COMHAIRLE CHONDAE AN CABHÁIN

Cavan County Council

Annual Environmental Report

2013

Ballyjamesduff Landfill WL0093-1

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01	Draft	BK	12/02/14
02	Final Issue	BK/CB	12/02/14

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

Ballyjamesduff Landfill has been operated as waste disposal facility by Cavan County Council since the late 1960s. It is located off the Derrylurgan road, approximately 600m north of Ballyjamesduff town on the eastern side of the Derrylurgan road. The site is predominantly bog and comprises some 1.62 hectares. 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.

A Waste Licence for the facility was issued by the EPA on 7th March 2002, Ref WL 93-1. Condition 11.4 of Waste Licence Ref. 93-1 requires the submission of an Annual Environmental Report (AER) for Ballyjamesduff Landfill facility. This document is produced in order to comply with requirements of Condition 11.4. The reporting period for the purposes of this AER is 1st January 2013 to 31st December 2013.

The site at Ballyjamesduff was closed in early March 2002. Prior to closing the site a temporary cap was placed on site.

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 purposes of this AER is 1st January 2013 to 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.

A register of Environmental Monitoring is now established and shall be maintained. Cavan County Council now carries out the full scope of sampling as required by the Licence.

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5.1 Surface Water

As detailed by table 5.1, there were slight exceedances in the surface water analysis for parameters COD and BOD. Sample SW1 is located upstream of the landfill while SW2 is located downstream. All monitoring locations are detailed in the site map which is presented in Appendix B.

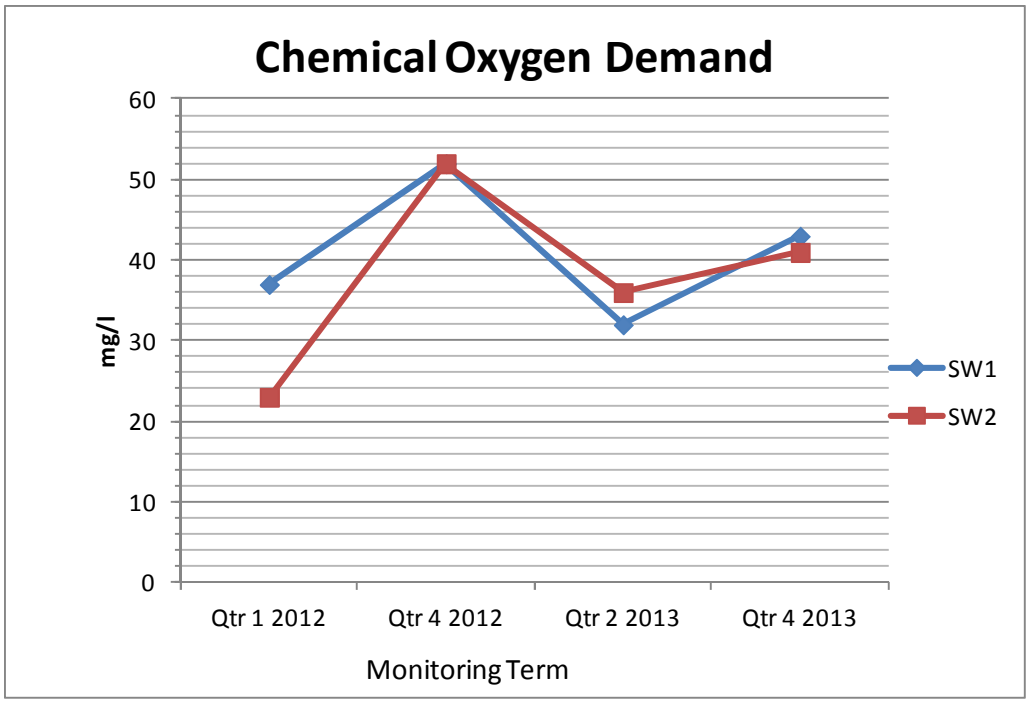
All parameters have been assessed against water limits as outlined in the European Communities (Drinking Water) (No.2) Regulations 2007. Results in Hatched Red indicate where the interim guide value has been exceeded.

Table 5.1 Surface water summary results

	Parameter	BOD	COD
	Units	mg/l	mg/l
SW1	Qtr 4 2013	<1	43
	Qtr 2 2013	<1	32
	Qtr 4 2012	5	52
	Qtr 1 2012	<1.0	37
SW2	Qtr 4 2013	6	41
	Qtr 2 2013	<1	36
	Qtr 4 2012	6	52
	Qtr 1 2012	<1.0	23
Discharge Cap	Qtr 4 2013	-	-
	Qtr 2 2013	<1	33
	Qtr 4 2012	-	-
	Qtr 1 2012	<1.0	29
S.I No. 294/1989 A1		5	

A comprehensive report of all results obtained in 2013 is presented in Appendix C.

Graph 5.1



All surface water locations were found to be within limits specified in the above regulations with the exception of COD and BOD on one occasion during 2013. Elevations from these parameters cannot be definitively associated to the landfill due to the presence of increased decaying organic matter in the form of decaying vegetation due to the winter season.

5.2 Groundwater

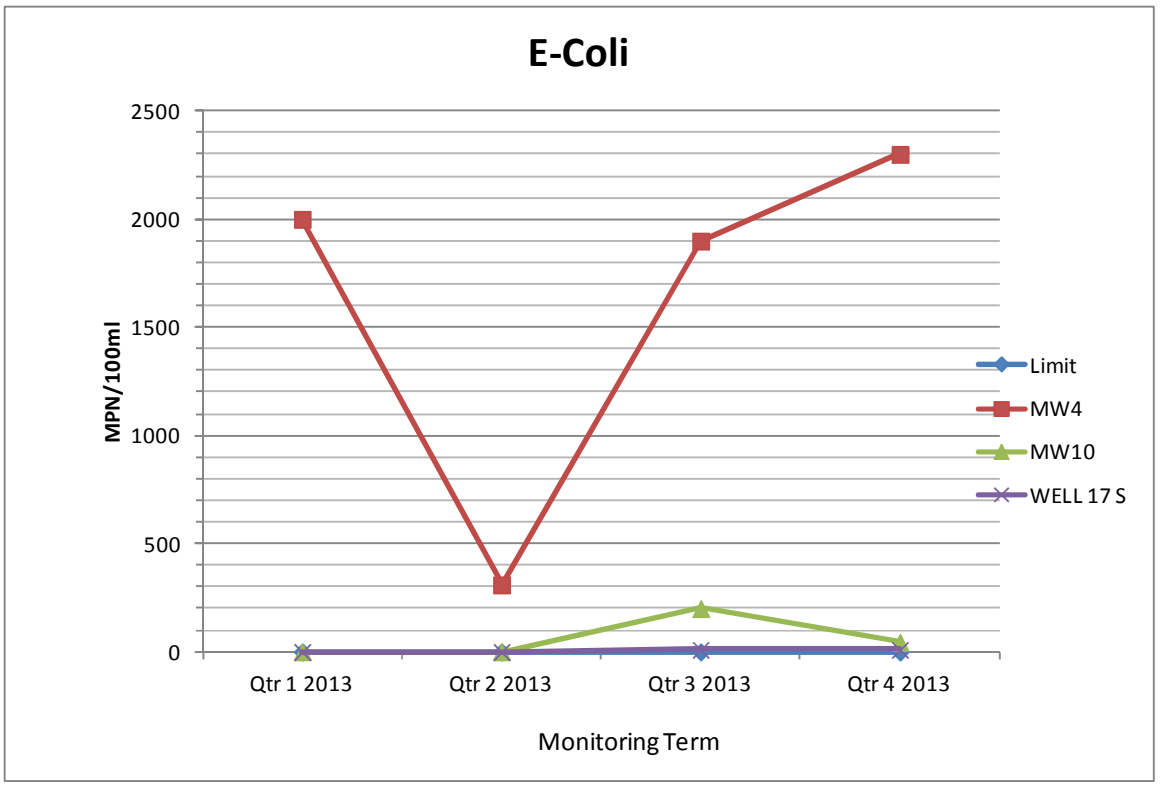
The following table details all reoccurring exceedances at all groundwater wells during 2013. Results in Hatched Red indicate where the interim guide value has been exceeded when compared to limits stipulated by the Environmental Protection Agency.

Table 5.2 Groundwater Summary Results

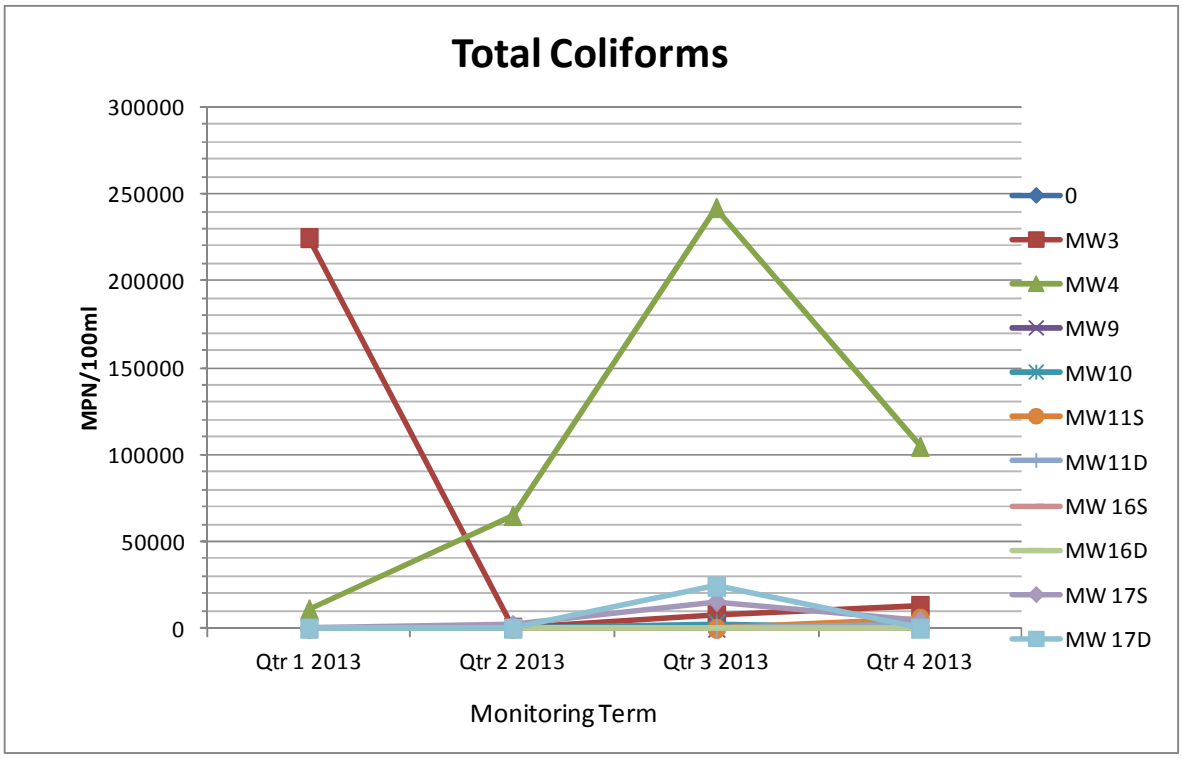
	Parameter	E.Coli	Ammonia	TON	Tot Coliforms	pH	Cond	Cl	Fe	K
	Units	MPN/ 100ml	mg/l N	mg/l N	MPN/ 100ml	pH Units	us/cm	mg/l	mg/l	mg/l
MW 3	Qtr 4 2013	200	25.586	0.262	13000	6.9	898	25.1	24222.8	16.6
	Qtr 3 2013	0	27.041	<0.138	8200	7.1	899	24.7	31846	13
	Qtr 2 2013	0	25.339	<0.138	520	7.2	802	20.3	31839.7	14.4
	Qtr 1 2013	0	21.472	<0.138	224700	7.1	783	21.1	22011.1	11
MW 4	Qtr 4 2013	2300	2.669	0.291	104600	7.1	272	18.8	592.5	12.2
	Qtr 3 2013	1900	2.107	<0.138	242100	7.2	400	23.4	1576.8	6.1
	Qtr 2 2013	310	3.791	<0.138	64880	7.1	507	21.3	3480.9	9.6
	Qtr 1 2013	2000	3.278	0.184	11000	7	460	22	4384.1	6.1
MW9	Qtr 4 2013	0	17.459	0.155	1700	6.9	985	15.3	19405.8	15.9
	Qtr 3 2013	0	14.407	<0.138	200	7.1	933	25.6	31210.5	11.4
	Qtr 2 2013	0	24.042	<0.138	200	7.1	929	37.9	7774.4	21.3
	Qtr 1 2013	0	18.365	<0.138	100	7	971	31.3	25695.2	13.8
Well MW 10	Qtr 4 2013	44.059	0.603	11300	7.2	1344	81	10	29.3	53.5
	Qtr 3 2013	200	23.033	<0.138	2900	7	1025	52	13012	16.3
	Qtr 2 2013	0	17.167	<0.138	200	7.2	883	24.1	6145	14.8
	Qtr 1 2013	0	24.26	<0.138	200	7.4	1001	37.2	1064	17.5
WELL 11 S	Qtr 4 2013 R	200	0.041	<0.138	20300	7.1	1266	270	38.9	4
	Qtr 4 2013	330	0.063	<0.138	5790	7	714	113.9	30.4	4.4
	Qtr 3 2013	0	0.194	0.871	0	7.3	467	42.2	39.9	2
	Qtr 2 2013	0	0.028	0.483	52	7.3	589	46.6	22.1	2.9
	Qtr 1 2013	0	0.043	0.568	100	7	566	40.9	20	1.9
WELL 11D	Qtr 4 2013 R	0	0.068	0.663	100	7.4	412	10.1	85.1	3.8
	Qtr 4 2013	170	0.051	<0.138	2140	7.4	400	7.9	<20	3.7
	Qtr 3 2013	0	0.053	<0.138	13	7.7	404	8.2	<20	1.5
	Qtr 2 2013	0	0.042	<0.138	36	7.6	405	7.5	<20	3
	Qtr 1 2013	0	0.047	<0.138	10	7.3	406	13.5	20	1.8
WELL 16 S	Qtr 4 2013	0	0.089	1.495	150	7.5	486	18	74.3	5.2
	Qtr 3 2013	0	0.225	0.153	160	7.5	480	20.1	<20	1.7
	Qtr 2 2013	0	0.139	0.187	0	7.8	455	17.9	48.4	3.7
	Qtr 1 2013	0	0.089	0.333	0	7.4	471	20.8	20	2.6
WELL 16 D	Qtr 4 2013	0	0.087	<0.138	150	7.4	489	18.5	79	4
	Qtr 3 2013	0	0.089	<0.138	649	7.5	511	20.2	88.8	1.5
	Qtr 2 2013	0	0.057	<0.138	0	7.6	489	18.2	84	3.1
	Qtr 1 2013	0	0.061	<0.138	0	7.4	490	20.5	63.8	1.9
WELL 17 S	Qtr 4 2013	10	8.51	0.29	4610	6.8	480	14.3	6443.4	6.2
	Qtr 3 2013	10	8.58	<0.138	15530	6.9	502	18.5	9699.9	2.6
	Qtr 2 2013	0	9.632	<0.138	2006	7.2	491	14.8	15976.6	3.9
	Qtr 1 2013	0	8.667	<0.138	100	6.9	481	16.4	10223.6	2.7
WELL 17 D	Qtr 4 2013	10	0.382	<0.138	10	7.3	501	16.4	293.4	4.4
	Qtr 3 2013	0	0.276	0.186	24210	7.5	516	18.9	96.7	2.3
	Qtr 2 2013	0	0.266	<0.138	2	7.6	493	16.1	260.4	3.7
	Qtr 1 2013	0	0.307	<0.138	21	7.2	503	15.8	258.2	2.6
WELL 18	Qtr 4 2013	0	0.061	<0.138	0	7.3	486	14.8	249.8	4.3
	Qtr 3 2013	0	0.042	<0.138	0	7.5	489	14.7	263.5	2.6
	Qtr 2 2013	0	0.035	<0.138	0	7.6	481	13.5	232.9	3.8
	Qtr 1 2013	0	0.083	<0.138	2	7.3	488	16.1	245.8	2.3
IGV		0	0.15	NAC	0	≥6.5 &≤9.5	1000	30	0.200	5

The following graphs detail all groundwater exceedances.

