COMHAIRLE CHONDAE AN CABHÁIN

Cavan County Council

Annual Environmental Report 2013

Bailieborough Landfill WL0091-1

Document Title	Annual Environmental Report 2013 Bailieborough Landfill WL0091-1		
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Boylan Engineering (Eng. & Environmental Consultancy) was commissioned by Cavan County Council to prepare the following Annual Environmental Report.

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1.0 INTRODUCTION

Bailieborough Landfill has been operated as waste disposal facility by Cavan County Council since the late 1960s. The landfill is located on the outskirts of the town of Bailieborough, (c. 1 km from town centre), in the town land of Tanderagee, which was a commercially exploited bog. The site was operated as a traditional landfill constructed on peat and relies on the properties of the peat bog for attenuation, dilution and dispersal. The total area of the site comprises 2.23 hectares.

A Waste Licence for the facility was issued by the EPA on 22nd February 2002, when the site officially closed and was thereafter remediated. Condition 11.6 of Waste Licence Ref. 91-1 requires the submission of an Annual Environmental Report (AER) for Bailieborough Landfill facility. This document is produced in order to comply with requirements of Condition 11.6.

The requirements for reporting of Annual Environmental Information arise under individual EPA licences issued under the EPA Acts 1992 – 2008, the Waste Management Acts 1996 – 2008 and other legislation.

This AER will provide information as outlined in Schedule F of the Licence "Content of the Annual Environmental Report".

2.0 REPORTING PERIOD

The reporting period for the purpose of this AER is 01st January 2013 - 31st December 2013.

3.0 WASTE ACTIVITIES CARRIED OUT AT THE FACILITY

There were no waste activities carried out at the facility.

4.0 QUANTITY AND COMPOSITION OF THE WASTE

There is no longer any waste being accepted at the site. The quantity of waste accepted is zero tonnes.

5.0 SUMMARY REPORT ON EMISSIONS

The PRTR Regulations are the European Communities (European Pollutant Release and Transfer Register) Regulation 2007, S.I. No. 123 of 2007), which signed into Irish Law on 22 March 2007 the E-PRTR Regulation, (EC) No 166/2006, concerning the establishment of a European Pollutant Release and Transfer Register. The summary of emissions is detailed in the (PRTR) Report which appears in Appendix A of this report. The PRTR has been uploaded onto the EPA website in accordance with our responsibility as Licensee.

Cavan County Council now carries out the full scope of sampling as required by the Licence. Monitoring had been reduced at the time of the restoration works and the full sampling regime had not been re-established until late 2009 when advised by the Agency.

5.1 Surface Water

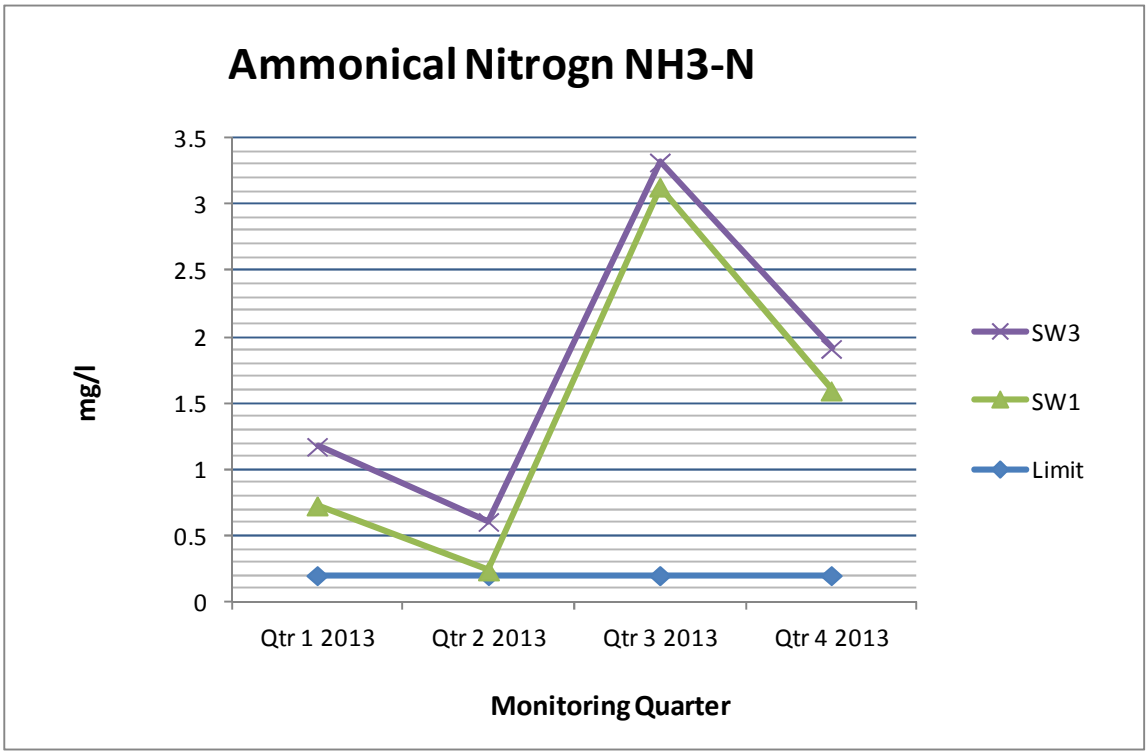
All monitoring locations are detailed in the site map which is presented in Appendix B.

As table 5.1 shows there was a high Ammonia, COD, Iron and Manganese levels recorded in the samples taken at the discharge cap, SW1 and SW3. SW1 is located downstream of the landfill while SW3 is located further downstream at the new monitoring location SW3 “Chapel Lough”.

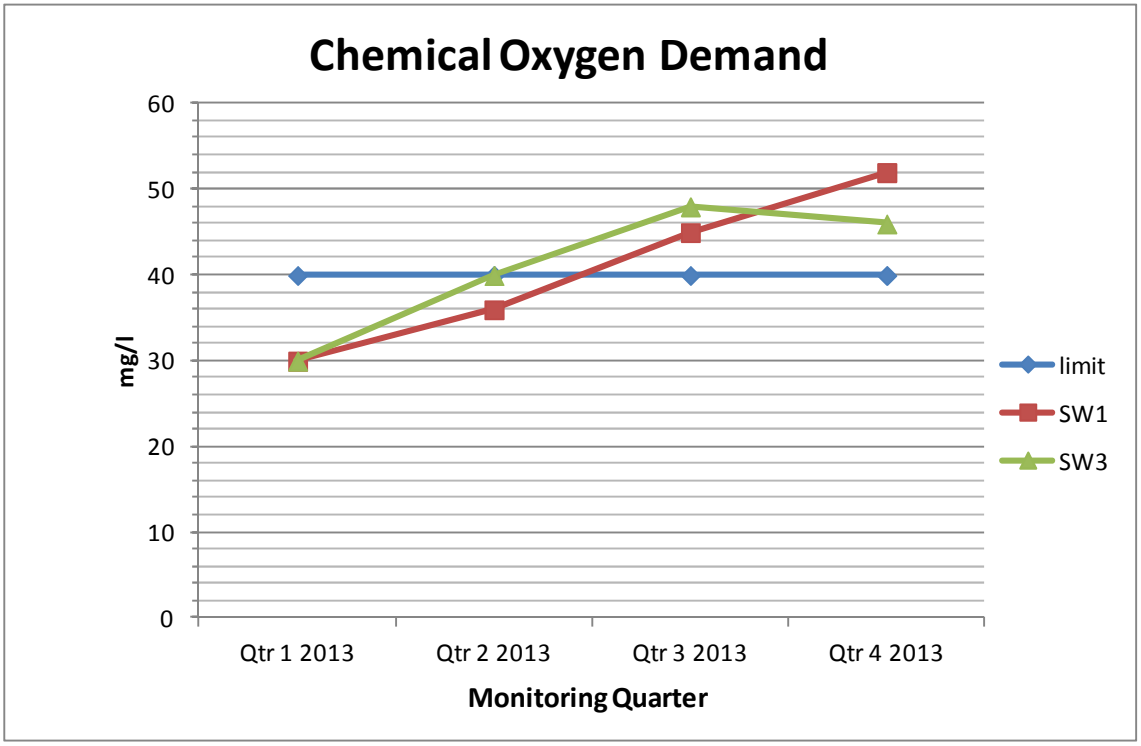
Table 5.1 Surface water summary results

	Parameter	Ammonia	pH	Cond	BOD	COD	Cl	SO4	Ortho-Phosphate (MRP)	DO	Fe	Mn	K	Na
	Units	mg/l N	pH Units	us/cm	mg/l	mg/l	mg/l	mg/l	mg/l P	mg/l	ug/l	ug/l	mg/l	mg/l
Discharge Cap	Qtr 4 2013	0.058	7.3	504	<1	24	10	98.3	<0.009	10	47.4	35.8	5	5.5
	Qtr 3 2013	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qtr 2 2013	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qtr 1 2013	-	-	-	-	-	-	-	-	-	-	-	-	-
SW1	Qtr 4 2013	1.393	6.9	321	<1	52	19.1	39.9	0.015	8	572.1	240.3	7.9	13.4
	Qtr 3 2013	2.931	7.2	442	<1	45	24.1	8.7	0.084	6.3	3688.2	2148.2	5.3	18.7
	Qtr 2 2013	0.036	7.2	267	3	36	21	26	0.01	8.3	858.2	902.1	5.1	14.6
	Qtr 1 2013	0.526	7.2	300	<1	30	27.4	15.9	0.078	8.7	453.2	219.9	5.6	17.9
SW3	Qtr 4 2013	0.317	6.8	320	<1	46	19.8	47	0.014	7	807.7	434.8	6.5	13.6
	Qtr 3 2013	0.185	7.1	301	<1	48	19.1	10.6	0.019	6.2	2008.7	1170.7	2.4	15.5
	Qtr 2 2013	0.369	7.1	259	<1	40	21.3	13.9	0.024	7.2	578.1	154.8	5.7	15.7
	Qtr 1 2013	0.446	7	303	3	30	20.3	33.5	<0.009	9.9	923.5	1349.9	4.2	14.9
S.I No 294/1989		0.2	≥5.5 and ≤8.5	1000	5	40	250	200		NAC	200	50		

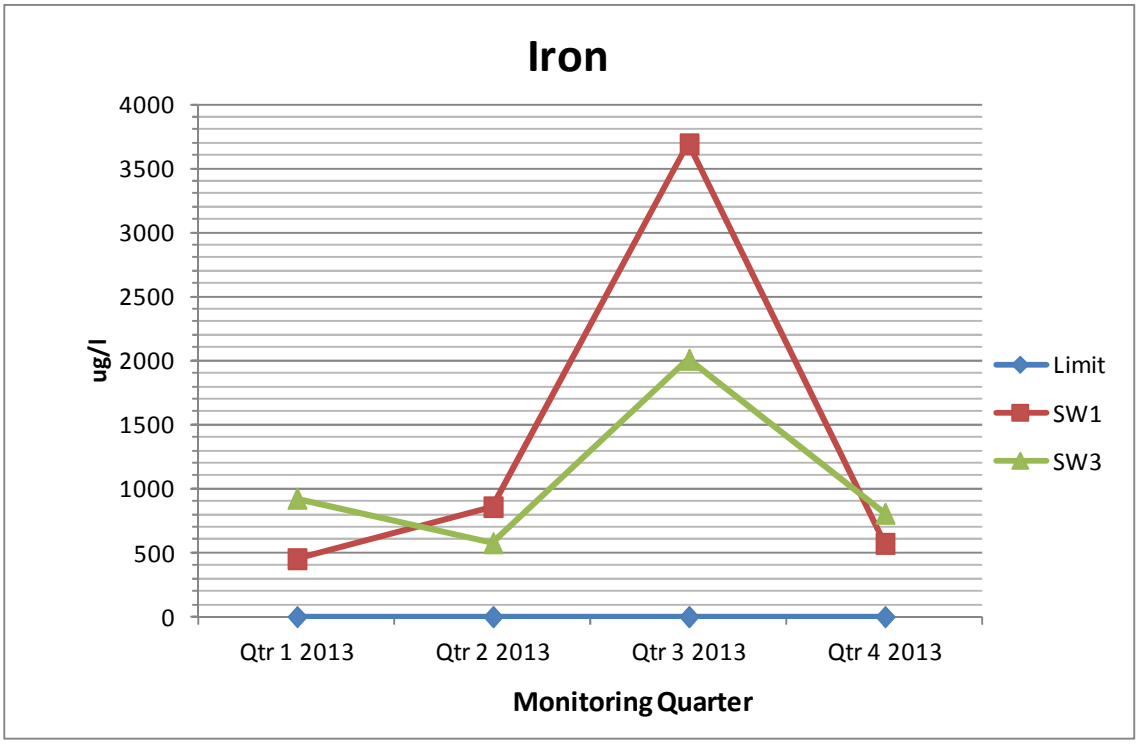
Graph 5.1



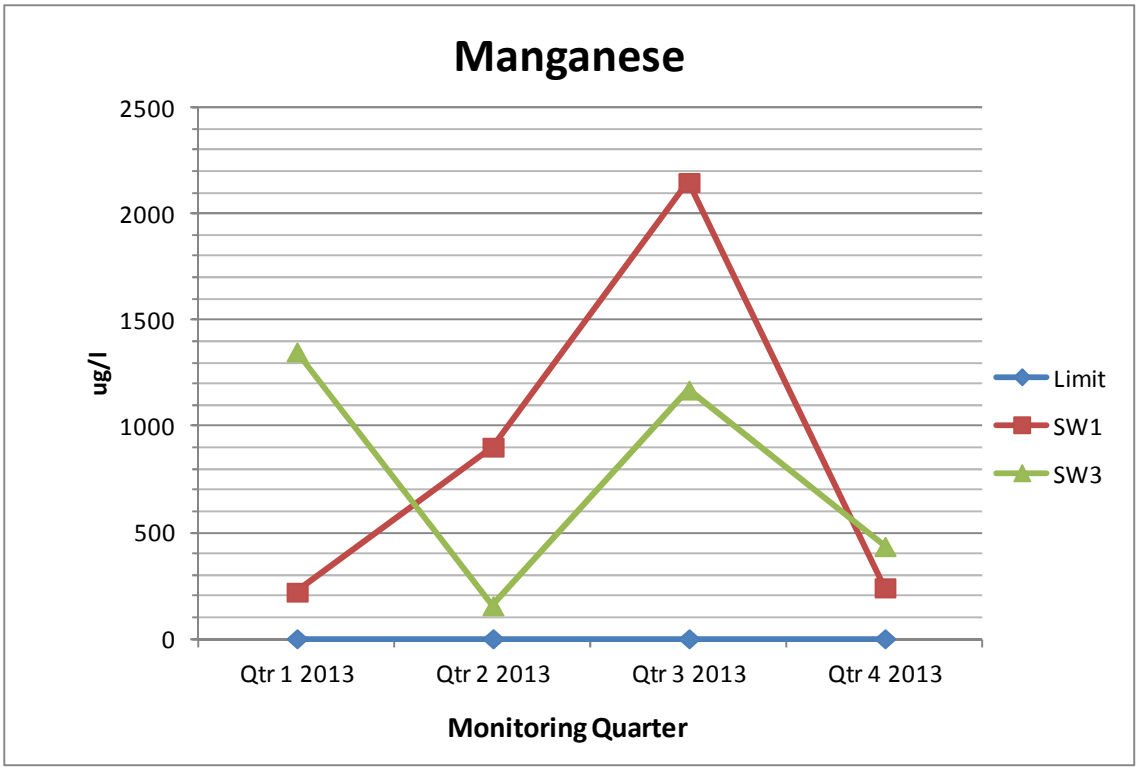
Graph 5.2



Graph 5.3



Graph 5.4



Elevated levels of Iron and Manganese can be attributed to the natural composition of the underlying geology however it is not uncommon to encounter high levels of both parameters in the vicinity of landfills. The elevated levels of Ammonia and COD encountered at SW1 and SW3 are attributed to low flows during which time the water may have become stagnant. One sample was obtained from the Cap Discharge location during 2013 due to the cap being dry on each of the other monitoring occasions.

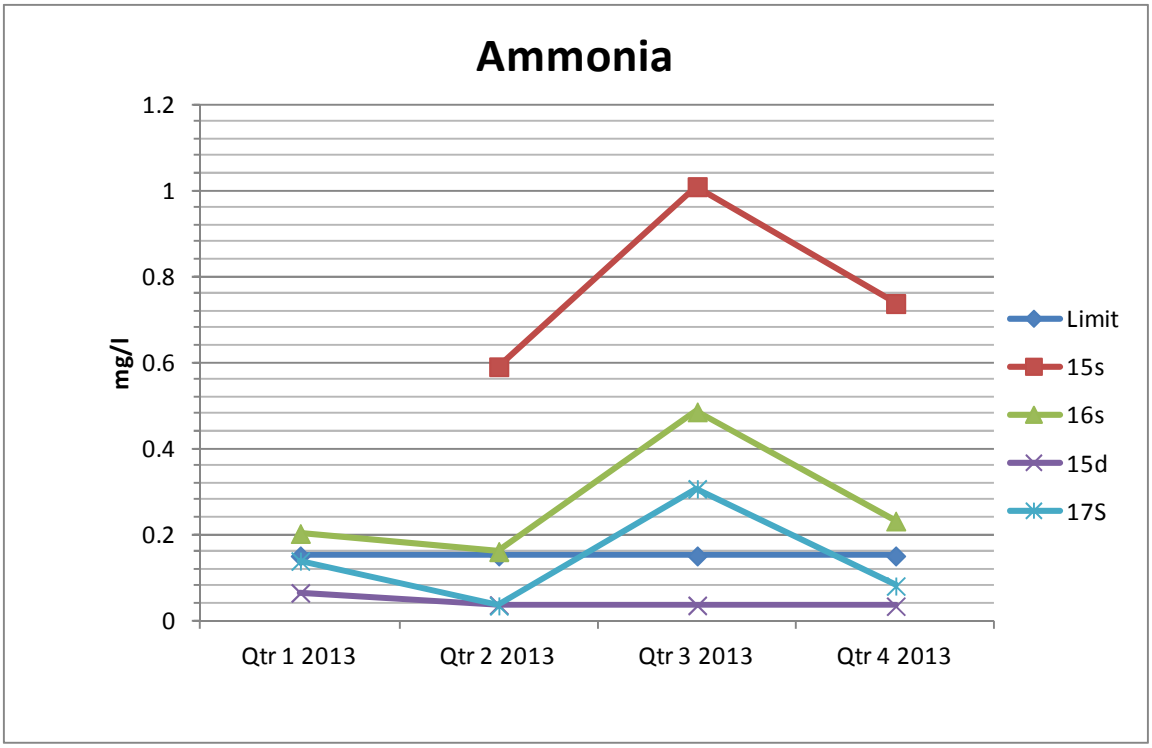
5.2 Groundwater

The following table details all reoccurring elevations at groundwater wells during 2013. Results in Hatched Red indicate where the interim guide value has been exceeded when compared to limits stipulated by the Environmental Protection Agency.

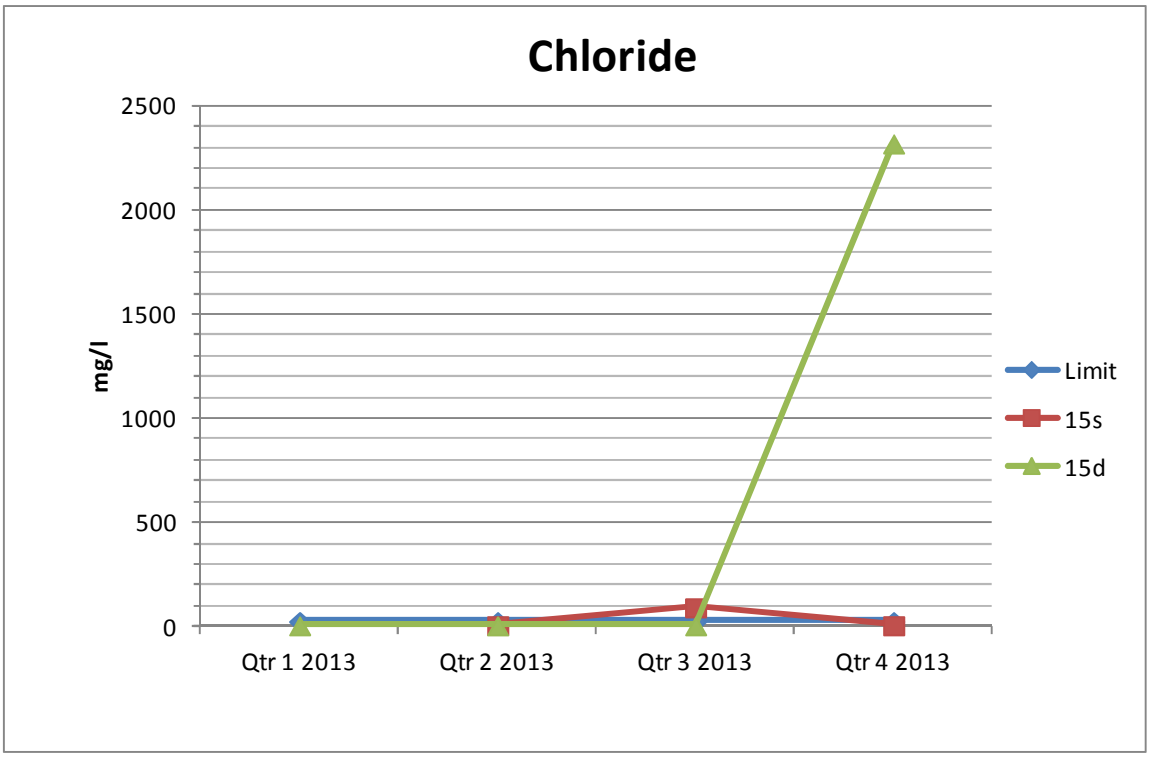
Table 5.2 Groundwater Summary Results

	Parameter	TOC	Ammonia	TON	pH	Cond	Cl	SO4	DO	Fe	Mn	K	Na
	Units	mg/l	mg/l N	mg/l N	pH Units	us/cm	mg/l	mg/l	mg/l	ug/l	ug/l	mg/l	mg/l
WELL 15 S	Qtr 4 2013	13.93	0.709	0.511	6	231	9.6	12.8	7	19676.7	507.6	5.2	8.5
	Qtr 3 2013	11.21	1.009	<0.138	6.1	437	95.6	33.2	6.1	24554	534.6	2.9	48
	Qtr 2 2013	11.62	0.59	<0.138	6.2	171	10.6	22.4	6.8	21058.8	412.2	3.7	7.4
	Qtr 1 2013	-	-	-	-	-	-	-	-	-	-	-	-
WELL 15 D	Qtr 4 2013	1.02	0.143	<0.138	7.6	302	2321.2	114.5	5	165.5	143.1	3.5	10.4
	Qtr 3 2013	1.42	0.035	<0.138	8	304	9.9	15.8	6.3	82	164.4	1.6	11.9
	Qtr 2 2013	0.88	0.036	<0.138	7.9	280	8.8	19.3	6	106.4	138.5	3.1	10.5
	Qtr 1 2013	0.59	0.064	<0.138	7.9	298	9.1	16.9	9.4	0.0448	137.3	2.1	10.7
WELL 16 S	Qtr 4 2013	2.34	0.319	0.154	6.5	264	9.3	23.9	8	448.1	317.3	4	8.7
	Qtr 3 2013	4.25	0.485	<0.138	6.7	305	11.1	35.6	7.5	2555.2	630	1.3	10.4
	Qtr 2 2013	2.42	0.16	<0.138	6.9	242	6.7	23.9	7.2	489.4	335.9	2.9	8.6
	Qtr 1 2013	2.53	0.202	<0.138	6.8	250	6.6	18.5	6.5	460.5	415	1.8	8.6
WELL 16 D	Qtr 4 2013	1.31	0.058	<0.138	7	271	17.2	65.9	4	443.6	633.2	3.5	14.1
	Qtr 3 2013	0.98	0.023	<0.138	7.4	274	10.5	19.8	6.7	489.2	624.6	1.3	15.5
	Qtr 2 2013	0.41	0.033	<0.138	7.4	251	9.6	23.6	5.8	450.8	591	3	15.3
	Qtr 1 2013	0.31	0.058	<0.138	7.3	266	9.3	19.8	5.7	446.9	674.4	1.7	15.2
MW 17 S	Qtr 4 2013	6.44	0.08	0.172	7	507	7	43.4	9	55.8	14.4	5	7.3
	Qtr 3 2013	4.62	0.306	<0.138	7.1	415	22.7	35.4	4.7	517.5	1595	1.5	12.8
	Qtr 2 2013	5.48	0.034	0.986	7.2	425	14.3	45.3	8.7	89.9	19.1	6.2	9.1
	Qtr 1 2013	6.82	0.138	1.039	7	448	9.5	40.5	9.6	36.7	13.9	3.1	7.6
Well 17 D	Qtr 4 2013	2.91	0.113	<0.138	7.4	482	8.8	27.2	5	23.3	1035	3.3	13.2
	Qtr 3 2013	3.48	0.022	<0.138	7.6	514	7.4	43.2	7	<20	1420	1.6	14.7
	Qtr 2 2013	3.1	0.04	0.138	7.4	500	6.4	47	2.9	27.9	1510	2.2	13.5
	Qtr 1 2013	2.86	0.085	0.259	7.5	489	7.6	40.6	7.2	21.3	910.6	2.7	14.3
Interim Guide Value		NAC	0.15	NAC	≥6.5 &≤9.5	1000	30	200	NAC	200	50	5	150

