Tier 2 Detailed Site Investigation Former Landfill at Tipperary Town

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1. INTRODUCTION

South Tipperary County Council (the Council) completed a Tier 1 Assessment of the closed Tipperary Town Landfill in accordance with the "Code of Practice Environmental risk Assessment for Unregulated Waste Disposal Sites (CoP)" published by the Environmental Protection Agency (EPA).

The Assessment concluded that the site was a Class A – High Risk site, due the potential for leachate migration to surface water and the risk to humans from landfill gas linked to the nature of the bedrock beneath the site.

In September 2009, the EPA prepared guidance on the completion of the Tier 2 Assessment, which recommended that it be completed in two phases. Phase 1 should consist of Exploratory Site Investigation Works, following which the findings of the Tier 1 Assessment should be revised and the need for and/or extent of a Phase 2 Detailed Site Investigation should be determined.

The Department of Environment Heritage and Local Government (DEHLG) advised all local authorities that the Tier 2 Assessment would require an input from consultants with experience in the investigation of waste disposal sites, and in particular risk assessment. The Council appointed O'Callaghan Moran & Associates (OCM) to complete the Tier 2 Assessment.

OCM completed the Exploratory Site Investigation in November 2009. Given the high risk ranking, OCM considered that a geophysical survey should be completed, although this is not recommended for the Exploratory Phase in the EPA guidance. The survey provided valuable information on the site and in particular

- Allowed a more comprehensive delineation of the lateral and vertical extent of the waste;
- Confirmed the presence of a leachate plume migrating toward the surface water drain to the east of the site;
- Identified pockets of metal buried in the waste, which could present difficulties in subsequent drilling;
- Confirmed the composition of waste types and distribution and established total thickness of waste ;
- Allowed estimates of the thickness of subsoil beneath the waste and depth to bedrock;
- Indicated that the bedrock was most likely a shaley limestone, which was not a Regionally Important Aquifer.

The investigations confirmed the Class A High Risk Site category. However, the highest risk was linked to leachate migration to the surface water system. The risk presented by landfill gas to site users was eliminated, as it was proposed to demolish the onsite buildings. The level of risk posed to nearby residences reduced from High to Moderate, based on the information on the nature of the underlying bedrock obtained from the geophysical survey.

OCM concluded it was likely that leachate was migrating from the site toward a wetland area and into a drain, which ultimately discharges to the River Ara, several kilometres downstream of the site. OCM also concluded that a Detailed Site Investigation was required to assess the risk posed by leachate migration to the shallow groundwater system and the surface water system and the risk of off-site migration of landfill gas.

The Council submitted the OCM Exploratory Works report to the EPA for comment. The EPA accepted OCM's conclusions and recommended that the Detailed Site Investigation should include works to confirm the nature of the bedrock beneath the site.

1.1 Work Scope

OCM scoped out the Detailed Site Investigation based on the results of the Exploratory Works and EPA's comments. A network of deep bedrock groundwater monitoring wells was not considered necessary, but one borehole should be installed to confirm the nature of the bedrock. Monitoring wells were required to monitor the shallow groundwater in subsoil zone, where potential leachate migration had been detected during the geophysical survey. The proposed works included:

- Review of surface water quality in the drain leaving the site (results not available for exploratory phase assessment).
- Installation of three groundwater monitoring wells in the subsoils.
- Installation of one borehole to the bedrock.
- Installation of three combined leachate/landfill gas monitoring wells in the waste body.
- Installation of five gas monitoring wells outside the waste body, three of which would also be suitable for groundwater monitoring.
- Topographical Survey

In response to EPA's comments, the findings of the geophysical survey were re-evaluated to determine the validity of the conclusion on the nature of the bedrock aquifer.

2. SITE DESCRIPTION

The site is in the Townland of Carrownreddy and is within the Tipperary Environs area Figure 2.1). It served as the landfill for Tipperary Town from circa 1940, until it closed l in 1990. It is currently used by Tipperary Town Council as a Depot for road maintenance materials and machinery.

The site is approximately 1.8 hectares and contains a fenced off area of 0.2 hectares, which was apparently used exclusively for the disposal of wastewater sludge. The southern, and part of the eastern and western boundary is fenced, but there is no visible boundary, other than the raised landfilled area, on the northern side. In addition to the sludges, the other wastes accepted were most likely to have been commercial and domestic.

The southern part of the site has a hardcore surface and is used for storing road maintenance materials and machinery. The remainder of the site, north of the shed is covered with miscellaneous wastes, including large mounds of construction & demolition waste, waste tyres, household waste, white goods (fridges, washing machines etc) and green waste.

2.1 Surrounding Land Use

The adjoining lands are currently used primarily for low intensity agriculture, (grazing horses). Immediately to the north is a marshy area. There are at least 20 residences within 250m of the north west and western site boundaries. There is also a newly developed housing estate located approximately 250m to the south eats of the site. A residential development (~250 houses) is under construction approximately 200m to the northeast of the site and it is the intention to develop the land between landfill and the residential estate for light industrial warehousing.

The lands to the south are currently used for grazing, but it is intended to develop these lands for social housing and light industrial use. There are currently no proposals to develop the lands to the west, but there are plans to extend the Lake Road west to link up with the R497, the Donohill Road.

Tipperary Town Council intends to move the Depot to an alternative location to enable the investigation and remediation of the site. In the longer term, the Council intends to leave the site as a closed landfill.

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South Tipperary County Council

TITLE

Site Location

Legend

FIGURE No.

2.1

SCALE

3. DETAILED SITE INVESTIGATION

The intrusive site investigation works, which included the installation of the groundwater water and landfill gas monitoring wells and the collection of surface water and groundwater samples for laboratory testing, were carried out between 16th and 20th November 2009.

The investigations were undertaken in accordance with BS10175, 2001, Investigation of Potentially Contaminated Sites - Code of Practice and were supervised by OCM personnel experienced in the investigation of landfills and contaminated lands. Ms Ruth Hennessy of the Council attended on site during the works.

3.1 Well Installation

OCM provide specifications for the monitoring wells to the drilling contractor, who was experienced in the investigation of waste disposal sites. A track mounted air rotary drill rig, capable of travelling on variable terrain, was used to install the wells. The boreholes were logged in accordance with BS5930. The borehole locations are shown on Figure 3.1 and borehole logs are included in Appendix 1.

3.1.1 Leachate/Landfill Gas Wells

Three combined leachate/landfill gas wells (MW-1, MW-2 and MW-3) were installed in the waste body. The boreholes were advanced to the base of the waste and drilling stopped once the underlying natural ground was encountered. The depth to the base of the waste ranged from 10.4m to 13.5m below ground level (bgl). Leachate was encountered in the boreholes at depths ranging from 5.85m to 6.4m bgl.

3.1.2 Groundwater/Landfill Gas Wells

Five groundwater/landfill gas wells (MW-4, MW-5, MW-6, MW-7 and MW-8) were installed outside the waste body to monitor groundwater quality and landfill gas. MW- 4, 5, 6, 7 and 8 were installed down hydraulic gradient of the landfill. MW -4 and MW-8 are to the east of the waste, MW-5 and MW-7 are to the south, MW-6 to the south west

The locations of MW-4 and 8 were based on the evidence of leachate migration identified in the geophysical survey. In particular, MW-4 was installed to see if leachate was reaching the surface water drain to the east of the site.

It was not possible to install boreholes in the lands to the north, northwest and northeast of the site because the marsh area was flooded and the soft ground conditions prevented safe access.

MW-4, 5, 6 and 8 were advanced to an average depth of 10m below ground level. MW-7 was advanced to a depth of 20m below ground level. This borehole was installed to try to prove the depth and nature of the bedrock.

The drilling proved 0.65m of soft brown clay underlain by up to eight metres of very stiff brown clay with occasional boulders, which are dry. In MW-7 the clay is underlain by a layer of clay with gravel that extends to a depth of 13.5m and are water bearing. These clayey gravels are underlain by sand and gravel to 14.1m. A layer of dry very stiff clay underlies this from 14.1m to 15.75m. Beneath this is a water bearing layer of gravels from 15.75 to 20m (Ref Table 3.1).

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It was not possible to drill beyond 20m because the gravels prevented the casing from advancing by jamming the drill stem against the casing.

To prevent MW-7 from becoming a conduit for vertical migration of water from the upper to the lower gravel zone the borehole was back filled with a concrete/bentonite slurry using a tremie pipe to plug the borehole from the base to a level above the clay layer. A summary of the subsoil profile is presented in Table 3.1.

Table 3.1 Subsoil Profile Summary

Depth (m)	Description
0 – 0.65	Soft brown Clay.
0.65 – 7.35	Brown very stiff sandy gravelly CLAY. Gravels are subangular dark grey limestone.
7.35 – 13.35	CLAY and GRAVEL. Gravels are subangular to subrounded. Groundwater strike at 8.85m.
13.35 – 14.1	Dark grey limestone SAND and GRAVEL.
14.1 – 15.75	Brown very stiff sandy gravelly CLAY. Gravels are subangular dark grey limestone.
15.75 – 20	Clay rich dark grey limestone GRAVELS. Gravels are subangular to subrounded. Groundwater strike at 15.75m.

* Subsoil profile based on the borehole log for MW-7

3.1.2.1 Well Construction

The leachate and landfill gas monitoring wells were constructed using high density polyethylene (HDPE) 50 mm diameter standpipes, which were slotted from the base of the hole (the base of the waste material) to approximately 1m below ground level.

A gravel filter pack was inserted in the annular space between the boring and the standpipe to a level of 0.5 m above the slotted section of the standpipe. Above the gravel filter the annular space was filled with a bentonite seal. The solid section of the well pipe was brought above the ground level and was fitted with a landfill gas cap and valve to allow landfill gas monitoring. A steel protective well casing, set in a concrete base, was placed around each standpipe.

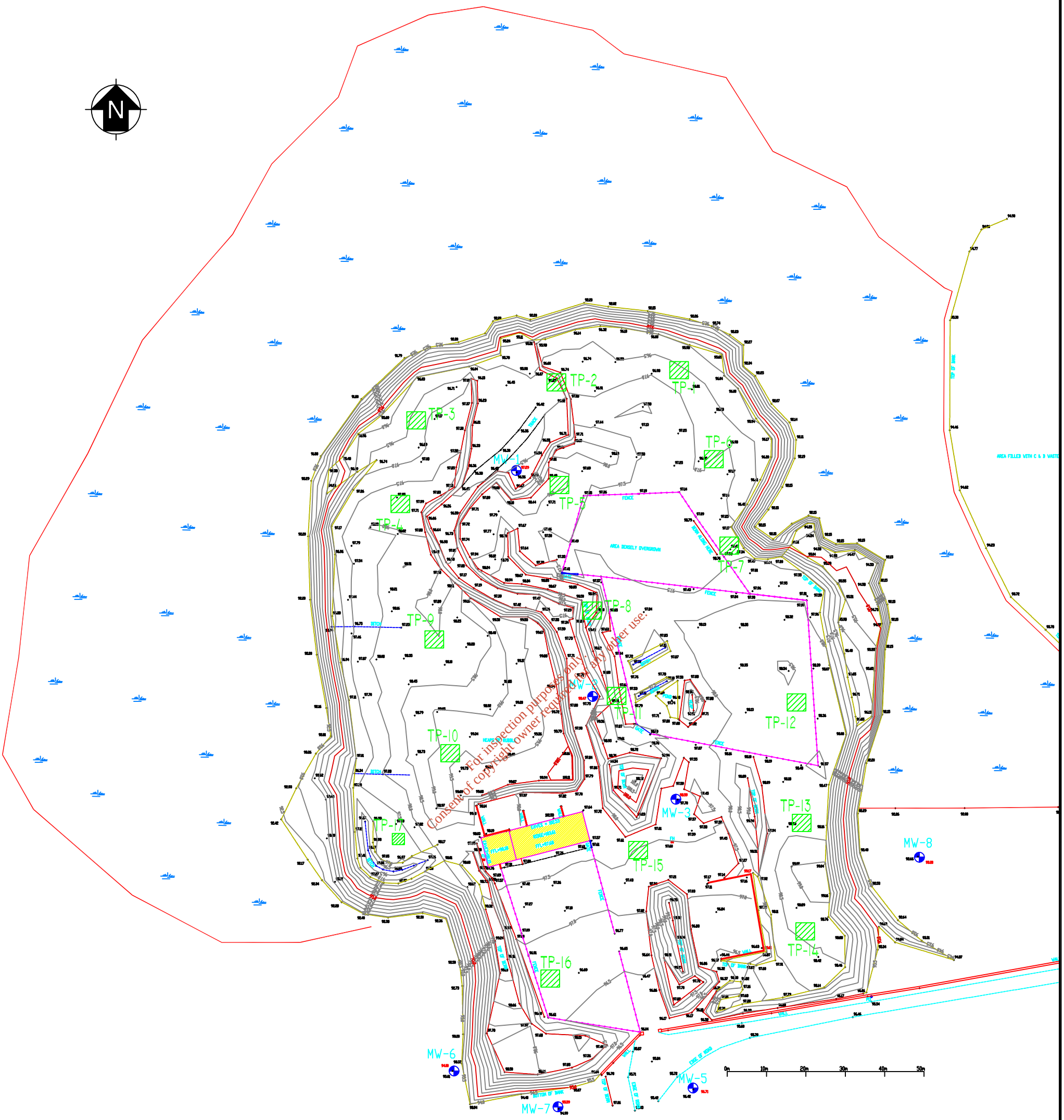
The groundwater wells were constructed using HDPE 50 mm diameter standpipes which were slotted from the base of the hole to approximately 2m below ground level.

A gravel filter pack was inserted in the annular space between the boring and the standpipe to a level of 0.5 m above the slotted section of the standpipe. Above the gravel filter the annular space was filled with a bentonite seal. The solid section of the well pipe was brought above the ground level and was fitted with a landfill gas cap and valve to allow landfill gas monitoring. A steel protective well casing, set in a concrete base, was placed around each standpipe.

3.2 Groundwater Monitoring

3.2.1 Sampling Methodology

Groundwater samples were taken from wells MW-4 to MW-8 on the 23rd November 2009. The samples were collected in accordance with the OCM groundwater sampling protocol, which is included in Appendix 2.



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CLIENT

SOUTH TIPPERARY COUNTY COUNCIL

DETAILS

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TRIAL PIT AND BOREHOLE LOCATIONS

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After completion of groundwater level measurements, each well was purged to remove the stagnant water in the well and surrounding gravel pack using a 12 volt submersible pump and dedicated polypropylene tubing in each well to prevent cross contamination. pH, electrical conductivity and temperature were measured and the results along with visual observations are presented in Table 3.2.

The samples were placed in laboratory prepared containers, stored in a cooler, and sent for analyses to Jones Environmental Forensics Ltd laboratory. The Chain of Custody (COC) documentation is included in Appendix 3.

Table 3.2 Groundwater Field Measurements

Borehole Number	MW-4	MW-5	MW-6	MW-7	MW-8
Water Level (mBTOC)	0.3	1.85	0.7	6.35	3.94
Top of Casing (mOD)	93.26	96.71	94	95.59	93.2
Water Level (mOD)	92.96	94.86	93.3	89.24	89.26
pH	7.98	8.22	8.16	7.99	7.65
EC (µS/cm)	1,365	1,126	1,320	1,102	1,398
Temperature	10.1	10.2	10.2	10.3	10.6
Colour	Cloudy	Cloudy	Cloudy	Clear	Clear
Odour	None	None	None	None	None
Recovery	Good	Good	Good	Good	Good

3.2.2 Laboratory Analysis

The samples were analysed for a range of organic and inorganic parameters that included, pH and electrical conductivity, dissolved oxygen, ammonia, nitrite, nitrate, orthophosphate, potassium, sodium, chloride, sulphate, metals, cyanide, total organic carbon (TOC), polyaromatic hydrocarbons (PAH), volatile organic compounds (VOC), semi-volatile organic compounds (sVOC) and pesticides.

The laboratory methodologies were all ISO/CEN approved or equivalent and the method detection limits (MDL) were all below the relevant guidance limit.

3.2.3 *Laboratory Results*

The full laboratory test report is in Appendix 3 and the results are summarised in Table 3.3, 3.4 and 3.5. The table includes Interim Guideline Values (IGV) published by the EPA. The IGVs are not statutory, but were developed to assist in the assessment of impacts on groundwater quality in the context of the implementation of the EU Water Framework Directive. The guidelines are based on, but are more conservative than the Dinking Water quality standards.

Table 3.3 Groundwater Results – Inorganics and Total Organic Carbon

Sample I.D. Sample Date	Units	MW-4	MW-6	MW-8	IGV
Arsenic	µg/l	6	6.6	6.6	10
Boron	µg/l	25	258	20	1,000
Cadmium	µg/l	<0.5	<0.5	<0.5	5
Copper	µg/l	<7	<7	12	30
Mercury	µg/l	<1	<1	<1	1
Nickel	µg/l	<2	2	4	20
Lead	µg/l	5	7	8	10
Zinc	µg/l	<3	<3	10	100
Iron	µg/l	<20	<20	<20	200
Manganese	µg/l	116	342	538	50
Calcium	mg/l	119.10	144.4	147.7	200
Magnesium	mg/l	9.30	14.82	19.03	50
Sulphate	mg/l	14.78	104.22	11.22	200
Chloride	mg/l	57.9	135.9	276.2	30
Fluoride	mg/l	<0.3	<0.3	<0.3	1
Total Alkalinity as CaCO3	mg/l	308	388	368	No Abnormal Change
Total Cyanide	µg/l	<40	<40	<40	10
Chromium - total	µg/l	<1.5	<1.5	<1.5	30
Phosphorous	µg/l	10	12	11	30
Potassium	mg/l	1.58	5.64	1.21	5
Sodium	mg/l	40.11	101.30	81.15	150
pH	pH units	7.82	8.02	8.30	6.5-9.5
Electrical Conductivity	µS/cm	1232	1389	1490	1,000
Total Oxidised Nitrogen	mg/l	1.22	42.27	<0.05	No Abnormal Change
Ammonia	mg/l	0.7	0.8	0.2	0.15
Total Dissolved Solids	mg/l	472	947	919	-
TOC	mg/l	5	10	6	-

Table 3.4 Groundwater Results PAH

Parameter	Units	MW-4	MW-6	MW-8	IGV
Naphthalene	µg/l	<0.1	<0.1	<0.1	**1**
Acenaphthylene	µg/l	<0.08	<0.08	<0.08	**-**
Acenaphthene	µg/l	<0.1	<0.1	<0.1	**-**
Fluorene	µg/l	<0.07	<0.07	<0.07	**-**
Phenanthrene	µg/l	<0.07	<0.07	<0.07	**-**
Anthracene	µg/l	<0.08	<0.08	<0.08	**10000**
Fluoranthene	µg/l	<0.09	<0.09	<0.09	**1**
Pyrene	µg/l	<0.12	<0.12	<0.12	**-**
Benz(a)anthracene	µg/l	<0.09	<0.09	<0.09	**-**
Chrysene	µg/l	<0.1	<0.1	<0.1	**-**
Benzo(bk)fluoranthene	µg/l	<0.26	<0.26	<0.26	**0.50**
Benzo(a)pyrene	µg/l	<0.12	<0.12	<0.12	**0.01**
Indeno(123cd)pyrene	µg/l	<0.1	<0.1	<0.1	**0.05**
Dibenzo(ah)anthracene	µg/l	<0.1	<0.1	<0.1	**-**
Benzo(ghi)perylene	µg/l	<0.12	<0.12	<0.12	**-**
2-Methylnaphthalene	µg/l	<10	<10	<10	**-**
Total PAHS	µg/l	<1.60	<1.60	<1.60	

Table 3.5 Groundwater Results VOC, sVOC and Pesticides -

Parameter	Units	MW-4	MW-6	MW-8	IGV
VOCs					
Ethylbenzene	µg/l	<3	<3	<3	10
p/m-Xylene	µg/l	<5	<5	<5	10
o-Xylene	µg/l	<3	<3	<3	10
1,2,4-Trimethylbenzene	µg/l	<3	<3	<3	-
4-Isopropyltoluene	µg/l	<3	<3	<3	-
Naphthalene	µg/l	<2	<2	<2	1
DRO	mg/l	<0.01	<0.01	<0.01	0.01
Mineral Oil	mg/l	<0.01	<0.01	<0.01	0.01
sVOC	µg/l	ND	ND	ND	-
Pesticides	µg/l	ND	ND	ND	

Elevated levels of ammonia manganese, chloride and electrical conductivity, which are indicative of leachate contamination were detected in the shallow gravel/clay zone The levels decrease in concentration moving from MW-8 located east of the waste body to MW-4, approximately 150m east of the landfill approximately 10 west of the drain.

