

**ANNUAL ENVIRONMENTAL REPORT  
CARROWBROWNE LANDFILL SITE  
EPA WASTE LICENCE W0013-1**

**2011**

**Environment Department  
Galway City Council  
City Hall  
College Road  
Galway**

**091 536595**

**March 2012**

## 1.0 INTRODUCTION

This is the fifth Annual Environmental Report (AER) to be submitted to the Agency for the Waste Licence (Ref W0013-1) for Carrowbrowne Landfill Site, Headford Road, Co. Galway, which was granted on 28<sup>th</sup> August 2003. This site is operated by Galway City Council and is located in the functional area of Galway County Council. Drawing No. 1 shows the site layout.

This report covers the period from January 2011 to December 2011.

## 2.0 WASTE ACTIVITIES CARRIED OUT AT FACILITY

The facility contains the Central Composting Facility for Galway City Council's domestic biodegradable waste component and the former city landfill which is now closed, remediation complete.

### 2.1 TYPES AND QUANTITIES OF WASTE ACCEPTED

#### 2.1.1 *Municipal source separated food and green waste collected by the City Council in brown wheelie bins for processing at the Central Composting Facility for Galway City*

The total tonnage of waste accepted from brown bins and Canteen waste from January 2011 to December 2011 was as follows:

Company	Tonnes
Galway City Council	3096
City Bin Company	2722
Barna Waste	435
Ballinrobe Waste	29
Walsh Waste	275
McGrath Waste	174
WERS Waste	33
Burke Waste	81
<b>Total</b>	<b>6845</b>

A breakdown of the monthly waste amounts accepted at the facility is given in Appendix A attached.

#### 2.1.2 *Inert Waste for Site Remediation*

No additional material was brought into the site during 2011. Remediation is complete.

#### 2.1.3 *Non Compliance with respect to DAFM requirements*

During the course of the year there were two Non compliances in respect of e-coli parameters of the Department of Agriculture ABPR requirements. The Department of Agriculture were advised and authorised the disposal of the material to landfill. The investigation in regard to the cause of the Non-compliance was inconclusive. The most likely cause was cross contamination during sampling.

### **3.0 SUMMARY REPORT ON EMISSIONS**

Emission limits are set out in Schedule C of the licence for the following: Noise; Landfill Gas (concentration limits in buildings); Dust Deposition; Surface Water (discharge from the civic waste facility); Gas Flare and the Composting Process.

As there is no civic waste facility, therefore the requirement to monitor surface water emissions from the civic waste facility was not applicable..

Drawing No. 2, Monitoring Locations AER 2011 shows the locations of the monitoring points.

A new gas flare was installed late 2006, combined with upgrading of the gas network, and the flare was commissioned in early 2007 and a maintenance contract with AFS Ltd. was agreed. For the first three months of 2011 the flare was monitored on a daily basis by a visual inspection, and details recorded as required. Thereafter, due to staff reductions the monitoring was reduced and was not recorded. In order to address the staffing deficit, AFS Ltd's contract was extended to include monitoring and balancing on a monthly basis in addition to the Maintenance and servicing of the flare is carried out on a quarterly basis by AFS Ltd.

In order to address the staffing deficit that has arisen over the last number of years, Fitz Scientific, formerly Euro Environmental Services, of Drogheda, have been engaged to carryout Sampling and Monitoring, as per Licence Requirements. During the course of 2011 Fitz Scientific have been becoming familiar with the site and endeavouring to meet the time deadlines with to quatterly and annual monitoring of the air, water, gas emmissions. This familiarisaton is ongoing however there remain gaps that we would hope to close out during 2012.

## **SUMMARY OF RESULTS OF ENVIRONMENTAL MONITORING**

### **SURFACE WATER MONITORING REQUIREMENTS**

Under the terms of Waste Licence 13-1, the licensee was required to monitor the following surface water monitoring points during the year, G37s, G22s, LF2, G24s, G29s, G38s, G23s, G12s and G21s (ref: Table D.4.1 of the licence).

#### **4.1.1 Monthly monitoring requirement:**

In previous years this requirement was fulfilled by staff within Environment department. Due to reduction in staffing over 2009-10 and into 2011 this requirement has not been fully met. In order to address this deficit, Outside Contractors Fitz Scientific, were engaged to monitor the above locations. The results available are included in attached as Appendix B.

**4.1.2 Quarterly monitoring requirement:**

To monitor the above locations for the following parameters:

- Ammoniacal Nitrogen (mg/l N)
- BOD (mg/l O<sub>2</sub>)
- COD (mg/l O<sub>2</sub>)
- Chloride (mg/l Cl)
- Dissolved Oxygen (% Saturation)
- Electrical Conductivity (µS/cm)
- pH
- Suspended Solids (mg/l)
- Temperature (°C)

Quarterly monitoring was carried out by Fitz Scientific during 2011. The results of the quarters 2,3 and 4 results for each monitoring location are given in Appendix B.2. Quarter 1 results are not available.

#### **4.1.3 Annual Monitoring Requirement:**

Under the terms of the waste licence the following parameters are required to be monitoring on an annual basis:

- Sulphate (mg/l SO<sub>4</sub>)
- Total Alkalinity (mg/l CaCO<sub>3</sub>)
- Total Phosphorous/orthophosphate (mg/l P)
- Total Oxidised Nitrogen (mg/l N)

The monitoring was carried out in October 2011 and the results of this monitoring are attached as Appendix B.3.

Monitoring was carried out by the EPA laboratory in Castlebar, Co. Mayo on the 11 and 12 May 2011. The summary of the results for each monitoring location are given in Appendix B3.

#### **4.1.4 Biological Assessment**

A biological Assessment was not carried out during course of 2011.

#### **4.1.5 Interpretation of Surface Water Monitoring Results**

The results show that surface water quality was generally consistent with previous years results.

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## **4.2 GROUNDWATER MONITORING REQUIREMENTS**

Groundwater was monitored at locations around the facility from January 2011 to December 2011. Drawing 2, Monitoring Locations AER 2011 shows the locations of the monitoring points: G1AP, G4AP, G9AP, G10AP, G1A, G4A, G10A, 106A, 108A and 116A.

#### **4.2.1 Quarterly Monitoring Requirement**

To monitor the above locations for the following parameters:

- Visual Inspection/Odour
- Groundwater Levels
- Ammoniacal Nitrogen (mg/l N)
- Chloride(mg/l Cl)
- Electrical Conductivity (µS/cm)

Quarterly monitoring was carried out by Fitz Scientific during 2011. The results of the quarters 2,3 and 4 results for each monitoring location are given in Appendix C.1. Quarter 1 results are not available.

Annual Monitoring was carried out by the EPA laboratory in Castlebar, Co. Mayo in May 2011. The summary of the results for each monitoring location are given in Appendix C.2

#### **4.2.2 Annual monitoring results**

The following parameters are required to be sampled on an annual basis under the terms of the Waste Licence. Results are given in Appendix C.2.

- Cyanide (mg/l CN)
- Fluoride (mg/l F)
- Sulphate (mg/l SO<sub>4</sub>)
- Total Alkalinity (mg/l CaCO<sub>3</sub>)
- Ortho-Phosphate (mg/l P)
- Total Oxidised Nitrogen (mg/l N)
- Faecal Coliforms (No. /100ml)
- Total Coliforms (No./100ml)
  
- Metals and non metals
- Mercury (ug/l Hg)
  
- List I and List II organic substances

#### **4.2.3 Interpretation of Groundwater Monitoring Results**

G116A borehole was damaged/destroyed during drainage works as part of Footpath works by a Contractor employed by Housing Section in and so is no longer available for sampling. During 2012 another suitable location will be identified and a new Borehole placed.

G10AP G10 was inaccessible and so was not monitored

Trend analysis of results taken at G4AP, G9AP, G1A, 106A, and 108A show that groundwater quality has remained variable but consistent or improved over the period.

- Locations G1AP and G4A have both continued to have consistently high readings for Ammonia, with G4A levels exceptionally high in the last 3 monitoring events. Reasons for the increase is being investigated and will continue to be monitored. These boreholes have both had consistently high readings since 2000. Both of these wells are located hydraulically up gradient of the landfill and therefore, any contamination may be from an agricultural source.

The results show that Ground water quality was generally consistent with previous results.

### **4.3 LEACHATE MONITORING REQUIREMENTS**

Leachate is required under the licence to be monitored at four locations at the facility. These locations are G7D, G11D, 110D. Further to discussions and agreement with the EPA in 2006, the leachate wells G7D, G11d & 110D were not re-drilled following the remediation works, and these wells are no longer monitored.

Thus Leachate is required to be monitored and L1 and L2 as shown on Drawing , Monitoring Locations AER 2011 attached. In addition, leachate is also monitored at

L3 (southern section of the site) and L4 (composting area), inlets to the leachate treatment system.

It was agreed that the monitoring of the leachate at L1, L3 and L4 entering the leachate treatment system would be sufficient for the purposes of leachate monitoring and management in accordance with licence no. 13-1. Signs have been installed to clearly identify each inlet pipe.

Fitz Scientific have been engaged to sample and report on the analysis carried out. It is recognised by the Licencee that there remains a body of work to be carried out in relation to the remediation of the Leachate Collection and Treatment system. To this end Tobins Consulting have been engaged to advise on remediation measures.

