		
						0	BRICK and CONCRETE rubble with some silty clay (MADE GROUND)	Strong hydrocarbon odour to 0.8m	0	
						1.0	Soft light brown-brown silty CLAY with some gravel		1.0	
						2.0			2.0	
						3.0		No odour Water seepage at 3m	3.0	
						4.0	Soft brown to orange-brown silty and clayey GRAVEL		4.0	
						5.0		No odour	5.0	
						6.0	Loose grey to brown GRAVEL with some silt		6.0	
						7.0	Dense silty and gravelly CLAY (BOULDER CLAY)	No odour	7.0	
						8.0	ROCKHEAD - Soft brown-grey MUDSTONE (BEDROCK)	No odour	8.0	
						9.0		Water strike at	9.0	
						10			10	

LOCATION / NOTES: 1. All measurements in m below ground level (mbgl)		LEGEND Disturbed Sample Undisturbed Sample Headspace Analysis Down Borehole Analysis Groundwater Table Perched Water Table		BOREHOLE LOG Job Title SOIL & GROUNDWATER INVESTIGATION Location LLANDARCY REFINERY Client BP LLANDARCY LTD App'd DRAFT Ref. CR/MC/BR5 Date MAY 99 Job No. 39991-004-401		DAMES & MOORE GROUP	
--	--	---	--	---	--	-----------------------------------	--

BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW154S&D		PAGE 2 of 2						
	NUMBER	TYPE					START DATE: 13/4/99		DRILLING METHOD: ROTARY AIR FLUSH						
							FINISH DATE: 13/4/99		BOREHOLE DIAMETER: 165 mm						
							DRILLER: R1		SCREEN TYPE & DIAMETER: 50 mm ID UPVC 19 mm ID HDPE						
							LOGGED BY: DB APPR'D BY:		SCREEN SLOT SIZE: 0.5 mm						
						DESCRIPTION		COMMENTS							
						Soft brown-grey MUDSTONE (BEDROCK)									
						LOCATION / NOTES:						LEGEND		BOREHOLE LOG	
						1. All measurements in m below ground level (mbgl)						☒ Disturbed Sample ☐ Undisturbed Sample * Headspace Analysis † Down Borehole Analysis Groundwater Table Perched Water Table		Job Title	
SOIL & GROUNDWATER INVESTIGATION															
Location															
LLANDARCY REFINERY															
Client															
BP LLANDARCY LTD		App'd													
DRAFT		Ref.													
CR/MC/BRS		Date													
MAY 99		Job No.													
39991-004-401		DAMES & MOORE													

BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW156D, S1, S2		PAGE 1 of 2	
	NUMBER	TYPE					START DATE: 9/4/99		DRILLING METHOD: Cable Percussion/Rotary	
							FINISH DATE: 9/4/99		BOREHOLE DIAMETER: 200/165 mm	
							DRILLER: CP2/R1		SCREEN TYPE & DIAMETER: 50 mm ID UPVC	
				LOGGED BY: JC/DB APPR'D BY:		SCREEN SLOT SIZE: 0.5 mm				
D	S2	S1						DESCRIPTION	COMMENTS	
					0			Loose mottled brown and grey sandy clayey SILT with frequent medium to coarse slag gravel, sandstone and brick fragments (MADE GROUND)	Dry Slight hydrocarbon odour	0
					1.0					1.0
					2.0			Soft dark brown and yellow PEAT	Very strong hydrocarbon odour and staining from 1.6-3.0m	2.0
					3.0				Damp No odour in peat from 3.0m	3.0
					4.0					4.0
					5.0					5.0
					6.0			becoming lighter in colour and red-brown at 5.5m		6.0
					7.0			Soft grey-brown CLAY	No hydrocarbon odour Dry beneath bentonite seal No odour	7.0
					8.0					8.0
					9.0			clay becoming gravelly at 9.0m		9.0
					10			Loose grey-brown gravel	No odour Water strike at 10m - productive	10

LOCATION / NOTES:	LEGEND	BOREHOLE LOG	
1. All measurements in m below ground level (mbgl)	☒ Disturbed Sample	Job Title	SOIL & GROUNDWATER INVESTIGATION
2. Cable Percussion to 7.5 m, Rotary with ODEX from 7.5m to 14.0 m	■ Undisturbed Sample	Location	LLANDARCY REFINERY
3. Temporary 200 mm casing installed to 7.5 m during Rotary drilling and well installation	* Headspace Analysis	Client	BP LLANDARCY LTD
	† Down Borehole Analysis	App'd	DRAFT
	▽ Groundwater Table	Ref.	CR/MC/BR5
	▽ Perched Water Table	Date	MAY 99
		Job No.	39991-004-401
		 DAMES & MOORE	

BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW156D, S1, S2		PAGE 2 of 2	
	NUMBER	TYPE					START DATE: 9/4/99		DRILLING METHOD: Cable Percussion/Rotary	
							FINISH DATE: 9/4/99		BOREHOLE DIAMETER: 200 mm	
							DRILLER: RD1		SCREEN TYPE & DIAMETER: 50 mm ID UPVC	
				LOGGED BY: JC/DB APPR'D BY:		SCREEN SLOT SIZE: 1 mm				
							DESCRIPTION		COMMENTS	
10							Loose grey-brown gravel		10	
11									11	
12							gravel becoming more dense		No odour	
13									13	
14							ROCKHEAD - Soft grey MUDSTONE (BEDROCK)		No odour	
15							Borehole terminated at 14.0 mbgl		15	
16									16	
17									17	
18									18	
19									19	
20									20	

LOCATION / NOTES: 1. All measurements in m below ground level (mbgl) 2. Cable Percussion to 7.5 m, Rotary with		LEGEND Disturbed Sample Undisturbed Sample Headspace Analysis Down Borehole Analysis Groundwater Table Perched Water Table	BOREHOLE LOG Job Title SOIL & GROUNDWATER INVESTIGATION Location LLANDARCY REFINERY Client BP LLANDARCY LTD App'd DRAFT Ref. CR/MC/BRS Date MAY 99 Job No. 39991-004-401	DAMES & MOORE GROUP
---	--	---	---	-----------------------------------

BOREHOLE CONSTRUCTION		SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW163		PAGE 1 of 2	
								NUMBER	TYPE	START DATE: 30/3/99	
		FINISH DATE: 30/3/99								BOREHOLE DIAMETER: 165/115 mm	
		DRILLER: R3								SCREEN TYPE & DIAMETER: 50 mm ID UPVC	
		LOGGED BY: JC						APPR'D BY:		SCREEN SLOT SIZE: 0.5 mm	
D	S							DESCRIPTION		COMMENTS	
						0		Soft dark brown sandy CLAY with frequent gravel (MADE GROUND)			0
						1.0					1.0
						2.0					2.0
						3.0		Dark grey very sandy CLAY with gravel			3.0
						4.0		becoming more sandy			4.0
				*364		5.0				Damp Very strong hydrocarbon odour from 4-5.5m	5.0
						6.0				Water strike at 5m	6.0
				*2.1		7.0		Dark brown very sandy silty CLAY with occasional gravel			7.0
				*1.9		8.0		Dark brown, slightly sandy, silty CLAY with frequent gravel			8.0
						9.0		Grey sandy silty CLAY with frequent gravel			9.0
				*1.5		10					10

LOCATION / NOTES:		LEGEND		BOREHOLE LOG	
1. All measurements in m below ground level (mbgl)		☒ Disturbed Sample ■ Undisturbed Sample ★ Headspace Analysis † Down Borehole Analysis ▼ Groundwater Table ▽ Perched Water Table		Job Title SOIL & GROUNDWATER INVESTIGATION	
2. ODEX to 13m rotary to 17m				Location LLANDARCY REFINERY	
				Client BP LLANDARCY LTD	
				App'd DRAFT	 DAMES & MOORE
				Ref. CR/MC/BRS	
				Date MAY 99	
				Job No. 39991-004-401	

BOREHOLE CONSTRUCTION		SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW163		PAGE 2 of 2	
								NUMBER	TYPE	START DATE: 30/3/99	
		FINISH DATE: 30/3/99								BOREHOLE DIAMETER: 165/115 mm	
		DRILLER: R3								SCREEN TYPE & DIAMETER: 50 mm ID UPVC	
								LOGGED BY: JC APPR'D BY:		SCREEN SLOT SIZE: 0.5 mm	
D	S							DESCRIPTION		COMMENTS	
						10		Grey sandy silty CLAY with frequent gravel		Dry No hydrocarbon odour	10
						11					11
						12					12
						13		Light grey sandy silty CLAY with frequent gravel			13
						14					14
						15					15
						16		ROCKHEAD: SANDSTONE (BEDROCK)		Damp water in hole at installation	16
						17					17
						18					18
						19					19
						20					20

LOCATION / NOTES: 1. All measurements in m below ground level (mbgl) 2. ODEX to 13m rotary to 17m		LEGEND Disturbed Sample Undisturbed Sample Headspace Analysis Down Borehole Analysis Groundwater Table Perched Water Table	BOREHOLE LOG Job Title SOIL & GROUNDWATER INVESTIGATION Location LLANDARCY REFINERY Client BP LLANDARCY LTD App'd DRAFT Ref. CR/MC/BRS Date MAY 99 Job No. 39991-004-401	DAMES & MOORE
--	--	---	---	--------------------------

BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW177D		PAGE 1 of 2	
	NUMBER	TYPE					START DATE: 24/3/99		DRILLING METHOD: ROTARY AIR FLUSH	
							FINISH DATE: 24/3/99		BOREHOLE DIAMETER: 165/115 mm	
							DRILLER: R4		SCREEN TYPE & DIAMETER: 50 mm ID UPVC	
LOGGED BY: SG		APPR'D BY:		SCREEN SLOT SIZE: 0.5 mm						
							DESCRIPTION	COMMENTS		
							Soft dark brown CLAY with some gravel, concrete fragments and coarse angular gravel (MADE GROUND)		0	
							Soft plastic brown CLAY lenses of silty clay from 0.6m	Areas of grey and black staining	1.0	
							occasional sub-rounded cobbles	Slight hydrocarbon odour hydrocarbon sheen on gravel	2.0	
								Damp at 3.4m Water ingress at 3.5m	3.0	
									4.0	
							Loose orange-brown clayey silty and very sandy GRAVEL		5.0	
									6.0	
									7.0	
									8.0	
							ROCKHEAD: Hard grey SANDSTONE (BEDROCK)		8.0	
									9.0	
									10	

LOCATION / NOTES:		LEGEND		BOREHOLE LOG	
1. All measurements in m below ground level (mbgl)			Disturbed Sample	Job Title SOIL & GROUNDWATER INVESTIGATION	
			Undisturbed Sample	Location LLANDARCY REFINERY	
			Headspace Analysis	Client BP LLANDARCY LTD	
			Down Borehole Analysis	App'd DRAFT	
			Groundwater Table	Ref. CR/MC/BRS	
			Perched Water Table	Date MAY 99	
				Job No. 39991-004-401	
				DAMES & MOORE	

BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW177D		PAGE 2 of 2						
	NUMBER	TYPE					START DATE: 24/3/99		DRILLING METHOD: ROTARY AIR FLUSH						
							FINISH DATE: 24/3/99		BOREHOLE DIAMETER: 165/115 mm						
							DRILLER: R4		SCREEN TYPE & DIAMETER: 50 mm ID UPVC						
							LOGGED BY: SG APPR'D BY:		SCREEN SLOT SIZE: 0.5 mm						
						DESCRIPTION		COMMENTS							
						10 Hard grey SANDSTONE (BEDROCK)									
						11									
						12									
						13									
						14									
						15									
						16									
						17									
						18									
						19									
						20									
												18 Borehole terminated at 18.0 mbgl			
						19									
						20									

LOCATION / NOTES: 1. All measurements in m below ground level (mbgl)		LEGEND Disturbed Sample Undisturbed Sample Headspace Analysis Down Borehole Analysis Groundwater Table Perched Water Table	BOREHOLE LOG Job Title SOIL & GROUNDWATER INVESTIGATION Location LLANDARCY REFINERY Client BP LLANDARCY LTD App'd DRAFT Ref. CR/MC/BR5 Date MAY 99 Job No. 39991-004-401	DAMES & MOORE GROUP
--	--	---	---	-----------------------------------

BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW183D		PAGE 1 of 2	
	NUMBER	TYPE					START DATE: 26/3/99	DRILLING METHOD: ROTARY AIR FLUSH	FINISH DATE: 26/3/99	BOREHOLE DIAMETER: 165/115 mm
							DESCRIPTION	COMMENTS		
					0		Loose dark brown-black silty GRAVEL with frequent cobbles, ash and slag (MADE GROUND)			0
					1.0		Loose to moderately dense grey silty clayey GRAVEL with few sub-angular cobbles	Damp Moderately strong hydrocarbon odour		1.0
			*10.9		2.0					2.0
					3.0					3.0
					4.0		Weak light grey-grey, very sandy GRAVEL (WEATHERED BEDROCK)	Slight to moderate hydrocarbon odour		4.0
			*12.6		5.0		ROCKHEAD: Consolidated light grey-brown SANDSTONE (BEDROCK)	Slight to moderate hydrocarbon odour		5.0
					6.0					6.0
					7.0					7.0
					8.0					8.0
					9.0			No odour Drilling very hard from approximately		9.0
					10					10

LOCATION / NOTES: 1. All measurements in m below ground level (mbgl) 2. ODEX to 5m, Rotary to 10.5mbgl		LEGEND Disturbed Sample Undisturbed Sample Headspace Analysis Down Borehole Analysis Groundwater Table Perched Water Table	BOREHOLE LOG Job Title SOIL & GROUNDWATER INVESTIGATION Location LLANDARCY REFINERY Client BP LLANDARCY LTD App'd DRAFT Ref. CR/MC/BRS Date MAY 99 Job No. 39991-004-401	 DAMES & MOORE GROUP
---	--	---	---	---------------------------------------

BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW183D		PAGE 2 of 2		
	NUMBER	TYPE					START DATE: 26/3/99		DRILLING METHOD: ROTARY AIR FLUSH		
							FINISH DATE: 26/3/99		BOREHOLE DIAMETER: 165/115 mm		
							DRILLER: R2		SCREEN TYPE & DIAMETER: 50 mm ID UPVC		
							LOGGED BY: PW APPR'D BY:		SCREEN SLOT SIZE: 0.5 mm		
						DESCRIPTION		COMMENTS			
						10		ROCKHEAD: Consolidated light grey-brown SANDSTONE (BEDROCK)		10	
						11				11	
						12				12	
						13				13	
						14				14	
						15				15	
						16				16	
						17				17	
						18				18	
						19				19	
						20				20	

LOCATION / NOTES:		LEGEND		BOREHOLE LOG	
1. All measurements in m below ground level (mbgl)		☒ Disturbed Sample		Job Title SOIL & GROUNDWATER INVESTIGATION	
2. ODEX to 5m, Rotary to 10.5mbgl		☐ Undisturbed Sample		Location LLANDARCY REFINERY	
		* Headspace Analysis		Client BP LLANDARCY LTD	
		† Down Borehole Analysis		App'd DRAFT	
		 Groundwater Table		Ref. CR/MC/BRS	
		 Perched Water Table		Date MAY 99	
				Job No. 39991-004-401	
				 DAMES & MOORE	

BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW235		PAGE 1 of 1	
	NUMBER	TYPE					DRILLING DATES: 10/04/01		DRILLING METHODS : Rotary Air Flush	
							DRILLER : Tectonics		BOREHOLE DIAMETER : 250mm	
							LOGGED BY : PW		SCREEN TYPE & DIAM: HDPE 50mm	
				CHECKED BY :		SCREEN SLOT SIZE: 1mm				
					0.0		DESCRIPTION		COMMENTS	0.0
					0.5		Loose, black, angular, fine-coarse GRAVEL with brick/wood/clinker. MADE GROUND			0.5
					1.0		With lagging foam between 2.0m and 3.0m			1.0
					1.5					1.5
					2.0					2.0
					2.5					2.5
					3.0					3.0
					3.5					3.5
					4.0					4.0
					4.5					4.5
				5.0		As above with abundant red brick between 4.5 and 5.25m MADE GROUND			5.0	
				5.5		With wood from 5.5m			5.5	
				6.0					6.0	
				6.5					6.5	
				7.0		Loose GRAVEL with ash and clinker. MADE GROUND		Free H/C strike at 7.0m	7.0	
				7.5					7.5	
				8.0		As above with clay and silt from 8.0m.MADE GROUND			8.0	
				8.5					8.5	
				9.0		Borehole terminated due to concrete obstruction.			9.0	
				9.5		End of Borehole			9.5	
				10.0					10.0	