3.3 Leachate Monitoring

3.3.1 Sampling Methodology

Leachate samples were collected from MW-1 to MW-3 on the 23rd November 2009. The samples were collected in accordance with the OCM sampling protocol, which is included in Appendix 2.

After completion of leachate level measurements, each well was purged using dedicated PVC bailers. The field measurements recorded are presented in Table 3.6. A strong hydrocarbon odour was noted from the sample collected from MW-1 and a black oily residue noted on the bailer. The samples were placed in laboratory prepared containers, stored in a cooler, and sent for analyses to Jones Environmental Forensics. The COC documentation is included in Appendix 3.

Table 3.6 Leachate Field Measurements

Borehole Number	MW-1	MW-2	MW-3
Water Level (mBTOC)	4.34	5.8	6.91
Top of Casing (mOD)	97.29	98.47	98.59
Water Level (mOD)	92.95	92.67	91.68
pH	8.26	8.69	8.01
EC	>3999	>3999	>3999
Temperature	10.9	10.8	10.8
Colour	Black	Black	Black
Odour	Hydrocarbon	Putrescible	Putrescible
Recovery	Good	Good	Good

3.3.2 Laboratory Analysis

The samples were analysed for a range of organic and inorganic parameters that included pH and electrical conductivity, total oxidised nitrogen (TON), ammonia, biological oxygen demand (BOD), chemical oxygen demand (COD), sulphate, chloride, fluoride, total alkalinity, metals, total cyanide, phosphorus, mineral oil, VOC, sVOC, PAH, diesel range organics (DRO) and pesticides. The laboratory methodologies were all ISO/CEN approved or equivalent and the method detection limits (MDL) were all below the relevant guidance limit.

3.3.3 Laboratory Results

The full laboratory test report is in Appendix 3 and the results are summarised in Tables 3.7, 3.8 and 3.9. Included in the Table for comparative purposes are the groundwater IGVs

Table 3.7 Leachate Results – Inorganics, TON and BOD

Sample I.D. Sample Date	Units	MW-1	MW-2	MW-3	IGV
Arsenic	µg/l	19.2	17.1	10.3	10
Boron	µg/l	945	1917	733	1,000
Cadmium	µg/l	<0.5	<0.5	<0.5	5
Copper	µg/l	<7	<7	<7	30
Mercury	µg/l	<1	<1	<1	1
Nickel	µg/l	4	15	<2	20
Lead	µg/l	16	5	11	10
Zinc	µg/l	4	11	4	100
Iron	µg/l	81	52	<20	200
Manganese	µg/l	903	385	706	50
Calcium	mg/l	122.30	47.91	166.40	200
Magnesium	mg/l	42.28	28.96	58.08	50
Sulphate	mg/l	6.79	100.53	3.15	200
Chloride	mg/l	235.2	948.6	1703.7	30
Fluoride	mg/l	<0.3	0.3	0.5	1
Total Cyanide	µg/l	<40	<40	<40	10
Chromium - total	µg/l	19.1	2.5	16.6	30
Phosphorous	µg/l	56	336	21	30
Potassium	mg/l	74.02	127.00	65.60	5
Sodium	mg/l	100.30	352.50	586.30	150
pH	pH units	8.01	8.50	7.88	6.5-9.5
Electrical Conductivity	µS/cm	3710	4370	6370	1,000
TON	mg/l	<0.05	<0.05	<0.05	No Abnormal Change
Ammonia	mg/l	70.5	43.5	18.1	0.15
BOD settled	mg/l	20	26	9	-
COD	mg/l	114	183	52	-

Table 3.8 Leachate PAH Results - 23/11/2009

Parameter	Units	MW-1	MW-2	MW-3	IGV
Naphthalene	µg/l	**42.5**	<0.1	<0.1	**1**
Acenaphthylene	µg/l	<0.08	<0.08	<0.08	**-**
Acenaphthene	µg/l	**1.4**	<0.1	<0.1	**-**
Fluorene	µg/l	**0.90**	<0.07	<0.07	**-**
Phenanthrene	µg/l	**0.80**	<0.07	<0.07	**-**
Anthracene	µg/l	<0.08	<0.08	<0.08	**10000**
Fluoranthene	µg/l	<0.09	<0.09	<0.09	**1**
Pyrene	µg/l	<0.12	<0.12	<0.12	**-**
Benz(a)anthracene	µg/l	<0.09	<0.09	<0.09	**-**
Chrysene	µg/l	<0.1	<0.1	<0.1	**-**
Benzo(bk)fluoranthene	µg/l	<0.26	<0.26	<0.26	**0.50**
Benzo(a)pyrene	µg/l	<0.12	<0.12	<0.12	**0.01**
Indeno(123cd)pyrene	µg/l	<0.1	<0.1	<0.1	**0.05**
Dibenzo(ah)anthracene	µg/l	<0.1	<0.1	<0.1	**-**
Benzo(ghi)perylene	µg/l	<0.12	<0.12	<0.12	**-**
2-Methylnaphthalene	µg/l	19	<10	<10	**-**
Total PAHS	µg/l	**64.60**	<1.60	<1.60	

Table 3.9 Leachate VOC, sVOC and Pesticides Results

Parameter	Units	MW-1	MW-2	MW-3	IGV
VOCs					
Ethylbenzene	µg/l	4	<3	<3	10
p/m-Xylene	µg/l	9	<5	<5	10
o-Xylene	µg/l	5	<3	<3	10
1,2,4-Trimethylbenzene	µg/l	8	<3	<3	-
4-Isopropyltoluene	µg/l	10	<3	<3	-
Naphthalene	µg/l	68	<2	<2	1
DRO	mg/l	0.351	0.092	<0.01	0.01
Mineral Oil	mg/l	<0.01	<0.01	<0.01	0.01
sVOC	µg/l	ND	ND	ND	-
Pesticides	µg/l	ND	ND	ND	

The results confirm the presence of an aged leachate in the waste mass. The leachate levels range from 91.68 – 92.95mOD and indicate variable levels associated with localized perching within the waste body. The water levels in the wells immediately outside the landfill ranges from 89.24 – 94.86mOD.

The variations in level again probably relate to local variations in the natural subsoil permeability. The variations in level between the leachate and the surrounding wells do not indicate a direct hydraulic connection between the leachate and the groundwater in the gravels. However, the levels of manganese, chloride and ammonia detected in the wells outside the landfill footprint do indicate that leachate has migrated, albeit at dilute concentrations, into this gravel zone.

3.4 Surface Water Monitoring

A surface water drain flows from the site to the east for 150m and then turns south towards and passes beneath the access road towards a housing development. Where the drain reaches this development it is piped through Tipperary Town and eventually discharges to the River Ara. A surface water sample was collected from the drain approximately 50m downstream of the waste body during the Exploratory Works, but the results were not available for inclusion in the Exploratory Phase Report.

3.4.1 Sampling Methodology

The sampling was carried out by full submergence of the laboratory supplied sample containers into the surface water body where possible. During submergence every effort was made to keep the container steady so as to prevent sediment disturbance. Field measurements of temperature, pH, electrical conductivity and dissolved oxygen were recorded.

The samples were stored in cooler boxes to maintain sample temperature at approximately 4°C. All the samples were submitted to Jones Environmental Forensics in the UK within 24 hours of sampling. The COC is included in Appendix 3.

3.4.2 Laboratory Analysis

The samples were analysed for a range of organic and inorganic parameters that included indicators of general water quality and leachate contamination. The laboratory methodologies were all ISO/CEN approved or equivalent and, with the exception of ammonia, the method detection limits were all below the relevant guidance limit.

3.4.3 Laboratory Results

The laboratory test report is contained in Appendix 3 and the results are summarised in Table 3.10. The table includes for comparative purposes Environmental Quality Standards (EQS) published by the EPA. The EQS limits are proposed water quality standards and are derived from the EU Directive on Drinking Water Quality 80/778/EEC and the Directive on the Protection of Groundwater against pollution caused by certain dangerous substances 80/66/EEC.

Table 3.10 Surface Water Results

Sample I.D.	Units	SW-1	EQS
pH	pH Units	7.290	4.5-9
Electrical Conductivity	uS/cm	707.000	-
Arsenic	mg/l	0.004	0.025
Boron	mg/l	0.034	-
Cadmium	mg/l	<0.005	0.0015
Copper	mg/l	<0.007	0.03
Lead	mg/l	<0.005	0.0072
Manganese	mg/l	<0.002	-
Magnesium	mg/l	9.420	-
Mercury	mg/l	<0.001	0.00007
Nickel	mg/l	<0.002	0.02
Iron	mg/l	0.182	1
Total Cyanide	mg/l	<0.04	0.01
Total Chromium	mg/l	<0.0015	0.0047
Zinc	mg/l	<0.003	0.1
Sulphate	mg/l	26.99	200
Chloride	mg/l	28.16	250
Calcium	mg/l	103.40	-
Fluoride	mg/l	<0.3	5
Phosphorus	mg/l	0.07	-
Total Oxidised Nitrogen	mg/l	0.50	No Abnormal change
Total Suspended Solids	mg/l	6.00	-
Total Alkalinity as CaCO3	mg/l	240.00	-
BOD	mg/l	3.00	5
COD	mg/l	23.00	-
Potassium	mg/l	5.44	-
Sodium	mg/l	17.54	-
Ammonia*	mg/l	1.32	0.02
PAH	mg/l	ND	-
VOC	mg/l	ND	-
sVOC	mg/l	ND	-
Pesticides	mg/l	ND	-
DRO	mg/l	<0.01	-
Mineral Oil	mg/l	<0.01	-

ND - denotes not detected

With the exception of ammonia (1.7mg/l), all of the parameters were less than the relevant EQS and there is no evidence of leachate contamination. It should be noted however that the sampling took place after a period of very wet weather, when dilution was significant.

3.5 Landfill Gas Monitoring

Landfill gas monitoring was conducted in all eight monitoring wells (MW-1 to MW-8) on the 23rd November, 2nd December and on the 10th December 2009. The monitoring included the measurement of methane, carbon dioxide, oxygen and atmospheric pressure using a Gas Data LSMx gas analyser. The meter was calibrated before use. The detection limit is 0.1% for methane, carbon dioxide and oxygen.

The results are presented in Table 3.11. The table includes guideline limits taken from the Department of the Environment (DOE) publication on the 'Protection of New Buildings and Occupants from Landfill Gas' (1994).

3.5.1 Wells Inside the Waste Body

MW-1, MW-2 and MW-3 are all located within the waste body. Carbon dioxide and methane were detected in all three wells ranging from 31.5% to 56% for methane, and 1.5% to 16% for carbon dioxide. Oxygen levels ranged from 0.8% to 1.4% for oxygen.

The guidelines stipulate that, where carbon dioxide or methane are present in a landfill at 0.5% v/v and 1% v/v respectively, then housing should not be erected within 50 m of the landfill and private gardens should not be allowed within 10 m. There is one building on site, which was previously used of materials including pipes. This building is no longer in use, has been sealed and will shortly be demolished. There is a halting site located approximately 150m to the south of the site.

3.5.2 Wells Outside the Waste Body

MW-4, MW-5, MW-6, MW-7 and MW-8 are all located outside the waste body. Methane was only detected in one of the wells, MW-8 along the eastern site boundary where the concentrations ranged from 0.8% to 1.3%. Carbon dioxide was detected in all of the wells, with the concentrations ranging from 0% to 5%. The oxygen levels ranged from 2.9% to 22.6%, with the lowest level detected in MW-8.

Table 3.11 Landfill Gas Monitoring Data: November and December 2009

Monitoring Well	Methane			Carbon Dioxide			Oxygen			Barometric Pressure		
	23/11/2009	02/12/2009	08/12/2009	23/11/2009	02/12/2009	08/12/2009	23/11/2009	02/12/2009	08/12/2009	23/11/2009	02/12/2009	08/12/2009
MW-1	31.5	53	52	12	15	16	1.4	1.1	1	1002	1001	1002
MW-2	55	55	56	3.6	3.9	4.1	1.3	1.1	1.1	1002	1001	1002
MW-3	35	37.5	38	1.5	3.6	3.7	1.1	0.8	0.9	1002	1001	1002
MW-4	0	0	0	1.9	2.1	2.5	22.3	19.9	18.4	1002	1001	1002
MW-5	0	0	0	1.6	0.9	1	18.1	21.8	21.6	1002	1001	1002
MW-6	0	0	0	1.8	4	3.6	21	20.1	20.1	1002	1001	1002
MW-7	0	0	0	0	0.9	1	22.6	3.7	19.1	1002	1001	1002
MW-8	0.8	1.1	1.3	5	4.5	4.6	2.9	3.6	3.6	1002	1001	1002
DOE Limit (%)	**0.5%**			**1%**			**-**			**-**		

DOE limit not established

3.6 Waste Characterisation

Waste Characterisation had been undertaken during the Exploratory Phase Site Investigations which were detailed in a separate Exploratory Phase Site Investigation report. As part of the assessment two waste samples were selected to be analysed but results had not been received in time for the completion of that report. The results are incorporated below to complete the characerisation process. The samples were analysed for the parameters set out in the EU Council Decision establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC (Council Decision).

The Council Decision sets threshold limits for a range of inorganic and organic parameters, which define whether a waste is suitable for disposal to an inert, non-hazardous or hazardous waste landfill. Based on field observations it was considered the parameters specified in the Council Decision were appropriate for assessment purposes. However, depending on the test results, additional analyses may be carried out.

The solid samples were tested for Total Organic Carbon (TOC), BTEX (benzene, toluene, ethylbenzene and xylene) Polychlorinated biphenyls (PCB), Mineral Oil and Polycyclic Aromatic Hydrocarbons (PAH). Leachate generated from the waste samples were tested for metals (arsenic, barium, cadmium, chromium, copper, mercury, molybdenum, nickel, lead, antimony, selenium and zinc), chloride, fluoride, soluble sulphate, phenols, dissolved organic carbon (DOC) and total dissolved solids (TDS). The laboratory methodologies were all ISO approved or equivalent and the method detection limits (MDL) were all below the relevant guidance limit.

The full laboratory test report is in Appendix 3 and the results are summarised in Table 3.1. Included in the Table are the WAC for Inert and Non-Hazardous Waste.

Table 3.12 Waste Characterisation

Parameter	Unit	TP-4	TP-15	Inert Landfill	Non-Hazardous Landfill
Antimony	**mg/kg**	0.03	0.24	0.06	0.7
Arsenic	**mg/kg**	0.08	0.115	0.5	2
Cadmium	**mg/kg**	<0.01	<0.01	0.04	1
Copper	**mg/kg**	<0.12	<0.12	2	50
Chromium	**mg/kg**	<0.02	<0.02	0.5	10
Lead	**mg/kg**	<0.1	<0.1	0.5	10
Nickel	**mg/kg**	<0.06	0.05	0.4	10
Molybdenum	**mg/kg**	0.13	0.95	0.5	10
Selenium	**mg/kg**	<0.03	<0.03	0.1	0.5
Zinc	**mg/kg**	0.05	0.09	4	50
Mercury	**mg/kg**	<0.001	<0.001	0.01	0.2
Barium	**mg/kg**	0.48	1.92	20	100
Chloride	**mg/kg**	70	1847	800	15,000
Fluoride	**mg/kg**	<1	<1	10	150
Sulphate*	**mg/kg**	503	934	1000*	20,000
Dissolved Organic Carbon	**mg/kg**	120	190	500	800
Total Dissolved Solids	**mg/kg**	2,340	5,860	4,000	60,000
Phenols	**mg/kg**	<1	<1	1	NE
Total Organic Carbon	**mg/kg**	2,100	2,300	30,000**	NE
Benzene	**mg/kg**	<0.002	<0.002	6	NE
Toluene	**mg/kg**	<0.002	<0.002	6	NE
Ethylbenzene	**mg/kg**	<0.002	<0.002	6	NE
Total Xylene	**mg/kg**	<0.006	<0.006	6	NE
PCB Total of 7	**mg/kg**	<0.035	<0.035	1	NE
Naphthalene	**mg/kg**	<0.03	<0.03	NE	NE
Acenaphthylene	**mg/kg**	<0.02	0.09	NE	NE
Acenaphthene	**mg/kg**	<0.02	0.06	NE	NE
Fluorene	**mg/kg**	<0.02	0.09	NE	NE
Phenanthrene	**mg/kg**	0.29	0.76	NE	NE
Anthracene	**mg/kg**	0.10	0.31	NE	NE
Fluoranthene	**mg/kg**	0.59	1.96	NE	NE
Pyrene	**mg/kg**	0.49	1.60	NE	NE
Benzo(a)anthracene	**mg/kg**	0.40	1.15	NE	NE
Chrysene	**mg/kg**	0.40	1.18	NE	NE
Benzo(b)+Benzo(k)fluoranthene	**mg/kg**	1.09	2.21	NE	NE
Benzo(a)pyrene	**mg/kg**	0.58	1.57	NE	NE
Indeno(123cd)pyrene	**mg/kg**	0.46	1.06	NE	NE
Dibenzo(ah)anthracene	**mg/kg**	0.40	0.61	NE	NE
Benzo(ghi)perylene	**mg/kg**	0.55	1.09	NE	NE
Coronene	**mg/kg**	0.19	0.3	NE	NE
Total 17 PAH's	**mg/kg**	5.54	14	NE	NE
Mineral Oil	**mg/kg**	<30	<30	500	NE

NE - Not Established

* - sulphate level exceeding inert waste limit may be considered as complying if the TDS value does not exceed 6,000mg/kg at L/S = 10l/kg.

**-a higher limit may be accepted provided the DOC values of 500mg/kg is achieved

The majority of the parameters were below the Inert Limits; however the levels of antimony, molybdenum, chloride and TDS exceeded the WAC Inert Limit in the samples from TP-15. No significant zones of potentially contaminated or hazardous waste were identified during the site investigations. Based on the site observations during the investigation and the sampling results, the waste is considered to be Non-Hazardous and typical of that found in small scale municipal landfills.

3.7 Re-evaluation of the Geophysical Site Investigation

The Agency review of the Geophysical Site Investigation noted *"that a reclassification of the aquifer vulnerability was being considered due to the results of the geophysical survey. Caution should be observed when reclassifying bedrock on resistivity surveys only – it is best practice to also use seismic geophysics for that interpretation"*

OCM requested APEX Geoservices, who conducted the survey, to review the findings in response of the EPA's comments. APEX comments are as follows:

The Tier 1 Desk Study Assessment indicated the presence of possible high vulnerability and karstic bedrock aquifer beneath the site. The expected resistivity response on R5 & R6 (resistivity lines run outside the landfill footprint) for high vulnerability and Waulsortian karst limestone would be **high resistivity (1000-5000 ohm-m)** at relatively shallow depth (5-10m). This was not the case and **low resistivity (50-250 ohm-m)** was observed to c. 22m bgl on both profiles. This resistivity range is typical of South Midlands gravelly clays with occasional gravel pockets.