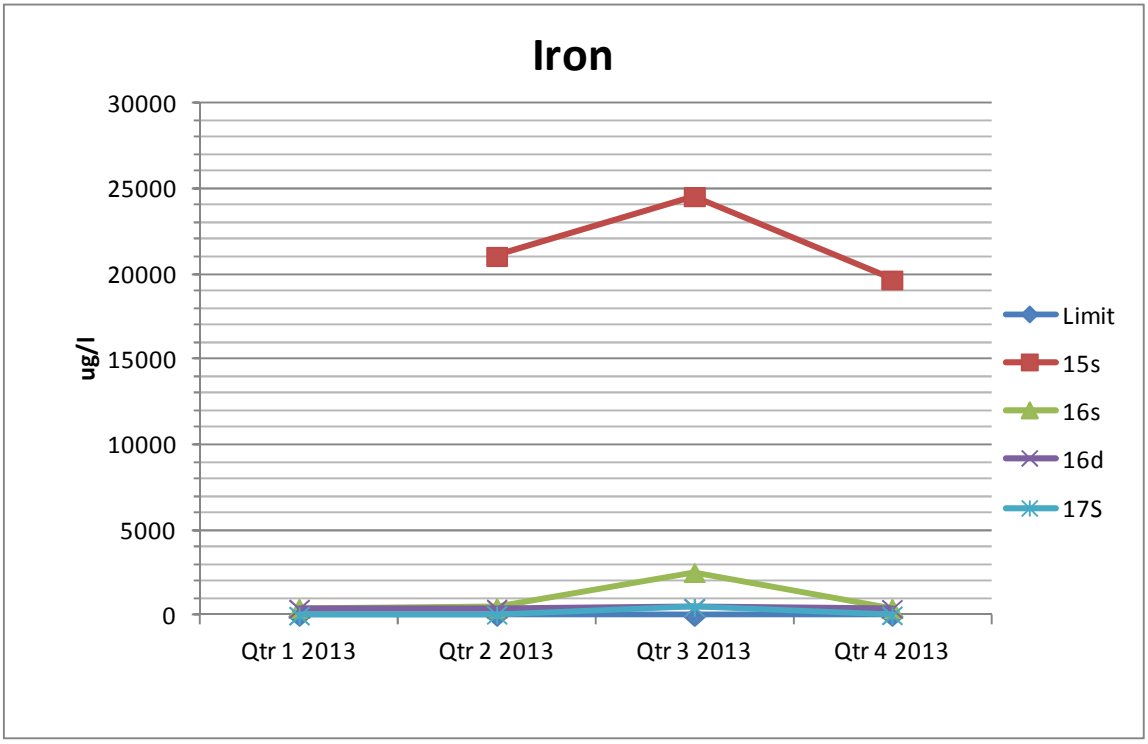
Graph 5.5



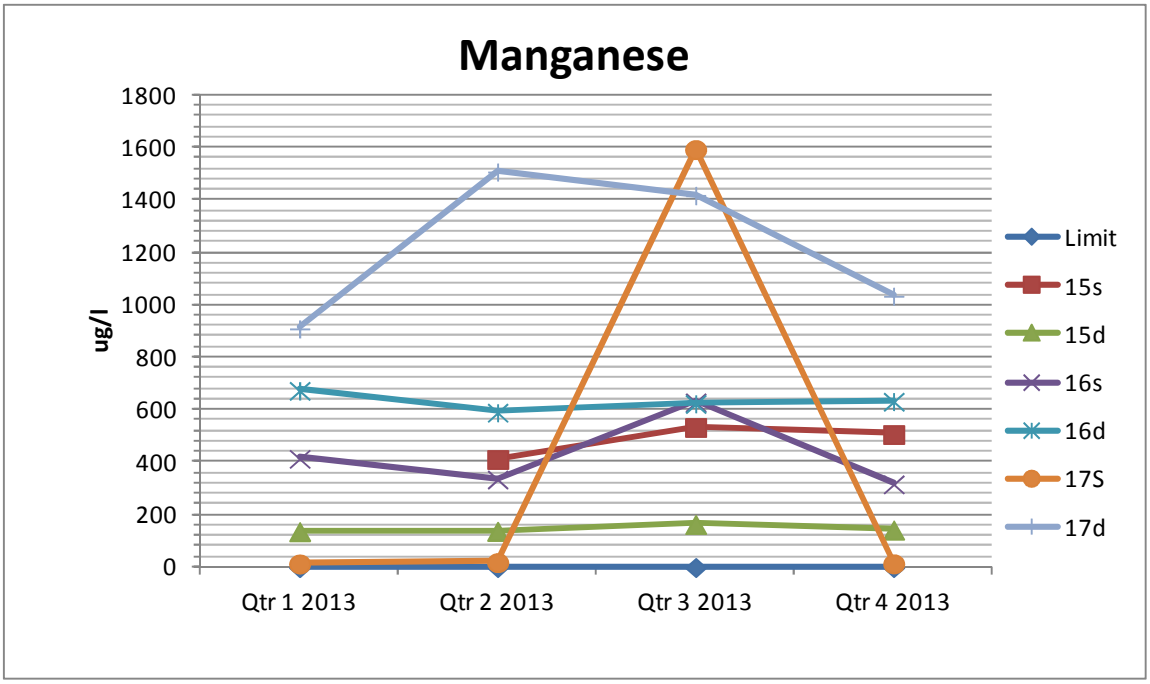
Graph 5.6



Graph 5.7



Graph 5.8



As detailed in the above graphs, there were numerous ground water elevations in the vicinity of this landfill during 2013.

Exceedances occurred in the following parameters:

- Ammonia: Elevated levels of this parameter were prevalent during 2013. Elevated levels of ammonia are strongly associated with pollution from waste water treatment systems as wella s agricultural activites and so contamination of these wells by the landfill cannot be definitively concluded.
- Iron: Although increased Iron levels can be attributed to contamination from landfills, it is also strongly associated with the native soils of the Cavan area and therefore cannot be directly linked to the landfill.
- Chloride: This parameter is an indication of contamination from a landfill source. In 2013 there was an elevated level of this parameter encountered at well MW15D. An elevation of this scale had never before been encountered at this location and so it was attributed to contamination from an external source such as road salt.
- Manganese: Elevated levels of Manganese can be associated with landfill contamination but can also be attributed to the natural composition of the underlying soils.

5.3 Leachate Monitoring

Leachate monitoring is carried out annually in accordance with the licence.

Leachate samples were obtained from new leachate wells which were installed prior to quarter 4 monitoring 2012. The following table details all results obtained from these wells during 2013.

Table 5.3 Leachate Summary Results

	Parameter	Ammonia	Cl	TON	SO4	Cond	pH	COD	BOD
	Units	mg/l N	mg/l	mg/l N	mg/l	us/cm	pH Units	mg/l	mg/l
WELL MW 18	Qtr 4 2013	273	<13	1.291	36.7	3259	7.1	890	98
	Qtr 3 2013	278	5.908	7.1	4104	81	3200	199.7	
	Qtr 4 2012	236	131.1	<0.69	34.8	2965	7	1374	27
WELL MW 19	Qtr 4 2013	4	<13	<0.69	92.5	422	6.7	101	14
	Qtr 3 2013	37	<0.69	6.7	1283	10	670	68.6	
	Qtr 4 2012	6	<13	0.702	33.6	526	6.6	1300	25
Interim Guide Values		0.15	200	NAC	200	1000	≥6.5&≤9.5		

5.4 Gas Emissions

Landfill gas monitoring is conducted at thirteen sampling locations. These locations are situated both inside and outside the landfill mass. Historic results for the period 2013 are displayed below.

Table 5.4 Gas Emissions Summary

Method		GA 2000	GA 2000	GA 2000	GA 2000	GA 2000
Parameter		CH_4	CO_2	O_2	H_2S	Barometric Pressure
Units		1% v/v	1.5 % v/v	%	PPM	mb
Client Ref	**Qtr**	-	-	-	-	-
MW 1	Qtr 4 2013	0	0.2	21.4	0	1008
	Qtr 3 2013	0	0	20.8	0	995
	Qtr 2 2013	0	0	20.8	0	998
	Qtr 1 2013	0	0	20.7	0	986
MW 2	Qtr 4 2013	0	1.1	21.8	0	1008
	Qtr 3 2013	0.1	1.1	21	0	995
	Qtr 2 2013	0.1	1.1	21	0	998
	Qtr 1 2013	0.2	1.2	21	0	982
MW 3	Qtr 4 2013	8	8.7	15.7	0	1009
	Qtr 3 2013	8	6.5	15.7	0	995
	Qtr 2 2013	12.9	13.8	11.3	0	998
	Qtr 1 2013	0.2	0.1	21.5	0	981
MW 6	Qtr 4 2013	0	2.3	19.9	0	1009
	Qtr 3 2013	0	0.4	20.2	0	996
	Qtr 2 2013	0	1.1	20.3	0	998
	Qtr 1 2013	0	1.5	18.6	0	986
MW 7	Qtr 4 2013	1.1	3.1	19.5	0	1008
	Qtr 3 2013	1.4	1.7	19.5	0	995
	Qtr 2 2013	0.2	0.4	19.7	0	998
	Qtr 1 2013	0.2	0.3	19.8	0	986
MW 8	Qtr 4 2013	25.4	23.4	1.9	0	1009
	Qtr 3 2013	35.8	26.1	0.7	0	995
	Qtr 2 2013	27.1	26.3	2	0	998
	Qtr 1 2013	10.3	19.9	1.3	0	986
MW 9	Qtr 4 2013	1.1	3.1	19.5	0	1008
	Qtr 3 2013	3.7	4.3	16.5	0	995
	Qtr 2 2013	2.1	3.8	18.2	0	998
	Qtr 1 2013	2.2	2.3	19.8	0	986
	Limit	**1**	**1.5**			

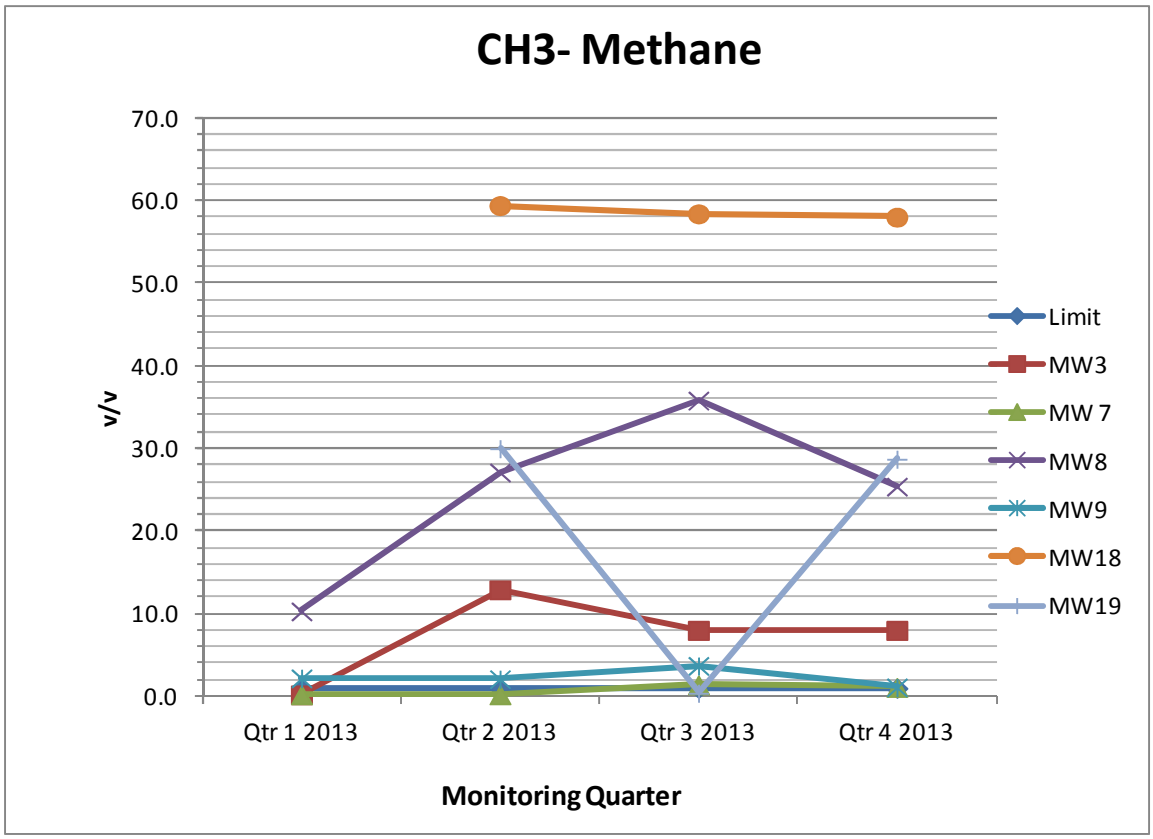
Method		GA 2000	GA 2000	GA 2000	GA 2000	GA 2000
Parameter		CH_4	CO_2	O_2	H_2S	Barometric Pressure
Units		1% v/v	1.5 % v/v	%	PPM	mb
Client Ref	**Qtr**	-	-	-	-	-
MW 10S	Qtr 4 2013	0	0.6	20.4	0	1009
	Qtr 3 2013	0	0.1	20.4	0	995
	Qtr 2 2013	0	2.2	15.2	0	998
	Qtr 1 2013	0.2	0.1	21.7	0	990
MW 10D	Qtr 4 2013	0	0.8	19.4	0	1010
	Qtr 3 2013	0	0.2	19.7	0	995
	Qtr 2 2013	0	0.4	20.4	0	998
	Qtr 1 2013	0.2	0.9	15.5	0	990
MW 17S	Qtr 4 2013	0	0	20	0	1008
	Qtr 3 2013	0	0	20.7	0	995
	Qtr 2 2013	0	0.1	20	0	998
	Qtr 1 2013	0.2	0.9	15.5	0	990
MW 17D	Qtr 4 2013	0	0	20.5	0	1008
	Qtr 3 2013	0	0	20.5	0	995
	Qtr 2 2013	0	0	20.5	0	982
	Qtr 1 2013	0.2	0.9	15.5	0	990
MW 18	Qtr 4 2013	58	27	0	0	1009
	Qtr 3 2013	58.4	26	0.2	0	995
	Qtr 2 2013	59.4	29.4	0.1	0	998
MW 19	Qtr 4 2013	28.7	22.4	1.1	0	1010
	Qtr 3 2013	0.4	0.4	20.6	0	994
	Qtr 2 2013	30	23.3	0.1	0	998
	Limit	**1**	**1.5**			

NOTES	
1	Instrument Serial No: GA 07721
2	Limit: Schedule C2, Licence
Exceedance	

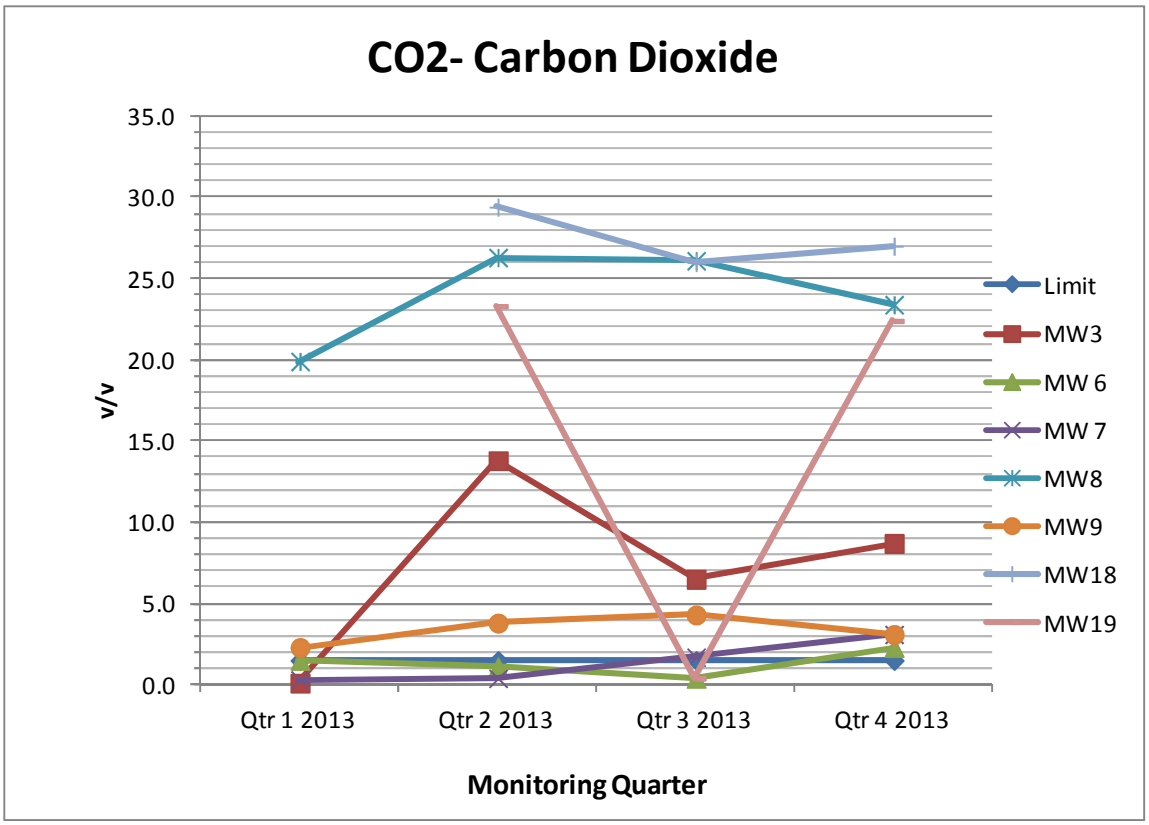
Results

The following graphs show gas monitoring results for 2013. These wells are located inside the waste mass.

Graph 5.9



Graph 6.0



Gas Monitoring on the site reveals typical low levels of Methane & Carbon Dioxide and higher levels of Oxygen. There were some high readings encountered at MW8, MW18 and MW19 which are all located in the centre of the waste body. There was no significant gas migration recorded in monitoring wells outside of the waste body. The results are typical of a closed landfill.

6.0 SUMMARY OF RESULTS & INTERPRETATION OF ENVIRONMENTAL MONITORING

Included in Appendix C is a copy of the 4th quarter monitoring results as reported by Monitoring Company Boylan Engineering. We are satisfied that we are carrying out the environmental monitoring as specified in the Waste Licence. We are also satisfied that there are no major environmental impacts associated with this facility.

7.0 RESOURCE & ENERGY CONSUMPTION SUMMARY

As there is in-sufficient gas produced to run a gas flare or engine there is no use for the gas resource on site. There is no energy consumed on site.

8.0 REPORT ON RESTORATION OF THE FACILITY

The site is fully restored and the cap intact. There was some horse grazing on the site at various times during 2013. Gorse overgrowth has become prolific on the cap.

9.0 ESTIMATED ANNUAL & CUMULATIVE QUANTITIES OF LANDFILL GAS EMITTED FROM THE FACILITY

This information is reported in the PRTR Report attached in Appendix A. The estimated quantity of Methane released is 58,800kgs/yr. Page one from the Annual Gas Survey is also presented in Appendix A.

10.0 FULL TITLE & WRITTEN SUMMARY OF ANY PROCEDURES DEVELOPED BY THE LICENSEE IN THE YEAR WHICH RELATES TOT HE FACILITY OPERATION

There was no change to or development of any procedures undertaken by the licensee or monitoring contractor in 2013. The environmental monitoring contractor 'Boylan Engineering' adhere to all standard practices for environmental monitoring.

11.0 REPORTED INCIDENTS & COMPLAINTS SUMMARY

There were no incidences in the reporting period 2013. There were no complaints received by the EPA or the Local Authority regarding this facility in the reporting period 2013.

12.0 REVIEW OF NUISANCE CONTROLS

As there are no known nuisances associated with this site there are no nuisance controls in place for noise or vermin. There is no odour detectable from the site and as these are the main nuisances associated with landfills the licensee has not reviewed the controls. This is substantiated by the absence of complaints regarding the facility. However, if any nuisances arise at the facility, the licensee will deal with them using appropriate measures and procedures.

13.0 REPORT ON TRAINING OF STAFF

Landfill Operations Manager Sinead Fox- for Cavan County Council deals with in full with any issues identified by the Agency Inspectors or any other party. Sinead has been fully trained in the control of landfill gas, the FAS Waste Management Training Course and carries a Safe Pass.

Table 13.1 Management Structure 2013

Position	Name	Duties
Director of Services Environment	Eoin Doyle	Oversee and assign responsibilities to staff regarding landfill
Senior Executive Officer	John Brannigan	Oversee general supervision, monitoring and reporting of the site.
Landfill Operations Manager	Sinead Fox	Responsible for general supervision, monitoring and reporting of the site.

Contact Person for Sanitary Authority for 2013/ 2014:

John Brannigan
Senior Executive Officer
Waste Management Section
Cavan County Council
Farnham Street,
Cavan

14.0 FINANCIAL PROVISION

Provision will be made in Cavan County Council Official Estimates for Charges as required under Condition 12 of Waste Licence Ref. 91-1.

15.0 ANY OTHER ITEMS AS SPECIFIED BY THE AGENCY

As requested by the Agency we have included in Appendix B a copy of the most recent Map of the site showing all Monitoring locations.

APPENDIX A

PRTR Emissions Report,

Landfill Gas Survey

| PRTR# : W0091 | Facility Name : Bailieborough Landfill | Filename : W0091_2013(1).xls | Return Year : 2013 |

Guidance to completing the PRTR workbook

AER Returns Workbook

Version 1.1.17

REFERENCE YEAR	2013

1. FACILITY IDENTIFICATION

Parent Company Name	Cavan County Council
Facility Name	Bailieborough Landfill
PRTR Identification Number	W0091
Licence Number	W0091-01

Waste or IPPC Classes of Activity

No.	class_name
3.1	Deposit on, in or under land (including landfill).
3.13	Storage prior to submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where the waste concerned is produced.
4.11	Use of waste obtained from any activity referred to in a preceding paragraph of this Schedule.
4.13	Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced.
4.2	Recycling or reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes).
4.4	Recycling or reclamation of other inorganic materials.
Address 1	Tanderagee
Address 2	Bailieborough
Address 3	Co Cavan
Address 4	
	Cavan
Country	Ireland
Coordinates of Location	-6.97327 53.9092
River Basin District	IEEA
NACE Code	3821
Main Economic Activity	Treatment and disposal of non-hazardous waste
AER Returns Contact Name	Sinead Fox
AER Returns Contact Email Address	sfox@cavancoco.ie
AER Returns Contact Position	Landfill Operations Manager
AER Returns Contact Telephone Number	0494378449
AER Returns Contact Mobile Phone Number	
AER Returns Contact Fax Number	
Production Volume	0.0
Production Volume Units	

Number of Installations	0
Number of Operating Hours in Year	0
Number of Employees	1
User Feedback/Comments	
Web Address	

2. PRTR CLASS ACTIVITIES

Activity Number	Activity Name
5(c)	Installations for the disposal of non-hazardous waste
50.1	General

3. SOLVENTS REGULATIONS (S.I. No. 543 of 2002)

Is it applicable?	No
Have you been granted an exemption ?	No
If applicable which activity class applies (as per Schedule 2 of the regulations) ?	
Is the reduction scheme compliance route being used ?	

4. WASTE IMPORTED/ACCEPTED ONTO SITE Guidance on waste imported/accepted onto site

Do you import/accept waste onto your site for on-site treatment (either recovery or disposal activities) ?	No

4.1 RELEASES TO AIR Link to previous years emissions data | PRTR# : W0091 | Facility Name : Bailieborough Landfill | Filename : W0091_2013(1).xls | Return Year : 2013 | 12/02/2014 11:13

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

RELEASES TO AIR					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD			QUANTITY			
			Method Used					
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
03	**Carbon dioxide (CO2)**	C	OTH	GASSIM	0.0	165000.0	0.0	165000.0
01	Methane (CH4)	C	OTH	GASSIM	0.0	0.0	0.0	58800.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION B : REMAINING PRTR POLLUTANTS

RELEASES TO AIR					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD			QUANTITY			
			Method Used					
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION C : REMAINING POLLUTANT EMISSIONS (As required in your Licence)

RELEASES TO AIR					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD			QUANTITY			
			Method Used					
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0

* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

Additional Data Requested from Landfill operators

For the purposes of the National Inventory on Greenhouse Gases, landfill operators are requested to provide summary data on landfill gas (Methane) flared or utilised on their facilities to accompany the figures for total methane generated. Operators should only report their Net methane (CH4) emission to the environment under T(total) KG/yr for Section A: Sector specific PRTR pollutants above. Please complete the table below:

Landfill: Bailieborough Landfill

Please enter summary data on the quantities of methane flared and / or utilised			Method Used			
	T (Total) kg/Year	**M/C/E**	**Method Code**	**Designation or Description**	**Facility Total Capacity m3 per hour**	
Total estimated methane generation (as per site model)	58800.0	C	OTH	GASSIM	N/A	
Methane flared	0.0				0.0	(Total Flaring Capacity)
Methane utilised in engine/s	0.0				0.0	(Total Utilising Capacity)
Net methane emission (as reported in Section A above)	58800.0	C	OTH	GISSIM	N/A	

Environmental Protection Agency

A survey of landfill sites to determine the quantity of methane flared and or recovered in utilisation plants for 2013

Please choose from the drop down menu the license number for your site	W0091
Please choose from the drop down menu the name of the landfill site	Bailieborough Landfill
Please enter the number of flares operational at your site in 2013	0
Please enter the number of engines operational at your site in 2013	0
Total methane flared	0 kg/year
Total methane utilised in engines	0 kg/year

Please note that the closing date for reciept of completed surveys is 31/03/2014

Introduction

The Office of Climate Licensing and Resource Use (OCLR) of the Environmental Protection Agency acts as the inventory agency in Ireland with responsibility for compiling and reporting national greenhouse gas inventories to the European Commission and the United Nations Framework Convention on Climate Change. In addition to meeting international commitments Ireland's national greenhouse gas inventory informs national agencies and Government departments as they face the challenge to curb emissions and meet Ireland's targets under the Kyoto Protocol. The national inventory also informs data suppliers, making them aware of the importance of their contributions to the inventory process and a means of identifying areas where input data may be improved.