LOCATION / NOTES:	LEGEND	BOREHOLE LOG	
NVO = No visual or olfactory evidence	Disturbed Sample Undisturbed Sample ✱ Headspace Analysis ✱ Down Borehole Analysis ~ Groundwater Table ~ Perched Water Table	Job Title: Containment Area Investigation Location: Llandarcy Refinery Client: BP Llandarcy Refinery URS	
		App'd:	Date: 04/09/2002
		Drawn : SS	Ref:
		Scale: As scale	Job No: 39991-016
		Drg. Size: A4	BOREHOLE LOG

BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW236		PAGE 1 of 1	
	NUMBER	TYPE					DRILLING DATES: 04/04/01 - 05/04/01		DRILLING METHODS : Rotary Air Flush	
							DRILLER : Tectonics		BOREHOLE DIAMETER : 250mm	
							LOGGED BY : PW		SCREEN TYPE & DIAM: HDPE 100mm	
							CHECKED BY :		SCREEN SLOT SIZE: 1mm	
DESCRIPTION							COMMENTS			
					0.0	Brown, silty/sandy GRAVEL fill, with brick fragments and plastic. MADE GROUND.	Damp. Much H/C staining	0.0		
					0.5	With H/C stained wood (probably sleepers) from 1.5m.			0.5	
					1.0	With plastic liner and ash from 2.0m.			1.0	
					1.5				1.5	
					2.0			2.0		
					2.5			2.5		
					3.0	Wood sleeper		3.0		
					3.5			3.5		
					4.0			4.0		
					4.5			4.5		
				5.0	As above with possible fibrous plant material from 6.0m with clay matrix. MADE GROUND	Heavy H/C staining and wetness from 5.0m	5.0			
				5.5				5.5		
				6.0				6.0		
				6.5				6.5		
				7.0		Very oily	7.0			
				7.5				7.5		
				8.0	Clayey, fine-coarse GRAVEL/gravelly clay with clinker and ash. MADE GROUND			8.0		
				8.5				8.5		
				9.0	Slightly clayey GRAVEL with clinker, ash and brick fragments. MADE GROUND		9.0			
				9.5			9.5			
				10.0			10.0			

LOCATION / NOTES:	LEGEND	BOREHOLE LOG	
NVO = No visual or olfactory evidence	Disturbed Sample Undisturbed Sample Headspace Analysis Down Borehole Analysis Groundwater Table Perched Water Table	Job Title: Containment Area Investigation Location: Llandarcy Refinery Client: BP Llandarcy Refinery	
			App'd: _____ Date: 04/09/2002 Drawn : SS Ref: _____ Scale: As scale Job No: 39991-016 Drg. Size: A4 BOREHOLE LOG

BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW238		PAGE 1 of 3	
	NUMBER	TYPE					DRILLING DATES: 05/04/01		DRILLING METHODS : Rotary Air Flush	
							DRILLER : Tectonics		BOREHOLE DIAMETER : 250mm	
							LOGGED BY : PW		SCREEN TYPE & DIAM: HDPE 100mm	
							CHECKED BY :		SCREEN SLOT SIZE: 1mm	
						DESCRIPTION	COMMENTS			
						Light-dark brown, silty/clayey/sandy med-coarse GRAVEL fill with brick fragments, wood, plastic liner and clinker. MADE GROUND		0.0		
						Dark grey, gravelly/sandy CLAY with brick fragments and pipe lagging. MADE GROUND		0.5		
								1.0		
								1.5		
								2.0		
								2.5		
								3.0		
								3.5		
								4.0		
						As above plus abundant lagging foam between 4.0 and 5.0m. MADE GROUND	Saturated with dark, black H/C	4.0		
							Abundant free product from 4.5m	4.5		
								5.0		

LOCATION / NOTES:	LEGEND	BOREHOLE LOG	
NVO = No visual or olfactory evidence	■ ✱ ✱ ⊥ ⊥ Disturbed Sample Undisturbed Sample Headspace Analysis Down Borehole Analysis Groundwater Table Perched Water Table	Job Title: Containment Area Investigation Location: Llandarcy Refinery Client: BP Llandarcy Refinery URS	
		App'd:	Date: 04/09/2002
		Drawn : SS	Ref:
		Scale: As scale	Job No: 39991-016
		Drg. Size: A4	BOREHOLE LOG

BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW238		PAGE 2 of 3	
	NUMBER	TYPE					DRILLING DATES: 05/04/01		DRILLING METHODS : Rotary Air Flush	
							DRILLER : Tectonics		BOREHOLE DIAMETER : 250mm	
							LOGGED BY : PW		SCREEN TYPE & DIAM: HDPE 100mm	
							CHECKED BY :		SCREEN SLOT SIZE: 1mm	
									COMMENTS	
					5.5					5.5
					6.0					6.0
					6.5					6.5
					7.0					7.0
					7.5					7.5
					8.0					8.0
					8.5					8.5
					9.0					9.0
					9.5					9.5
					10.0					10.0

LOCATION / NOTES:	LEGEND	BOREHOLE LOG	
NVO = No visual or olfactory evidence	Disturbed Sample Undisturbed Sample ★ Headspace Analysis ⬇ Down Borehole Analysis ~ Groundwater Table ~ Perched Water Table	Job Title: Containment Area Investigation Location: Llandarcy Refinery Client: BP Llandarcy Refinery URS App'd: _____ Date: 04/09/2002 Drawn : SS Ref: _____ Scale: As scale Job No: 39991-016 Drg. Size: A4 BOREHOLE LOG	

BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW238		PAGE 3 of 3	
	NUMBER	TYPE					DRILLING DATES: 05/04/01		DRILLING METHODS : Rotary Air Flush	
							DRILLER : Tectonics		BOREHOLE DIAMETER : 250mm	
							LOGGED BY : PW		SCREEN TYPE & DIAM: HDPE 100mm	
							CHECKED BY :		SCREEN SLOT SIZE: 1mm	
							COMMENTS			
						End of Borehole				
									10.5	
									11.0	
									11.5	
									12.0	
									12.5	
									13.0	
									13.5	
									14.0	
									14.5	
									15.0	

LOCATION / NOTES:

NVO = No visual or olfactory evidence

LEGEND

- Disturbed Sample
- Undisturbed Sample
- Headspace Analysis
- Down Borehole Analysis
- Groundwater Table
- Perched Water Table

BOREHOLE LOG

Job Title: Containment Area Investigation

Location: Llandarcy Refinery

Client: BP Llandarcy Refinery

App'd:	Date: 04/09/2002
Drawn : SS	Ref:
Scale: As scale	Job No: 39991-016
Drg. Size: A4	BOREHOLE LOG

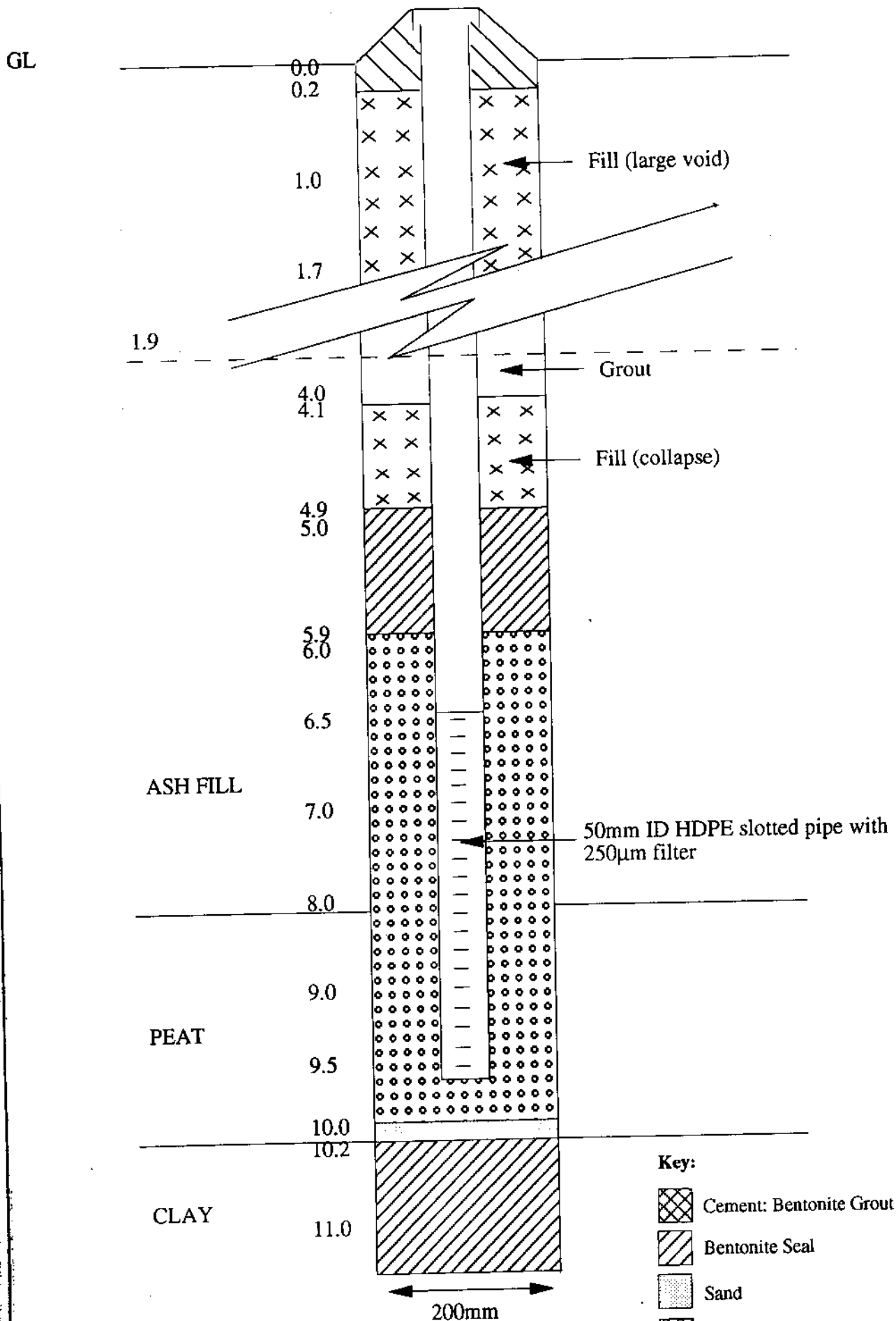
Project GROUND INVESTIGATION, WASTE DISPOSAL LAGOON										BOREHOLE No. GA 7	
Client BP Oil Llandarcy Refinery					Contractor Thyssen Geotechnical					Sheet 1 of 2	
Rig Type Shell and Auger					Location See map					Driller RH Engineer BF	
Hole Diameter 200mm					Ground Surface Elevation mOD. 9.19					Date Started 15/2/94	
Completion Depth 11.7					Casing Details Cased to 11.2m					Date Completed 15/2/94	
Downhole Depth	Borehole Progress	Depth to Water	Samples/Tests			Symbolic Log	Elevation, m OD	Depth, m (thickness m)	Geological Description	Installation Details	
			Depth/m		No.						Type
			From	To							
1		▽ 1.80	0.0	1.0	1	B			MADEGROUND; dark brown, very sandy, gravelly clay, gravel is fine to medium angular dark grey sandstone, some cobbles.		
	1.60		1.80	2	B		1.0	MADEGROUND; black ash fill with occasional brick, clay, sand and fine gravel			
2	2.00		2.50	3	B		1.9	MADEGROUND; black, fine-medium gravel sized ash, oily, tarry smell.			
3	2.95		3.2	4	B						
4	3.95		4.2	5	B			...ash 'blowing' into casing			
5											
6											
7	7.0		8.0	6	B						
8	8.0		8.8	7	B						
					▽		8.2	Blackened reeds and moss vegetation			
	8.8	9.4	8	B	▽		8.4	Spongy, dark brown, fibrous PEAT, blackened at top surface, peat is woody less fibrous with depth.			
9					▽						
	9.9	10.2	9	B	▽						
Remarks Water struck at 1.80m, rises to 1.50m after 20 minutes . Obstruction 1.0-1.6 no returns Water cased off in peat, reappears at top of clay..											
Scale 1 to 50			Golder Associates			Cable Percussion Record			Project No. 93523185		

Project GROUND INVESTIGATION, WASTE DISPOSAL LAGOON										BOREHOLE No. GA 7	
Client BP Oil Llandarcy Refinery					Contractor Thyssen Geotechnical					Sheet 2 of 2	
Rig Type Shell and Auger					Location See map					Driller RH Engineer BF	
Hole Diameter 200mm					Ground Surface Elevation mOD. 9.19					Date Started 15/2/94	
Completion Depth 11.7					Casing Details Cased to 11.2m					Date Completed 15/2/94	

Downhole Depth	Borehole Progress	Depth to Water	Samples/Tests				Symbolic Log	Elevation, m OD	Depth, m (thickness m)	Geological Description	Installation Details
			Depth/m		No.	Type					
			From	To							
11			10.2	10.5	10	B		10.2	Soft, light grey and brown, sandy slightly gravelly CLAY.		
			11.20	11.65	11	U					
			11.65	11.70	12	D		11.3	Soft, light grey mottled brown, sandy, gravelly CLAY, gravel of rounded fine to medium sandstone		
12								11.7	END OF BOREHOLE		
13											
14											
15											
16											
17											
18											
19											

Remarks											
Scale 1 to 50			Golder Associates			Cable Percussion Record			Project No. 93523185		

Installation Details Borehole G7



BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: CARW007		PAGE 1 of 1	
	NUMBER	TYPE					DRILLING DATES: 17/01/01		DRILLING METHODS : Percussive	
							DRILLER : Geotechnical		BOREHOLE DIAMETER : ~100mm	
							LOGGED BY : URS		SCREEN TYPE & DIAM: UPVC 50mm	
							CHECKED BY :		SCREEN SLOT SIZE: 1mm	
							DESCRIPTION	COMMENTS		
							Loose, black, sandy fine-med GRAVEL comprising Ash. MADE GROUND.	Dry, NVO	0.0	
								Damp from 0.7m, slight odour	0.5	
								Wet (product) from 0.8m mod-odour	1.0	
									1.5	
									2.0	
							Soft, dark and light grey, slightly sandy, very clayey SILT.	Damp, stained, slight odour	2.0	
							Soft, light grey, silty CLAY	Damp, NVO	2.5	
							Med-firm, pale yellow/orange/grey, slightly silty CLAY with occasional sub-rounded gravels and cobbles.	Dry, NVO	3.0	
							Med-firm grey, very sandy SILT	Dry, NVO	3.5	
							End of Borehole		4.0	
									4.5	
									5.0	

LOCATION / NOTES:	LEGEND	BOREHOLE LOG	
NVO = No visual or olfactory evidence	Disturbed Sample Undisturbed Sample Headspace Analysis Down Borehole Analysis Groundwater Table Perched Water Table	Job Title: Containment Area Investigation Location: Llandarcy Refinery Client: BP Llandarcy Refinery	
		URS Drawn : SS Scale: As scale Drg. Size: A4 App'd: _____ Date: 05/09/2002 Ref: _____ Job No: 39991-016 BOREHOLE LOG	

BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: CARW015		PAGE 1 of 1	
	NUMBER	TYPE					DRILLING DATES: 12/01/01		DRILLING METHODS : Percussive	
							DRILLER : Geotechnical		BOREHOLE DIAMETER : ~100mm	
		LOGGED BY : URS		SCREEN TYPE & DIAM: UPVC 50mm		CHECKED BY :		SCREEN SLOT SIZE: 1mm		
					0.0		DESCRIPTION	COMMENTS	0.0	
							Soft, brown, gravelly, sandy SILT top soil. MADE GROUND	Rootlets. Damp. NVO		
							Loose, brown/orange friable sandy SILT. MADE GROUND	Dry NVO		
			*4.9		0.5		Sandstone cobbles. MADE GROUND	Dry. Some staining	0.5	
							Dense, brown/grey, very gravelly, slightly clayey, sandy SILT. MADE GROUND	Damp-Wet. Stained, slight odour		
			*5.5		1.0		Loose-dense (compressed), black, sandy GRAVEL comprising ash and clinker. MADE GROUND	Damp Peaty odour	1.0	
			*11.7				Firm, black/grey gravelly, sandy, clayey SILT with sandstone cobbles. MADE GROUND	Wet. Product. Staining. Mod sulphurous odour.		
			*11.1		1.5		Soft, black, fibrous, silty PEAT. MADE GROUND		1.5	
							Med-dense black gravels and cobbles of ash and clinker. MADE GROUND			
					2.0		Firm, dark grey/brown gravelly, slightly sandy, clayey SILT, with occasional cobbles. MADE GROUND	Damp. Staining. Slight odour.	2.0	
							NO sample from 1.5 to 3.0m			
					2.5				2.5	
					3.0				3.0	
							Very loose black, fine, gravelly SAND.	Wet - Product. Mod. odour.		
			*103		3.5				3.5	
				4.0				4.0		
				4.5				4.5		
				5.0		End of Borehole		5.0		