At c. 22m, there was a distinct transition on both R5 and R6 to slightly higher resistivity material **(250-400 ohm-m),** which was interpreted as shaley or argillaceous bedrock (probable Athassel dark shaley cherty limestone) rather than the expected cleaner Knockordan or Waulsortian-equivalent limestone. Such variations from the published geological maps would not be unusual in drift covered areas.

Given the strongly contrasting resistivity readings (250 – 400 ohm-m found versus 1000 – 5000 ohm-m typical of the Rkd Aquifer mapped for the area beneath the site) OCM concurs with the Apex Geoservices comments

A deep borehole (MW-7) was installed away from the landfill footprint to try to establish the nature of the bedrock. Dark grey shaley limestone gravels were encountered from approximately 15.5 -20m when the drilling terminated due to the nature of the gravels.

While top of bedrock was not confirmed, the nature of the gravels and difficulty in advancing the drill stem in this hole suggests that the top of bedrock was close. This is supported by the depth to bedrock estimated in the geophysical survey. OCM considers that, based on the nature of the gravels at depth (shaley limestone), and the geophysical interpretation provided by Apex, that the bedrock beneath the site is a shaley limestone and not the Waulsortian karst aquifer.

3.8 Assessment of Surface and Groundwater Pathways for Leachate Migration

3.8.1 Surface Water

Leachate levels recorded in the waste (MW-1 – MW-3) range from 91.68 – 92.95mOD. These levels are all typically more than 0.5m above the natural ground level surrounding the landfill and indicate that the leachate can potentially migrate through the landfill into the Marsh and ultimately into the drain to the east. It is possible therefore that leachate reaches the drain through the ponded marsh area seeping out along the base of the waste. However, based on the existing data the level of impact at such times is very low due to dilution by run-off from the surrounding lands.

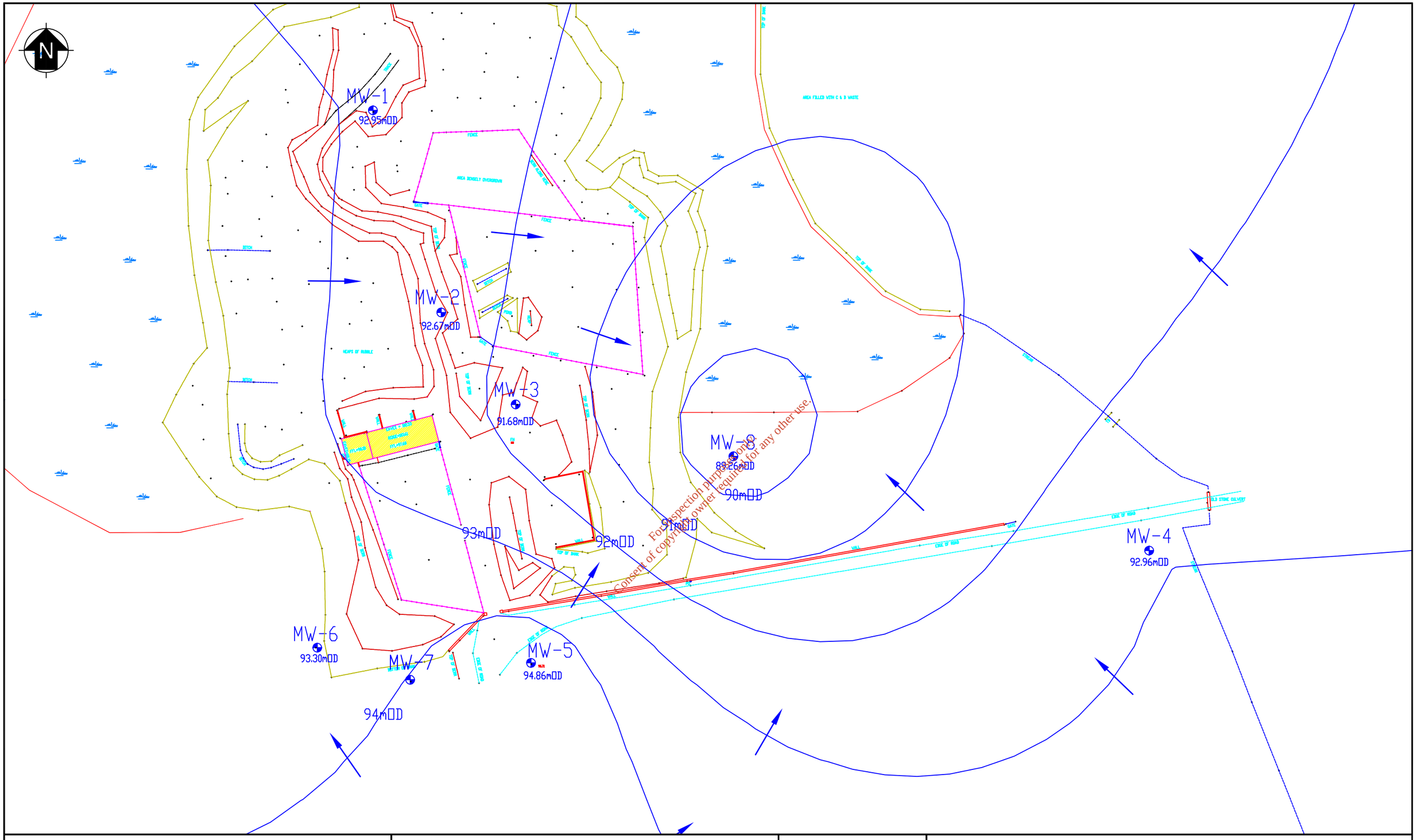
No leachate break outs were observed around the margins of the landfill and the marsh area did not look to be significantly impacted as a result of leachate discharge from the waste. Long term monitoring of the marsh and surface water drain is required to determine if surface water is impacted by leachate discharges from the site, particularly during low flow conditions. Monitoring of water quality in the marsh area may also be required though it is likely that the water in this area will be stagnant with low oxygen levels given its topographically low setting.

A groundwater flow direction has been compiled for the site (Figure 3.2). The groundwater table appears to reflect the topography of the natural ground with a low point in the vicinity of MW-8 to the east of the landfill and flow toward this area from all other areas.

The log for MW-4 located 10m from the surface water drain to the east of the landfill well indicates that the subsoil here comprise 7-8m of clay between the gravel/clay zone at depth and the base of the drain where the drain flows from north to south to the east of the landfill. There does not appear to be any direct connection therefore between this clayey gravel zone at depth and the drain. It appears that the marsh area is the outlet for groundwater /leachate within the catchment and that as the marsh area fills up it over flows to the surface water drain. Leachate migration from the waste is occurring from the waste body toward the natural low point in the marsh along the interface between the base of the waste and compacted natural ground where the landfill merges with the marsh area.

It is unclear if the upper gravelly clay zone is just a lense of gravel in the local area but it has been intersected in all the shallow wells. Groundwater level data indicates that currently leachate migration is not occurring through this zone down hydraulic gradient to the east and south toward the River Ara

The presence of a hard dry 1.75m thick clay layer beneath the uppermost gravel zone would most likely prevent leachate migration to the bedrock aquifer. As the available site investigation data indicates that the aquifer is likely to be Ll, the risk posed is less significant than if the aquifer were a regionally important karst bedrock aquifer.



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environmental management for business

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DRAWING No.
3.2

NOTES

TITLE
GROUNDWATER FLOW DIRECTION MAP

SCALE

REV.

The public supply well (Tipperary CoOp) is located 1.5 km to the south of the site are uncontaminated, which indicates that leachate contamination in the gravels is not impacting on water quality in the bedrock aquifer.

Comparing the concentrations of (ammonia, chloride and manganese) detected in the groundwater wells with the concentrations in the leachate in the waste indicates that substantial dilution and attenuation is occurring within 5-10m of the landfill mass. It is considered likely there that further dilution and possible natural attenuation is occurring in the marsh area prior to discharge out of the catchment in the drain.

3.9 Assessment of Landfill Gas Pathway

The monitoring in the waste body (MW-1, 2 and 3) indicates that methane and carbon dioxide are still being generated at significant levels. The monitoring in the perimeter wells identified carbon dioxide levels ranging from 2.5 to 4.6%, however methane was only detected at one location, MW-8 located 10m to the east of the of the waste.

While the levels of CO_2 are above the DOE limits they are not very elevated and could at a distance from the site (MW-4) in part be naturally occurring. Methane is most likely associated with the presence of landfill gas emanating from the waste body. Because of the presence of the marsh and ponding water it was not possible to install monitoring wells to the north of the landfill. It is possible that some landfill gas migration may also be occurring into the marsh area. However the marsh land probably acts as a buffer between the landfill and the reclaimed lands to the north of the site, allowing ventilation to atmosphere or dissolution into the ponded water during the winter months.

The on-site building is no longer used and it is planned to demolish the structure in the near future. The risk to on-site users has therefore been eliminated.

The lands north and northwest, approximately 200 - 300m away, have been reclaimed with construction demolition waste as part of the planned future development for residential and commercial purposes. Currently there is a halting site located 150m to the south of the site. There are no other residential dwellings within 250m of the site. It is also possible that in the future the lands surrounding the site could be developed for residential and/or commercial purposes. Long term monitoring for landfill gas will be required around the landfill to ensure that any risk posed to areas proposed for development in the future can be mitigated in advance.

4. REVISION OF TIER 2 RISK ASSESSMENT & CONCEPTUAL SITE MODEL

4.1 Revised Conceptual Site Model

A revised conceptual Site Model is presented on Figure 4.1 below. This model illustrates the presence of low –to moderate permeability boulder clay and gravel which are in turn underlain by layer of low permeability hard clays. Beneath the clay layer is a layer of gravels which in turn appears to overly the shaley limestone Ll aquifer beneath the site. The landfill appears to be located at the low point in a local catchment where both groundwater and surfacewater discharge via a Marsh to the drain to the east of the site.

The leachate, while present in the shallow ground water is likely to be contained above the deeper clay layer. Direct discharge to drain via the groundwater pathway is not considered to occur. This appears to occur via the Marsh which in turn discharges slowly to the drain as water levels rise in the winter period. The marsh conditions more than likely result in some natural attenuation of the leachate prior to discharge of water from the marsh to the stream.

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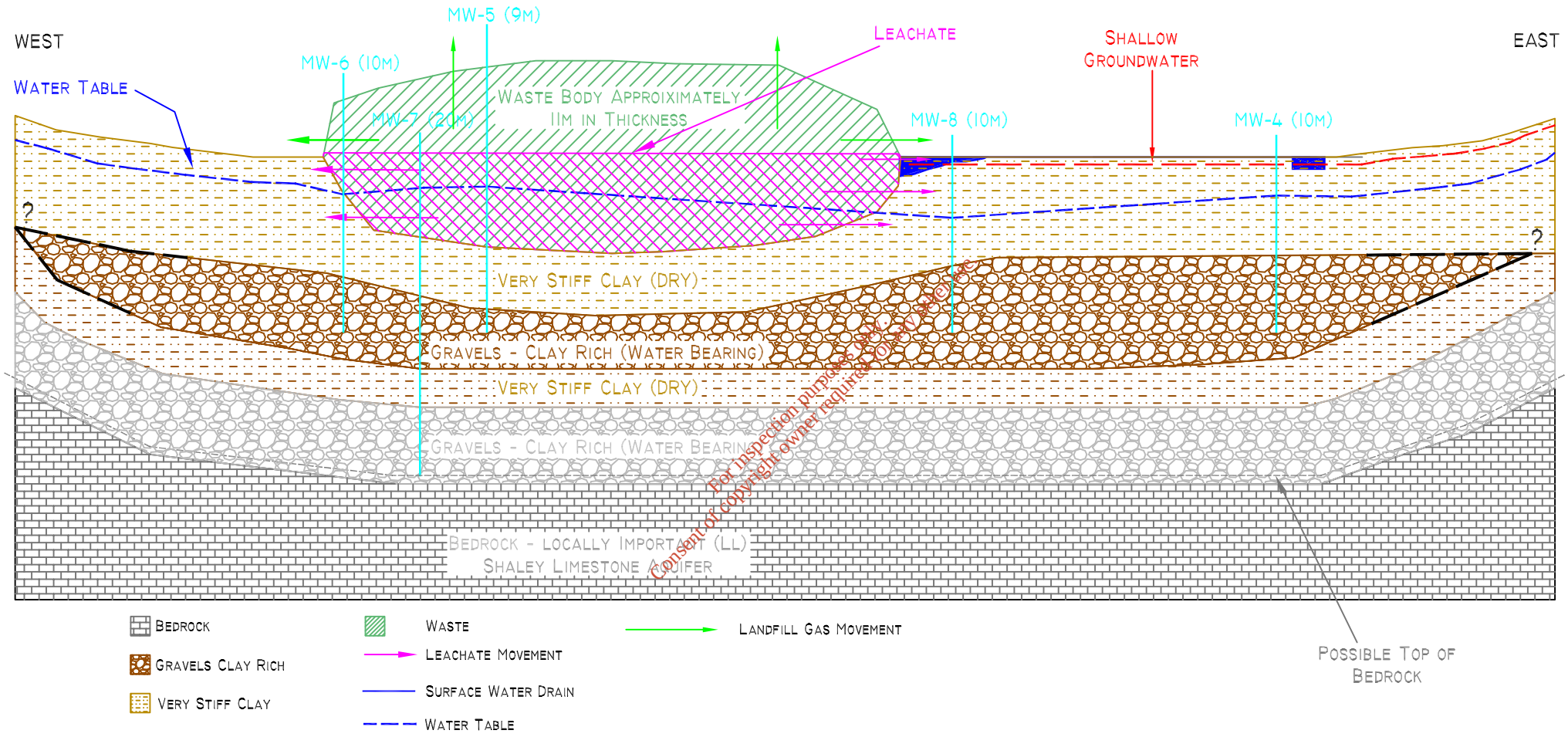

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TITLE
CONCEPTUAL SITE MODEL

details

FIGURE No.
4.1

SCALE

REV.

4.2 Revised Risk Assessment

OCM has modified the original risk assessment on the basis of the findings of the Exploratory Phase and the changes are highlighted in blue.

Table 6

Ref	**Source**	*Score*	*Rational*
1a	Leachate	7	▪ <5 hectares ▪ Waste likely to be both municipal & industrial
1b	Gas	7	▪ <5 hectares ▪ Highest rating given as proportion of municipal: industrial waste is not known.

Table 7

Ref	**Pathways**	*Score*	*Rational*
2a	Groundwater vulnerability	2	▪ GSI data states that the site is rated as having high vulnerability.
2b	Groundwater flow regime	1	▪ Bedrock was originally considered to be karst. The drilling data and geophysical survey indicates that bedrock is not karst and is likely to be Shaley Limestone i.e Ll Aquifer. Score reduces from 5 to 1.
2c	Surface water drainage	2	▪ Landfill is reportedly connected to town surface water drainage system
2d	Landfill gas lateral migration	3	▪ Residences not currently within 250m of site, but will be within 5 years ▪ Karst bedrock
2e	Landfill gas vertical migration	0	▪ Building on site not occupied and will be removed risk score reduces from 5 – 0

Table 8

Ref	**Receptors**	*Score*	*Rational*
3a	Human presence (leachate)	2	▪ Currently no houses within 250m, there will be within 5 years ▪ Note: All houses will be served by public water
3b	Protected areas	1	▪ No protected areas within 1 km of site ▪ The marsh area has been considered as an undesignated GWDTE, precautionary approach. ▪ No consultation with the NPWS has taken place.
3c	Aquifer category	5	▪ Locally Important Ll aquifer underlies the site, score reduces from 5 to 3
3d	Public water supply	3	▪ Public water supply is greater than 1km away (Cordangan) ▪ Karst bedrock – but different geological formation ▪ Precautionary approach assumed
3e	Surface water bodies	3	▪ Surface water drain within 50m of site boundary
3f	Human presence (gas)	0	▪ Building on site unoccupied and to be removed score reduces from 5 to 0

The risk assessment revised after the Detailed Site Investigations indicates that the site remains High risk for leachate because the pathway from the marsh to the drain appears viable. Further monitoring is required to establish if impacts on surface water quality is occurring during low flow conditions.

Landfill Gas Risk remains Moderate because of detection of carbon dioxide in the perimeter wells and methane in one well. The risk posed to receptors cannot be eliminated and needs to be assessed as part of a longer term monitoring programme.

Note: The table below represents the Tier 1 Risk rating for this site. SPR1 to 9 represent the leachate risk scores. SPR10 & 11 represent Landfill Gas Risk. The migration pathways are colour coded as follows:

Groundwater & Surface Water	Groundwater only	Surface water only	Lateral & Vertical

Calculator		SPR Values	Maximum Score	Normalised Score
SPR1	1a x (2a + 2b + 2c) x 3e	105	300	35.00%
SPR2	1a x (2a + 2b + 2c) x 3b	0	300	0.00%
SPR3	1a x (2a + 2b) x 3a	42	240	17.50%
SPR4	1a x (2a + 2b) x 3b	0	240	0.00%
SPR5	1a x (2a + 2b) x 3c	63	400	15.75%
SPR6	1a x (2a + 2b) x 3d	0	560	0.00%
SPR7	1a x (2a + 2b) x 3e	63	240	26.25%
SPR8	1a x 2c x 3e	42	60	70.00%
SPR9	1a x 2c x 3b	0	60	0.00%
SPR10	1b x 2d x 3f	21	150	14.00%
SPR11	1b x 2e x 3f	This linkage is not present due to no receptor above the source		
Overall Risk Score		105		**70.00%**
				A

Risk Classification	Range of Risk Scores
Highest Risk (Class A)	**Greater than 70 for any individual SPR linkage**
Moderate Risk (Class B)	**40-70 for any individual SPR linkage**
Lowest Risk (Class C)	**Less than 40 for any individual SPR linkage**

Risk Classification	**HIGHEST**

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The Detailed Site investigation indicates that the site currently a Class A High Risk Site based on the risk posed to the surface water system.

However, impact on the surface water quality in the drain is currently low with only ammonia exceeding EQS limits. This may in part be due to natural attenuation within the marsh and very high rainfall levels which are attenuating the impact on the surface water system.

It is possible that some leachate migration is occurring from the site toward the marsh wetland area and into the drain, which ultimately discharges to the River Ara several kilometres downstream of the site.

Based on the groundwater flow direction data the groundwater in the catchment is moving to a low point in the vicinity of the marsh. It is likely that the marsh is therefore the local discharge for groundwater.

Significant dilution of leachate appears to be occurring between the landfill and the groundwater based observation of the substantial reduction in Manganese, Chloride and Ammonia levels seen between the leachate in the waste and the external monitoring wells located within 5-10m of the landfill.

Water quality in the public groundwater abstraction well located 1.4km down hydraulic gradient of the site is of good quality which supports the assumption that the clay layer beneath the gravels and above the bedrock inhibits the vertical migration of groundwater.

Some remedial measures may be required to minimize the risk posed by leachate and landfill gas to off-site receptors but further monitoring of landfill gas, surface water quality and groundwater quality over a longer time period will be required to establish the extent of remediation required.

5.2 Recommendations

5.2.1 Leachate Risk

OCM recommend that the more recently deposited waste material deposited at the landfill be capped with low permeability soils/subsoils to minimise the infiltration of rainfall to the waste.

5.2.1.1 Surface Water

OCM recommend that monitoring of the surface water in the marsh area and in the drain be undertaken during lower flow conditions to establish if leachate is migrating into the marsh area and/or into the stream. Monitoring should be undertaken for an initial period of 6 months from April to September on a bimonthly basis (once every two months).

5.2.1.2 Groundwater

Following capping of the site OCM recommend that monitoring of the groundwater be undertaken to establish the effectiveness of the capping programme in reducing the generation of leachate beneath the site. Monitoring should be undertaken at least bi-annually for this purpose.

5.2.2 Landfill Gas

OCM recommend that when the water levels receed that landfill gas monitoring wells be installed to the north, north east and northwest of the marsh area.