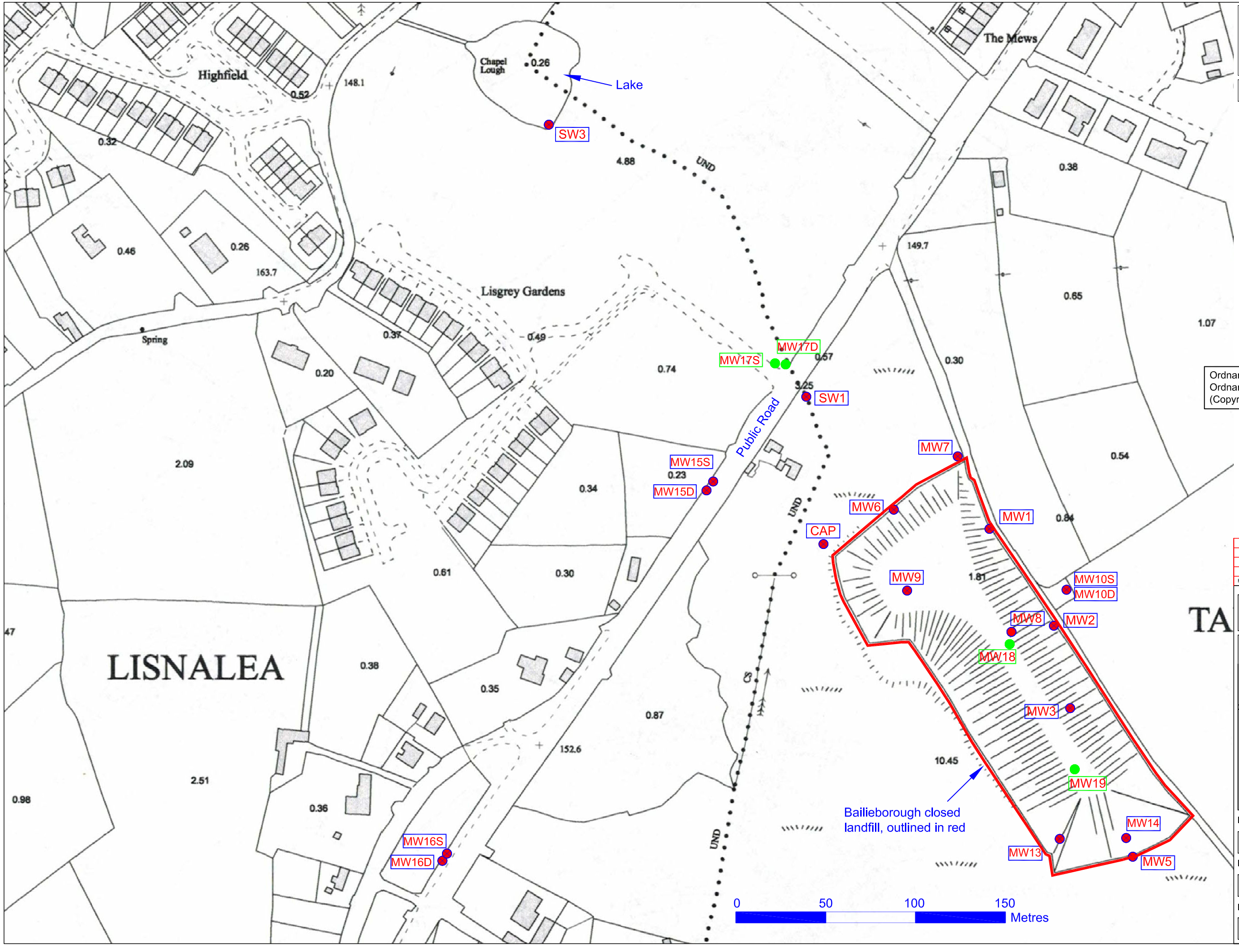
It is on this basis that the Environmental Protection Agency is asking landfill operators to partake in this survey so that the most uptodate information on methane flaring and recovery in utilisation plants at landfills sites is used in calculating the contribution of the waste sector to national greenhouse gas emissions

The Environmental Protection Agency wishes to thank you for partaking in this survey. If you have any questions about the survey and how to complete it please view the "Help sheet" worksheet. If however, your query is not answered by viewing the "Help sheet" worksheet please contact:
LFGProject@epa.ie

Once completed please send the completed file as an attachment clearly stating the name and or license number of the landfill site (e.g. W000 Xanadu landfill_2013) to:
LFGProject@epa.ie

APPENDIX B

Site Map



Please Note
Do not scale from drawing.
All dimensions should be verified on site before construction and any discrepancies found brought to the attention of the Engineer.

All drawings remain the property of the Boylan Engineering, permission must be sought to copy any drawing or section there of.

NOTES / LEGEND

Rev.		
Rev. 1	01.11.12	Additional wells

Client: Cavan County Council

Project:
Bailieborough Landfill (WL91-01)

Boylan engineering
Main St., Mullagh, Kells, Co. Meath.
Phone: 046 - 928 6000
Email: info@boylanengineering.ie
Website: www.boylanengineering.ie

Drawn By	Approved by
A. Clarke	B. Keating

Drawing No.	Drawing Name
001	Monitoring Well Locations

Date	Scale	Rev.
06.04.2012	1:2000	001

APPENDIX C
Q4 Monitoring Report

GAS MONITORING REPORT FOR BAILIEBOROUGH LANDFILL W0091-01

Client: **Cavan County Council**

Site Location: **Tanderagee, Bailieborough**

Report No.: CCC-02-01-03-04-Rev 0

Produced by: Brona Keating, BSc, P.Grad.Dip. Environmental Eng.

Approved by: **Date:** 12th December 2013

Cathal Boylan, BEng, CEng, MIEI
CHARTERED ENGINEER

Boylan Engineering
Company Reg. 430482
Address: Main St., Mullagh, Kells Co. Meath.
Phone: 046 – 928 6000 / 087 – 820 5470
Fax: 046 – 928 6002
Email: info@boylanengineering.ie
Web: www.boylanengineering.ie

Rev.	Date	Description

I SUMMARY

Boylan Engineering (Eng. & Environmental Consultancy) was commissioned by Cavan County Council to carry out Gas Monitoring at Bailieborough Landfill (W0091-01), Tandragee, Co Cavan for quarter four 2013.

Brona Keating, Environmental Consultant carried out all monitoring. This report shall document the findings.

Table of Contents

1. INTRODUCTION

Bailieborough landfill is situated approximately 1 kilometre from Bailieborough town centre in the townland of Tandergee. The site which comprises some 2.23 hectares was originally peat land which was stripped for commercial purposes. The site was then operated as a traditional landfill until its closure in 2002. A waste licence was issued by the Environmental Protection Agency after the closure of the site and remedial works were completed.

Condition 8.1 of the waste licence requires that monitoring be carried out in accordance with Schedule D of the licence. The following report give details of the landfill gas sampling programme conducted on site and also summarises findings and analytical results for quarter four 2013.

The purpose of landfill gas monitoring at closed landfills is to:

- Ensure the facility is compliant with the waste license
- Ensure the facility is not causing environmental pollution
- Ensure the facility is not posing a risk to human health
- Ensure the facility is not creating an unacceptable risk to atmosphere, water, soil, plants or animals
- Ensure that the facility is not causing a nuisance through noise or odors
- Ensure the facility is not adversely affecting the countryside or places of interest
- Compare actual site behavior with expected/modeled behavior
- Assess the effectiveness of gas control measures installed at the site
- Establish a reliable database of information for the landfill throughout its life

Landfill gas is generated by decomposition of organic materials in waste deposited at landfills. Typically, the gas is a mixture of Methane (up to 65% by volume) Carbon Dioxide (up to 35% per volume). It can also contain minor constituents at low concentrations (typically less than 1% volume contains 120-150 trace constituents).
The landfill directive requires that appropriate measures are taken in order to control the accumulation and migration of landfill gas.

2. METHODOLOGY

2.1 Landfill Gas Analysis

The following procedure is employed by Bróna Keating of Boylan Engineering to ensure accurate monitoring:

- EPA, Landfill Manual, landfill monitoring 2nd Edition is adhered to.
- Prior to sampling, a dip meter is used to measure water levels, if present, in the wells.
- GA 2000 landfill gas analyser is used to measure the gas levels.
- The analyser is purged and connected to the sealed well monitoring nozzle.
- The monitoring nozzle is turned to the open position and the analyser measured the gas levels at 60 second intervals for no less than 10 minutes. The analyser is allowed to run for this period of time to allow for a representative average to be obtained.
- All data is recorded on the Gas Analysis field sheet.
- The instrument is removed after 10 minutes and the monitoring nozzle returned to the closed position.
- The GA2000 is switched off between each monitoring location so as to allow the instrument to purge.
- This process is repeated at each monitoring location.
- Data for the GA 2000 was downloaded in the Boylan Engineering office.

2.3 Monitoring Locations

Quarter 4 2013					
Monitoring Well	**Sample Type**	**Cover Level M (OD Malin Head)**	**Water Level M (OD Malin Head)**	**Water Depth M (Top of Casing)**	**National Grid Co-Ordinates**
MW1	Gas	151.55	148.75	2.8	N296071.96 E267506.68
MW2	Gas	152.72	150.12	2.6	N296018.08 E267540.57
MW3	GW	159.27	155.97	3.3	N295972.19 E267549.66
MW6	Gas	150.27	147.07	3.2	N296082.66 E267451.47
MW8	Leachate	160.74	157.54	3.2	N296014.48 E267517.14
MW9	Leachate	157.94	153.44	4.5	N296037.63 E267458.87
MW10S	GW	154.76	149.06	5.7	N296038.12 E267458.8
MW10D	GW	154.76	149.06	5.7	N296038.12 E267458.87
MW15S	GW	150.36	148.73	1.63	N296097.36 E267343.36
MW15D	Gas	150.39	148.79	1.6	N296092.30 E267344.88
MW16S	Gas	152.6	151.15	1.45	N295888.86 E267202.87
MW16D	GW	152.53	151.33	1.2	N295885.59 E267200.97
SW1	GW	-	-	-	n/a
SW3	GW	-	-	-	n/a
CAP Discharge	GW	-	-	-	n/a
MW17S	GW	149.7	148.27	1.43	N296174 E267321
MW17D	GW	149.61	148.61	1	N296176 E267327
MW18	Leachate	161.1	-	-	N296018 E267451
MW19	Leachate	162.24	-	-	N295948 E267487

2.4 Weather Report

REPORTS FROM BALLYHAISE (A)							
Date	**Rainfall**	**Max**	**Min**	**Grass Min Temp**	**Mean Wind Speed**	**Gusts**	**Sunshine**
	(mm)	**Temp**	**Temp**	**(°C)**	**(knots)**	**(if >= 34 knots)**	**(hours)**
		(°C)	**(°C)**				
19/11/2013	0.2	6.6	-0.4	-1.8	7		

3.0 SUMMARY OF RESULTS

Table 3.0 04th Quarter Landfill Gas monitoring 2013

Method		GA 2000	GA 2000	GA 2000	GA 2000	GA 2000	
Parameter		CH_4	CO_2	O_2	H_2S	Barometric Pressure	Position to waste mass
Units		% v/v	% v/v	%	PPM	mb	
Date Testing		06/12/2013					
GA 2000 Ref	Client Ref						
10	MW 1	0	0.2	21.4	0	1008	Outside
11	MW 2	0	1.1	21.8	0	1008	Outside
6	MW 3	8	8.7	15.7	0	1009	Inside
3	MW 6	0	2.3	19.9	0	1009	Outside
9	MW 7	1.1	3.1	19.5	0	1008	Outside
4	MW 8	25.4	23.4	1.9	0	1009	Inside
8	MW 9	1.1	3.1	19.5	0	1008	Inside
2	MW 10 S	0	0.6	20.4	0	1009	Outside
1	MW 10 D	0	0.8	19.4	0	1010	Outside
12	MW17S	0	0	20	0	1008	Outside
13	MW17D	0	0	20.5	0	1008	Outside
5	MW18	58	27	0	0	1009	Inside
7	MW19	28.7	22.4	1.1	0	1010	Inside
	Limit	1	1.5				

Exceedance,outside waste mass

NOTES

1 Instrument Serial No: GA 07721

2 Limit: Schedule C2, Licence

4.0 DISCUSSION

The rate of gas generation at a landfill site varies through the life of a landfill and is dependent on several factors such as waste type, depths, moisture content, degree of compaction, landfill pH, temperature and the length of time since the waste was deposited. Landfill gas can move in any direction within the waste body and migrate from a site. The potential for gas migration will depend on the gas quality, volume, the site engineering works, geological characteristics of the surrounding strata and on man-made pathways such as sewers and drains.

Results obtained from monitoring during quarter four, 2013 show that the levels of gas are relatively consistent with previous results in all existing wells. Results obtained from the new well MW18 which is within the waste mass was elevated for Methane and Carbon Dioxide. It is recommended that further gas monitoring is conducted for comparison purposes. Gas analysis of the new wells outside of the waste mass revealed that they did not contain Methane.

5.0 CONCLUSION

The results obtained from landfill gas analysis are also relatively consistent with previous monitoring events and do not show any signs of dramatic exceedances; therefore there is no evidence of any major negative environmental impact associated with this landfill. However, it is important to monitor the trend in exceedance of Methane at this landfill and any dramatic increase in the parameter should be regarded as critical. The Methane content of landfill gas is flammable, forming potentially explosive mixtures in certain conditions, which raises concern about its uncontrolled migration and release. The next environmental and landfill gas monitoring will be conducted in the 01st quarter of 2014.

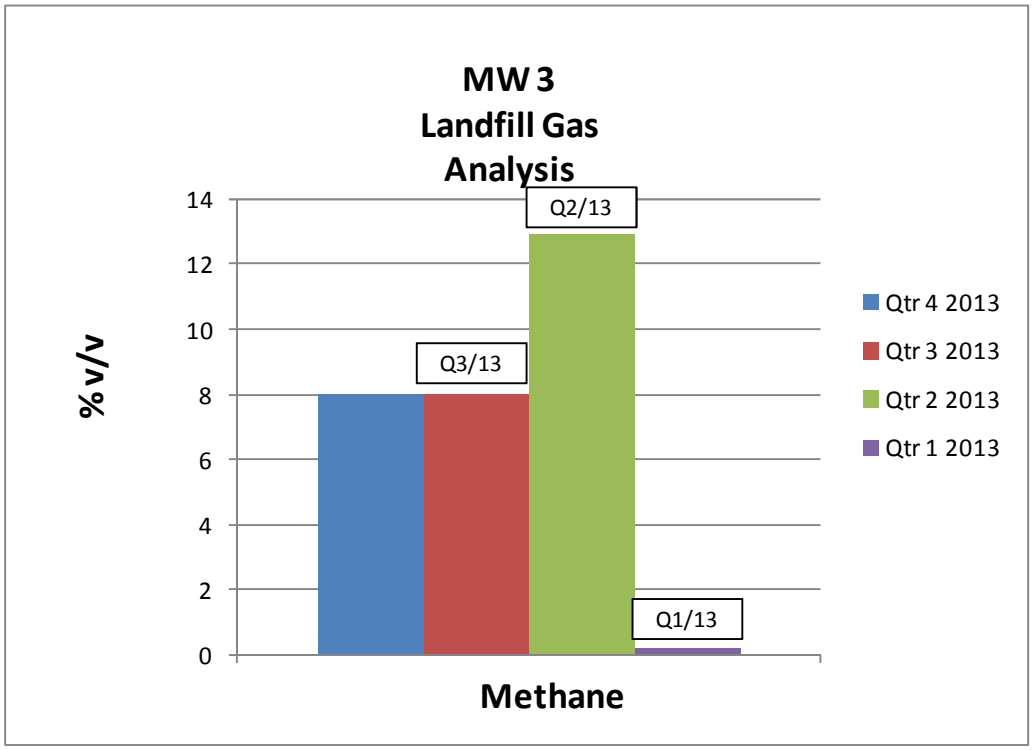
APPENDIX 1 HISTORICAL DATA-TABLES

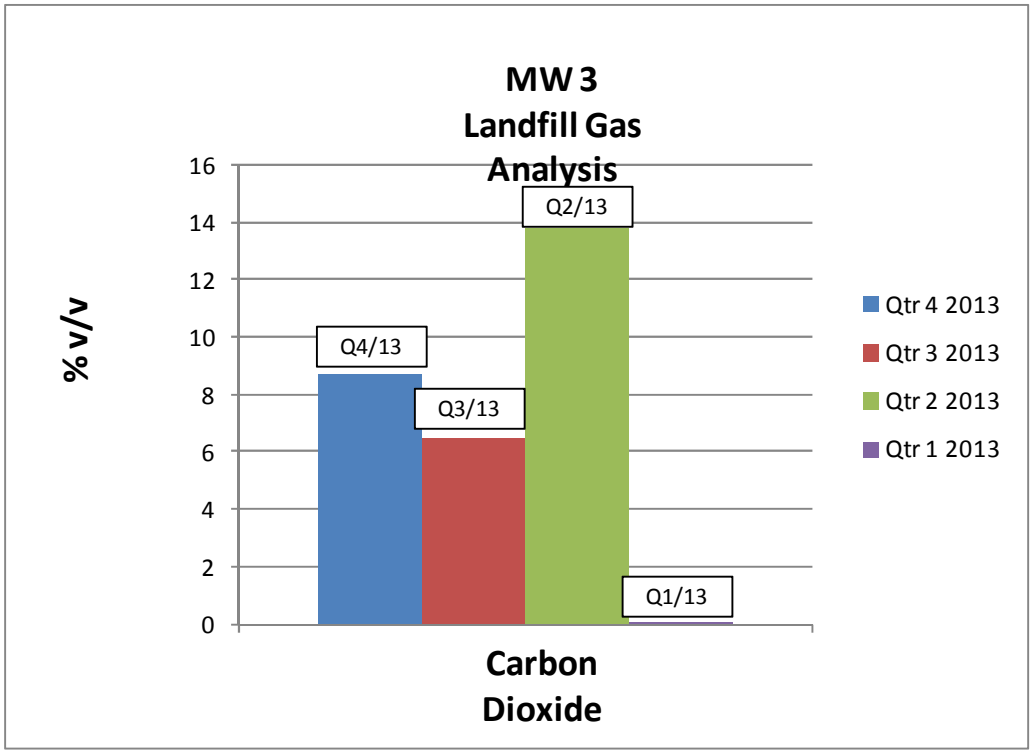
Method		GA 2000	GA 2000	GA 2000	GA 2000	GA 2000
Parameter		CH_4	CO_2	O_2	H_2S	Barometric Pressure
Units		1% v/v	1.5 % v/v	%	PPM	mb
Client Ref	Qtr	-	-	-	-	-
MW 1	Qtr 4 2013	0	0.2	21.4	0	1008
	Qtr 3 2013	0	0	20.8	0	995
	Qtr 2 2013	0	0	20.8	0	998
	Qtr 1 2013	0	0	20.7	0	986
MW 2	Qtr 4 2013	0	1.1	21.8	0	1008
	Qtr 3 2013	0.1	1.1	21	0	995
	Qtr 2 2013	0.1	1.1	21	0	998
	Qtr 1 2013	0.2	1.2	21	0	982
MW 3	Qtr 4 2013	8	8.7	15.7	0	1009
	Qtr 3 2013	8	6.5	15.7	0	995
	Qtr 2 2013	12.9	13.8	11.3	0	998
	Qtr 1 2013	0.2	0.1	21.5	0	981
MW 6	Qtr 4 2013	0	2.3	19.9	0	1009
	Qtr 3 2013	0	0.4	20.2	0	996
	Qtr 2 2013	0	1.1	20.3	0	998
	Qtr 1 2013	0	1.5	18.6	0	986
MW 7	Qtr 4 2013	1.1	3.1	19.5	0	1008
	Qtr 3 2013	1.4	1.7	19.5	0	995
	Qtr 2 2013	0.2	0.4	19.7	0	998
	Qtr 1 2013	0.2	0.3	19.8	0	986
MW 8	Qtr 4 2013	25.4	23.4	1.9	0	1009
	Qtr 3 2013	35.8	26.1	0.7	0	995
	Qtr 2 2013	27.1	26.3	2	0	998
	Qtr 1 2013	10.3	19.9	1.3	0	986

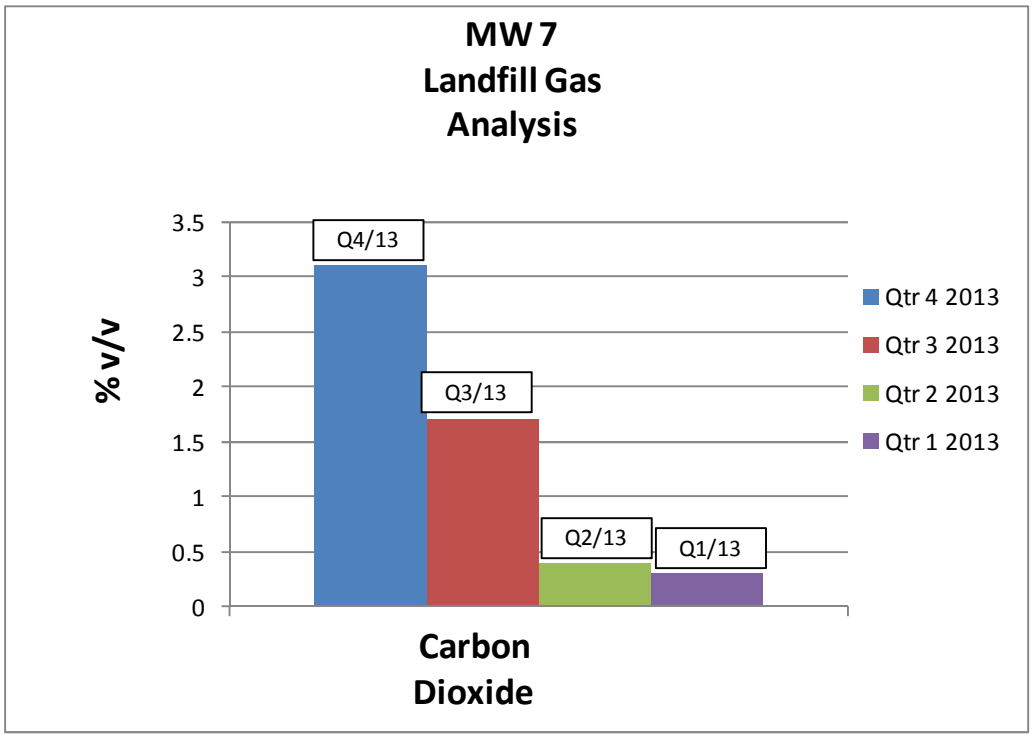
MW 9	Qtr 4 2013	1.1	3.1	19.5	0	1008
	Qtr 3 2013	3.7	4.3	16.5	0	995
	Qtr 2 2013	2.1	3.8	18.2	0	998
	Qtr 1 2013	2.2	2.3	19.8	0	986
MW 10S	Qtr 4 2013	0	0.6	20.4	0	1009
	Qtr 3 2013	0	0.1	20.4	0	995
	Qtr 2 2013	0	2.2	15.2	0	998
	Qtr 1 2013	0.2	0.1	21.7	0	990
MW 10D	Qtr 4 2013	0	0.8	19.4	0	1010
	Qtr 3 2013	0	0.2	19.7	0	995
	Qtr 2 2013	0	0.4	20.4	0	998
	Qtr 1 2013	0.2	0.9	15.5	0	990
MW 17S	Qtr 4 2013	0	0	20	0	1008
	Qtr 3 2013	0	0	20.7	0	995
	Qtr 2 2013	0	0.1	20	0	998
	Qtr 1 2013	0.2	0.9	15.5	0	990
MW 17D	Qtr 4 2013	0	0	20.5	0	1008
	Qtr 3 2013	0	0	20.5	0	995
	Qtr 2 2013	0	0	20.5	0	982
	Qtr 1 2013	0.2	0.9	15.5	0	990
MW 18	Qtr 4 2013	58	27	0	0	1009
	Qtr 3 2013	58.4	26	0.2	0	995
	Qtr 2 2013	59.4	29.4	0.1	0	998
MW 19	Qtr 4 2013	28.7	22.4	1.1	0	1010
	Qtr 3 2013	0.4	0.4	20.6	0	994
	Qtr 2 2013	30	23.3	0.1	0	998
	Limit	**1**	**1.5**			

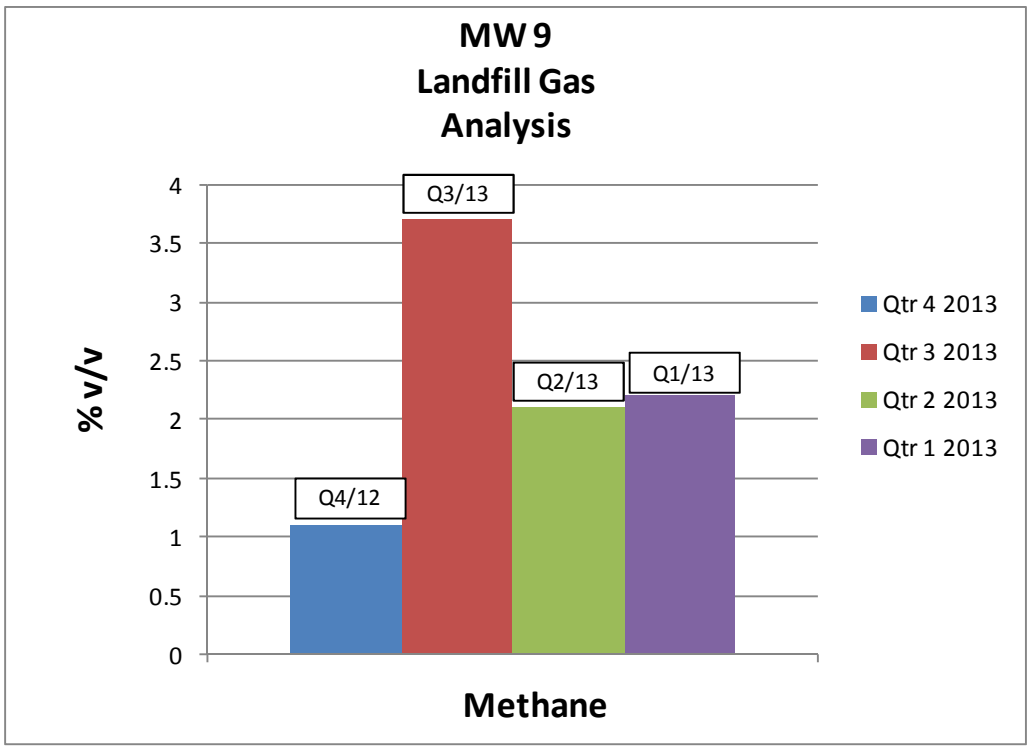
NOTES	
1	Instrument Serial No: GA 07721
2	Limit: Schedule C2, Licence
Exceedance	