LOCATION / NOTES:	LEGEND	BOREHOLE LOG	
NVO = No visual or olfactory evidence		Job Title: Containment Area Investigation Location: Llandarcy Refinery Client: BP Llandarcy Refinery	
			App'd: _____ Date: 05/09/2002 Drawn : SS Ref: _____ Scale: As scale Job No: 39991-016 Drg. Size: A4 BOREHOLE LOG

BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: CARW025		PAGE 1 of 1	
	NUMBER	TYPE					DRILLING DATES: 19/06/01		DRILLING METHODS: Percussive	
							DRILLER: Geotechnical		BOREHOLE DIAMETER: ~100mm	
							LOGGED BY: NL		SCREEN TYPE & DIAM: UPVC 50mm	
							CHECKED BY:		SCREEN SLOT SIZE: 1mm	
					0.0		DESCRIPTION	COMMENTS	0.0	
					0.5		Grass over brown, silty TOP SOIL	NVO		
					1.0		MADE GROUND. Mixed brown/grey, silt and sand with some gravels and small cobbles. Fragments of brick and concrete.	Mod odour		
					1.5		Becomes more uniformly silt with clay after 1.1m	Slight sheen, some black staining. Mod to string HC odour		
					2.0		Grey SILT becoming sandy (fine) with depth. Thin (10cm) band of peat at 2.2m. Black staining increasing to 2.8m, then saturated with oil. MADE GROUND	V. Strong HC odour. Sheen throughout		
				2.5						
					3.0		Borehole drilled to 6.0m, collapsed to 3.1m			
					3.5		End of Borehole			
					4.0					
					4.5					
					5.0					
					5.5					
					6.0					

LOCATION / NOTES:	LEGEND	BOREHOLE LOG	
NVO = No visual or olfactory evidence	Disturbed Sample Undisturbed Sample Headspace Analysis Down Borehole Analysis Groundwater Table Perched Water Table	Job Title: Contamination Area Investigation Location: Llandarcy Refinery Client: BP Llandarcy Refinery App'd: _____ Date: 04/09/2002 Drawn: SS Ref: _____ Scale: As scale Job No: 39991-016 Drg. Size: A4 BOREHOLE LOG	

BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: CARW029B		PAGE 1 of 1	
	NUMBER	TYPE					DRILLING DATES: 18/06/01		DRILLING METHODS: Percussive	
							DRILLER: Geotechnical		BOREHOLE DIAMETER: ~100mm	
							LOGGED BY: IM		SCREEN TYPE & DIAM: UPVC 50mm	
							CHECKED BY:		SCREEN SLOT SIZE: 1mm	
DESCRIPTION							COMMENTS			
MADE GROUND. Loose, brown, silty SAND with concrete fragments up to 50mm.							NVO	0.0		
MADE GROUND. Stiff, brown CLAY with brick (up to 80mm), coal, shale and sandstone fragments.							Black staining due to HC	0.5		
								1.0		
								1.5		
								2.0		
							Wet	2.5		
								3.0		
PEAT - stained black by HC product							Strong HC odour	3.5		
End of Borehole								4.0		
								4.5		
								5.0		
								5.5		
								6.0		

LOCATION / NOTES:	LEGEND	BOREHOLE LOG	
NVO = No visual or olfactory evidence	Disturbed Sample ■ Undisturbed Sample ✱ Headspace Analysis ✱ Down Borehole Analysis ▽ Groundwater Table ▽ Perched Water Table	Job Title: Containment Area Investigation Location: Llandarcy Refinery Client: BP Llandarcy Refinery	
		URS Drawn: SS Scale: As scale Drg. Size: A4 App'd: _____ Date: 04/09/2002 Ref: _____ Job No: 39991-016 BOREHOLE LOG	

BOREHOLE CONSTRUCTION	SAMPLE		SOIL VAPOUR (ppm)	GROUNDWATER	DEPTH (m)	GEOLOGY	BOREHOLE NUMBER: MSMW25d		PAGE 1 of 1	
	NUMBER	TYPE					START DATE: 01/06/98	DRILLING METHOD: Cable Percussion/Rotary	FINISH DATE: 09/06/98	BOREHOLE DIAMETER: 200/165/150mm
					0		Soft brown sandy, silty CLAY with red brick fragments (MADE GROUND)		Very strong hydrocarbon odour	0
			*21.1		1.0		Soft to very soft grey-brown sandy silty CLAY with occasional cobbles		Water strike at 1.5m - oily sheen on water surface - very strong hydrocarbon odour	1.0
			*765		2.0		Dense to very dense blue-grey medium grained coarse sandstone GRAVEL with cobbles		obstruction at 1.5m	2.0
			*118		3.0		Rotary drilling from 3.0 mbgl			3.0
					4.0		ROCKHEAD: Competent fine grained grey SANDSTONE			4.0
					5.0		Fissile brown SILTSTONE			5.0
					6.0		Fine grained grey SANDSTONE intercalated with fissile siltstone			6.0
					7.0		Borehole terminated at 7.0 mbgl			7.0
LOCATION / NOTES: 1. All measurements in m below ground level (mbgl) 2. Cable Percussion to 3.0 mbgl, Rotary to 7.5 mbgl with odex casing installed to 4.5 mbgl						LEGEND Disturbed Sample Undisturbed Sample * Headspace Analysis † Down Borehole Analysis Groundwater Table Perched Water Table		BOREHOLE LOG Job Title SOIL & GROUNDWATER INVESTIGATION Location LLANDARCY REFINERY Client BP LLANDARCY App'd DRAFT Ref. MC/CR/BRS Date JUL 98 Job No. 39991-001-401		



DAMES & MOORE

APPENDIX ESID2

GROUNDWATER QUALITY DATA

Sample Location	Date	TPH >C6-C8 6 split	TPH >C8-C10 6 split	TPH >C10-C12 6 split	TPH >C12-C16 6 split	TPH >C16-C21 6 split	TPH >C21-C40 6 split	TPH >C6-C40 6 split	TPH GRO	Gasoline Range Organics C6-C10	Aliphatics >C10-C12	Aliphatics >C12-C16 Aqueous
		ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
MSMW025D	29/05/2008	540	226	621	410	87	<50	1880		365		
MSMW025D	20/10/2008	314	161	422	245	<20	<50	1140		445		
MSMW025D	29/11/2010										370	<10
MSMW025D	16/04/2009										59	<10
MSMW025S	29/05/2008	531	255	879	635	77	<50	2380		274		
MSMW025S	20/10/2008	411	258	706	502	53	<50	1930		453		
MSMW025S	29/11/2010										433	<10
MSMW025S	16/04/2009										68	<10
MSMW034	03/06/2008	-	-	-	-	-	-	-				
MSMW034S	03/06/2008	143	1620	616	830	400	<50	3610	NR		-	-
MSMW034S	23/10/2008	91	1440	606	726	336	<100	3200	1580		-	-
MSMW034S	06/11/2009	-	-	-	-	-	-	-	-		210	<10
MSMW034S	06/05/2010	-	-	-	-	-	-	-	-		219	66
MSMW034S	25/11/2010	-	-	-	-	-	-	-	-		233	<10
MSMW034S	20/04/2009										48	<10
MSMW035S	30/05/2008	<10	<10	<10	<20	<20	<50	<50	NS		-	-
MSMW035S	23/10/2008	<10	<10	<10	<20	<20	<50	<50	-		-	-
MSMW035S	06/11/2009	-	-	-	-	-	-	-	-		<10	<10
MSMW035S	14/05/2010	-	-	-	-	-	-	-	-		<10	<10
MSMW035S	25/11/2010	-	-	-	-	-	-	-	-		<10	<10
MSMW035S	20/04/2009										<10	<10
MSMW035S2	20/04/2009										<10	<10
MSMW155S	28/05/2008	<10	<10	10	85	76	<50	171	NS		-	-
MSMW155S	23/10/2008	<10	<10	32	176	187	230	625	-		-	-
MSMW155S	12/11/2009	-	-	-	-	-	-	-	-		<10	<10
MSMW155S	14/05/2010	-	-	-	-	-	-	-	-		<10	<10
MSMW155S	26/11/2010	-	-	-	-	-	-	-	-		<10	<10
MSMW155S	15/04/2009										<10	<10
MSMW155S2	14/05/2010	-	-	-	-	-	-	-	-		<10	<10
MSMW156S2	28/05/2008	<10	<10	13	88	98	180	379	NS		-	-
MSMW156S2	28/05/2008	<10	<10	<10	62	82	153	297			-	-
MSMW156S2	23/10/2008	<70	<70	<70	168	169	581	918	-		-	-
MSMW156S2	12/11/2009	-	-	-	-	-	-	-	-		<10	<10
MSMW156S2	14/05/2010	-	-	-	-	-	-	-	-		<10	<10
MSMW156S2	25/11/2010	-	-	-	-	-	-	-	-		<10	37
MSMW156S2	24/04/2009										-	-
MSMW156S2	24/04/2009										<10	-
MSMW163S	23/10/2008	<90	<90	<90	<180	<180	<450	<450		121		
MSMW163S	14/05/2010										37.7	<10
MSMW163S	29/11/2010										38	<10
MSMW163S	20/04/2009										<10	<10
MSMW177S	28/05/2008	1190	394	1790	931		<50	4310		<20		
MSMW177S	20/10/2008	973	462	1840	915	36	<50	4230		891		
MSMW177S	16/04/2009										400	<10
MSMW183	06/11/2009										82	<10
MSMW183S	01/05/2008	1240	144	122	23	<20	<50	1530		843	-	-
MSMW183S	20/10/2008	963	179	141	41	<20	<50	1320		939		
MSMW183S	05/05/2010										113	<10
MSMW183S	23/11/2010										108	<10
MSMW183S	16/04/2009										<10	<10
MSMW183S2	16/04/2009										<10	<10
MSMW191	01/05/2008	1550	488	541	144	34	<50	2750	-	2210	-	-
MSMW191	22/10/2008	1310	324	420	46	<20	<50	2100		2100		
MSMW191	06/11/2009										160	<10
MSMW191	05/05/2010										254	<10
MSMW191	23/11/2010										346	<10
MSMW191	16/04/2009										65	<10

Sample Location	Date	Aliphatics >C16-C21 Aqueous	Aliphatics >C21-C35 Aqueous	Aliphatics >C6-C8	Aliphatics >C8-C10	Aliphatics C5-C6	Aromatics >C7-C8	Aromatics >EC10-EC12	Aromatics >EC12-EC16 Aqueous	Aromatics >EC16-EC21 Aqueous	Aromatics >EC21-EC35 Aqueous	Aromatics >EC8-EC10
		ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
MSMW025D	29/05/2008											
MSMW025D	20/10/2008											
MSMW025D	29/11/2010	<10	<10	1060	192	341	<10	247	105	<10	<10	130
MSMW025D	16/04/2009	<10	<10	810	34	530	<10	89	150	<10	<10	50
MSMW025S	29/05/2008											
MSMW025S	20/10/2008											
MSMW025S	29/11/2010	<10	<10	969	229	296	<10	289	179	<10	<10	153
MSMW025S	16/04/2009	<10	<10	680	40	530	<10	100	210	38	94	61
MSMW034	03/06/2008											
MSMW034S	03/06/2008	-	-	-	-	-	-	-	-	-	-	-
MSMW034S	23/10/2008	-	-	-	-	-	-	-	-	-	-	-
MSMW034S	06/11/2009	<10	<10	100	550	18	<10	310	180	90	<10	830
MSMW034S	06/05/2010	<10	<10	154	581	56.9	<10	329	712	517	30	886
MSMW034S	25/11/2010	<10	<10	99	628	32	<10	155	84	22	<10	420
MSMW034S	20/04/2009	<10	<10	73	420	71	<10	71	280	19	<10	630
MSMW035S	30/05/2008	-	-	-	-	-	-	-	-	-	-	-
MSMW035S	23/10/2008	-	-	-	-	-	-	-	-	-	-	-
MSMW035S	06/11/2009	<10	<10	<10	<10	<10	<10	<10	<10	10	<10	<10
MSMW035S	14/05/2010	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
MSMW035S	25/11/2010	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
MSMW035S	20/04/2009	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
MSMW035S2	20/04/2009	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
MSMW155S	28/05/2008	-	-	-	-	-	-	-	-	-	-	-
MSMW155S	23/10/2008	-	-	-	-	-	-	-	-	-	-	-
MSMW155S	12/11/2009	<10	<10	<10	<10	<10	<10	<10	38	64	16	<10
MSMW155S	14/05/2010	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
MSMW155S	26/11/2010	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
MSMW155S	15/04/2009	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
MSMW155S2	14/05/2010	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
MSMW156S2	28/05/2008	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	28/05/2008	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	23/10/2008	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	12/11/2009	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
MSMW156S2	14/05/2010	<10	76	<10	<10	<10	<10	<10	<10	<10	<10	<10
MSMW156S2	25/11/2010	16	<10	<10	<10	<10	<10	<10	14	<10	<10	<10
MSMW156S2	24/04/2009	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	24/04/2009	-	-	<10	<10	<10	<10	<10	-	-	-	<10
MSMW163S	23/10/2008											
MSMW163S	14/05/2010	<10	<10	218	58.8	<10	<10	56.6	<10	<10	<10	88.2
MSMW163S	29/11/2010	<10	<10	103	51	<10	<10	25	<10	<10	<10	34
MSMW163S	20/04/2009	<10	<10	12	<10	<10	<10	<10	<10	<10	<10	<10
MSMW177S	28/05/2008											
MSMW177S	20/10/2008											
MSMW177S	16/04/2009	<10	<10	2100	34	770	<10	600	280	<10	<10	50
MSMW183	06/11/2009	<10	<10	2100	110	1100	16	120	<10	<10	<10	180
MSMW183S	01/05/2008	-	-	-	-	-	-	-	-	-	-	-
MSMW183S	20/10/2008											
MSMW183S	05/05/2010	<10	<10	1900	19.2	1510	14	170	<10	<10	<10	41.8
MSMW183S	23/11/2010	<10	<10	952	106	424	10	72	<10	<10	<10	82
MSMW183S	16/04/2009	<10	<10	1600	<10	1200	<10	<10	11	<10	<10	<10
MSMW183S2	16/04/2009	<10	<10	1800	<10	1400	<10	<10	12	<10	<10	<10
MSMW191	01/05/2008	-	-	-	-	-	-	-	-	-	-	-
MSMW191	22/10/2008											
MSMW191	06/11/2009	<10	<10	2200	210	940	<10	230	16	<10	<10	310
MSMW191	05/05/2010	<10	<10	4780	385	2450	47	382	16	<10	<10	660
MSMW191	23/11/2010	<10	<10	1740	306	610	<10	231	<10	<10	<10	222
MSMW191	16/04/2009	<10	<10	3300	120	1400	33	98	34	<10	<10	230