The leachate treated on site is made up of several sources i.e. Landfill, Compost site, domestic effluent from Permanent Transient halting site and an element from Barna waste Facility.

#### **4.3.1 Weekly Monitoring Requirement:**

To monitor leachate levels in G7D, G11D and 110D.

Monitoring of the leachate levels was discontinued in 2006 due to the remediation works. This requirement will be re-examined during 2012 in conjunction the review being carried out by Tobins Consulting of the Leachate Collection and Treatment system.

#### **4.3.2 Quarterly Monitoring Requirement:**

To monitor for the following parameters at locations L1, Leachate was also monitored at L3 & L4 (additional leachate inlets) and L2 (leachate leaving the leachate treatment system):

- Visual Inspection/odour
- Ammoniacal Nitrogen (mg/l N)
- BOD (mg/l O<sub>2</sub>)
- COD (mg/l O<sub>2</sub>)
- Chloride (mg/l Cl)
- Electrical Conductivity (µS/cm)
- pH

The summary of the quarterly results are contained in Appendix D.1. There would be appear to be a gap in the results. These will be provided once received.

#### **4.3.2 Annual Monitoring Requirement**

The following parameters were monitored in May 2011 to fulfil the annual monitoring requirement for leachate as set out in the Licence.

- Cyanide (mg/l CN)
- Fluoride (mg/l F)
- Sulphate (mg/l SO<sub>4</sub>)
- Ortho-Phosphate (mg/l P)
- Total Oxidised Nitrogen (mg/l N)



- Faecal Coliforms (No. /100ml)
- Total Coliforms (No./100ml)
  
- Metals and non metals
- Mercury (ug/l Hg)

The summary of the annual results are contained in Appendix D.2.

#### **4.3.2 Sludge Arisings from Leachate Treatment system**

A WAC analysis of the Sludge arisings from the Leachate treatment system is included in Appendix D.2.

Tobins Consulting Engineers have been requested to advise on suitable further treatment and end destination for the sludge arising from the Leachate treatment system on site.

## **4.4 DUST, BIOAEROSOLS & ODOUR**

### **4.4.1 *PM<sub>10</sub>***

The annual PM<sub>10</sub> monitoring event was carried out by Fitz Scientific at three locations between the 10 and 13<sup>th</sup> October 2011, with results as follows: 111.11µg/m<sup>3</sup> at the weighbridge. East of the ASP slab the level was 51.39µg/m<sup>3</sup> at the other location, east of landfill the level was 31.94µg/m<sup>3</sup>.

One result was considerably outside the limit of 50µg/m<sup>3</sup>. This result is most likely as a result of the activities in a neighbouring Waste facility.

Another result was marginally over the limit, while the other was well within the limit. No corrective action was deemed necessary, however this will be kept under review.

### **4.4.2 *Bioaerosols***

The annual Bioaerosol monitoring was carried out by Fitz Scientific at locations on however at the time of writing the results are not to hand. These will be furnished as soon as available.

The results are given in Appendix E.1.

### **4.4.3 *Odour***

*Fortnightly requirement:*

To monitor for odour from the composting facility. A sample sheet is attached as an example in Appendix E.2.

*Annual Requirement:*

Annual olfactometric monitoring of odour was carried out by Fitz Scientific during 2011. At the time of writing the results are not available.

Results of this monitoring are included in Appendix E.2.

### **4.4.4 *Dust Monitoring***

Dust monitoring was carried out by Fitz Scientific. at four dust monitoring locations around the site during June, October and November. The results show all samples were below the limit value of 350mg/m<sup>2</sup>/day except at D3 close to the compost site where an exceedance was recorded on two occasions in June and in October.

### **4.4.5 *Gas Monitoring***

Landfill gas monitoring was carried out by Fitz Scientific during 2011 as per schedule D1 of the Licence, i.e. from May 2011 Monthly. Copies of the reports are available for inspection in City Council offices.

*Monthly Requirement*

Monitor Methane Carbon Dioxide, Oxygen and atmospheric pressure at each of 4 Manifolds MA, MB, MC and MD. MB is no longer available to monitor. This is an element of work for the remediation of the Gas infrastructure on site.

The licensee recognises that there is a considerable amount of work outstanding in order to bring the facility within Licence requirements. To this end AFS Ltd have been engaged to advise on the remediation works to be undertaken. The works are to be in three phases. Phase 1 is complete. Phase 2 is expected to be complete over the coming months, which will include the re-connection of MB through to Gas Flare. Through 2011 AFS have been engaged on a monthly basis monitoring and balancing the gas collection system.

## **4.5 NOISE**

Noise monitoring was carried out by Fitz Scientific on 12 October 2011. This is an annual requirement of the waste licence. The composting activities noise levels on the site perimeter are within the site limit of 55dBA and this noise level attenuates with distance so that at the nearest house to the south of the landfill, the noise level is well below this. The results are detailed in appendix F.1 The site is in compliance with the terms of the licence with respect to noise.

## **COMPOST QUALITY**

### **E-coli & Salmonella**

A full record "in process sampling" has been maintained on site. There were no incidents of non compliance with respect to Salmonella. There were two incident of non-compliance wrt E-coli. The material was re-incorporated into the process or disposed to landfill with permission of DAFM.

Sampling was carried out initially by City Council Staff. With the reduction of staff numbers the sampling was outsourced to Fitz Scientific.

### **Finished Compost**

Samples of finished compost were not taken during much of the year 2011 due to staff reductions. The results such as they were indicated that the material was immature. Finished Compost is retained in storage on the landfill. Having assessed the situation it was decided to decline feedstock from suppliers other than GalwayCity council collection from October 2011. It is envisaged that the facility would be opened to other feedstock suppliers sometime during 2012.

## **4.0 VOLUME OF LEACHATE PRODUCED AND VOLUME OF LEACHATE TRANSPORTED/DISCHARGED OFF-SITE**

The quantity of leachate pumped from Carrowbrowne for 2011 was 88,500m<sup>3</sup> approximately.

## **5.0 REPORT ON DEVELOPMENT WORKS UNDERTAKEN DURING THE REPORTING PERIOD**

In addition to the remediation and capping works, a number of infrastructural works were carried out at Carrowbrowne during 2011. These included:

- Repairs to fencing around the landfill site;
- repairs to Airducting to ASP's
- repairs and maintenance to Drainage of Cleanside ASP's;
- Significant Drainage works were carried out by Galway City Council housing department to the west of the landfill, in order to relieve a drainage issue in lands owned by GalwayCity Council adjoining the landfill.

## **7.0 REPORT ON RESTORATION**

The restoration and capping of the landfill was completed in 2009.  
No works were done in 2011.

**6.0 REPORT ON ENVIRONMENTAL OBJECTIVES AND TARGETS OUTLINED IN 2010**

<b>OBJECTIVE &amp; TARGET 2011</b>	<b>PROGRESS</b>
1. Records Management. Target: On-going.	On-going in 2011.
2. Training Target: Provide training for site operatives in 2011 in the following: Confined Spaces Working at Heights CRE, Composting Facility Management Training	Training was provided for 3 staff in the following: manual handling, Confined spaces, working at height One staff member trained in Risk Assessment Staff targeted for Compost facility training were released on Career break, without replacement.
3. Train 1 member in operation and monitoring of Gas collection and Flare operation and monitoring. Target: End 2011	Staff targeted for training were released on Career break, without replacement.
4. Remediation of Lagoon and leachate collection system	No progress was made due to staff reductions and financial constraints.

**7.0 SCHEDULE OF ENVIRONMENTAL OBJECTIVES AND TARGETS FOR 2012**

<b>OBJECTIVE 2011</b>	<b>TARGET 2012</b>
1. Records Management.	On-going in 2011.
2 Training: Provide training for site operatives in 2012 in the following:  Animal By-Product Training Composting Operator Training	End 2012 One additional Operate trained in CRE Composting Course during 2012
3 Complete Phase 2 of remediation works to Landfill gas collection system. AFS Ltd	End 2012, subject to financial constraint and additional budget approval.
4. Install Alarm system to Flare	Mid 2012, ordered
5. Review all manhole and pumping station covers around the site and replace where required.	End 2012
6. Develop and complete a phased remediation Plan for Leachate Collection system as recommended by Tobins Consulting.	End 2012, subject to Senior management approval of additional budgetary allocation.
7. Restore freeboard of 750mm at Leachate Lagoon.	End June 2012,
8. Develop a phased remediation Plan for Leachate TREATMENT system as recommended by Tobins Consulting. Including SCADA and ALARMS for Leachate collection	End 2012, subject to Senior management approval of additional budgetary allocation.

and treatment system	
9. Repair/replace damaged or inaccessible monitoring Locations e.g. B/H 116A	During 2012, subject to Senior management approval of additional budgetary allocation.