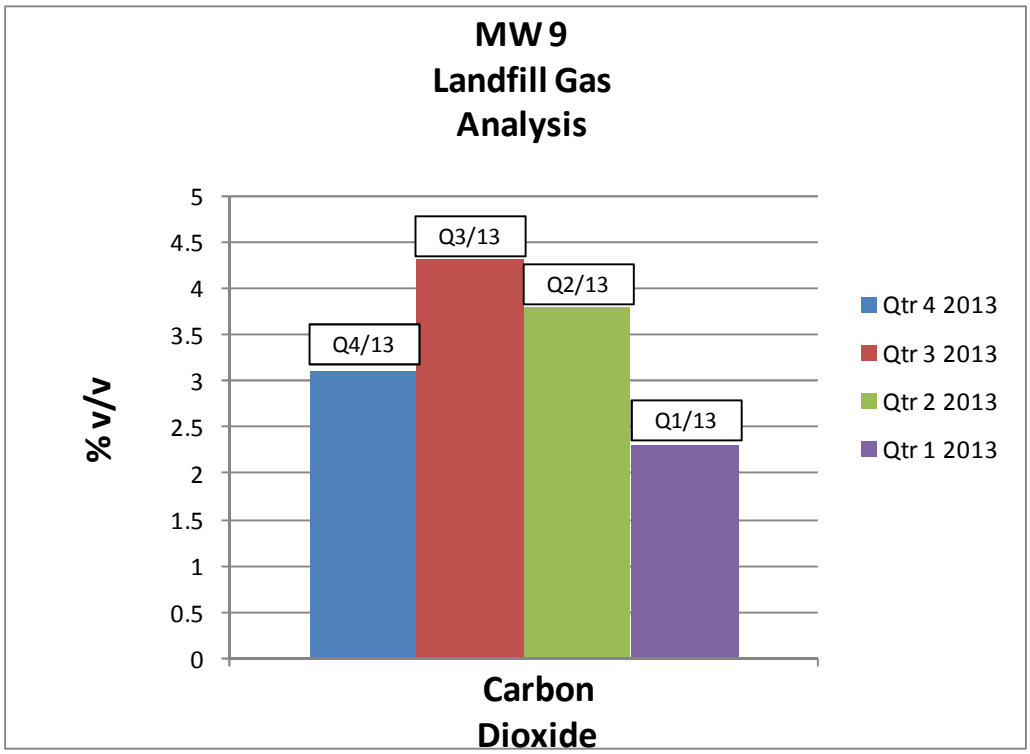
HISTORICAL DATA- CHARTS






MW 7
Landfill Gas
Analysis
% v/v
3.5
3
2.5
2
1.5
1
0.5
0
Q4/13
Q3/13
Q2/13
Q1/13
Qtr 4 2013
Qtr 3 2013
Qtr 2 2013
Qtr 1 2013
Carbon
Dioxide


MW 9
Landfill Gas
Analysis
% v/v
4
3.5
3
2.5
2
1.5
1
0.5
0
Q4/12
Q3/13
Q2/13
Q1/13
Qtr 4 2013
Qtr 3 2013
Qtr 2 2013
Qtr 1 2013
Methane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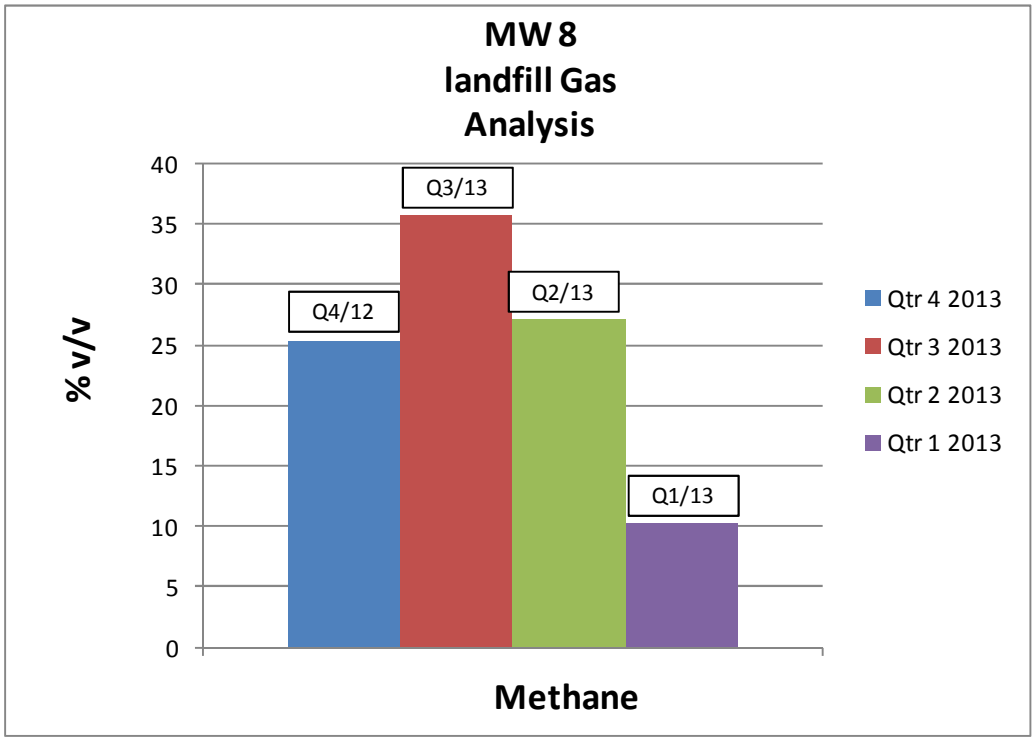
Landfill Gas
Analysis
% v/v
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Q4/13
Q3/13
Q2/13
Q1/13
Qtr 4 2013
Qtr 3 2013
Qtr 2 2013
Qtr 1 2013
Carbon
Dioxide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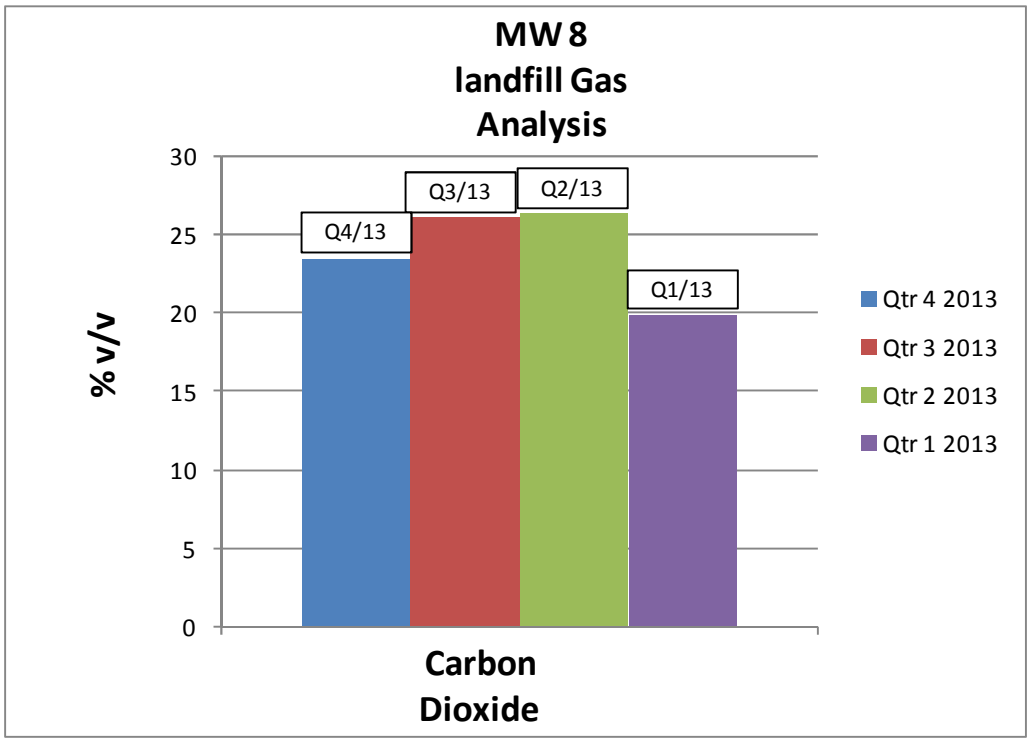
landfill Gas
Analysis
% v/v
40
35
30
25
20
15
10
5
0
Q4/12
Q3/13
Q2/13
Q1/13
Qtr 4 2013
Qtr 3 2013
Qtr 2 2013
Qtr 1 2013
Methane


MW 8
landfill Gas
Analysis
% v/v
30
25
20
15
10
5
0
Q4/13
Q3/13
Q2/13
Q1/13
Carbon
Dioxide
Qtr 4 2013
Qtr 3 2013
Qtr 2 2013
Qtr 1 2013

APPENDIX 2- LANDFILL GAS BREAKDOWN

MW 1

Date	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
06/12/2013 16:58	0	0.2	21.4	0	1008
06/12/2013 16:59	0	0.2	21.4	0	1008
06/12/2013 17:00	0	0.2	21.4	0	1008
06/12/2013 17:01	0	0.2	21.5	0	1008
06/12/2013 17:02	0	0.2	21.5	0	1008

MW 2

Date	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
06/12/2013 17:05	0	1.1	21.8	0	1008
06/12/2013 17:06	0	1.1	21.8	0	1008
06/12/2013 17:07	0	1.1	21.8	0	1008
06/12/2013 17:08	0	1.1	21.8	0	1008
06/12/2013 17:09	0	1.1	21.8	0	1008

MW 3

Date	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
06/12/2013 16:31	6.6	7.2	16.9	0	1009
06/12/2013 16:32	8	8.6	15.8	0	1009
06/12/2013 16:33	8	8.7	15.6	0	1009
06/12/2013 16:34	8.6	9.3	15.3	0	1009
06/12/2013 16:35	9	9.6	15	0	1009

MW 6

Date	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
06/12/2013 16:06	0	2.3	19.9	0	1009
06/12/2013 16:07	0	2.3	19.9	0	1009
06/12/2013 16:08	0	2.3	20	0	1009
06/12/2013 16:09	0	2.3	20	0	1009
06/12/2013 16:10	0	2.3	19.9	0	1009

MW 7

Date	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
06/12/2013 16:51	0	0.2	21.5	0	1008
06/12/2013 16:52	0	0.2	21.5	0	1008
06/12/2013 16:53	0	0.2	21.5	0	1008
06/12/2013 16:54	0	0.2	21.5	0	1008
06/12/2013 16:55	0	0.2	21.5	0	1008

MW 8

Date	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
06/12/2013 16:12	25.4	23.4	1.9	0	1009
06/12/2013 16:13	25.3	23.4	1.9	0	1009
06/12/2013 16:14	25.3	23.4	1.9	0	1009
06/12/2013 16:15	25.4	23.4	1.9	0	1009
06/12/2013 16:16	25.4	23.4	1.9	0	1009

MW 9

Date	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
06/12/2013 16:45	2.2	4.9	18	0	1008
06/12/2013 16:46	1.2	3.5	19.2	0	1008
06/12/2013 16:47	1	2.8	19.8	0	1008
06/12/2013 16:48	0.7	2.3	20.1	0	1008
06/12/2013 16:49	0.5	1.9	20.5	0	1008

MW 10S

Date	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
06/12/2013 15:52	0	0.8	19.9	0	1009
06/12/2013 15:53	0	0.6	20.4	0	1009
06/12/2013 15:54	0	0.6	20.5	0	1009
06/12/2013 15:55	0	0.6	20.6	0	1009
06/12/2013 15:56	0	0.6	20.6	0	1009

MW 10D

Date	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
06/12/2013 15:44	0	1.7	17.5	0	1010
06/12/2013 15:45	0	0.9	19.3	0	1010
06/12/2013 15:46	0	0.6	19.9	0	1010
06/12/2013 15:47	0	0.5	20.1	0	1010
06/12/2013 15:48	0	0.4	20.3	0	1010

MW 17S

Date	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
06/12/2013 17:11	0	0	20	0	1008
06/12/2013 17:12	0	0	20	0	1008
06/12/2013 17:13	0	0	20	0	1008
06/12/2013 17:14	0	0	20	0	1008
06/12/2013 17:15	0	0	20	0	1008

MW 17D

Date	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
06/12/2013 17:16	0	0	20.5	0	1008
06/12/2013 17:17	0	0	20.5	0	1008
06/12/2013 17:18	0	0	20.5	0	1008
06/12/2013 17:19	0	0	20.5	0	1008
06/12/2013 17:20	0	0	20.5	0	1008

MW 18

Date	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
06/12/2013 16:19	58	27	0	0	1009
06/12/2013 16:20	58	27	0	0	1009
06/12/2013 16:21	58	27	0	0	1009
06/12/2013 16:22	58	27	0	0	1009
06/12/2013 16:23	58	27	0	0	1009

MW 19

Date	CH4 (%)	CO2 (%)	O2 (%)	H2S (PPM)	Barometric Pressure (mb)
06/12/2013 16:37	28.7	22.4	1.1	0	1010
06/12/2013 16:38	28.7	22.4	1.1	0	1010
06/12/2013 16:39	28.7	22.4	1.1	0	1010
06/12/2013 16:40	28.7	22.4	1.1	0	1010
06/12/2013 16:41	28.7	22.4	1.1	0	1010

APPENDIX 3 – FIELD SHEETS

Landfill Gas Monitoring Form

Facility Name: Ballyboroughy **Waste License No:**	**Facility Address:** Tandragee
Licensee:	
Date of Licensing:	**Date of sampling:** 06/12/13
Instrument Used:	**Date next full calibration:** **Last field calibration: (inc date & gases)**
Monitoring Personnel: Bjorn Keating	**Weather:** Dry

Results

Station Number	Time	GA2000 ID	CH_4	CO_2	O_2	CO	H_2S	Barometric Pressure (mbar)	Comments
MW10D	15:46	/	0	1.7	17.5	/	0	1010	
MW10S	15:52	/	0	0.8	19.9	/	0	1009	
MW6	16:06	/	0	2.3	19.9	/	0	1009	
MW8	16:12	/	25.4	23.4	1.9	/	0	1009	
MW18	16:19	/	58	27	0	/	0	1009	
MW3	16:31	/	6.6	7.2	16.9	/	0	1009	
MW19	16:37	/	28.7	22.4	1.1	/	0	1010	
MW9	16:45	/	22	4.9	18	/	0	1008	
MW7	16:51	/	0	0.2	21.5	/	0	1008	
MW1	16:58	/	0	0.2	21.4	/	0	1008	
MW2	17:05	/	0	1.1	21.8	/	0	1008	

General Comments:

MW175	17:11	/	0	0	20	/	0	1008
MW170	17:16	/	0	0	20.5	/	0	1008

APPENDIX 4 – CALIBRATION CERTIFICATE-GA2000

CALIBRATION CERTIFICATE

MAKE: Geotechnical Instruments CERT NO: 10915
MODEL: GA2000
SERIAL No: 7841
CUSTOMER: CSL

CALIBRATION DATE: 9/7/13
NEXT CALIBRATION DUE **Jan 14**

Calibration Method
Test gases of known concentrations are directed past the instrument sensors. Instrument allowed to stabilise and readings taken.

TEST RESULTS

GAS/CONCENTRATION	INITIAL READING	FINAL READING
60.0% Vol. Methane	58.1	60.1
40.0% Vol. Carbon Dioxide	38.4	40.0
20.9% Vol. Oxygen	21.1	20.9
5.0% Vol. Oxygen	4.5	4.5
0.0% Vol. Oxygen	0.0	0.0
200 ppm Carbon Monoxide	207	203
25 ppm Hydrogen Sulphide	28	25

TEST GAS ANALYSIS CERTIFICATION

Gas	Lot No.	Cylinder No.	Exp.Date	Supplier
CH4/CO2 mix	S25099	2	May-15	Stg
O2	850293	20	Feb-14	Calgaz
H2S	1393098	109	Oct-14	Calgaz
CO	1377075	12	Oct-15	Calgaz

Instrument Passed as fit for Service

Tested By:

ervice, Instrumentation and Telemetry
olutions for the water industry

Company Registration No.: 195032

GROUNDWATER MONITORING REPORT FOR BAILIEBOROUGH LANDFILL W0091-01

Client: **Cavan County Council**

Site Location: **Tanderagee, Bailieborough**

Report No.: CCC-02-01-03-04-Rev 0

Produced by: Brona Keating, BSc, P.Grad.Dip. Environmental Eng.

Approved by: **Date:** 19th December 2013

Cathal Boylan, BEng, CEng, MIEI
CHARTERED ENGINEER

Boylan Engineering
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Email: info@boylanengineering.ie
Web: www.boylanengineering.ie

Rev.	Date	Description

I SUMMARY

Boylan Engineering (Eng. & Environmental Consultancy) was commissioned by Cavan County Council to carry out Environmental Monitoring at Bailieborough Landfill (W0091-01), Tandragee, Co Cavan for quarter four 2013.

Brona Keating, Environmental Consultant carried out all monitoring. This report shall document the findings.

Table of Contents

List of Tables

Appendix

1. INTRODUCTION

Bailieborough landfill is situated approximately 1 kilometre from Bailieborough town centre in the townland of Tandergee. The site which comprises some 2.23 hectares was originally peat land which was stripped for commercial purposes. The site was then operated as a traditional landfill until its closure in 2002. A waste licence was issued by the Environmental Protection Agency after the closure of the site and remedial works were completed.

Condition 8.1 of the waste licence requires that monitoring be carried out in accordance with Schedule D of the licence. The following report give details of the groundwater, sampling programme conducted on site and also summarises findings and analytical results for quarter four 2013.

The purpose of environmental monitoring at closed landfills is to:

- Ensure the facility is compliant with the waste license
- Ensure the facility is not causing environmental pollution
- Ensure the facility is not posing a risk to human health
- Ensure the facility is not creating an unacceptable risk to atmosphere, water, soil, plants or animals
- Ensure the facility is not adversely affecting the countryside or places of interest
- Compare actual site behavior with expected/modeled behavior
- Establish a reliable database of information for the landfill throughout its life

According to the Response matrix for landfills, Bailieborough landfill is situated in the R2[1] Zone. This zone was categorized using a vulnerability rating combined with the aquifer category for the area. Landfills situated in R2[1] Zones are acceptable subject to guidance in the EPA Landfill Design Manual or conditions of a waste licence - (EPA, groundwater protection Responses for Landfills). Unfortunately this landfill was constructed prior to this guidance and conditions were issued only after its closure.

The generation of Leachate is one of the main hazards to groundwater from the disposal of waste by land filling. The conditions within a landfill vary over time from aerobic to anaerobic thus allowing for different chemical reactions to take place. Most landfill leachates have a high BOD, COD, Ammonia, Chloride, Sodium, Potassium, Hardness and Boron levels - (EPA, groundwater protection Responses for Landfills).

2. METHODOLOGY

2.1 Environmental Sampling

The following procedure is conducted by Boylan Engineering to ensure accurate groundwater monitoring:

- ISO 5667: Guidance on sampling of groundwaters is adhered to.
- Prior to sampling, the depth of water in groundwater wells is measured by dipping. Dipping the wells before sampling allows for calculation of the volume of water in the well. This data is recorded on the field sheet for volume calculation which is presented in appendix 3.
- Once the volume was calculated the boreholes are purged three times their volume before sampling.
- Sampling is conducted using a Waterra inertial lift pump and associated tubing, pumping water directly from the borehole to the appropriate sampling bottles.
- Designated tubing is used at each location.
- Having obtained a representative sample the following parameters are measured on-site using a Hanna HI 98129 combination waterproof high accuracy.
    - Conductivity
    - Temperature
    - pH

- Boylan Engineering operate a Sample Submission/Chain of Custody form, which accompanies the samples at all times. These forms are located in the appendix 4.

2.2 Laboratory Analysis

- Samples are sent to Environmental Laboratory Service (ELS) (Ireland) for analysis of the required parameters in designated cool boxes with ice packs. These boxes insure that samples are maintained at a consistent temperature between 0^{o}C and 4^{o}C on their journey to the laboratory.
- On arrival at the laboratory, samples are stored between 0^{o}C and 4^{o}C.
- All samples received are inspected by Laboratory Manager Mr. Brendan Murray.
- All samples are assigned a unique reference number and are recorded on the Laboratory Information Management System (LIMS)
- All staff involved in the analysis of samples hold a minimum honours science degree.
- In the event of a Quality Control Check failure for a given parameter, a note will be included on the analysis report detailing the QC fail.
- Analysis of samples is conducted under the INAB accreditation and associated quality control procedures are employed in every aspect of analysis.
- Analysis methods are listed in Appendix 2.

2.3 Monitoring Locations

Quarter 4 2013					
Monitoring Well	Sample Type	Cover Level M (OD Malin Head)	Water Level M (OD Malin Head)	Water Depth M (Top of Casing)	National Grid Co-Ordinates
MW1	Gas	151.55	148.75	2.8	N296071.96 E267506.68
MW2	Gas	152.72	150.12	2.6	N296018.08 E267540.57
MW3	GW	159.27	155.97	3.3	N295972.19 E267549.66
MW6	Gas	150.27	147.07	3.2	N296082.66 E267451.47
MW8	Leachate	160.74	157.54	3.2	N296014.48 E267517.14
MW9	Leachate	157.94	153.44	4.5	N296037.63 E267458.87
MW10S	GW	154.76	149.06	5.7	N296038.12 E267458.8
MW10D	GW	154.76	149.06	5.7	N296038.12 E267458.87
MW15S	GW	150.36	148.73	1.63	N296097.36 E267343.36
MW15D	Gas	150.39	148.79	1.6	N296092.30 E267344.88
MW16S	Gas	152.6	151.15	1.45	N295888.86 E267202.87
MW16D	GW	152.53	151.33	1.2	N295885.59 E267200.97
SW1	GW	-	-	-	n/a
SW3	GW	-	-	-	n/a
CAP Discharge	GW	-	-	-	n/a
MW17S	GW	149.7	148.27	1.43	N296174 E267321
MW17D	GW	149.61	148.61	1	N296176 E267327
MW18	Leachate	161.1	-	-	N296018 E267451
MW19	Leachate	162.24	-	-	N295948 E267487

2.4 Weather Report

REPORTS FROM BALLYHAISE (A)							
Date	Rainfall	Max	Min	Grass Min Temp	Mean Wind Speed	Gusts	Sunshine
	(mm)	Temp	Temp	(°C)	(knots)	(if >= 34 knots)	(hours)
		(°C)	(°C)				
12/11/2013	0.1	10.1	3.8	0.9	6.4		

3.0 SUMMARY OF RESULTS

Table 1.0 04th Quarter Ground water monitoring 2013

Report Number: 71140
Monitoring Date: 12.11.13

Method		Site Tests					TOC	Ammonia	AQ2-UP1	Titralab		Titralab	AQ2-UP2		DO	Total Cyanide High (Sub)	Total Phosphorus-TP	PhenolsTotal - Index (Sub1)
Method Number		Site Tests					DEFAULT	EW003	EW154M	EW153			EW154M		EW043	DEFAULT	EW146	DEFAULT
Parameter		Sample temperature (to be done onsite)	Cond	pH	Water Level from TOC	Visual Inspection	TOC	Ammonia	TON (as N)(calc)	pH	Cond	Alkalinity Total (R2 pH4.5)	Chloride	Sulphate	Dissolved Oxygen	Total Cyanide High	Total Phosphorus-TP	Phenols-Total
Units		Deg C	us/cm	pH units	Meter's	-	mg/l	mg/l N	mg/l N	pH Units	us/cm	mg/L CaCO3	mg/l	mg/l	mg/l	ug/L	mg/l P	mg/L
Limit of Detection		-	-	-	-	-	0.25	0.007	0.138	0.3	25	10	2.6	1.0	1.0	10	0.01	0.15
Date Testing		12.11.13					13.11.13											
ELS Ref	Client Ref																	
71140/005	MW 15S	11.7	251	7.83	5.6	Brown	13.93	0.709	0.511	6	231	51	9.6	12.8	7	<10	2.96	<0.15
71140/006	MW 15D	10.8	297	8.11	1.82	Clear	1.02	0.143	<0.138	7.6	302	138	2321.2	114.5	5	<10	0.06	<0.15
71140/003	MW 16S	11.4	268	7.23	1.6	Grey	2.34	0.319	0.154	6.5	264	113	9.3	23.9	8	<10	1.26	<0.15
71140/004	MW 16D	10.3	271	7.56	1.48	Clear	1.31	0.058	<0.138	7	271	116	17.2	65.9	4	<10	0.09	<0.15
71140/001	MW 17S	11.3	506	7.67	1.17	Brown	6.44	0.08	0.172	7	507	175	7	43.4	9	<10	1.53	<0.15
71140/002	MW 17D	10	485	7.70	1.35	Clear	2.91	0.113	<0.138	7.4	482	235	8.8	27.2	5	<10	0.01	<0.15
IGV			1000	≥6.5 and ≤9.5			NAC	0.15	NAC	≥6.5 and ≤9.5	1000	NAC	30	200	NAC	10	-	-

Method		Coliforms	Coliforms	Ion Chromatography	Residue on Evaporation (Tot Solids-TS)	Metals-Total	Metals-Dissolved											
Method Number		MIC133		EW137	EW060	EM130												
Parameter		Total Coliforms	E. Coli	Fluoride	Residue on Evaporation (Tot Solids-TS)	Chromium-Total	Iron Dissolved	Manganese Dissolved	Potassium Dissolved	Sodium Dissolved	Cadmium-Dissolved	Calcium-Dissolved	Copper-Dissolved	Lead-Dissolved	Magnesium-Dissolved	Mercury-Dissolved	Zinc-Dissolved	Boron-Dissolved
Units		MPN/100ml	MPN/100ml	mg/L	mg/L	ug/L	ug/L	ug/L	mg/l	mg/l	ug/L	mg/L	mg/L	ug/L	mg/L	ug/L	ug/L	mg/L
Limit of Detection		0		0.1	10.0	1.0	20.0	0.001	0.2	0.5	0.1	1.0	0.00	0.3		0.02	1.0	0.02
Date Testing		13.11.13																
ELS Ref	Client Ref																	
71140/005	MW 15S	750	0	<0.1	2744	112.8	19676.7	507.6	5.2	8.5	<0.1	24.5	<0.003	1.1	5.3	<0.02	7.4	<0.02
71140/006	MW 15D	30	0	0.1	200	1.7	165.5	143.1	3.5	10.4	<0.1	33.9		<0.3	12.7	<0.02	13.2	<0.02
71140/003	MW 16S	0	0	0.2	850	40	448.1	317.3	4	8.7	<0.1	23.7	<0.003	<0.3	14.7	<0.02	7.7	<0.02
71140/004	MW 16D	0	0	0.7	172	<1	443.6	633.2	3.5	14.1	<0.1	27.2	<0.003	<0.3	9	<0.02	28.5	<0.02
71140/001	MW 17S	30	0	0.1	1934	84.3	55.8	14.4	5	7.3	<0.1	81	0.006	0.4	14	<0.02	3.9	<0.02
71140/002	MW 17D	60	0	<0.1	312	1.3	23.3	1035.3	3.3	13.2	<0.1	59.4	<0.003	0.3	21.7	<0.02	30.8	<0.02
IGV		0	0	1	-	30	200	50	5	150	0.005	200	0.03	10	50	1	100	1

Exceedance

NOTES
1 Sub-contract analysis denoted by *
2 ND - Concentration was below the limit of detection
3 NAC- No Abnormal Change
4 IGV - Interim Guide Value

As there are no limits set in the waste licence for groundwater, results are compared to the Interim Guide Values for the protection of Groundwater in Ireland, where available.