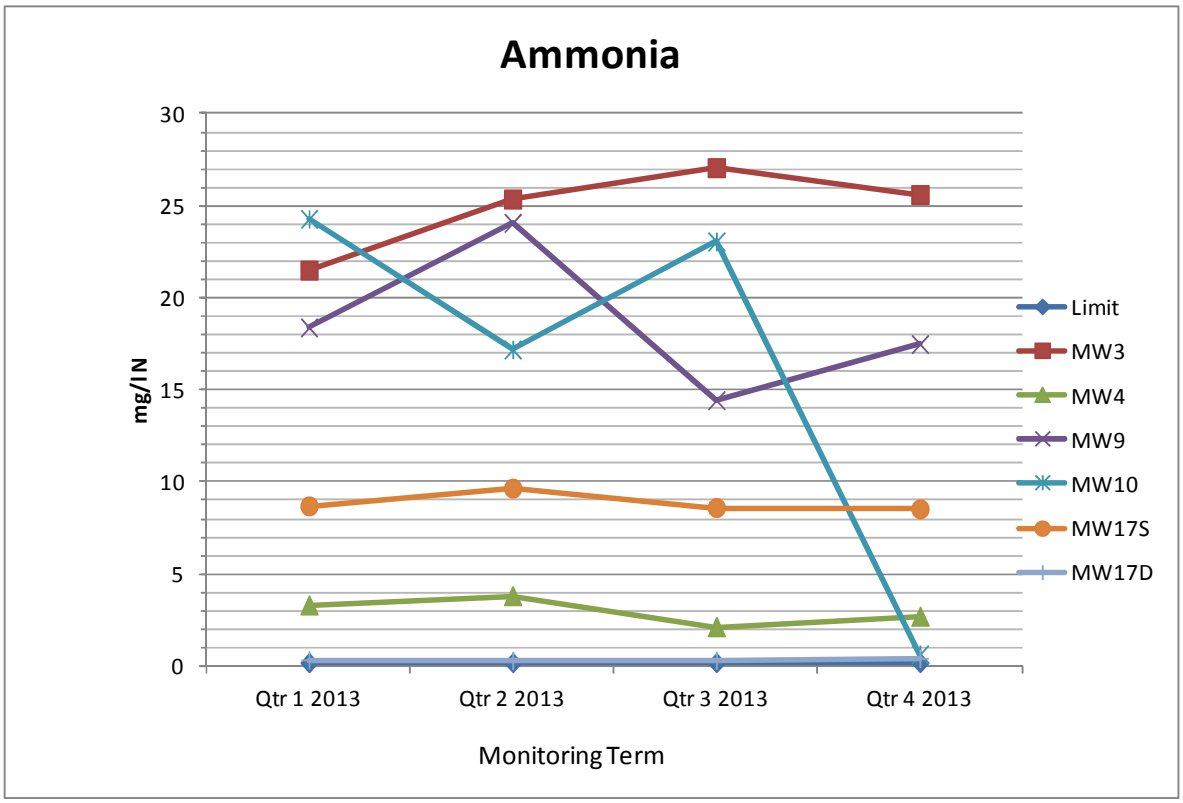
Graph 5.2



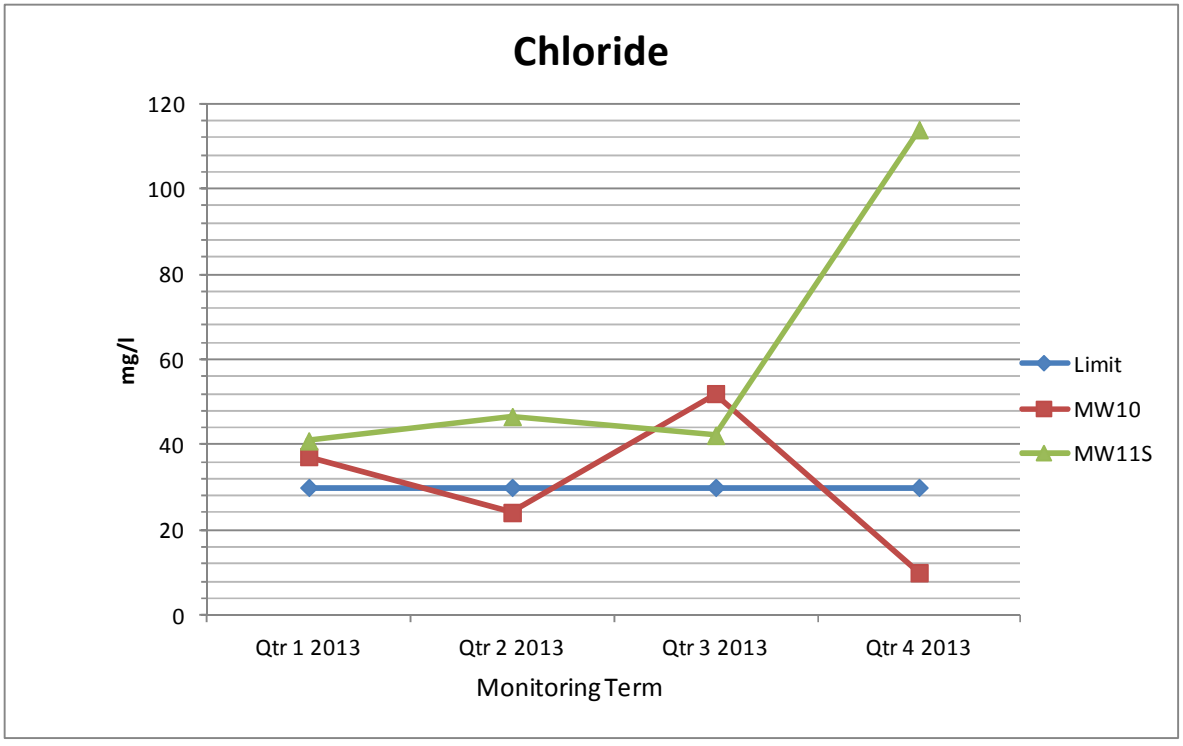
Graph 5.3



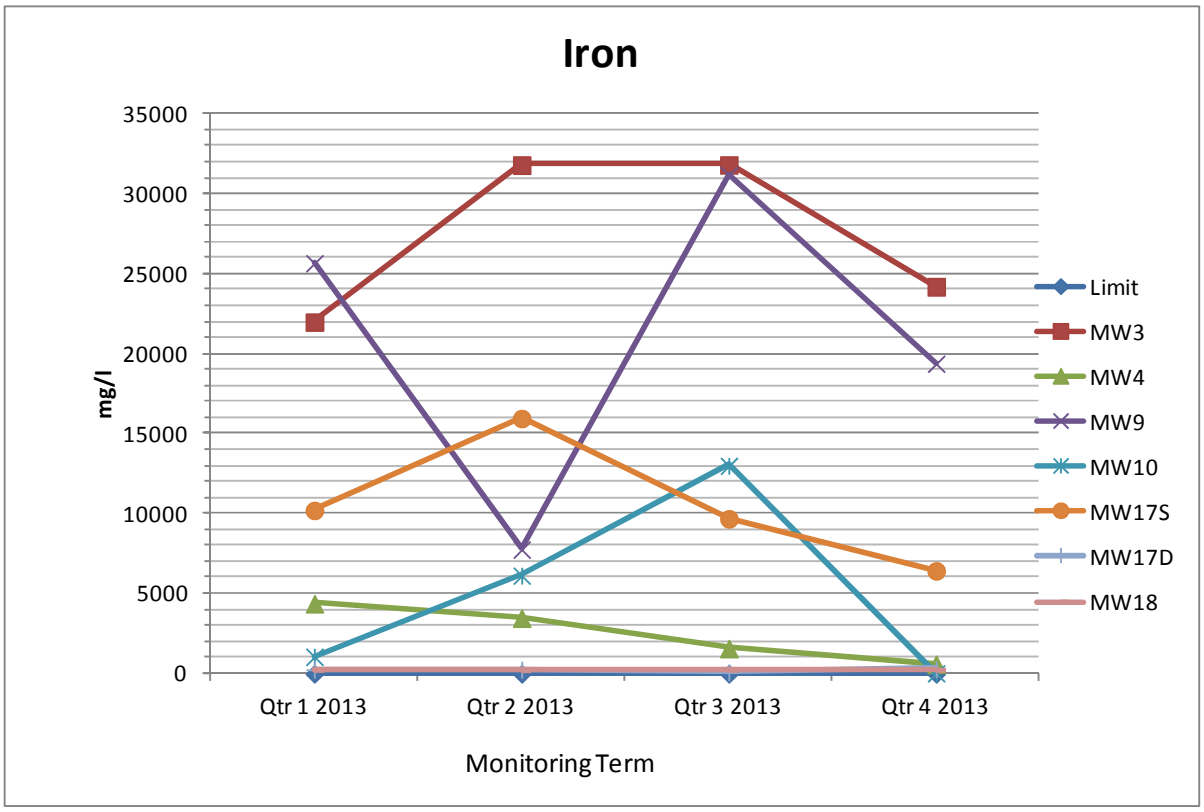
Graph 5.4



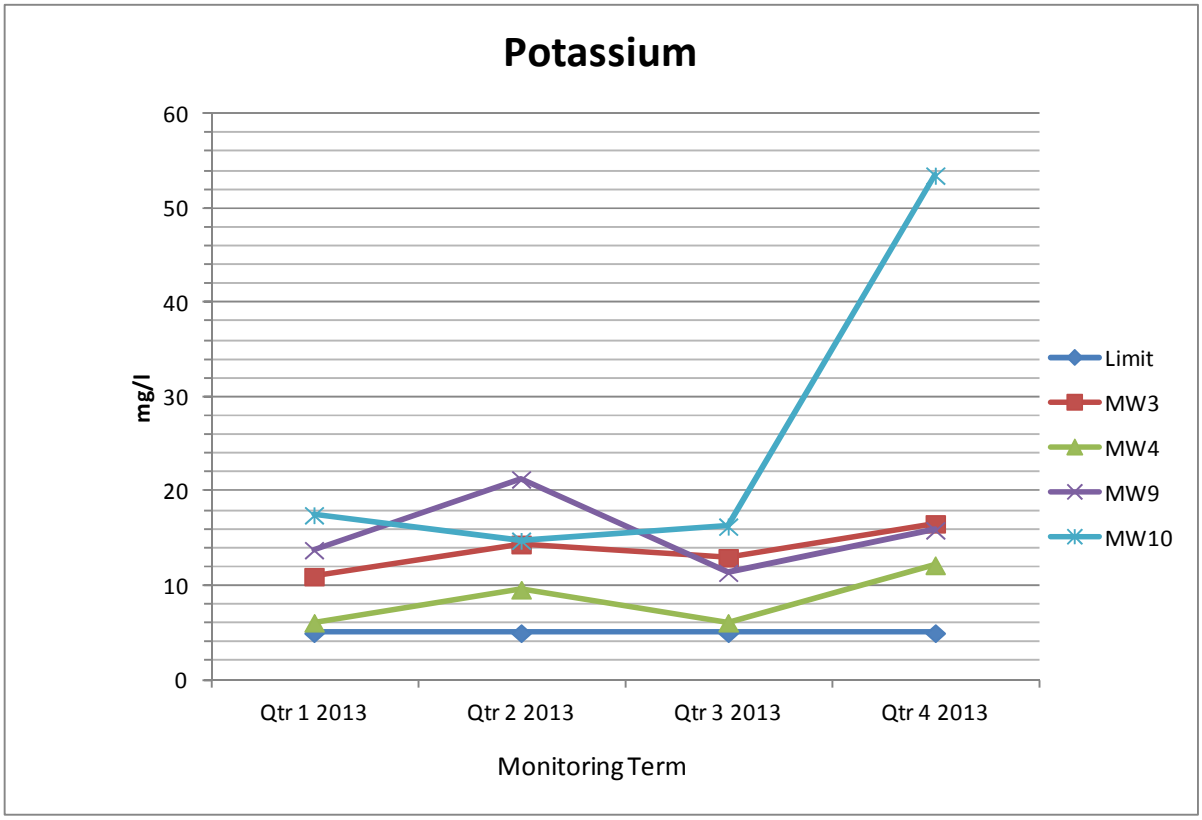
Graph 5.5



Graph 5.6



Graph 5.7



As detailed in the above graphs, there were numerous ground water exceedances at this landfill during 2013.

Exceedances occurred in the following parameters:

- ***Escherichia coli:*** Elevated levels of this parameter were found in samples MW3, MW4, MW10, MW11S, MW11D, 1MW17S & MW17D. It is not uncommon for wells in the vicinity of a landfill to be contaminated with *E. coli.* It is also attributed to influx of contamination from other sources such as septic tanks, slurry spreading and animal faecal contaminations. It should be noted that there were numerous horses present on the landfill for the most part of 2013 and as such the E.Coli contamination cannot be solely attributed to the landfill itself.
- **Ammonia:** Elevated levels of this parameter were prevalent during 2013. Elevated levels of ammonia are strongly associated with pollution from waste water treatment systems and so contamination of these wells by the landfill cannot be definitively concluded.
- **Total Coliforms:** elevated levels of this parameter can be attributed to contamination from organic matter; therefore exceedances in this parameter may not be directly linked to the landfill.
- **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:** Historical results obtained from this parameter show frequent exceedances. However, during 2013 the exceedances in this parameter were isolated to only three wells MW9, MW10 and MW11S. Contamination of well 11S from the landfill is impossible due to MW11S being located up gradient of the landfill. Therefore chloride contamination should be concluded to be from an alternative source in this instance.
- **Potassium:** Elevated levels of potassium can be associated with landfill contamination but it can also be associated with contamination from agricultural sources such as fertilizers. Therefore direct contamination from the landfill cannot be concluded.

- **Cyanide:** An exceedance in this parameter was encountered in quarter 4 2013 at well MW11S. This well is situated up gradient from the landfill and so cannot be attributed to the landfill.

5.3 Leachate Monitoring

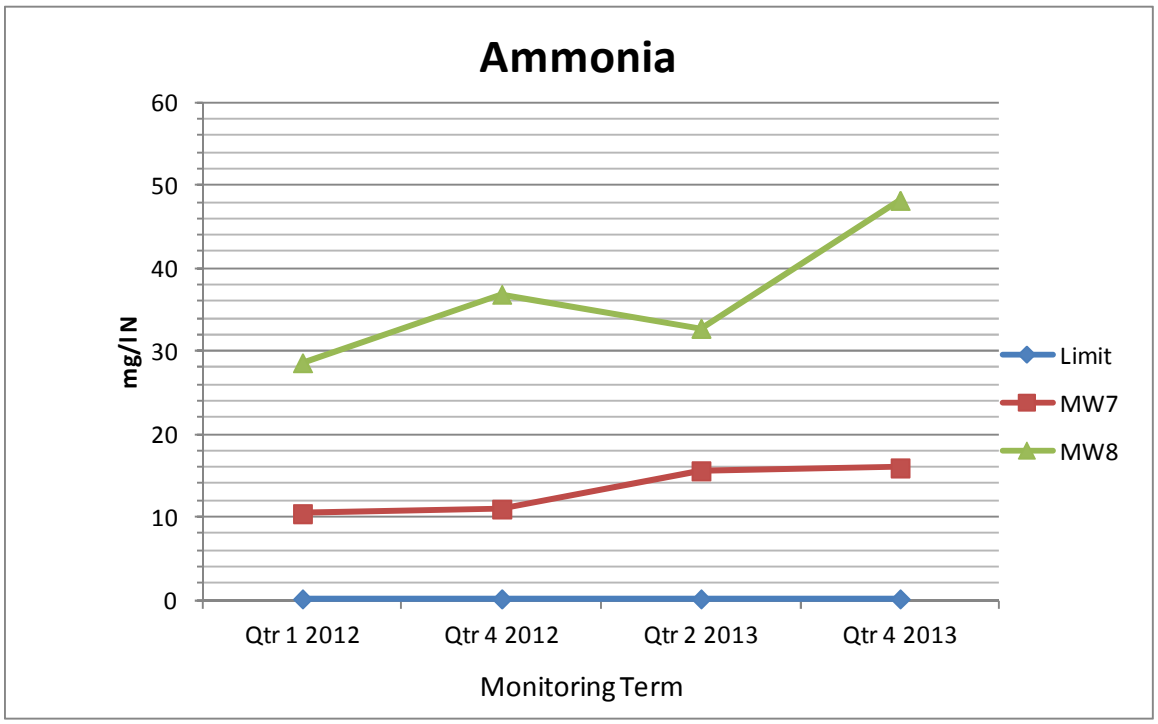
Leachate monitoring is carried out biannually in accordance with the licence.

Re-occurring exceedances are displayed below. Results in Hatched Red indicate where the interim guide value has been exceeded when compared to limits stipulated by the Environmental Protection Agency.

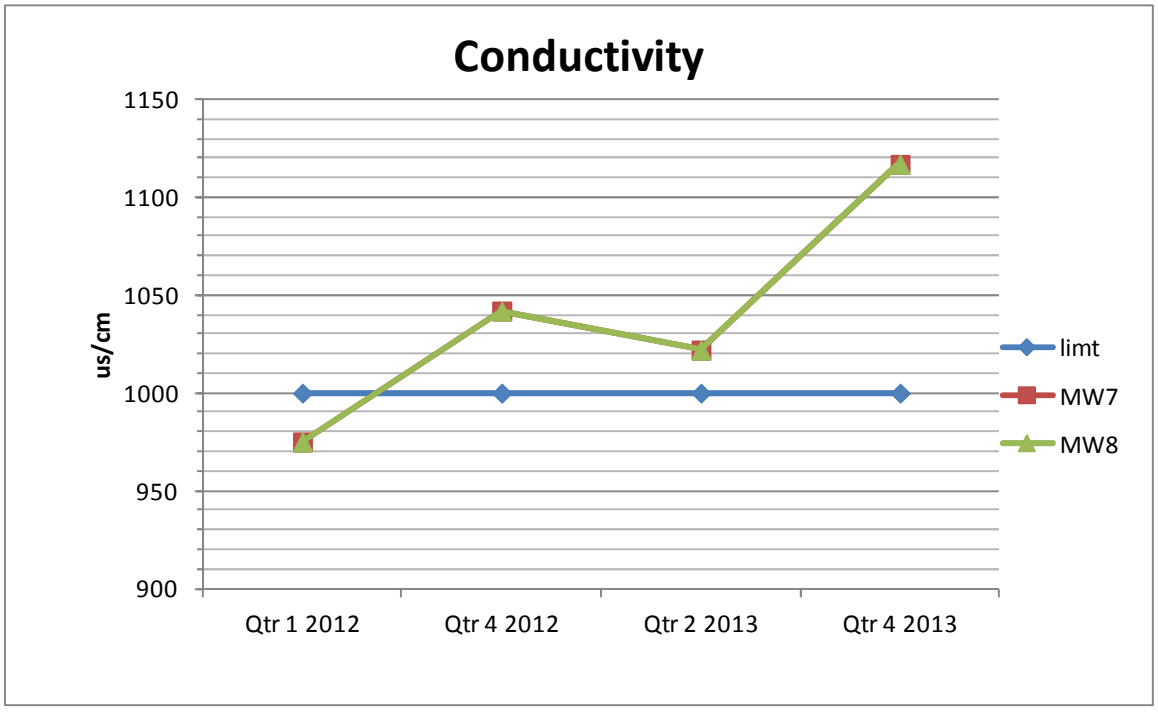
Table 5.3 Leachate Summary Results

	Parameter	Ammonia	Cond
	Units	mg/l N	us/cm
WELL MW 7	Qtr 4 2013	15.956	1117
	Qtr 2 2013	15.597	1022
	Qtr 4 2012	10.985	1042
	Qtr 1 2012	10.438	975
WELL MW 8	Qtr 4 2013	48.217	1467
	Qtr 2 2013	32.78	1237
	Qtr 4 2012	36.89	1515
	Qtr 1 2012	28.627	1396
Interim Guide Values		0.15	1000

Graph 5.8



Graph 5.9



As can be seen from the above figures the conductivity reading at this landfill remain steady and are typical of those associated with a mature landfill.

Results obtained for ammonia at these wells are elevated in comparison to Interim Guide Values for groundwater. Although ammonia is associated with leachate, it is also strongly associated with agricultural activities such as manure spreading, an activity which is prevalent in the surrounding area. As such the elevated levels cannot be solely attributed to the landfill at this time.

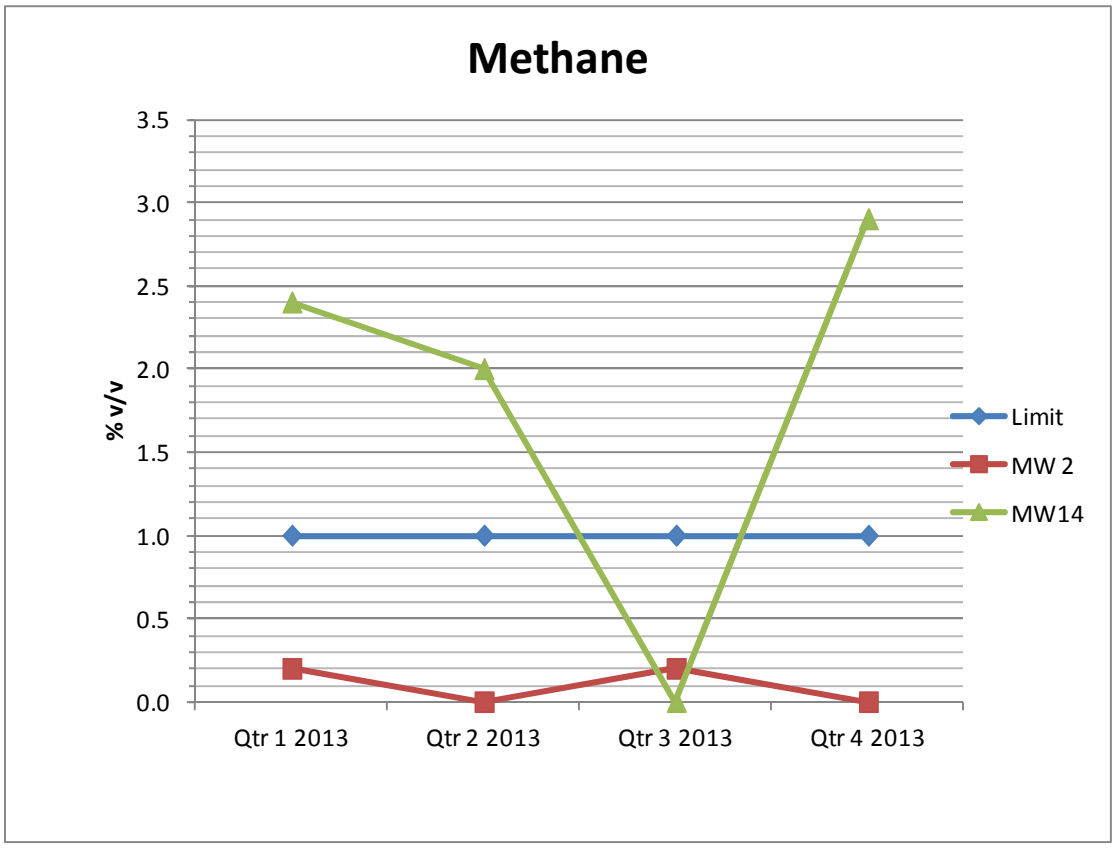
5.4 Gas Emissions

Landfill gas was monitored at five locations both within and outside the landfill mass. The following table details all results during 2013.