OCM recommend that landfill gas monitoring be undertaken particularly in the southern section of the site (MW5, 6 and 7) at monthly intervals to assess the risk of off-site migration toward the halting site, the residential area within 250m of the site.

OCM recommend that all wells be monitored at least annually to assess landfill gas levels. In the event that development occurs within 250m of the site boundary the more frequent monitoring would be required.

If monitoring shows that landfill gas levels increase as a result of capping OCM recommend that mitigation measures be developed to reduce the landfill gas levels. Such measures may include the installation of additional landfill gas wells within the site to ventilate the site.

APPENDIX 1

Borehole Logs

O'Callaghan Moran & Associates
Phone: 021-4321521 Fax: 021-4321522

Borehole I.D. MW-01

Project: 09-188-01

Client: South Tipperary Co. Co.

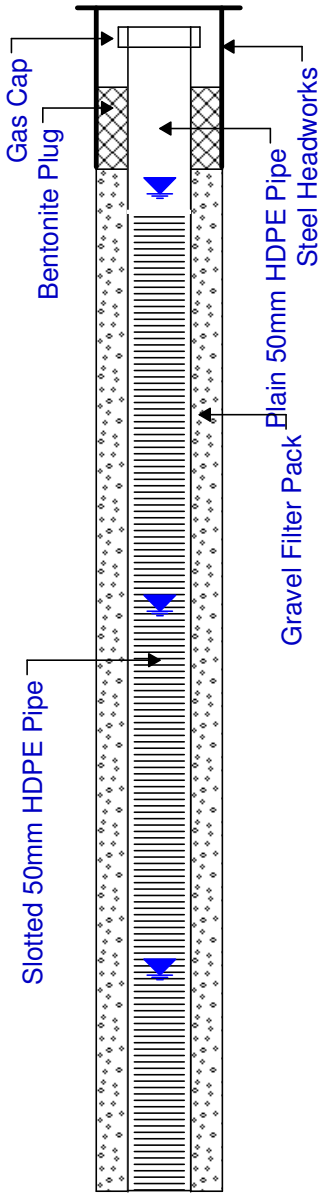
Location: Tipperary Town Landfill

Borehole Depth: MW-01

SWL (m): 4.34m

Borehole Type: MW-01

Depth (m)	Lithology Description	Lithology	Well Construction Details
0	Ground Surface		
0	***Fill/Waste*** Fill comprised of black sandy gravelly Clay with plactics, timber, glass and papers. Water strikes at 1.3m, 6.4m, 10.85m.		
11	***Clay*** Very stiff brown sandy gravelly Clay.		



Drilling Contractor:

Hole Size:

Drill Method: Air Rotary

Geologist: B. Sexton

Drill Date: 16/11/2009

Sheet: 1 of 1

O'Callaghan Moran & Associates
Phone: 021-4321521 Fax: 021-4321522

Borehole I.D. MW-02

Project: 09-188-01

Client: South Tipperary Co. Co.

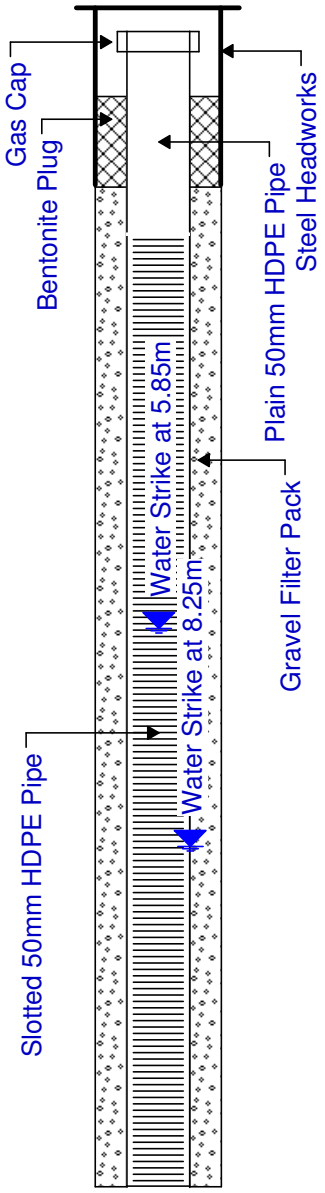
Location: Tipperary Town Landfill

Borehole Depth: MW-02

SWL (m): 5.8m

Borehole Type: MW-02

Depth (m)	Lithology Description	Lithology	Well Construction Details
0	Ground Surface		
0	***Fill/Waste*** Fill comprised of black sandy gravelly Clay with plactics, timber, glass and papers. Water strikes at 5.85m and 8.25m.		
12	***Clay*** Very stiff brown sandy gravelly Clay.		



Drilling Contractor:

Hole Size:

Drill Method: Air Rotary

Geologist: B. Sexton

Drill Date: 17/11/2009

Sheet: 1 of 1

O'Callaghan Moran & Associates
Phone: 021-4321521 Fax: 021-4321522

Borehole I.D. MW-03

Project: 09-188-01

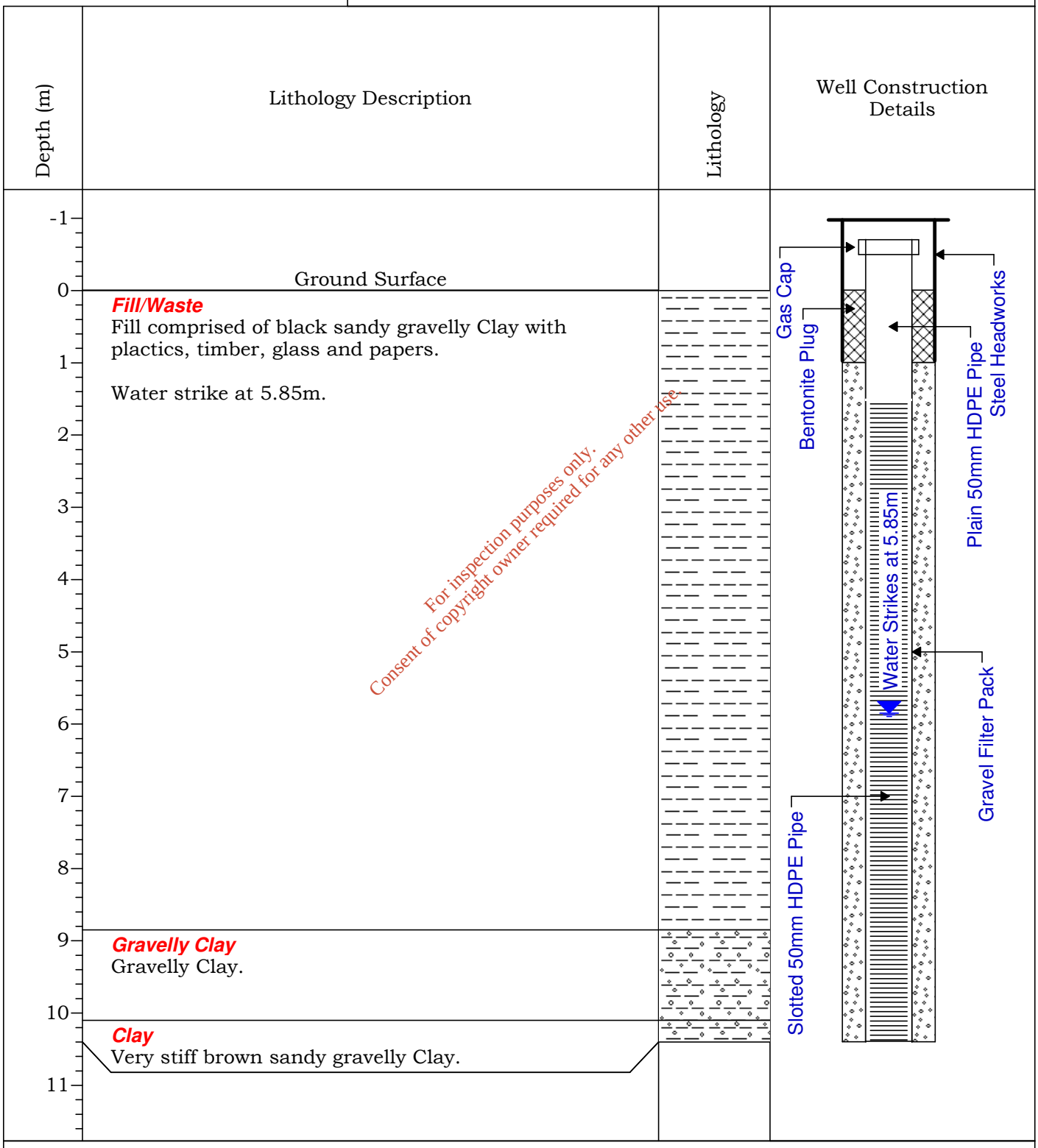
Client: South Tipperary Co. Co.

Location: Tipperary Town Landfill

Borehole Depth: MW-03

SWL (m): 6.91m

Borehole Type: MW-03



Drilling Contractor:

Hole Size:

Drill Method: Air Rotary

Geologist: B. Sexton

Drill Date: 17/11/2009

Sheet: 1 of 1

O'Callaghan Moran & Associates
Phone: 021-4321521 Fax: 021-4321522

Borehole I.D. MW-04

Project: 09-188-01

Client: South Tipperary Co. Co.

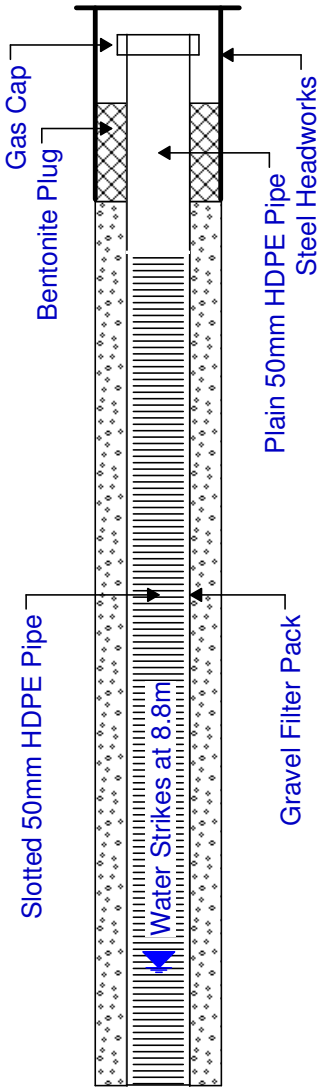
Location: Tipperary Town Landfill

Borehole Depth: MW-04

SWL (m): 0.2m

Borehole Type: MW-04

Depth (m)	Lithology Description	Lithology	Well Construction Details
0	Ground Surface		
0	***Clay*** Very soft brown Clay.		
1	***Clay*** Very stiff brown sandy gravelly Clay with occassional boulders. Gravels are subangular dark grey limestone.		
9	***Gravel*** Clay rich Gravels. Gravels are subrounded to subangular dark grey limestone. Groundwater strike at 8.8m.		



Drilling Contractor:

Hole Size:

Drill Method: Air Rotary

Geologist: B. Sexton

Drill Date: 18/11/2009

Sheet: 1 of 1

O'Callaghan Moran & Associates
Phone: 021-4321521 Fax: 021-4321522

Borehole I.D. MW-05

Project: 09-188-01

Client: South Tipperary Co. Co.

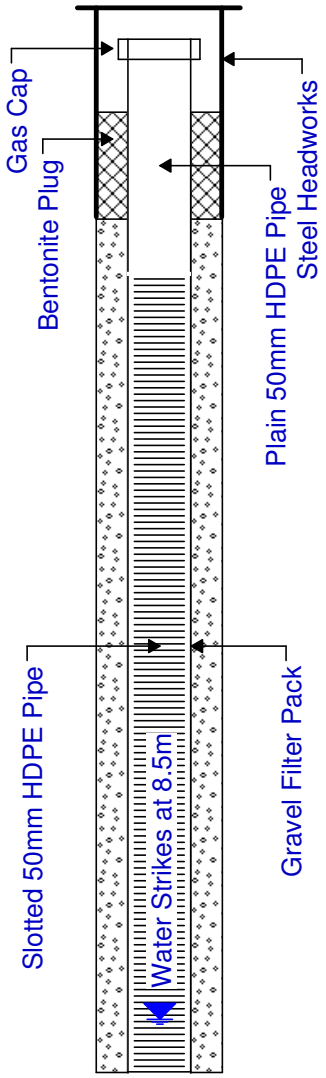
Location: Tipperary Town Landfill

Borehole Depth: MW-05

SWL (m): 1.85m

Borehole Type: MW-05

Depth (m)	Lithology Description	Lithology	Well Construction Details
0	Ground Surface		
0	***Clay*** Very soft brown Clay.		
1	***Clay*** Very stiff brown sandy gravelly Clay with occassional boulders. Gravels are subangular dark grey limestone. Groundwater strike at 8.5m.		



Drilling Contractor:

Hole Size:

Drill Method: Air Rotary

Geologist: B. Sexton

Drill Date: 18/11/2009

Sheet: 1 of 1

O'Callaghan Moran & Associates
Phone: 021-4321521 Fax: 021-4321522

Borehole I.D. MW-06

Project: 09-188-01

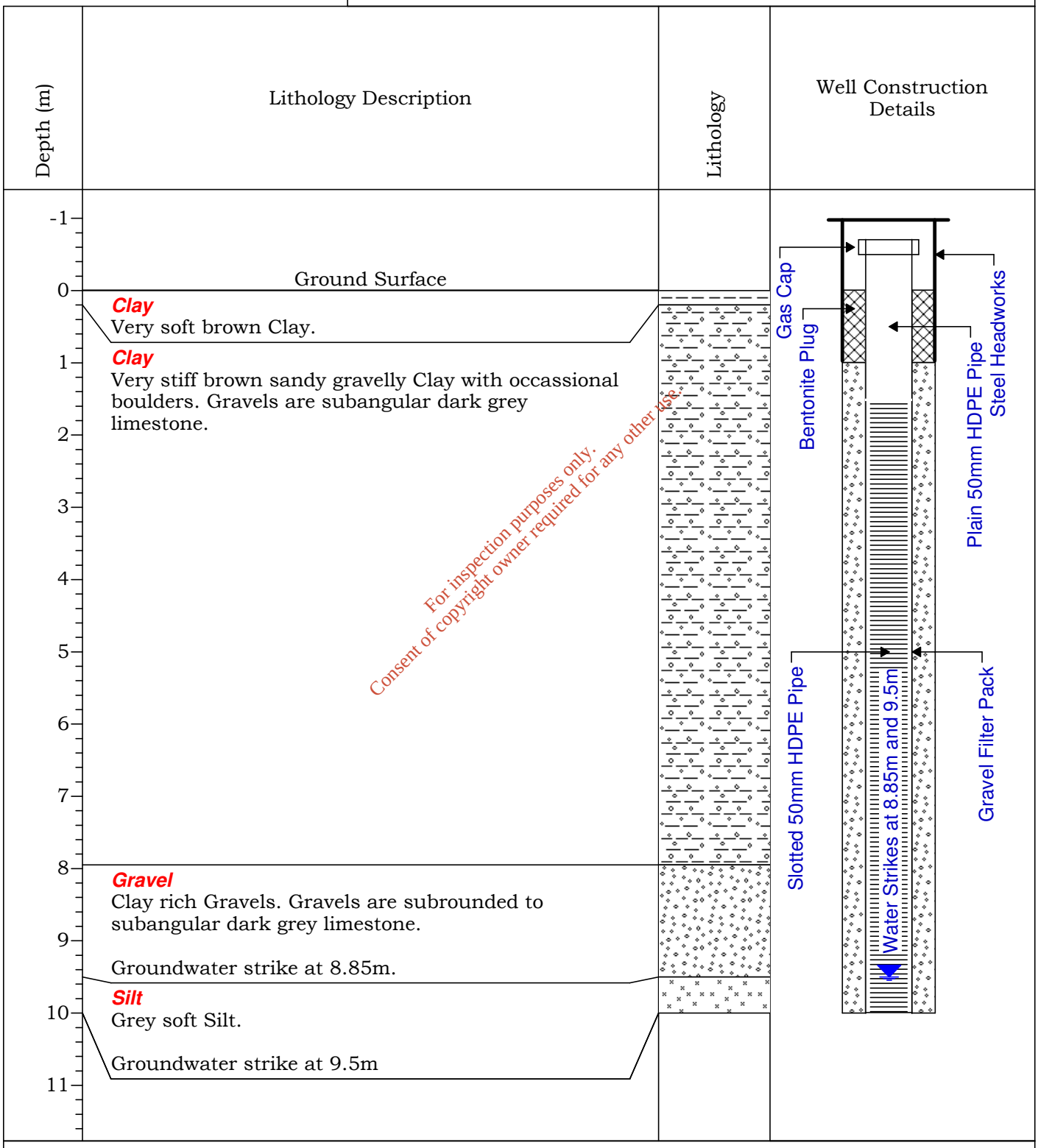
Client: South Tipperary Co. Co.

Location: Tipperary Town Landfill

Borehole Depth: MW-06

SWL (m): 0.7m

Borehole Type: MW-06



Drilling Contractor:

Hole Size:

Drill Method: Air Rotary

Geologist: B. Sexton

Drill Date: 19/11/2009

Sheet: 1 of 1

O'Callaghan Moran & Associates
Phone: 021-4321521 Fax: 021-4321522

Borehole I.D. MW-07 Revised

Project: 09-188-01

Client: South Tipperary Co. Co.