4.0 DISCUSSION

4.1 Ground water

Monitoring of groundwater is a common and necessary event in landfill sites both during their active life and post closure. The significance of such monitoring is so the facilities can demonstrate that there is no potential for the migration of hazardous constituents from the unit into the groundwater systems.

Monitoring was conducted on the 12th November 2013. Results in Hatched Red indicate where the interim guide value has been exceeded. Results from Quarter four 2013 show that there were exceedances at various ground water monitoring locations for parameters; Ammonia, pH, Chloride, Iron and Manganese, Potassium, Chromium and Total Coliforms. Previous results detailed in the historical data show that exceedances for Ammonia, Iron and Manganese are on par with previous monitoring events. The exceedance in pH has been noted at location MW 15S on previous monitoring events.

Elevated Iron levels at the remaining wells can be an indication of contamination. However, the hypothesis that is proposed is that the source of this Iron is not the landfill leachate, but the native soils beneath the landfill. Iron can become mobilised due to changing pH and/or redox conditions in the environment underneath the landfill. Alternatively, the Leachate from the non hazardous waste may produce reducing conditions beneath the landfill, allowing the solution of Iron and Manganese from the underlying deposits. Elevated Iron may also be attributed to the natural composition of this area. All exceedances will be carefully examined in quarter 1 2014 and compared to previous monitoring episodes.

Historical results for comparison purposes are presented in tabular and graphic form in Appendix 1.

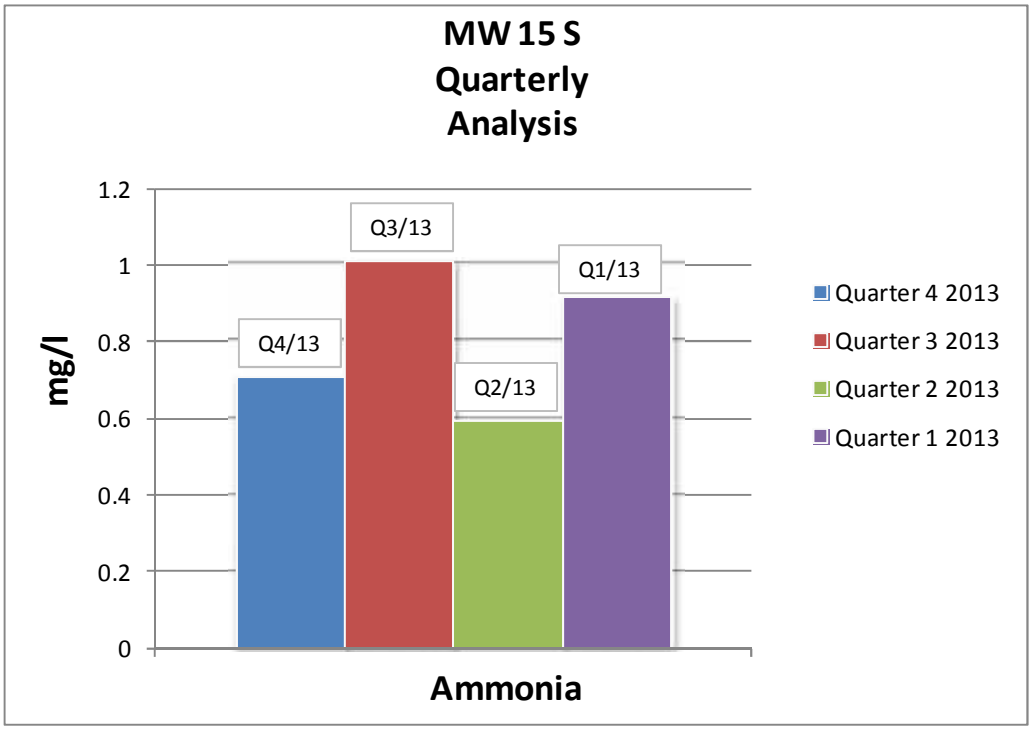
5.0 CONCLUSION

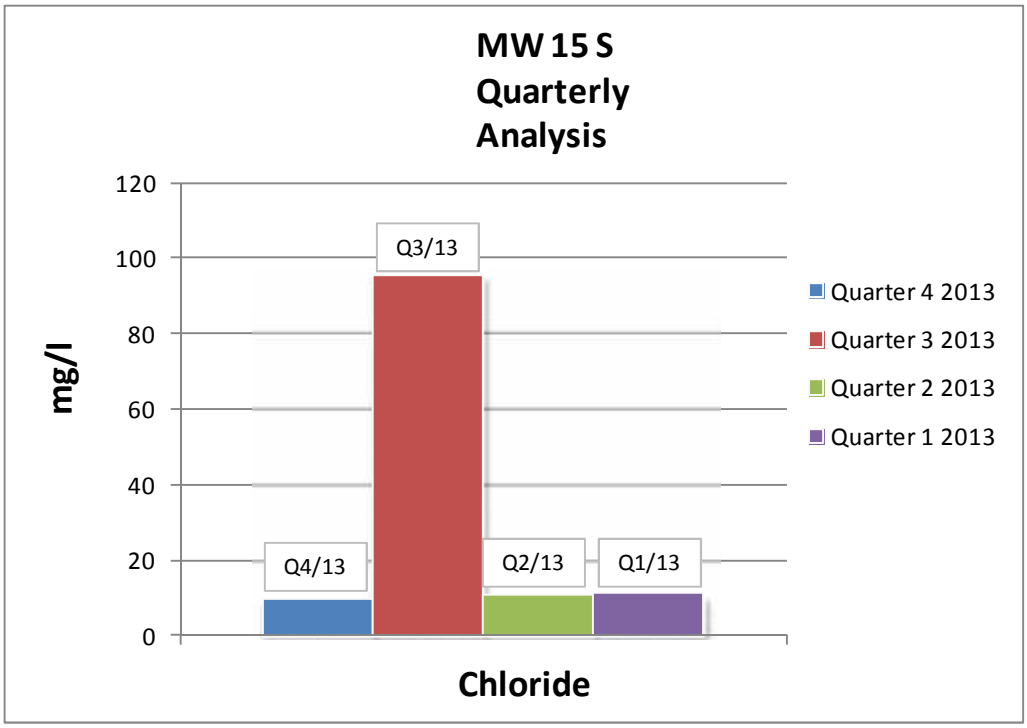
The results obtained from environmental monitoring are relatively consistent with previous monitoring events. The levels of exceeded parameters do not show any signs of dramatic exceedences therefore there is no evidence of any major negative environmental impact associated with this landfill.

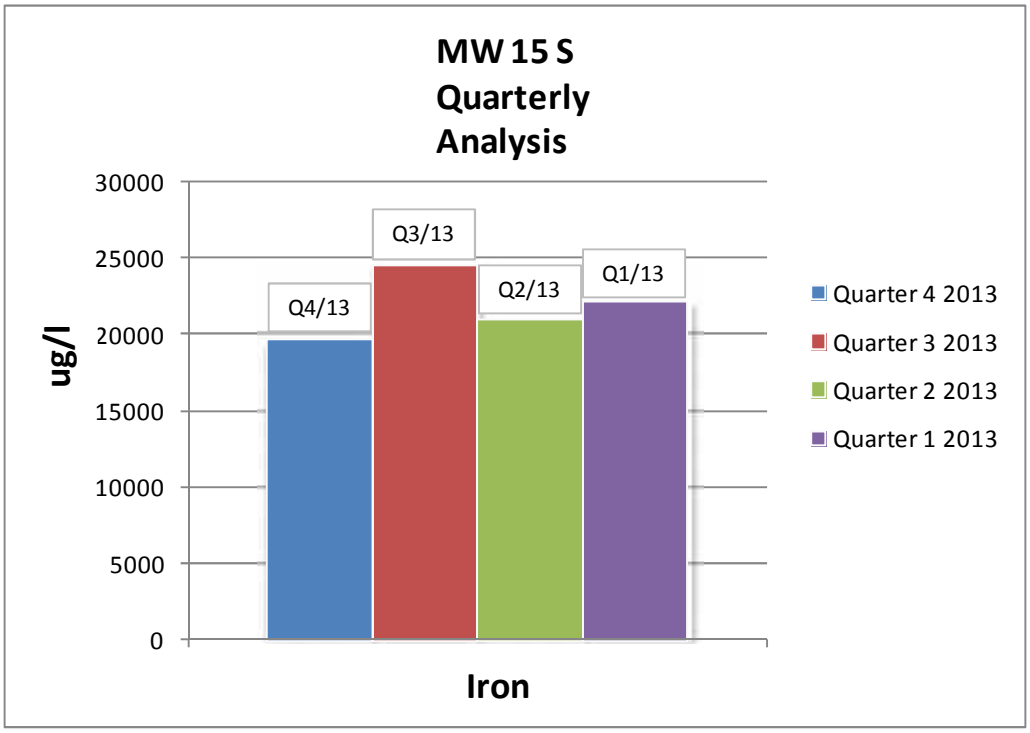
APPENDIX 1 HISTORICAL DATA-TABLES

	Parameter	TOC	Ammonia	TON	pH	Cond	Cl	SO4	DO	Fe	Mn	K	Na
	Units	mg/l	mg/l N	mg/l N	pH Units	us/cm	mg/l	mg/l	mg/l	ug/l	ug/l	mg/l	mg/l
WELL 15 S	Qtr 4 2013	13.93	0.709	0.511	6	231	9.6	12.8	7	19676.7	507.6	5.2	8.5
	Qtr 3 2013	11.21	1.009	<0.138	6.1	437	95.6	33.2	6.1	24554	534.6	2.9	48
	Qtr 2 2013	11.62	0.59	<0.138	6.2	171	10.6	22.4	6.8	21058.8	412.2	3.7	7.4
	Qtr 1 2013	-	-	-	-	-	-	-	-	-	-	-	-
WELL 15 D	Qtr 4 2013	1.02	0.143	<0.138	7.6	302	2321.2	114.5	5	165.5	143.1	3.5	10.4
	Qtr 3 2013	1.42	0.035	<0.138	8	304	9.9	15.8	6.3	82	164.4	1.6	11.9
	Qtr 2 2013	0.88	0.036	<0.138	7.9	280	8.8	19.3	6	106.4	138.5	3.1	10.5
	Qtr 1 2013	0.59	0.064	<0.138	7.9	298	9.1	16.9	9.4	0.0448	137.3	2.1	10.7
WELL 16 S	Qtr 4 2013	2.34	0.319	0.154	6.5	264	9.3	23.9	8	448.1	317.3	4	8.7
	Qtr 3 2013	4.25	0.485	<0.138	6.7	305	11.1	35.6	7.5	2555.2	630	1.3	10.4
	Qtr 2 2013	2.42	0.16	<0.138	6.9	242	6.7	23.9	7.2	489.4	335.9	2.9	8.6
	Qtr 1 2013	2.53	0.202	<0.138	6.8	250	6.6	18.5	6.5	460.5	415	1.8	8.6
WELL 16 D	Qtr 4 2013	1.31	0.058	<0.138	7	271	17.2	65.9	4	443.6	633.2	3.5	14.1
	Qtr 3 2013	0.98	0.023	<0.138	7.4	274	10.5	19.8	6.7	489.2	624.6	1.3	15.5
	Qtr 2 2013	0.41	0.033	<0.138	7.4	251	9.6	23.6	5.8	450.8	591	3	15.3
	Qtr 1 2013	0.31	0.058	<0.138	7.3	266	9.3	19.8	5.7	446.9	674.4	1.7	15.2
MW 17 S	Qtr 4 2013	6.44	0.08	0.172	7	507	7	43.4	9	55.8	14.4	5	7.3
	Qtr 3 2013	4.62	0.306	<0.138	7.1	415	22.7	35.4	4.7	517.5	1595	1.5	12.8
	Qtr 2 2013	5.48	0.034	0.986	7.2	425	14.3	45.3	8.7	89.9	19.1	6.2	9.1
	Qtr 1 2013	6.82	0.138	1.039	7	448	9.5	40.5	9.6	36.7	13.9	3.1	7.6
Well 17 D	Qtr 4 2013	2.91	0.113	<0.138	7.4	482	8.8	27.2	5	23.3	1035	3.3	13.2
	Qtr 3 2013	3.48	0.022	<0.138	7.6	514	7.4	43.2	7	<20	1420	1.6	14.7
	Qtr 2 2013	3.1	0.04	0.138	7.4	500	6.4	47	2.9	27.9	1510	2.2	13.5
	Qtr 1 2013	2.86	0.085	0.259	7.5	489	7.6	40.6	7.2	21.3	910.6	2.7	14.3
Interim Guide Value		NAC	0.15	NAC	≥6.5 &≤9.5	1000	30	200	NAC	200	50	5	150

HISTORICAL DATA- CHARTS



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Quarterly
Analysis
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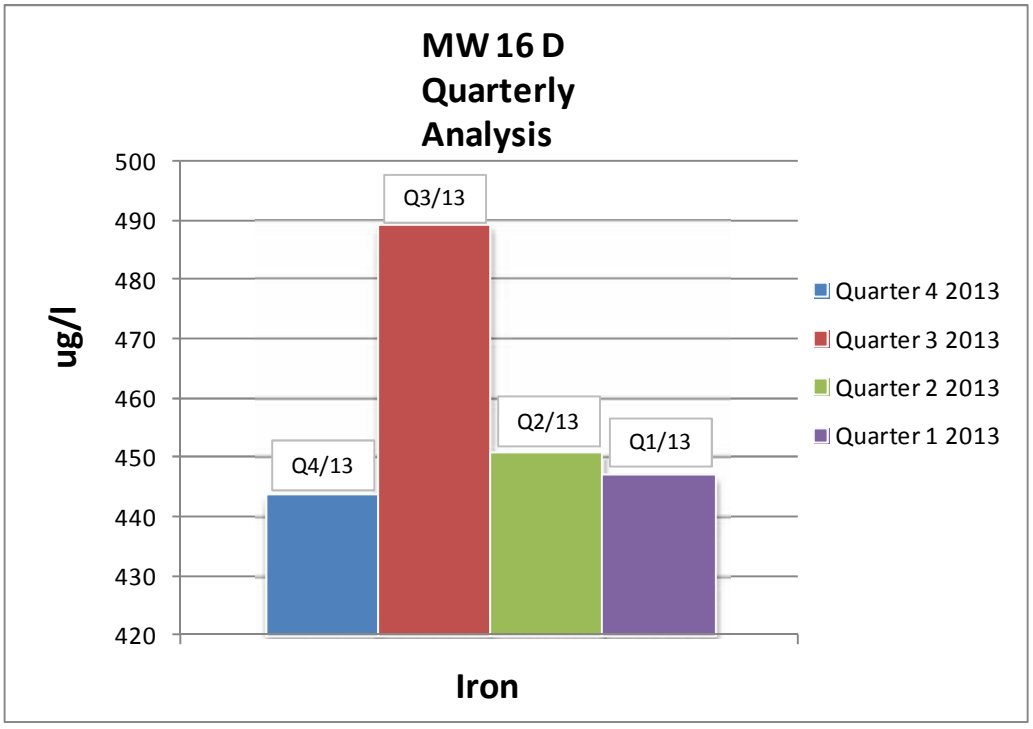
25000
20000
15000
10000
5000
0
ug/l
Q4/13
Q3/13
Q2/13
Q1/13
Iron
Quarter 4 2013
Quarter 3 2013
Quarter 2 2013
Quarter 1 2013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Quarterly
Analysis
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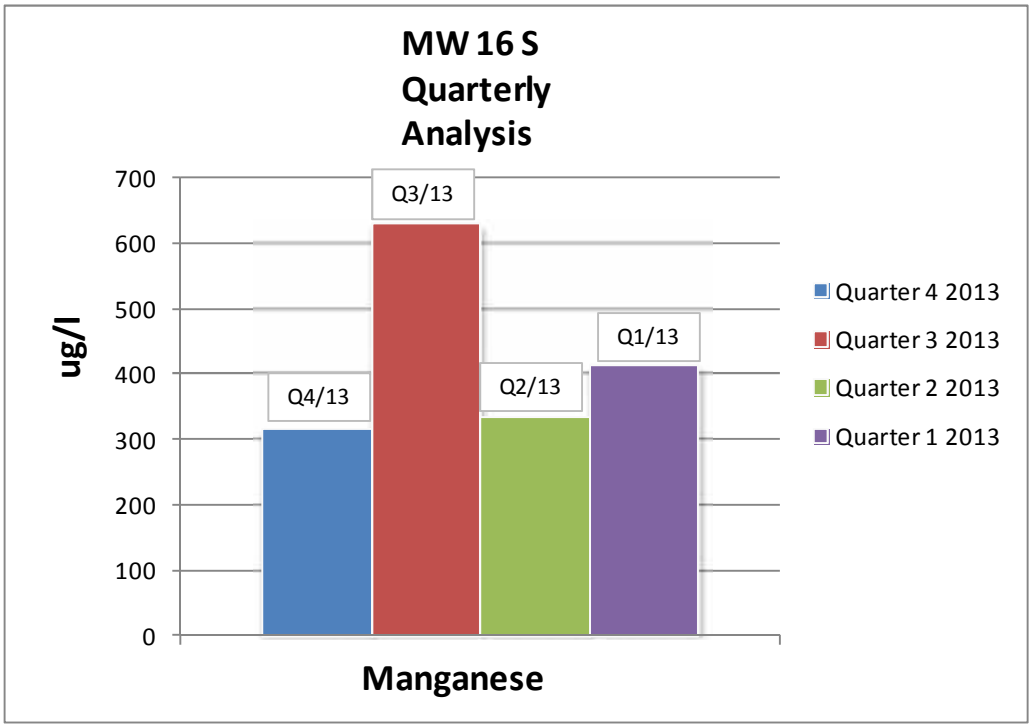
480
470
460
450
440
430
420
ug/l
Q4/13
Q3/13
Q2/13
Q1/13
Iron
Quarter 4 2013
Quarter 3 2013
Quarter 2 2013
Quarter 1 2013


MW 16 S
Quarterly
Analysis
700
600
500
400
300
200
100
0
ug/l
Q3/13
Q4/13
Q2/13
Q1/13
Quarter 4 2013
Quarter 3 2013
Quarter 2 2013
Quarter 1 2013
Manganese

APPENDIX 2- ANALYSIS METHODS

ESLLTD INAB ACCREDITATION SCHEDULE SUMMARY SHEET

Miscellaneous (P,G,W,S) Ammonia/Ammonium 0.007-1mg/l N EW003 Chloride 2.6-250mg/l EW015 Flouride 0.1 - 2 mg/l EW137 COD 6-1500 mg/l EW094 Nitrate 0.12-50 mg/l N EW034 Nitrite 0.013-1 mg/l N EW035 pH 4 – 10 pH Units EW138 Phospate 0.009-1 mg/l P EW007 TOC 0.25-100mg/l EW123 Total Phosphorous 0.03-1 mg/l P EW002	**Other VOC's EO025 (P,G,S)** Bromomethane 0.5 - 35 µg/l Ethyl Ether/Diethyl Ether0.5 - 35 µg/l 1,1 Dichloroethene0.5 - 35 µg/l Iodomethane/Mthy. Iodide 0.5 - 35 µg/l Carbon Disulphide 0.5 - 35 µg/l Allyl Chloride0.5 - 35 µg/l Methylene Chloride/DCM 5.0 - 35 µg/l 2-Propenenitrile/Acrylonitrile 2.0 - 35 µg/l Chloromethyl Cyanide 0.5 - 35 µg/l Hexachlorobutadiene0.5 - 35 µg/l Trans-1,2 Dichloroethene0.5 - 35 µg/l MtBE0.5 - 35 µg/l 1,1 Dichloroethane0.5 - 35 µg/l 2,2 Dichloropropane0.5 - 35 µg/l Cis-1,2 Dichloroethene0.5 - 35 µg/l Methyl Acrylate5.0 - 35 µg/l Bromochloromethane0.5 - 35 µg/l Tetrahydrofuran5.0 - 35 µg/l 1,1,1 Trichloroethane0.5 - 35 µg/l 1-Chlorobutane0.5 - 35 µg/l Carbon Tetrachloride0.5 - 35 µg/l 1,1 Dichloropropene0.5 - 35 µg/l 1,2 Dichloropropane0.5 - 35 µg/l Dibromomethane0.5 - 35 µg/l Methyl Methacrylate0.5 - 35 µg/l 1,3 Dichloropropene, cis2.0 - 35 µg/l MIBK/4 Methyl 2 Pentanone 2.0 - 35 µg/l Toluene0.5 - 35 µg/l 1,3 Dichloropropene trans2.0 - 35 µg/l Ethyl Methacrylate1.0 - 35 µg/l 1,1,2 Trichloroethane0.5 - 35 µg/l 1,3 Dichloropropane0.5 - 35 µg/l 2 Hexanone 1.0 - 35 µg/l 1,2 Dibromoethane0.5 - 35 µg/l Chlorobenzene0.5 - 35 µg/l 1,1,1,2 Tetrachloroethane2.0 - 35 µg/l Ethyl Benzene0.5 - 35 µg/l m & p Xylene0.5 - 35 µg/l O Xylene0.5 - 35 µg/l Styrene2.0 - 35 µg/l Isopropyl Benzene0.5 - 35 µg/l Bromobenzene0.5 - 35 µg/l 1,1,2,2 Tetrachloroethane0.5 - 35 µg/l 1,2,3 Trichloropropane2.0 - 35 µg/l Propyl Benzene0.5 - 35 µg/l 2-Chlorotoluene0.5 - 35 µg/l 4 Chlorotoluene0.5 - 35 µg/l 1,3,5 Trimethylbenzene0.5 - 35 µg/l Tert Butyl Benzene0.5 - 35 µg/l 1,2,4 Trimethylbenzene0.5 - 35 µg/l Sec Butyl Benzene0.5 - 35 µg/l 1,3 Dichlorobenzene0.5 - 35 µg/l P Isopropyltoluene0.5 - 35 µg/l 1,4 Dichlorobenzene0.5 - 35 µg/l 1,2 Dichlorobenzene0.5 - 35 µg/l N Butyl Benzene0.5 - 35 µg/l Hexachloroethane5.0 - 35 µg/l 1,2,4 Tribromo 3Chloropropane 1.0 - 35 µg/l 1,2,4 Trichlorobenzene0.5 - 35 µg/l 1,2,3 Trichlorobenzene0.5 - 35 µg/l	**PAH EO119 (P,G,S)** *Range 0.01 - 0.2 µg/l* Acenaphthene Benzo (a) Anthracene Benzo (a) Pyrene Benzo (b) Fluoranthene Benzo (ghi) Perylene Benzo (k) Fluoranthene Chrysene Dibenzo (ah) Anthracene Fluoranthene Fluorene Indeno (123 cd) Pyrene Phenanthrene Pyrene **Acid Herbicides (P,G,S)** *Range 0.01 - 0.2 µg/l* 2,4,5-TH 2,4-D H 2,4-DBH MCPA H Picloram H **Organophosphorus Pesticides(P,G,S)** *Range 0.01 - 0.2 µg/l* Famphur OP Methyl Parathion OP Parathion OP Thionazin OP **Organochlorine Pesticides (P,G,S)** *Range 0.01 - 0.2 µg/l* Aldrin BHC Alpha isomer OC BHC Beta isomer OC BHC Delta isomer OC Dieldrin OC Endosulphan Alpha isomer OC Endosulphan Beta isomer OC Endosulphan Sulphate OC Endrin OC Heptachlor Epoxide OC Heptachlor OC Lindane OC P,P'DDE OC P,P-DDD OC P,P-DDT OC
SI439 Potable Water VOCs & THM EO025 (P,G,S) Benzene 0.1-35 µg/l 1,2-Dichloroethane 0.1-35 µg/l Tetrachloroetene 0.1-35 µg/l Trichloroethene 0.1-35 µg/l Chloroform 1.0-150 µg/l Bromoform 1.0-35 µg/l Dibromochloromethane 1.0-35 µg/l Dromodichloromethane 2.0-35 µg/l		

Notes
1.Sample Matrix:P=Potable Water (Drinking), G=Ground Water , S=Surface Water, W=Waste Water

APPENDIX 3 – FIELD SHEETS

ON SITE SAMPLING FORM

Facility Name: Ballinbrough

Waste Licence No: W0091-01

Report To:

Sampling Date: 12/11/13

Sample Type (GW, SW, Leachate) All

Personnel: B. Keating

Weather: Dry

Other Remarks:

GPS:

Sample Ref No	Sample Type	Time	DO Level	Elec Cond (us)	pH pH units	Temp °C	Visual	Instrument
MW16S	GW	✓	✓	263	7.23	11.4		Grey
MW16D	GW	✓	✓	271	7.58	10.3		clear
MW15S	GW	✓	✓	251	7.83	11.7		Brown
MW15D	GW	✓	✓	297	8.11	10.8		clear
MW17S	GW	✓	✓	506	7.69	11.3		Brown
MW17D	GW	✓	✓	495	7.70	10.0		clear
SW3	SW	✓	✓	326	7.12	9.0		clear
CAP	SW	✓	✓	511	7.41	9.1		clear
SW1	SW	✓		328	7.11	9.0		clear

Cavan County Council Groundwater Sampling ref.