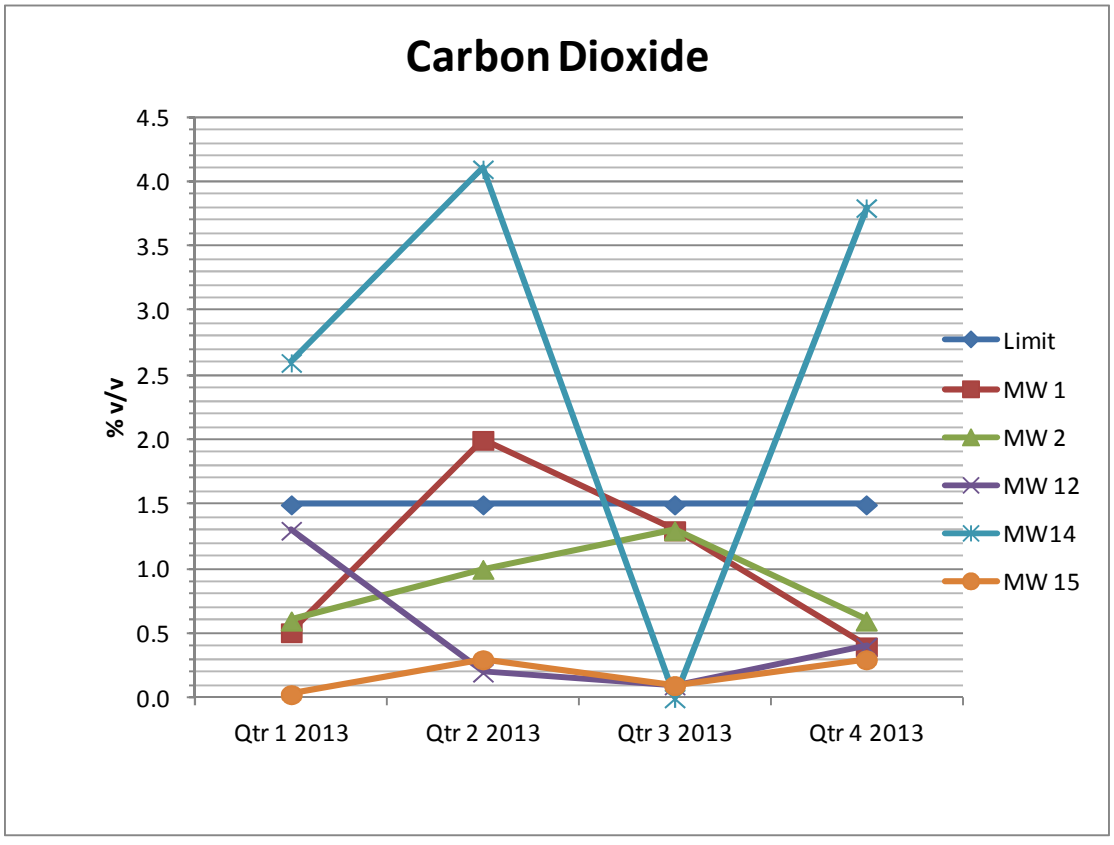
Table 5.4 Gas Emissions Summary Results

Method		GA 2000	GA 2000	GA 2000	GA 2000	GA 2000
Parameter		CH_4	CO_2	O_2	H_2S	Barometric Pressure
Units		% v/v	% v/v	%	PPM	mb
Client Ref	Qtr	-	-	-	-	-
MW 1	Qtr 4 2013	0	0.4	20.7	0	1019
	Qtr 3 2013	0	1.3	19	0	999
	Qtr 2 2013	0.0	2.0	19.6	0	999
	Qtr 1 2013	0.2	0.51	20.9	0	996
MW 2	Qtr 4 2013	0	0.6	20.6	0	1018
	Qtr 3 2013	0.2	1.3	18.7	0	999
	Qtr 2 2013	0.0	1.0	20.1	0	999
	Qtr 1 2013	0.2	0.6	21	0	996
MW 5	Qtr 4 2013	0	0.3	20.8	0	1018
	Qtr 3 2013	0	0.1	20.8	0	998
	Qtr 2 2013	0.0	0.3	21.0	0	999
MW 12	Qtr 4 2013	0	0.4	20.8	0	1018
	Qtr 3 2013	0	0.1	20.8	0	998
	Qtr 2 2013	0.0	0.2	20.8	0	999
	Qtr 1 2013	0.6	1.3	21.4	0	995
MW 13	Qtr 4 2013	0	0.1	20.7	0	1019
	Qtr 3 2013	0	0.1	20.7	0	997
	Qtr 2 2013	0.0	0.4	20.8	0	999
	Qtr 1 2013	0.2	0	23.2	0	995
MW 14	Qtr 4 2013	2.9	3.8	18.8	0	1017
	Qtr 3 2013	0	0	20.9	0	998
	Qtr 2 2013	2.0	4.1	17.3	0	999
	Qtr 1 2013	2.4	2.6	20.1	0	995
MW 15	Qtr 4 2013	0	0.3	20.8	0	1018
	Qtr 3 2013	0	0.1	20.7	0	998
	Qtr 2 2013	0.0	0.3	20.5	0	999
	Qtr 1 2013	0.2	0.03	22.2	0	996
	Limit	**1**	**2**			

Graph 6.0



Graph 6.1



Gas Monitoring on the site reveals typical low levels of Methane & Carbon Dioxide and higher levels of Oxygen. There were no exceedances in licence limits for wells located outside the waste mass. The results are typical of a closed landfill.

6.0 SUMMARY OF RESULTS AND INTERPRETATION OF ENVIRONMENTAL MONITORING

As reported in section 4 there were a number of elevations recorded in 2013. Included in Appendix C is a copy of the quarter 4 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. We will continue to monitor and report as per the licence requirement.

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 FACILITY

The site is fully restored and the cap intact. There were horses grazing on the site during 2013.

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

This information is reported in the PRTR Report attached in Appendix A. The estimated quantity of Methane released is 36,900kgs/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 TO THE FACILITY OPERATION

There was no change to or development of any procedures undertaken by the licensee or monitoring contractor in 2013.

11.0 REPORTED INCIDENTS AND 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 parameters such as 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 backed up by the absence of any 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 by the FAS Waste Management Training Course, carries a Safe Pass and has been trained in Landfill Gas Management.

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 ANY OTHER ITEMS SPECIFIED BY THE AGENCY

As per the licence 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

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	Ballyjamesduff Landfill
PRTR Identification Number	W0093
Licence Number	W0093-01

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	Derrylurgan
Address 2	Ballyjamesduff
Address 3	Co Cavan
Address 4	
	Cavan
Country	Ireland
Coordinates of Location	-7.20884 53.8687
River Basin District	IEGBNISH
NACE Code	3821
Main Economic Activity	Treatment and disposal of non-hazardous waste
AER Returns Contact Name	vincient Craig
AER Returns Contact Email Address	vcraig@cavancoco.ie
AER Returns Contact Position	Landfill Operations Manager
AER Returns Contact Telephone Number	049-4378410
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	0
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

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	102000.0	0.0	102000.0
01	**Methane (CH4)**	C	OTH	GASSIM	0.0	0.0	0.0	36900.0

* 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: Ballyjamesduff Landfill

Please enter summary data on the quantities of methane flared and / or utilised	**T (Total) kg/Year**	**M/C/E**	**Method Used**		**Facility Total Capacity m3 per hour**	
			Method Code	**Designation or Description**		
Total estimated methane generation (as per site model)	36900.0	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)	36900.0	C	OTH	GASSIM	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	W0093
Please choose from the drop down menu the name of the landfill site	Ballyjamesduff 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

APPENDIX D
Declaration

Cavan County Council
Comhairle Chontae an Chabháin

Teach Na Cúirte, An Cabháin
Courthouse, Cavan

Declaration

Ballyjamesduff Landfill WL0093/1

Cavan County Council hereby certifies that the content of the full pdf. AER W0093-012013AER.pdf uploaded to the EPA website is a true copy of the original AER.

Signed Sinead Fox Dated 11/2/14

Sinead Fox
Waste Management
Cavan County Council

APPENDIX C
Q4 Monitoring Report

GROUND WATER MONITORING REPORT FOR BALLYJAMESDUFF LANDFILL W0093-01

Client: **Cavan County Council**

Site Location: **Derrylurgan, Ballyjamesduff**

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

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

Approved by: _____ **Date:** 05th February 2014

Cathal Boylan, BEng, CEng, MIEI
CHARTERED ENGINEER

Boylan Engineering
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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 Ballyjamesduff Landfill (W0093-01), Derrylurgan, Ballyjamesduff, Co Cavan for quarter four 2013.

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

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Appendix

1. 0 INTRODUCTION

Ballyjamesduff landfill is situated approximately 600m from Ballyjamesduff town centre in the town land of Derrylurgan. The site was in operation from the 1960's and comprises some 1.62 hectares. The site was originally peat land which was stripped for commercial purposes and was then operated as a traditional landfill until its closure in March 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. 0 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 3.

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	94.92	91.72	3.2	N291352.31 E252020.68
MW2	Gas	92.92	90.82	2.1	N291377.38 E252082.84
MW3	GW	94.39	92.39	2.0	N291369.28 E252109.44
MW4	GW	93.65	93.05	0.6	N291309.78 E252129.14
MW8	Leachate	96.56	-	TBC	N291346.99 E252041.22
MW9	GW	95.69	92.39	3.3	N291369.67 E252103.93
MW10	GW	93.95	91.95	2.0	N291314.86 E252138.12
MW11S	GW	TBC	-	2.4	TBC
MW11D	GW	TBC	-	11.4	TBC
MW12	Gas	94.38	-	n/a	N291236.30 E252110.10
MW14	Gas	98.77	-	n/a	N291263.92 E252131.54
MW16S	GW	94.02	93.22	0.8	N252076.89 E291174.65
MW16D	GW	94.16	94.16	0.0	N252077.36 E291173.27
MW17S	GW	93.59	92.64	1.0	N251997.04 E291377.19
MW17D	GW	93.63	93.63	0.0	N251997.80 E291376.00
MW18	GW	93.5	93.5	0.0	N251986.57 E291425.39
SW1	SW	n/a	-	n/a	TBC
SW2	SW	n/a	-	n/a	TBC
Cap	SW	n/a	-	n/a	TBC

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)				
06/12/2013	0.8	8.7	3.4	1.7	6.6		

3.0 SUMMARY OF RESULTS

Table 1.0 04th Quarter Ground water monitoring 2013

Report Number: 70987
Monitoring Date: 06.11.13

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		6.11.13					7.11.13											
ELS Ref	Client Ref																	
70987/001	MW3	10.8	890	7.21	2	Heavy Silt	12.19	25.586	0.262	6.9	898	429	25.1	11.8	6	<10	1.88	<0.15
70987/002	MW4	10.2	275	7.12	0.6	Heavy Silt	11.63	2.669	0.291	7.1	272	119	18.8	43.9	3	<10	1.48	<0.15
70987/003	MW9	10.1	896	7.13	3.3	Heavy Silt	12.73	17.459	0.155	6.9	985	491	15.3	1.1	8	<10	0.43	<0.15
70987/004	MW10	10.4	1079	7.21	2	Heavy Silt	15.23	44.059	0.603	7.2	1344	582	81	26.4	10	<10	0.13	<0.15
70987/005	MW11S	11.2	722	7.11	2.4	Straw	0.99	0.063	<0.138	7	714	235	113.9	29.8	7	87	0.1	<0.15
70987/006	MW11D	10.9	413	7.69	11.4	Straw	<0.25	0.051	<0.138	7.4	400	210	7.9	13.6	6	<10	0.06	<0.15
70987/007	MW16S	11.9	519	7.64	0.8	Brown	1.11	0.089	1.495	7.5	486	203	18	54.1	8	<10	0.2	<0.15
70987/008	MW16D	10.7	487	7.57	0	Clear	0.37	0.087	<0.138	7.4	489	184	18.5	65.7	3	<10	0.02	<0.15
70987/009	MW17S	10.8	523	7.18	0.95	Grey	2.92	8.51	0.29	6.8	480	224	14.3	21.6	7	<10	0.52	<0.15
70987/010	MW17D	10.3	497	7.52	0.1	Clear	1.12	0.382	<0.138	7.3	501	242	16.4	22.9	3	<10	0.04	<0.15
70987/011	MW18	10.4	484	7.72	0	Clear	0.51	0.061	<0.138	7.3	486	233	14.8	26.5	3	<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/100m	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		07.11.13																
ELS Ref	Client Ref																	
70987/001	MW3	13000	200	0.1	1044	20.3	24222.8	854	16.6	27.9	<0.1	123.9	<0.003	<0.3	18.6	<0.02	72.4	0.58
70987/002	MW4	104600	2300	<0.1	6826	157.5	592.5	510.5	12.2	12.5	<0.1	37.6	<0.003	0.9	5.9	<0.02	150.1	<0.02
70987/003	MW9	1700	0	<0.1	1018	18.3	19405.8	2131.6	15.9	19.8	<0.1	148.2	<0.003	0.8	36	<0.02	26.1	0.07
70987/004	MW10	11300	0	<0.1	826	1.7	130.8	2001.4	29.3	53.5	<0.1	184.3	<0.003	<0.3	29.3	<0.02	106	0.31
70987/005	MW11S	5790	330	0.2	616	11.3	30.4	106.3	4.4	32.2	<0.1	81	<0.003	<0.3	26.6	<0.02	362.8	<0.02
70987/006	MW11D	2140	170	0.2	288	2.2	<20	120.5	3.7	21.6	<0.1	53.6	<0.003	<0.3	11.9	<0.02	6.6	<0.02
70987/007	MW16S	150	0	0.2	720	48.9	74.3	102.8	5.2	24.1	<0.1	71	<0.003	<0.3	12.7	<0.02	3	<0.02
70987/008	MW16D	150	0	0.2	334	<1	79	921	4	20.8	<0.1	75.3	<0.003	0.8	13.3	<0.02	17.7	<0.02
70987/009	MW17S	4610	10	0.1	760	28.3	6443.4	847.8	6.2	24.3	<0.1	60.4	<0.003	0.3	11.7	<0.02	2.9	<0.02
70987/010	MW17D	10	10	0.1	300	<1	293.4	1134.6	4.4	27.2	<0.1	67.5	<0.003	0.6	14.7	<0.02	27.3	<0.02
70987/011	MW18	0	0	0.1	292	<1	249.8	711.7	4.3	28.3	<0.1	65.5	<0.003	0.5	14.8	<0.02	20.6	<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

Table 2.0 04th Quarter Ground water monitoring 2013 REPEAT

Report Number:	72442
Monitoring Date:	13.01.14

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 Initiated		13.1.14					14.1.14											
ELS Ref	Client Ref																	
72442/001	MW11S	11.4	1270	7.25	2.3	Straw	1.47	0.041	<0.138	7.1	1266	284	270	55.4	6	15	0.76	<0.15
72442/002	MW11D	11.2	418	7.46	11.5	Straw	1.83	0.068	0.663	7.4	412	201	10.1	13.5	8	<9	0.16	<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/100m	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 Initiated		14.01.14																
ELS Ref	Client Ref																	
72442/001	MW11S	20300	200	<0.1	58	92.8	38.9	2848	4	44.9	0.1	158.9	<0.003	<0.3	47.9	<0.02	29.8	<0.02
72442/002	MW11D	100	0	0.2	22.1	5	85.1	350	3.8	21.2	<0.1	56.2	<0.003	<0.3	12.7	<0.02	9.2	<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.

4.0 DISCUSSION

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 06th November 2013. Results in Hatched Red indicate where the interim guide value has been exceeded. Results from the fourth quarter 2013 show that there were exceedances at various ground water monitoring locations for parameters; Iron, Ammonia, Conductivity, Total Coliforms, E-coli, Potassium Chloride, Zinc, Manganese, Chromium and also Cyanide. Previous results detailed in the historical data show that these exceedances are on par with previous monitoring events with the exception of Cyanide. Further to this exceedance in the Interim Guide value for Cyanide an immediate retest for this parameter was conducted at wells 11S & 11D. These results were found to be less than the Interim guide value of 10ug/l however during a retest of all parameters conducted in January a slightly elevated level of cyanide was discovered fort the second time in well MW11S. A hydrological report completed in 2013 clearly states that wells 11S and 11D are up gradient from the landfill and so the source of the contamination is deemed to be leachate from Silage bales which were being stored within 10 metres up gradient of the wells. This is further substantiated by the presence of orange/brown liquid found within the unsealed well casing. The silage bales have since been moved from the vicinity of the wells.

Elevated Iron levels can be an indication of contamination. 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 from the underlying deposits. Elevated Iron may also be attributed to the natural composition of this area.
Historical results for comparison purposes are presented in tabular and graphic form in Appendix 1.

5.0 CONCLUSION

The groundwater results obtained are relatively consistent with previous monitoring events with the exception of slightly elevated Cyanide. This parameter is attributed to an external contamination source such as the silage bales. The landfill did not cause this exceedance on this occasion Therefore there is no evidence of any major negative environmental impact associated with this landfill. Information relating to previous results can be seen in the historical data tables in Appendix 1.

APPENDIX 1- HISTORICAL DATA

	Parameter	TOC	E.Coli	Ammonia	TON	Tot Coliforms	pH	Cond	Cl	DO	Total Phenols	Fe	K	Na
	Units	mg/l	MPN/ 100ml	mg/l N	mg/l N	MPN/ 100ml	pH Units	us/cm	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
MW 3	Qtr 4 2013	12.19	200	25.586	0.262	13000	6.9	898	25.1	6	<0.15	24222.8	16.6	27.9
	Qtr 3 2013	13.46	0	27.041	<0.138	8200	7.1	899	24.7	1.1	<0.15	31846	13	27.3
	Qtr 2 2013	15.55	0	25.339	<0.138	520	7.2	802	20.3	1.5	<0.15	31839.7	14.4	25.1
	Qtr 1 2013	28.35	0	21.472	<0.138	224700	7.1	783	21.1	2.2	<0.15	22011.1	11	24.3
MW 4	Qtr 4 2013	11.63	2300	2.669	0.291	104600	7.1	272	18.8	3	<0.15	592.5	12.2	12.5
	Qtr 3 2013	14.63	1900	2.107	<0.138	242100	7.2	400	23.4	4.1	<0.15	1576.8	6.1	16.1
	Qtr 2 2013	14.03	310	3.791	<0.138	64880	7.1	507	21.3	5.5	<0.15	3480.9	9.6	18.2
	Qtr 1 2013	31.5	2000	3.278	0.184	11000	7	460	22	5.1	<0.15	4384.1	6.1	16.2
MW9	Qtr 4 2013	12.73	0	17.459	0.155	1700	6.9	985	15.3	8	<0.15	19405.8	15.9	19.8
	Qtr 3 2013	12.28	0	14.407	<0.138	200	7.1	933	25.6	2.1	<0.15	31210.5	11.4	22
	Qtr 2 2013	15.8	0	24.042	<0.138	200	7.1	929	37.9	2.8	<0.15	7774.4	21.3	24.7
	Qtr 1 2013	13.45	0	18.365	<0.138	100	7	971	31.3	2.3	<0.15	25695.2	13.8	28.5
Well MW 10	Qtr 4 2013	0	44.059	0.603	11300	7.2	1344	81	10	<0.15	130.8	29.3	53.5	
	Qtr 3 2013	15.64	200	23.033	<0.138	2900	7	1025	52	2.8	<0.15	13012	16.3	27.4
	Qtr 2 2013	12.58	0	17.167	<0.138	200	7.2	883	24.1	6.6	<0.15	6145	14.8	25.3
	Qtr 1 2013	16.11	0	24.26	<0.138	200	7.4	1001	37.2	7.4	<0.15	1064	17.5	25.1
WELL 11 S	Qtr 4 2013 R	1.47	200	0.041	<0.138	20300	7.1	1266	270	6	<0.15	38.9	4	44.9
	Qtr 4 2013	0.99	330	0.063	<0.138	5790	7	714	113.9	7	<0.15	30.4	4.4	32.2
	Qtr 3 2013	2.02	0	0.194	0.871	0	7.3	467	42.2	7.6	<0.15	39.9	2	23.2
	Qtr 2 2013	1.3	0	0.028	0.483	52	7.3	589	46.6	7.1	<0.15	22.1	2.9	30.2
	Qtr 1 2013	1.65	0	0.043	0.568	100	7	566	40.9	8.1	<0.15	20	1.9	31
WELL 11D	Qtr 4 2013 R	1.83	0	0.068	0.663	100	7.4	412	10.1	8	<0.15	85.1	3.8	21.2
	Qtr 4 2013	<0.25	170	0.051	<0.138	2140	7.4	400	7.9	6	<0.15	<20	3.7	21.6
	Qtr 3 2013	0.82	0	0.053	<0.138	13	7.7	404	8.2	5.6	<0.15	<20	1.5	22.7
	Qtr 2 2013	0.62	0	0.042	<0.138	36	7.6	405	7.5	5.1	<0.15	<20	3	21.4
	Qtr 1 2013	0.79	0	0.047	<0.138	10	7.3	406	13.5	6.9	<0.15	20	1.8	21.6
WELL 16 S	Qtr 4 2013	1.11	0	0.089	1.495	150	7.5	486	18	8	<0.15	74.3	5.2	24.1
	Qtr 3 2013	1.62	0	0.225	0.153	160	7.5	480	20.1	5.8	<0.15	<20	1.7	23.4
	Qtr 2 2013	0.92	0	0.139	0.187	0	7.8	455	17.9	6.3	<0.15	48.4	3.7	20.1
	Qtr 1 2013	1.4	0	0.089	0.333	0	7.4	471	20.8	6.1	<0.15	20	2.6	21.8
WELL 16 D	Qtr 4 2013	0.37	0	0.087	<0.138	150	7.4	489	18.5	3	<0.15	79	4	20.8
	Qtr 3 2013	0.91	0	0.089	<0.138	649	7.5	511	20.2	6.1	<0.15	88.8	1.5	22.4
	Qtr 2 2013	0.29	0	0.057	<0.138	0	7.6	489	18.2	6.9	<0.15	84	3.1	20.6
	Qtr 1 2013	0.67	0	0.061	<0.138	0	7.4	490	20.5	7.6	<0.15	63.8	1.9	21.2
WELL 17 S	Qtr 4 2013	2.92	10	8.51	0.29	4610	6.8	480	14.3	7	<0.15	6443.4	6.2	24.3
	Qtr 3 2013	4.51	10	8.58	<0.138	15530	6.9	502	18.5	3.8	<0.15	9699.9	2.6	24.9
	Qtr 2 2013	3.78	0	9.632	<0.138	2006	7.2	491	14.8	6.5	<0.15	15976.6	3.9	23.6
	Qtr 1 2013	4.85	0	8.667	<0.138	100	6.9	481	16.4	6.3	<0.15	10223.6	2.7	23.5
WELL 17 D	Qtr 4 2013	1.12	10	0.382	<0.138	10	7.3	501	16.4	3	<0.15	293.4	4.4	27.2
	Qtr 3 2013	8.15	0	0.276	0.186	24210	7.5	516	18.9	7.4	<0.15	96.7	2.3	30.5
	Qtr 2 2013	0.76	0	0.266	<0.138	2	7.6	493	16.1	5.4	<0.15	260.4	3.7	27.7
	Qtr 1 2013	0.83	0	0.307	<0.138	21	7.2	503	15.8	5.8	<0.15	258.2	2.6	28.4
WELL 18	Qtr 4 2013	0.51	0	0.061	<0.138	0	7.3	486	14.8	3	<0.15	249.8	4.3	28.3
	Qtr 3 2013	1.02	0	0.042	<0.138	0	7.5	489	14.7	4.1	<0.15	263.5	2.6	29.9
	Qtr 2 2013	0.59	0	0.035	<0.138	0	7.6	481	13.5	6.3	<0.15	232.9	3.8	27.2
	Qtr 1 2013	0.6	0	0.083	<0.138	2	7.3	488	16.1	8.1	<0.15	245.8	2.3	29.2
IGV		NAC	0	0.15	NAC	0	≥6.5 &≤9.5	1000	30	NAC	0.0005	0.200	5	150