Sample Location	Date	Aromatics C6-C7	Benzene	Ethyl benzene	GRO (C4-C12)	m & p Xylene	MTBE	o Xylene	Toluene	BTEX, Total	Total Aliphatics C5-C35 Aqueous	Total Aromatics C6-C35 Aqueous	TPH (Aliphatics and Aromatics C5-C35) Aqueous	Total Aliphatics >C12-C35 Aqueous	Total Aliphatics C5-C12
		ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
MSMW025D	29/05/2008														
MSMW025D	20/10/2008														
MSMW025D	29/11/2010	34	27.2	<2.5	2380	<2.5		<1.7	3.3		1963	516			
MSMW025D	16/04/2009	32	32	<10	1600	<10	<10	<10	<10		1400	320	1800		
MSMW025S	29/05/2008														
MSMW025S	20/10/2008														
MSMW025S	29/11/2010	27	19.6	<2.5	2400	<2.5		<1.7	2.49		1927	648			
MSMW025S	16/04/2009	24	24	<10	1500	<10	<10	<10	<10		1300	530	1800		
MSMW034	03/06/2008														
MSMW034S	03/06/2008	-	-	-	-	-	-	-	-		-	-	-	-	-
MSMW034S	23/10/2008	-	-	-	-	-	-	-	-		-	-	-	-	-
MSMW034S	06/11/2009	14	14	<10	2100	<10	25	<10	<10		880	1400	2300	-	-
MSMW034S	06/05/2010	14	14	<5	2240	<8	<3	14	<4	28	1080	2490	3570	66	-
MSMW034S	25/11/2010	-	12.6	<2.5	1580	<2.5	-	2.04	<1.4		992	691	1690	-	-
MSMW034S	20/04/2009	<10	<10	<10	1300	<10	<10	<10	<10		610	1000	1600	-	-
MSMW035S	30/05/2008	-	-	-	-	-	-	-	-		-	-	-	-	-
MSMW035S	23/10/2008	-	-	-	-	-	-	-	-		-	-	-	-	-
MSMW035S	06/11/2009	<10	<10	<10	<10	<10	<10	<10	<10		<10	<10	<10	-	-
MSMW035S	14/05/2010	<10	<7	<5	<42	<8	<3	<3	<4	<10	<10	<10	<10	<10	-
MSMW035S	25/11/2010	-	<1.3	<2.5	<50	<2.5	-	<1.7	<1.4		<10	<10	<10	-	-
MSMW035S	20/04/2009	<10	<10	<10	<10	<10	<10	<10	<10		<10	<10	<10	-	-
MSMW035S2	20/04/2009	<10	<10	<10	<10	<10	<10	<10	<10		<10	<10	<10	-	-
MSMW155S	28/05/2008	-	-	-	-	-	-	-	-		-	-	-	-	-
MSMW155S	23/10/2008	-	-	-	-	-	-	-	-		-	-	-	-	-
MSMW155S	12/11/2009	<10	<10	<10	<10	<10	<10	<10	<10		<10	120	120	-	-
MSMW155S	14/05/2010	<10	<7	<5	<42	<8	<3	<3	<4	<10	<10	<10	<10	<10	-
MSMW155S	26/11/2010	-	-	-	<50	-	-	-	-		<10	<10	<10	-	-
MSMW155S	15/04/2009	<10	<10	<10	<10	<10	<10	<10	<10		<10	<10	<10	-	-
MSMW155S2	14/05/2010	<10	<7	<5	<42	<8	<3	<3	<4	<10	<10	<10	<10	<10	-
MSMW156S2	28/05/2008	-	-	-	-	-	-	-	-		-	-	-	-	-
MSMW156S2	28/05/2008	-	-	-	-	-	-	-	-		-	-	-	-	-
MSMW156S2	23/10/2008	-	-	-	-	-	-	-	-		-	-	-	-	-
MSMW156S2	12/11/2009	<10	<10	<10	<10	<10	<10	<10	<10		<10	<10	<10	-	-
MSMW156S2	14/05/2010	<10	<7	<5	<42	<8	<3	<3	<4	<10	<10	<10	76	76	-
MSMW156S2	25/11/2010	-	-	-	<50	-	-	-	-		53	14	83	-	-
MSMW156S2	24/04/2009	-	-	-	-	-	-	-	-		-	-	-	-	<10
MSMW156S2	24/04/2009	<10	<10	<10	<10	<10	<10	<10	<10						
MSMW163S	23/10/2008														
MSMW163S	14/05/2010	<10	<7	<5	482	<8	17	<3	<4	<10	315	145	460	<10	315
MSMW163S	29/11/2010	<10			265						192	59			
MSMW163S	20/04/2009	<10	<10	<10	12	<10	<10	<10	<10		12	<10	12	-	-
MSMW177S	28/05/2008														
MSMW177S	20/10/2008														
MSMW177S	16/04/2009	<10	<10	<10	3900	<10	<10	<10	<10		3300	930	4200		
MSMW183	06/11/2009	350	350	<10	4100	14	<10	<10	16		3400	660	4100		
MSMW183S	01/05/2008	-	-	-	-	-	-	-	-		-	-	-	-	-
MSMW183S	20/10/2008														
MSMW183S	05/05/2010	190	190	<5	3960	13	<3	<3	14	217	3540	416	3960	<10	3540
MSMW183S	23/11/2010	260	239	<2.5	2020	11.8		<1.7	12.5		1590	424			
MSMW183S	16/04/2009	240	240	<10	3000	<10	<10	<10	<10		2800	250	3000		
MSMW183S2	16/04/2009	260	260	<10	3500	<10	<10	<10	<10		3200	270	3500		
MSMW191	01/05/2008	-	-	-	-	-	-	-	-		-	-	-	-	-
MSMW191	22/10/2008														
MSMW191	06/11/2009	<10	<10	<10	2100	<10	<10	<10	<10		3500	560	4100		
MSMW191	05/05/2010	264	264	30	9220	52	<3	<3	47	393	7870	1370	9240	<10	7870
MSMW191	23/11/2010	112	109	7.54	3570	11.8		<1.7	17.3		3002	565			
MSMW191	16/04/2009	220	220	15	5500	29	<10	<10	33		4900	610	5500		

Sample Location	Date	Total Aromatics >EC12-EC35 Aqueous	Total Aromatics C6-C12	Total Aliphatics & Aromatics >C5-35 (aq)	Ethylbenzene	Dichlorodifluoromethane	Chloromethane	Chloroethane	Bromomethane	Trichlorofluoromethane	1,1-Dichloroethene	Dichloromethane	Carbon disulphide
		ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	
MSMW025D	29/05/2008												
MSMW025D	20/10/2008												
MSMW025D	29/11/2010			2480		<7	<9	<2.5	<2	<1.3	<1.2	<3.7	<1.3
MSMW025D	16/04/2009					-	-	-	-	-	-	-	-
MSMW025S	29/05/2008												
MSMW025S	20/10/2008												
MSMW025S	29/11/2010			2580		<7	<9	<2.5	<2	<1.3	<1.2	<3.7	<1.3
MSMW025S	16/04/2009					-	-	-	-	-	-	-	-
MSMW034	03/06/2008					-	-	-	-	-	-	<1.0	
MSMW034S	03/06/2008	-	-		-	-	-	-	-	-	-	-	
MSMW034S	23/10/2008	-	-		-	-	-	-	-	-	-	-	
MSMW034S	06/11/2009	-	-		<2	<1	<1	<2	<2	<2	<1	<3	<2
MSMW034S	06/05/2010	1260	-	1330	-	-	-	-	-	-	-	-	
MSMW034S	25/11/2010	-	-	1690	<2.5	<7	<9	<2.5	<2	<1.3	<1.2	<3.7	<1.3
MSMW034S	20/04/2009	-	-										
MSMW035S	30/05/2008	-	-		-	-	-	-	-	-	-	-	
MSMW035S	23/10/2008	-	-		-	-	-	-	-	-	-	-	
MSMW035S	06/11/2009	-	-		-	-	-	-	-	-	-	-	-
MSMW035S	14/05/2010	<10	-	<10	-	-	-	-	-	-	-	-	
MSMW035S	25/11/2010	-	-	<10	-	<7	<9	<2.5	<2	<1.3	<1.2	<3.7	<1.3
MSMW035S	20/04/2009	-	-										
MSMW035S2	20/04/2009	-	-										
MSMW155S	28/05/2008	-	-		-	-	-	-	-	-	-	-	
MSMW155S	23/10/2008	-	-		-	-	-	-	-	-	-	-	
MSMW155S	12/11/2009	-	-		-	-	-	-	-	-	-	-	-
MSMW155S	14/05/2010	<10	-	<10	-	-	-	-	-	-	-	-	
MSMW155S	26/11/2010	-	-	<10	-	-	-	-	-	-	-	-	
MSMW155S	15/04/2009												
MSMW155S2	14/05/2010	<10	-	<10	-	-	-	-	-	-	-	-	
MSMW156S2	28/05/2008	-	-		-	-	-	-	-	-	-	-	
MSMW156S2	28/05/2008	-	-		-	-	-	-	-	-	-	-	
MSMW156S2	23/10/2008	-	-		-	-	-	-	-	-	-	-	
MSMW156S2	12/11/2009	-	-		-	<1	<1	-	-	-	-	-	-
MSMW156S2	14/05/2010	<10	-	76	-	-	-	-	-	-	-	-	
MSMW156S2	25/11/2010	-	-	83	-	-	-	-	-	-	-	-	
MSMW156S2	24/04/2009	-	<10										
MSMW156S2	24/04/2009												
MSMW163S	23/10/2008												
MSMW163S	14/05/2010	<10	145	<10	-	-	-	-	-	-	-	-	-
MSMW163S	29/11/2010			256									
MSMW163S	20/04/2009	-	-										
MSMW177S	28/05/2008												
MSMW177S	20/10/2008												
MSMW177S	16/04/2009					-	-	-	-	-	-	-	-
MSMW183	06/11/2009					<1	<1	<2	<2	<2	<1	<3	<2
MSMW183S	01/05/2008	-	-		<2.0	-	-	-	-	-	-	<2.0	
MSMW183S	20/10/2008					<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
MSMW183S	05/05/2010	<10	416	<10	<2.5	<1.3	<1.7	<2.5	<2	<1.3	<1.2	<3.7	<1.3
MSMW183S	23/11/2010			2020		<7	<9	<2.5	<2	<1.3	<1.2	<3.7	<1.3
MSMW183S	16/04/2009					<1	<1		<2	<2	<1	<3	<2
MSMW183S2	16/04/2009					<1	<1		<2	<2	<1	<3	<2
MSMW191	01/05/2008	-	-		13	-	-	-	-	-	-	<1.0	
MSMW191	22/10/2008					<1.0	8.6	<1.0	<1.0	<1.0	<1.0	<1.0	
MSMW191	06/11/2009					<1	<1		<2	<2	<1	<3	<2
MSMW191	05/05/2010	16	1350	16	16.6	<1.3	<1.7	<2.5	<2	<1.3	<1.2	<3.7	<1.3
MSMW191	23/11/2010			3570		<7	<9	<2.5	<2	<1.3	<1.2	<3.7	<1.3
MSMW191	16/04/2009					<1	<1		<2	<2	<1	<3	<2

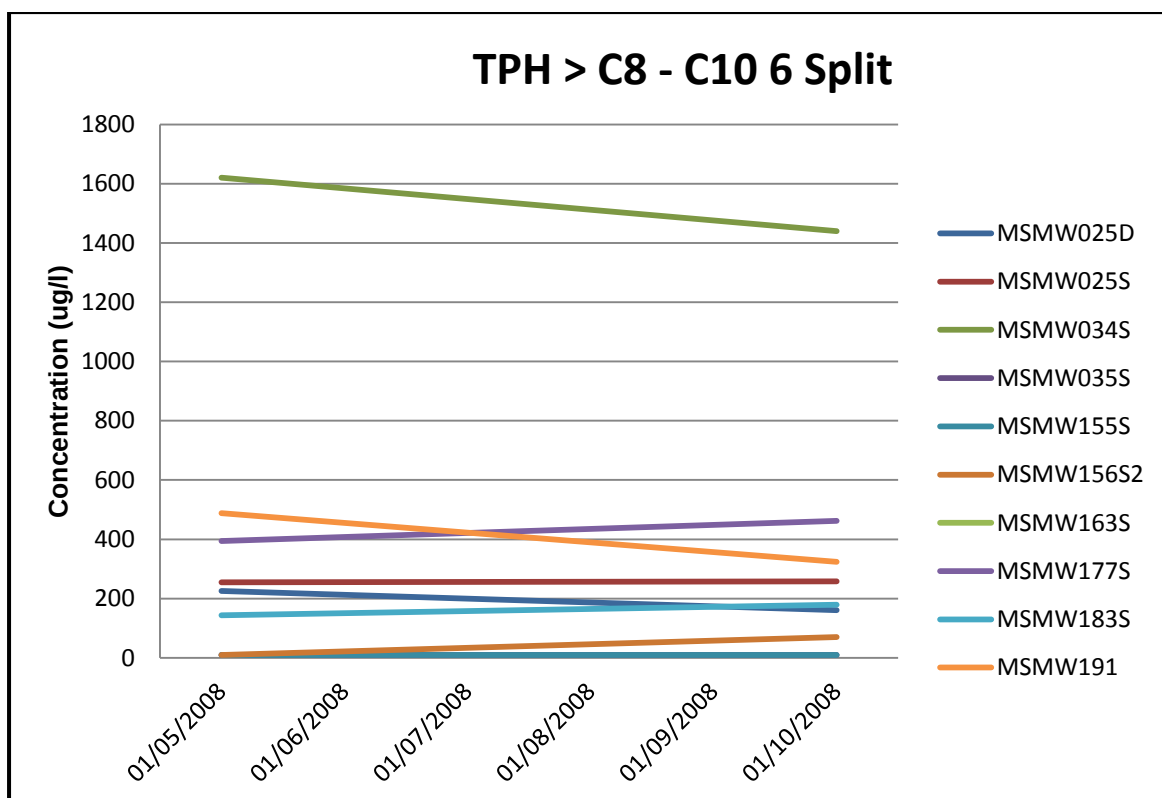
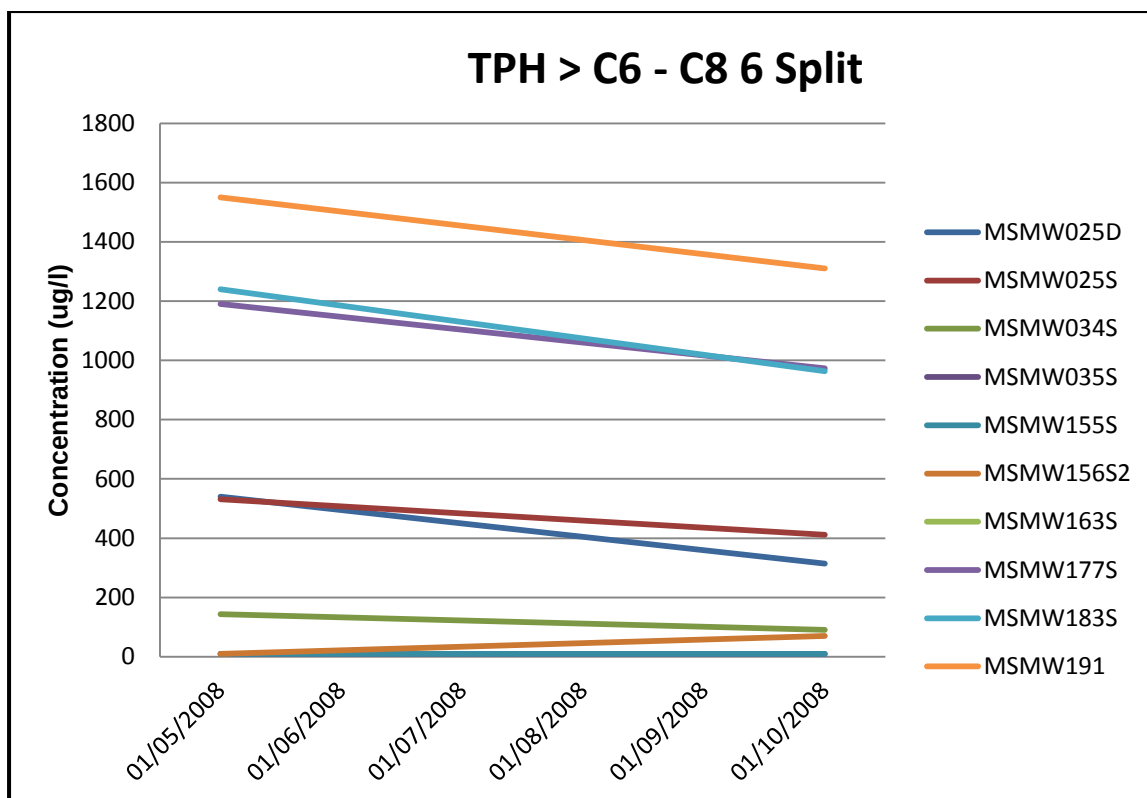
Sample Location	Date	1,1-Dichloroethane	Cis-1,2-dichloroethene	2,2-Dichloropropane	Chloroform	Bromochloromethane	1,1,1-Trichloroethane	1,1-Dichloropropene	1,2-Dichloroethane	Benzene	1,2-Dichloropropane	Trichloroethene	Bromodichloromethane	Dibromomethane	Cis-1,3-dichloropropene	Toluene
		ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l
MSMW025D	29/05/2008															
MSMW025D	20/10/2008															
MSMW025D	29/11/2010	<1.2	<2.3	<3.8	<1.8	<1.9	<1.3	<1.3	<3.3	27.2	<3	<2.5	<0.9	<2.7	<1.9	3.3
MSMW025D	16/04/2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW025S	29/05/2008															
MSMW025S	20/10/2008															
MSMW025S	29/11/2010	<1.2	<2.3	<3.8	<1.8	<1.9	<1.3	<1.3	<3.3	19.6	<3	<2.5	<0.9	<2.7	<1.9	2.49
MSMW025S	16/04/2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW034	03/06/2008	-	-	-	-	-	-	-	<1.0	25.3	-	-	-	-	-	<1.0
MSMW034S	03/06/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW034S	23/10/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW034S	06/11/2009	<1	<2	<1	<2	<2	<1	<1	<4	17	<3	<2	<1	<3	<2	<1
MSMW034S	06/05/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW034S	25/11/2010	<1.2	<2.3	<3.8	<1.8	<1.9	<1.3	<1.3	<3.3	12.6	<3	<2.5	<0.9	<2.7	<1.9	<1.4
MSMW034S	20/04/2009															
MSMW035S	30/05/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW035S	23/10/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW035S	06/11/2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW035S	14/05/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW035S	25/11/2010	<1.2	<2.3	<3.8	<1.8	<1.9	<1.3	<1.3	<3.3	<1.3	<3	<2.5	<0.9	<2.7	<1.9	<1.4
MSMW035S	20/04/2009															
MSMW035S2	20/04/2009															
MSMW155S	28/05/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW155S	23/10/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW155S	12/11/2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW155S	14/05/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW155S	26/11/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW155S	15/04/2009															
MSMW155S2	14/05/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	28/05/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	28/05/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	23/10/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	12/11/2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	14/05/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	25/11/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	24/04/2009															
MSMW156S2	24/04/2009															
MSMW163S	23/10/2008															
MSMW163S	14/05/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW163S	29/11/2010															
MSMW163S	20/04/2009															
MSMW177S	28/05/2008															
MSMW177S	20/10/2008															
MSMW177S	16/04/2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW183	06/11/2009	<1	<2	<1	<2	<2	<1	<1	<4	270	<3	<2	<1	<3	<2	15
MSMW183S	01/05/2008	-	-	-	-	-	-	-	<2.0	294	-	-	-	-	-	14.4
MSMW183S	20/10/2008	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	296	<2.0	<2.0	<2.0	<2.0	<2.0	14.2
MSMW183S	05/05/2010	<1.2	<2.3	<3.8	<1.8	<1.9	<1.3	<1.3	<3.3	228	<3	<2.5	<0.9	<2.7	<1.9	11.4
MSMW183S	23/11/2010	<1.2	<2.3	<3.8	<1.8	<1.9	<1.3	<1.3	<3.3	239	<3	<2.5	<0.9	<2.7	<1.9	12.5
MSMW183S	16/04/2009	<1	<2	<1	<2	<2	<1	<1	<4	250	<3	<2	<1	<3	<2	12
MSMW183S2	16/04/2009	<1	<2	<1	<2	<2	<1	<1	<4	270	<3	<2	<1	<3	<2	14
MSMW191	01/05/2008	-	-	-	-	-	-	-	<1.0	133	-	-	-	-	-	21.9
MSMW191	22/10/2008	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	166	<1.0	<1.0	<1.0	<1.0	<1.0	27.3
MSMW191	06/11/2009	<1	<2	<1	<2	<2	<1	<1	<4	98	<3	<2	<1	<3	<2	18
MSMW191	05/05/2010	<1.2	<2.3	<3.8	<1.8	<1.9	<1.3	<1.3	<3.3	194	<3	<2.5	<0.9	<2.7	<1.9	30.3
MSMW191	23/11/2010	<1.2	<2.3	<3.8	<1.8	<1.9	<1.3	<1.3	<3.3	109	<3	<2.5	<0.9	<2.7	<1.9	17.3
MSMW191	16/04/2009	<1	<2	<1	<2	<2	<1	<1	<4	240	<3	<2	<1	<3	<2	39