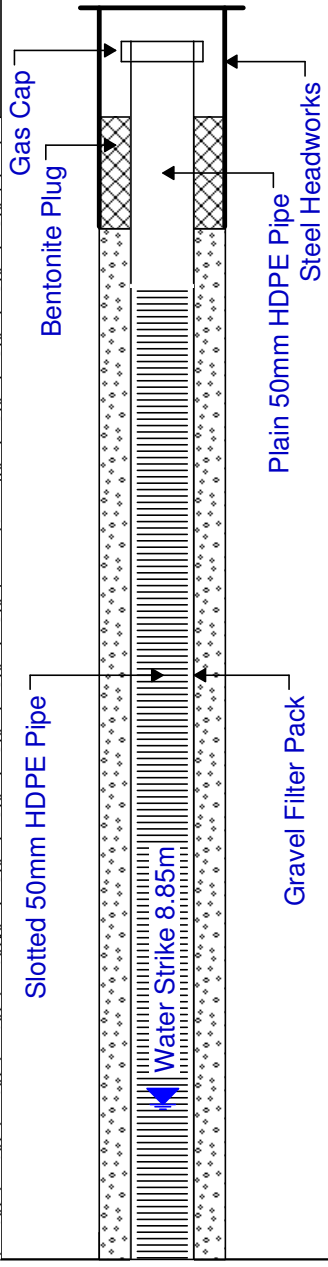
Location: Tipperary Town Landfill

Borehole Depth: MW-07 Revised

SWL (m): 6.35m

Borehole Type: MW-07 Revised

Depth (m)	Lithology Description	Lithology	Well Construction Details
0	Ground Surface		
0	***Clay*** Clay with minor amounts of concrete.		
1	***Clay*** Brown very stiff sandy gravelly Clay. Gravels are subangular dark grey limestone.		
3	***Sand*** Brown medium sand.		
4	***Gravelly Clay*** Brown very stiff sandy gravelly Clay. Gravels are subangular dark grey limestone.		
7	***Gravel*** Clay rich dark grey limestone Gravels. Gravels are subangular to subrounded. Groundwater strike at 8.85m.		
10			



Drilling Contractor:

Hole Size:

Drill Method: Air Rotary

Geologist: B. Sexton

Drill Date: 19/11/2009

Sheet: 1 of 2

O'Callaghan Moran & Associates
Phone: 021-4321521 Fax: 021-4321522

Borehole I.D. MW-07 Revised

Project: 09-188-01

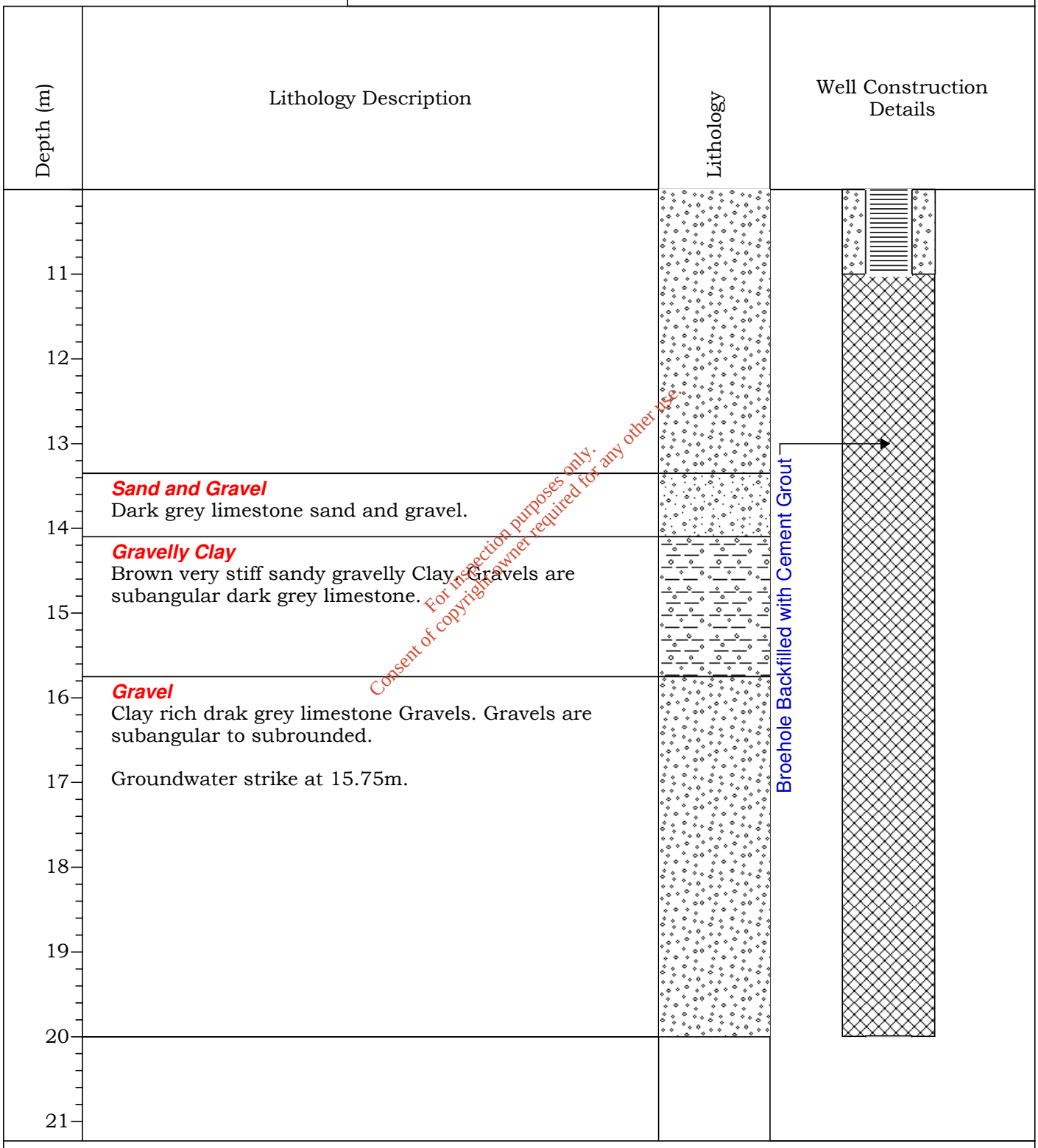
Client: South Tipperary Co. Co.

Location: Tipperary Town Landfill

Borehole Depth: MW-07 Revised

SWL (m): 6.35m

Borehole Type: MW-07 Revised



Drilling Contractor:

Hole Size:

Drill Method: Air Rotary

Geologist: B. Sexton

Drill Date: 19/11/2009

Sheet: 2 of 2

O'Callaghan Moran & Associates
Phone: 021-4321521 Fax: 021-4321522

Borehole I.D. MW-08

Project: 09-188-01

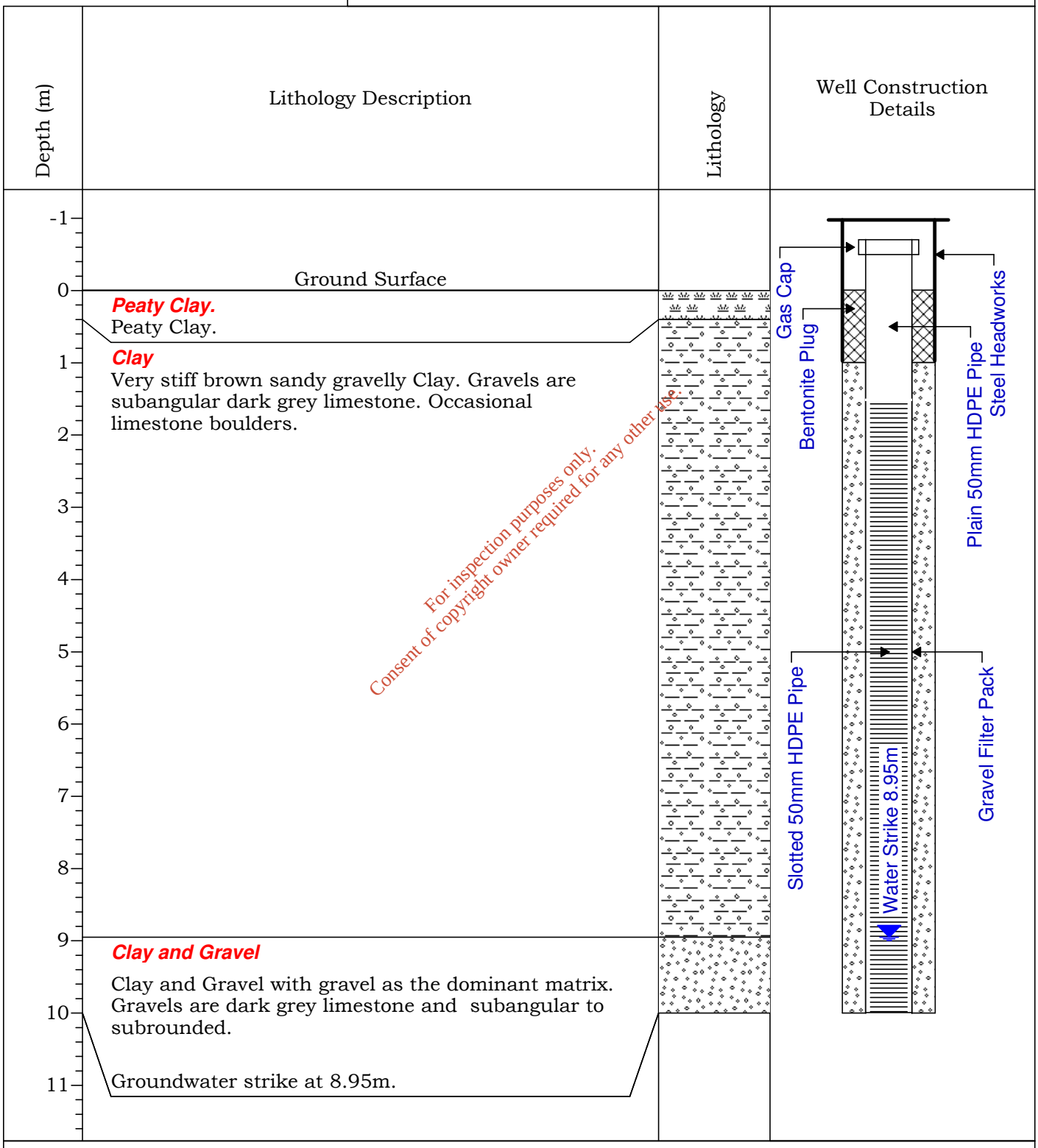
Client: South Tipperary Co. Co.

Location: Tipperary Town Landfill

Borehole Depth: MW-08

SWL (m): 3.94m

Borehole Type: MW-08



Drilling Contractor:

Hole Size:

Drill Method: Air Rotary

Geologist: B. Sexton

Drill Date: 20/11/2009

Sheet: 1 of 1

APPENDIX 2

OCM Sampling Protocol

STANDARD OPERATING PROCEDURE

SURFACE WATER SAMPLING

The primary objective of surface water sampling is to evaluate the chemical quality of a water body. The purpose of this procedure is to ensure that representative samples of surface water are collected and documented using consistent methods to ensure sample integrity. Surface water grab samples may be collected from rivers, streams, lakes and wetlands. In cases where the depth of the surface water body prevents sampling from the banks of the water body, sampling from, a boat may be required.

1.0 SAMPLING PROCEDURES

1) 1.1 Equipment Needed

- Personal protective clothing and equipment as required in the site-specific risk assessment.
- Decontamination equipment and supplies if known contaminated site.
- Temperature probe EC meter, pH meter, dissolved oxygen meter.
- Appropriate sample containers (some will be pre-preserved), labels and chain of custody documentation.
- Field logbook.
- Hard plastic cooler with ice pack.

1.2 Field Parameter Measurement

Measurements of field parameters of pH, temperature and electrical conductivity are made during sampling. Note visual (colour, turbidity) and odour (e.g hydrocarbon, hydrogen sulphide) characteristics in the field logbook.

1.3 Collection of Water Samples

All samples for chemical analysis will be placed in laboratory prepared bottles. The types of sample containers and preservative required for each type of analysis are described in the workplan. If required, preservatives will be placed in the sample containers prior to collecting the samples.

The following procedure will be used -

1) Slowly submerge unpreserved one-liter amber glass or plastic-capped bottles completely into the water. Open and fill bottle from below the water surface. If wading is required, approach the sample site from downstream and do not enter the actual sample area. Do not disturb bottom sediments. Open-end of the bottle should be pointed at approximately 90° to the upstream direction, in undisturbed gently flowing water. This procedure will be performed to minimize the effects due to high turbulence and aeration, or if surface scum is prevalent.

2) Collect a sufficient volume of water to fill all sample containers.

3) For VOC analysis. Pour the samples slowly into the laboratory prepared 40 ml glass vial. Overfill each vial slightly to eliminate air bubbles, a convex meniscus should be present at the top of the vial. Ensure that the Teflon liner of the septum cap is facing inward and that no bubbles are entrapped. After capping securely, turn bottle upside-down, tap it against your other hand, and observe sample water for bubbles. If bubbles are observed, remove the cap, overfill the vial and reseal. Repeat this step for each vial until the samples with no bubbles are obtained.

4) Obtain the semi-volatile compound/pesticides/PCBs sample(s) by transferring the water to a laboratory prepared 1000 ml amber glass bottle with Teflon-lined cap. Fill the bottle to the bottom of the neck and follow steps 4, 5 and 6 above.

5) Dissolved metals (if necessary) may require filtering the sample water through a .45 micron filter. The water is collected in a 1 litre, unpreserved, plastic or glass bottle with HNO_3 preservative. Filtering must be done within 15 minutes of sample collection.

6) Obtain the total metals sample by directly transferring the water into a laboratory prepared 1000 ml plastic or glass bottle with HNO_3 preservative. Ensure the pH of the metals sampled is less than 2 by pouring off an aliquot in a clean jar and testing for pH using litmus paper.

7) Collect and prepare Field QA/QC samples in accordance with separate SOP.

8) Place a label on the container and enter the following information: -

   Client/Site Name
   Date Collected
   Time Collected
   Analysis

Preservative
Sample Identification Number

9) Place custody seals on the container caps. As soon as possible, place sample containers in a cooler with ice and maintain at 4°C. Surround the bottles with packaging.

10) Record pertinent information in the field logbook and on the Field Data Sheet for Sampling Location. Complete chain-of-custody form, place in cooler and seal and label the cooler.

11) Be sure to record all data required on the Field Data Sheet or Sampling Location and appropriate entries into the field logbook.

12) Decontaminate all sampling equipment according to procedure.

END.

STANDARD OPERATING PROCEDURE

GROUNDWATER SAMPLING

The primary objective of groundwater sampling is to establish groundwater quality and evaluate whether the potential contaminant sources at a site have impacted the groundwater in the underlying aquifer. The additional objective is to measure hydraulic gradient, or slope, of the water table to evaluate the direction of groundwater flow.

The purpose of this procedure is to ensure that representative samples of groundwater are collected and documented using consistent methods to ensure sample integrity.

1.0 SAMPLING PROCEDURES

1.1 Well Operating and Purging Procedures

All groundwater sampling will be conducted after the installed and developed wells have been allowed to equilibrate for at least 2 to 3 days. A Field Data Sheet for Well Sampling will be completed for each well.

Groundwater sampling teams will use to following procedure for approaching, opening, purging and sampling all wells, unless directed otherwise by a site specific workplan.

1) Prior to placing any equipment into the well, decontaminate the sampling equipment according to standard decontamination protocol.

2) Ensure you have a working FID/PID, a well key, and a depth-to-water meter.

3) Unlock and open the well cap just enough to insert the probe of the PID/FID. Take and record a reading. A decision to upgrade PPE may be necessary based on the FID/PID readings in the breathing zone.

4) Where practical, the surface water column will be visually examined for the presence of hydrocarbons, if present or suspected, the thickness of the hydrocarbon layer will be measured using an oil/water interface probe prior to taking the depth-to-water measurement.

5) Insert the water level probe into the well and measure and record the static water level to the nearest 0.01 m with respect to the established survey point on top of the well casing.

6) Decontaminate the water level probe with DDI water (Do not rinse with any solvents unless product was encountered).

7) Calculate and record the minimum volume of water to be purged according to the following conversion factors: -

1 well volume	=	water column in metres x litres/linear metre
50mm casing	=	2.0 LPM
100mm casing	=	8.1 LPM
150mm casing	=	18.2 LPM
200mm casing	=	32.4 LPM

8) Purge the well of at least 3 casing volumes by pumping or bailing with a decontaminated submersible pump or PVC bailer equipped with a bottom filling check valve (if the purge volume is low, generally less than 100 litres, the sampling team might find it more efficient to purge with a bailer than a pump). Use a graduated bucket to track the amount of water removed from the well. Periodically determine the pH, temperature and specific conductance of the purged water. Continue purging until the well has been completely evacuated or until the pH and specific conductance measurements have stabilised for at least one well volume. Wells that become dewatered before producing three casing volumes will be sampled as soon as practical once they recover sufficiently.

9) Dispose of purge water collected in the graduated bucket by pouring onto the ground at a distance of 50 to 60 metres from the vicinity of the well. If the water is known or suspected to be significantly contaminated, it may be necessary to store the purge water in a secure container, such as a drum, pending proper disposal.

10) Be aware and record any unusual occurrence during purging such as cascading (a shallow water entry zone that trickles into the borehole).

1.2 Field Parameter Measurement

Measurements of field parameters of pH, temperature and electrical conductivity are collected and organic vapour screening is conducted while the well is purged. To facilitate the collection of basic field parameters, the field team needs to: -

- Purge three well volumes of water from the well and measure field parameters for each well volume removed.

- Collection of water samples should take place after stabilisation of the following parameters: -

  - Temperature $^{+}$/- 1°C
  - pH (meter or paper) $^{+}$/- 0.2 units
  - Specific conductivity $^{+}$/- 5%

- If the aforementioned parameters do not stabilise within three purge volumes, the well will be purged up to a maximum of six borehole volumes unless two consecutive sets of stabilised parameters are obtained.

- Note any observations in the field logbook.

1.3 Collection of Water Samples

All samples or chemical analysis will be placed in laboratory prepared bottles. The types of sample containers and preservative required for each type of analysis are described in the workplan. If required, preservatives will be placed in the sample containers prior to collecting the samples.

The following procedure will be used to sample a well: -

1) After the well has been purged and allowed to recover, sample the well using a properly decontaminated or dedicated disposable bailer. Gently lower the bailer into the water column. Allow the bailer to sink and fill with a minimum of surface disturbance.

2) Slowly raise the bailer out of the well. Do not allow the bailer line to contact the ground, either by coiling it on a clean plastic sheet or by looping it from arm to arm as the line is extracted from the well.

3) Samples will be collected for VOCs analysis immediately after purging is complete and before other samples are collected. Pour the samples slowly into the laboratory prepared 40 ml glass vial. Overfill each vial slightly to eliminate air bubbles, a convex meniscus should be present at the top of the vial. Ensure that the Teflon liner of the septum cap is facing inward and that no bubbles are entrapped. After capping securely, turn bottle upside-down, tap it against your other hand, and observe sample water for bubbles. If bubbles are observed, remove the cap, overfill the vial and reseal. Repeat this step for each vial until the samples with no bubbles are obtained.

4) Place a label on the container and enter the following information: -

   Client/Site Name
   Date Collected
   Time Collected
   Analysis
   Preservative
   Sample Identification Number

5) Record pertinent information in the field logbook and on the Field Data Sheet for Well Sampling. Complete chain-of-custody form.

6) Place custody seals on the container caps. As soon as possible, place sample containers in a cooler with ice packs and maintain at 4°C until extraction. Surround the bottles with appropriate packaging.

7) Obtain the semi-volatile compound/pesticides/PCBs sample(s) by transferring the water to a laboratory prepared 1000 ml amber glass bottle with Teflon-lined cap. Fill the bottle to the bottom of the neck and follow steps 4, 5 and 6 above.

8) Dissolved metals (if necessary) requires the team to filter the sample water through a .45 micron filter. The water is collected in a 1 litre, unpreserved, plastic or glass bottle with HNO_3 preservative. Filtering must be done within 15 minutes of sample collection.

9) Obtain the total metals sample by directly transferring the water from the bailer into a laboratory prepared 1000 ml plastic or glass bottle with HNO_3 preservative.

10) Be sure the pH of the metals sampled is less than 2 by pouring off an aliquot in a clean jar and testing for pH using litmus paper. Dispose of this water and rinse the jar.

11) Collect and prepare Field QA/QC samples in accordance with separate SOP.

12) Be sure to record all data required on the Field Data Sheet or Well Sampling and appropriate entries into the field logbook.

13) Secure the well cap and replace the locking cover.

14) Decontaminate all sampling equipment according to procedure.

15) Decontaminate submersible pumps as follows: -

Scrub pump and cord in a tub of appropriate detergent and potable water
Pump at least 80 litres of soapy water through pump
Rinse with potable water
Pump at least 80 litres of rinse water through the pump
Rinse with DI water before lowering pump into the next well.

END.

STANDARD OPERATING PROCEDURE

LANDFILL GAS MONITORING

The primary objective of landfill gas monitoring is to assess if gas generation would be likely to give rise to a risk to human health or to the environment. It also helps determine trends in gas generation and migration and evaluates the effectiveness of any in-situ gas control measures. The purpose of this procedure is to ensure that representative measurements of landfill gas are collected using appropriate safety procedures.

1.0 SAMPLING PROCEDURES

All landfill gas monitoring equipment used will be certified intrinsically safe. All landfill gas monitoring equipment shall be regularly calibrated and serviced according to the manufacturer's specification.

The following procedure will be used for monitoring of landfill gas levels in all monitoring boreholes, unless directed otherwise.

1) On arrival at the site, test the equipment in accordance with manufacturer's recommendations and record the ambient gas concentrations, atmospheric pressure and temperature in a field notebook. This ensures the gas analyser chamber is purged prior to monitoring. Record the wind speed and direction and other weather conditions.

2) Unlock the borehole cover. Examine the appearance of the standpipe, cap and gas valve and note any damage or changes since previous recordings. Record any visible (steam), audible or olfactory signs of gas migration. Record the ground conditions (e.g. dry, wet, frozen, compacted, loose etc). If signs of gas migration are noted, measurement of gas concentrations should be made around the standpipe to ensure there are no dangerous accumulations of gas.