Exceedance

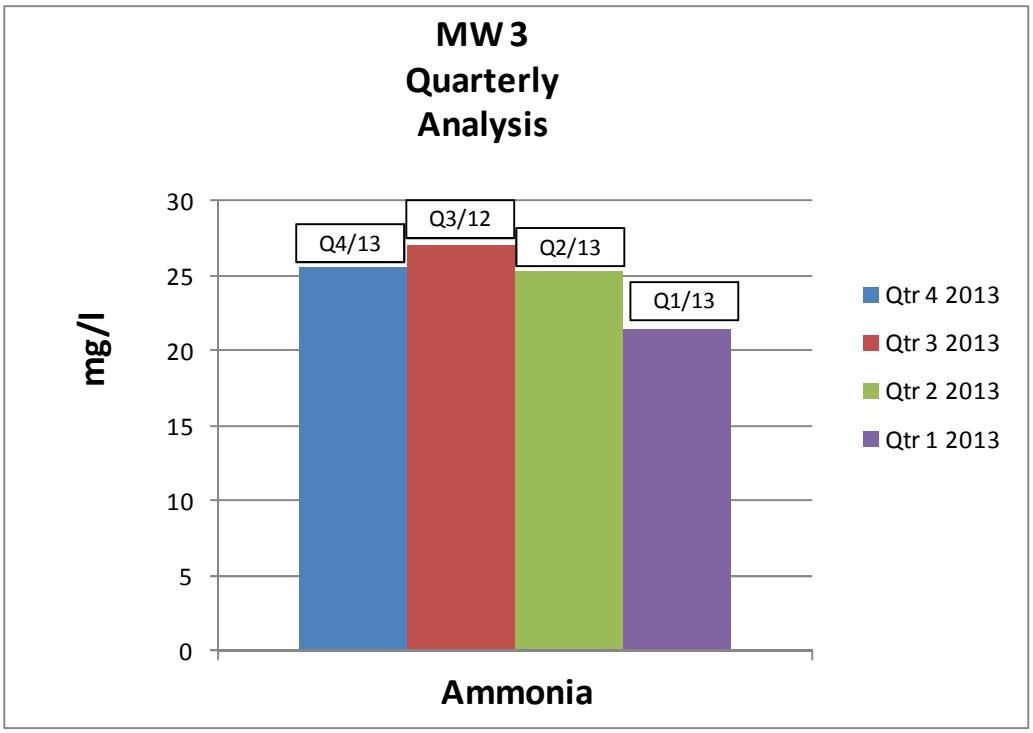
NOTES

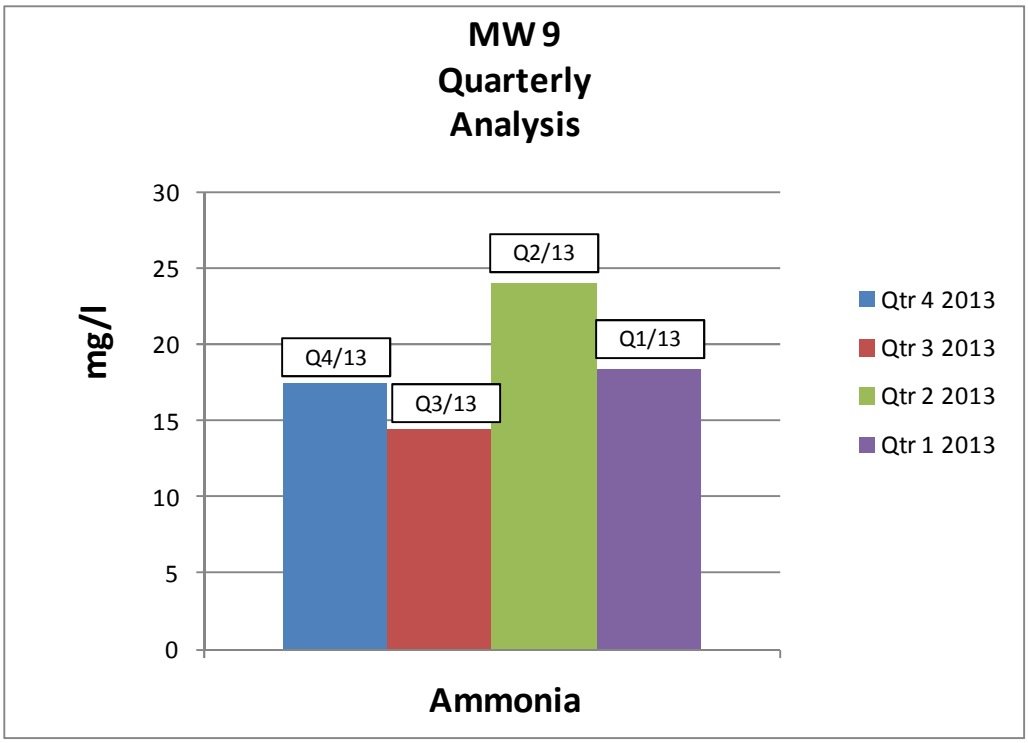
1 Sub-contract analysis denoted by *

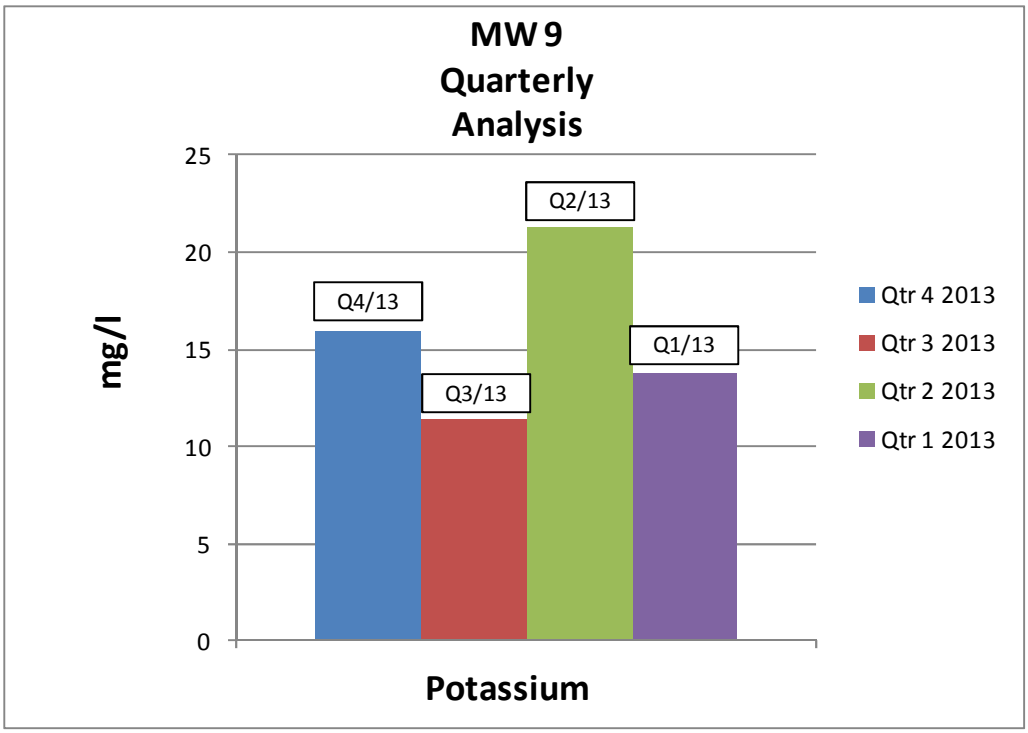
2 ND - Concentration was below the limit of detection

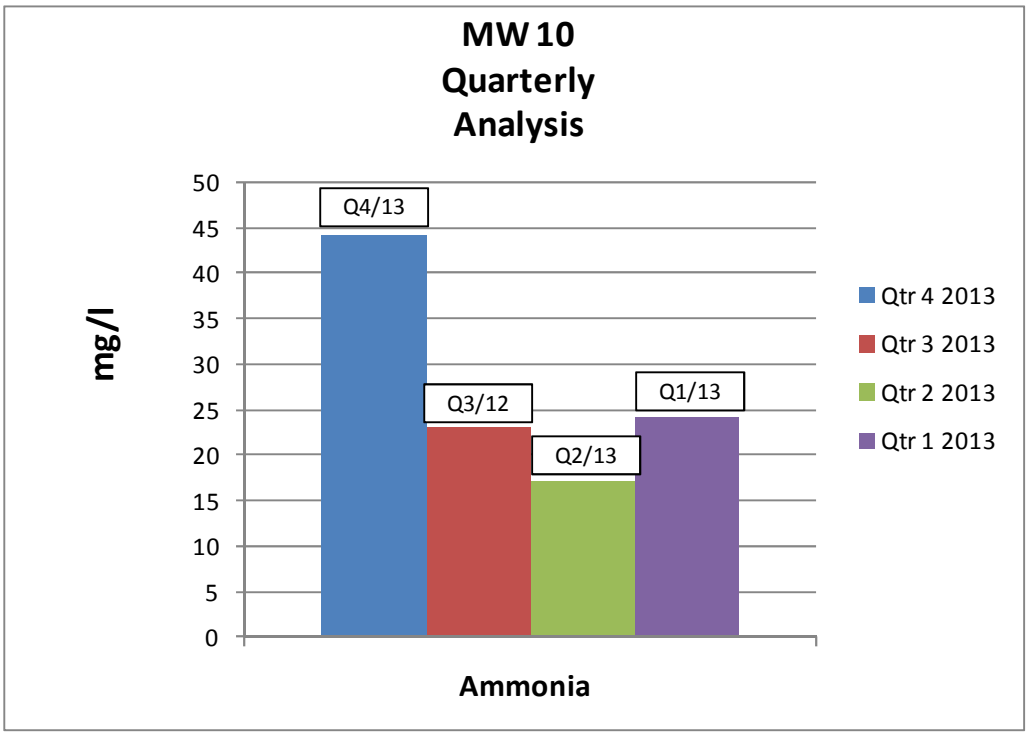
3 NAC- No Abnormal Change

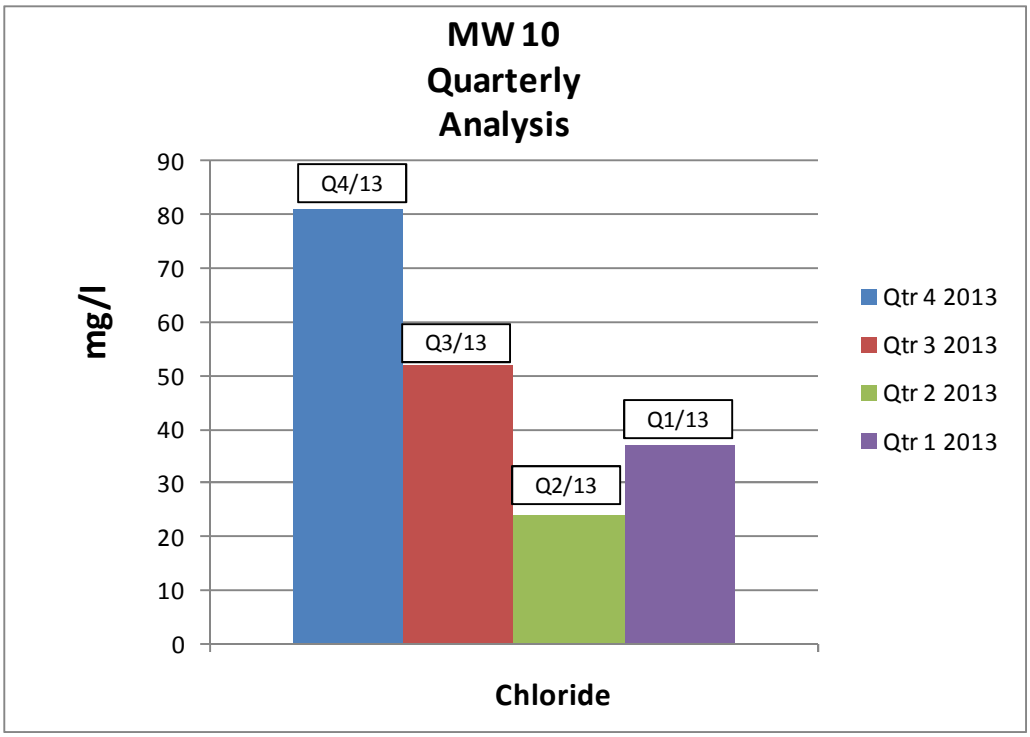
HISTORICAL DATA- CHATRS

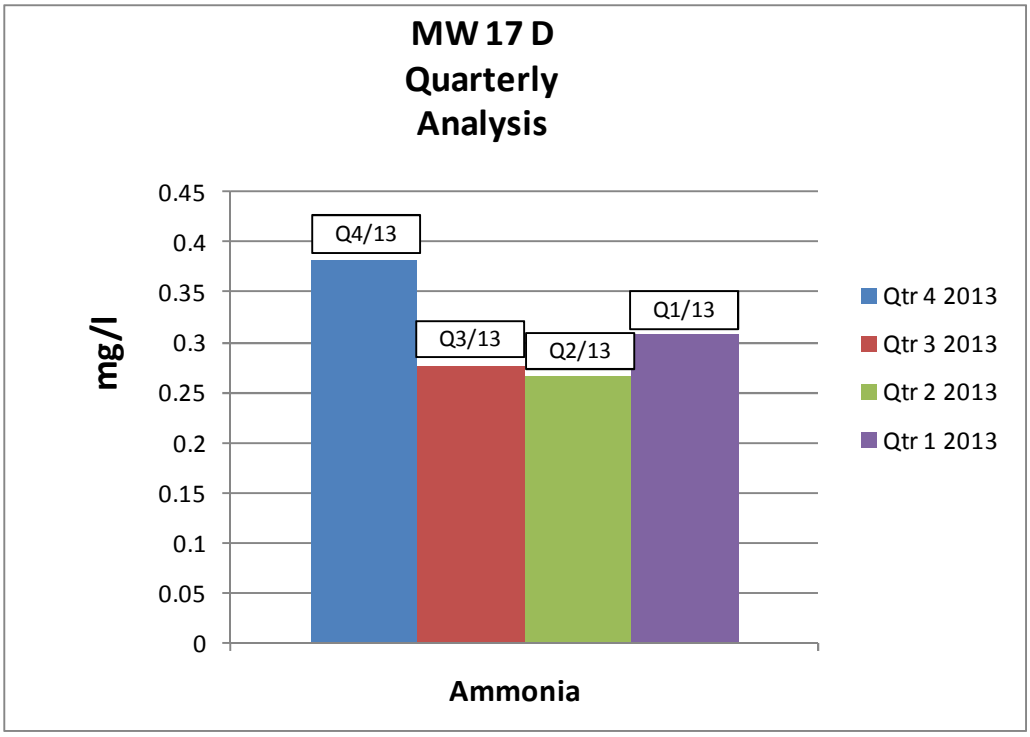


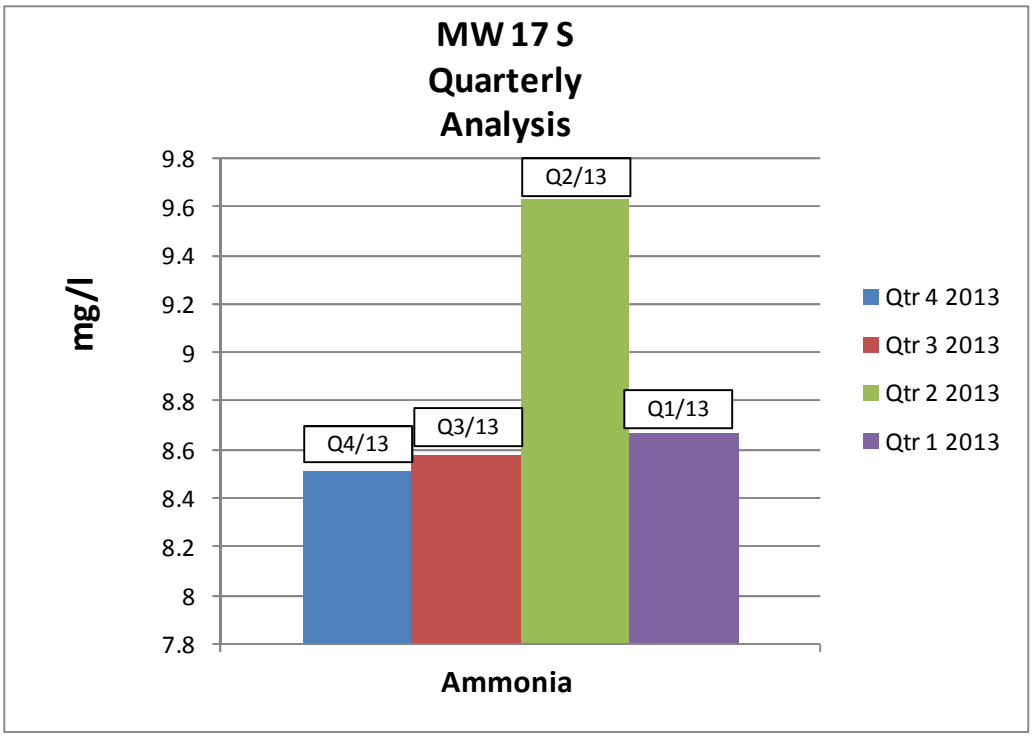


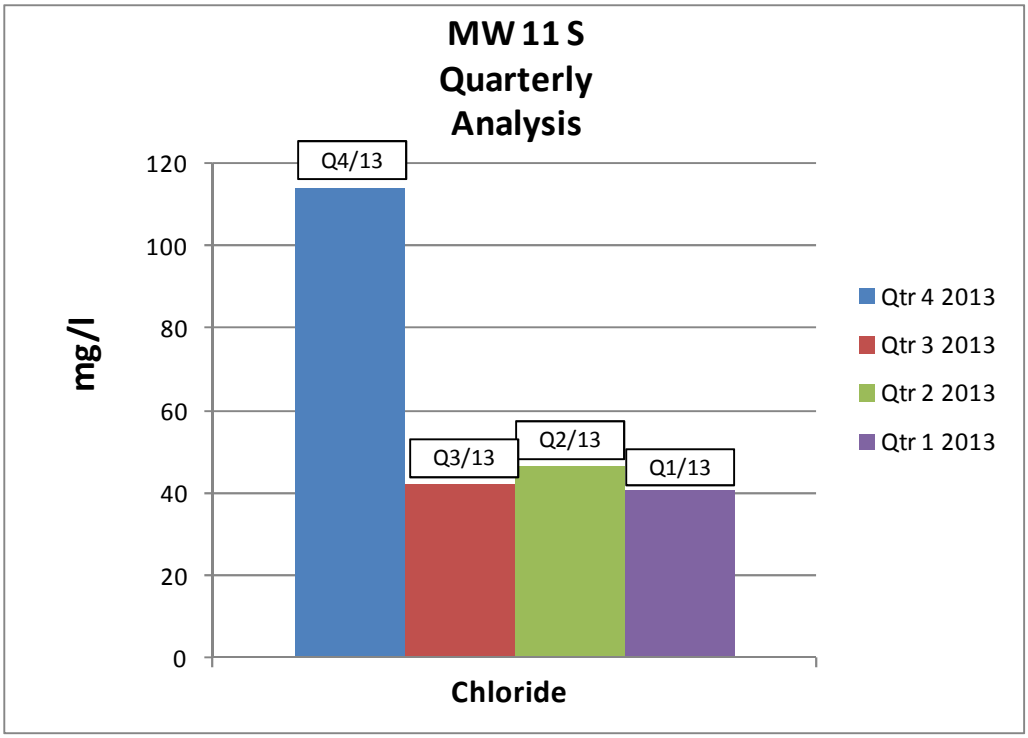

MW 9
Quarterly
Analysis
25
20
15
10
5
0
mg/l
Q4/13
Q3/13
Q2/13
Q1/13
Qtr 4 2013
Qtr 3 2013
Qtr 2 2013
Qtr 1 2013
Potassium