Site Reference: Ballybrough **Permit No.** W0091-01 **Date:** 12/11/13 **Personnel:** B Keating

Sample Ref	Depth of Well (m)	Depth of water below Ground Level (m) B	Depth of water column A-B=h	Diameter of well (m)	Radius of well (m)	Radius squared (m^2)	Volume of water in well (m3) π r2h	Volume of water in well litres (m^3 x 1000)	Volume of water to purge (litres x 3)	Time to purge (mins)
(Shallow/Deep)	A	B		C	(C/2) = r	r^2				
MW16S	5	1.45	3.55	0.05	0.025	0.000625	0.0069687	6.9687	20.900	4 min
MW16D	27	1.2	25.8	0.05	0.025	0.000625	0.050632	50.6325	151.897	25 min
MW15S	5	1.63	3.37	0.05	0.025	0.000625	0.0066125	6.613625	19.8408	4 min
MW15D	25	1.60	23.4	0.05	0.025	0.000625	0.0459225	45.9225	137.7675	23 min
MW17S	?	1.43		0.05	0.025	0.000625				
MW17D	?	1.00		0.05	0.025	0.000625				
				0.05	0.025	0.000625				
				0.05	0.025	0.000625				
				0.05	0.025	0.000625				
				0.05	0.025	0.000625				
				0.05	0.025	0.000625				

Boylan engineering

CAVAN COUNTY COUNCIL

CLOSED LANDFILL MONITORING INTEGRITY FORM

SITE Ballieborough DATE 12/11/13 PERSONNEL B.Lee

ITEM		CONDITION		COMMENTS
	GOOD	NEEDS MAINTENANCE	N/A	
GROUNDWATER MONITORING WELLS	✓			
-Labeled	✓			
-Well cap integrity	✓			
-Water drainage	✓			
-Locks	✓			
LANDFILL GAS VENTS				
-Riser condition	✓			
-Concrete collar condition	✓			
-Screen condition	✓			
LANDFILL GAS MONITORING WELLS				
-Labeled	✓			
-Well cap integrity	✓			
-Water drainage	✓			
-Traffic protection	✓			
-Concrete collar condition	✓			
-Screen Condition	✓			
-Locks	✓	Replacements Needed During Q1 2014		
SURFACE WATER MONITORING LOCATIONS				
-Access	✓			
-Disturbance	✓			

APPENDIX 4 – SAMPLE SUBMISSION FORMS

els

Environmental Laboratory Services Ltd
Acorn Business Campus
Mahon Industrial Park,
Blackrock
Cork
Tel: 021-4536141

SAMPLE SUBMISSION FORM

6592

DETAILS TO APPEAR ON ANALYSIS REPORT

Contact Name: 407 Bioscheck
Address: Boylan Eng Mullagh Cavan

Customer Name: Boylan Eng
PO Number:
NOTE: Use a separate sheet for different PO Numbers
For all customers a PO Number must be provided with the samples

CONTRACT DETAILS

ELS Quote No: 407
NOTE: To reduce potential for error this field must be completed
Use a separate sheet for different Quote Numbers

Results Due (Tick): [illegible] ✓

NOTE: Standard lead time is 10 working days and 15 working days for test sub-contrac[ted]
Deviations should be agreed in advance and may incur an extra charge

SAMPLE DETAILS

Number	Sample Reference NOTE: Whatever appears in this section, is the ONLY detail that will appear on the analysis report (Do not write the required detail on the bottles as it is normally not clear)	Tests Requested NOTE: To reduce potential for error please complete this field clearly indicating per quote, per sheet attached or list the specific tests below	Number of bottles submitted	Sample Type Drinking Water (DW), Ground Water (GW), Surface Water (SW), Waste Water (WW), Sludge, Soil/Sdt, Solvent, Air
71140 1	MW 17S	See QN	Full Unit	GW
2	MW 17D	"	"	"
3	MW 16S	"	"	"
4	MW 16D	"	"	"
5	MW 15S	"	"	"

ONLY FIVE SAMPLES ALLOWED PER SUBMISSION SHEET

ADDITIONAL INFORMATION AND SIGNATURES

To be filled by the person submitting samples

Signature: [signature]
Date:
Phone No. 0469286000
No. samples submitted: 6
No. of pages: 1 of 4
Additional Info (if any):

To be filled by ELS Ltd

Signature: MD
Date: 13/11/13
Time:
Condition: Satisfactory / Unsatisfactory (See notes above)
Additional Info:

ENVIRONMENTAL
LABORATORY SERVICES
Acorn Business Campus
Mahon Industrial Park,
Blackrock,
Cork
Ireland
Tel: +353 21 453 6141
Fax: +353 21 453 6149
Web: www.irishwatertesting.com

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 111T

Contact Name	Cathal Boylan	**Report Number**	**71140 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	71140/001 13/11/2013 13/11/2013
Tel No	046 9286000	**Received or Collected**	Fastway
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	28/11/2013
Quotation No	QN000407	**Sample Type**	Ground Waters
Customer Ref	MW 17S		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.007		0.080	mg/l N	INAB	
AQ2-UP1								
Nitrate (as N)		EW154M-1	0.12		0.17	mg/l N	INAB	
Nitrite (as N)		EW154M-1	0.013		<0.013	mg/l N	INAB	
TON (as N)		EW154M-1	0.138		0.172	mg/l N	INAB	
AQ2-UP2								
Chloride		EW154M-1	2.6		7.0	mg/L	INAB	
Sulphate		EW154M-1	1.0		43.4	mg/L	INAB	
Coliforms								
Total Coliforms		MIC133	0		30	MPN/100ml		
E. Coli		MIC133	0		0	MPN/100ml		
Dissolved Oxygen								
Dissolved Oxygen		EW043	1		9	mg/L	INAB	
Ion Chromatography								
Fluoride		EW137	0.1		0.1	mg/L	INAB	
Metals-Dissolved								
Iron-Dissolved		EM130	20.0		55.8	ug/L	INAB	
Manganese-Dissolved		EM130	1.0		14.4	ug/L	INAB	
Boron-Dissolved		EM130	0.02		<0.02	mg/L	INAB	
Cadmium-Dissolved		EM130	0.1		<0.1	ug/L	INAB	
Calcium-Dissolved		EM130	1.0		81.0	mg/L	INAB	
Copper-Dissolved		EM130	0.003		0.006	mg/L	INAB	
Lead-Dissolved		EM130	0.3		0.4	ug/L	INAB	
Magnesium-Dissolved		EM130	0.3		14.0	mg/L	INAB	
Zinc-Dissolved		EM130	1.0		3.9	ug/L	INAB	
Mercury-Dissolved		EM130	0.02		<0.02	ug/L	INAB	
Potassium-Dissolved		EM130	0.2		5.0	mg/L	INAB	
Sodium-Dissolved		EM130	0.5		7.3	mg/L	INAB	
Metals-Total								
Chromium-Total		EM130	1.0		84.3	ug/L		
PhenolsTotal -Index (Sub1)								
Phenols-Total	*	Default	0.15		<0.15	mg/L	YES	
Residue on Evaporation (Tot Solids-TS)								
Residue on Evaporation (Tot Solids-TS)		EW060	10.0		1934.0	mg/L		

Signed : _____ 28/11/2013

Technical Manager (or Deputy): **Brendan Murray**

NOTES
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2.SPEC= Allowable limit or parametric value
3.OOS=Result which is outside specification highlighted as OOS
4.LOQ=Limit of Quantification or lowest value that can be reported for the test
5.ACCRED=Indicates matrix accreditation for the test,a blank field indicates not accredited

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Fax: +353 21 453 6149
Web: www.irishwatertesting.com

Contact Name	Cathal Boylan	**Report Number**	**71140 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	71140/001 13/11/2013 13/11/2013
Tel No	046 9286000	**Received or Collected**	Fastway
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	28/11/2013
Quotation No	QN000407	**Sample Type**	Ground Waters
Customer Ref	MW 17S		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Titralab									
	pH		EW153	0.0		7.0	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		507	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		175	mg/L CaCO3	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	10		<10	ug/L	YES	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		6.44	mg/L	INAB	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		1.53	mg/l P	INAB	

Signed : _____ 28/11/2013

Technical Manager (or Deputy): **Brendan Murray**

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DETAILED IN SCOPE REG NO. 111T

Contact Name	Cathal Boylan	**Report Number**	**71140 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	71140/002 13/11/2013 13/11/2013
Tel No	046 9286000	**Received or Collected**	Fastway
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	28/11/2013
Quotation No	QN000407	**Sample Type**	Ground Waters
Customer Ref	MW 17D		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.007		0.113	mg/l N	INAB	
AQ2-UP1								
Nitrate (as N)		EW154M-1	0.12		<0.12	mg/l N	INAB	
Nitrite (as N)		EW154M-1	0.013		<0.013	mg/l N	INAB	
TON (as N)		EW154M-1	0.138		<0.138	mg/l N	INAB	
AQ2-UP2								
Chloride		EW154M-1	2.6		8.8	mg/L	INAB	
Sulphate		EW154M-1	1.0		27.2	mg/L	INAB	
Coliforms								
Total Coliforms		MIC133	0		60	MPN/100ml		
E. Coli		MIC133	0		0	MPN/100ml		
Dissolved Oxygen								
Dissolved Oxygen		EW043	1		5	mg/L	INAB	
Ion Chromatography								
Fluoride		EW137	0.1		<0.1	mg/L	INAB	
Metals-Dissolved								
Iron-Dissolved		EM130	20.0		23.3	ug/L	INAB	
Manganese-Dissolved		EM130	1.0		1035.3	ug/L	INAB	
Boron-Dissolved		EM130	0.02		<0.02	mg/L	INAB	
Cadmium-Dissolved		EM130	0.1		<0.1	ug/L	INAB	
Calcium-Dissolved		EM130	1.0		59.4	mg/L	INAB	
Copper-Dissolved		EM130	0.003		<0.003	mg/L	INAB	
Lead-Dissolved		EM130	0.3		0.3	ug/L	INAB	
Magnesium-Dissolved		EM130	0.3		21.7	mg/L	INAB	
Zinc-Dissolved		EM130	1.0		30.8	ug/L	INAB	
Mercury-Dissolved		EM130	0.02		<0.02	ug/L	INAB	
Potassium-Dissolved		EM130	0.2		3.3	mg/L	INAB	
Sodium-Dissolved		EM130	0.5		13.2	mg/L	INAB	
Metals-Total								
Chromium-Total		EM130	1.0		1.3	ug/L		
PhenolsTotal -Index (Sub1)								
Phenols-Total	*	Default	0.15		<0.15	mg/L	YES	
Residue on Evaporation (Tot Solids-TS)								
Residue on Evaporation (Tot Solids-TS)		EW060	10.0		312.0	mg/L		
Titralab								

Signed : _____ 28/11/2013

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Contact Name	Cathal Boylan	**Report Number**	**71140 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	71140/002 13/11/2013 13/11/2013
Tel No	046 9286000	**Received or Collected**	Fastway
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	28/11/2013
Quotation No	QN000407	**Sample Type**	Ground Waters
Customer Ref	MW 17D		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Titralab									
	pH		EW153	0.0		7.4	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		482	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		235	mg/L CaCO3	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	10		<10	ug/L	YES	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		2.91	mg/L	INAB	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		0.01	mg/l P	INAB	

Signed : _____ 28/11/2013

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DETAILED IN SCOPE REG NO. 111T

Contact Name	Cathal Boylan	**Report Number**	**71140 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	71140/003 13/11/2013 13/11/2013
Tel No	046 9286000	**Received or Collected**	Fastway
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	28/11/2013
Quotation No	QN000407	**Sample Type**	Ground Waters
Customer Ref	MW 16S		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.007		0.319	mg/l N	INAB	
AQ2-UP1								
Nitrate (as N)		EW154M-1	0.12		<0.12	mg/l N	INAB	
Nitrite (as N)		EW154M-1	0.013		0.064	mg/l N	INAB	
TON (as N)		EW154M-1	0.138		0.154	mg/l N	INAB	
AQ2-UP2								
Chloride		EW154M-1	2.6		9.3	mg/L	INAB	
Sulphate		EW154M-1	1.0		23.9	mg/L	INAB	
Coliforms								
Total Coliforms		MIC133	0		0	MPN/100ml		
E. Coli		MIC133	0		0	MPN/100ml		
Dissolved Oxygen								
Dissolved Oxygen		EW043	1		8	mg/L	INAB	
Ion Chromatography								
Fluoride		EW137	0.1		0.2	mg/L	INAB	
Metals-Dissolved								
Iron-Dissolved		EM130	20.0		448.1	ug/L	INAB	
Manganese-Dissolved		EM130	1.0		317.3	ug/L		
Boron-Dissolved		EM130	0.02		<0.02	mg/L	INAB	
Cadmium-Dissolved		EM130	0.1		<0.1	ug/L	INAB	
Calcium-Dissolved		EM130	1.0		23.7	mg/L	INAB	
Copper-Dissolved		EM130	0.003		<0.003	mg/L	INAB	
Lead-Dissolved		EM130	0.3		<0.3	ug/L	INAB	
Magnesium-Dissolved		EM130	0.3		14.7	mg/L	INAB	
Zinc-Dissolved		EM130	1.0		7.7	ug/L	INAB	
Mercury-Dissolved		EM130	0.02		<0.02	ug/L	INAB	
Potassium-Dissolved		EM130	0.2		4.0	mg/L	INAB	
Sodium-Dissolved		EM130	0.5		8.7	mg/L	INAB	
Metals-Total								
Chromium-Total		EM130	1.0		40.0	ug/L		
PhenolsTotal -Index (Sub1)								
Phenols-Total	*	Default	0.15		<0.15	mg/L	YES	
Residue on Evaporation (Tot Solids-TS)								
Residue on Evaporation (Tot Solids-TS)		EW060	10.0		850.0	mg/L		
Titralab								

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Technical Manager (or Deputy): **Brendan Murray**

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Contact Name	Cathal Boylan	**Report Number**	**71140 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	71140/003 13/11/2013 13/11/2013
Tel No	046 9286000	**Received or Collected**	Fastway
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	28/11/2013
Quotation No	QN000407	**Sample Type**	Ground Waters
Customer Ref	MW 16S		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Titralab									
	pH		EW153	0.0		6.5	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		264	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		113	mg/L CaCO3	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	10		<10	ug/L	YES	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		2.34	mg/L	INAB	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		1.26	mg/l P	INAB	

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Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	71140/004 13/11/2013 13/11/2013
Tel No	046 9286000	**Received or Collected**	Fastway
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	28/11/2013
Quotation No	QN000407	**Sample Type**	Ground Waters
Customer Ref	MW 16D		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.007		0.058	mg/l N	INAB	
AQ2-UP1								
Nitrate (as N)		EW154M-1	0.12		<0.12	mg/l N	INAB	
Nitrite (as N)		EW154M-1	0.013		<0.013	mg/l N	INAB	
TON (as N)		EW154M-1	0.138		<0.138	mg/l N	INAB	
AQ2-UP2								
Chloride		EW154M-1	2.6		17.2	mg/L	INAB	
Sulphate		EW154M-1	1.0		65.9	mg/L	INAB	
Coliforms								
Total Coliforms		MIC133	0		0	MPN/100ml		
E. Coli		MIC133	0		0	MPN/100ml		
Dissolved Oxygen								
Dissolved Oxygen		EW043	1		4	mg/L	INAB	
Ion Chromatography								
Fluoride		EW137	0.1		0.7	mg/L	INAB	
Metals-Dissolved								
Iron-Dissolved		EM130	20.0		443.6	ug/L	INAB	
Manganese-Dissolved		EM130	1.0		633.2	ug/L	INAB	
Boron-Dissolved		EM130	0.02		<0.02	mg/L	INAB	
Cadmium-Dissolved		EM130	0.1		<0.1	ug/L	INAB	
Calcium-Dissolved		EM130	1.0		27.2	mg/L	INAB	
Copper-Dissolved		EM130	0.003		<0.003	mg/L	INAB	
Lead-Dissolved		EM130	0.3		<0.3	ug/L	INAB	
Magnesium-Dissolved		EM130	0.3		9.0	mg/L	INAB	
Zinc-Dissolved		EM130	1.0		28.5	ug/L	INAB	
Mercury-Dissolved		EM130	0.02		<0.02	ug/L	INAB	
Potassium-Dissolved		EM130	0.2		3.5	mg/L	INAB	
Sodium-Dissolved		EM130	0.5		14.1	mg/L	INAB	
Metals-Total								
Chromium-Total		EM130	1.0		<1.0	ug/L		
PhenolsTotal -Index (Sub1)								
Phenols-Total	*	Default	0.15		<0.15	mg/L	YES	
Residue on Evaporation (Tot Solids-TS)								
Residue on Evaporation (Tot Solids-TS)		EW060	10.0		172.0	mg/L		
Titralab								

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Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	28/11/2013
Quotation No	QN000407	**Sample Type**	Ground Waters
Customer Ref	MW 16D		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Titralab									
	pH		EW153	0.0		7.0	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		271	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		116	mg/L CaCO3	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	10		<10	ug/L	YES	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		1.31	mg/L	INAB	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		0.09	mg/l P	INAB	

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DETAILED IN SCOPE REG NO. 111T

Contact Name	Cathal Boylan	**Report Number**	**71140 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	71140/005 13/11/2013 13/11/2013
Tel No	046 9286000	**Received or Collected**	Fastway
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	28/11/2013
Quotation No	QN000407	**Sample Type**	Ground Waters
Customer Ref	MW 15S		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.007		0.709	mg/l N	INAB	
AQ2-UP1								
Nitrate (as N)		EW154M-1	0.12		0.45	mg/l N	INAB	
Nitrite (as N)		EW154M-1	0.013		0.061	mg/l N	INAB	
TON (as N)		EW154M-1	0.138		0.511	mg/l N	INAB	
AQ2-UP2								
Chloride		EW154M-1	2.6		9.6	mg/L	INAB	
Sulphate		EW154M-1	1.0		12.8	mg/L	INAB	
Coliforms								
Total Coliforms		MIC133	0		750	MPN/100ml		
E. Coli		MIC133	0		0	MPN/100ml		
Dissolved Oxygen								
Dissolved Oxygen		EW043	1		7	mg/L	INAB	
Ion Chromatography								
Fluoride		EW137	0.1		<0.1	mg/L	INAB	
Metals-Dissolved								
Iron-Dissolved		EM130	20.0		19676.7	ug/L	INAB	
Manganese-Dissolved		EM130	1.0		507.6	ug/L	INAB	
Boron-Dissolved		EM130	0.02		<0.02	mg/L	INAB	
Cadmium-Dissolved		EM130	0.1		<0.1	ug/L	INAB	
Calcium-Dissolved		EM130	1.0		24.5	mg/L	INAB	
Copper-Dissolved		EM130	0.003		<0.003	mg/L	INAB	
Lead-Dissolved		EM130	0.3		1.1	ug/L	INAB	
Magnesium-Dissolved		EM130	0.3		5.3	mg/L	INAB	
Zinc-Dissolved		EM130	1.0		7.4	ug/L	INAB	
Mercury-Dissolved		EM130	0.02		<0.02	ug/L	INAB	
Potassium-Dissolved		EM130	0.2		5.2	mg/L	INAB	
Sodium-Dissolved		EM130	0.5		8.5	mg/L	INAB	
Metals-Total								
Chromium-Total		EM130	1.0		112.8	ug/L		
PhenolsTotal -Index (Sub1)								
Phenols-Total	*	Default	0.15		<0.15	mg/L	YES	
Residue on Evaporation (Tot Solids-TS)								
Residue on Evaporation (Tot Solids-TS)		EW060	10.0		2744.0	mg/L		
Titralab								

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Tel No	046 9286000	**Received or Collected**	Fastway
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	28/11/2013
Quotation No	QN000407	**Sample Type**	Ground Waters
Customer Ref	MW 15S		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Titralab									
	pH		EW153	0.0		6.0	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		231	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		51	mg/L CaCO3	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	10		<10	ug/L	YES	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		13.93	mg/L	INAB	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		2.96	mg/l P	INAB	

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Contact Name	Cathal Boylan	**Report Number**	**71140 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	71140/006 13/11/2013 13/11/2013
Tel No	046 9286000	**Received or Collected**	Fastway
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	28/11/2013
Quotation No	QN000407	**Sample Type**	Ground Waters
Customer Ref	MW 15D		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.007		0.143	mg/l N	INAB	
AQ2-UP1								
Nitrate (as N)		EW154M-1	0.12		<0.12	mg/l N	INAB	
Nitrite (as N)		EW154M-1	0.013		<0.013	mg/l N	INAB	
TON (as N)		EW154M-1	0.138		<0.138	mg/l N	INAB	
AQ2-UP2								
Chloride		EW154M-1	2.6		2321.2	mg/L	INAB	
Sulphate		EW154M-1	1.0		114.5	mg/L	INAB	
Coliforms								
Total Coliforms		MIC133	0		30	MPN/100ml		
E. Coli		MIC133	0		0	MPN/100ml		
Dissolved Oxygen								
Dissolved Oxygen		EW043	1		5	mg/L	INAB	
Ion Chromatography								
Fluoride		EW137	0.1		0.1	mg/L	INAB	
Metals-Dissolved								
Iron-Dissolved		EM130	20.0		165.5	ug/L	INAB	
Manganese-Dissolved		EM130	1.0		143.1	ug/L	INAB	
Boron-Dissolved		EM130	0.02		<0.02	mg/L	INAB	
Cadmium-Dissolved		EM130	0.1		<0.1	ug/L	INAB	
Calcium-Dissolved		EM130	1.0		33.9	mg/L	INAB	
Copper-Dissolved		EM130	0.003		5.04707E-05	mg/L	INAB	
Lead-Dissolved		EM130	0.3		<0.3	ug/L	INAB	
Magnesium-Dissolved		EM130	0.3		12.7	mg/L	INAB	
Zinc-Dissolved		EM130	1.0		13.2	ug/L	INAB	
Mercury-Dissolved		EM130	0.02		<0.02	ug/L	INAB	
Potassium-Dissolved		EM130	0.2		3.5	mg/L	INAB	
Sodium-Dissolved		EM130	0.5		10.4	mg/L	INAB	
Metals-Total								
Chromium-Total		EM130	1.0		1.7	ug/L		
PhenolsTotal -Index (Sub1)								
Phenols-Total	*	Default	0.15		<0.15	mg/L	YES	
Residue on Evaporation (Tot Solids-TS)								
Residue on Evaporation (Tot Solids-TS)		EW060	10.0		200.0	mg/L		
Titralab								

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Tel No	046 9286000	**Received or Collected**	Fastway
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	28/11/2013
Quotation No	QN000407	**Sample Type**	Ground Waters
Customer Ref	MW 15D		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Titralab									
	pH		EW153	0.0		7.6	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		302	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		138	mg/L CaCO3	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	10		<10	ug/L	YES	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		1.02	mg/L	INAB	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		0.06	mg/l P	INAB	

Signed : _____ 28/11/2013

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LEACHATE MONITORING REPORT FOR BAILIEBOROUGH LANDFILL W0091-01

Client: **Cavan County Council**

Site Location: **Tanderagee, Bailieborough**

Report No.: CCC-02-01-03-04-Rev 0

Produced by: Brona Keating, BSc, P.Grad.Dip. Environmental Eng.

Approved by: **Date:** 19th December 2013

Cathal Boylan, BEng, CEng, MIEI
CHARTERED ENGINEER

Boylan Engineering
Company Reg. 430482
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Phone: 046 – 928 6000 / 087 – 820 5470
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Email: info@boylanengineering.ie
Web: www.boylanengineering.ie

Rev.	Date	Description

I SUMMARY

Boylan Engineering (Eng. & Environmental Consultancy) was commissioned by Cavan County Council to carry out Environmental Monitoring at Bailieborough Landfill (W0091-01), Tandragee, Co Cavan for quarter four 2013.

Brona Keating, Environmental Consultant carried out all monitoring. This report shall document the findings.

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List of Tables

Appendix

1. INTRODUCTION

Bailieborough landfill is situated approximately 1 kilometre from Bailieborough town centre in the townland of Tandergee. The site which comprises some 2.23 hectares was originally peat land which was stripped for commercial purposes. The site was then operated as a traditional landfill until its closure in 2002. A waste licence was issued by the Environmental Protection Agency after the closure of the site and remedial works were completed.

Condition 8.1 of the waste licence requires that monitoring be carried out in accordance with Schedule D of the licence. The following report give details of the leachate sampling programme conducted on site and also summarises findings and analytical results for quarter four 2013.