3) If the standpipe is fitted with a gas valve, switch on the gas analyser and securely connect the gas analyser inlet port to the gas sample valve via the inlet tube. Open the gas valve and switch on the analyser pump. Run the pump for sufficient time to remove a representative sample from the borehole. Turn the pump off.

4) Record methane (CH_4), carbon dioxide (CO_2) and oxygen (O_2) peaks and steady concentrations.

5) Record atmospheric pressure (mb) and temperature (°C).

6) When measurements are completed, the gas sample valve must be closed and the analyser disconnected.

7) A measurement of the depth to water in the borehole should be undertaken after completion of all gas measurements. Insert the water level probe into the well and measure and record the static water level to the nearest 0.01 m with respect to the established survey point on top of the well casing.

8) Be sure to record all data required in the field log book.

9) Secure the well cap and replace the locking cover.

10) Briefly run the pump on the gas analyser to purge the analyser chamber with ambient air before proceeding to the next monitoring location.

END.

APPENDIX 3

Laboratory Reports and Chain of Custody Documentation

Jones Environmental Laboratory

Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

Tel: +44 (0) 1244 833780
Fax: +44 (0) 1244 833781

O'Callaghan Moran & Associates
Granary House
Rutland Street
Cork

UKAS TESTING
No.4225

Attention :	Barry Sexton
Date :	18th November 2009
Your reference :	09-188-01
Our reference :	Test Report 09/3607
Location :	Tipperary Town Landfill
Date samples received :	05/11/09
Status :	Final Report
Issue :	1

Five soil and one water samples were received for analysis on 5th November 2009 which was completed on 18th November 2009. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced.
All interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

J W Farrell- Jones CChem FRSC
Chartered Chemist

Jones Environmental Laboratory

Client Name:	O'Callaghan Moran & Associates	**Report :**	**Solids**
Reference:	09-188-01		
Location:	Tipperary Town Landfill	**Solids:** V=60g VOC jar, J=250g glass jar, T=plastic tub	
Contact:	Barry Sexton		
JE Job No.:	09/3607		

J E Sample No.	1-2	3-4	5-6	7-8	9-10							
Sample ID	TP-1	TP-4	TP-11	TP-12	TP-15							
Depth	-	-	-	-	-							
COC No / misc											Please see attached notes for all abbreviations and acronyms	
Containers	J T	J T	J T	J T	J T							
Sample Date	03/11/09	03/11/09	03/11/09	03/11/09	03/11/09							
Sample Type	Soil	Soil	Soil	Soil	Soil							
Batch Number	1	1	1	1	1						**LOD**	**Units**	**Method No.**
Date of Receipt	05//11/09	05//11/09	05//11/09	05//11/09	05//11/09							
DRO/EPH (C8-40)	~	397	~	~	2192						<30	mg/ kg	TM5/PM8
Mineral Oil (interpretation & calculation)	~	<30	~	~	<30						<30	mg/ kg	TM5/PM8
Benzene #	~	<2	~	~	<2						<2	µg/ kg	TM2/PM7
Toluene #	~	<2	~	~	<2						<2	µg/ kg	TM2/PM7
Ethyl benzene #	~	<2	~	~	<2						<2	µg/ kg	TM2/PM7
m/p-Xylene #	~	<4	~	~	<4						<4	µg/ kg	TM2/PM7
o-Xylene #	~	<2	~	~	<2						<2	µg/ kg	TM2/PM7
Total BTEX #	~	<12	~	~	<12						<12	µg/ kg	TM2/PM7
MTBE #	~	<4	~	~	<4						<4	µg/ kg	TM2/PM7
PCB 28#	~	<5	~	~	<5						<5	µg/ kg	TM17/PM8
PCB 52#	~	<5	~	~	<5						<5	µg/ kg	TM17/PM8
PCB 101#	~	<5	~	~	<5						<5	µg/ kg	TM17/PM8
PCB 118#	~	<5	~	~	<5						<5	µg/ kg	TM17/PM8
PCB 138#	~	<5	~	~	<5						<5	µg/ kg	TM17/PM8
PCB 153#	~	<5	~	~	<5						<5	µg/ kg	TM17/PM8
PCB 180#	~	<5	~	~	<5						<5	µg/ kg	TM17/PM8
Total 7 PCBs#	~	<35	~	~	<35						<35	µg/ kg	TM17/PM8
TOC #	~	2.1	~	~	12.3						<0.2	%	TM021
% Dry Matter	~	79.9	~	~	64.3						<0.1	%	PM4

	sample	ID	Depth	EPH/DRO Interpretations
Interpretation	3-4	TP-4	-	Naturally Occurring Compounds
Interpretation	9-10	TP-15	-	Naturally Occurring Compounds

Jones Environmental Laboratory

Client Name:	O'Callaghan Moran & Associates	**Report :**	**Solids**
Reference:	09-188-01		
Location:	Tipperary Town Landfill	**Solids:**	V=60g VOC jar, J=250g glass jar, T=plastic tub
Contact:	Barry Sexton		
JE Job No.:	09/3607		

J E Sample No.	1-2	3-4	5-6	7-8	9-10						LOD	Units	Method No.
Sample ID	TP-1	TP-4	TP-11	TP-12	TP-15								
Depth	-	-	-	-	-								
COC No / misc													
Containers	J T	J T	J T	J T	J T								
Sample Date	03/11/09	03/11/09	03/11/09	03/11/09	03/11/09								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1								
Date of Receipt	05//11/09	05//11/09	05//11/09	05//11/09	05//11/09								
PAH 6 Total													
Fluoranthene #	~	0.59	~	~	1.96						<0.02	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	~	1.09	~	~	2.21						<0.04	mg/kg	TM4/PM8
Benzo(a)pyrene #	~	0.58	~	~	1.57						<0.02	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	~	0.46	~	~	1.06						<0.02	mg/kg	TM4/PM8
Benzo(ghi)perylene #	~	0.55	~	~	1.09						<0.04	mg/kg	TM4/PM8
PAH 6 Total	~	3.27	~	~	7.89						**<0.07**	**mg/kg**	**TM4/PM8**
PAH 16													
Naphthalene #	~	<0.03	~	~	<0.03						<0.03	mg/kg	TM4/PM8
Acenaphthylene	~	<0.02	~	~	0.09						<0.02	mg/kg	TM4/PM8
Acenaphthene #	~	<0.02	~	~	0.06						<0.02	mg/kg	TM4/PM8
Fluorene #	~	<0.02	~	~	0.09						<0.02	mg/kg	TM4/PM8
Phenanthrene #	~	0.29	~	~	0.76						<0.02	mg/kg	TM4/PM8
Anthracene #	~	0.10	~	~	0.31						<0.02	mg/kg	TM4/PM8
Fluoranthene #	~	0.59	~	~	1.96						<0.02	mg/kg	TM4/PM8
Pyrene #	~	0.49	~	~	1.60						<0.03	mg/kg	TM4/PM8
Benz(a)anthracene #	~	0.40	~	~	1.15						<0.02	mg/kg	TM4/PM8
Chrysene #	~	0.40	~	~	1.18						<0.04	mg/kg	TM4/PM8
Benzo(bk)fluoranthene #	~	1.09	~	~	2.21						<0.04	mg/kg	TM4/PM8
Benzo(a)pyrene #	~	0.58	~	~	1.57						<0.02	mg/kg	TM4/PM8
Indeno(123cd)pyrene #	~	0.46	~	~	1.06						<0.02	mg/kg	TM4/PM8
Dibenzo(ah)anthracene #	~	0.40	~	~	0.61						<0.02	mg/kg	TM4/PM8
Benzo(ghi)perylene #	~	0.55	~	~	1.09						<0.04	mg/kg	TM4/PM8
PAH 16 Total	~	5.35	~	~	13.74						**<0.38**	**mg/kg**	**TM4/PM8**
Coronene	~	0.19	~		0.30						<0.02	mg/kg	TM4/PM8
PAH 17 Total	~	5.54	~	~	14.00						**<0.40**	**mg/kg**	**TM4/PM8**

Please see attached notes for all abbreviations and acronyms

Client Name: O'Callaghan Moran & Associates
Reference: 09-188-01
Location: Tipperary Town Landfill
Contact: Barry Sexton
JE Job No.: 09/3607

Report : **CEN 10:1 Leachates (expressed as mg/kg)**

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1-2	3-4	5-6	7-8	9-10						LOD	Units	Method No.
Sample ID	TP-1	TP-4	TP-11	TP-12	TP-15								
Depth	-	-	-	-	-								
COC No / misc													
Containers	J T	J T	J T	J T	J T								
Sample Date	03/11/09	03/11/09	03/11/09	03/11/09	03/11/09								
Sample Type	Soil	Soil	Soil	Soil	Soil								
Batch Number	1	1	1	1	1								
Date of Receipt	05//11/09	05//11/09	05//11/09	05//11/09	05//11/09								
Arsenic	~	0.08	~	~	0.115						<0.01	mg/kg	TM30
Barium	~	0.48	~	~	1.92						<0.03	mg/kg	TM30
Cadmium	~	<0.01	~	~	<0.01						<0.01	mg/kg	TM30
Chromium	~	<0.02	~	~	<0.02						<0.02	mg/kg	TM30
Copper	~	<0.12	~	~	<0.12						<0.12	mg/kg	TM30
Mercury	~	<0.001	~	~	<0.001						<0.001	mg/kg	TM30
Molybdenum	~	0.13	~	~	0.95						<0.05	mg/kg	TM30
Nickel	~	<0.06	~	~	0.05						<0.06	mg/kg	TM30
Lead	~	<0.1	~	~	<0.1						<0.1	mg/kg	TM30
Antimony	~	0.03	~	~	0.24						<0.03	mg/kg	TM30
Selenium	~	<0.03	~	~	<0.03						<0.03	mg/kg	TM30
Zinc	~	0.05	~	~	0.09						<0.04	mg/kg	TM30
Chloride	~	70	~	~	1847						<1	mg/kg	TM38
Fluoride	~	<1	~	~	<1						<1	mg/kg	TM38
Sulphate (Soluble)	~	503	~	~	934						<1	mg/kg	TM38
Phenol	~	<1	~	~	<1						<1	mg/kg	TM26
DOC	~	120	~	~	190						<20	mg/kg	TM060
TDS	~	2340	~	~	5860						<400	mg/kg	TM20

Jones Environmental Laboratory

Client Name:	O'Callaghan Moran & Associates	**Report :**	**Liquids**
Reference:	09-188-01		
Location:	Tipperary Town Landfill		
Contact:	Barry Sexton	**Liquids/products:**	V=40ml vial, G=glass bottle, P=plastic bottle
JE Job No.:	09/3607		$H=H_2SO_4$, Z=ZnAc, N=NaOH, $HN=HN0_3$

Please see attached notes for all abbreviations and acronyms

J E Sample No.	11-16	LOD	Units	Method No.
Sample ID	SW1			
Depth	-			
COC No / misc				
Containers	V H P G			
Sample Date	03/11/09			
Sample Type	Water			
Batch Number	1			
Date of Receipt	05/11/09			
pH#	7.29	<0.01	pH units	TM19/PM11
Electrical Conductivity# @25°C	707	<100	µS/cm	TM28/PM11
Total Oxidised Nitrogen as N#	0.50	<0.05	mg/l	TM038W
Ammonia Total as NH3#	1.32	<0.2	mg/l	TM038W
Total Suspended Solids	6	<10	mg/l	TM037W
Dissolved Oxygen	5	<1	mg/l	TM059
BOD settled	3	<1	mg/l	TM058W
COD	23	<7	mg/l	TM057W
Arsenic - dissolved #	3.7	<2.5	µg/l	TM 030W
Boron - dissolved	34	<12	µg/l	TM 030W
Cadmium - dissolved #	<0.5	<0.5	µg/l	TM 030W
Copper - dissolved #	<7	<7	µg/l	TM 030W
Mercury - dissolved #	<1	<1	µg/l	TM 030W
Nickel - dissolved #	<2	<2	µg/l	TM 030W
Lead - dissolved #	<5	<5	µg/l	TM 030W
Zinc - dissolved #	<3	<3	µg/l	TM 030W
Iron - dissolved #	182	<20	µg/l	TM 030W
Manganese - dissolved #	<2	<2	µg/l	TM 030W
Calcium - dissolved	103.4	<0.03	mg/l	TM 030W
Magnesium - dissolved	9.42	<0.02	mg/l	TM 030W
Sulphate#	26.99	<0.05	mg/l	TM038W
Chloride#	28.16	<0.3	mg/l	TM038W
Fluoride	<0.3	<0.3	mg/l	TM027W
Total Alkalinity as CaCO3#	240	<1	mg/l	TM032W
Total Cyanide*	<40	<40	µg/l	subcontracted
Chromium - total	<1.5	<1.5	µg/l	TM 030W
Phosphorous - dissolved #	70	<5	µg/l	TM 030W
Potassium - dissolved	5.44	<0.04	mg/l	TM 030W
Sodium - dissolved	17.54	<0.15	mg/l	TM 030W

Jones Environmental Laboratory

Client Name:	O'Callaghan Moran & Associates	**Report :**	**Liquids**
Reference:	09-188-01		
Location:	Tipperary Town Landfill		
Contact:	Barry Sexton	**Liquids/products:**	V=40ml vial, G=glass bottle, P=plastic bottle
JE Job No.:	09/3607		$H=H_2SO_4$, Z=ZnAc, N=NaOH, $HN=HN0_3$

J E Sample No.	11-16										Please see attached notes for all abbreviations and acronyms		
Sample ID	SW1												
Depth	-												
COC No / misc													
Containers	V H P G												
Sample Date	03/11/09												
Sample Type	Water												
Batch Number	1												
Date of Receipt	05/11/09												
											LOD	**Units**	**Method No.**
VOCs #	See Tab										<1-27	µg/l	TM15/PM10
SVOCs (dissolved)	See Tab										<10	µg/l	TM16/PM9
Combined OP & OC Pesticides	See Tab										<0.01	µg/l	TM042
PAH 16 (Dissolved) MS													
Naphthalene	<0.1										<0.1	µg/l	TM4/PM9
Acenaphthylene	<0.08										<0.08	µg/l	TM4/PM9
Acenaphthene	<0.1										<0.1	µg/l	TM4/PM9
Fluorene	<0.07										<0.07	µg/l	TM4/PM9
Phenanthrene	<0.07										<0.07	µg/l	TM4/PM9
Anthracene	<0.08										<0.08	µg/l	TM4/PM9
Fluoranthene	<0.09										<0.09	µg/l	TM4/PM9
Pyrene	<0.12										<0.12	µg/l	TM4/PM9
Benz(a)anthracene	<0.09										<0.09	µg/l	TM4/PM9
Chrysene	<0.1										<0.1	µg/l	TM4/PM9
Benzo(bk)fluoranthene	<0.26										<0.26	µg/l	TM4/PM9
Benzo(a)pyrene	<0.12										<0.12	µg/l	TM4/PM9
Indeno(123cd)pyrene	<0.1										<0.1	µg/l	TM4/PM9
Dibenzo(ah)anthracene	<0.1										<0.1	µg/l	TM4/PM9
Benzo(ghi)perylene	<0.12										<0.12	µg/l	TM4/PM9
PAH 16 Total	<1.60										<1.60	µg/l	TM4/PM9
EPH (C8-C40) (dissolved) # SS	<10										<10	µg/ l	TM5/PM9
Mineral Oil (interpretation & calculation)	<10										<10	µg/ l	TM5/PM9

Client Name: O'Callaghan Moran & Associates **SVOC Report : LIQUID**

Reference: 09-188-01

Location: Tipperary Town Landfill

Contact: Barry Sexton

JE Job No.: 09/3607

J E Sample No.	11-16												
Sample ID	SW1												
Depth	-												
COC No / misc													
Containers	V H P G												
Sample Date	03/11/09												
Sample Type	Water												
Batch Number	1												
Date of Receipt	05/11/09												

Please see attached notes for all abbreviations and acronyms

											LOD	Units	Method No.
Phenols													
2-Chlorophenol	<10										<10	µg/ l	TM16/PM9
2-Methylphenol	<10										<10	µg/ l	TM16/PM9
2-Nitrophenol	<10										<10	µg/ l	TM16/PM9
2,4-Dichlorophenol	<10										<10	µg/ l	TM16/PM9
2,4-Dimethylphenol	<10										<10	µg/ l	TM16/PM9
2,4,5-Trichlorophenol	<10										<10	µg/ l	TM16/PM9
2,4,6-Trichlorophenol	<10										<10	µg/ l	TM16/PM9
4-Chloro-3-methylphenol	<10										<10	µg/ l	TM16/PM9
4-Methylphenol	<10										<10	µg/ l	TM16/PM9
4-Nitrophenol	<10										<10	µg/ l	TM16/PM9
Pentachlorophenol	<10										<10	µg/ l	TM16/PM9
Phenol	<10										<10	µg/ l	TM16/PM9
PAHs													
2-Chloronaphthalene	<10										<10	µg/ l	TM16/PM9
2-Methylnaphthalene	<10										<10	µg/ l	TM16/PM9
Naphthalene											<10	µg/ l	TM16/PM9
Acenaphthylene											<10	µg/ l	TM16/PM9
Acenaphthene											<10	µg/ l	TM16/PM9
Fluorene											<10	µg/ l	TM16/PM9
Phenanthrene											<10	µg/ l	TM16/PM9
Anthracene											<10	µg/ l	TM16/PM9
Fluoranthene	SEE										<10	µg/ l	TM16/PM9
Pyrene	PAH										<10	µg/ l	TM16/PM9
Benz(a)anthracene	RESULTS										<10	µg/ l	TM16/PM9
Chrysene											<10	µg/ l	TM16/PM9
Benzo(bk)fluoranthene											<10	µg/ l	TM16/PM9
Benzo(a)pyrene											<10	µg/ l	TM16/PM9
Indeno(123cd)pyrene											<10	µg/ l	TM16/PM9
Dibenzo(ah)anthracene											<10	µg/ l	TM16/PM9
Benzo(ghi)perylene											<10	µg/ l	TM16/PM9
Phthalates													
Bis(2-ethylhexyl) phthalate	<10										<10	µg/ l	TM16/PM9
Butylbenzyl phthalate	<10										<10	µg/ l	TM16/PM9
Di-n-butyl phthalate	<10										<10	µg/ l	TM16/PM9
Di-n-Octyl phthalate	<10										<10	µg/ l	TM16/PM9
Diethyl phthalate	<10										<10	µg/ l	TM16/PM9
Dimethyl phthalate	<10										<10	µg/ l	TM16/PM9
Other SVOCs													
1,2-Dichlorobenzene	<10										<10	µg/ l	TM16/PM9
1,2,4-Trichlorobenzene	<10										<10	µg/ l	TM16/PM9
1,3-Dichlorobenzene	<10										<10	µg/ l	TM16/PM9
1,4-Dichlorobenzene	<10										<10	µg/ l	TM16/PM9
2-Nitroaniline	<10										<10	µg/ l	TM16/PM9
2,4-Dinitrotoluene	<10										<10	µg/ l	TM16/PM9
2,6-Dinitrotoluene	<10										<10	µg/ l	TM16/PM9
3-Nitroaniline	<10										<10	µg/ l	TM16/PM9
4-Bromophenylphenylether	<10										<10	µg/ l	TM16/PM9
4-Chloroaniline	<10										<10	µg/ l	TM16/PM9
4-Chlorophenylphenylether	<10										<10	µg/ l	TM16/PM9
4-Nitroaniline	<10										<10	µg/ l	TM16/PM9
Azobenzene	<10										<10	µg/ l	TM16/PM9
Bis(2-chloroethoxy)methane	<10										<10	µg/ l	TM16/PM9
Bis(2-chloroethyl)ether	<10										<10	µg/ l	TM16/PM9
Carbazole	<10										<10	µg/ l	TM16/PM9
Dibenzofuran	<10										<10	µg/ l	TM16/PM9
Hexachlorobenzene	<10										<10	µg/ l	TM16/PM9
Hexachlorobutadiene	<10										<10	µg/ l	TM16/PM9
Hexachlorocyclopentadiene	<10										<10	µg/ l	TM16/PM9
Hexachloroethane	<10										<10	µg/ l	TM16/PM9
Isophorone	<10										<10	µg/ l	TM16/PM9
N-nitrosodi-n-propylamine	<10										<10	µg/ l	TM16/PM9
Nitrobenzene	<10										<10	µg/ l	TM16/PM9