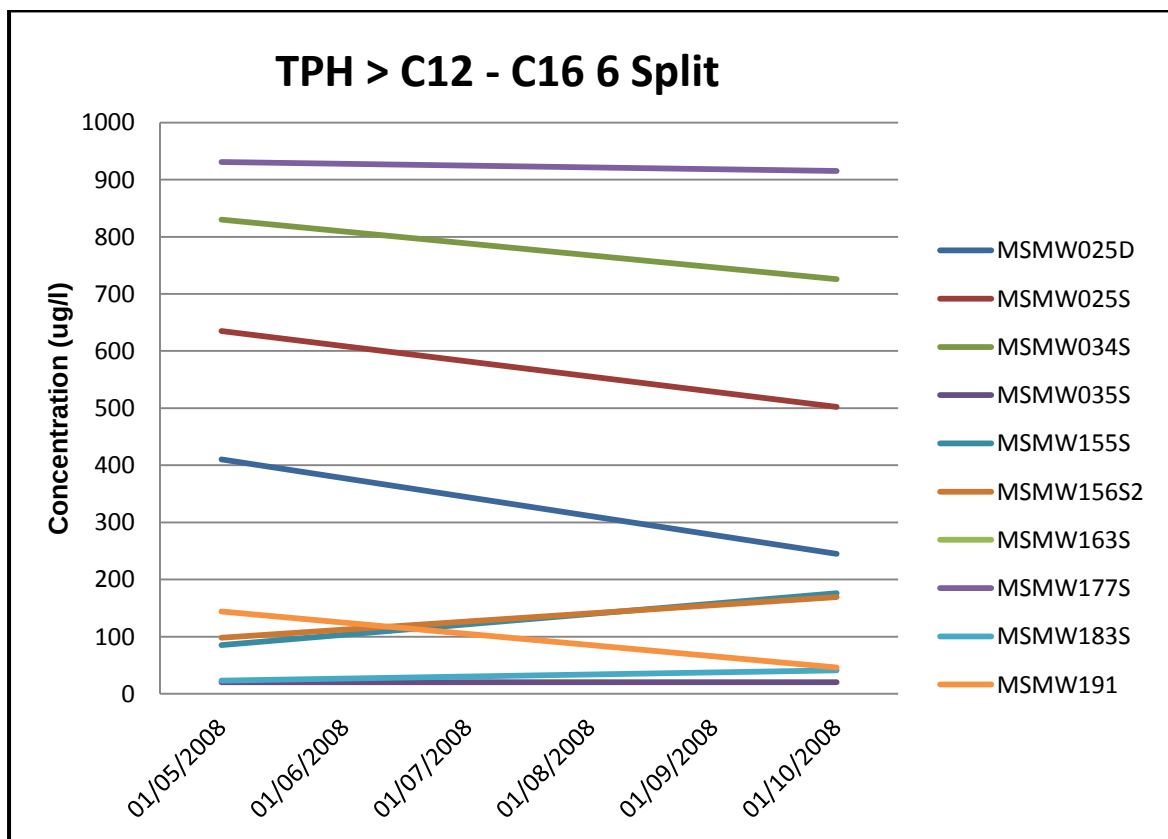
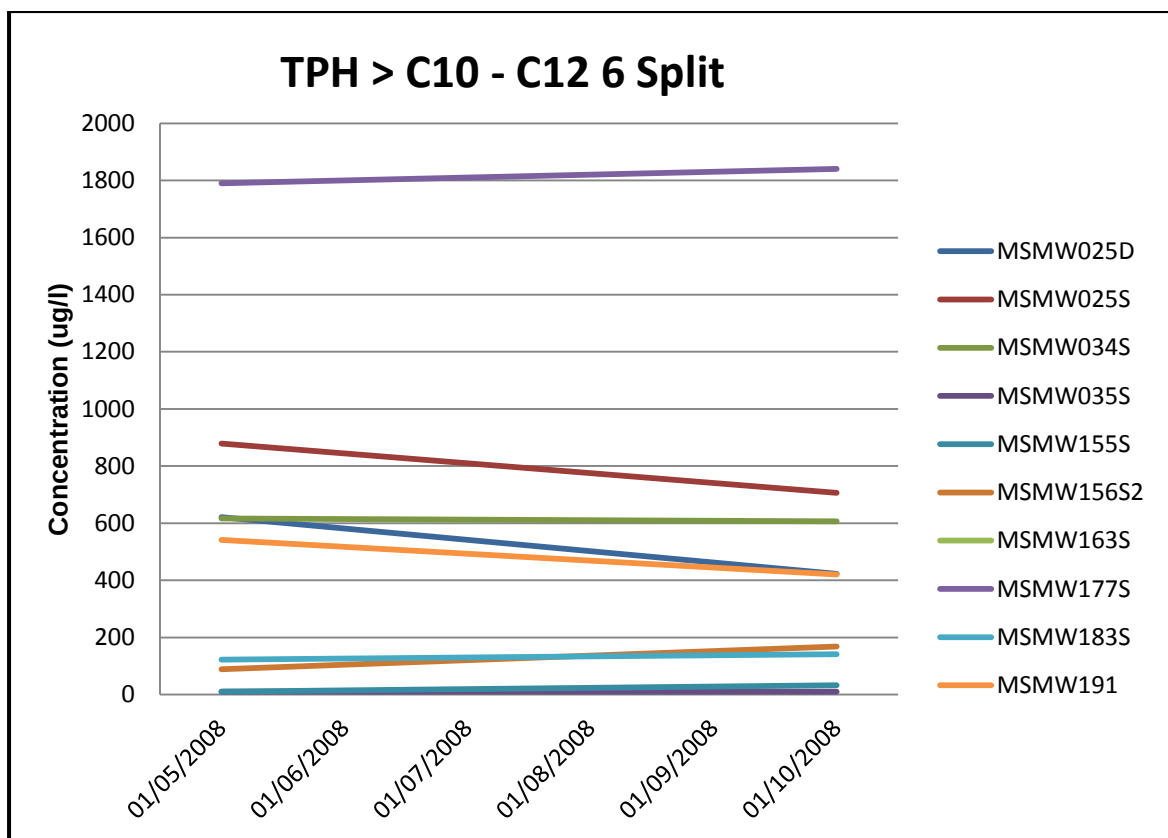
Sample Location	Date	Trans-1,3-dichloropropene ug/l	1,1,2-trichloroethane ug/l	Carbon Tetrachloride ug/l	Vinyl Chloride ug/l	1,3-dichloropropane ug/l	Tetrachloroethene ug/l	Dibromochloromethane ug/l	1,2-dibromoethane ug/l	Chlorobenzene ug/l	1,1,1,2-tetrachloroethane ug/l	Ethyl Benzene ug/l	m,p-xylene ug/l	o-xylene ug/l	Styrene ug/l	Bromoform ug/l
MSMW025D	29/05/2008															
MSMW025D	20/10/2008															
MSMW025D	29/11/2010	<3.5	<2.2	<1.4	<1.2	<2.2	<1.5	<1.7	<2.3	<3.5	<1.3	<2.5	<2.5	<1.7	<1.2	<3
MSMW025D	16/04/2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW025S	29/05/2008															
MSMW025S	20/10/2008															
MSMW025S	29/11/2010	<3.5	<2.2	<1.4	<1.2	<2.2	<1.5	<1.7	<2.3	<3.5	<1.3	<2.5	<2.5	<1.7	<1.2	<3
MSMW025S	16/04/2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW034	03/06/2008	-	-	-	-	-	-	-	-	-	-	1.3	<1.0	1.6	-	-
MSMW034S	03/06/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW034S	23/10/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW034S	06/11/2009	<3	<2	<1	<1	<2	<2	<2	<2	<4	<1	<2	<2	3	<1	<3
MSMW034S	06/05/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW034S	25/11/2010	<3.5	<2.2	<1.4	<1.2	<2.2	<1.5	<1.7	<2.3	<3.5	<1.3	<2.5	<2.5	2.04	<1.2	<3
MSMW034S	20/04/2009															
MSMW035S	30/05/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW035S	23/10/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW035S	06/11/2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW035S	14/05/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW035S	25/11/2010	<3.5	<2.2	<1.4	<1.2	<2.2	<1.5	<1.7	<2.3	<3.5	<1.3	<2.5	<2.5	<1.7	<1.2	<3
MSMW035S	20/04/2009															
MSMW035S2	20/04/2009															
MSMW155S	28/05/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW155S	23/10/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW155S	12/11/2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW155S	14/05/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW155S	26/11/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW155S	15/04/2009															
MSMW155S2	14/05/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	28/05/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	28/05/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	23/10/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	12/11/2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	14/05/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	25/11/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	24/04/2009															
MSMW156S2	24/04/2009															
MSMW163S	23/10/2008															
MSMW163S	14/05/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW163S	29/11/2010															
MSMW163S	20/04/2009															
MSMW177S	28/05/2008															
MSMW177S	20/10/2008															
MSMW177S	16/04/2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW183	06/11/2009	<3	<2	<1	<1	<2	<2	<2	<2	<4	<1	<2	13	<1	<1	<3
MSMW183S	01/05/2008	-	-	-	-	-	-	-	-	-	-	<2.0	14.3	<2.0	-	-
MSMW183S	20/10/2008	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	12.6	<2.0	<2.0	<2.0
MSMW183S	05/05/2010	<3.5	<2.2	<1.4	<1.2	<2.2	<1.5	<1.7	<2.3	<3.5	<1.3	<2.5	9.13	<1.7	<1.2	<3
MSMW183S	23/11/2010	<3.5	<2.2	<1.4	<1.2	<2.2	<1.5	<1.7	<2.3	<3.5	<1.3	<2.5	11.8	<1.7	<1.2	<3
MSMW183S	16/04/2009	<3	<2	<1	<1	<2	<2	<2	<2	<4	<1	<2	12	<1	<1	<3
MSMW183S2	16/04/2009	<3	<2	<1	<1	<2	<2	<2	<2	<4	<1	<2	14	<1	<1	<3
MSMW191	01/05/2008	-	-	-	-	-	-	-	-	-	-	13	19.5	2	-	-
MSMW191	22/10/2008	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	13.8	22.6	2.6	<1.0	<1.0
MSMW191	06/11/2009	<3	<2	<1	<1	<2	<2	<2	<2	<4	<1	13	14	1	<1	<3
MSMW191	05/05/2010	<3.5	<2.2	<1.4	<1.2	<2.2	<1.5	<1.7	<2.3	<3.5	<1.3	16.6	20.6	<1.7	<1.2	<3
MSMW191	23/11/2010	<3.5	<2.2	<1.4	<1.2	<2.2	<1.5	<1.7	<2.3	<3.5	<1.3	7.54	11.8	<1.7	<1.2	<3
MSMW191	16/04/2009	<3	<2	<1	<1	<2	<2	<2	<2	<4	<1	23	33	4	<1	<3