## 10.0 FULL TITLE AND A WRITTEN SUMMARY OF ANY PROCEDURES DEVELOPED/UPDATED BY THE LICENSEE IN THE YEAR 2011

They can be listed and summarised as follows:

- Trommel Operation and screen change
- Traffic Management
- Mixer Operation and Cleaning
- Temperature Probe
- Compost Sampling E-Coli
- HACCP

## 11.0 REPORTED INCIDENTS AND COMPLAINTS SUMMARIES

- There were no complaints received in 2011. Regular contact is made with neighbours in order to elicit if there are any issues.
- There were no Incidents reported during the reporting period.
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## 12.0 REPORTS ON FINANCIAL PROVISION MADE UNDER THIS LICENCE, MANAGEMENT AND STAFFING STRUCTURE OF THE FACILITY AND A PROGRAMME FOR PUBLIC INFORMATION.

### 12.1 *Budget*

Provision of approximately €155,426.00 Euros has been put into the Council Estimates for 2012 for the operation and monitoring of the landfill.

### 12.2 *Staffing Structure and Management*

Overall management of the Waste Licence comes under the remit of the Senior Engineer, Environment: Kevin Swift, A/Director of Services.

The staff structure is as follows:

#### **Management Structure**

Facility Manager: Theo McLoughlin, A/Senior Executive Engineer  
 Facility Deputy Manager – Michael Garvey, Eng Tech, II, to March 2011.  
 Deputy Manager – Landfill – J. O'Connor General Wastes Supervisor  
 Deputy Manager Grade 1– Composting – Richard Devlin,  
 Deputy Manager Grade 2– Composting – David Noone,  
 General Operative – Composting – John Murphy  
 General Operative – Composting – John Bailey, joined November 2011.

It has become evident through 2009-11 that the existing staffing at the Compost site is inadequate to fulfil the operational needs of the compost

facility. The addition of another General Operative has been very beneficial late in 2011 and it is hoped that this can continue, however his continued presence on site is subject to Environment Section global staffing which is critical.

The departure of Michael Garvey, Engineering Technician in March 2011, without replacement has had a very severe impact on the ability to maintain compliance with the Licence. Throughout 2010-11 it also became evident that the outsourcing of elements of the monitoring and sampling was going to be necessary in order to continue to bring the facility back within compliance. This effort will continue through 2012.

## **12.0 REPORT ON TRAINING OF STAFF**

Staff at the composting facility have been trained in the procedures applicable to the facility. This is an ongoing requirement but particularly demanding during 2011.

Staff induction and training has been a particular issue during 2011. H&S risk assessments required a full review of all operations and full risk assessment throughout 2011.

In addition there are annual training sessions with regard to the Safety Statement and training in procedures is given as they arise or as amendments are made.



## **Drawings**

### ***Monitoring Locations AER 2011***

Please goto <http://www.autodwg.com> to register the program, the note will be removed.



# CARROWBROWNE

SITE BOUNDARY : \_\_\_\_\_

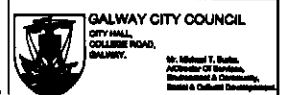
EXTRACTS FROM O.S. SHEETS :

Of Sheet No. 3282-B  
Of Sheet No. 3283-A

- LEGEND**
- Groundwater Sampling Site
  - Surface Water Sampling Site
  - Leachate Monitoring Location
  - Landfill Gas Monitoring Site
  - ⊠ Manhole
  - Noise Monitoring Location
  - Odour
  - ⊠ PM10 & Bioerosols
  - ⊠ Microbiols (MA- MD)
  - L1- Leachate From Landfill Southern Section
  - ⊠ L2- Odour Pipe
  - L3- Leachate From Landfill, Northern Section
  - L4- Composting Area (Inlet)
  - L5- Water From Gas Network
  - L6- Effluent From Slime Wash
  - Outfall 1 From Landfill
  - Outfall 2 From Landfill

- NOTES**
1. REQUIRED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING
  2. ALL LEVELS RELATE TO NEW ORDNANCE DATUM AT MALLEN BRAD

No.	Amendments	DATE	INT.
B05	Revised design layout of site plan, 25-3-04		
B04	Revised layout plan, 18-10-03		
B03	Revised layout plan, 18-10-03		
B01	Amendment to site plan, 18-10-03		
A02	Amendment to site plan, 18-10-03		
A01	Site plan, 18-10-03		



**GALWAY CITY COUNCIL**  
CITY HALL  
COLLIERIE ROAD,  
GALWAY.

Project:  
**CARROWBROWNE LANDFILL SITE**  
E.P.A Licence Ref: 13-1

Title Of Drawing  
**Monitoring Locations**

**2011**

SCALE  
N.T.S

DRAWN BY: Mr. B. McDonagh  
CHECKED BY: Mr. E. Johnson  
DATE: April '08

DRAWING NO: 1



## **Appendix B.1**

### ***Surface Water Monitoring Requirements*** **Visual Inspection & Odour**

## **Appendix B.2**

### ***Summary of Surface Water Monitoring Requirements*** **Quarterly Results**

Q2, Q3, Q4 only

Appendix 1: Table of Results for Surface Water Monitoring Points

Q2 2011

W0013-01

Lab-Ref	units	A1	A2	A3	G23s	G38s	G24s	G22s	G37s	G12s	LF2	G29s	G21s	SW1	Trigger Limits as per W.L. 0013-10
Ammonia	mg/L as N	0.16	0.17	3.11	0.080	0.088	1.840	0.566	0.140	0.123	N/S	N/S	N/S	N/S	-
BOD	mg/l	5	5	7	3	<2	4	<2	<2	9	N/S	N/S	N/S	N/S	-
Chloride	mg/L	250	250	250	19.62	23.30	27.10	23.96	22.34	27.61	N/S	N/S	N/S	N/S	-
COD	mg/L	-	-	40	66	27	51	38	31	52	N/S	N/S	N/S	N/S	-
Conductivity	µmhos/cm @25°C	1000	1000	1000	173.5	543	577	523	556	697	N/S	N/S	N/S	N/S	-
Dissolved Oxygen	%	>80%	>50%	>30%	87.4	66.4	38.6	46.7	63.0	79.6	N/S	N/S	N/S	N/S	-
Mineral Oil	ug/L	-	-	-	0.0064	<0.0025	0.10062	0.00478	0.03099	<0.0025	N/S	N/S	N/S	N/S	5mg/l
pH	pH Units	5.5 - 8.5	5.5 - 9.0	5.5 - 9.0	7.6	7.8	7.7	7.8	7.8	8.0	N/S	N/S	N/S	N/S	-
Solids (Total Suspended)	mg/L	50	-	-	8	5	21	5	2	16	N/S	N/S	N/S	N/S	-
Temperature	degrees C	25	25	25	13.3	13.0	12.8	12.8	19.0	20.2	N/S	N/S	N/S	N/S	-

N/S = No sample could be retrieved as monitoring location was not found

Appendix B2

Appendix 1: Table of Results for Surface Water Monitoring Points

Q3 2011

W013-01

Lab Ref	units	A1	A2	A3	G23s	G18s	G21s	G22s	G23s	G12s	LF2	G29s	G21s	SW1	Trigger Limits as per W.L. 0013-10
A000000	mg/l as	0.16	0.17	3.11	0.01	0.06	1.30	0.197	3.10	1.97	N/S	N/S	N/S	N/S	-
		5	5	7	8	<2	<2	<2	4	20	N/S	N/S	N/S	N/S	-
		250	250	250	16.11	19.33	25.31	21.33	26.37	24.88	N/S	N/S	N/S	N/S	-
G0010	%	-	-	40	217	22	24	29	77	60	N/S	N/S	N/S	N/S	-
		1000	1000	1000	79.1	595	594	616	419	781	N/S	N/S	N/S	N/S	-
		>60%	>50%	>30%	86.7	42.8	26.7	36.7	43.5	52.6	N/S	N/S	N/S	N/S	-
G0010	%	-	-	-	<2.5	<2.5	<2.5	*	*	<2.5	N/S	N/S	N/S	N/S	5mg/l
		5.5 - 8.5	5.5 - 9.0	5.5 - 9.0	6.1	7.3	7.3	7.3	7.3	7.4	N/S	N/S	N/S	N/S	-
G0010	%	50	-	-	155	7	10	2	19	14	N/S	N/S	N/S	N/S	-
		25	25	25	18.3	17.3	18.0	15.3	15.9	17.3	N/S	N/S	N/S	N/S	-

N/S = No sample could be retrieved as monitoring location was not found.

\* = Not enough sample to conduct test.