MW 10
Quarterly
Analysis
50
45
40
35
30
25
20
15
10
5
0
mg/l
Q4/13
Q3/12
Q2/13
Q1/13
Qtr 4 2013
Qtr 3 2013
Qtr 2 2013
Qtr 1 2013
Ammonia


MW 10
Quarterly
Analysis
90
80
70
60
50
40
30
20
10
0
mg/l
Q4/13
Q3/13
Q2/13
Q1/13
Qtr 4 2013
Qtr 3 2013
Qtr 2 2013
Qtr 1 2013
Chloride


MW 17 D
Quarterly
Analysis
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
mg/l
Q4/13
Q3/13
Q2/13
Q1/13
Qtr 4 2013
Qtr 3 2013
Qtr 2 2013
Qtr 1 2013
Ammonia


MW 17 S
Quarterly
Analysis
9.8
9.6
9.4
9.2
9
8.8
8.6
8.4
8.2
8
7.8
mg/l
Q4/13
Q3/13
Q2/13
Q1/13
Ammonia
Qtr 4 2013
Qtr 3 2013
Qtr 2 2013
Qtr 1 2013


MW 11 S
Quarterly
Analysis
120
100
80
60
40
20
0
mg/l
Q4/13
Q3/13
Q2/13
Q1/13
Chloride
Qtr 4 2013
Qtr 3 2013
Qtr 2 2013
Qtr 1 2013

APPENDIX 3- 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 EW015
Flouride 0.1 - 2 mg/l EW137
COD 8-1500 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
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 50ug/l BRO3 (EW137)
Colour 2.5-50mg/l PtCCo (EW021)
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 (EW013)
Total Dissolved Solids 1-1000mg/l (EW046)
Total Hardness 3-330mg/l CaCO3 (EM099)
Total Oxidised Nitrogen 0.138-51mg/l N (EW051)

Metals EM130 (P,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 – 20mg/l
Manganese 1.0 - 100µg/l
Mercury 0.02 - 2µg/l
Molybdenum 1.0 - 100µg/l
Nickel 0.5 - 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

SI439 Potable Water VOCs & THM EO025 (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 Ether0.5 - 35 µg/l
11 Dichloroethene0.5 - 35 µg/l
Iodomethane/Mehyl 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
Chlormethyl Cyanide 0.5 - 35 µg/l
Hexachlorobutadiene0.5 - 35 µg/l
Trans-1,2 Dichloroethene0.5 - 35 µg/l
MtBE0.5 - 35 µg/l
11 Dichloroethane0.5 - 35 µg/l
22 Dichloropropane0.5 - 35 µg/l
Cis-12 Dichloroethene0.5 - 35 µg/l
Methyl Acrylate5.0 - 35 µg/l
Bromochloromethane0.5 - 35 µg/l
Tetrahydrofuran5.0 - 35 µg/l
111 Trichloroethane0.5 - 35 µg/l
1-Chlorobutane0.5 - 35 µg/l
Carbon Tetrachloride0.5 - 35 µg/l
11 Dichloropropene0.5 - 35 µg/l
12 Dichloropropane0.5 - 35 µg/l
Dibromomethane0.5 - 35 µg/l
Methyl Methacrylate0.5 - 35 µg/l
13 Dichloropropene, cis2.0 - 35 µg/l
MIBK/4 Methyl 2 Pentanone 2.0 - 35 µg/l
Toluene0.5 - 35 µg/l
13 Dichloropropene,trans2.0 - 35 µg/l
Ethyl Methacrylate2.0 - 35 µg/l
112 Trichloroethane0.5 - 35 µg/l
13 Dichloropropane0.5 - 35 µg/l
2 Hexanone1.0 - 35 µg/l
12 Dibromoethane0.5 - 35 µg/l
Chlorobenzene0.5 - 35 µg/l
1112 Tetrachloroethane2.0 - 35 µg/l
Ethyl Benzene0.5 - 35 µg/l
m & p Xylene0.5 - 35 µg/l
O Xylene0.5 - 35 µg/l
Stryene2.0 - 35 µg/l
Isopropyl Benzene0.5 - 35 µg/l
Bromobenzene0.5 - 35 µg/l
1122 Tetrachloroethane0.5 - 35 µg/l
123 Trichloropropane2.0 - 35 µg/l
Propyl Benzene0.5 - 35 µg/l
2-Chlorotoluene0.5 - 35 µg/l
4 Chlorotoluene0.5 - 35 µg/l
135 Trimenthylbenzene0.5 - 35 µg/l
Tert Butyl Benzene0.5 - 35 µg/l
124 Trimethlbenzene0.5 - 35 µg/l
Sec Butyl Benzene0.5 - 35 µg/l
13 Dichlorobenzene0.5 - 35 µg/l
P Isopropyltoluene0.5 - 35 µg/l
14 Dichlorobenzene0.5 - 35 µg/l
12 Dichlorobenzene0.5 - 35 µg/l
N Butyl Benzene0.5 - 35 µg/l
Hexachloroethane5.0 - 35 µg/l
12 Dibromo 3Chloropropane 2.0 - 35 µg/l
124 Trichlorobenzene0.5 - 35 µg/l
123 Trichlorobenzene0.5 - 35 µg/l

PAH EO129 (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
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

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

APPENDIX 4 – FIELD SHEETS

ON SITE SAMPLING FORM

Facility Name: Ballyjamesduff | **Waste Licence No:**

Report To:

Sampling Date: 6/11/13 | **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
mw165	GW	✓	✓	519	7.64	11.9	Brown	
16D	GW	✓	✓	437	757	10.7	Clear	
175	GW	✓	✓	523	718	10.8	Grey	
17D	GW	✓	✓	497	7.52	10.3	Clear	
18	GW	✓	✓	484	7.72	10.4	Clear	
110	GW	✓	✓	413	7.69	10.9	Straw	
115	GW	✓	✓	772	7.11	11.2	Straw	
10	GW	✓	✓	1679	7.21	10.4	Grey	
SW1	SW	✓	✓	191	6.84	7.5	Straw	
SW2	SW	✓	✓	275	7.25	7.5	Straw	
3	GW	✓	✓	896	7.4	10.8	Heavy Silt	
4	GW	✓	✓	275	712	10.2	Heavy Silt	
9	GW	✓	✓	896	7.13	10.1	Heavy Silt	

COMMENTS: Discharge Cap 1 Flooded

Cavan County Council Groundwater Sampling ref.

Site Reference: Ballyjamesduff **Permit No.** **Date:** 6/11/13 **Personnel:** B Watters

Sample Ref	Depth of Well	Depth of water below Ground Level	Depth of water column	Diameter of well	Radius of well	Radius squared	Volume of water in well	Volume of water in well	Volume of water to purge	Time to purge
	(m)	(m) B	A-B=h	(m)	(m)	(m^2)	(m3) π r2h	litres	(litres x 3)	(mins)
(Shallow/Deep)	A	B		C	(C/2) = r	r^2		(m^3 x 1000)		
MW 16S	5	0.8	4.2	0.05	0.025	0.000625	0.008246	8.2425	24.7	4min
MW16D	10	0	10	0.05	0.025	0.000625	0.019625	19.625	58.87	10min
MW17S	5	0.95	4.05	0.05	0.025	0.000625	0.007948	7.948	23.8	4min
MW17D	15	0.1	14.9	0.05	0.025	0.000625	0.029241	29.24	87.72	14.6 min
MW18	21	0	21	0.05	0.025	0.000625	0.041212	41.21	123.63	20 min
MW11S	5	2.4	2.6	0.05	0.025	0.000625	0.005162	5.1025	15.307	3min
MW11D	30	11.4	18.6	0.05	0.025	0.000625	0.036502	36.50	109.50	18min
MW3	2.9	2	0.9	0.05	0.025	0.000625	0.001766	1.766	5.29	2 min
MW9	4.5	3.3	4.2	0.05	0.025	0.000625	0.008246	8.24	25.72	5min
MW4	22	0.6	1.6	0.05	0.025	0.000625	0.00314	3.14	9.42	2 min
MW10	34	2.0	1.4	0.05	0.025	0.000625	0.002749	2.747	8.242	2 min

Boylan engineering

CAVAN COUNTY COUNCIL

CLOSED LANDFILL MONITORING INTEGRITY FORM

SITE Ballyjamesduff DATE 6/11/13 PERSONNEL S. Keating

ITEM	CONDITION			COMMENTS
	GOOD	NEEDS MAINTENANCE	N/A	
GROUNDWATER MONITORING WELLS				Horses present during monitoring
-Labeled	✓			
-Well cap integrity	✓			
-Water drainage	✓			
-Locks	Some	need Replacing		
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	Some	need Replacing		
SURFACE WATER MONITORING LOCATIONS				
-Access	✓			
-Disturbance	✓			

APPENDIX 5 – CHAIN OF CUSTODY/SAMPLE SUBMISSION

els

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

SAMPLE SUBMISSION FORM

6588

DETAILS TO APPEAR ON ANALYSIS REPORT

Contract Name / Address: Ryan Hanley / Boyle Co.

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.: 105
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 (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)
7087 8 – 1	MW 16S	See QN	Full Kit	GW
9 – 2	MW16D			
10 – 3	MW 17S			
11 – 4	MW 17 D			
12 – 5	MW 18			

ONLY FIVE SAMPLES ALLOWED PER SUBMISSION SHEET

ADDITIONAL INFORMATION AND SIGNATURES

To be filled by the person submitting samples

Signature	[signature]	Phone No.	
Date	6/11/13		
No. samples submitted	11	No. of pages	2 of 5
Additional Info (if any)			

To be filled by ELS Ltd

Signature	07/11/13		
Date	[signature]	Time	
Condition	Satisfactory		Unsatisfactory -See notes above
Additional Info.			

els

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

SAMPLE SUBMISSION FORM

6590

DETAILS TO APPEAR ON ANALYSIS REPORT

Contact Name: Brena Keating
Address: Ballyantine, Mullagh, Cavan

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. WOS

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

70887

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
6- 1	mw 11S	All on		
7- 2	mw 11D			
3				
4				
5				

ONLY FIVE SAMPLES ALLOWED PER SUBMISSION SHEET

ADDITIONAL INFORMATION AND SIGNATURES

To be filled by the person submitting samples

Signature: B. Keating Phone No.:
Date: 6/11/15
No. samples submitted: 2 No. of pages: 4 of 5
Additional Info(If any):

To be filled by ELS Ltd

Signature: [illegible]
Date: 07/11/15 Time
Condition ☐ Satisfactory ☐ Unsatisfactory -See notes above
Additional Info.

NOTES FOR CUSTOMER

1. Feel free to save this submission sheet to your desktop

els

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

SAMPLE SUBMISSION FORM

DETAILS TO APPEAR ON ANALYSIS REPORT

Contact Name
Address

Customer Name:

6589

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-contra
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
70987				
1	MW 3	See ON	Full Vial	GW
2	MW 4			
3	MW 9			
4	MW 10			
5				

ONLY FIVE SAMPLES ALLOWED PER SUBMISSION SHEET

ADDITIONAL INFORMATION AND SIGNATURES

To be filled by the person submitting samples

Signature
Phone No.
Date 6/11/13
No. samples submitted 11
No. of pages 3 of 5
Additional Info(If any)

To be filled by ELS Ltd

Signature
Date 07/11/13 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**	**70987 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70987/001 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW3		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.007		25.586	mg/l N	INAB	
AQ2-UP1								
Nitrate (as N)		EW154M-1	0.12		0.20	mg/l N	INAB	
Nitrite (as N)		EW154M-1	0.013		0.062	mg/l N	INAB	
TON (as N)		EW154M-1	0.138		0.262	mg/l N	INAB	
AQ2-UP2								
Chloride		EW154M-1	2.6		25.1	mg/L	INAB	
Sulphate		EW154M-1	1.0		11.8	mg/L	INAB	
Coliforms								
Total Coliforms		MIC133	0		13000	MPN/100ml		
E. Coli		MIC133	0		200	MPN/100ml		
Dissolved Oxygen								
Dissolved Oxygen		EW043	1		6	mg/L	INAB	
Ion Chromatography								
Fluoride		EW137	0.1		0.1	mg/L	INAB	
Metals-Dissolved								
Iron-Dissolved		EM130	20.0		24222.8	ug/L	INAB	
Manganese-Dissolved		EM130	1.0		854.0	ug/L	INAB	
Boron-Dissolved		EM130	0.02		0.58	mg/L	INAB	
Cadmium-Dissolved		EM130	0.1		<0.1	ug/L	INAB	
Calcium-Dissolved		EM130	1.0		123.9	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		18.6	mg/L	INAB	
Zinc-Dissolved		EM130	1.0		72.4	ug/L	INAB	
Mercury-Dissolved		EM130	0.02		<0.02	ug/L	INAB	
Potassium-Dissolved		EM130	0.2		16.6	mg/L	INAB	
Sodium-Dissolved		EM130	0.5		27.9	mg/L	INAB	
Metals-Total								
Chromium-Total		EM130	1.0		20.3	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		1044.0	mg/L		

Signed : _____ 27/11/2013

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

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Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70987/001 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW3		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Titralab									
	pH		EW153	0.0		6.9	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		898	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		429	mg/L CaCO3	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	10		<10	ug/L	YES	
	<9								
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		12.19	mg/L	INAB	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		1.88	mg/l P	INAB	

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DETAILED IN SCOPE REG NO. 111T

Contact Name	Cathal Boylan	**Report Number**	**70987 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70987/002 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW4		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.007		2.669	mg/l N	INAB	
AQ2-UP1								
Nitrate (as N)		EW154M-1	0.12		0.28	mg/l N	INAB	
Nitrite (as N)		EW154M-1	0.013		<0.013	mg/l N	INAB	
TON (as N)		EW154M-1	0.138		0.291	mg/l N	INAB	
AQ2-UP2								
Chloride		EW154M-1	2.6		18.8	mg/L	INAB	
Sulphate		EW154M-1	1.0		43.9	mg/L	INAB	
Coliforms								
Total Coliforms		MIC133	0		104600	MPN/100ml		
E. Coli		MIC133	0		2300	MPN/100ml		
Dissolved Oxygen								
Dissolved Oxygen		EW043	1		3	mg/L	INAB	
Ion Chromatography								
Fluoride		EW137	0.1		<0.1	mg/L	INAB	
Metals-Dissolved								
Iron-Dissolved		EM130	20.0		592.5	ug/L	INAB	
Manganese-Dissolved		EM130	1.0		510.5	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		37.6	mg/L	INAB	
Copper-Dissolved		EM130	0.003		<0.003	mg/L	INAB	
Lead-Dissolved		EM130	0.3		0.9	ug/L	INAB	
Magnesium-Dissolved		EM130	0.3		5.9	mg/L	INAB	
Zinc-Dissolved		EM130	1.0		150.1	ug/L	INAB	
Mercury-Dissolved		EM130	0.02		<0.02	ug/L	INAB	
Potassium-Dissolved		EM130	0.2		12.2	mg/L	INAB	
Sodium-Dissolved		EM130	0.5		12.5	mg/L	INAB	
Metals-Total								
Chromium-Total		EM130	1.0		157.5	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		6826.0	mg/L		
Titralab								

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Contact Name	Cathal Boylan	**Report Number**	**70987 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70987/002 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW4		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Titralab									
	pH		EW153	0.0		7.1	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		272	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		119	mg/L CaCO3	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	10		<10	ug/L	YES	
	<9								
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		11.63	mg/L	INAB	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		1.48	mg/l P	INAB	

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DETAILED IN SCOPE REG NO. 111T

Contact Name	Cathal Boylan	**Report Number**	**70987 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70987/003 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW9		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.007		17.459	mg/l N	INAB	
AQ2-UP1								
Nitrate (as N)		EW154M-1	0.12		0.15	mg/l N	INAB	
Nitrite (as N)		EW154M-1	0.013		<0.013	mg/l N	INAB	
TON (as N)		EW154M-1	0.138		0.155	mg/l N	INAB	
AQ2-UP2								
Chloride		EW154M-1	2.6		15.3	mg/L	INAB	
Sulphate		EW154M-1	1.0		1.1	mg/L	INAB	
Coliforms								
Total Coliforms		MIC133	0		1700	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		<0.1	mg/L	INAB	
Metals-Dissolved								
Iron-Dissolved		EM130	20.0		19405.8	ug/L	INAB	
Manganese-Dissolved		EM130	1.0		2131.6	ug/L	INAB	
Boron-Dissolved		EM130	0.02		0.07	mg/L	INAB	
Cadmium-Dissolved		EM130	0.1		<0.1	ug/L	INAB	
Calcium-Dissolved		EM130	1.0		148.2	mg/L	INAB	
Copper-Dissolved		EM130	0.003		<0.003	mg/L	INAB	
Lead-Dissolved		EM130	0.3		0.8	ug/L	INAB	
Magnesium-Dissolved		EM130	0.3		36.0	mg/L	INAB	
Zinc-Dissolved		EM130	1.0		26.1	ug/L	INAB	
Mercury-Dissolved		EM130	0.02		<0.02	ug/L	INAB	
Potassium-Dissolved		EM130	0.2		15.9	mg/L	INAB	
Sodium-Dissolved		EM130	0.5		19.8	mg/L	INAB	
Metals-Total								
Chromium-Total		EM130	1.0		18.3	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		1018.0	mg/L		
Titralab								

Signed : _____ 27/11/2013

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

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Contact Name	Cathal Boylan	**Report Number**	**70987 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70987/003 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW9		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Titralab									
	pH		EW153	0.0		6.9	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		985	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		491	mg/L CaCO3	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	10		<10	ug/L	YES	
	<9								
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		12.73	mg/L	INAB	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		0.43	mg/l P	INAB	

Signed : _____ 27/11/2013

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DETAILED IN SCOPE REG NO. 111T

Contact Name	Cathal Boylan	**Report Number**	**70987 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70987/004 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW10		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.007		44.059	mg/l N	INAB	
AQ2-UP1								
Nitrate (as N)		EW154M-1	0.12		0.60	mg/l N	INAB	
Nitrite (as N)		EW154M-1	0.013		<0.013	mg/l N	INAB	
TON (as N)		EW154M-1	0.138		0.603	mg/l N	INAB	
AQ2-UP2								
Chloride		EW154M-1	2.6		81.0	mg/L	INAB	
Sulphate		EW154M-1	1.0		26.4	mg/L	INAB	
Coliforms								
Total Coliforms		MIC133	0		11300	MPN/100ml		
E. Coli		MIC133	0		0	MPN/100ml		
Dissolved Oxygen								
Dissolved Oxygen		EW043	1		10	mg/L	INAB	
Ion Chromatography								
Fluoride		EW137	0.1		<0.1	mg/L	INAB	
Metals-Dissolved								
Iron-Dissolved		EM130	20.0		130.8	ug/L	INAB	
Manganese-Dissolved		EM130	1.0		2001.4	ug/L	INAB	
Boron-Dissolved		EM130	0.02		0.31	mg/L	INAB	
Cadmium-Dissolved		EM130	0.1		<0.1	ug/L	INAB	
Calcium-Dissolved		EM130	1.0		184.3	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		29.3	mg/L	INAB	
Zinc-Dissolved		EM130	1.0		106.0	ug/L	INAB	
Mercury-Dissolved		EM130	0.02		<0.02	ug/L	INAB	
Potassium-Dissolved		EM130	0.2		29.3	mg/L	INAB	
Sodium-Dissolved		EM130	0.5		53.5	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		826.0	mg/L		
Titralab								

Signed : _____ 27/11/2013

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

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Contact Name	Cathal Boylan	**Report Number**	**70987 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70987/004 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW10		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Titralab									
	pH		EW153	0.0		7.2	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		1344	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		582	mg/L CaCO3	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	10		<10	ug/L	YES	
	<9								
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		15.23	mg/L	INAB	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		0.13	mg/l P	INAB	

Signed : _____ 27/11/2013

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

Contact Name	Cathal Boylan	**Report Number**	**70987 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70987/005 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW11S		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.007		0.063	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		113.9	mg/L	INAB	
Sulphate		EW154M-1	1.0		29.8	mg/L	INAB	
Coliforms								
Total Coliforms		MIC133	0		5790	MPN/100ml		
E. Coli		MIC133	0		330	MPN/100ml		
Dissolved Oxygen								
Dissolved Oxygen		EW043	1		7	mg/L	INAB	
Ion Chromatography								
Fluoride		EW137	0.1		0.2	mg/L	INAB	
Metals-Dissolved								
Iron-Dissolved		EM130	20.0		30.4	ug/L	INAB	
Manganese-Dissolved		EM130	1.0		106.3	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		81.0	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		26.6	mg/L	INAB	
Zinc-Dissolved		EM130	1.0		362.8	ug/L	INAB	
Mercury-Dissolved		EM130	0.02		<0.02	ug/L	INAB	
Potassium-Dissolved		EM130	0.2		4.4	mg/L	INAB	
Sodium-Dissolved		EM130	0.5		32.2	mg/L	INAB	
Metals-Total								
Chromium-Total		EM130	1.0		11.3	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		616.0	mg/L		
Titralab								