Client Name: O'Callaghan Moran & Associates **VOC Report :** **LIQUID**

Reference: 09-188-01

Location: Tipperary Town Landfill

Contact: Barry Sexton

JE Job No.: 09/3607

J E Sample No.	11-16													
Sample ID	SW1													
Depth	-													
COC No / misc														
Containers	V H P G													
Sample Date	03/11/09													
Sample Type	Water													
Batch Number	1													
Date of Receipt	05/11/09													

Please see attached notes for all abbreviations and acronyms

											LOD	Units	Method No.
Dichlorodifluoromethane	<2										<2	µg/l	TM15/PM10
Methyl Tertiary Butyl Ether	<2										<2	µg/l	TM15/PM10
Chloromethane #	<3										<3	µg/l	TM15/PM10
Vinyl Chloride	<2										<2	µg/l	TM15/PM10
Bromomethane	<1										<1	µg/l	TM15/PM10
Chloroethane #	<3										<3	µg/l	TM15/PM10
Trichlorofluoromethane #	<3										<3	µg/l	TM15/PM10
1,1-Dichloroethene #	<3										<3	µg/l	TM15/PM10
Carbon Disulphide #	NA										<3	µg/l	TM15/PM10
Dichloromethane #	<3										<3	µg/l	TM15/PM10
trans-1-2-Dichloroethene #	<3										<3	µg/l	TM15/PM10
1,1-Dichloroethane #	<3										<3	µg/l	TM15/PM10
cis-1-2-Dichloroethene #	<3										<3	µg/l	TM15/PM10
2,2-Dichloropropane	<1										<1	µg/l	TM15/PM10
Bromochloromethane #	<2										<2	µg/l	TM15/PM10
Chloroform #	<3										<3	µg/l	TM15/PM10
1,1,1-Trichloroethane #	<3										<3	µg/l	TM15/PM10
1,1-Dichloropropene #	<3										<3	µg/l	TM15/PM10
Carbon tetrachloride #	<2										<2	µg/l	TM15/PM10
1,2-Dichloroethane #	<2										<2	µg/l	TM15/PM10
Benzene #	<3										<3	µg/l	TM15/PM10
Trichloroethene	<3										<3	µg/l	TM15/PM10
1,2-Dichloropropane #	<2										<2	µg/l	TM15/PM10
Dibromomethane #	<3										<3	µg/l	TM15/PM10
Bromodichloromethane #	<3										<3	µg/l	TM15/PM10
cis-1-3-Dichloropropene #	<2										<2	µg/l	TM15/PM10
Toluene #	<3										<3	µg/l	TM15/PM10
trans-1-3-Dichloropropene #	<2										<2	µg/l	TM15/PM10
1,1,2-Trichloroethane #	<2										<2	µg/l	TM15/PM10
Tetrachloroethene #	<3										<3	µg/l	TM15/PM10
1,3-Dichloropropane #	<2										<2	µg/l	TM15/PM10
Dibromochloromethane #	<2										<2	µg/l	TM15/PM10
1,2-Dibromoethane #	<2										<2	µg/l	TM15/PM10
Chlorobenzene #	<2										<2	µg/l	TM15/PM10
1,1,1,2-Tetrachloroethane #	<2										<2	µg/l	TM15/PM10
Ethylbenzene #	<3										<3	µg/l	TM15/PM10
p/m-Xylene #	<5										<5	µg/l	TM15/PM10
o-Xylene #	<3										<3	µg/l	TM15/PM10
Styrene #	<2										<2	µg/l	TM15/PM10
Bromoform #	<2										<2	µg/l	TM15/PM10
Isopropylbenzene #	<3										<3	µg/l	TM15/PM10
1,1,2,2-Tetrachloroethane	<4										<4	µg/l	TM15/PM10
Bromobenzene #	<2										<2	µg/l	TM15/PM10
1,2,3-Trichloropropane #	<3										<3	µg/l	TM15/PM10
Propylbenzene #	<3										<3	µg/l	TM15/PM10
2-Chlorotoluene #	<3										<3	µg/l	TM15/PM10
1,3,5-Trimethylbenzene #	<3										<3	µg/l	TM15/PM10
4-Chlorotoluene #	<3										<3	µg/l	TM15/PM10
tert-Butylbenzene #	<3										<3	µg/l	TM15/PM10
1,2,4-Trimethylbenzene #	<3										<3	µg/l	TM15/PM10
sec-Butylbenzene #	<3										<3	µg/l	TM15/PM10
4-Isopropyltoluene #	<3										<3	µg/l	TM15/PM10
1,3-Dichlorobenzene #	<3										<3	µg/l	TM15/PM10
1,4-Dichlorobenzene #	<3										<3	µg/l	TM15/PM10
n-Butylbenzene #	<3										<3	µg/l	TM15/PM10
1,2-Dichlorobenzene #	<3										<3	µg/l	TM15/PM10
1,2-Dibromo-3-chloropropane	<2										<2	µg/l	TM15/PM10
1,2,4-Trichlorobenzene	<3										<3	µg/l	TM15/PM10
Hexachlorobutadiene #	<3										<3	µg/l	TM15/PM10
Naphthalene	<2										<2	µg/l	TM15/PM10
1,2,3-Trichlorobenzene	<3										<3	µg/l	TM15/PM10

All solid results are expressed on a dry weight basis unless stated otherwise.

Jones Environmental Laboratory

Client Name: O'Callaghan Moran & Associates
Reference: 09-188-01
Location: Tipperary Town Landfill
Contact: Barry Sexton
JE Job No.: 09/3607

J E Sample No.	11-16												
Sample ID	SW1												
Depth	-												
Containers	V H P G												
Sample Date	03/11/09												
Sample Type	Water												
Batch Number	1												
Date of Receipt	05/11/09												
											LOD	Units	Method Number
Combined Pesticide Suite													
Dichlorvos	<0.01										<0.01	µg/l	TM042
Mevinphos	<0.01										<0.01	µg/l	TM042
Alpha-BHC	<0.01										<0.01	µg/l	TM042
Beta-BHC	<0.01										<0.01	µg/l	TM042
Gamma-BHC	<0.01										<0.01	µg/l	TM042
Diazinon	<0.01										<0.01	µg/l	TM042
Methyl Parathion	<0.01										<0.01	µg/l	TM042
Ethyl Parathion (Parathion)	<0.01										<0.01	µg/l	TM042
Heptachlor	<0.01										<0.01	µg/l	TM042
Fenitrothion	<0.01										<0.01	µg/l	TM042
Aldrin	<0.01										<0.01	µg/l	TM042
Malathion	<0.01										<0.01	µg/l	TM042
Heptachlor Epoxide	<0.01										<0.01	µg/l	TM042
Endosulfan I	<0.01										<0.01	µg/l	TM042
Dieldrin	<0.01										<0.01	µg/l	TM042
4, 4'-DDE	<0.01										<0.01	µg/l	TM042
Endosulfan II	<0.01										<0.01	µg/l	TM042
4,4'-DDD	<0.01										<0.01	µg/l	TM042
Ethion	<0.01										<0.01	µg/l	TM042
Endrin	<0.01										<0.01	µg/l	TM042
Endosulfan Sulphate	<0.01										<0.01	µg/l	TM042
4,4'-DDT	<0.01										<0.01	µg/l	TM042
Methoxychlor	<0.01										<0.01	µg/l	TM042
Azinphos Methyl	<0.01										<0.01	µg/l	TM042
Disulfoton	<0.01										<0.01	µg/l	TM042

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

SOILS

Please note we are only MCERTS accredited for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. Your final report will reflect this, with non-MCERTS results on separate pages.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. If we are instructed to keep samples, a storage charge of £1 (1.5 Euros) per sample per month will be applied until we are asked to dispose of them.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Asbestos screens where requested will be undertaken by a UKAS accredited laboratory.

WATERS

Please note we are not a Drinking Water Inspectorate (DWI) Approved Laboratory . It is important that detection limits are carefully considered when requesting water analysis.

UKAS accreditation applies to tap water, surface water and groundwater only, any other liquids are outside our scope of accreditation

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples. All samples are treated as groundwaters and anlalysis performed on settled samples unless we are instructed otherwise.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any analysis that may be compromised highlighted on your schedule/ report by the use of a symbol.

The use of any of the following symbols indicates that the sample was deviating and the test result may be unreliable:

$ sample temperature on receipt considered inappropriate for analysis requested

^ samples exceeding recomended holding times

& samples received in inappropriate containers (e.g. volatile samples not submitted in VOC jars/vials)

~ no sampling date given, unable to confirm if samples are with acceptable holding times

ABBREVIATIONS and ACRONYMS USED

- UKAS accredited

M - MCERTS accredited

NAD - No Asbestos Detected

ND - None Detected (usually refers to VOC and/SVOC TICs)

SS - Calibrated against a single substance

* - analysis subcontracted to a Jones Environmental approved laboratory.

W - Results expressed on as received basis

+ Failed AQC results should be considered as indicative only and are not accredited.

++ Result outside calibration range, may be possible to re-run with higher detection limits

T.P Tour Gas + Soil

CHAIN OF CUSTODY

CLIENT: O'Callaghan Moran & Associates
ADDRESS: Granary House, Rutland Street, Cork.

PROJECT MANAGER (PM): Barry Sexton
MOBILE: 00353 - 87 6119640
PROJECT ID: 09 - 188 - 01
SITE: Tipperary Town Landfill

SAMPLER: B. Sexton
MOBILE:
EMAIL REPORT TO: B. Sexton
cc REPORT TO:
INVOICE TO: (if different to report) OCM
QUOTE NUMBER: P.O No:

Jones Environmental Laboratory.

Chain of Custody sheet page 1 of 1

TURNAROUND - please tick

10 DAY		4 DAY		Other	
5 DAY		3 DAY			

FOR LABORATORY USE ONLY
AVERAGE COOL BOX TEMP.(if required):
SAMPLE RECIEPT CONDITION:

SAMPLE INFORMATION (note: S = Soil, W=Water, P=Product/oil)

ANALYSIS REQUIRED including SUITE names

Lab ID	Sample ID	Matrix	Date	Time	Depth in Metres	Preservation	Humus Site	DO, pH, EC	Total Sus. Solids	Total Ammonia	TOC, TOX	BOD, COD	Metals	Total Alkalinity	Sulphate	Chloride	Total Cyanide	Fluoride	Pesticides	VOC's, SVOC	PAH	Ca, K, P	Total Chromium	COMMENTS
	TP - 1	S																						
	TP - 4	S					✓																	Metals:
	TP - 11	S																						Ca, Mg, Fe, Mn, Cd
	TP - 12	S																						
	TP - 15	S																						Cu, Ni, Pb, Zn, As, B
	SW - 1	W					✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
																								Hg

NOTE: If an MCERTS report is required this must be requested when samples are scheduled.

RELINQUISHED BY:		RECEIVED BY:		METHOD of SHIPMENT
Name:	Date:	Name:	Date:	Consignment note No:
Of: Barry Sexton	Time:	Of:	Time:	Courier Company:

Health & Safety instructions including known hazards (eg suspected asbestos)

Jones Environmental Laboratory
Unit 3 Deeside Point, Zone 3 Deeside Industrial Park, Deeside, Flintshire CH5 2UA Tel: 01244 833 780

JEL 6863

QF-PM1.1 v2

Jones Environmental Laboratory

Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

Tel: +44 (0) 1244 833780
Fax: +44 (0) 1244 833781

O'Callaghan Moran & Associates
Granary House
Rutland Street
Cork

UKAS TESTING
No.4225

Attention :	Barry Sexton
Date :	8th December 2009
Your reference :	09-188-01
Our reference :	Test Report 09/3874
Location :	Tipperary Town Landfill
Date samples received :	25/11/09
Status :	Final Report
Issue :	1

Eight samples were received for analysis on 25th November 2009 which was completed on 8th December 2009. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced.
All interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

J W Farrell- Jones CChem FRSC
Chartered Chemist

Jones Environmental Laboratory

Client Name:	O'Callaghan Moran & Associates	**Report :**	**Liquids**
Reference:	09-188-01		
Location:	Tipperary Town Landfill		
Contact:	Barry Sexton	**Liquids/products:**	V=40ml vial, G=glass bottle, P=plastic bottle
JE Job No.:	09/3874		$H=H_2SO_4$, Z=ZnAc, N=NaOH, $HN=HN0_3$

J E Sample No.	1-6	7-12	13-18	19-24	25-30	31-36	37-42	43-48			LOD	Units	Method No.
Sample ID	MW1	MW2	MW3	MW4	MW5	MW6	MW7	MW8					
Depth	-	-	-	-	-	-	-	-					
COC No / misc													
Containers	V H P G	V H P G	V H P G	V H P G	V H P G	V H P G	V H P G	V H P G					
Sample Date	23/11/09	23/11/09	23/11/09	23/11/09	23/11/09	23/11/09	23/11/09	23/11/09					
Sample Type	Water	Water	Water	Water	Water	Water	Water	Water					
Batch Number	1	1	1	1	1	1	1	1					
Date of Receipt	25/11/09	25/11/09	25/11/09	25/11/09	25/11/09	25/11/09	25/11/09	25/11/09					
pH#	8.01	8.50	7.88	78.20	~	8.02	~	8.30			<0.01	pH units	TM19/PM11
Electrical Conductivity# @25°C	3710	4370	6370	1232	~	1389	~	1490			<100	µS/cm	TM28/PM11
Total Oxidised Nitrogen as N#	<0.05	<0.05	<0.05	1.22	~	42.27	~	<0.05			<0.05	mg/l	TM038W
Ammonia Total as NH3#	70.5	43.5	18.1	0.7	~	0.8	~	0.2			<0.2	mg/l	TM038W
Total Dissolved Solids	~	~	~	472	~	947	~	919			<35	mg/l	TM020W
TOC	~	~	~	5	~	10	~	6			<2	mg/l	TM060W
BOD settled	20	26	9	~	~	~	~	~			<1	mg/l	TM058W
COD	114	183	52	~	~	~	~	~			<7	mg/l	TM057W
Arsenic - dissolved #	19.2	17.1	10.3	6	~	6.6	~	6.6			<2.5	µg/l	TM 030W
Boron - dissolved	945	1917	733	25	~	258	~	20			<12	µg/l	TM 030W
Cadmium - dissolved #	<0.5	<0.5	<0.5	<0.5	~	<0.5	~	<0.5			<0.5	µg/l	TM 030W
Copper - dissolved #	<7	<7	<7	<7	~	<7	~	12			<7	µg/l	TM 030W
Mercury - dissolved #	<1	<1	<1	<1	~	<1	~	<1			<1	µg/l	TM 030W
Nickel - dissolved #	4	15	<2	<2	~	2	~	4			<2	µg/l	TM 030W
Lead - dissolved #	16	5	11	5	~	7	~	8			<5	µg/l	TM 030W
Zinc - dissolved #	4	11	4	<3	~	<3	~	10			<3	µg/l	TM 030W
Iron - dissolved #	81	52	<20	<20	~	<20	~	<20			<20	µg/l	TM 030W
Manganese - dissolved #	903	385	706	116	~	342	~	538			<2	µg/l	TM 030W
Calcium - dissolved	122.30	47.91	166.40	119.10	~	144.4	~	147.7			<0.03	mg/l	TM 030W
Magnesium - dissolved	42.28	28.96	58.08	9.30	~	14.82	~	19.03			<0.02	mg/l	TM 030W
Sulphate#	6.79	100.53	3.15	14.78	~	104.22	~	11.22			<0.05	mg/l	TM038W
Chloride#	235.2	948.6	1703.7	57.9	~	135.9	~	276.2			<0.3	mg/l	TM038W
Fluoride	<0.3	0.3	0.5	<0.3	~	<0.3	~	<0.3			<0.3	mg/l	TM027W
Total Alkalinity as CaCO3#	~	~	~	308	~	388	~	368			<1	mg/l	TM032W
Total Cyanide*	<40	<40	<40	<40	~	<40	~	<40			<40	µg/l	subcontracted
Chromium - total	19.1	2.5	16.6	<1.5	~	<1.5	~	<1.5			<1.5	µg/l	TM 030W
Phosphorous - dissolved #	56	336	21	10	~	12	~	11			<5	µg/l	TM 030W
Potassium - dissolved	74.02	127.00	65.60	1.58	~	5.64	~	1.21			<0.04	mg/l	TM 030W
Sodium - dissolved	100.30	352.50	586.30	40.11	~	101.30	~	81.15			<0.15	mg/l	TM 030W
EPH (C8-C40) (dissolved) # SS	352	92	<10	<10	~	<10	~	<10			<10	µg/ l	TM5/PM9
Mineral Oil (interpretation & calculation)	<10	<10	<10	<10	~	<10	~	<10			<10	µg/ l	TM5/PM9

Please see attached notes for all abbreviations and acronyms

Jones Environmental Laboratory

Client Name:	O'Callaghan Moran & Associates	**Report :**	**Liquids**
Reference:	09-188-01		
Location:	Tipperary Town Landfill		
Contact:	Barry Sexton	**Liquids/products:**	V=40ml vial, G=glass bottle, P=plastic bottle
JE Job No.:	09/3874		$H=H_2SO_4$, Z=ZnAc, N=NaOH, $HN=HN0_3$

J E Sample No.	1-6	7-12	13-18	19-24	25-30	31-36	37-42	43-48			LOD	Units	Method No.
Sample ID	MW1	MW2	MW3	MW4	MW5	MW6	MW7	MW8					
Depth	-	-	-	-	-	-	-	-					
COC No / misc													
Containers	V H P G	V H P G	V H P G	V H P G	V H P G	V H P G	V H P G	V H P G					
Sample Date	23/11/09	23/11/09	23/11/09	23/11/09	23/11/09	23/11/09	23/11/09	23/11/09					
Sample Type	Water	Water	Water	Water	Water	Water	Water	Water					
Batch Number	1	1	1	1	1	1	1	1					
Date of Receipt	25/11/09	25/11/09	25/11/09	25/11/09	25/11/09	25/11/09	25/11/09	25/11/09					
VOCs #	See tab	See tab	See tab	See tab	~	See tab	~	See tab			<1-27	µg/l	TM15/PM10
SVOCs (dissolved)	See tab	See tab	See tab	See tab	~	See tab	~	See tab			<10	µg/l	TM16/PM9
Combined OP & OC Pesticides	See tab	See tab	See tab	See tab	~	See tab	~	See tab			<0.01	µg/l	TM042
PAH 16 (Dissolved) MS													
Naphthalene	42.5	<0.1	<0.1	<0.1	~	<0.1	~	<0.1			<0.1	µg/l	TM4/PM9
Acenaphthylene	<0.08	<0.08	<0.08	<0.08	~	<0.08	~	<0.08			<0.08	µg/l	TM4/PM9
Acenaphthene	1.4	<0.1	<0.1	<0.1	~	<0.1	~	<0.1			<0.1	µg/l	TM4/PM9
Fluorene	0.90	<0.07	<0.07	<0.07	~	<0.07	~	<0.07			<0.07	µg/l	TM4/PM9
Phenanthrene	0.80	<0.07	<0.07	<0.07	~	<0.07	~	<0.07			<0.07	µg/l	TM4/PM9
Anthracene	<0.08	<0.08	<0.08	<0.08	~	<0.08	~	<0.08			<0.08	µg/l	TM4/PM9
Fluoranthene	<0.09	<0.09	<0.09	<0.09	~	<0.09	~	<0.09			<0.09	µg/l	TM4/PM9
Pyrene	<0.12	<0.12	<0.12	<0.12	~	<0.12	~	<0.12			<0.12	µg/l	TM4/PM9
Benz(a)anthracene	<0.09	<0.09	<0.09	<0.09	~	<0.09	~	<0.09			<0.09	µg/l	TM4/PM9
Chrysene	<0.1	<0.1	<0.1	<0.1	~	<0.1	~	<0.1			<0.1	µg/l	TM4/PM9
Benzo(bk)fluoranthene	<0.26	<0.26	<0.26	<0.26	~	<0.26	~	<0.26			<0.26	µg/l	TM4/PM9
Benzo(a)pyrene	<0.12	<0.12	<0.12	<0.12	~	<0.12	~	<0.12			<0.12	µg/l	TM4/PM9
Indeno(123cd)pyrene	<0.1	<0.1	<0.1	<0.1	~	<0.1	~	<0.1			<0.1	µg/l	TM4/PM9
Dibenzo(ah)anthracene	<0.1	<0.1	<0.1	<0.1	~	<0.1	~	<0.1			<0.1	µg/l	TM4/PM9
Benzo(ghi)perylene	<0.12	<0.12	<0.12	<0.12	~	<0.12	~	<0.12			<0.12	µg/l	TM4/PM9
PAH 16 Total	45.60	<1.60	<1.60	<1.60	~	<1.60	~	<1.60			<1.60	µg/l	TM4/PM9