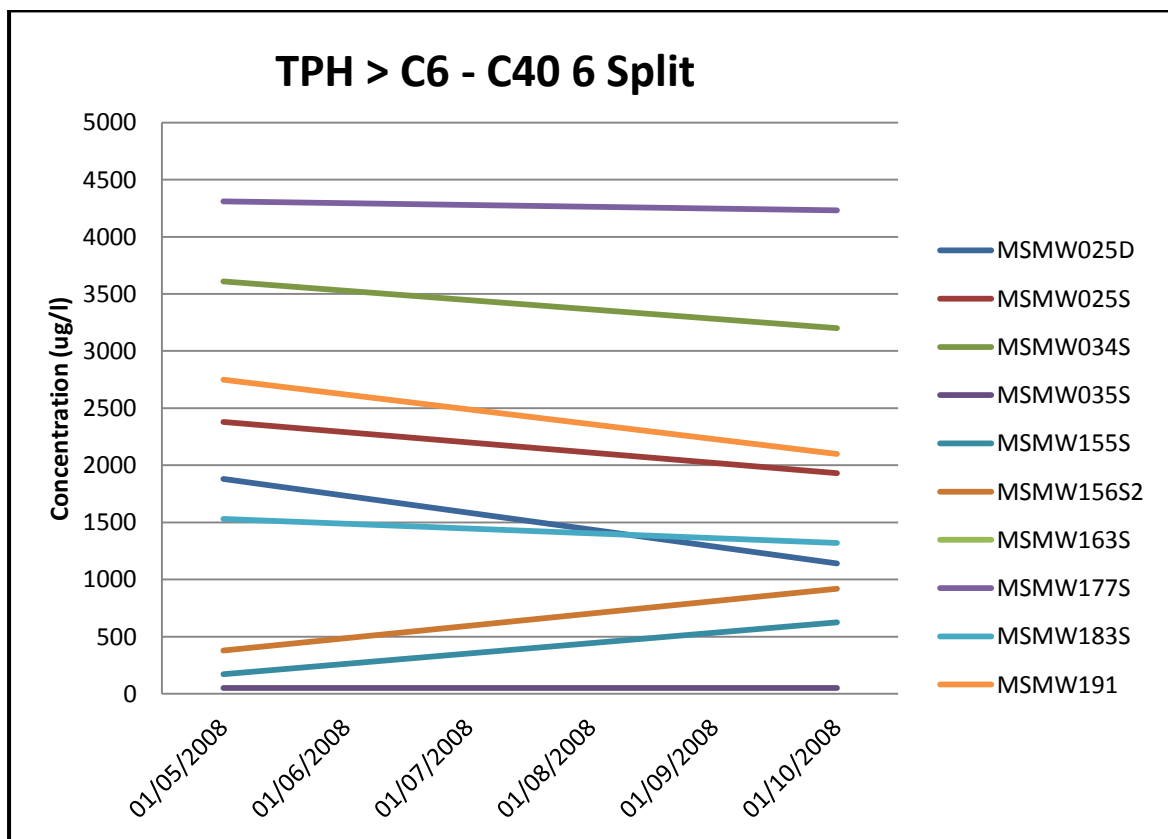
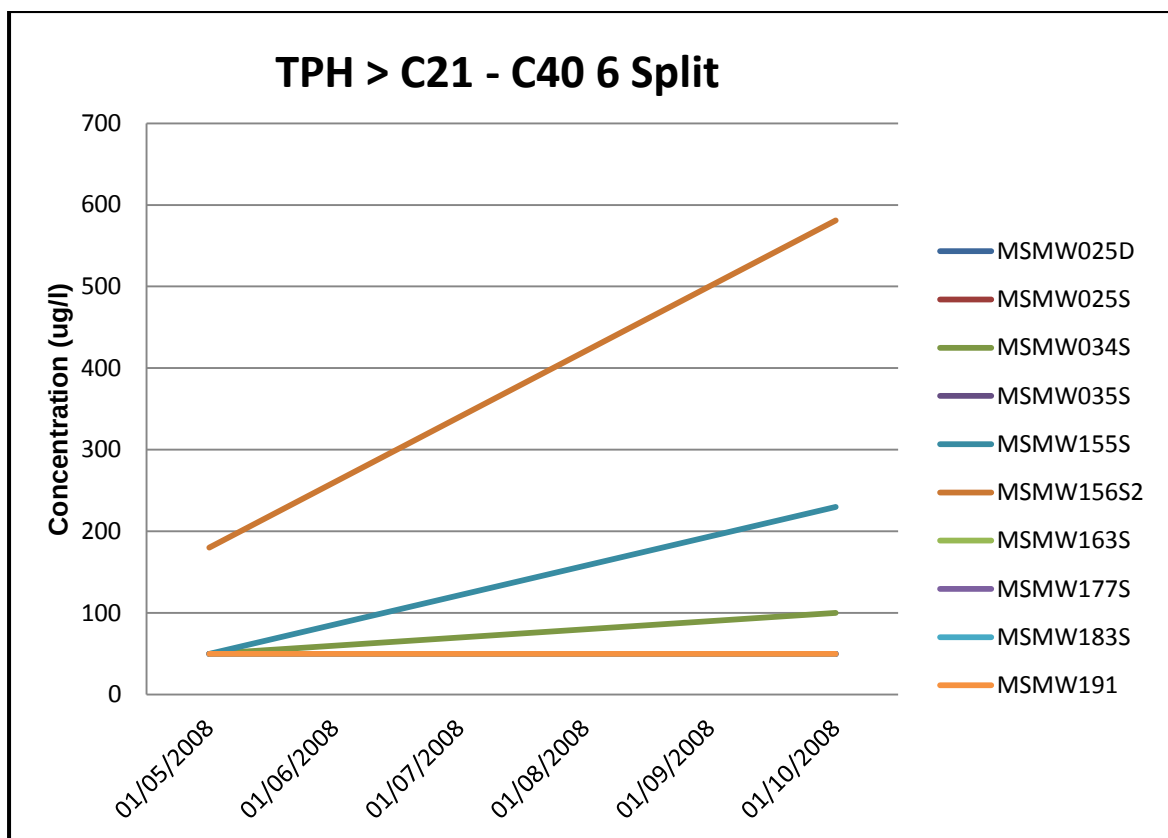
Sample Location	Date	Trans-1,2-dichloroethene ug/l	Isopropylbenzene ug/l	1,1,2,2-tetrachloroethane ug/l	1,2,3-trichloropropane ug/l	n-propylbenzene ug/l	Bromobenzene ug/l	2-chlorotoluene ug/l	1,3,5-trimethylbenzene ug/l	4-chlorotoluene ug/l	tert-butylbenzene ug/l	1,2,4-trimethylbenzene ug/l	sec-butylbenzene ug/l	p-isopropyltoluene ug/l	1,3-dichlorobenzene ug/l
MSMW025D	29/05/2008														
MSMW025D	20/10/2008														
MSMW025D	29/11/2010	<1.9	25.6	<5.2	<7.8	20.7	<2	<1.9	<1.8	<1.9	28.2	<1.7	10.8	<2.6	<2.2
MSMW025D	16/04/2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW025S	29/05/2008														
MSMW025S	20/10/2008														
MSMW025S	29/11/2010	<1.9	18.3	<5.2	<7.8	11.8	<2	<1.9	<1.8	<1.9	36.4	<1.7	8.62	<2.6	<2.2
MSMW025S	16/04/2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW034	03/06/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW034S	03/06/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW034S	23/10/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW034S	06/11/2009	<2	8	<5	<9	4	<1	<2	3	<2	<2	7	<1	<3	<2
MSMW034S	06/05/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW034S	25/11/2010	<1.9	5.73	<5.2	<7.8	2.83	<2	<1.9	2.23	<1.9	<2	5.09	2.11	<2.6	<2.2
MSMW034S	20/04/2009														
MSMW035S	30/05/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW035S	23/10/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW035S	06/11/2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW035S	14/05/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW035S	25/11/2010	<1.9	<1.4	<5.2	<7.8	<2.6	<2	<1.9	<1.8	<1.9	<2	<1.7	<1.7	<2.6	<2.2
MSMW035S	20/04/2009														
MSMW035S2	20/04/2009														
MSMW155S	28/05/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW155S	23/10/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW155S	12/11/2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW155S	14/05/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW155S	26/11/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW155S	15/04/2009														
MSMW155S2	14/05/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	28/05/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	28/05/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	23/10/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	12/11/2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	14/05/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	25/11/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW156S2	24/04/2009														
MSMW156S2	24/04/2009														
MSMW163S	23/10/2008														
MSMW163S	14/05/2010	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW163S	29/11/2010														
MSMW163S	20/04/2009														
MSMW177S	28/05/2008														
MSMW177S	20/10/2008														
MSMW177S	16/04/2009	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW183	06/11/2009	<2	11	<5	<9	5	<1	<2	3	<2	<2	7	3	<3	<2
MSMW183S	01/05/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW183S	20/10/2008	10.8	<2.0	<2.0	<2.0	6.4	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.3	<2.0	<2.0
MSMW183S	05/05/2010	<1.9	<1.4	<5.2	<7.8	<2.6	<2	<1.9	<1.8	<1.9	<2	<1.7	<1.7	<2.6	<2.2
MSMW183S	23/11/2010	<1.9	11.1	<5.2	<7.8	5.13	<2	<1.9	<1.8	<1.9	<2	<1.7	2.82	<2.6	<2.2
MSMW183S	16/04/2009	<2	6	<5	<9	<3	<1	<2	<1	<2	<2	<1	1	<3	<2
MSMW183S2	16/04/2009	<2	12	<5	<9	5	<1	<2	<1	<2	<2	<1	2	<3	<2
MSMW191	01/05/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MSMW191	22/10/2008	42.3	<1.0	<1.0	<1.0	40.3	<1.0	<1.0	13	<1.0	1.6	1.5	10.7	2.1	<1.0
MSMW191	06/11/2009	<2	35	<5	<9	28	<1	<2	3	<2	<2	7	8	<3	<2
MSMW191	05/05/2010	<1.9	30	<5.2	<7.8	22.8	<2	<1.9	2.03	<1.9	<2	<1.7	5.12	<2.6	<2.2
MSMW191	23/11/2010	<1.9	26.2	<5.2	<7.8	19.3	<2	<1.9	<1.8	<1.9	<2	<1.7	7.85	<2.6	<2.2
MSMW191	16/04/2009	<2	42	<5	<9	31	<1	<2	2	<2	<2	2	6	<3	<2

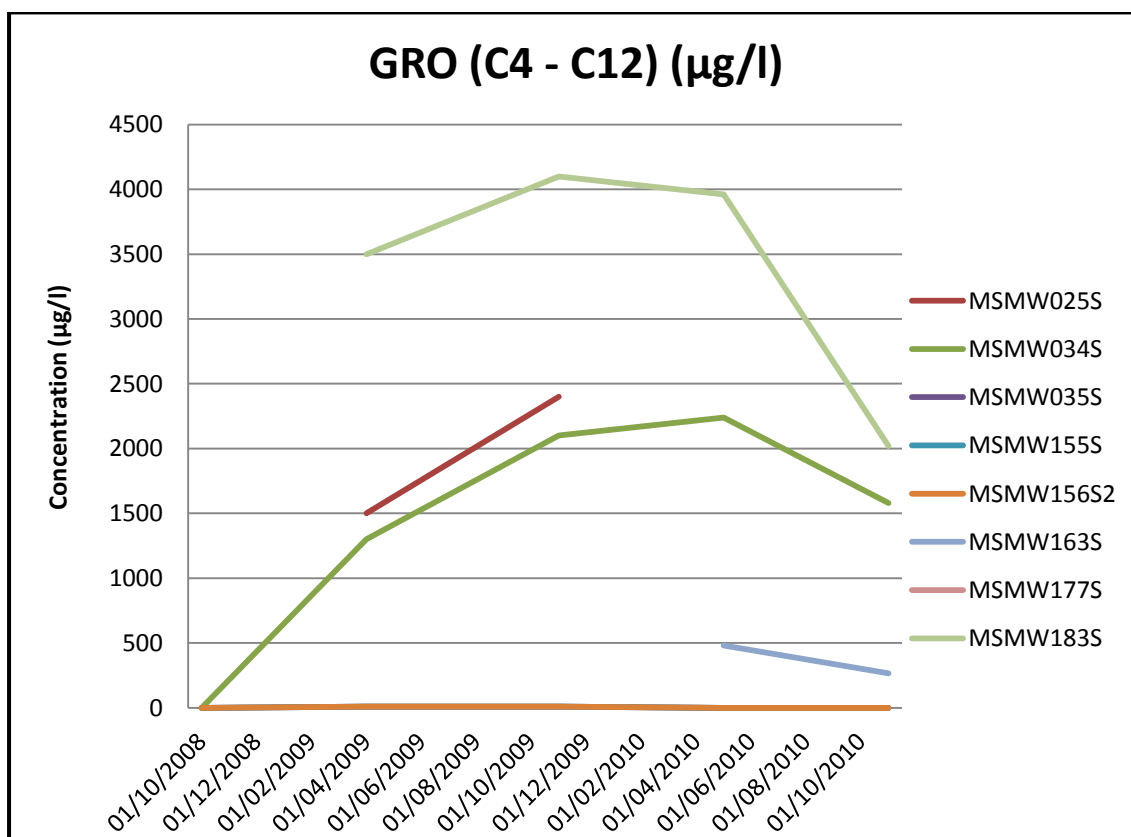
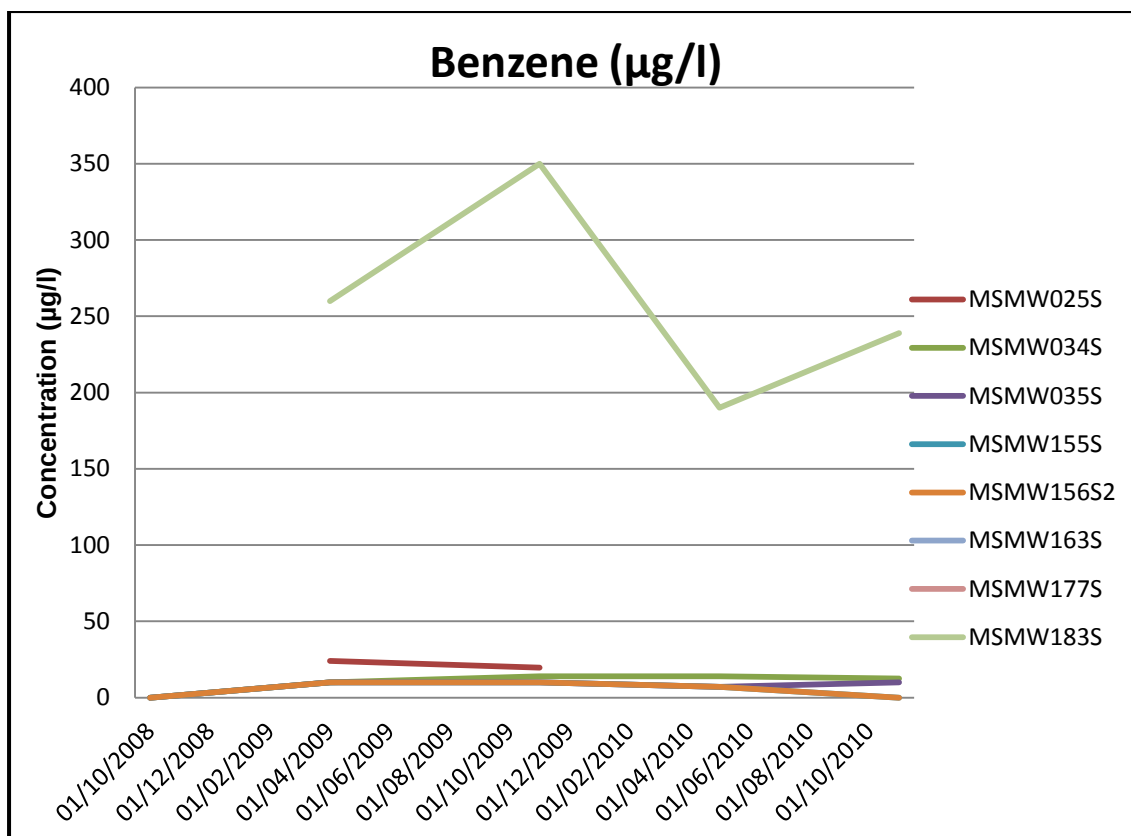
Sample Location	Date	1,4-dichlorobenzene	n-butylbenzene	1,2-dichlorobenzene	1,2-dibromo-3-chloropropane	1,2,4-trichlorobenzene	Hexachlorobutadiene	tert-amyl methyl ether (TAME)
		ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	
MSMW025D	29/05/2008							
MSMW025D	20/10/2008							
MSMW025D	29/11/2010	<2.7	3.6	<3.7	<9.8	<2.3	<2.5	<1
MSMW025D	16/04/2009	-	-	-	-	-	-	-
MSMW025S	29/05/2008							
MSMW025S	20/10/2008							
MSMW025S	29/11/2010	<2.7	2.69	<3.7	<9.8	<2.3	<2.5	<1
MSMW025S	16/04/2009	-	-	-	-	-	-	-
MSMW034	03/06/2008	-	-	-	-	-	-	
MSMW034S	03/06/2008	-	-	-	-	-	-	
MSMW034S	23/10/2008	-	-	-	-	-	-	
MSMW034S	06/11/2009	<1	<2	<3	<10	<2	<3	
MSMW034S	06/05/2010	-	-	-	-	-	-	-
MSMW034S	25/11/2010	<2.7	<2	<3.7	<9.8	<2.3	<2.5	<1
MSMW034S	20/04/2009							
MSMW035S	30/05/2008	-	-	-	-	-	-	
MSMW035S	23/10/2008	-	-	-	-	-	-	
MSMW035S	06/11/2009	-	-	-	-	-	-	
MSMW035S	14/05/2010	-	-	-	-	-	-	-
MSMW035S	25/11/2010	<2.7	<2	<3.7	<9.8	<2.3	<2.5	<1
MSMW035S	20/04/2009							
MSMW035S2	20/04/2009							
MSMW155S	28/05/2008	-	-	-	-	-	-	
MSMW155S	23/10/2008	-	-	-	-	-	-	
MSMW155S	12/11/2009	-	-	-	-	-	-	
MSMW155S	14/05/2010	-	-	-	-	-	-	-
MSMW155S	26/11/2010	-	-	-	-	-	-	
MSMW155S	15/04/2009							
MSMW155S2	14/05/2010	-	-	-	-	-	-	-
MSMW156S2	28/05/2008	-	-	-	-	-	-	
MSMW156S2	28/05/2008	-	-	-	-	-	-	
MSMW156S2	23/10/2008	-	-	-	-	-	-	
MSMW156S2	12/11/2009	-	-	-	-	-	-	
MSMW156S2	14/05/2010	-	-	-	-	-	-	-
MSMW156S2	25/11/2010	-	-	-	-	-	-	
MSMW156S2	24/04/2009							
MSMW156S2	24/04/2009							
MSMW163S	23/10/2008							
MSMW163S	14/05/2010	-	-	-	-	-	-	-
MSMW163S	29/11/2010							
MSMW163S	20/04/2009							
MSMW177S	28/05/2008							
MSMW177S	20/10/2008							
MSMW177S	16/04/2009	-	-	-	-	-	-	-
MSMW183	06/11/2009	<1	<2		<10	<2	<3	
MSMW183S	01/05/2008	-	-	-	-	-	-	
MSMW183S	20/10/2008	<2.0	<2.0	<2.0	<4.0	<2.0	<2.0	
MSMW183S	05/05/2010	<2.7	<2	<3.7	<9.8	<2.3	<2.5	<10
MSMW183S	23/11/2010	<2.7	<2	<3.7	<9.8	<2.3	<2.5	<1
MSMW183S	16/04/2009	<1	<2	<3	<10	<2	<3	
MSMW183S2	16/04/2009	<1	<2	<3	<10	<2	<3	
MSMW191	01/05/2008	-	-	-	-	-	-	
MSMW191	22/10/2008	<1.0	<1.0	<1.0	<2.0	<1.0	<1.0	
MSMW191	06/11/2009	<1	7	<3	<10	<2	<3	
MSMW191	05/05/2010	<2.7	<2	<3.7	<9.8	<2.3	<2.5	<10
MSMW191	23/11/2010	<2.7	<2	<3.7	<9.8	<2.3	<2.5	<1
MSMW191	16/04/2009	<1	<2	<3	<10	<2	<3	