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

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Contact Name	Cathal Boylan	**Report Number**	**70987 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number**	70987/005
		Date of Receipt	07/11/2013
		Date Started	07/11/2013
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	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW11S		

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		714	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		87	ug/L	YES	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		0.99	mg/L	INAB	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		0.10	mg/l P	INAB	

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Contact Name	Cathal Boylan	**Report Number**	**70987 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70987/006 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW11D		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.007		0.051	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		7.9	mg/L	INAB	
Sulphate		EW154M-1	1.0		13.6	mg/L	INAB	
Coliforms								
Total Coliforms		MIC133	0		2140	MPN/100ml		
E. Coli		MIC133	0		170	MPN/100ml		
Dissolved Oxygen								
Dissolved Oxygen		EW043	1		6	mg/L	INAB	
Ion Chromatography								
Fluoride		EW137	0.1		0.2	mg/L	INAB	
Metals-Dissolved								
Iron-Dissolved		EM130	20.0		<20.0	ug/L	INAB	
Manganese-Dissolved		EM130	1.0		120.5	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		53.6	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		11.9	mg/L	INAB	
Zinc-Dissolved		EM130	1.0		6.6	ug/L	INAB	
Mercury-Dissolved		EM130	0.02		<0.02	ug/L	INAB	
Potassium-Dissolved		EM130	0.2		3.7	mg/L	INAB	
Sodium-Dissolved		EM130	0.5		21.6	mg/L	INAB	
Metals-Total								
Chromium-Total		EM130	1.0		2.2	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		288.0	mg/L		
Titralab								

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Contact Name	Cathal Boylan	**Report Number**	**70987 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70987/006 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW11D		

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		400	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		210	mg/L CaCO3	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	10		<10	ug/L	YES	
	<9								
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		<0.25	mg/L	INAB	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		0.06	mg/l P	INAB	

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Contact Name	Cathal Boylan	**Report Number**	**70987 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70987/007 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW16S		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.007		0.089	mg/l N	INAB	
AQ2-UP1								
Nitrate (as N)		EW154M-1	0.12		1.49	mg/l N	INAB	
Nitrite (as N)		EW154M-1	0.013		<0.013	mg/l N	INAB	
TON (as N)		EW154M-1	0.138		1.495	mg/l N	INAB	
AQ2-UP2								
Chloride		EW154M-1	2.6		18.0	mg/L	INAB	
Sulphate		EW154M-1	1.0		54.1	mg/L	INAB	
Coliforms								
Total Coliforms		MIC133	0		150	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		74.3	ug/L	INAB	
Manganese-Dissolved		EM130	1.0		102.8	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		71.0	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		12.7	mg/L	INAB	
Zinc-Dissolved		EM130	1.0		3.0	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		24.1	mg/L	INAB	
Metals-Total								
Chromium-Total		EM130	1.0		48.9	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		720.0	mg/L		
Titralab								

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Contact Name	Cathal Boylan	**Report Number**	**70987 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70987/007 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW16S		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Titralab									
	pH		EW153	0.0		7.5	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		486	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		203	mg/L CaCO3	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	10		<10	ug/L	YES	
	<9								
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		1.11	mg/L	INAB	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		0.20	mg/l P	INAB	

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Contact Name	Cathal Boylan	**Report Number**	**70987 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70987/008 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW16D		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.007		0.087	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		18.5	mg/L	INAB	
Sulphate		EW154M-1	1.0		65.7	mg/L	INAB	
Coliforms								
Total Coliforms		MIC133	0		150	MPN/100ml		
E. Coli		MIC133	0		0	MPN/100ml		
Dissolved Oxygen								
Dissolved Oxygen		EW043	1		3	mg/L	INAB	
Ion Chromatography								
Fluoride		EW137	0.1		0.2	mg/L	INAB	
Metals-Dissolved								
Iron-Dissolved		EM130	20.0		79.0	ug/L	INAB	
Manganese-Dissolved		EM130	1.0		921.0	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		75.3	mg/L	INAB	
Copper-Dissolved		EM130	0.003		<0.003	mg/L	INAB	
Lead-Dissolved		EM130	0.3		0.8	ug/L	INAB	
Magnesium-Dissolved		EM130	0.3		13.3	mg/L	INAB	
Zinc-Dissolved		EM130	1.0		17.7	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		20.8	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		334.0	mg/L		
Titralab								

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Contact Name	Cathal Boylan	**Report Number**	**70987 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70987/008 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW16D		

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		489	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		184	mg/L CaCO3	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	10		<10	ug/L	YES	
	<9								
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		0.37	mg/L	INAB	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		0.02	mg/l P	INAB	

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Contact Name	Cathal Boylan	**Report Number**	**70987 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70987/009 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW17S		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.007		8.510	mg/l N	INAB	
AQ2-UP1								
Nitrate (as N)		EW154M-1	0.12		0.28	mg/l N	INAB	
Nitrite (as N)		EW154M-1	0.013		<0.013	mg/l N	INAB	
TON (as N)		EW154M-1	0.138		0.290	mg/l N	INAB	
AQ2-UP2								
Chloride		EW154M-1	2.6		14.3	mg/L	INAB	
Sulphate		EW154M-1	1.0		21.6	mg/L	INAB	
Coliforms								
Total Coliforms		MIC133	0		4610	MPN/100ml		
E. Coli		MIC133	0		10	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		6443.4	ug/L	INAB	
Manganese-Dissolved		EM130	1.0		847.8	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		60.4	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		11.7	mg/L	INAB	
Zinc-Dissolved		EM130	1.0		2.9	ug/L	INAB	
Mercury-Dissolved		EM130	0.02		<0.02	ug/L	INAB	
Potassium-Dissolved		EM130	0.2		6.2	mg/L	INAB	
Sodium-Dissolved		EM130	0.5		24.3	mg/L	INAB	
Metals-Total								
Chromium-Total		EM130	1.0		28.3	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		760.0	mg/L		
Titralab								

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Contact Name	Cathal Boylan	**Report Number**	**70987 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70987/009 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW17S		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Titralab									
	pH		EW153	0.0		6.8	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		480	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		224	mg/L CaCO3	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	10		<10	ug/L	YES	
	<9								
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		2.92	mg/L	INAB	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		0.52	mg/l P	INAB	

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Contact Name	Cathal Boylan	**Report Number**	**70987 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70987/010 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW17D		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.007		0.382	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		16.4	mg/L	INAB	
Sulphate		EW154M-1	1.0		22.9	mg/L	INAB	
Coliforms								
Total Coliforms		MIC133	0		10	MPN/100ml		
E. Coli		MIC133	0		10	MPN/100ml		
Dissolved Oxygen								
Dissolved Oxygen		EW043	1		3	mg/L	INAB	
Ion Chromatography								
Fluoride		EW137	0.1		0.1	mg/L	INAB	
Metals-Dissolved								
Iron-Dissolved		EM130	20.0		293.4	ug/L	INAB	
Manganese-Dissolved		EM130	1.0		1134.6	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		67.5	mg/L	INAB	
Copper-Dissolved		EM130	0.003		<0.003	mg/L	INAB	
Lead-Dissolved		EM130	0.3		0.6	ug/L	INAB	
Magnesium-Dissolved		EM130	0.3		14.7	mg/L	INAB	
Zinc-Dissolved		EM130	1.0		27.3	ug/L	INAB	
Mercury-Dissolved		EM130	0.02		<0.02	ug/L	INAB	
Potassium-Dissolved		EM130	0.2		4.4	mg/L	INAB	
Sodium-Dissolved		EM130	0.5		27.2	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		300.0	mg/L		
Titralab								

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Contact Name	Cathal Boylan	**Report Number**	**70987 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70987/010 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW17D		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Titralab									
	pH		EW153	0.0		7.3	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		501	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		242	mg/L CaCO3	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	10		<10	ug/L	YES	
	<9								
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		1.12	mg/L	INAB	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		0.04	mg/l P	INAB	

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Contact Name	Cathal Boylan	**Report Number**	**70987 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70987/011 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW18		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia									
	Ammonia (as N)		EW154M-1	0.007		0.061	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		14.8	mg/L	INAB	
	Sulphate		EW154M-1	1.0		26.5	mg/L	INAB	
Coliforms									
	Total Coliforms		MIC133	0		0	MPN/100ml		
	E. Coli		MIC133	0		0	MPN/100ml		
Dissolved Oxygen									
	Dissolved Oxygen		EW043	1		3	mg/L	INAB	
Ion Chromatography									
	Fluoride		EW137	0.1		0.1	mg/L	INAB	
Metals-Dissolved									
	Iron-Dissolved		EM130	20.0		249.8	ug/L	INAB	
	Manganese-Dissolved		EM130	1.0		711.7	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		65.5	mg/L	INAB	
	Copper-Dissolved		EM130	0.003		<0.003	mg/L	INAB	
	Lead-Dissolved		EM130	0.3		0.5	ug/L	INAB	
	Magnesium-Dissolved		EM130	0.3		14.8	mg/L	INAB	
	Zinc-Dissolved		EM130	1.0		20.6	ug/L	INAB	
	Mercury-Dissolved		EM130	0.02		<0.02	ug/L	INAB	
	Potassium-Dissolved		EM130	0.2		4.3	mg/L	INAB	
	Sodium-Dissolved		EM130	0.5		28.3	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		292.0	mg/L		
Titralab									

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Contact Name	Cathal Boylan	**Report Number**	**70987 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70987/011 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW18		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Titralab									
	pH		EW153	0.0		7.3	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		486	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		233	mg/L CaCO3	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	10		<10	ug/L	YES	
	<9								
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		0.51	mg/L	INAB	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		0.01	mg/l P	INAB	

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

Contact Name	Cathal Boylan	**Report Number**	**72442 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	72442/001 14/01/2014 14/01/2014
Tel No	046 9286000	**Received or Collected**	An Post
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	28/01/2014
Quotation No	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW11S		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.007		0.041	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		270.0	mg/L	INAB	
Sulphate		EW154M-1	1.0		55.4	mg/L	INAB	
Coliforms								
Total Coliforms		MIC133	0		20300	MPN/100ml		
E. Coli		MIC133	0		200	MPN/100ml		
Dissolved Oxygen								
Dissolved Oxygen		EW043	1		6	mg/L	INAB	
Ion Chromatography								
Fluoride		EW137	0.1		<0.1	mg/L	INAB	
Metals-Dissolved								
Iron-Dissolved		EM130	20.0		58.0	ug/L	INAB	
Manganese-Dissolved		EM130	1.0		38.9	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		158.9	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		47.9	mg/L	INAB	
Zinc-Dissolved		EM130	1.0		29.8	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		44.9	mg/L	INAB	
Metals-Total								
Chromium-Total		EM130	1.0		92.8	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		2848.0	mg/L		

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

Contact Name	Cathal Boylan	**Report Number**	**72442 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number**	72442/001
		Date of Receipt	14/01/2014
		Date Started	14/01/2014
Tel No	046 9286000	**Received or Collected**	An Post
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	28/01/2014
Quotation No	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW11S		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Temperature (Site)									
	Temperature (Site)		Default	0.0		Not Analyzed	Deg C		
Titralab									
	pH		EW153	0.0		7.1	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		1266	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		284	mg/L CaCO3	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	10		15	ug/L	YES	
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		1.47	mg/L	INAB	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		0.76	mg/l P	INAB	

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

Contact Name	Cathal Boylan	**Report Number**	**72442 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	72442/002 14/01/2014 14/01/2014
Tel No	046 9286000	**Received or Collected**	An Post
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	28/01/2014
Quotation No	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW11D		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.007		0.068	mg/l N	INAB	
AQ2-UP1								
Nitrate (as N)		EW154M-1	0.12		0.66	mg/l N	INAB	
Nitrite (as N)		EW154M-1	0.013		<0.013	mg/l N	INAB	
TON (as N)		EW154M-1	0.138		0.663	mg/l N	INAB	
AQ2-UP2								
Chloride		EW154M-1	2.6		10.1	mg/L	INAB	
Sulphate		EW154M-1	1.0		13.5	mg/L	INAB	
Coliforms								
Total Coliforms		MIC133	0		100	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		22.1	ug/L	INAB	
Manganese-Dissolved		EM130	1.0		85.1	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		56.2	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		12.7	mg/L	INAB	
Zinc-Dissolved		EM130	1.0		9.2	ug/L	INAB	
Mercury-Dissolved		EM130	0.02		<0.02	ug/L	INAB	
Potassium-Dissolved		EM130	0.2		3.8	mg/L	INAB	
Sodium-Dissolved		EM130	0.5		21.2	mg/L	INAB	
Metals-Total								
Chromium-Total		EM130	1.0		5.0	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		350.0	mg/L		
Temperature (Site)								

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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**	**72442 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number**	72442/002
		Date of Receipt	14/01/2014
		Date Started	14/01/2014
Tel No	046 9286000	**Received or Collected**	An Post
Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	28/01/2014
Quotation No	QN000405	**Sample Type**	Ground Waters
Customer Ref	MW11D		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Temperature (Site)									
	Temperature (Site)		Default	0.0		Not Analyzed	Deg C		
Titralab									
	pH		EW153	0.0		7.4	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		412	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		201	mg/L CaCO3	INAB	
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	10		Analyst Comment	ug/L	YES	
	Result <9ug/L								
Total Organic Carbon (TOC)									
	Total Organic Carbon (TOC)		EW123	0.25		1.83	mg/L	INAB	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		0.16	mg/l P	INAB	

Signed : _____ 28/01/2014

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

SURFACE WATER MONITORING REPORT FOR BALLYJAMESDUFF LANDFILL W0093-01

Client: **Cavan County Council**

Site Location: **Derrylurgan, Ballyjamesduff**

Report No.: CCC-03-01-03-04-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
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 Environmental Monitoring at Ballyjamesduff Landfill (W0093-01), Derrylurgan, Ballyjamesduff, 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. 0 INTRODUCTION

Ballyjamesduff landfill is situated approximately 600m from Ballyjamesduff town centre in the town land of Derrylurgan. The site was in operation from the 1960's and comprises some 1.62 hectares. The site was originally peat land which was stripped for commercial purposes and was then operated as a traditional landfill until its closure in March 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 two 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, Ballyjamesduff 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. 0 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 3.

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	94.92	91.72	3.2	N291352.31 E252020.68
MW2	Gas	92.92	90.82	2.1	N291377.38 E252082.84
MW3	GW	94.39	92.39	2.0	N291369.28 E252109.44
MW4	GW	93.65	93.05	0.6	N291309.78 E252129.14
MW8	Leachate	96.56	-	TBC	N291346.99 E252041.22
MW9	GW	95.69	92.39	3.3	N291369.67 E252103.93
MW10	GW	93.95	91.95	2.0	N291314.86 E252138.12
MW11S	GW	TBC	-	2.4	TBC
MW11D	GW	TBC	-	11.4	TBC
MW12	Gas	94.38	-	n/a	N291236.30 E252110.10
MW14	Gas	98.77	-	n/a	N291263.92 E252131.54
MW16S	GW	94.02	93.22	0.8	N252076.89 E291174.65
MW16D	GW	94.16	94.16	0.0	N252077.36 E291173.27
MW17S	GW	93.59	92.64	1.0	N251997.04 E291377.19
MW17D	GW	93.63	93.63	0.0	N251997.80 E291376.00
MW18	GW	93.5	93.5	0.0	N251986.57 E291425.39
SW1	SW	n/a	-	n/a	TBC
SW2	SW	n/a	-	n/a	TBC
Cap	SW	n/a	-	n/a	TBC

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)**				
06/11/2013	1	7.9	3.1	0.3	5.5		

3.0 SUMMARY OF RESULTS

Table 1.0 04th Quarter Surface water monitoring 2013

Report Number		70990													
Monitoring Date		06/11/2013													
Method		**Site Tests**	**Site Tests**	**Site Tests**	**Site Tests**	**Ammonia**	**Titralab**	**Titralab**	**BOD**	**COD**	**Suspended Solids**	**AQ2-UP2**	**Dissolved Oxygen**	**Total Phosphorus-TP**	**AQ2-UP1**
Method Number		**Site Tests**	**Site Tests**	**Site Tests**	**Site Tests**	**EW003**	**EW138**	**EW139**	**EW001**	**EW094**	**EW013**	**EW015**	**EW043**	**EW146**	**EW154M**
Parameter		Sample temperature (to be done onsite)	Cond	pH	Visual Inspection	Ammonia	pH	Cond	BOD	COD	Suspended Solids	Cl	DO	Total Phosphorus-TP	TON (as N)(Calc)
Units		Deg C	us/cm	pH units	-	mg/l N	pH Units	uscm-1@20	mg/L	mg/L	mg/L	mg/L	mg/L	mg/l P	mg/l N
Limit of Detection		-	-	-	-	0.007	0.3	25	1	8	5	2.6	1.0	0.01	0.138
Date Testing		6.11.13				7.11.13									
ELS Ref	**Client Ref**														
70990/001	SW 1	7.5	191	6.84	Clear	0.081	6.8	189	<1	43	10	14.9	10	0.11	0.694
70990/002	SW 2	7.5	275	7.25	Clear	0.031	7.2	273	6	41	17	27.3	11	0.08	<0.138
S.I No. 294/1989						0.2	≥5.5 and ≤8.5	1000	5	40		250			NAC

Method		**Titralab**	**AQ2-UP2**	**Total Metals**	**Metals-Dissolved**										
Method Number		**EW153**	**EW154M-1**	**EM130**											
Parameter		Alkalinity Total (R2 pH4.5)	Sulphate	Chromium-Total	Iron-Dissolved	Manganese-Dissolved	Potassium-Dissolved	Sodium-Dissolved	Cadmium-Dissolved	Calcium-Dissolved	Copper-Dissolved	Lead-Dissolved	Magnesium-Dissolved	Mercury-Dissolved	Zinc-Dissolved
Units		mg/L CaCO3	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
Limit of Detection		10	1	1	20	1	0.2	0.5	0.1	1	0.003	0.3	0.3	0.02	1
Date Testing		07.11.13													
ELS Ref	**Client Ref**														
70990/001	SW 1	64	15.7	1.1	372.2	83.1	11.3	9.2	<0.1	24	0.003	<0.3	4.1	<0.02	60.3
70990/002	SW 2	92	19.1	<1	158.3	16.3	15.1	13	<0.1	29.3	0.003	<0.3	5.6	<0.02	10.2
S.I No. 294/1989		NAC	200	30	1000	300		150	5		0.03	10		1	100

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 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 and at SW2. The discharge cap was flooded with water from the adjoining river and so a sample could not be attained. When results were compared to the EQS standards marginal exceedances for BOD and COD were found. These exceedance were

With regard to all surface water samples, all results were within specified limits.
Historical results for comparison purposes are presented in tabular and graphic form in Appendix 1.

5.0 CONCLUSION

The surface results obtained are relatively consistent with previous monitoring events and do not show any signs of exceedences. Therefore there is no evidence of any major negative environmental impact associated with this landfill. Information relating to previous results can be seen in the historical data tables in Appendix 1.