The purpose of environmental monitoring at closed landfills is to:

- Ensure the facility is compliant with the waste license
- Ensure the facility is not causing environmental pollution
- Ensure the facility is not posing a risk to human health
- Ensure the facility is not creating an unacceptable risk to atmosphere, water, soil, plants or animals
- Ensure the facility is not adversely affecting the countryside or places of interest
- Compare actual site behavior with expected/modeled behavior
- Establish a reliable database of information for the landfill throughout its life

According to the Response matrix for landfills, Bailieborough landfill is situated in the R2[1] Zone. This zone was categorized using a vulnerability rating combined with the aquifer category for the area. Landfills situated in R2[1] Zones are acceptable subject to guidance in the EPA Landfill Design Manual or conditions of a waste licence - (EPA, groundwater protection Responses for Landfills). Unfortunately this landfill was constructed prior to this guidance and conditions were issued only after its closure.

The generation of Leachate is one of the main hazards to groundwater from the disposal of waste by land filling. The conditions within a landfill vary over time from aerobic to anaerobic thus allowing for different chemical reactions to take place. Most landfill leachates have a high BOD, COD, Ammonia, Chloride, Sodium, Potassium, Hardness and Boron levels - (EPA, groundwater protection Responses for Landfills).

2. METHODOLOGY

2.1 Environmental Sampling

The following procedure is conducted by Boylan Engineering to ensure accurate surface water monitoring:

- Leachate samples are taken by grab sample using a Telescoup and Pendulum beaker.
- Having obtained a representative sample the following parameters are measured on-site using a Hanna HI 98129 combination waterproof high accuracy.
    - Conductivity
    - Temperature
    - pH

- Boylan Engineering operate a Sample Submission/Chain of Custody form, which accompanies the samples at all times. These forms are located in the appendix 4.

2.2 Laboratory Analysis

- Samples are sent to Environmental Laboratory Service (ELS) (Ireland) for analysis of the required parameters in designated cool boxes with ice packs. These boxes insure that samples are maintained at a consistent temperature between 0^{o}C and 4^{o}C on their journey to the laboratory.
- On arrival at the laboratory, samples are stored between 0^{o}C and 4^{o}C.
- All samples received are inspected by Laboratory Manager Mr. Brendan Murray.
- All samples are assigned a unique reference number and are recorded on the Laboratory Information Management System (LIMS)
- All staff involved in the analysis of samples hold a minimum honours science degree.
- In the event of a Quality Control Check failure for a given parameter, a note will be included on the analysis report detailing the QC fail.
- Analysis of samples is conducted under the INAB accreditation and associated quality control procedures are employed in every aspect of analysis.
- Analysis methods are listed in Appendix 2.

2.3 Monitoring Locations

Quarter 4 2013					
Monitoring Well	Sample Type	Cover Level M (OD Malin Head)	Water Level M (OD Malin Head)	Water Depth M (Top of Casing)	National Grid Co-Ordinates
MW1	Gas	151.55	148.75	2.8	N296071.96 E267506.68
MW2	Gas	152.72	150.12	2.6	N296018.08 E267540.57
MW3	GW	159.27	155.97	3.3	N295972.19 E267549.66
MW6	Gas	150.27	147.07	3.2	N296082.66 E267451.47
MW8	Leachate	160.74	157.54	3.2	N296014.48 E267517.14
MW9	Leachate	157.94	153.44	4.5	N296037.63 E267458.87
MW10S	GW	154.76	149.06	5.7	N296038.12 E267458.8
MW10D	GW	154.76	149.06	5.7	N296038.12 E267458.87
MW15S	GW	150.36	148.73	1.63	N296097.36 E267343.36
MW15D	Gas	150.39	148.79	1.6	N296092.30 E267344.88
MW16S	Gas	152.6	151.15	1.45	N295888.86 E267202.87
MW16D	GW	152.53	151.33	1.2	N295885.59 E267200.97
SW1	GW	-	-	-	n/a
SW3	GW	-	-	-	n/a
CAP Discharge	GW	-	-	-	n/a
MW17S	GW	149.7	148.27	1.43	N296174 E267321
MW17D	GW	149.61	148.61	1	N296176 E267327
MW18	Leachate	161.1	-	-	N296018 E267451
MW19	Leachate	162.24	-	-	N295948 E267487

2.4 Weather Report

REPORTS FROM BALLYHAISE (A)							
Date	Rainfall	Max	Min	Grass Min Temp	Mean Wind Speed	Gusts	Sunshine
	(mm)	Temp	Temp	(°C)	(knots)	(if >= 34 knots)	(hours)
		(°C)	(°C)				
12/11/2013	0.1	10.1	3.8	0.9	6.4		

3.0 SUMMARY OF RESULTS

Table 1.0 03rd Quarter Leachate monitoring 2013

Report Number:	71139
Monitoring Date:	12.11.13

Method		Site Tests	Ammonia	AQ2-UP1	Titralab		AQ2-UP2		5-Day	HACH	Coliforms		Ion Chromatography	AQ2-UP1
Method Number		Site Tests	EW003	EW154M	EW153		EW154M-1		EW001	EW094	MIC133		EW137	EW154M
Parameter		Visual Inspection	Ammonia	TON (as N)(calc)	pH	Cond	Sulphate	Cl	BOD	COD	E. Coli	Total Coliforms	Fluoride	Phosphate-Ortho(as P) (MRP)
Units		-	mg/l N	mg/l N	pH Units	us/cm	mg/L	mg/l	mg/l	mg/l	MPN/100ml	MPN/100ml	mg/L	mg/l P
Limit of Detection		-	0.035	0.69	0.3	25	5	13	1.0	8.0	10	10	0.1	0.045
Date Testing Initiated			13.11.13											
ELS Ref	Client Ref													
71139/001	MW18	Brown	273.151	1.291	7.1	3259	36.7	<13	98	890	<10	100	<0.1	0.087
71139/002	MW19	Brown	4.282	<0.69	6.7	422	92.5	<13	14	101	100	100	0.1	<0.045
IGV			0.15	-	≥6.5 and ≤9.5	1000	200	30	200	NAC	0	0	1	-

Method		Total Cyanide High (Sub)	Total Phosphorus-TP	Metals-Total	Metals-Dissolved										
Method Number		DEFAULT	EW146	EM130											
Parameter		Total Cyanide High	Total Phosphorus-TP	Chromium-Total	Iron-Dissolved	Manganese-Dissolved	Potassium-Dissolved	Sodium-Dissolved	Cadmium-Dissolved	Calcium-Dissolved	Copper-Dissolved	Lead-Dissolved	Magnesium-Dissolved	Mercury-Dissolved	Zinc-Dissolved	Boron-Dissolved
Units		ug/L	mg/l P	ug/L	ug/L	ug/L	mg/L	mg/L	ug/L	mg/L	mg/L	ug/L	mg/L	ug/L	ug/L	ug/L
Limit of Detection		9	0.1	1	20	1	0.2	0.5	0.1	1	0.003	0.3	0.3	0.02	1	0.02
Date Testing Initiated		13.11.13														
ELS Ref	Client Ref															
71139/001	MW18	<9	5.5	129.5	986.7	1010.7	135.8	155.3	<0.1	116	0.003	<0.3	74.4	<0.02	3.9	1.09
71139/002	MW19	<9	0.4	20.4	23055.8	522.7	7.5	12	<0.1	54.9	<0.003	<0.3	8	<0.02	23	0.04
IGV		10	-	30	200	50	5	150	0.005	200	0.03	10	50	1	100	1

Exceedance

NOTES

1 Sub-contract analysis denoted by *

2 ND - Concentration was below the limit of detection

3 NAC- No Abnormal Change

As there are no limits set in the waste licence for leachate, results are compared to the Interim Guide Values for the protection of Groundwater in Ireland, where available.

4.0 DISCUSSION

Leachate consists of water that has become contaminated as it passes through a waste disposal site. It contains insoluble waste constituents which have not degraded chemically or biochemically. This leachate can cause a treat to surrounding surface and ground waters. The composition of leachate will vary depending on the age of the landfill. As there are no limits set in the waste licence for leachate, results are compared to the Interim Guide Values for the protection of Groundwater in Ireland, where available. Results in Hatched Red indicate where the interim guide value has been exceeded. A leachate sample was abstracted from wells MW18 and MW19 during quarter three monitoring. Results show that the Interim Guide Value was exceeded at on this occasion for the parameters Ammonia, conductivity, E-coli, Total Coli forms, Sodium, Manganese, Potassium, Iron and Chromium. These results are consistent with those obtained in previous monitoring events.

Historical results for comparison purposes are presented in tabular and graphic form in Appendix 1.

5.0 CONCLUSION

The results obtained from environmental monitoring are relatively consistent with previous monitoring events. The levels of exceeded parameters do not show any signs of dramatic exceedences therefore there is no evidence of any major negative environmental impact associated with this landfill.

APPENDIX 1 HISTORICAL DATA-TABLES

	Parameter	Ammonia	Cl	TON	SO4	Cond	pH	COD	BOD
	Units	mg/l N	mg/l	mg/l N	mg/l	us/cm	pH Units	mg/l	mg/l
WELL MW 18	Qtr 4 2013	273	<13	1.291	36.7	3259	7.1	890	98
	Qtr 3 2013	278	5.908	7.1	4104	81	3200	199.7	
	Qtr 4 2012	236	131.1	<0.69	34.8	2965	7	1374	27
WELL MW 19	Qtr 4 2013	4	<13	<0.69	92.5	422	6.7	101	14
	Qtr 3 2013	37	<0.69	6.7	1283	10	670	68.6	
	Qtr 4 2012	6	<13	0.702	33.6	526	6.6	1300	25
Interim Guide Values		0.15	200	NAC	200	1000	≥6.5&≤9.5		

APPENDIX 2 – CHAIN OF CUSTODY/SAMPLE SUBMISSION

els

Environmental Laboratory Services Ltd
Acorn Business Campus,
Mahon Industrial Park,
Blackrock,
Cork
Tel: 021-4536141

SAMPLE SUBMISSION FORM

6595

DETAILS TO APPEAR ON ANALYSIS REPORT

Contact Name
Address

Customer Name:
PO Number:
NOTE Use a separate sheet for different PO Numbers
For all customers a PO Number must be provided with the samples

CONTRACT DETAILS

ELS Quote No.
NOTE: To reduce potential for error this field must be completed
Use a separate sheet for different Quote Numbers

Results Due (Tick)

NOTE Standard lead time is 10 working days and 15 working days for test sub-contracted.
Deviations should be agreed in advance and may incur an extra charge

SAMPLE DETAILS

Number	Sample Reference NOTE: Whatever appears in this section, is the ONLY detail that will appear on the analysis report (Do not write the required detail on the bottles as it is normally not clear)	Tests Requested NOTE: To reduce potential for error please complete this field clearly indicating per quote, per sheet attached or list the specific tests below	Number of bottles submitted	Sample Type Drinking Water (DW), Ground Water (GW), Surface Water (SW), Waste Water (WW), Sludge, Soil, Silt, Solvent, Air
1	MW 18	See QN	Full Kit	WW
2	MW 19	"	"	"
3				
4				
5				

ONLY FIVE SAMPLES ALLOWED PER SUBMISSION SHEET

ADDITIONAL INFORMATION AND SIGNATURES

To be filled by the person submitting samples

Signature
Phone No.
Date 12/11/13
No. samples submitted 2
No. of pages
Additional Info (If any)

To be filled by ELS Ltd

Signature
Date 13/11/13
Time
Condition
Satisfactory
Unsatisfactory (See notes above)
Additional Info.

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 111T

Contact Name	Cathal Boylan	**Report Number**	**71139 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	71139/001 13/11/2013 13/11/2013
Tel No	046 9286000	**Received or Collected**	Fastway
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	28/11/2013
Quotation No	QN000407	**Sample Type**	Waste Water
Customer Ref	MW18		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.035		273.151	mg/l N	INAB	
AQ2-UP1								
Nitrate (as N)		EW154M-1	0.60		1.28	mg/l N	INAB	
Nitrite (as N)		EW154M-1	0.065		<0.065	mg/l N	INAB	
TON (as N)		EW154M-1	0.69		1.291	mg/l N		
Phosphate-Ortho(as P) (MRP)		EW154M-1	0.045		0.087	mg/l P	INAB	
AQ2-UP2								
Chloride		EW154M-1	13.0		<13.0	mg/L	INAB	
Sulphate		EW154M-1	5.0		36.7	mg/L		
BOD								
BOD		EW001	1		98	mg/L	INAB	
COD								
COD		EW094	8		890	mg/L	INAB	
Coliforms								
Total Coliforms		MIC133	10		100	MPN/100ml		
E. Coli		MIC133	10		<10	MPN/100ml		
Ion Chromatography								
Fluoride		EW137	0.1		<0.1	mg/L	INAB	
Metals-Dissolved								
Boron-Dissolved		EM130	0.02		1.09	ug/L		
Calcium-Dissolved		EM130	1.0		116.0	mg/L		
Iron-Dissolved		EM130	20.0		986.7	ug/L		
Magnesium-Dissolved		EM130	0.3		74.4	mg/L		
Manganese-Dissolved		EM130	1.0		1010.7	ug/L		
Potassium-Dissolved		EM130	0.2		135.8	mg/L		
Sodium-Dissolved		EM130	0.5		155.3	mg/L		
Cadmium-Dissolved		EM130	0.1		<0.1	ug/L		
Copper-Dissolved		EM130	0.003		0.003	mg/L		
Lead-Dissolved		EM130	0.3		<0.3	ug/L		
Zinc-Dissolved		EM130	1.0		3.9	ug/L		
Mercury-Dissolved		EM130	0.02		<0.02	ug/L		
Metals-Total								
Chromium-Total		EM130	1.0		129.5	ug/L		
Titralab								

Signed : _____ 28/11/2013

Technical Manager (or Deputy): **Brendan Murray**

NOTES
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2.SPEC= Allowable limit or parametric value
3.OOS=Result which is outside specification highlighted as OOS
4.LOQ=Limit of Quantification or lowest value that can be reported for the test
5.ACCRED=Indicates matrix accreditation for the test,a blank field indicates not accredited

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Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	71139/001 13/11/2013 13/11/2013
Tel No	046 9286000	**Received or Collected**	Fastway
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	28/11/2013
Quotation No	QN000407	**Sample Type**	Waste Water
Customer Ref	MW18		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Titralab									
	pH		EW153			7.1	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		3259	uscm-1@20	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	9		<9	ug/L	YES	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.1		5.5	mg/l P	INAB	

Signed : _____ 28/11/2013

Technical Manager (or Deputy): **Brendan Murray**

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ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 111T

Contact Name	Cathal Boylan	**Report Number**	**71139 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	71139/002 13/11/2013 13/11/2013
Tel No	046 9286000	**Received or Collected**	Fastway
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	28/11/2013
Quotation No	QN000407	**Sample Type**	Waste Water
Customer Ref	MW19		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.035		4.282	mg/l N	INAB	
AQ2-UP1								
Nitrate (as N)		EW154M-1	0.60		<0.60	mg/l N	INAB	
Nitrite (as N)		EW154M-1	0.065		<0.065	mg/l N	INAB	
TON (as N)		EW154M-1	0.69		<0.690	mg/l N		
Phosphate-Ortho(as P) (MRP)		EW154M-1	0.045		<0.045	mg/l P	INAB	
AQ2-UP2								
Chloride		EW154M-1	13.0		<13.0	mg/L	INAB	
Sulphate		EW154M-1	5.0		92.5	mg/L		
BOD								
BOD		EW001	1		14	mg/L	INAB	
COD								
COD		EW094	8		101	mg/L	INAB	
Coliforms								
Total Coliforms		MIC133	10		100	MPN/100ml		
E. Coli		MIC133	10		100	MPN/100ml		
Ion Chromatography								
Fluoride		EW137	0.1		0.1	mg/L	INAB	
Metals-Dissolved								
Boron-Dissolved		EM130	0.02		0.04	ug/L		
Calcium-Dissolved		EM130	1.0		54.9	mg/L		
Iron-Dissolved		EM130	20.0		23055.8	ug/L		
Magnesium-Dissolved		EM130	0.3		8.0	mg/L		
Potassium-Dissolved		EM130	0.2		7.5	mg/L		
Sodium-Dissolved		EM130	0.5		12.0	mg/L		
Manganese-Dissolved		EM130	1.0		522.7	ug/L		
Cadmium-Dissolved		EM130	0.1		<0.1	ug/L		
Copper-Dissolved		EM130	0.003		<0.003	mg/L		
Lead-Dissolved		EM130	0.3		<0.3	ug/L		
Zinc-Dissolved		EM130	1.0		23.0	ug/L		
Mercury-Dissolved		EM130	0.02		<0.02	ug/L		
Metals-Total								
Chromium-Total		EM130	1.0		20.4	ug/L		
Titralab								
pH		EW153			6.7	pH Units	INAB	

Signed : _____ 28/11/2013

Technical Manager (or Deputy): **Brendan Murray**

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Contact Name	Cathal Boylan	**Report Number**	**71139 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	71139/002 13/11/2013 13/11/2013
Tel No	046 9286000	**Received or Collected**	Fastway
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	28/11/2013
Quotation No	QN000407	**Sample Type**	Waste Water
Customer Ref	MW19		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Titralab									
	Conductivity @20 DegC		EW153	25		422	uscm-1@20	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	9		<9	ug/L	YES	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.1		0.4	mg/l P	INAB	

Signed : _____ 28/11/2013

Technical Manager (or Deputy): **Brendan Murray**

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SURFACE WATER MONITORING REPORT FOR BAILIEBOROUGH LANDFILL W0091-01

Client: **Cavan County Council**

Site Location: **Tanderagee, Bailieborough**

Report No.: CCC-02-01-03-04-Rev 0

Produced by: Brona Keating, BSc, P.Grad.Dip. Environmental Eng.

Approved by: **Date:** 19th December 2013

Cathal Boylan, BEng, CEng, MIEI
CHARTERED ENGINEER

Boylan Engineering
Company Reg. 430482
Address: Main St., Mullagh, Kells Co. Meath.
Phone: 046 – 928 6000 / 087 – 820 5470
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Email: info@boylanengineering.ie
Web: www.boylanengineering.ie

Rev.	Date	Description

I SUMMARY

Boylan Engineering (Eng. & Environmental Consultancy) was commissioned by Cavan County Council to carry out Environmental Monitoring at Bailieborough Landfill (W0091-01), Tandragee, Co Cavan for quarter four 2013.

Brona Keating, Environmental Consultant carried out all monitoring. This report shall document the findings.

Table of Contents

List of Tables

Appendix

1. INTRODUCTION

Bailieborough landfill is situated approximately 1 kilometre from Bailieborough town centre in the townland of Tandergee. The site which comprises some 2.23 hectares was originally peat land which was stripped for commercial purposes. The site was then operated as a traditional landfill until its closure in 2002. A waste licence was issued by the Environmental Protection Agency after the closure of the site and remedial works were completed.

Condition 8.1 of the waste licence requires that monitoring be carried out in accordance with Schedule D of the licence. The following report give details of the surface water sampling programme conducted on site and also summarises findings and analytical results for quarter four 2013.

The purpose of environmental monitoring at closed landfills is to:

- Ensure the facility is compliant with the waste license
- Ensure the facility is not causing environmental pollution
- Ensure the facility is not posing a risk to human health
- Ensure the facility is not creating an unacceptable risk to atmosphere, water, soil, plants or animals
- Ensure the facility is not adversely affecting the countryside or places of interest
- Compare actual site behavior with expected/modeled behavior
- Establish a reliable database of information for the landfill throughout its life

According to the Response matrix for landfills, Bailieborough landfill is situated in the R2[1] Zone. This zone was categorized using a vulnerability rating combined with the aquifer category for the area. Landfills situated in R2[1] Zones are acceptable subject to guidance in the EPA Landfill Design Manual or conditions of a waste licence - (EPA, groundwater protection Responses for Landfills). Unfortunately this landfill was constructed prior to this guidance and conditions were issued only after its closure.

The generation of Leachate is one of the main hazards to groundwater from the disposal of waste by land filling. The conditions within a landfill vary over time from aerobic to anaerobic thus allowing for different chemical reactions to take place. Most landfill leachates have a high BOD, COD, Ammonia, Chloride, Sodium, Potassium, Hardness and Boron levels - (EPA, groundwater protection Responses for Landfills).

2. METHODOLOGY

2.1 Environmental Sampling

The following procedure is conducted by Boylan Engineering to ensure accurate surface water monitoring:

- Surface water samples are taken by grab sample using a Telescoup and Pendulum beaker.
- Having obtained a representative sample the following parameters are measured on-site using a Hanna HI 98129 combination waterproof high accuracy.
    - Conductivity
    - Temperature
    - pH

- Boylan Engineering operate a Sample Submission/Chain of Custody form, which accompanies the samples at all times. These forms are located in the appendix 4.

2.2 Laboratory Analysis

- Samples are sent to Environmental Laboratory Service (ELS) (Ireland) for analysis of the required parameters in designated cool boxes with ice packs. These boxes insure that samples are maintained at a consistent temperature between 0^{o}C and 4^{o}C on their journey to the laboratory.
- On arrival at the laboratory, samples are stored between 0^{o}C and 4^{o}C.
- All samples received are inspected by Laboratory Manager Mr. Brendan Murray.
- All samples are assigned a unique reference number and are recorded on the Laboratory Information Management System (LIMS)
- All staff involved in the analysis of samples hold a minimum honours science degree.
- In the event of a Quality Control Check failure for a given parameter, a note will be included on the analysis report detailing the QC fail.
- Analysis of samples is conducted under the INAB accreditation and associated quality control procedures are employed in every aspect of analysis.
- Analysis methods are listed in Appendix 2.

2.3 Monitoring Locations

Quarter 4 2013					
Monitoring Well	Sample Type	Cover Level M (OD Malin Head)	Water Level M (OD Malin Head)	Water Depth M (Top of Casing)	National Grid Co-Ordinates
MW1	Gas	151.55	148.75	2.8	N296071.96 E267506.68
MW2	Gas	152.72	150.12	2.6	N296018.08 E267540.57
MW3	GW	159.27	155.97	3.3	N295972.19 E267549.66
MW6	Gas	150.27	147.07	3.2	N296082.66 E267451.47
MW8	Leachate	160.74	157.54	3.2	N296014.48 E267517.14
MW9	Leachate	157.94	153.44	4.5	N296037.63 E267458.87
MW10S	GW	154.76	149.06	5.7	N296038.12 E267458.8
MW10D	GW	154.76	149.06	5.7	N296038.12 E267458.87
MW15S	GW	150.36	148.73	1.63	N296097.36 E267343.36
MW15D	Gas	150.39	148.79	1.6	N296092.30 E267344.88
MW16S	Gas	152.6	151.15	1.45	N295888.86 E267202.87
MW16D	GW	152.53	151.33	1.2	N295885.59 E267200.97
SW1	GW	-	-	-	n/a
SW3	GW	-	-	-	n/a
CAP Discharge	GW	-	-	-	n/a
MW17S	GW	149.7	148.27	1.43	N296174 E267321
MW17D	GW	149.61	148.61	1	N296176 E267327
MW18	Leachate	161.1	-	-	N296018 E267451
MW19	Leachate	162.24	-	-	N295948 E267487

2.4 Weather Report

REPORTS FROM BALLYHAISE (A)							
Date	Rainfall	Max	Min	Grass Min Temp	Mean Wind Speed	Gusts	Sunshine
	(mm)	Temp	Temp	(°C)	(knots)	(if >= 34 knots)	(hours)
		(°C)	(°C)				
12/11/2013	0.1	10.1	3.8	0.9	6.4		

3.0 SUMMARY OF RESULTS

Table 1.0 03rd Quarter Surface water monitoring 2013

Report Number	71142
Monitoring Date	12/11/2013

Method		Site Tests	Site Tests	Site Tests	Site Tests	AQ2	Titralab		5-Day	HACH	AQ2-UP1			SS	Titralab
Method Number		Site Tests	Site Tests	Site Tests	Site Tests	EW003	EW138	EW139	EW001	EW094	EW015	EW015	EW007	EW153	EW013
Parameter		Sample temperature (to be done onsite)	Cond	pH	Visual Inspection	Ammonia	pH	Cond	BOD	COD	Cl	SO4	Ortho-Phosphate (MRP)	Suspended Solids	Alkalinity
Units		Deg C	us/cm	pH units	-	mg/l N	pH Units	us/cm	mg/l	mg/l	mg/l	mg/l	mg/l P	mg/l	mg/l CaCO3
Limit of Detection		-	-	-	-	0.007	0.3	25	1	8	2.6	1.0	0.009	5	10
Date Testing Initiated		12.11.13				13.1.13									
ELS Ref	Client Ref														
71141/001	SW1	7	328	7.11	Straw	1.393	6.9	321	<1	52	19.1	39.9	0.015	<5	109
71141/002	SW3 Lake	7	326	7.12	Clear	0.317	6.8	320	<1	46	19.8	47	0.014	<5	107
71141/002	Cap	9.1	511	7.41	Clear	0.058	7.3	504	<1	24	10	98.3	<0.009	5	186
S.I No. 294/1989						0.2	≥5.5 and ≤8.5	1000	5	40	250	200	-	-	-

Method		ICPMS				Metals Dissolved							Metals Total	AQ2-UP1	Inolab
Method Number		EM130												EW154M	EW043
Parameter		Iron-Dissolved	Manganese-Dissolved	Potassium-Dissolved	Sodium-Dissolved	Cadmium-Dissolved	Calcium-Dissolved	Copper-Dissolved	Lead-Dissolved	Magnesium-Dissolved	Mercury-Dissolved	Zinc-Dissolved	Chromium-Total	TON (as N)(Calc)	DO
Units		ug/L	ug/L	mg/L	mg/L	ug/L	mg/L	mg/L	ug/L	mg/L	ug/L	ug/L	ug/L	mg/l N	mg/l
Limit of Detection		20.000	1.0	0.2	0.5	0.1	1	20	0.3	0.3	0.02	1	1	0.138	1.0
Date Testing Initiated		12.11.13													
ELS Ref	Client Ref														
71141/001	SW1	572.1	240.3	7.9	13.4	<0.1	36.3	<0.003	<0.3	7.8	<0.02	36.8	<1	1.034	8
71141/002	SW3 Lake	807.7	434.8	6.5	13.6	<0.1	36.9	<0.003	<0.3	8	<0.02	62.7	<1	1.088	7
71141/002	Cap	47.4	35.8	5	5.5	<0.1	85.7	0.006	<0.3	11.8	<0.02	47.6	<1	0.308	10
S.I No. 294/1989		200	50	-	-	5	-	0.03	10	-	1	100	30	-	-

Exceedance	
NOTES	
1	Sub-contract analysis denoted by *
2	ND - Concentration was below the limit of detection
3	NAC- No

As there are no limits set in the waste licence for surface water, results are compared to S.I. No. 294/1989 — European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989.