Appendix 1  
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Appendix 1: Table of Results for Surface Water Monitoring Points

Q4 2011

W0013-01

Lab Ref	Units	A1	A2	A3	G23s	G18s	G7s	G22s	G27s	G12s	LF2	G29s	G21s	SW1	Trigger Limits as per W.L. 0013-10
	mg/L as	0.16	0.17	3.11	0.032	0.017	0.348	0.138	0.113	1.49	N/S	N/S	0.709	N/S	-
		5	5	7	<2	5	<2	<2	<2	<2	N/S	N/S	3	N/S	-
		250	250	250	24.91	21.55	26.57	25.43	24.74	40.77	N/S	N/S	24.56	N/S	-
		-	-	40	60	47	65	66	67	48	N/S	N/S	41	N/S	-
		1000	1000	1000	128	528	410	344	434	715	N/S	N/S	553	N/S	-
		>60%	>50%	>30%	58.4	34.8	24.7	38.7	28.4	41.7	N/S	N/S	39.0	N/S	-
		-	-	-	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	N/S	N/S	<2.5	N/S	5mg/l
		5.5 - 8.5	5.5 - 9.0	5.5 - 9.0	7.0	7.2	7.2	7.2	7.3	7.5	N/S	N/S	7.3	N/S	-
		50	-	-	9	38	10	12	9	10	N/S	N/S	14	N/S	-
		25	25	25	18.9	17.8	18.7	19.5	19.7	19.8	N/S	N/S	18.1	N/S	-

N/S = No sample could be retrieved as monitoring location was not found

Appendix B2



## **Appendix B.3**

### ***Summary of Surface Water Monitoring Requirements*** **Annual Results**



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<b>Customer</b>	Theo Mc Loughlin Galway City Council Liosban Ind. Est Galway	<b>Lab Report Ref. No.</b>	4910/022/13
		<b>Date of Receipt</b>	14/10/2011
		<b>Sampled On</b>	12/10/2011
		<b>Date Testing Commenced</b>	14/10/2011
		<b>Received or Collected</b>	By Fitz: Aadil
		<b>Condition on Receipt</b>	Acceptable
<b>Customer PO</b>	400092412	<b>Date of Report</b>	27/10/2011
<b>Customer Ref</b>	Carrowbrowne G12s Annual	<b>Sample Type</b>	Surface Water

## CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
**Alkalinity (Surface Water)	102	Colorimetry	253	mg/L CaCO <sub>3</sub>	
Boron (Surface Water)	177	ICPMS	13.22	ug/L	UKAS
Cadmium (Surface Water)	177	ICPMS	<0.01	ug/L	UKAS
Calcium (Surface water)	184	ICPMS	69.32	mg/L	UKAS
Chromium (Surface Water)	177	ICPMS	<0.58	ug/L	UKAS
Copper (Surface Water)	177	ICPMS	<0.21	ug/L	UKAS
Iron (Surface Water)	177	ICPMS	97.96	ug/L	UKAS
Lead (Surface Water)	177	ICPMS	<0.02	ug/L	UKAS
Magnesium (Surface water)	184	ICPMS	5.255	mg/L	UKAS
Manganese (Surface Water)	177	ICPMS	37.16	ug/L	UKAS
Mercury (Surface water)	178	ICPMS	<0.03	ug/L	UKAS
Nickel (Surface Water)	177	ICPMS	1.44	ug/L	UKAS
Nitrogen (Total Oxidised) (Surface W	151	Colorimetry	1.14	mg/L as N	UKAS
Pesticides (Organochlorine)	156	GCMS	<0.1	ug/L	
Pesticides (Organophosphorous)	159	GCMS	<0.1	ug/L	
**Phosphate (Ortho) Surface Water	117	Colorimetry	0.079	mg/L as P	
**Phosphate (Total) Surface Water	166	Colorimetry	0.104	mg/L as P	
Potassium (Surface water)	184	ICPMS	12.69	mg/L	UKAS
SemiVolatile Organic Compounds	155	GCMS	<0.5	ug/L	
Sodium (Surface water)	184	ICPMS	14.71	mg/L	UKAS
Sulphate (Surface Water)	119	Colorimetry	78.42	mg/L	UKAS
Volatile Organic Compounds	154	GCMS	<1	ug/L	
Zinc (Surface Water)	177	ICPMS	<0.63	ug/L	UKAS

Signed: A Harmon  
Aoire Harmon - Technical Supervisor

7 1 NOV 2011

Date: 27/10/11

Acc. : Accredited Parameters by ISO 17025:2005

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Results contained in this report relate only to the samples tested

\*\*The analytical result for this parameter may not be reflective of the concentration present at the time of sampling. The maximum recommended preservation time for this parameter has been exceeded.

<b>Customer</b>	Theo Mc Loughlin Galway City Council Liosban Ind. Est Galway	<b>Lab Report Ref. No.</b>	4910/022/14
	Galway	<b>Date of Receipt</b>	14/10/2011
<b>Customer PO</b>	400092412	<b>Sampled On</b>	14/10/2011
<b>Customer Ref</b>	Carrowbrowne G21s Annual	<b>Date Testing Commenced</b>	14/10/2011
		<b>Received or Collected</b>	By Fitz: Aadil
		<b>Condition on Receipt</b>	Acceptable
		<b>Date of Report</b>	27/10/2011
		<b>Sample Type</b>	Surface Water

## CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Alkalinity (Surface Water)	102	Colorimetry	244	mg/L CaCO3	UKAS
Boron (Surface Water)	177	ICPMS	<5.51	ug/L	UKAS
Cadmium (Surface Water)	177	ICPMS	<0.01	ug/L	UKAS
Calcium (Surface water)	184	ICPMS	65.52	mg/L	UKAS
Chromium (Surface Water)	177	ICPMS	<0.58	ug/L	UKAS
Copper (Surface Water)	177	ICPMS	<0.21	ug/L	UKAS
Iron (Surface Water)	177	ICPMS	73.38	ug/L	UKAS
Lead (Surface Water)	177	ICPMS	<0.02	ug/L	UKAS
Magnesium (Surface water)	184	ICPMS	2.939	mg/L	UKAS
Manganese (Surface Water)	177	ICPMS	7.833	ug/L	UKAS
Mercury (Surface water)	178	ICPMS	<0.03	ug/L	UKAS
Nickel (Surface Water)	177	ICPMS	1.177	ug/L	UKAS
Nitrogen (Total Oxidised) (Surface W	151	Colorimetry	<0.07	mg/L as N	UKAS
Pesticides (Organochlorine)	156	GCMS	<0.1	ug/L	
Pesticides (Organophosphorous)	159	GCMS	<0.1	ug/L	
Phosphate (Ortho) Surface Water	117	Colorimetry	0.034	mg/L as P	UKAS
Phosphate (Total) Surface Water	166	Colorimetry	0.112	mg/L as P	UKAS
Potassium (Surface water)	184	ICPMS	2.987	mg/L	UKAS
SemiVolatile Organic Compounds	155	GCMS	<0.5	ug/L	
Sodium (Surface water)	184	ICPMS	7.471	mg/L	UKAS
Sulphate (Surface Water)	119	Colorimetry	36.06	mg/L	UKAS
Volatile Organic Compounds	154	GCMS	<1	ug/L	
Zinc (Surface Water)	177	ICPMS	<0.63	ug/L	UKAS

Signed: A Harmon

Date: 27/10/11

**Aoife Harmon - Technical Supervisor**

Acc. : Accredited Parameters by ISO 17025:2005

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<b>Customer</b>	Theo Mc Loughlin Galway City Council Liosban Ind. Est Galway	<b>Lab Report Ref. No.</b>	4910/022/09
	Galway	<b>Date of Receipt</b>	14/10/2011
<b>Customer PO</b>	400092412	<b>Sampled On</b>	12/10/2011
<b>Customer Ref</b>	Carrowbrowne G22s Annual	<b>Date Testing Commenced</b>	14/10/2011
		<b>Received or Collected</b>	By Fitz: Aadil
		<b>Condition on Receipt</b>	Acceptable
		<b>Date of Report</b>	27/10/2011
		<b>Sample Type</b>	Surface Water

## CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
**Alkalinity (Surface Water)	102	Colorimetry	171	mg/L CaCO3	
Boron (Surface Water)	177	ICPMS	<5.51	ug/L	UKAS
Cadmium (Surface Water)	177	ICPMS	<0.01	ug/L	UKAS
Calcium (Surface water)	184	ICPMS	33.69	mg/L	UKAS
Chromium (Surface Water)	177	ICPMS	<0.58	ug/L	UKAS
Copper (Surface Water)	177	ICPMS	<0.21	ug/L	UKAS
Iron (Surface Water)	177	ICPMS	255.3	ug/L	UKAS
Lead (Surface Water)	177	ICFMS	<0.02	ug/L	UKAS
Magnesium (Surface water)	184	ICPMS	1.725	mg/L	UKAS
Manganese (Surface Water)	177	ICPMS	12.87	ug/L	UKAS
Mercury (Surface water)	178	ICPMS	<0.03	ug/L	UKAS
Nickel (Surface Water)	177	ICPMS	0.552	ug/L	UKAS
Nitrogen (Total Oxidised) (Surface W	151	Colorimetry	1.05	mg/L as N	UKAS
Pesticides (Organochlorine)	156	GCMS	<0.1	ug/L	
Pesticides (Organophosphorous)	159	GCMS	<0.1	ug/L	
**Phosphate (Ortho) Surface Water	117	Colorimetry	0.050	mg/L as P	
**Phosphate (Total) Surface Water	166	Colorimetry	0.070	mg/L as P	
Potassium (Surface water)	184	ICPMS	1.076	mg/L	UKAS
SemiVolatile Organic Compounds	155	GCMS	<0.5	ug/L	
Sodium (Surface water)	184	ICPMS	6.081	mg/L	UKAS
Sulphate (Surface Water)	119	Colorimetry	<0.72	mg/L	UKAS
Volatile Organic Compounds	154	GCMS	<1	ug/L	
Zinc (Surface Water)	177	ICPMS	<0.63	ug/L	UKAS