APPENDIX 1- HISTORICAL DATA

	Parameter	Ammonia	pH	Cond	BOD	COD	Total Suspended Solids	Cl	DO
	Units	mg/l N	pH Units	us/cm	mg/l	mg/l	mg/l	mg/l	mg/l
SW1	Qtr 4 2013	0.081	6.8	189	<1	43	10	14.9	10
	Qtr 2 2013	0.041	7.6	200	<1	32	15	15.6	9.9
	Qtr 4 2012	0.06	6.8	127	5	52	16	8.7	9.2
	Qtr 1 2012	0.10	7.2	198	<1.0	37	15	15.1	10.5
SW2	Qtr 4 2013	0.031	7.2	273	6	41	17	27.3	11
	Qtr 2 2013	0.028	7.7	270	<1	36	<5	<2.6	8.3
	Qtr 4 2012	0.05	7.1	126	6	52	75	9.6	8.8
	Qtr 1 2012	0.13	7.2	201	<1.0	23	<5	15.2	10.4
Discharge Cap	Qtr 4 2013	-	-	-	-	-	-	-	-
	Qtr 2 2013	0.089	7.5	206	<1	33	17	15.8	9.9
	Qtr 4 2012	-	-	-	-	-	-	-	-
	Qtr 1 2012	0.12	7.3	432	<1.0	29	<5	7.3	6.6
S.I No. 294/1989 A1		0.2	≥5.5 and ≤8.5	1000	5		50	250	>60%

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 EW015
Flouride 0.1 - 2 mg/l EW137
COD 8-1500 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
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 50ug/l BRO3 (EW137)
Colour 2.5-50mg/l PtCCo (EW021)
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 (EW013)
Total Dissolved Solids 1-1000mg/l (EW046)
Total Hardness 3-330mg/l CaCO3 (EM099)
Total Oxidised Nitrogen 0.138-51mg/l N (EW051)

Metals EM130 (P,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 – 20mg/l
Manganese 1.0 - 100µg/l
Mercury 0.02 - 2µg/l
Molybdenum 1.0 - 100µg/l
Nickel 0.5 - 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

SI439 Potable Water VOCs & THM EO025 (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 Ether0.5 - 35 µg/l
11 Dichloroethene0.5 - 35 µg/l
Iodomethane/Mehyl 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
Chlormethyl Cyanide 0.5 - 35 µg/l
Hexachlorobutadiene0.5 - 35 µg/l
Trans-1,2 Dichloroethene0.5 - 35 µg/l
MtBE0.5 - 35 µg/l
11 Dichloroethane0.5 - 35 µg/l
22 Dichloropropane0.5 - 35 µg/l
Cis-12 Dichloroethene0.5 - 35 µg/l
Methyl Acrylate5.0 - 35 µg/l
Bromochloromethane0.5 - 35 µg/l
Tetrahydrofuran5.0 - 35 µg/l
111 Trichloroethane0.5 - 35 µg/l
1-Chlorobutane0.5 - 35 µg/l
Carbon Tetrachloride0.5 - 35 µg/l
11 Dichloropropene0.5 - 35 µg/l
12 Dichloropropane0.5 - 35 µg/l
Dibromomethane0.5 - 35 µg/l
Methyl Methacrylate0.5 - 35 µg/l
13 Dichloropropene, cis2.0 - 35 µg/l
MIBK/4 Methyl 2 Pentanone 2.0 - 35 µg/l
Toluene0.5 - 35 µg/l
13 Dichloropropene,trans2.0 - 35 µg/l
Ethyl Methacrylate2.0 - 35 µg/l
112 Trichloroethane0.5 - 35 µg/l
13 Dichloropropane0.5 - 35 µg/l
2 Hexanone1.0 - 35 µg/l
12 Dibromoethane0.5 - 35 µg/l
Chlorobenzene0.5 - 35 µg/l
1112 Tetrachloroethane2.0 - 35 µg/l
Ethyl Benzene0.5 - 35 µg/l
m & p Xylene0.5 - 35 µg/l
O Xylene0.5 - 35 µg/l
Stryene2.0 - 35 µg/l
Isopropyl Benzene0.5 - 35 µg/l
Bromobenzene0.5 - 35 µg/l
1122 Tetrachloroethane0.5 - 35 µg/l
123 Trichloropropane2.0 - 35 µg/l
Propyl Benzene0.5 - 35 µg/l
2-Chlorotoluene0.5 - 35 µg/l
4 Chlorotoluene0.5 - 35 µg/l
135 Trimenthylbenzene0.5 - 35 µg/l
Tert Butyl Benzene0.5 - 35 µg/l
124 Trimethlbenzene0.5 - 35 µg/l
Sec Butyl Benzene0.5 - 35 µg/l
13 Dichlorobenzene0.5 - 35 µg/l
P Isopropyltoluene0.5 - 35 µg/l
14 Dichlorobenzene0.5 - 35 µg/l
12 Dichlorobenzene0.5 - 35 µg/l
N Butyl Benzene0.5 - 35 µg/l
Hexachloroethane5.0 - 35 µg/l
12 Dibromo 3Chloropropane 2.0 - 35 µg/l
124 Trichlorobenzene0.5 - 35 µg/l
123 Trichlorobenzene0.5 - 35 µg/l

PAH EO129 (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
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

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: Ballyconnell **Waste Licence No:**

Report To:

Sampling Date: 6/11/13 **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
mw165	GW	✓	✓	519	7.64	11.9	Brown	
16D	GW	✓	✓	487	757	10.7	Clear	
175	GW	✓	✓	523	7.18	10.8	Grey	
17D	GW	✓	✓	497	7.52	10.3	Clear	
18	GW	✓	✓	484	7.72	10.4	Clear	
110	GW	✓	✓	413	7.69	10.9	Straw	
115	GW	✓	✓	772	7.11	11.2	Straw	
10	GW	✓	✓	1679	7.21	10.4	Grey	
SW1	SW	✓	✓	191	6.84	7.5	Straw	
SW2	SW	✓	✓	275	7.25	7.5	Straw	
3	GW	✓	✓	890	7.4	10.8	Heavy Silt	
4	GW	✓	✓	275	7.12	10.2	Heavy Silt	
9	GW	✓	✓	896	7.13	10.1	Heavy Silt	

COMMENTS: Discharge Cap 1 flooded

APPENDIX 4 – CHAIN OF CUSTODY/SAMPLE SUBMISSION

els

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

SAMPLE SUBMISSION FORM

6587

DETAILS TO APPEAR ON ANALYSIS REPORT

Contact Name / Address: Baylen

Customer Name: Baylen

PO Number:

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

CONTRACT DETAILS

ELS Quote No. 405

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 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	SW1	See QN	[illegible]	SW
2	SW2			
3				
4				
5				

ONLY FIVE SAMPLES ALLOWED PER SUBMISSION SHEET

ADDITIONAL INFORMATION AND SIGNATURES

To be filled by the person submitting samples			
Signature	[signature]	Phone No.	0216927[illegible]
Date	07/11/13		
No. samples submitted	2	No. of pages	1 of 5
Additional Info (If any)			

To be filled by ELS Ltd			
Signature	[signature]		
Date	07/11/13	Time	
Condition	Satisfactory		Unsatisfactory - See notes above
Additional Info.			

NOTES FOR CUSTOMER

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**	**70990 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70990/001 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Surface Waters
Customer Ref	SW 1		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia									
	Ammonia (as N)		EW154M-1	0.007		0.081	mg/l N	INAB	
AQ2-UP1									
	Nitrate (as N)		EW154M-1	0.12		0.69	mg/l N	INAB	
	Nitrite (as N)		EW154M-1	0.013		<0.013	mg/l N	INAB	
	TON (as N)		EW154M-1	0.138		0.694	mg/l N	INAB	
AQ2-UP2									
	Chloride		EW154M-1	2.6		14.9	mg/L	INAB	
	Sulphate		EW154M-1	1.0		15.7	mg/L	INAB	
BOD									
	BOD		EW001	1		<1	mg/L	INAB	
COD									
	COD		EW094	8		43	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		24.0	mg/L	INAB	
	Copper-Dissolved		EM130	0.003		0.003	mg/L	INAB	
	Iron-Dissolved		EM130	20.0		372.2	ug/L	INAB	
	Lead-Dissolved		EM130	0.3		<0.3	ug/L	INAB	
	Magnesium-Dissolved		EM130	0.3		4.1	mg/L	INAB	
	Manganese-Dissolved		EM130	1.0		83.1	ug/L	INAB	
	Mercury-Dissolved		EM130	0.02		<0.02	ug/L	INAB	
	Potassium-Dissolved		EM130	0.2		11.3	mg/L	INAB	
	Sodium-Dissolved		EM130	0.5		9.2	mg/L	INAB	
	Zinc-Dissolved		EM130	1.0		60.3	ug/L	INAB	
Metals-Total									
	Chromium-Total		EM130	1.0		1.1	ug/L		
Suspended Solids									
	Suspended Solids		EW013	5		10	mg/L	INAB	
Titralab									
	pH		EW153			6.8	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		189	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		64	mg/L CaCO3	INAB	

Signed : _____ 27/11/2013

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

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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

Contact Name	Cathal Boylan	**Report Number**	**70990 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70990/001 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Surface Waters
Customer Ref	SW 1		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		0.11	mg/l P	INAB	

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

Contact Name	Cathal Boylan	**Report Number**	**70990 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70990/002 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Surface Waters
Customer Ref	SW 2		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia									
	Ammonia (as N)		EW154M-1	0.007		0.031	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		27.3	mg/L	INAB	
	Sulphate		EW154M-1	1.0		19.1	mg/L	INAB	
BOD									
	BOD		EW001	1		6	mg/L	INAB	
COD									
	COD		EW094	8		41	mg/L	INAB	
Dissolved Oxygen									
	Dissolved Oxygen		EW043	1		11	mg/L	INAB	
Metals-Dissolved									
	Cadmium-Dissolved		EM130	0.1		<0.1	ug/L	INAB	
	Calcium-Dissolved		EM130	1.0		29.3	mg/L	INAB	
	Copper-Dissolved		EM130	0.003		0.003	mg/L	INAB	
	Iron-Dissolved		EM130	20.0		158.3	ug/L	INAB	
	Lead-Dissolved		EM130	0.3		<0.3	ug/L	INAB	
	Magnesium-Dissolved		EM130	0.3		5.6	mg/L	INAB	
	Manganese-Dissolved		EM130	1.0		16.3	ug/L	INAB	
	Mercury-Dissolved		EM130	0.02		<0.02	ug/L	INAB	
	Potassium-Dissolved		EM130	0.2		15.1	mg/L	INAB	
	Sodium-Dissolved		EM130	0.5		13.0	mg/L	INAB	
	Zinc-Dissolved		EM130	1.0		10.2	ug/L	INAB	
Metals-Total									
	Chromium-Total		EM130	1.0		<1.0	ug/L		
Suspended Solids									
	Suspended Solids		EW013	5		17	mg/L	INAB	
Titralab									
	pH		EW153			7.2	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		273	uscm-1@20	INAB	
	Alkalinity Total (R2 pH4.5)		EW153	10		92	mg/L CaCO3	INAB	
Total Phosphorus-TP									

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Fax No		**Condition on Receipt**	Good
Customer PO	Not Required	**Date of Report**	27/11/2013
Quotation No	QN000405	**Sample Type**	Surface Waters
Customer Ref	SW 2		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.01		0.08	mg/l P	INAB	

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LEACHATE MONITORING REPORT FOR BALLYJAMESDUFF LANDFILL W0093-01

Client: **Cavan County Council**

Site Location: **Derrylurgan, Ballyjamesduff**

Report No.: CCC-03-01-03-04-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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Rev.	Date	Description

I SUMMARY

Boylan Engineering (Eng. & Environmental Consultancy) was commissioned by Cavan County Council to carry out Environmental Monitoring at Ballyjamesduff Landfill (W0093-01), Derrylurgan, Ballyjamesduff, Co Cavan for quarter four 2013.

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

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Appendix

1. 0 INTRODUCTION

Ballyjamesduff landfill is situated approximately 600m from Ballyjamesduff town centre in the town land of Derrylurgan. The site was in operation from the 1960's and comprises some 1.62 hectares. The site was originally peat land which was stripped for commercial purposes and was then operated as a traditional landfill until its closure in March 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 reports give details of 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
- Assess the effectiveness of gas control measures installed at the site
- Establish a reliable database of information for the landfill throughout its life

According to the Response matrix for landfills, Ballyjamesduff 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. 0 METHODOLOGY

2.1 Environmental Sampling

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

- ISO 5667: Guidance on sampling of groundwaters is adhered to.
- Prior to sampling, the depth of water in wells is measured by dipping.
- 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 analyser and a Hanna 9164 meter, respectively.
    - 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 3.

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	149.16	5.6	N296038.12 E267458.8
MW10D	GW	154.76	149.26	5.5	N296038.12 E267458.87
MW15S	GW	150.36	146.99	3.37	N296097.36 E267343.36
MW15D	Gas	150.39	126.99	23.4	N296092.30 E267344.88
MW16S	Gas	152.6	149.05	3.55	N295888.86 E267202.87
MW16D	GW	152.53	126.73	25.8	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)**				
06/11/2013	1	7.9	3.1	0.3	5.5		

2.0 SUMMARY OF RESULTS

Table 1.0 04th Quarter Leachate monitoring 2013

Report Number		70989													
Monitoring Date:		06/11/2013													
Method Number		**Site Tests**	**EW154M**	**EW154M**	**EW153**	**EW153**	**EW001**	**EW096**	**EW154M-1**		**MIC133**		**EW137**	**DEFAULT**	**EW146**
Parameter		Visual Inspection	Ammonia (as N)	TON (as N)(Calc)	pH	Conductivity @20 DegC	BOD	COD	Chloride	Sulphate	E. Coli	Total Coliforms	Fluoride	Total Cyanide High	Total Phosphorus-TP
Units			mg/l N	mg/l N	pH Units	uscm-1@20	mg/L	mg/L	mg/L	mg/L	MPN/100ml	MPN/100ml	mg/L	ug/L	mg/l P
Limit of Detection		-	0.007	0.138	0.3	25	1	8	2.6	1	0	0	0.1	10	0.01
Date Testing		6.11.13	7.11.13												
ELS Ref	**Client Ref**														
70989/001	MW7	Heavy Silt	15.956	0.717	6.7	1117	20	225	15.4	25.1	<10	200	<0.1	<9	12.5
70989/002	MW8	Heavy Silt	48.217	<0.69	7.3	1467	40	215	27	<5	<10	104600	<0.1	<9	6.3
Inerim Guide Value			0.15	-	≥6.5&≤9.5	1000	-	-	30	200	0	0	1	0.01	-

Method Number		**EM130**												
Parameter		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	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		1	20	1	0.2	0.5	0.1	1	0.003	0.3	0.3	0.02	1	0.02
Date Testing		07.11.13												
ELS Ref	**Client Ref**													
70989/001	MW7	21.2	61293.2	5453.6	13.9	14.6	<0.1	216.3	<0.003	0.5	35.3	<0.02	26.9	0.19
70989/002	MW8	8.3	6736.5	2027.7	42	30.1	<0.1	212.3	<0.003	<0.3	40.8	<0.02	49.5	0.22
Inerim Guide Value		30	200	50	5	150	5	200	0.03	10	50	1	100	1

Exceedance	
NOTES	
1	Sub-contract analysis denoted by *

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 MW7 and MW8 during quarter two monitoring. Results show that the Interim Guide Value was exceeded at on this occasion for the parameters Ammonia, Total Coli forms, Iron, Manganese, Potassium and Calcium and conductivity. 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

5.1 Environmental Monitoring

The results obtained are relatively consistent with previous monitoring events and do not show any signs of dramatic exceedences. Therefore there is no evidence of any major negative environmental impact associated with this landfill. Information relating to previous results can be seen in the historical data tables in Appendix 1.

APPENDIX 1- HISTORICAL DATA

	Parameter	Ammonia	TON	pH	Cond	BOD	COD	Cl
	Units	mg/l N	mg/l N	pH Units	us/cm	mg/l	mg/l	mg/l
WELL MW 7	Qtr 4 2013	15.956	0.717	6.7	1117	20	225	15.4
	Qtr 2 2013	15.597	<0.69	7	1022	7	225	<13
	Qtr 4 2012	10.985	<0.69	6.9	1042	6	79	<13
	Qtr 1 2012	10.438	<0.69	6.8	975	<1.0	100	<13.0
WELL MW 8	Qtr 4 2013	48.217	<0.69	7.3	1467	40	215	27
	Qtr 2 2013	32.78	<0.69	7.5	1237	27	342	24.7
	Qtr 4 2012	36.89	<0.69	7.3	1515	54	93	30
	Qtr 1 2012	28.627	<0.69	7.2	1396	38	156	26.3
Interim Guide Values		0.15	NAC	≥6.5&≤9.5	1000			200

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 EW015
Flouride 0.1 - 2 mg/l EW137
COD 8-1500 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
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 50ug/l BRO3 (EW137)
Colour 2.5-50mg/l PtCCo (EW021)
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 (EW013)
Total Dissolved Solids 1-1000mg/l (EW046)
Total Hardness 3-330mg/l CaCO3 (EM099)
Total Oxidised Nitrogen 0.138-51mg/l N (EW051)

Metals EM130 (P,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 – 20mg/l
Manganese 1.0 - 100µg/l
Mercury 0.02 - 2µg/l
Molybdenum 1.0 - 100µg/l
Nickel 0.5 - 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

SI439 Potable Water VOCs & THM EO025 (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 Ether0.5 - 35 µg/l
11 Dichloroethene0.5 - 35 µg/l
Iodomethane/Mehyl 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
Chlormethyl Cyanide 0.5 - 35 µg/l
Hexachlorobutadiene0.5 - 35 µg/l
Trans-1,2 Dichloroethene0.5 - 35 µg/l
MtBE0.5 - 35 µg/l
11 Dichloroethane0.5 - 35 µg/l
22 Dichloropropane0.5 - 35 µg/l
Cis-12 Dichloroethene0.5 - 35 µg/l
Methyl Acrylate5.0 - 35 µg/l
Bromochloromethane0.5 - 35 µg/l
Tetrahydrofuran5.0 - 35 µg/l
111 Trichloroethane0.5 - 35 µg/l
1-Chlorobutane0.5 - 35 µg/l
Carbon Tetrachloride0.5 - 35 µg/l
11 Dichloropropene0.5 - 35 µg/l
12 Dichloropropane0.5 - 35 µg/l
Dibromomethane0.5 - 35 µg/l
Methyl Methacrylate0.5 - 35 µg/l
13 Dichloropropene, cis2.0 - 35 µg/l
MIBK/4 Methyl 2 Pentanone 2.0 - 35 µg/l
Toluene0.5 - 35 µg/l
13 Dichloropropene,trans2.0 - 35 µg/l
Ethyl Methacrylate2.0 - 35 µg/l
112 Trichloroethane0.5 - 35 µg/l
13 Dichloropropane0.5 - 35 µg/l
2 Hexanone1.0 - 35 µg/l
12 Dibromoethane0.5 - 35 µg/l
Chlorobenzene0.5 - 35 µg/l
1112 Tetrachloroethane2.0 - 35 µg/l
Ethyl Benzene0.5 - 35 µg/l
m & p Xylene0.5 - 35 µg/l
O Xylene0.5 - 35 µg/l
Stryene2.0 - 35 µg/l
Isopropyl Benzene0.5 - 35 µg/l
Bromobenzene0.5 - 35 µg/l
1122 Tetrachloroethane0.5 - 35 µg/l
123 Trichloropropane2.0 - 35 µg/l
Propyl Benzene0.5 - 35 µg/l
2-Chlorotoluene0.5 - 35 µg/l
4 Chlorotoluene0.5 - 35 µg/l
135 Trimenthylbenzene0.5 - 35 µg/l
Tert Butyl Benzene0.5 - 35 µg/l
124 Trimethlbenzene0.5 - 35 µg/l
Sec Butyl Benzene0.5 - 35 µg/l
13 Dichlorobenzene0.5 - 35 µg/l
P Isopropyltoluene0.5 - 35 µg/l
14 Dichlorobenzene0.5 - 35 µg/l
12 Dichlorobenzene0.5 - 35 µg/l
N Butyl Benzene0.5 - 35 µg/l
Hexachloroethane5.0 - 35 µg/l
12 Dibromo 3Chloropropane 2.0 - 35 µg/l
124 Trichlorobenzene0.5 - 35 µg/l
123 Trichlorobenzene0.5 - 35 µg/l

PAH EO129 (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
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

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

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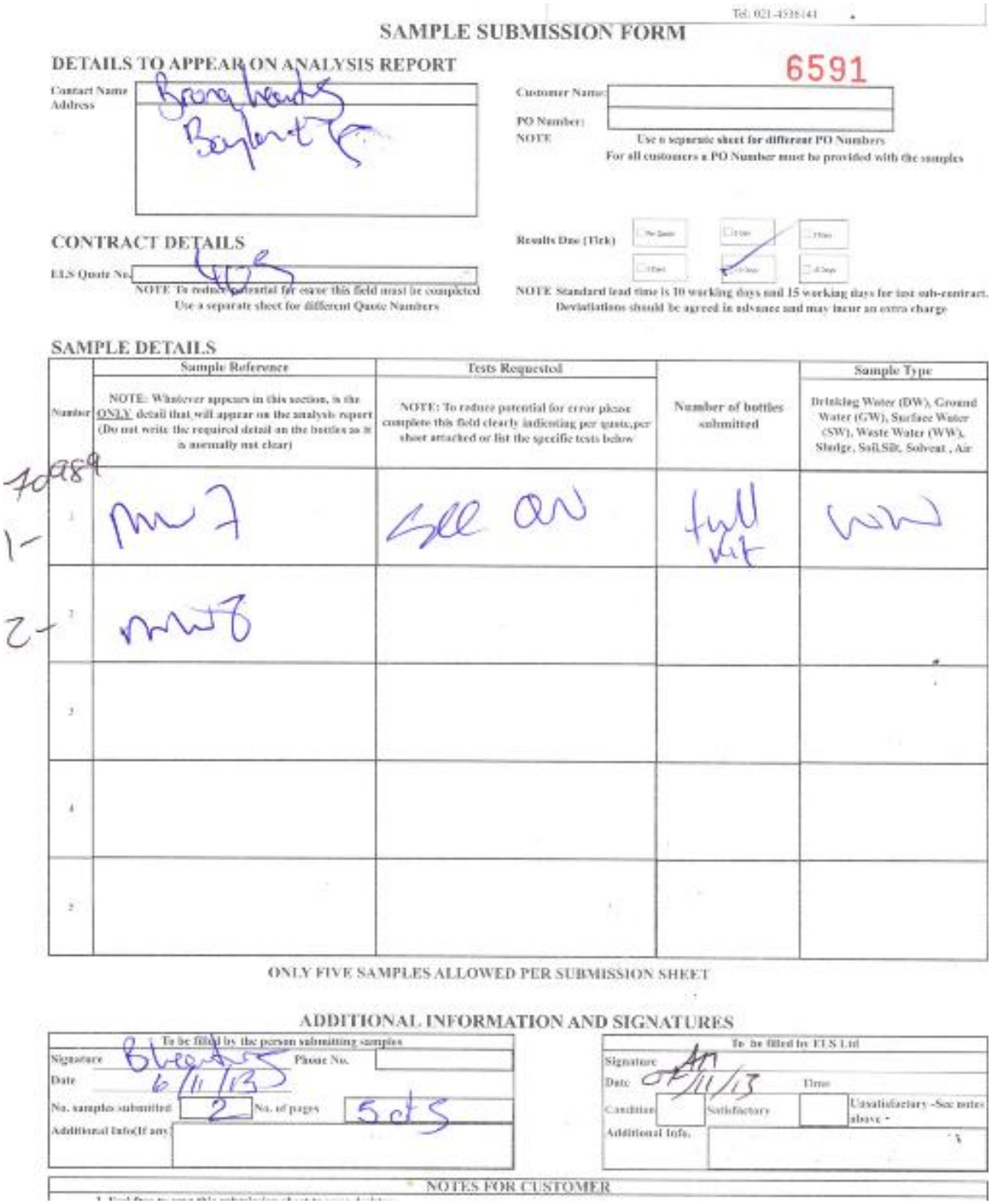
APPENDIX 3 – CHAIN OF CUSTODY/SAMPLE SUBMISSION



Tel: 021-4538141

SAMPLE SUBMISSION FORM

DETAILS TO APPEAR ON ANALYSIS REPORT

6591

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-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(SB), Solvent , Air
1				
2				
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
No. samples submitted
No. of pages
Additional Info(If any)

To be filled by ELS Ltd

Signature
Date
Time
Condition
Satisfactory
Unsatisfactory -See notes above -
Additional Info.