Please see attached notes for all abbreviations and acronyms

Jones Environmental Laboratory

Client Name: O'Callaghan Moran & Associates **VOC Report : Liquids**

Reference: 09-188-01

Location: Tipperary Town Landfill

Contact: Barry Sexton **Liquids/products:** V=40ml vial, G=glass bottle, P=plastic bottle

JE Job No.: 09/3874 H=H_2SO_4, Z=ZnAc, N=NaOH, HN=$HN0_3$

J E Sample No.	1-6	7-12	13-18	19-24	31-36	43-48					LOD	Units	Method No.
Sample ID	MW1	MW2	MW3	MW4	MW6	MW8							
Depth	-	-	-	-	-	-							
COC No / misc													
Containers	V H P G	V H P G	V H P G	V H P G	V H P G	V H P G							
Sample Date	23/11/09	23/11/09	23/11/09	23/11/09	23/11/09	23/11/09							
Sample Type	Water	Water	Water	Water	Water	Water							
Batch Number	1	1	1	1	1	1							
Date of Receipt	25/11/09	25/11/09	25/11/09	25/11/09	25/11/09	25/11/09							
Dichlorodifluoromethane	<2	<2	<2	<2	<2	<2					<2	µg/l	TM15/PM10
Methyl Tertiary Butyl Ether	<2	<2	<2	<2	<2	<2					<2	µg/l	TM15/PM10
Chloromethane #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
Vinyl Chloride	<2	<2	<2	<2	<2	<2					<2	µg/l	TM15/PM10
Bromomethane	<1	<1	<1	<1	<1	<1					<1	µg/l	TM15/PM10
Chloroethane #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
Trichlorofluoromethane #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
1,1-Dichloroethene #	<6	<6	<6	<6	<6	<6					<6	µg/l	TM15/PM10
Carbon Disulphide #	NA	NA	NA	NA	NA	NA					<3	µg/l	TM15/PM10
Dichloromethane #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
trans-1-2-Dichloroethene #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
1,1-Dichloroethane #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
cis-1-2-Dichloroethene #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
2,2-Dichloropropane	<1	<1	<1	<1	<1	<1					<1	µg/l	TM15/PM10
Bromochloromethane #	<2	<2	<2	<2	<2	<2					<2	µg/l	TM15/PM10
Chloroform #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
1,1,1-Trichloroethane #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
1,1-Dichloropropene #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
Carbon tetrachloride #	<2	<2	<2	<2	<2	<2					<2	µg/l	TM15/PM10
1,2-Dichloroethane #	<2	<2	<2	<2	<2	<2					<2	µg/l	TM15/PM10
Benzene #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
Trichloroethene	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
1,2-Dichloropropane #	<2	<2	<2	<2	<2	<2					<2	µg/l	TM15/PM10
Dibromomethane #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
Bromodichloromethane #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
cis-1-3-Dichloropropene #	<2	<2	<2	<2	<2	<2					<2	µg/l	TM15/PM10
Toluene #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
trans-1-3-Dichloropropene #	<2	<2	<2	<2	<2	<2					<2	µg/l	TM15/PM10
1,1,2-Trichloroethane #	<2	<2	<2	<2	<2	<2					<2	µg/l	TM15/PM10
Tetrachloroethene #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
1,3-Dichloropropane #	<2	<2	<2	<2	<2	<2					<2	µg/l	TM15/PM10
Dibromochloromethane #	<2	<2	<2	<2	<2	<2					<2	µg/l	TM15/PM10
1,2-Dibromoethane #	<2	<2	<2	<2	<2	<2					<2	µg/l	TM15/PM10
Chlorobenzene #	<2	<2	<2	<2	<2	<2					<2	µg/l	TM15/PM10
1,1,1,2-Tetrachloroethane #	<2	<2	<2	<2	<2	<2					<2	µg/l	TM15/PM10
Ethylbenzene #	4	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
p/m-Xylene #	9	<5	<5	<5	<5	<5					<5	µg/l	TM15/PM10
o-Xylene #	5	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
Styrene #	<2	<2	<2	<2	<2	<2					<2	µg/l	TM15/PM10
Bromoform #	<2	<2	<2	<2	<2	<2					<2	µg/l	TM15/PM10
Isopropylbenzene #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
1,1,2,2-Tetrachloroethane	<4	<4	<4	<4	<4	<4					<4	µg/l	TM15/PM10
Bromobenzene #	<2	<2	<2	<2	<2	<2					<2	µg/l	TM15/PM10
1,2,3-Trichloropropane #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
Propylbenzene #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
2-Chlorotoluene #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
1,3,5-Trimethylbenzene #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
4-Chlorotoluene #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
tert-Butylbenzene #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
1,2,4-Trimethylbenzene #	8	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
sec-Butylbenzene #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
4-Isopropyltoluene #	10	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
1,3-Dichlorobenzene #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
1,4-Dichlorobenzene #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
n-Butylbenzene #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
1,2-Dichlorobenzene #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
1,2-Dibromo-3-chloropropane	<2	<2	<2	<2	<2	<2					<2	µg/l	TM15/PM10
1,2,4-Trichlorobenzene	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
Hexachlorobutadiene #	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10
Naphthalene	68	<2	<2	<2	<2	<2					<2	µg/l	TM15/PM10
1,2,3-Trichlorobenzene	<3	<3	<3	<3	<3	<3					<3	µg/l	TM15/PM10

Please see attached notes for all abbreviations and acronyms

Client Name: O'Callaghan Moran & Associates **SVOC Report : Liquids**

Reference: 09-188-01

Location: Tipperary Town Landfill

Contact: Barry Sexton **Liquids/products:** V=40ml vial, G=glass bottle, P=plastic bottle

JE Job No.: 09/3874 $H=H_2SO_4$, Z=ZnAc, N=NaOH, $HN=HN0_3$

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1-6	7-12	13-18	19-24	31-36	43-48	LOD	Units	Method No.
Sample ID	MW1	MW2	MW3	MW4	MW6	MW8			
Depth	-	-	-	-	-	-			
COC No / misc									
Containers	V H P G	V H P G	V H P G	V H P G	V H P G	V H P G			
Sample Date	23/11/09	23/11/09	23/11/09	23/11/09	23/11/09	23/11/09			
Sample Type	Water	Water	Water	Water	Water	Water			
Batch Number	1	1	1	1	1	1			
Date of Receipt	25/11/09	25/11/09	25/11/09	25/11/09	25/11/09	25/11/09			
Phenols									
2-Chlorophenol	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
2-Methylphenol	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
2-Nitrophenol	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
2,4-Dichlorophenol	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
2,4-Dimethylphenol	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
2,4,5-Trichlorophenol	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
2,4,6-Trichlorophenol	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
4-Chloro-3-methylphenol	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
4-Methylphenol	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
4-Nitrophenol	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
Pentachlorophenol	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
Phenol	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
PAHs									
2-Chloronaphthalene	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
2-Methylnaphthalene	19	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
Naphthalene	SEE PAH RESULTS						<10	µg/ l	TM16/PM9
Acenaphthylene							<10	µg/ l	TM16/PM9
Acenaphthene							<10	µg/ l	TM16/PM9
Fluorene							<10	µg/ l	TM16/PM9
Phenanthrene							<10	µg/ l	TM16/PM9
Anthracene							<10	µg/ l	TM16/PM9
Fluoranthene							<10	µg/ l	TM16/PM9
Pyrene							<10	µg/ l	TM16/PM9
Benz(a)anthracene							<10	µg/ l	TM16/PM9
Chrysene							<10	µg/ l	TM16/PM9
Benzo(bk)fluoranthene							<10	µg/ l	TM16/PM9
Benzo(a)pyrene							<10	µg/ l	TM16/PM9
Indeno(123cd)pyrene							<10	µg/ l	TM16/PM9
Dibenzo(ah)anthracene							<10	µg/ l	TM16/PM9
Benzo(ghi)perylene							<10	µg/ l	TM16/PM9
Phthalates									
Bis(2-ethylhexyl) phthalate	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
Butylbenzyl phthalate	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
Di-n-butyl phthalate	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
Di-n-Octyl phthalate	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
Diethyl phthalate	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
Dimethyl phthalate	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
Other SVOCs									
1,2-Dichlorobenzene	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
1,2,4-Trichlorobenzene	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
1,3-Dichlorobenzene	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
1,4-Dichlorobenzene	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
2-Nitroaniline	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
2,4-Dinitrotoluene	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
2,6-Dinitrotoluene	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
3-Nitroaniline	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
4-Bromophenylphenylether	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
4-Chloroaniline	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
4-Chlorophenylphenylether	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
4-Nitroaniline	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
Azobenzene	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
Bis(2-chloroethoxy)methane	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
Bis(2-chloroethyl)ether	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
Carbazole	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
Dibenzofuran	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
Hexachlorobenzene	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
Hexachlorobutadiene	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
Hexachlorocyclopentadiene	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
Hexachloroethane	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
Isophorone	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
N-nitrosodi-n-propylamine	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9
Nitrobenzene	<10	<10	<10	<10	<10	<10	<10	µg/ l	TM16/PM9

Client Name: O'Callaghan Moran & Associates

Reference: 09-188-01

Location: Tipperary Town Landfill

Contact: Barry Sexton

JE Job No.: 09/3874

Report - Pesticides - waters

Liquids/products: V=40ml vial, G=glass bottle, P=plastic bottle
$H=H_2SO_4$, Z=ZnAc, N=NaOH, $HN=HN0_3$

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1-6	7-12	13-18	19-24	31-36	43-48					LOD	Units	Method No.
Sample ID	MW1	MW2	MW3	MW4	MW6	MW8							
Depth	-	-	-	-	-	-							
COC No / misc													
Containers	V H P G	V H P G	V H P G	V H P G	V H P G	V H P G							
Sample Date	23/11/09	23/11/09	23/11/09	23/11/09	23/11/09	23/11/09							
Sample Type	Water	Water	Water	Water	Water	Water							
Batch Number	1	1	1	1	1	1							
Date of Receipt	25/11/09	25/11/09	25/11/09	25/11/09	25/11/09	25/11/09							
Combined Pesticide Suite													
Dichlorvos	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
Mevinphos	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
Alpha-BHC	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
Beta-BHC	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
Gamma-BHC	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
Diazinon	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
Methyl Parathion	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
Ethyl Parathion (Parathion)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
Heptachlor	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
Fenitrothion	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
Aldrin	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
Malathion	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
Heptachlor Epoxide	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
Endosulfan I	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
Dieldrin	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
4, 4'-DDE	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
Endosulfan II	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
4,4'-DDD	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
Ethion	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
Endrin	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
Endosulfan Sulphate	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
4,4'-DDT	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
Methoxychlor	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
Azinphos Methyl	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042
Disulfoton	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01					<0.01	µg/l	TM042

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

SOILS

Please note we are only MCERTS accredited for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. Your final report will reflect this, with non-MCERTS results on separate pages.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. If we are instructed to keep samples, a storage charge of £1 (1.5 Euros) per sample per month will be applied until we are asked to dispose of them.

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Asbestos screens where requested will be undertaken by a UKAS accredited laboratory.

WATERS

Please note we are not a Drinking Water Inspectorate (DWI) Approved Laboratory . It is important that detection limits are carefully considered when requesting water analysis.

UKAS accreditation applies to tap water, surface water and groundwater only, any other liquids are outside our scope of accreditation

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples. All samples are treated as groundwaters and anlalysis performed on settled samples unless we are instructed otherwise.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any analysis that may be compromised highlighted on your schedule/ report by the use of a symbol.

The use of any of the following symbols indicates that the sample was deviating and the test result may be unreliable:

$ sample temperature on receipt considered inappropriate for analysis requested

^ samples exceeding recomended holding times

& samples received in inappropriate containers (e.g. volatile samples not submitted in VOC jars/vials)

~ no sampling date given, unable to confirm if samples are with acceptable holding times

ABBREVIATIONS and ACRONYMS USED

- UKAS accredited

M - MCERTS accredited

NAD - No Asbestos Detected

ND - None Detected (usually refers to VOC and/SVOC TICs)

SS - Calibrated against a single substance

* - analysis subcontracted to a Jones Environmental approved laboratory.

W - Results expressed on as received basis

+ Failed AQC results should be considered as indicative only and are not accredited.

++ Result outside calibration range, may be possible to re-run with higher detection limits

Tip Gate

CHAIN OF CUSTODY

CLIENT: O'Callaghan Moran & Associates
ADDRESS: Granary House, Rutland Street, Cork

PROJECT MANAGER (PM): Barry Sartin
MOBILE: 00353-87-6119640
PROJECT ID: 09-188-01
SITE: Tipperary Town Landfill

SAMPLER: B. Sartin
MOBILE:
EMAIL REPORT TO: B. Sartin
cc REPORT TO:
INVOICE TO: (if different to report) OCM
QUOTE NUMBER: P.O No:

Jones Environmental Laboratory.

Chain of Custody sheet page 1 of 1

TURNAROUND - please tick

10 DAY	✓	4 DAY		Other	
5 DAY		3 DAY			

FOR LABORATORY USE ONLY
AVERAGE COOL BOX TEMP.(if required):
SAMPLE RECIEPT CONDITION:

SAMPLE INFORMATION (note: S = Soil, W=Water, P=Product/oil)

ANALYSIS REQUIRED including SUITE names

Lab ID	Sample ID	Matrix	Date	Time	Depth in Metres	Preservation	pH, EC	Ammonia	TON	Metals	Sulphate	Chloride	Total Cyanide	Fluoride	VOC (MT)	Pesticides	Dis. K+	Total Cr	TDS, TDC	Total Alkalinity	BOD, COD	DRO	Phenol
	MW-1	W	24.1.9				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	MW-2	W	"				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	MW-3	W	"				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	MW-4	W	"				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	MW-5	W	"				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	MW-6	W	"				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	MW-7	W	"				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	MW-8	W	"				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

COMMENTS

Notes: e.g. Heavily contaminated samples
e.g. "High PAHs expected".

NOTE: If an MCERTS report is required this must be requested when samples are scheduled.

Metals to include Co, Mg, Fe, Mn, Cd, Ca, Ni, Pb, Zn, As, B

Hg

RELINQUISHED BY:
Name:
Of:
Date:
Time:

RECEIVED BY:
Name:
Of:
Date:
Time:

METHOD of SHIPMENT
Consignment note No:
Courier Company:

Health & Safety instructions including known hazards (eg suspected asbestos)

Jones Environmental Laboratory
Unit 3 Deeside Point, Zone 3 Deeside Industrial Park, Deeside, Flintshire CH5 2UA Tel: 01244 833 780

JEL 6851

QF-PM1.1 v2

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Barry Sexton
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Cork
Co.Cork

Certificate No.: 352046
Job Ref: 09K05195
Sample Ref No.: *LSN* 38/66411
Page No.: 1 of 5
Date Received: 23/11/2009
Date Reported: 24/11/2009

TEST REPORT

Sample Description Water - MW-4 - 23/11/09 - 11:20

Date Testing Initiated: 23/11/2009
Category: MICRO
Sample Condition: Satisfactory
Order No.: NA
Supplier Code:

Test	Result	Unit	Method	Comments	Est.
Total Coliform Count-Colilert	**1,986**	**MPN/100mls**	**MTC121**		
E.COLI Count - Colilert	**10**	**MPN/100mls**	**MTC121**		

All tests are carried out according to our INAB schedule of accreditation.

Comments, opinions and interpretations expressed herein are outside this current scope of INAB accreditation.
Results apply only to samples tested, and as received at the Laboratory.

Signed for and on behalf of Exova (Ireland) Ltd.

Michelle Everard
B.Sc (Biosciences)
Snr.Tech Microbiology Division

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Certificate No.: 352046
Job Ref: 09K05195
Sample Ref No.: *LSN* 38/66412
Page No.: 2 of 5
Date Received: 23/11/2009
Date Reported: 24/11/2009

TEST REPORT

Sample Description Water - MW-5 - 23/11/09 - 11:35

Date Testing Initiated: 23/11/2009
Category: MICRO
Sample Condition: Satisfactory
Order No.: NA
Supplier Code:

Test	Result	Unit	Method	Comments	Est.
Total Coliform Count-Colilert	**205**	**MPN/100mls**	**MTC121**		
E.COLI Count - Colilert	**21**	**MPN/100mls**	**MTC121**		

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Certificate No.: 352046
Job Ref: 09K05195
Sample Ref No.: *LSN* 38/66413
Page No.: 3 of 5
Date Received: 23/11/2009
Date Reported: 24/11/2009

TEST REPORT

Sample Description Water - MW-6 - 23/11/09 - 11:45

Date Testing Initiated: 23/11/2009
Category: MICRO
Sample Condition: Satisfactory
Order No.: NA
Supplier Code:

Test	Result	Unit	Method	Comments	Est.
Total Coliform Count-Colilert	**2,420**	**MPN/100mls**	**MTC121**		
E.COLI Count - Colilert	**10**	**MPN/100mls**	**MTC121**		

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Certificate No.: 352046
Job Ref: 09K05195
Sample Ref No.: *LSN* 38/66414
Page No.: 4 of 5
Date Received: 23/11/2009
Date Reported: 24/11/2009

TEST REPORT

Sample Description Water - MW-7 - 23/11/09 - 12:15

Date Testing Initiated: 23/11/2009
Category: MICRO
Sample Condition: Satisfactory
Order No.: NA
Supplier Code:

Test	Result	Unit	Method	Comments	Est.
Total Coliform Count-Colilert	**248**	**MPN/100mls**	**MTC121**		
E.COLI Count - Colilert	**26**	**MPN/100mls**	**MTC121**		

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Certificate No.: 352046
Job Ref: 09K05195
Sample Ref No.: *LSN* 38/66415
Page No.: 5 of 5
Date Received: 23/11/2009
Date Reported: 24/11/2009

TEST REPORT

Sample Description Water - MW-8 - 23/11/09 - 11:55

Date Testing Initiated: 23/11/2009
Category: MICRO
Sample Condition: Satisfactory
Order No.: NA
Supplier Code:

Test	Result	Unit	Method	Comments	Est.
Total Coliform Count-Colilert	**1,986**	**MPN/100mls**	**MTC121**		
E.COLI Count - Colilert	**50**	**MPN/100mls**	**MTC121**		

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO.183T

183T