- 1 NOV 2011

**Signed:** A Harmon  
**Aoife Harmon - Technical Supervisor**

**Date:** 27/10/11

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<b>Customer</b>	Theo Mc Loughlin Galway City Council Liosban Ind. Est Galway	<b>Lab Report Ref. No.</b>	4910/022/12
	Galway	<b>Date of Receipt</b>	14/10/2011
<b>Customer PO</b>	400092412	<b>Sampled On</b>	12/10/2011
<b>Customer Ref</b>	Carrowbrowne G23s Annual	<b>Date Testing Commenced</b>	14/10/2011
		<b>Received or Collected</b>	By Fitz: Aadil
		<b>Condition on Receipt</b>	Acceptable
		<b>Date of Report</b>	27/10/2011
		<b>Sample Type</b>	Surface Water

## CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
**Alkalinity (Surface Water)	102	Colorimetry	266	mg/L CaCO <sub>3</sub>	
Boron (Surface Water)	177	ICPMS	15.01	ug/L	UKAS
Cadmium (Surface Water)	177	ICPMS	<0.01	ug/L	UKAS
Calcium (Surface water)	184	ICPMS	6.496	mg/L	UKAS
Chromium (Surface Water)	177	ICPMS	<0.58	ug/L	UKAS
Copper (Surface Water)	177	ICPMS	<0.21	ug/L	UKAS
Iron (Surface Water)	177	ICPMS	151.1	ug/L	UKAS
Lead (Surface Water)	177	ICPMS	<0.02	ug/L	UKAS
Magnesium (Surface water)	184	ICPMS	1.081	mg/L	UKAS
Manganese (Surface Water)	177	ICPMS	4.23	ug/L	UKAS
Mercury (Surface water)	178	ICPMS	<0.03	ug/L	UKAS
Nickel (Surface Water)	177	ICPMS	<0.27	ug/L	UKAS
Nitrogen (Total Oxidised) (Surface W	151	Colorimetry	<0.07	mg/L as N	UKAS
Pesticides (Organochlorine)	156	GCMS	<0.1	ug/L	
Pesticides (Organophosphorous)	159	GCMS	<0.1	ug/L	
**Phosphate (Ortho) Surface Water	117	Colorimetry	<0.006	mg/L as P	
**Phosphate (Total) Surface Water	166	Colorimetry	0.020	mg/L as P	
Potassium (Surface water)	184	ICPMS	0.422	mg/L	UKAS
SemiVolatile Organic Compounds	155	GCMS	<0.5	ug/L	
Sodium (Surface water)	184	ICPMS	6.485	mg/L	UKAS
Sulphate (Surface Water)	119	Colorimetry	<0.72	mg/L	UKAS
Volatile Organic Compounds	154	GCMS	<1	ug/L	
Zinc (Surface Water)	177	ICPMS	<0.63	ug/L	UKAS

Signed: A Harmon  
**Aoife Harmon - Technical Supervisor**

Date: 27/10/11

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<b>Customer</b>	Theo Mc Loughlin Galway City Council Liosban Ind. Est Galway	<b>Lab Report Ref. No.</b>	4910/022/10
		<b>Date of Receipt</b>	14/10/2011
		<b>Sampled On</b>	12/10/2011
		<b>Date Testing Commenced</b>	14/10/2011
		<b>Received or Collected</b>	By Fitz: Aadil
		<b>Condition on Receipt</b>	Acceptable
<b>Customer PO</b>	400092412	<b>Date of Report</b>	27/10/2011
<b>Customer Ref</b>	Carrowbrowne G24s Annual	<b>Sample Type</b>	Surface Water

## **CERTIFICATE OF ANALYSIS**

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
**Alkalinity (Surface Water)	102	Colorimetry	244	mg/L CaCO <sub>3</sub>	
Boron (Surface Water)	177	ICPMS	<5.51	ug/L	UKAS
Cadmium (Surface Water)	177	ICPMS	<0.01	ug/L	UKAS
Calcium (Surface water)	184	ICPMS	47.25	mg/L	UKAS
Chromium (Surface Water)	177	ICPMS	<0.58	ug/L	UKAS
Copper (Surface Water)	177	ICPMS	<0.21	ug/L	UKAS
Iron (Surface Water)	177	ICPMS	317.5	ug/L	UKAS
Lead (Surface Water)	177	ICPMS	<0.02	ug/L	UKAS
Magnesium (Surface water)	184	ICPMS	2.214	mg/L	UKAS
Manganese (Surface Water)	177	ICPMS	24.73	ug/L	UKAS
Mercury (Surface water)	178	ICPMS	<0.03	ug/L	UKAS
Nickel (Surface Water)	177	ICPMS	0.626	ug/L	UKAS
Nitrogen (Total Oxidised) (Surface W	151	Colorimetry	1.22	mg/L as N	UKAS
Pesticides (Organochlorine)	156	GCMS	<0.1	ug/L	
Pesticides (Organophosphorous)	159	GCMS	<0.1	ug/L	
**Phosphate (Ortho) Surface Water	117	Colorimetry	0.045	mg/L as P	
**Phosphate (Total) Surface Water	166	Colorimetry	0.069	mg/L as P	
Potassium (Surface water)	184	ICPMS	1.688	mg/L	UKAS
SemiVolatile Organic Compounds	155	GCMS	<0.5	ug/L	
Sodium (Surface water)	184	ICPMS	7.272	mg/L	UKAS
Sulphate (Surface Water)	119	Colorimetry	16.79	mg/L	UKAS
Volatile Organic Compounds	154	GCMS	<1	ug/L	
Zinc (Surface Water)	177	ICPMS	<0.63	ug/L	UKAS

Signed: A Harmon  
**Aoife Harmon - Technical Supervisor**

Date: 27/10/11

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<b>Customer</b>	Theo Mc Loughlin Galway City Council Liosban Ind. Est Galway	<b>Lab Report Ref. No.</b>	4910/022/08
	Galway	<b>Date of Receipt</b>	14/10/2011
<b>Customer PO</b>	400092412	<b>Sampled On</b>	12/10/2011
<b>Customer Ref</b>	Carrowbrowne G37s Annual	<b>Date Testing Commenced</b>	14/10/2011
		<b>Received or Collected</b>	By Fitz: Aadil
		<b>Condition on Receipt</b>	Acceptable
		<b>Date of Report</b>	27/10/2011
		<b>Sample Type</b>	Surface Water

## CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
**Alkalinity (Surface Water)	102	Colorimetry	141	mg/L CaCO <sub>3</sub>	
Boron (Surface Water)	177	ICPMS	<5.51	ug/L	UKAS
Cadmium (Surface Water)	177	ICPMS	<0.01	ug/L	UKAS
Calcium (Surface water)	184	ICPMS	48.01	mg/L	UKAS
Chromium (Surface Water)	177	ICPMS	<0.58	ug/L	UKAS
Copper (Surface Water)	177	ICPMS	<0.21	ug/L	UKAS
Iron (Surface Water)	177	ICPMS	304.2	ug/L	UKAS
Lead (Surface Water)	177	ICPMS	<0.02	ug/L	UKAS
Magnesium (Surface water)	184	ICPMS	2.103	mg/L	UKAS
Manganese (Surface Water)	177	ICPMS	15.77	ug/L	UKAS
Mercury (Surface water)	178	ICPMS	<0.03	ug/L	UKAS
Nickel (Surface Water)	177	ICPMS	0.571	ug/L	UKAS
Nitrogen (Total Oxidised) (Surface W	151	Colorimetry	1.14	mg/L as N	UKAS
Pesticides (Organochlorine)	156	GCMS	<0.1	ug/L	
Pesticides (Organophosphorous)	159	GCMS	<0.1	ug/L	
**Phosphate (Ortho) Surface Water	117	Colorimetry	0.077	mg/L as P	
**Phosphate (Total) Surface Water	166	Colorimetry	0.096	mg/L as P	
Potassium (Surface water)	184	ICPMS	1.271	mg/L	UKAS
SemiVolatile Organic Compounds	155	GCMS	<0.5	ug/L	
Sodium (Surface water)	184	ICPMS	5.963	mg/L	UKAS
Sulphate (Surface Water)	119	Colorimetry	<0.72	mg/L	UKAS
Volatile Organic Compounds	154	GCMS	<1	ug/L	
Zinc (Surface Water)	177	ICPMS	<0.63	ug/L	UKAS



Signed: A Harmon  
**Aoife Harmon - Technical Supervisor**

Date: 27/10/11

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<b>Customer</b>	Theo Mc Loughlin Galway City Council Liosban Ind. Est Galway	<b>Lab Report Ref. No.</b>	4910/022/11
		<b>Date of Receipt</b>	14/10/2011
		<b>Sampled On</b>	12/10/2011
		<b>Date Testing Commenced</b>	14/10/2011
		<b>Received or Collected</b>	By Fitz: Aadil
<b>Customer PO</b>	400092412	<b>Condition on Receipt</b>	Acceptable
<b>Customer Ref</b>	Carrowbrowne G38s Annual	<b>Date of Report</b>	27/10/2011
		<b>Sample Type</b>	Surface Water

## CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
**Alkalinity (Surface Water)	102	Colorimetry	17	mg/L CaCO3	
Boron (Surface Water)	177	ICPMS	<5.51	ug/L	UKAS
Cadmium (Surface Water)	177	ICPMS	<0.01	ug/L	UKAS
Calcium (Surface water)	184	ICPMS	67.15	mg/L	UKAS
Chromium (Surface Water)	177	ICPMS	<0.58	ug/L	UKAS
Copper (Surface Water)	177	ICPMS	<0.21	ug/L	UKAS
Iron (Surface Water)	177	ICPMS	185.1	ug/L	UKAS
Lead (Surface Water)	177	ICPMS	<0.02	ug/L	UKAS
Magnesium (Surface water)	184	ICPMS	2.832	mg/L	UKAS
Manganese (Surface Water)	177	ICPMS	127.4	ug/L	UKAS
Mercury (Surface water)	178	ICPMS	<0.03	ug/L	UKAS
Nickel (Surface Water)	177	ICPMS	1.884	ug/L	UKAS
Nitrogen (Total Oxidised) (Surface W	151	Colorimetry	1.76	mg/L as N	UKAS
Pesticides (Organochlorine)	156	GCMS	<0.1	ug/L	
Pesticides (Organophosphorous)	159	GCMS	<0.1	ug/L	
**Phosphate (Ortho) Surface Water	117	Colorimetry	0.036	mg/L as P	
**Phosphate (Total) Surface Water	166	Colorimetry	0.088	mg/L as P	
Potassium (Surface water)	184	ICPMS	2.50	mg/L	UKAS
SemiVolatile Organic Compounds	155	GCMS	<0.5	ug/L	
Sodium (Surface water)	184	ICPMS	7.281	mg/L	UKAS
Sulphate (Surface Water)	119	Colorimetry	30.30	mg/L	UKAS
Volatile Organic Compounds	154	GCMS	<1	ug/L	
Zinc (Surface Water)	177	ICPMS	<0.63	ug/L	UKAS

Signed: A Harmon  
**Aoife Harmon - Technical Supervisor**

Date: 27/10/11

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email: info@fitzsci.ie

<b>Customer</b>	Theo Mc Loughlin Galway City Council Liosban Ind. Est Galway	<b>Lab Report Ref. No.</b>	4910/016/08
	Galway	<b>Date of Receipt</b>	17/05/2011
<b>Customer PO</b>	400101319	<b>Sampled On</b>	16/05/2011
<b>Customer Ref</b>	Carrowbrowne - G24S - 16/5/11	<b>Date Testing Commenced</b>	17/05/2011
		<b>Received or Collected</b>	by Fitz:Paul
		<b>Condition on Receipt</b>	Acceptable
		<b>Date of Report</b>	24/05/2011
		<b>Sample Type</b>	Surface Water

## CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Ammonia (Surface Water)	114	Colorimetry	1.84	mg/L as N	UKAS
BOD (Surface Water)	113	Electrometry	4	mg/L	UKAS
Chloride (Surface Water)	100	Colorimetry	27.1	mg/L	UKAS
COD (Surface Water)	107	Colorimetry	51	mg/L	UKAS
Conductivity (Surface Water)	112	Electrometry	577	uscM -1@25C	UKAS
Dissolved Oxygen (mg/l)	715	DO Meter	4.06	mg/L	
Mineral Oil by Calculation	189	GC-FID	100.62	ug/L	
pH (Surface Water)	110	Electrometry	7.7	pH Units	UKAS
Solids (Total Suspended)	106	Filtration/ Drying @ 104C	21	mg/L	
Temperature	715	DO Meter	12.8	degrees C	

Signed :   
Katherine McQuillan - Technical Manager

Date : 24/5/11

Acc. : Accredited Parameters by ISO 17025:2005

All organic results are analysed as received and all results are corrected for dry weight at 104 C  
Results shall not be reproduced, except in full, without the approval of Fitz Scientific  
Results contained in this report relate only to the samples tested

\*\*The analytical result for this parameter may not be reflective of the concentration present at the time of sampling. The maximum recommended preservation time for this parameter has been exceeded.



Appendix 2

**Test Report**

Report of: Analysis of landfill site sample(s)  
Report to: Galway City Council  
Report date: 09/06/11

Facility: **Carrowbrowne Landfill Site**  
Carrowbrowne, Headford Road, Galway  
Reference No: W0013-01

Date collected: 11/05/2011 Date received: 11/05/2011

Comments:

- |   |  |
|---|--|
| 1) All Metals Analysed in the EPA, Dublin Laboratory  | 10) nr "not reported"  |
| 2) Cyanide Analysed by Alcontrol Laboratories, Dublin | 11) no "none observed"   |
| 3) Phenolic Compounds Analysed by Alcontrol Labs.     | 12) VOB "Visible On Bottom"  |
| 4) TOC Analysed by Alcontrol Laboratories, Dublin     | 13) tntc "Too numerous to count"   |
| 5) VOCs Analysed by EPA, Kilkenny                     | 14) F "Field measured parameters"  |
| 6) Solvents Analysed by EPA, Dublin                   | 15) Total Kjeldahl Nitrogen = Total Nitrogen - Total Oxidised Nitrogen                       |
| 7) nm "Not measured"                                  | 16) Colour Analysis: Hazen units = mg/l Pt Co  |
| 8) nd "None detected"                                 | 17) The scope and accuracy of the analysis is shown on the reverse side of each report sheet |
| 9) nt "No time" - Time not recorded                   | 18) (**) Indicates parameters / results produced from non-accredited analytical methods      |

<b>Laboratory Ref:</b>			1101632
<b>Type of sample:</b>			Surface Water
<b>Sampling point:</b>			G12S
<b>Sampled by:</b>			Cathal Ruane
<b>Time Sampled:</b>			12.40
<b>Start/End - Dates of Analysis:</b>			11-05-11/27-05-11
<b>Status of results:</b>			<b>Final</b>
Parameter	Units	Limits	
F ** Temperature	°C		15.8
F ** Dissolved Oxygen %Sat	% Saturation		178
B4 pH	pH Units		8.6
B5 Conductivity @25°C	µS/cm		670
B2 Biochemical Oxygen Demand	mg/l O2		8
B1 Chemical Oxygen Demand	mg/l O2		79
B7 Suspended Solids	mg/l		32
C1 Ammonia	mg/l N		<0.03
C1 ortho-Phosphate (as P)	mg/l P		0.047
C1 Total Oxidised Nitrogen (as N)	mg/l N		<0.4
C1 Chloride	mg/l Cl		25
B1 4 Alkalinity-total (as CaCO3)	mg/l CaCO3		236
D1 Fluoride	mg/l F		0.18
D1 Sulphate	mg/l SO4		79
** Boron	µg/l		97
** Sodium	mg/l		19

Appendix B

<b>Laboratory Ref:</b> 1101632 <b>Type of sample:</b> Surface Water <b>Sampling point:</b> G12S <b>Sampled by:</b> Cathal Ruane <b>Time Sampled:</b> 12.40 <b>Start/End - Dates of Analysis:</b> 11-05-11/27-05-11 <b>Status of results:</b> Final		
Parameter	Units	Limits
** Magnesium	mg/l	9.1
** Potassium	mg/l	15
** Calcium	mg/l	102
** Chromium	µg/l	<1
** Iron	µg/l	247
** Manganese	µg/l	47
** Nickel	µg/l	<0.5
** Copper	µg/l	2
** Zinc	µg/l	46
** Cadmium	µg/l	0.49
** Mercury	µg/l	<0.05
** Lead	µg/l	<0.5

Signed: Ray Smith Date: 09/06/11  
 Ray Smith  
 Regional Chemist, EPA Castlebar

City Council

**Test Report**

Report of: Analysis of landfill site sample(s)  
Report to: Galway City Council  
Report date: 09/06/11

Facility: **Carrowbrowne Landfill Site**  
Carrowbrowne, Headford Road, Galway  
Reference No: W0013-01

Date collected: 12/05/2011      Date received: 12/05/2011

Comments:

- |   |  |
|---|--|
| 1) All Metals Analysed in the EPA, Dublin Laboratory  | 10) nr "not reported"  |
| 2) Cyanide Analysed by Alcontrol Laboratories, Dublin | 11) no "none observed"   |
| 3) Phenolic Compounds Analysed by Alcontrol Labs.     | 12) VOB "Visible On Bottom"  |
| 4) TOC Analysed by Alcontrol Laboratories, Dublin     | 13) ntnc "Too numerous to count"   |
| 5) VOCs Analysed by EPA, Kilkenny                     | 14) F "Field measured parameters"  |
| 6) Solvents Analysed by EPA, Dublin                   | 15) Total Kjeldahl Nitrogen = Total Nitrogen - Total Oxidised Nitrogen                       |
| 7) nm "Not measured"                                  | 16) Colour Analysis: Hazen units = mg/l Pt Co  |
| 8) nd "None detected"                                 | 17) The scope and accuracy of the analysis is shown on the reverse side of each report sheet |
| 9) nt "No time" - Time not recorded                   | 18) (**) indicates parameters / results produced from non-accredited analytical methods      |