Sample Location	Date	Naphthalene	1,2,3-trichlorobenzene	1,3,5-trichlorobenzene	MTBE	Dibromofluoromethane	Toluene-d8	4-bromofluorobenzene
		ug/l	ug/l		ug/l	%Recovery	%Recovery	%Recovery
MSMW025D	29/05/2008							
MSMW025D	20/10/2008							
MSMW025D	29/11/2010	<3.5	<3.1	<10	<1.6			
MSMW025D	16/04/2009	-	-	-	-	-	-	-
MSMW025S	29/05/2008							
MSMW025S	20/10/2008							
MSMW025S	29/11/2010	<3.5	<3.1	<10	<1.6			
MSMW025S	16/04/2009	-	-	-	-	-	-	-
MSMW034	03/06/2008	-	-		<1.0	93.7	103.4	106.3
MSMW034S	03/06/2008	-	-		-	-	-	-
MSMW034S	23/10/2008	-	-		-	-	-	-
MSMW034S	06/11/2009	<4	<3		<2	110	99	100
MSMW034S	06/05/2010	-	-	-	-	-	-	-
MSMW034S	25/11/2010	<3.5	<3.1	<10	<1.6	-	-	-
MSMW034S	20/04/2009							
MSMW035S	30/05/2008	-	-		-	-	-	-
MSMW035S	23/10/2008	-	-		-	-	-	-
MSMW035S	06/11/2009	-	-		-	-	-	-
MSMW035S	14/05/2010	-	-	-	-	-	-	-
MSMW035S	25/11/2010	<3.5	<3.1	<10	<1.6	-	-	-
MSMW035S	20/04/2009							
MSMW035S2	20/04/2009							
MSMW155S	28/05/2008	-	-		-	-	-	-
MSMW155S	23/10/2008	-	-		-	-	-	-
MSMW155S	12/11/2009	-	-		-	-	-	-
MSMW155S	14/05/2010	-	-	-	-	-	-	-
MSMW155S	26/11/2010	-	-		-	-	-	-
MSMW155S	15/04/2009							
MSMW155S2	14/05/2010	-	-	-	-	-	-	-
MSMW156S2	28/05/2008	-	-		-	-	-	-
MSMW156S2	28/05/2008	-	-		-	-	-	-
MSMW156S2	23/10/2008	-	-		-	-	-	-
MSMW156S2	12/11/2009	-	-		-	-	-	-
MSMW156S2	14/05/2010	-	-	-	-	-	-	-
MSMW156S2	25/11/2010	-	-		-	-	-	-
MSMW156S2	24/04/2009							
MSMW156S2	24/04/2009							
MSMW163S	23/10/2008							
MSMW163S	14/05/2010	-	-	-	-	-	-	-
MSMW163S	29/11/2010							
MSMW163S	20/04/2009							
MSMW177S	28/05/2008							
MSMW177S	20/10/2008							
MSMW177S	16/04/2009	-	-	-	-	-	-	-
MSMW183	06/11/2009	<4	<3		<2	110	100	99
MSMW183S	01/05/2008	-	-		<2.0	99.6	99.2	97.9
MSMW183S	20/10/2008	<2.0	<2.0		<2.0	100.7	100.6	97.6
MSMW183S	05/05/2010	<3.5	<3.1	<10	<1.6	102	103	99
MSMW183S	23/11/2010	<3.5	<3.1	<10	<1.6			
MSMW183S	16/04/2009	<4	<3		<2	100	99	99
MSMW183S2	16/04/2009	<4	<3		<2	100	100	100
MSMW191	01/05/2008	-	-		<1.0	98.7	104.3	96
MSMW191	22/10/2008	3.8	<1.0		<1.0	91.9	103.6	89.5
MSMW191	06/11/2009	<4	<3		<2	99	100	100
MSMW191	05/05/2010	6.07	<3.1	<10	<1.6	102	102	99.5
MSMW191	23/11/2010	<3.5	<3.1	<10	<1.6			
MSMW191	16/04/2009	9	<3		<2	100	100	100









APPENDIX ESID3

GAS QUALITY DATA

Date	Hole	Flow (l/h)		Methane (CH4)		Carbon Dioxide		Oxygen (O2)		H2S (ppm)	CO (ppm)	Atmos. Pressure	Relative pressure	Location
		Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady					
28/11/2011	MSMW154S	-0.2	0		1.3		13.9		1	0	0	1016	NR	off-site (south)
06/12/2011	MSMW154S	0.7	0		19.9		13.1		0.9	0	0	1007		-0.04 off-site (south)
15/12/2011	MSMW154S	-4.4	0		15.5		11.2		3.5	0	0	1000		-0.51 off-site (south)
03/01/2012	MSMW154S	6.2	1.2		13.1		11.8		0.7	0	0	1006		-0.14 off-site (south)
12/02/2013	MSMW154S	0.1	0.1		83.7		7.8		0.9	0	0	1021		0.4 off-site (south)
24/04/2013	MSMW154S	0	0	3.3	1.3		2.7		16.9	0	0	1027		0.07 off-site (south)
08/05/2013	MSMW154S	0.1	0.1	18.6	18.6		12.8		0.8	0	1	1004		-0.05 off-site (south)
28/11/2011	MSMW154D	2.7	0		0.4		0.3		20.4	0	2	1016	NR	off-site (south)
06/12/2011	MSMW154D	0	0		8.2		2.7		17	0	2	1007		-0.04 off-site (south)
15/12/2011	MSMW154D	-2.4	0		4.8		1.8		18.3	0	0	1000		-0.51 off-site (south)
03/01/2012	MSMW154D	7.9	1.3		3.3		1.3		18.8	0	9	1006		-0.14 off-site (south)
12/02/2013	MSMW154D	0	0	50.3	49.6	0	5.7	0	6.8	0	0	1021		0.4 off-site (south)
24/04/2013	MSMW154D	-4.7	-4.7	0.2	0.2		0.3		20.7	0	0	1027		0.07 off-site (south)
08/05/2013	MSMW154D	0.1	0.1	0.2	0.2		0.3		20.8	0	1	1004		-0.05 off-site (south)
28/11/2011	MSMW155D	1.4	0		0		0.4		20.7	0	0	1015	NR	non-landfill (west)
06/12/2011	MSMW155D	0.5	0		0.3		1.8		19.2	0	0	1007		-0.04 non-landfill (west)
15/12/2011	MSMW155D	-0.1	0		0.2		1.3		20.5	0	0	1000		-0.45 non-landfill (west)
03/01/2012	MSMW155D	-0.4	0		0.1		1.5		18.9	0	0	1006		-0.17 non-landfill (west)
12/02/2013	MSMW155D	0.1	0.1	0.3	0.1	0	0.3	0	20.3	0	0	1021		0.4 non-landfill (west)
09/04/2013	MSMW155D	0	0	0	0		0.2		21.6	0	0	1003		-0.02 non-landfill (west)
24/04/2013	MSMW155D	0	0	0	0		0.4		21.3	0	0	1027		0.09 non-landfill (west)
08/05/2013	MSMW155D	0.1	0.1	0.1	0.1		0.1		21.5	0	0	1004		-0.07 non-landfill (west)
28/11/2011	MSMW155S	0.2	0		0		0.1		21.3	0	0	1015	NR	non-landfill (west)
06/12/2011	MSMW155S	5.5	0		0.9		0.5		19.8	0	0	1007		-0.04 non-landfill (west)
15/12/2011	MSMW155S	6.2	0		3.6		1.1		18	0	0	1000		-0.45 non-landfill (west)
03/01/2012	MSMW155S	3.9	0.1		2.9		1.5		16.4	0	0	1006		-0.17 non-landfill (west)
12/02/2013	MSMW155S	0	0	0.2	0.2	0	0.1	0	20.7	0	0	1021		0.4 non-landfill (west)
09/04/2013	MSMW155S	0	0	1.6	0.9		0.1		21.5	0	0	1003		-0.02 non-landfill (west)
24/04/2013	MSMW155S	-3.8	-3.8	0.1	0.1		0		20.9	0	0	1027		0.09 non-landfill (west)
08/05/2013	MSMW155S	-2	-2	0.1	0.1		1.2		17.8	0	0	1004		-0.07 non-landfill (west)
28/11/2011	GA7S	6	0		0		0.9		20.7	0	0	1015	NR	non-landfill (west)
06/12/2011	GA7S	0	0		0		1.3		20.8	0	0	1007		0.08 non-landfill (west)
15/12/2011	GA7S	0	0		0		3		20.1	0	0	1000		2.6 non-landfill (west)
03/01/2012	GA7S	-7.5	0		0.1		4.3		18.9	0	0	1006		-0.17 non-landfill (west)
12/02/2013	GA7S	0.2	0.1	7	4.5	0	2.4	0	8.1	0	0	1021		0.68 non-landfill (west)
09/04/2013	GA7S	0	0	0.1	0.1		0.1		21.4	0	0	1003		-0.02 non-landfill (west)
24/04/2013	GA7S	0	0	0	0		0.3		21.4	0	0	1027		0.2 non-landfill (west)
08/05/2013	GA7S	0	0	0.1	0.2		0.7		20.3	0	0	1004		-0.05 non-landfill (west)
28/11/2011	CARW015	0	0		40.5		4.2		1.1	0	0	1015	NR	non-landfill (west)
06/12/2011	CARW015	0	0		14.2		2.9		0.6	0	0	1007		-0.16 non-landfill (west)
15/12/2011	CARW015													non-landfill (west)
03/01/2012	CARW015	-2.3	0		0.4		2.7		1.8					1.64 non-landfill (west)
12/02/2013	CARW015													non-landfill (west)
28/11/2011	CARW025	9	1.5		90.6		1.2		0.3	7	0	1015	NR	non-landfill (west)
06/12/2011	CARW025		Tap open		73.8		0.6		5.8	2	0	1007		-0.16 non-landfill (west)
15/12/2011	CARW025	16.8	2.2		99.9		0.6		0.6	0	0	1000		-0.46 non-landfill (west)
03/01/2012	CARW025	22.3	1.6		90.8		0.4		3.1	8	0	1006		-0.46 non-landfill (west)
12/02/2013	CARW025	0	0	0.2	0.2		0.1		20.9	0	0	1021	0.631944444	non-landfill (west)
09/04/2013	CARW025	5.1	3.8	94.6	31.6		0.1		19.6	0	0	1003		0 non-landfill (west)
24/04/2013	CARW025	9.5	4.3	84.1	17.4		0.4		17.1	0	0	1026		0.12 non-landfill (west)
08/05/2013	CARW025	0	0	31.5	20.5		14.5		14	0	0	1004		-0.07 non-landfill (west)
12/10/2010	CARW029B		0		0.2		0.5		20.9	ND	ND	1017		non-landfill (west)
25/10/2010	CARW029B		-1.1		1.3		1.5		18.8	0	0	1025		non-landfill (west)
28/11/2011	CARW029B	4.4	0.2		0.8		2.3		19.7	0	0	1015	NR	non-landfill (west)
06/12/2011	CARW029B	0	0		0		0.6		21.5	0	0	1007		3.71 non-landfill (west)
15/12/2011	CARW029B	0.2	0		0.6		2.1		19.7	0	0	1000		1.56 non-landfill (west)
03/01/2012	CARW029B	0	0		0.1		0.2		21.3	0	0	1006		0 non-landfill (west)
12/02/2013	CARW029B	0	0	0.1	0.1		0.2		20.8	0	0	1021		1.01 non-landfill (west)
09/04/2013	CARW029B	0.1	0	0	0		0.3		21.3	0	0	1003		0 non-landfill (west)
24/04/2013	CARW029B	0	0	0.1	0		0.1		0.1	0	0	1026		0.12 non-landfill (west)
08/05/2013	CARW029B	0	0	2	1.8		0.05		20.5	0	0	1005		-0.06 non-landfill (west)