4.0 DISCUSSION

As there are no limits set in the waste license for surface water, results are compared to the S.I. No. 294/1989 — European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989 where available.

Surface water samples were taken at SW1 (downstream of landfill) at SW3 and at the landfill CAP discharge.

With regard to all surface water samples, results in hatched red indicate that limits were exceeded for the following parameters: Ammonia, COD, Iron and Manganese. Previous results detailed in the historical data show that exceedances for each of these parameters is on par with previous monitoring events.

Historical results for comparison purposes are presented in tabular and graphic form in Appendix 1.

5.0 CONCLUSION

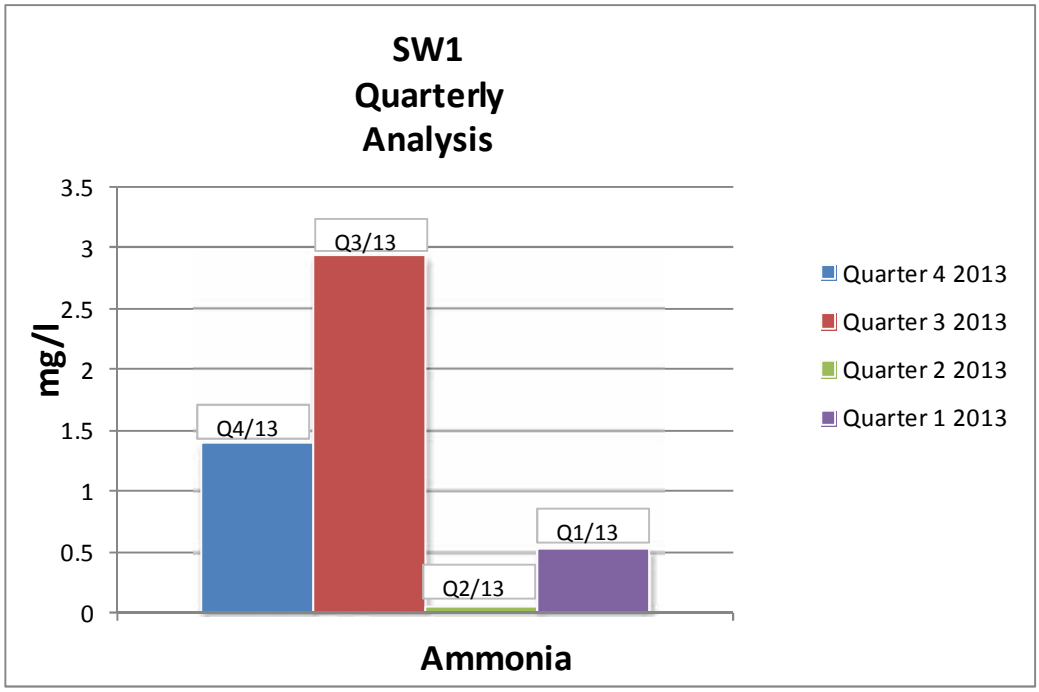
The results obtained from environmental monitoring are relatively consistent with previous monitoring events. The levels of exceeded parameters do not show any signs of dramatic exceedences therefore there is no evidence of any major negative environmental impact associated with this landfill.

APPENDIX 1 HISTORICAL DATA-TABLES

	Parameter	Ammonia	pH	Cond	BOD	COD	Cl	SO4	Ortho-Phosphate (MRP)	DO	Fe	Mn	K	Na
	Units	mg/l N	pH Units	us/cm	mg/l	mg/l	mg/l	mg/l	mg/l P	mg/l	ug/l	ug/l	mg/l	mg/l
Discharge Cap	Qtr 4 2013	0.058	7.3	504	<1	24	10	98.3	<0.009	10	47.4	35.8	5	5.5
	Qtr 3 2013	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qtr 2 2013	-	-	-	-	-	-	-	-	-	-	-	-	-
	Qtr 1 2013	-	-	-	-	-	-	-	-	-	-	-	-	-
SW1	Qtr 4 2013	1.393	6.9	321	<1	52	19.1	39.9	0.015	8	572.1	240.3	7.9	13.4
	Qtr 3 2013	2.931	7.2	442	<1	45	24.1	8.7	0.084	6.3	3688.2	2148.2	5.3	18.7
	Qtr 2 2013	0.036	7.2	267	3	36	21	26	0.01	8.3	858.2	902.1	5.1	14.6
	Qtr 1 2013	0.526	7.2	300	<1	30	27.4	15.9	0.078	8.7	453.2	219.9	5.6	17.9
SW3	Qtr 4 2013	0.317	6.8	320	<1	46	19.8	47	0.014	7	807.7	434.8	6.5	13.6
	Qtr 3 2013	0.185	7.1	301	<1	48	19.1	10.6	0.019	6.2	2008.7	1170.7	2.4	15.5
	Qtr 2 2013	0.369	7.1	259	<1	40	21.3	13.9	0.024	7.2	578.1	154.8	5.7	15.7
	Qtr 1 2013	0.446	7	303	3	30	20.3	33.5	<0.009	9.9	923.5	1349.9	4.2	14.9
S.I No 294/1989		0.2	≥5.5 and ≤8.5	1000	5	40	250	200		NAC	200	50		

HISTORICAL DATA- CHARTS

Surface water



APPENDIX 2- ANALYSIS METHODS

ELS LTD INAB ACCREDITATION SCHEDULE SUMMARY SHEET

Miscellaneous (P,G,W,S)
Ammonia/Ammonium 0.007-1mg/l N EW003
Chloride 2.6-250 mg/l EW005
Flouride 0.1 - 2 mg/l EW137
COD 8-1500mg/l EW094
Nitrate 0.12-50 mg/l N EW034
Nitrite 0.013-1 mg/l N EW035
pH 4 – 10 pH Units EW138
Phosphate 0.009-1 mg/l P EW007
TOC 0.25-100mg/l EW123
Total Phosphorous 0.03-1 mg/l P EW002

Miscellaneous (P,G,S)
Bromate 1 to 50us/l BRO3 (EW137)
Colour 2.5-50mg/l PtCCo (EW011)
Conductivity 132-6000 us/cm EW139
Dissolved Oxygen 1 to 10 mg/l (EW043)
Sulphate 1-250mg/l SO4(EW016)
Suspended Solids 5-1000mg/l (EW015)
Total Dissolved Solids 1-1000mg/l (EW045)
Total Hardness 3-330mg/l CaCO3 (EM099)
Total Oxidised Nitrogen 0.138-5(mg/l N (EW041)

Metals EM130 (F,G,S)
Aluminium 5.0 – 500 µg/l
Antimony 0.1 – 10µg/l
Arsenic 0.2 - 20µg/l
Barium 1.0 - 100µg/l
Boron 0.02 – 2mg/l
Cadmium 0.1 - 10µg/l
Calcium 1.0 – 100mg/l
Chromium 1.0 - 100µg/l
Cobalt 1.0 - 100µg/l
Copper 3 - 4000µg/l
Iron 5.0 - 500µg/l
Lead 0.3 - 30µg/l
Magnesium 0.3 – 30mg/l
Manganese 1.0 - 100µg/l
Mercury 0.02 - 2µg/l
Molybdenum 1.0 - 100µg/l
Nickel 2.5 - 50µg/l
Potassium 0.2 – 20mg/l
Selenium 0.2 - 20µg/l
Sodium 0.5 – 50mg/l
Strontium 1.0 - 100µg/l
Tin 1.0 - 100µg/l
Vanadium 1.0 - 100µg/l
Zinc 1.0 - 100µg/l

SI 439 Potable Water VOCs & THM
EC025 (P,G,S)
Benzene 0.1-35 µg/l
1,2 Dichloroethane 0.1-35 µg/l
Tetrachloroethene 0.1-35 µg/l
Trichloroethene 0.1-35 µg/l
Chloroform 1.0-150 µg/l
Bromoform 1.0-35 µg/l
Dibromochloromethane 1.0-35 µg/l
Bromodichloromethane 2.0-35 µg/l

Other VOC's EO025 (P,G,S)
Bromomethane 0.5 - 35 µg/l
Ethyl Ether/Diethyl Ether 0.5 - 35 µg/l
1,1 Dichloroethene 0.5 - 35 µg/l
Iodomethane/Methyl Iodide 0.5 - 35 µg/l
Carbon Disulphide 0.5 - 35 µg/l
Allyl Chloride 0.5 - 35 µg/l
Methylene Chloride/DCM 5.0 - 35 µg/l
2-Propenenitrile/Acrylonitrile 2.0 - 35 µg/l
Chloromethyl Cyanide 0.5 - 35 µg/l
Hexachlorobutadiene 0.5 - 35 µg/l
Trans-1,2 Dichloroethene 0.5 - 35 µg/l
MtBE 0.5 - 35 µg/l
1,1 Dichloroethane 0.5 - 35 µg/l
2,2 Dichloropropane 0.5 - 35 µg/l
Cis-1,2 Dichloroethene 0.5 - 35 µg/l
Methyl Acrylate 5.0 - 35 µg/l
Bromochloromethane 0.5 - 35 µg/l
Tetrahydrofuran 5.0 - 35 µg/l
1,1,1 Trichloroethane 0.5 - 35 µg/l
1-Chlorobutane 0.5 - 35 µg/l
Carbon Tetrachloride 0.5 - 35 µg/l
1,1 Dichloropropene 0.5 - 35 µg/l
1,2 Dichloropropane 0.5 - 35 µg/l
Dibromomethane 0.5 - 35 µg/l
Methyl Methacrylate 0.5 - 35 µg/l
1,3 Dichloropropene, cis 2.0 - 35 µg/l
MIBK/4 Methyl 2 Pentanone 2.0 - 35 µg/l
Toluene 0.5 - 35 µg/l
1,3 Dichloropropene, trans 2.0 - 35 µg/l
Ethyl Methacrylate 2.0 - 35 µg/l
1,1,2 Trichloroethane 0.5 - 35 µg/l
1,3 Dichloropropane 0.5 - 35 µg/l
2 Hexanone 1.0 - 35 µg/l
1,2 Dibromoethane 0.5 - 35 µg/l
Chlorobenzene 0.5 - 35 µg/l
1,1,1,2 Tetrachloroethane 2.0 - 35 µg/l
Ethyl Benzene 0.5 - 35 µg/l
m & p Xylene 0.5 - 35 µg/l
O Xylene 0.5 - 35 µg/l
Styrene 2.0 - 35 µg/l
Isopropyl Benzene 0.5 - 35 µg/l
Bromobenzene 0.5 - 35 µg/l
1,1,2,2 Tetrachloroethane 0.5 - 35 µg/l
1,2,3 Trichloropropane 2.0 - 35 µg/l
Propyl Benzene 0.5 - 35 µg/l
2-Chlorotoluene 0.5 - 35 µg/l
4 Chlorotoluene 0.5 - 35 µg/l
1,3,5 Trimethylbenzene 0.5 - 35 µg/l
Tert Butyl Benzene 0.5 - 35 µg/l
1,2,4 Trimethlbenzene 0.5 - 35 µg/l
Sec Butyl Benzene 0.5 - 35 µg/l
1,3 Dichlorobenzene 0.5 - 35 µg/l
P Isopropyltoluene 0.5 - 35 µg/l
1,4 Dichlorobenzene 0.5 - 35 µg/l
1,2 Dichlorobenzene 0.5 - 35 µg/l
N Butyl Benzene 0.5 - 35 µg/l
Hexachloroethane 5.0 - 35 µg/l
1,2 Dibromo 3Chloropropane 2.0 - 35 µg/l
1,2,4 Trichlorobenzene 0.5 - 35 µg/l
1,2,3 Trichlorobenzene 0.5 - 35 µg/l

PAH EO125 (P,G,S)
Range 0.01 - 0.2 µg/l
Acenaphthene
Benzo (a) Anthracene
Benzo (a) Pyrene
Benzo (b) Fluoranthene
Benzo (ghi) Perylene
Benzo (k) Fluoranthene
Chrysene
Dibenzo (ah) Anthracene
Fluoranthene
Fluorene
Indeno (123-cd) Pyrene
Phenanthrene
Pyrene

Acid Herbicides (P,G,S)
Range 0.01 - 0.2 µg/l
2,4,5-T H
2,4-D H
2,4-DB H
MCPA H
Picloram H

Organophosphorus Pesticides (P,G,S)
Range 0.01 - 0.2 µg/l
Fenphur OP
Methyl Parathion OP
Parathion OP
Thionazin OP

Organochlorine Pesticides (P,G,S)
Range 0.01 - 0.2 µg/l
Aldrin
BHC Alpha isomer OC
BHC Beta isomer OC
BHC Delta isomer OC
Dieldrin OC
Endosulphan Alpha isomer OC
Endosulphan Beta isomer OC
Endosulphan Sulphate OC
Endrin OC
Heptachlor Epoxide OC
Heptachlor OC
Lindane OC
P,P' DDE OC
P,P-DDT OC
P,P-DDT OC

Notes
1 Sample Matrix: P=Potable Water (Drinking) , G=Ground Water , S=Surface Water, W=Waste Water

APPENDIX 3 – FIELD SHEETS

ON SITE SAMPLING FORM

Facility Name: Bailieborough	**Waste Licence No:** W0091-01
Report To:	
Sampling Date: 12/11/13	**Sample Type (GW, SW, Leachate)** All
Personnel: B. Keating	**Weather:** Dry
Other Remarks:	**GPS:**

Sample Ref No	Sample Type	Time	DO Level	Elec Cond (us)	pH pH units	Temp °C	Visual	Instrument
MW16S	GW	/	/	267	7.23	11.4		Grey
MW16D	GW	/	/	271	7.58	10.3		clear
MW15S	GW	/	/	251	7.83	11.7		Brown
MW15D	GW	/	/	297	8.11	10.8		clear
MW17S	GW	/	/	506	7.62	11.3		Brown
MW17D	GW	/	/	486	7.70	10.0		clear
SW3	SW	/	/	326	7.12	9.0		clear
CAP	SW	/	/	511	7.41	9.1		clear
SW1	SW	/		328	7.11	9.0		clear

APPENDIX 4 – CHAIN OF CUSTODY/SAMPLE SUBMISSION

els

Environmental Laboratory Services Ltd
Acorn Business Campus,
Mahon Industrial Park,
Blackrock,
Cork
Tel: (021-4313131

SAMPLE SUBMISSION FORM

6594

DETAILS TO APPEAR ON ANALYSIS REPORT

Contact Name
Address

Customer Name:

PO Number:

NOTE: Use a separate sheet for different PO Numbers
For all customers a PO Number must be provided with the samples

CONTRACT DETAILS

ELS Quote No. 407

NOTE: To reduce potential for error this field must be completed
Use a separate sheet for different Quote Numbers

Results Due (Tick)

NOTE: Standard lead time is 10 working days and 15 working days for test sub-contract.
Deviations should be agreed in advance and may incur an extra charge

SAMPLE DETAILS

Number	Sample Reference	Tests Requested	Number of bottles submitted	Sample Type
	NOTE: Whatever appears in this section, is the ONLY detail that will appear on the analysis report (Do not write the required detail on the bottles as it is normally not clear)	NOTE: To reduce potential for error please complete this field clearly indicating per quote,per sheet attached or list the specific tests below		Drinking Water (DW), Ground Water (GW), Surface Water (SW), Waste Water (WW), Sludge, Soil,Silt, Solvent , Air
1	SW1	See QN	Full kit	GW
2	SW3 Lake			
3	CAP			
4				
5				

ONLY FIVE SAMPLES ALLOWED PER SUBMISSION SHEET

ADDITIONAL INFORMATION AND SIGNATURES

To be filled by the person submitting samples

Signature:
Phone No.
Date:
No. samples submitted: 3
No. of pages: 3 of 4
Additional Info(If any)

To be filled by ELS Ltd

Signature: MR
Date: 3/11/13
Time
Condition: Satisfactory / Unsatisfactory -See notes above
Additional Info

ENVIRONMENTAL LABORATORY SERVICES
Acorn Business Campus
Mahon Industrial Park,
Blackrock,
Cork
Ireland
Tel: +353 21 453 6141
Fax: +353 21 453 6149
Web: www.irishwatertesting.com

ISO 17025 INAB ACCREDITED TESTING DETAILED IN SCOPE REG NO. 111T

Contact Name	Cathal Boylan	**Report Number**	**71141 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	71141/001 13/11/2013 13/11/2013
Tel No	046 9286000	**Received or Collected**	Fastway
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	27/11/2013
Quotation No	QN000407	**Sample Type**	Surface Waters
Customer Ref	SW1		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia									
	Ammonia (as N)		EW154M-1	0.007		1.393	mg/l N	INAB	
AQ2-UP1									
	Nitrate (as N)		EW154M-1	0.12		1.01	mg/l N	INAB	
	Nitrite (as N)		EW154M-1	0.013		0.024	mg/l N	INAB	
	TON (as N)		EW154M-1	0.138		1.034	mg/l N	INAB	
	Phosphate-Ortho(as P)		EW154M-1	0.009		0.015	mg/l P	INAB	
AQ2-UP2									
	Chloride		EW154M-1	2.6		19.1	mg/L	INAB	
	Sulphate		EW154M-1	1.0		39.9	mg/L	INAB	
BOD									
	BOD		EW001	1		<1	mg/L	INAB	
COD									
	COD		EW094	8		52	mg/L	INAB	
Dissolved Oxygen									
	Dissolved Oxygen		EW043	1		8	mg/L	INAB	
Metals-Dissolved									
	Cadmium-Dissolved		EM130	0.1		<0.1	ug/L	INAB	
	Calcium-Dissolved		EM130	1.0		36.3	mg/L	INAB	
	Copper-Dissolved		EM130	0.003		<0.003	mg/L	INAB	
	Iron-Dissolved		EM130	20.0		572.1	ug/L	INAB	
	Lead-Dissolved		EM130	0.3		<0.3	ug/L	INAB	
	Magnesium-Dissolved		EM130	0.3		7.8	mg/L	INAB	
	Manganese-Dissolved		EM130	1.0		240.3	ug/L	INAB	
	Mercury-Dissolved		EM130	0.02		<0.02	ug/L	INAB	
	Potassium-Dissolved		EM130	0.2		7.9	mg/L	INAB	
	Sodium-Dissolved		EM130	0.5		13.4	mg/L	INAB	
	Zinc-Dissolved		EM130	1.0		36.8	ug/L	INAB	
Metals-Total									
	Chromium-Total		EM130	1.0		<1.0	ug/L		
Suspended Solids									
	Suspended Solids		EW013	5		<5	mg/L	INAB	
Titralab									
	pH		EW153			6.9	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		321	uscm-1@20	INAB	

Signed : _____ 27/11/2013

Technical Manager (or Deputy): **Brendan Murray**

NOTES
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2.SPEC= Allowable limit or parametric value
3.OOS=Result which is outside specification highlighted as OOS
4.LOQ=Limit of Quantification or lowest value that can be reported for the test
5.ACCRED=Indicates matrix accreditation for the test,a blank field indicates not accredited

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Contact Name	Cathal Boylan	**Report Number**	**71141 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	71141/001 13/11/2013 13/11/2013
Tel No	046 9286000	**Received or Collected**	Fastway
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	27/11/2013
Quotation No	QN000407	**Sample Type**	Surface Waters
Customer Ref	SW1		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Titralab									
	Alkalinity Total (R2 pH4.5)		EW153	10		109	mg/L CaCO3	INAB	

Signed : _____ 27/11/2013

Technical Manager (or Deputy): **Brendan Murray**

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ISO 17025 IVNAB ACCREDITED TESTING
DETAILED IN SCOPE REG NO. 111T

Contact Name	Cathal Boylan	**Report Number**	**71141 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	71141/002 13/11/2013 13/11/2013
Tel No	046 9286000	**Received or Collected**	Fastway
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	27/11/2013
Quotation No	QN000407	**Sample Type**	Surface Waters
Customer Ref	SW3 Lake		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia									
	Ammonia (as N)		EW154M-1	0.007		0.317	mg/l N	INAB	
AQ2-UP1									
	Nitrate (as N)		EW154M-1	0.12		1.08	mg/l N	INAB	
	Nitrite (as N)		EW154M-1	0.013		<0.013	mg/l N	INAB	
	TON (as N)		EW154M-1	0.138		1.088	mg/l N	INAB	
	Phosphate-Ortho(as P)		EW154M-1	0.009		0.014	mg/l P	INAB	
AQ2-UP2									
	Chloride		EW154M-1	2.6		19.8	mg/L	INAB	
	Sulphate		EW154M-1	1.0		47.0	mg/L	INAB	
BOD									
	BOD		EW001	1		<1	mg/L	INAB	
COD									
	COD		EW094	8		46	mg/L	INAB	
Dissolved Oxygen									
	Dissolved Oxygen		EW043	1		7	mg/L	INAB	
Metals-Dissolved									
	Cadmium-Dissolved		EM130	0.1		<0.1	ug/L	INAB	
	Calcium-Dissolved		EM130	1.0		36.9	mg/L	INAB	
	Copper-Dissolved		EM130	0.003		<0.003	mg/L	INAB	
	Iron-Dissolved		EM130	20.0		807.7	ug/L	INAB	
	Lead-Dissolved		EM130	0.3		<0.3	ug/L	INAB	
	Magnesium-Dissolved		EM130	0.3		8.0	mg/L	INAB	
	Manganese-Dissolved		EM130	1.0		434.8	ug/L	INAB	
	Mercury-Dissolved		EM130	0.02		<0.02	ug/L	INAB	
	Potassium-Dissolved		EM130	0.2		6.5	mg/L	INAB	
	Sodium-Dissolved		EM130	0.5		13.6	mg/L	INAB	
	Zinc-Dissolved		EM130	1.0		62.7	ug/L	INAB	
Metals-Total									
	Chromium-Total		EM130	1.0		<1.0	ug/L		
Suspended Solids									
	Suspended Solids		EW013	5		<5	mg/L	INAB	
Titralab									
	pH		EW153			6.8	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		320	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		107	mg/L CaCO3	INAB	

Signed : _____ 27/11/2013

Technical Manager (or Deputy): **Brendan Murray**

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ISO 17025 INAB ACCREDITED TESTING
DETAILED IN SCOPE REG NO. 111T

Contact Name	Cathal Boylan	**Report Number**	**71141 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	71141/003 13/11/2013 13/11/2013
Tel No	046 9286000	**Received or Collected**	Fastway
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	27/11/2013
Quotation No	QN000407	**Sample Type**	Surface Waters
Customer Ref	CAP		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.007		0.058	mg/l N	INAB	
AQ2-UP1								
Nitrate (as N)		EW154M-1	0.12		0.31	mg/l N	INAB	
Nitrite (as N)		EW154M-1	0.013		<0.013	mg/l N	INAB	
TON (as N)		EW154M-1	0.138		0.308	mg/l N	INAB	
Phosphate-Ortho(as P)		EW154M-1	0.009		<0.009	mg/l P	INAB	
AQ2-UP2								
Chloride		EW154M-1	2.6		10.0	mg/L	INAB	
Sulphate		EW154M-1	1.0		98.3	mg/L	INAB	
BOD								
BOD		EW001	1		<1	mg/L	INAB	
COD								
COD		EW094	8		24	mg/L	INAB	
Dissolved Oxygen								
Dissolved Oxygen		EW043	1		10	mg/L	INAB	
Metals-Dissolved								
Cadmium-Dissolved		EM130	0.1		<0.1	ug/L	INAB	
Calcium-Dissolved		EM130	1.0		85.7	mg/L	INAB	
Copper-Dissolved		EM130	0.003		0.006	mg/L	INAB	
Iron-Dissolved		EM130	20.0		47.4	ug/L	INAB	
Lead-Dissolved		EM130	0.3		<0.3	ug/L	INAB	
Magnesium-Dissolved		EM130	0.3		11.8	mg/L	INAB	
Manganese-Dissolved		EM130	1.0		35.8	ug/L	INAB	
Mercury-Dissolved		EM130	0.02		<0.02	ug/L	INAB	
Potassium-Dissolved		EM130	0.2		5.0	mg/L	INAB	
Sodium-Dissolved		EM130	0.5		5.5	mg/L	INAB	
Zinc-Dissolved		EM130	1.0		47.6	ug/L	INAB	
Metals-Total								
Chromium-Total		EM130	1.0		<1.0	ug/L		
Suspended Solids								
Suspended Solids		EW013	5		5	mg/L	INAB	
Titralab								
pH		EW153			7.3	pH Units	INAB	
Conductivity @20 DegC		EW153	25		504	uscm-1@20	INAB	
Alkalinity Total (R2 pH4.5)		EW153	10		186	mg/L CaCO3	INAB	

Signed : _____ 27/11/2013

Technical Manager (or Deputy): **Brendan Murray**

NOTES
1.This Report shall not be Reproduced except in full, without the permission of the laboratory and only relates to the items tested.
2.SPEC= Allowable limit or parametric value
3.OOS=Result which is outside specification highlighted as OOS
4.LOQ=Limit of Quantification or lowest value that can be reported for the test
5.ACCRED=Indicates matrix accreditation for the test,a blank field indicates not accredited

APPENDIX D
Declaration

Cavan County Council
Comhairle Chontae an Chabháin

Teach Na Cúirte, An Cabháin
Courthouse, Cavan

Declaration

Bailieborough Landfill AER W0091-01

Cavan County Council hereby certifies that the content of the full pdf. AER W0091-012013AER.pdf uploaded to the EPA website is a true copy of the original AER.

Signed Sinead Fox Dated 10/2/14

Sinead Fox
Landfill Operations Manager
Cavan County Council