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GALWAY COUNTY COUNCIL

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			Laboratory Ref:	1101673	1101674	1101675	1101676	1101677	1101678	1101679
			Type of sample:	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
			Sampling point:	G22S	G23S	G24S	G29S	G37S	G38S	LF2
			Sampled by:	Cathal Ruane	Cathal Ruane	Cathal Ruane	Cathal Ruane	Cathal Ruane	Cathal Ruane	Cathal Ruane
			Time Sampled:	10.50	10.35	13.05	11.55	11.05	11.25	12.45
			Start/End - Dates of Analysis:	12-05-11/27-05-11	12-05-11/27-05-11	12-05-11/27-05-11	12-05-11/27-05-11	12-05-11/27-05-11	12-05-11/27-05-11	12-05-11/27-05-11
			Status of results:	Final	Final	Final	Final	Final	Final	Final
Parameter	Units	Limits								
F..	Temperature	°C		13.1	13.4	13.5	12.8	13.0	12.7	13.0
F..	Dissolved Oxygen %Sat	% Saturation		71	98	56	98	83	71	61
B4	pH	pH Units		7.5	7.3	7.4	7.9	7.7	7.5	7.6
B5	Conductivity @25°C	µS/cm		438	172	517	516	531	515	497
B2	Biochemical Oxygen Demand	mg/l O2		4.2	1.4	5.5	3.2	3.5	3.2	5.9
B1	Chemical Oxygen Demand	mg/l O2		54	57	66	39	39	42	58
B7	Suspended Solids	mg/l		<8	<8	<8	<8	<8	<8	8
C1	Ammonia	mg/l N		0.32	<0.03	1.5	0.11	0.15	<0.03	0.71
C1	ortho-Phosphate (as P)	mg/l P		0.032	<0.012	0.027	0.016	0.039	0.015	0.025
C1	Total Oxidised Nitrogen (as N)	mg/l N		0.8	<0.4	0.9	0.8	0.7	<0.4	0.9
C1	Chloride	mg/l Cl		21	18	25	24	21	21	23
B1	Alkalinity-total (as CaCO3)	mg/l CaCO3		186	55	216	220	232	214	218
D1	Fluoride	mg/l F		0.10	<0.03	0.15	0.17	0.14	0.16	0.11
D1	Sulphate	mg/l SO4		9.0	1.3	16	23	14	26	11
**	Boron	µg/l		<50	<10	<50	<50	<50	<50	<50
**	Sodium	mg/l		11	10	14	13	11	11	12
**	Magnesium	mg/l		3.3	2.4	3.7	4.2	3.6	4.2	3.4
**	Potassium	mg/l		1.9	<0.5	3.2	3.6	1.5	3.3	2.2
**	Calcium	mg/l		63	19	74	80	84	78	74
**	Chromium	µg/l		<1	<0.5	<1	<1	<0.5	<0.5	<0.5
**	Iron	µg/l		515	163	547	184	367	100	451
**	Manganese	µg/l		52	2	55	18	48	19	45
**	Nickel	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Appendix B3

			Laboratory Ref:	1101673	1101674	1101675	1101676	1101677	1101678	1101679
			Type of sample:	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
			Sampling point:	G22S	G23S	G24S	G29S	G37S	G38S	LF2
			Sampled by:	Cathal Ruane	Cathal Ruane	Cathal Ruane	Cathal Ruane	Cathal Ruane	Cathal Ruane	Cathal Ruane
			Time Sampled:	10.50	10.35	13.05	11.55	11.05	11.25	12.45
			Start/End - Dates of Analysis:	12-05-11/27-05-11	12-05-11/27-05-11	12-05-11/27-05-11	12-05-11/27-05-11	12-05-11/27-05-11	12-05-11/27-05-11	12-05-11/27-05-11
			Status of results:	Final	Final	Final	Final	Final	Final	Final
Parameter	Units	Limits								
Copper	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc	µg/l		48	14	10	9	11	6	10	
Cadmium	µg/l		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mercury	µg/l		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lead	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Signed: Ray Smith Date: 09/06/11  
 Ray Smith  
 Regional Chemist, EPA Castlebar

Appendix B3

## **Appendix C.1**

### ***Summary of Ground Water Monitoring Requirements Quarterly Results***

Appendix 1: Table of Results for Groundwater Monitoring Points

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W0013-01

Appendix C1

Parameter Name	Units	EPA Guideline	10/02/07	10/02/07	10/02/07	G108AP	G1A	G2A
Lab Ref						4910/020/07	4910/020/08	NOT FOUND
Ammonia	mg/L as N	0.15	8.65	1.21	6.08	-	3.54	3.76
Chloride	mg/L	30	27.39	29.37	30.62	-	21.6	22.07
Conductivity	uscM - 1@25C	1000	999	890	634	-	811	659
pH	pH Units	≥6.5 and ≤9.5	6.8	7.1	7.2	-	7.0	7.0
Total Organic Carbon	mg/L	Not specified	90.10	11.10	14.70	-	18.00	9.43
Depth	m	-	1.5	0.80	1.7	-	1.9	0.7
Parameter Name	Units	EPA Guideline	10/02/09	10/02/09	10/02/09	108A	116A	
Lab Ref						4910/020/10	NOT FOUND	
Ammonia	mg/L as N	0.15	77.86	-	-	6.21	0.894	-
Chloride	mg/L	30	150	-	-	27.25	18.28	-
Conductivity	uscM - 1@25C	1000	2020	-	-	650	558	-
pH	pH Units	≥6.5 and ≤9.5	7.0	-	-	7.1	7.2	-
Total Organic Carbon	mg/L	Not specified	23.80	-	-	14.10	15.80	-
Depth	m	-	2.07	-	-	1.4	2.25	-



Appendix 1: Table of Results for Groundwater Monitoring Points

Q4

W0013-01

Appendix C1

Parameter Name	Units	EPA Gold 1/0	EPA Gold 1/0	EPA Gold 1/0	EPA Gold 1/0	NOT FOUND	G108AP 4910/023/04	G1A 4910/023/05	G2A NOT FOUND
Ammonia	mg/L as N	0.15	8.47	0.748	8.75	-	0.98	3.75	-
Chloride	mg/L	30	28.41	30.32	27.58	-	19.45	21.67	-
Conductivity	uscm - 1@25C	1000	969	880	664	-	550	660	-
pH	pH Units	≥6.5 and ≤9.5	6.7	7.0	7.1	-	7.1	7.1	-
Total Organic Carbon	mg/L	Not specified	46.80	16.50	17.60	-	18.00	9.65	-
Depth	m	-	1.8	1.3	1.2	-	1.8	0.6	-
Parameter Name	Units	EPA Gold 1/0	EPA Gold 1/0	EPA Gold 1/0	EPA Gold 1/0	NOT FOUND	G108AP 4910/023/04	G1A 4910/023/05	G2A NOT FOUND
Ammonia	mg/L as N	0.15	75.20	-	-	6.44	2.33	-	-
Chloride	mg/L	30	155.37	-	-	27.59	25.84	-	-
Conductivity	uscm - 1@25C	1000	2000	-	-	623	819	-	-
pH	pH Units	≥6.5 and ≤9.5	7.0	-	-	7.1	7.0	-	-
Total Organic Carbon	mg/L	Not specified	29.60	-	-	17.80	15.30	-	-
Depth	m	-	1.1	-	-	1.3	2.15	-	-

Appendix 1: Table of Results for Groundwater Monitoring Points

G2

W0013-01

Appendix C1

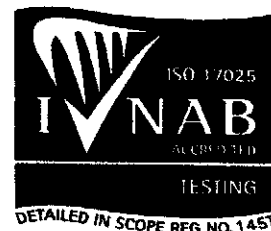
Parameter Name	Units	EPA Guideline	G1AP	G2AP	G3AP	G10AP	G108AP	G1A	G2A
Lab/Ref			4910/017/05	4910/017/06	4910/016/03	NOT FOUND	4910/0116/05	4910/017/07	NOT FOUND
Ammonia	mg/L as N	0.15	8.38	1.00	0.486	-	0.817	3.84	-
Chloride	mg/L	30	26.47	27.84	10.62	-	21.56	21.84	-
Conductivity	uscM - 1@25C	1000	1007	898	451	-	576	674	-
pH	pH Units	≥ 6.5 and ≤9.5	7.0	7.0	8.1	-	7.2	7.1	-
Total Organic Carbon	mg/L	Not specified	82.20	13.90	2.96	-	14.80	8.83	-
Depth	m	-	-	0.80	0.70	-	0.90	-	-
Parameter Name	Units	EPA Guideline	G1A	G10A	G106A	G106A	108A	116A	
Lab/Ref			4910/017/01	NOT FOUND	NOT FOUND	4910/017/09	4910/016/04	NOT FOUND	
Ammonia	mg/L as N	0.15	82.41	-	-	6.82	3.87	-	
Chloride	mg/L	30	160.34	-	-	27.12	20.42	-	
Conductivity	uscM - 1@25C	1000	2140	-	-	670	792	-	
pH	pH Units	≥ 6.5 and ≤9.5	7.0	-	-	7.1	7.0	-	
Total Organic Carbon	mg/L	Not specified	26.40	-	-	14.90	12.60	-	
Depth	m	-	2.07	-	-	-	1.50	-	

**Appendix C.2**

***Summary of Ground Water Monitoring Requirements  
Annual Results***



Environmental Protection Agency  
Regional Inspectorate  
John Moore Road, Castlebar



### Test Report

Report of: Analysis of landfill site sample(s)  
Report to: Galway City Council  
Report date: 09/06/11