NOTES FOR CUSTOMER

ENVIRONMENTAL LABORATORY SERVICES
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Cork
Ireland
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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**	**70989 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70989/001 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Waste Water
Customer Ref	MW7		

CERTIFICATE OF ANALYSIS

TEST / ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia								
Ammonia (as N)		EW154M-1	0.035		15.956	mg/l N	INAB	
AQ2-UP1								
Nitrate (as N)		EW154M-1	0.60		0.71	mg/l N	INAB	
Nitrite (as N)		EW154M-1	0.065		<0.065	mg/l N	INAB	
TON (as N)		EW154M-1	0.69		0.717	mg/l N		
AQ2-UP2								
Chloride		EW154M-1	13.0		15.4	mg/L	INAB	
Sulphate		EW154M-1	5.0		25.1	mg/L		
BOD								
BOD		EW001	1		20	mg/L	INAB	
COD								
COD		EW094	8		225	mg/L	INAB	
Coliforms								
Total Coliforms		MIC133	10		200	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		0.19	ug/L		
Calcium-Dissolved		EM130	1.0		216.3	mg/L		
Magnesium-Dissolved		EM130	0.3		35.3	mg/L		
Potassium-Dissolved		EM130	0.2		13.9	mg/L		
Sodium-Dissolved		EM130	0.5		14.6	mg/L		
Iron-Dissolved		EM130	20.0		61293.2	ug/L		
Manganese-Dissolved		EM130	1.0		5453.6	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		0.5	ug/L		
Zinc-Dissolved		EM130	1.0		26.9	ug/L		
Mercury-Dissolved		EM130	0.02		<0.02	ug/L		
Metals-Total								
Chromium-Total		EM130	1.0		21.2	ug/L		
Titralab								
pH		EW153			6.7	pH Units	INAB	

Signed : _____ 27/11/2013

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

NOTES
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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**	**70989 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70989/001 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Waste Water
Customer Ref	MW7		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Titralab									
	Conductivity @20 DegC		EW153	25		1117	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		12.5	mg/l P	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**	**70989 - 1**
Address	Boylan Engineering Main Street, Mullagh,	**Sample Number** **Date of Receipt** **Date Started**	70989/002 07/11/2013 07/11/2013
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	QN000405	**Sample Type**	Waste Water
Customer Ref	MW8		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Ammonia									
	Ammonia (as N)		EW154M-1	0.035		48.217	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		
AQ2-UP2									
	Chloride		EW154M-1	13.0		27.0	mg/L	INAB	
	Sulphate		EW154M-1	5.0		<5.0	mg/L		
BOD									
	BOD		EW001	1		40	mg/L	INAB	
COD									
	COD		EW094	8		215	mg/L	INAB	
Coliforms									
	Total Coliforms		MIC133	10		104600	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		0.22	ug/L		
	Calcium-Dissolved		EM130	1.0		212.3	mg/L		
	Magnesium-Dissolved		EM130	0.3		40.8	mg/L		
	Potassium-Dissolved		EM130	0.2		42.0	mg/L		
	Sodium-Dissolved		EM130	0.5		30.1	mg/L		
	Iron-Dissolved		EM130	20.0		6736.5	ug/L		
	Manganese-Dissolved		EM130	1.0		2027.7	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		49.5	ug/L		
	Mercury-Dissolved		EM130	0.02		<0.02	ug/L		
Metals-Total									
	Chromium-Total		EM130	1.0		8.3	ug/L		
Titralab									
	pH		EW153			7.3	pH Units	INAB	
	Conductivity @20 DegC		EW153	25		1467	uscm-1@20	INAB	

Signed : _____ 27/11/2013

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

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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**	27/11/2013
Quotation No	QN000405	**Sample Type**	Waste Water
Customer Ref	MW8		

CERTIFICATE OF ANALYSIS

TEST	ANALYTE	SUB	METHOD	LOQ	SPEC	RESULT	UNITS	ACCRED.	OOS
Total Cyanide High (Sub)									
	Total Cyanide High	*	Default	9		<9	ug/L	YES	
Total Phosphorus-TP									
	Total Phosphorus-TP		EW146	0.1		6.3	mg/l P	INAB	

Signed : _____ 27/11/2013

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GAS MONITORING REPORT
FOR BALLYJAMESDUFF LANDFILL
W0093-01

Client: **Cavan County Council**

Site Location: **Derrylurgan, Ballyjamesduff**

Report No.: CCC-03-01-03-04-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 Environmental Monitoring at Ballyjamesduff Landfill (W0093-01), Derrylurgan, Ballyjamesduff, Co Cavan for quarter four 2013.

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

Table of Contents

Tables

Appendix

1. 0 INTRODUCTION

Ballyjamesduff landfill is situated approximately 600m from Ballyjamesduff town centre in the town land of Derrylurgan. The site was in operation from the 1960's and comprises some 1.62 hectares. The site was originally peat land which was stripped for commercial purposes and was then operated as a traditional landfill until its closure in March 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. 0 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 5 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.

2.2 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.
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- 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	94.92	91.72	3.2	N291352.31 E252020.68
MW2	Gas	92.92	90.82	2.1	N291377.38 E252082.84
MW3	GW	94.39	92.39	2.0	N291369.28 E252109.44
MW4	GW	93.65	93.05	0.6	N291309.78 E252129.14
MW8	Leachate	96.56	-	TBC	N291346.99 E252041.22
MW9	GW	95.69	92.39	3.3	N291369.67 E252103.93
MW10	GW	93.95	91.95	2.0	N291314.86 E252138.12
MW11S	GW	TBC	-	2.4	TBC
MW11D	GW	TBC	-	11.4	TBC
MW12	Gas	94.38	-	n/a	N291236.30 E252110.10
MW14	Gas	98.77	-	n/a	N291263.92 E252131.54
MW16S	GW	94.02	93.22	0.8	N252076.89 E291174.65
MW16D	GW	94.16	94.16	0.0	N252077.36 E291173.27
MW17S	GW	93.59	92.64	1.0	N251997.04 E291377.19
MW17D	GW	93.63	93.63	0.0	N251997.80 E291376.00
MW18	GW	93.5	93.5	0.0	N251986.57 E291425.39
SW1	SW	n/a	-	n/a	TBC
SW2	SW	n/a	-	n/a	TBC
Cap	SW	n/a	-	n/a	TBC

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)				
06/12/2013	0.8	8.7	3.4	1.7	6.6		

3.0 SUMMARY OF RESULTS

Table 1.0 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						
1	MW 1	0	0.4	20.7	0	1019	Outside
3	MW 2	0	0.6	20.6	0	1018	Outside
4	MW5	0	0.3	20.8	0	1018	Outside
5	MW 12	0	0.4	20.8	0	1018	Inside
2	MW 13	0	0.1	20.7	0	1019	Outside
6	MW 14	2.9	3.8	18.8	0	1017	Inside
7	MW 15	0	0.3	20.8	0	1018	Outside
	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 three are relatively consistent with previous results and as the well is within the waste mass it is not observed as being an exceedance. It is preferable that the results are within the limits stipulated within the licence.

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 first quarter of 2014.

APPENDIX 1- HISTORICAL DATA

Method		GA 2000	GA 2000	GA 2000	GA 2000	GA 2000
Parameter		CH_4	CO_2	O_2	H_2S	Barometric Pressure
Units		% v/v	% v/v	%	PPM	mb
Client Ref	Qtr	-	-	-	-	-
MW 1	Qtr 4 2013	0	0.4	20.7	0	1019
	Qtr 3 2013	0	1.3	19	0	999
	Qtr 2 2013	0.0	2.0	19.6	0	999
	Qtr 1 2013	0.2	0.51	20.9	0	996
MW 2	Qtr 4 2013	0	0.6	20.6	0	1018
	Qtr 3 2013	0.2	1.3	18.7	0	999
	Qtr 2 2013	0.0	1.0	20.1	0	999
	Qtr 1 2013	0.2	0.6	21	0	996
MW 5	Qtr 4 2013	0	0.3	20.8	0	1018
	Qtr 3 2013	0	0.1	20.8	0	998
	Qtr 2 2013	0.0	0.3	21.0	0	999
MW 12	Qtr 4 2013	0	0.4	20.8	0	1018
	Qtr 3 2013	0	0.1	20.8	0	998
	Qtr 2 2013	0.0	0.2	20.8	0	999
	Qtr 1 2013	0.6	1.3	21.4	0	995
MW 13	Qtr 4 2013	0	0.1	20.7	0	1019
	Qtr 3 2013	0	0.1	20.7	0	997
	Qtr 2 2013	0.0	0.4	20.8	0	999
	Qtr 1 2013	0.2	0	23.2	0	995
MW 14	Qtr 4 2013	2.9	3.8	18.8	0	1017
	Qtr 3 2013	0	0	20.9	0	998
	Qtr 2 2013	2.0	4.1	17.3	0	999
	Qtr 1 2013	2.4	2.6	20.1	0	995
MW 15	Qtr 4 2013	0	0.3	20.8	0	1018
	Qtr 3 2013	0	0.1	20.7	0	998
	Qtr 2 2013	0.0	0.3	20.5	0	999
	Qtr 1 2013	0.2	0.03	22.2	0	996
	Limit	**1**	**2**			

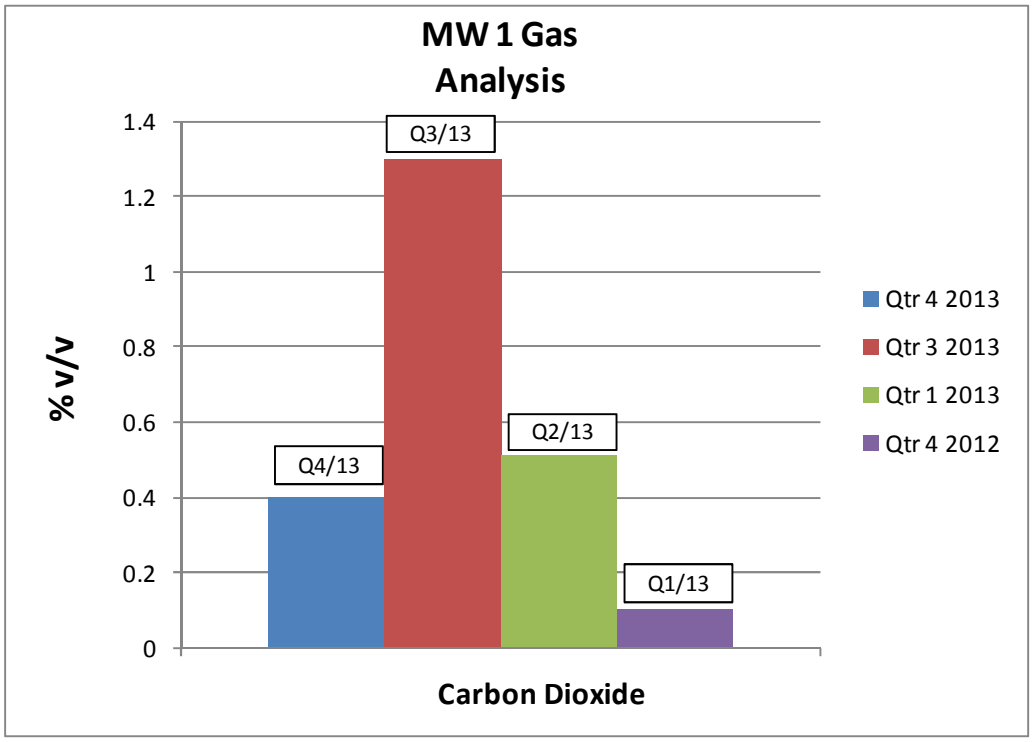
Exceedance of waste

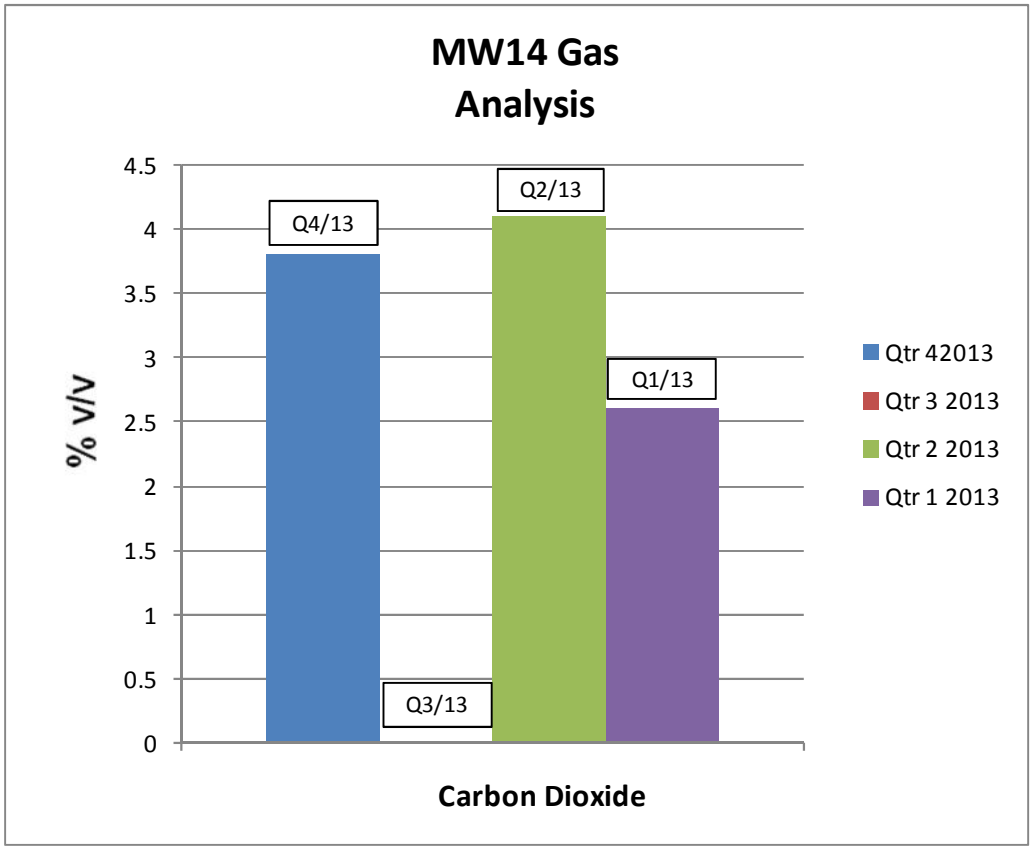
NOTES

1 Instrument Serial No: GA 07721

2 Limit: Schedule C2, Licence

HISTORICAL DATA- CHATRS





APPENDIX 2- LANDFILL GAS BREAKDOWN

MW1

DATE	CH4	CO2	O2	H2S	Barometric Pressure (mb)
06/12/2013 13:25	0	0.4	20.6	0	1019
06/12/2013 13:26	0	0.4	20.7	0	1019
06/12/2013 13:27	0	0.4	20.6	0	1019
06/12/2013 13:28	0	0.4	20.7	0	1019
06/12/2013 13:29	0	0.4	20.7	0	1019

MW 2

DATE	CH4	CO2	O2	H2S	Barometric Pressure (mb)
06/12/2013 13:40	0	1.1	20.2	0	1018
06/12/2013 13:41	0	0.6	20.6	0	1018
06/12/2013 13:42	0	0.4	20.7	0	1018
06/12/2013 13:43	0	0.4	20.8	0	1018
06/12/2013 13:44	0	0.3	20.8	0	1018

MW 5

DATE	CH4	CO2	O2	H2S	Barometric Pressure (mb)
06/12/2013 13:46	0	0.3	20.8	0	1018
06/12/2013 13:47	0	0.3	20.8	0	1018
06/12/2013 13:48	0	0.3	20.8	0	1018
06/12/2013 13:49	0	0.3	20.8	0	1018
06/12/2013 13:50	0	0.3	20.8	0	1018

MW 12

DATE	CH4	CO2	O2	H2S	Barometric Pressure (mb)
06/12/2013 13:55	0	0.5	20.7	0	1018
06/12/2013 13:56	0	0.4	20.8	0	1018
06/12/2013 13:57	0	0.4	20.8	0	1018
06/12/2013 13:58	0	0.4	20.8	0	1018
06/12/2013 13:59	0	0.4	20.8	0	1018

MW 13

DATE	CH4	CO2	O2	H2S	Barometric Pressure (mb)
06/12/2013 13:30	0	0.1	20.7	0	1019
06/12/2013 13:31	0	0.1	20.7	0	1019
06/12/2013 13:32	0	0.1	20.7	0	1019
06/12/2013 13:33	0	0.1	20.7	0	1019
06/12/2013 13:34	0	0.1	20.7	0	1019

MW 14

DATE	CH4	CO2	O2	H2S	Barometric Pressure (mb)
06/12/2013 14:00	2.9	3.7	19	0	1017
06/12/2013 14:01	2.9	3.8	18.8	0	1017
06/12/2013 14:02	2.9	3.7	18.7	0	1017
06/12/2013 14:03	2.9	3.8	18.7	0	1017
06/12/2013 14:04	2.9	3.8	18.6	0	1017

MW 15

DATE	CH4	CO2	O2	H2S	Barometric Pressure (mb)
06/12/2013 14:07	0	0.3	20.9	0	1018
06/12/2013 14:08	0	0.3	20.9	0	1018
06/12/2013 14:09	0	0.3	20.8	0	1018
06/12/2013 14:10	0	0.3	20.7	0	1018
06/12/2013 14:11	0	0.3	20.7	0	1018

APPENDIX 3 – FIELD SHEETS

Landfill Gas Monitoring Form

Facility Name: Ballynacusdutt **Waste License No:**	**Facility Address:** Derrybrogan
Licensee:	
Date of Licensing:	**Date of sampling:** 06/12/13
Instrument Used: GA2000	**Date next full calibration:** **Last field calibration: (inc date & gases)**
Monitoring Personnel:	**Weather:** Dry

Results

Station Number	Time	GA2000 ID	CH_4	CO_2	O_2	CO	H_2S	Barometric Pressure (mbar)	Comments
MW11	13:25	✓	0	0.4	20.6	✓	0	1019	
MW13	13:30	✓	0	0.1	20.7	✓	0	1019	
MW7	13:40	✓	0	1.1	20.2	✓	0	1018	
MW5	13:46	✓	0	0.3	20.8	✓	0	1018	
MW12	13:55	✓	0	0.5	20.7	✓	0	1018	
MW14	14:00	✓	2.9	3.7	19	✓	0	1017	
MW15	14:07		0	0.3	20.9	✓	0	1018	

General Comments:

APPENDIX 4 – CALIBRATION CERTIFICATE-GA 2000

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