Date	Hole	Flow (l/h)		Methane (CH4)		Carbon Dioxide		Oxygen (O2)		H2S (ppm)	CO (ppm)	Atmos. Pressure	Relative pressure	Location
		Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady					
12/10/2010	CARW024		0		0.6		2		19.3	1	ND	1017		in-landfill
25/10/2010	CARW024		-1.1		0.8		3.5		18.8	0	1	1025		in-landfill
17/11/2010	CARW024		-0.4		0.1				17.6	ND	ND	995		in-landfill
19/04/2011	CARW024		-1		0.1		0.6		19.6	0	1	1013		in-landfill
28/11/2011	CARW024	0	0		0		0.3		21.2	0	0	1015	NR	in-landfill
06/12/2011	CARW024	0	0		0		0.7		21.1	0	0	1007	-0.27	in-landfill
15/12/2011	CARW024	0	0		0		0.4		21.4	0	0	1000	1.56	in-landfill
03/01/2012	CARW024	0	0		0		0.1		21.4	0	0	1006	-82.2	in-landfill
12/02/2013	CARW024	0	0	0.1	0.1		0.1		20.9	0	0	1022	0.38	in-landfill
09/04/2013	CARW024	0	0	0	0		0		21.5	0	1	1003	0	in-landfill
24/04/2013	CARW024	0	0	0	0		0.4		20.9	0	0	1026	0.13	in-landfill
08/05/2013	CARW024	0	0	0.1	0.1		0		21.3	0	0	1004	-0.05	in-landfill
12/10/2010	MSMW156D		0		0.1		0		21.2	ND	ND	1017	-0.2	non-landfill (west)
25/10/2010	MSMW156D		-0.8		0.1		0.1		21.8	0	0	1025	0.6	non-landfill (west)
17/11/2010	MSMW156D		-0.3		0.1		0.1		21.6	ND	ND	995	0.51	non-landfill (west)
28/11/2011	MSMW156D	0	0		0		3.1		20.2	0	0	1015	NR	non-landfill (west)
06/12/2011	MSMW156D	0	0		0		0.3		21.7	0	0	1007	-0.37	non-landfill (west)
15/12/2011	MSMW156D	0	0	0.1	0		0.3		21.6	0	0	1000	-0.45	non-landfill (west)
03/01/2012	MSMW156D	0	0		0		0.1		21.5	0	0	1006	-82.2	non-landfill (west)
12/02/2013	MSMW156D	0	0	0.6	0.6		2.8		19.5	0	0	1021	-1.9	non-landfill (west)
09/04/2013	MSMW156D	0	0	0	0		0		21.7	0	1	1003	0.01	non-landfill (west)
24/04/2013	MSMW156D	0	0	0	0		0.1		21.4	0	0	1026	0.13	non-landfill (west)
08/05/2013	MSMW156D	0	0	0.1	0.1		0		21.4	0	0	1004	-0.05	non-landfill (west)
28/11/2011	MSMW156S1	-2.2	0		0.4		6		7.1	0	0	1015	NR	non-landfill (west)
06/12/2011	MSMW156S1	0	0		3.5		4.2		16.1	0	0	1007	-0.37	non-landfill (west)
15/12/2011	MSMW156S1	-0.8	0	6	5.7	3	2.7		19.1	0	0	1000	-0.45	non-landfill (west)
03/01/2012	MSMW156S1	0	0		2.9		2.7		18.8	0	0	1006	-82.2	non-landfill (west)
12/02/2013	MSMW156S1	0	0	3.6	3.6		2.4		18.4	0	0	1021	-1.9	non-landfill (west)
09/04/2013	MSMW156S1	0.8	0.2	0.8	0.5		0.3		20.9	0	0	1003	0.01	non-landfill (west)
24/04/2013	MSMW156S1	0.1	0.1	0.1	0.1		0.5		21	0	0	1026	0.13	non-landfill (west)
08/05/2013	MSMW156S1	0.1	0.1	0.1	0.1		0.1		21.3	0	0	1004	-0.05	non-landfill (west)
28/11/2011	MSMW156S2	0	0		5.8		6.6		20.6	0	0	1015	NR	non-landfill (west)
06/12/2011	MSMW156S2	0.3	0		34.2		4.2		11.5	7	0	1007	-0.37	non-landfill (west)
15/12/2011	MSMW156S2	-1.4	0	42.8	0.8	4.4	0.1	9.9	21.5	2	3	1000	-0.45	non-landfill (west)
03/01/2012	MSMW156S2	0	0		34.1		4.3		10.3	0	6	1006	-14.39	non-landfill (west)
12/02/2013	MSMW156S2	0.1	0.1	1	0.9		0.2		20.4	0	0	1021	-1.9	non-landfill (west)
09/04/2013	MSMW156S2	0	0	0.8	0.2		0		21.6	0	0	1003	0.01	non-landfill (west)
24/04/2013	MSMW156S2	0.2	0.1	0	0		0		21.4	0	0	1026	0.13	non-landfill (west)
08/05/2013	MSMW156S2	0.1	0.1	17.4	17.4		1.2		16.8	0	4	1004	-0.05	non-landfill (west)
09/04/2013	CARW002	0.4	0	0.1	0		0.4		21.6	0	0	1002	0	off-site (east)
24/04/2013	CARW002	0	0	0.1	0.1		2.4		20.6	0	0	1026	0.11	off-site (east)
08/05/2013	CARW002	-0.2	-0.2	0.6	0.6		7.2		16.9	0	4	1004	0.07	off-site (east)
09/04/2013	CARW005	2.1	0.2	0	0		0		21.7	0	0	1002	0	non-landfill (east)
24/04/2013	CARW005	0	0	0	0		0.1		21.3	0	0	1027	0.09	non-landfill (east)
08/05/2013	CARW005	0.4	0.4	0.2	0.2		0.8		19.7	0	0	1004	0.07	non-landfill (east)
09/04/2013	CARW007	0	0	0	0		0.6		21	0	0	1002	0	non-landfill (east)
24/04/2013	CARW007	-0.1	-0.1	0	0		0.7		20.6	0	0	1027	0.09	non-landfill (east)
08/05/2013	CARW007	0	0	0.1	0.1		0.5		20.9	0	0	1004	0.07	non-landfill (east)
09/04/2013	MSMW027S	-0.1	-0.1	0	0.1		0		21.7	0	0	1002	-0.02	non-landfill (west)
24/04/2013	MSMW027S	0	0	0	0		0		21.4	0	0	1027	0.1	non-landfill (west)
08/05/2013	MSMW027S	0	0	0.1	0.1		2.8		17.7	0	0	1004	-0.07	non-landfill (west)
12/10/2010	MSMW034		0.2		0.1		0.1		20.9	ND	ND	1017	-0.2	in landfill
25/10/2010	MSMW034		-1		0.1		0.9		20.2	0	0	1025	0.6	in landfill
17/11/2010	MSMW034		-0.3		0		0.4		21.1	ND	ND	995	0.51	in landfill
09/04/2013	MSMW034D	0	0	0	0		0.1		21.4	0	0	1002	0	in landfill
24/04/2013	MSMW034D	0	0	0	0		0.2		21.1	0	0	1026	0.11	in landfill
08/05/2013	MSMW034D	0.2	0.2	0.1	0.1		0.6		20.3	0	0	1004	0.07	in landfill

Date	Hole	Flow (l/h)		Methane (CH4)		Carbon Dioxide		Oxygen (O2)		H2S (ppm)	CO (ppm)	Atmos. Pressure	Relative pressure	Location
		Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady					
12/10/2010	MSMW035D1		0		0		0		21	ND	ND	1017	-0.2	in landfill
25/10/2010	MSMW035D1		-1		0		1		21	0	0	1025	0.6	in landfill
17/11/2010	MSMW035D1		-0.3		0.1		1.2		20.9	ND	ND	995	0.51	in landfill
09/04/2013	MSMW035D	0	0	0	0		0.1		21.4	0	1	1002	0	in landfill
24/04/2013	MSMW035D	-0.1	-0.1	0	0		0.3		21.4	0	0	1027	0.07	in landfill
08/05/2013	MSMW035D	0.2	0.2	0.1	0.1		0.8		20.5	0	0	1004	0.06	in landfill
12/10/2010	MSMW035D2		0.1		0		0		21	ND	ND	1017	-0.2	in landfill
25/10/2010	MSMW035D2		-1		0		0.4		21.5	0	0	1025	0.6	in landfill
17/11/2010	MSMW035D2		-0.3		0		0.2		21.5	ND	ND	995	0.51	in landfill
09/04/2013	MSMW035D2	0	0	0	0		0.1		21.4	0	0	1002	0	in landfill
24/04/2013	MSMW035D2	0	0	0	0		0.1		21.4	0	0	1027	0.07	in landfill
08/05/2013	MSMW035D2	0.2	0.2	0.1	0.1		0.3		21.4	0	0	1004	0.06	in landfill
12/10/2010	MSMW035S		0.1		0		0		21.2	ND	ND	1017	-0.2	in landfill
25/10/2010	MSMW035S		-1		0		0.2		21.5	0	0	1025	0.6	in landfill
17/11/2010	MSMW035S		-0.3		0		0.6		21.4	ND	ND	995	0.51	in landfill
09/04/2013	MSMW035S	0	0	0	0		0.3		21.6	0	0	1002	0	in landfill
24/04/2013	MSMW035S	-4.5	-4.5	0	0		2.2		19	0	0	1027	0.07	in landfill
08/05/2013	MSMW035S	0	0	0.1	0.1		1.7		19.6	0	0	1004	0.06	in landfill
12/10/2010	MSMW235		1.5		15.9		11.5		0.6	ND	ND	1017	-0.2	in landfill
25/10/2010	MSMW235		-1.1		13		12.1		0.5	0	0	1025	0.6	in landfill
17/11/2010	MSMW235		1.6		16.4		8.8		1.2	ND	ND	995	0.51	in landfill
09/04/2013	MSMW235	0.2	0.2	20.8	20.8		9.7		0.7	5	2	1001	0.05	in landfill
24/04/2013	MSMW235	0	0	20.4	20.4		9.5		0.3	0	2	1025	0.11	in landfill
08/05/2013	MSMW235	-0.2	-0.2	23	22.9		9.4		0.8	0	2	1004	0.04	in landfill
12/10/2010	MSMW236		0		2.4		0.2		20.8	ND	ND	1017	-0.2	in landfill
25/10/2010	MSMW236		-1.1		44.6		4.4		10.2	0	1	1025	0.6	in landfill
17/11/2010	MSMW236		1.2		0.1		0.2		21.2	ND	ND	995	0.51	in landfill
09/04/2013	MSMW236	0	0	11.5	11.5		1.1		18.7	0	1	1001	0.05	in landfill
24/04/2013	MSMW236	0	0	16.1	16.1		7.9		11	0	0	1025	0.11	in landfill
08/05/2013	MSMW236	0	0	22.3	22.2		7.4		4.4	1	1	1004	0	in landfill
12/10/2010	MSMW238		0		0.7		2.9		16.2	ND	ND	1017	-0.2	in landfill
25/10/2010	MSMW238		-0.8		5.2		10.3		4.2	0	0	1025	0.6	in landfill
17/11/2010	MSMW238								flooded					in landfill
09/04/2013	MSMW238	0	0	39.4	39		5.2		11.6	0	0	1001	0.05	in landfill
24/04/2013	MSMW238	0	0	34.8	34.8		5.8		11.8	0	0	1025	0.11	in landfill
08/05/2013	MSMW238	0.1	0.1	34.9	34.9		7		6.1	0	1	1004	0	in landfill
12/10/2010	MSMW152D		0		0.1		0		21.5	ND	ND	1017	-0.2	in landfill
25/10/2010	MSMW152D		-1		0.1		0.3		21.6	0	0	1025	0.6	in landfill
17/11/2010	MSMW152D		-0.4		0		0.2		21.8	ND	ND	995	0.51	in landfill
12/10/2010	MSMW033S		0.1		0		0		21.5	ND	ND	1017	-0.2	in landfill
25/10/2010	MSMW033S		-1		0		0.2		21.8	0	0	1025	0.6	in landfill
17/11/2010	MSMW033S		-0.3		0		0.1		21.6	ND	ND	995	0.51	in landfill
12/10/2010	MSMW033D		0		0.1		1.6		19.2	ND	ND	1017	-0.2	in landfill
25/10/2010	MSMW033D		-1		0		2		19.5	0	0	1025	0.6	in landfill
17/11/2010	MSMW033D		-0.3		0		1.9		19.2	ND	ND	995	0.51	in landfill
12/10/2010	MSMW239		0		0.1		0		21.5	ND	ND	1017	-0.2	in landfill
25/10/2010	MSMW239		-1		0.3		3		18	0	0	1025	0.6	in landfill
17/11/2010	MSMW239								flooded					in landfill
12/10/2010	MSMW228		0		0.1		0.7		20.1	ND	ND	1017	-0.2	in landfill
25/10/2010	MSMW228		-1.1		0.1		9.1		5.6	0	0	1025	0.6	in landfill
17/11/2010	MSMW228								Flooded					in landfill

Date	Hole	Flow (l/h)		Methane (CH4)		Carbon Dioxide		Oxygen (O2)		H2S (ppm)	CO (ppm)	Atmos. Pressure	Relative pressure	Location
		Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady					
09/04/2013	CBH 2	-0.1	-0.1	0	0		0		21.6	0	0	1003	-0.02	in landfill
24/04/2013	CBH 2	0	0	0	0		0.1		21.2	0	0	1026	0.11	in landfill
08/05/2013	CBH 2	0	0	0.2	0.2		0.8		19.6	0	0	1004	0.04	in landfill
09/04/2013	CBH 4	0.1	0.1	0.3	0.3		0		21.4	0	0	1003	-0.02	in landfill
24/04/2013	CBH 4	0	0	0.4	0.4		0.2		21	0	0	1026	0.11	in landfill
08/05/2013	CBH 4	0	0	0.6	0.6		0.1		21	0	0	1004	0.04	in landfill
09/04/2013	CBH 20	0.2	2	34.9	34.7		8.6		1.5	0	0	1003	0.05	in landfill
24/04/2013	CBH 20	0.2	0.2	35	34.9		9.1		0.5	2	10	1025	0.13	in landfill
08/05/2013	CBH 20	0.2	0.2	39.1	39.1		9.4		0.7	16	2	1003	0.18	in landfill
09/04/2013	CBH 31	0.5	0.4	44.7	44.7		4.6		2.1	11	2	1003	0.05	in landfill
24/04/2013	CBH 31	0	0	33.2	33.2		5.6		4.7	211	3	1025	0.11	in landfill
08/05/2013	CBH 31	0	0	45.8	45.8		4.2		0.1	368	3	1003	0.18	in landfill
09/04/2013	CBH 33	-0.1	-0.1	2.8	2.8		7.7		3.7	0	1	1004	0.05	in landfill
24/04/2013	CBH 33	0	0	0	0		0		21.5	0	0	1025	0.14	in landfill
08/05/2013	CBH 33	0	0	0.4	0.3		0		21.5	0	0	1003	0.14	in landfill
09/04/2013	CBH 36	0.1	0.1	3.2	3.2		9.7		3.9	0	1	1003	0.07	in landfill
24/04/2013	CBH 36	0	0	0	0		0		21.4	0	0	1025	0.14	in landfill
08/05/2013	CBH 36	0	0	0.1	0.1		0		21.5	0	0	1003	0.06	in landfill
09/04/2013	CBH 37	0.1	0	0.8	0.8		5.7		10.3	0	1	1003	0.07	in landfill
24/04/2013	CBH 37	0	0	0.2	0.2		0.6		19.5	0	0	1025	0.14	in landfill
08/05/2013	CBH 37	0.1	0.1	0.1	0.1		0		21.5	0	0	1003	0.14	in landfill
09/04/2013	CBH 41	0	0	12.7	11.6		2.5		15.7	0	0	1003	0.06	in landfill
24/04/2013	CBH 41	16	15.9	64.1	63.9		3		0.7	2	0	1025	0.1	in landfill
08/05/2013	CBH 41	0.2	0.2	46.8	46.8		2.6		0.9	0	0	1003	0.14	in landfill
09/04/2013	CBH 42	-0.1	0	18	18		1.7		15.5	0	1	1001	-0.05	in landfill
24/04/2013	CBH 42	0	0	53.2	53.2		5.3		0.6	0	8	1025	0.14	in landfill
08/05/2013	CBH 42	0	0	84.8	84.4		2.2		0.9	0	0	1004	0.07	in landfill
09/04/2013	CBH 48	-0.1	0.1	8.8	8.7		7.6		2.1	0	1	1003	0.05	in landfill
24/04/2013	CBH 48	0.1	0.1	2.5	2.5		4.3		11.9	0	0	1025	0.09	in landfill
08/05/2013	CBH 48	0	0	11.7	11.7		8.7		0.4	0	2	1003	0.18	in landfill
09/04/2013	CBH 58	0	0	0.5	0.5		2.7		16.3	0	1	1004	0.05	in landfill
24/04/2013	CBH 58	0	0	0.2	0		0.2		21.1	0	0	1025	0.11	in landfill
08/05/2013	CBH 58	0	0	0.1	0.1		0		21.4	2	0	1003	0.14	in landfill
09/04/2013	CBH 63	-0.1	-0.1	0	0		11.1		4.7	0	1	1003	0.08	in landfill
24/04/2013	CBH 63	-0.2	-0.2	0	0		2.9		17.5	0	0	1025	0.1	in landfill
08/05/2013	CBH 63	0	0	0.1	0.1		1.9		19.2	0	0	1003	0.06	in landfill

Richard Mitchener

Atkins

The Axis

10 Holliday Street

Birmingham

B1 1TF

richard.mitchener@atkinsglobal.com

© Atkins Ltd except where stated otherwise.

The Atkins logo, 'Carbon Critical Design' and the strapline
'Plan Design Enable' are trademarks of Atkins Ltd.