Facility: **Carrowbrowne Landfill Site**  
Carrowbrowne, Headford Road, Galway

Reference No: W0013-01

Date collected: 11/05/2011                      Date received: 11/05/2011

Comments:

- |   |  |
|---|--|
| 1) All Metals Analysed in the EPA, Dublin Laboratory  | 10) nr "not reported"  |
| 2) Cyanide Analysed by Alcontrol Laboratories, Dublin | 11) no "none observed"   |
| 3) Phenolic Compounds Analysed by Alcontrol Labs.     | 12) VOB "Visible On Bottom"  |
| 4) TOC Analysed by Alcontrol Laboratories, Dublin     | 13) tnrc "Too numerous to count"   |
| 5) VOCs Analysed by EPA, Kilkenny                     | 14) F "Field measured parameters"  |
| 6) Solvents Analysed by EPA, Dublin                   | 15) Total Kjeldahl Nitrogen = Total Nitrogen - Total Oxidised Nitrogen                       |
| 7) nm "Not measured"                                  | 16) Colour Analysis: Hazen units = mg/l Pt Co  |
| 8) nd "None detected"                                 | 17) The scope and accuracy of the analysis is shown on the reverse side of each report sheet |
| 9) nt "No time" - Time not recorded                   | 18) (**) Indicates parameters / results produced from non-accredited analytical methods      |

*Appendix C2*

			Laboratory Ref:	1101633	1101634	1101635	1101636	1101637
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
			Sampling point:	G9AP	108A	116A - no sample	G4A	G10A - no sample
			Sampled by:	Cathal Ruane	Cathal Ruane	Cathal Ruane	Cathal Ruane	Cathal Ruane
			Time Sampled:	11.50	12.05	13.45	11.10	11.05
			Start/End - Dates of Analysis:	11-05-11/27-05-11	11-05-11/27-05-11	/	11-05-11/27-05-11	/
			Status of results:	Final	Final	Final	Final	Final
Parameter	Units	Limits						
F**	Temperature	°C	10.8	10.0	-	11.5	-	
B4	pH	pH Units	6.9	7.1	-	6.7	-	
B5	Conductivity @25°C	µS/cm	679	589	-	2290	-	
C1	Ammonia	mg/l N	0.11	0.99	-	84	-	
C1	ortho-Phosphate (as P)	mg/l P	0.031	0.025	-	0.127	-	
C1	Total Oxidised Nitrogen (as N)	mg/l N	<0.4	<0.4	-	<0.4	-	
C1	Chloride	mg/l Cl	19	20	-	160	-	
**	Cyanide	mg/l CN	<0.05	<0.05	-	<0.05	-	
D1	Fluoride	mg/l F	0.08	0.10	-	0.45	-	
D1	Sulphate	mg/l SO4	3.4	<0.5	-	12	-	
B1 4	Alkalinity-total (as CaCO3)	mg/l CaCO3	316	286	-	930	-	
**	Total Organic Carbon	mg/l C	42	17	-	36	-	
**	Total coliforms	No/100 ml	nm	nm	-	nm	-	
**	Faecal coliforms	No/100 ml	nm	nm	-	nm	-	
**	Boron	µg/l	<10	<50	-	484	-	
**	Sodium	mg/l	16	11	-	130	-	
**	Magnesium	mg/l	7.7	4.0	-	33	-	
**	Potassium	mg/l	1.0	1.9	-	63	-	
**	Calcium	mg/l	118	103	-	180	-	
**	Chromium	µg/l	1	<1	-	2	-	
**	Iron	µg/l	8117	3212	-	1067	-	
**	Manganese	µg/l	2200	170	-	300	-	
**	Nickel	µg/l	2	<0.5	-	<0.5	-	
**	Copper	µg/l	<0.5	<0.5	-	<1	-	

Appendix C2

			Laboratory Ref:	1101633	1101634	1101635	1101636	1101637
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
			Sampling point:	G9AP	108A	116A - no sample	G4A	G10A - no sample
			Sampled by:	Cathal Ruane	Cathal Ruane	Cathal Ruane	Cathal Ruane	Cathal Ruane
			Time Sampled:	11.50	12.05	13.45	11.10	11.05
			Start/End - Dates of Analysis:	11-05-11/27-05-11	11-05-11/27-05-11	/	11-05-11/27-05-11	/
			Status of results:	<b>Final</b>	<b>Final</b>	<b>Final</b>	<b>Final</b>	<b>Final</b>
Parameter	Units	Limits						
** Zinc	µg/l		10	6	-	1	-	-
** Cadmium	µg/l		0.23	<0.1	-	<0.1	-	-
** Mercury	µg/l		<0.05	<0.05	-	<0.05	-	-
** Lead	µg/l		<1	<0.5	-	<0.5	-	-

Signed: Ray Smith Date: 09/06/11  
Ray Smith  
Regional Chemist, EPA Castlebar

Appendix C2



Environmental Protection Agency  
Regional Inspectorate  
John Moore Road, Castlebar



### Test Report

Report of: Analysis of landfill site sample(s)  
Report to: Galway City Council  
Report date: 09/06/11

Facility: **Carrowbrowne Landfill Site**  
Carrowbrowne, Headford Road, Galway  
Reference No: W0013-01

Date collected: 11/05/2011                      Date received: 11/05/2011

Comments:

- |   |  |
|---|--|
| 1) All Metals Analysed in the EPA, Dublin Laboratory  | 10) nr "not reported"  |
| 2) Cyanide Analysed by Alcontrol Laboratories, Dublin | 11) no "none observed"   |
| 3) Phenolic Compounds Analysed by Alcontrol Labs.     | 12) VOB "Visible On Bottom"  |
| 4) TOC Analysed by Alcontrol Laboratories, Dublin     | 13) tntc "Too numerous to count"   |
| 5) VOCs Analysed by EPA, Kilkenny                     | 14) F "Field measured parameters"  |
| 6) Solvents Analysed by EPA, Dublin                   | 15) Total Kjeldahl Nitrogen = Total Nitrogen - Total Oxidised Nitrogen                       |
| 7) nm "Not measured"                                  | 16) Colour Analysis: Hazen units = mg/l Pt Co  |
| 8) nd "None detected"                                 | 17) The scope and accuracy of the analysis is shown on the reverse side of each report sheet |
| 9) nt "No time" - Time not recorded                   | 18) (**) Indicates parameters / results produced from non-accredited analytical methods      |

*Appendix C2*

			Laboratory Ref:	1101638	1101639	1101640	1101641	1101642
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
			Sampling point:	G1AP	G4AP	106A	G10AP - no sample	G1A
			Sampled by:	Cathal Ruane	Cathal Ruane	Cathal Ruane	Cathal Ruane	Cathal Ruane
			Time Sampled:	13.10	11.35	12.55	11.05	13.35
			Start/End - Dates of Analysis:	11-05-11/27-05-11	11-05-11/27-05-11	11-05-11/27-05-11	/	11-05-11/27-05-11
			Status of results:	Final	Final	Final	Final	Final
Parameter	Units	Limits						
F**	Temperature	°C		11.7	11.9	11.4	-	11.1
B4	pH	pH Units		6.7	7.0	7.0	-	7.0
B5	Conductivity @25°C	µS/cm		1026	906	685	-	686
C1	Ammonia	mg/l N		9.1	2.1	6.9	-	3.7
C1	ortho-Phosphate (as P)	mg/l P		0.300	0.064	0.123	-	0.066
C1	Total Oxidised Nitrogen (as N)	mg/l N		<0.4	<0.4	<0.4	-	<0.4
C1	Chloride	mg/l Cl		26	27	27	-	21
**	Cyanide	mg/l CN		<0.05	<0.05	<0.05	-	<0.05
D1	Fluoride	mg/l F		0.08	0.10	0.22	-	0.30
D1	Sulphate	mg/l SO4		<0.5	2.2	<0.5	-	<0.5
B1	Alkalinity-total (as CaCO3)	mg/l CaCO3		515	464	316	-	324
**	Total Organic Carbon	mg/l C		104	17	17	-	11
**	Total coliforms	No/100 ml		nm	nm	nm	-	nm
**	Faecal coliforms	No/100 ml		nm	nm	nm	-	nm
**	Boron	µg/l		<50	<50	<50	-	<50
**	Sodium	mg/l		98	22	16	-	12
**	Magnesium	mg/l		6.8	6.0	3.4	-	1.3
**	Potassium	mg/l		9.2	6.4	5.2	-	0.6
**	Calcium	mg/l		118	160	106	-	121
**	Chromium	µg/l		4	<0.5	<1	-	<1
**	Iron	µg/l		17630	248	2358	-	1454
**	Manganese	µg/l		1800	800	120	-	100
**	Nickel	µg/l		4	<0.5	<0.5	-	<0.5
**	Copper	µg/l		<0.5	<1	<1	-	<1

Appendix C2



			Laboratory Ref:	1101638	1101639	1101640	1101641	1101642
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
			Sampling point:	G1AP	G4AP	106A	G10AP - no sample	G1A
			Sampled by:	Cathal Ruane	Cathal Ruane	Cathal Ruane	Cathal Ruane	Cathal Ruane
			Time Sampled:	13.10	11.35	12.55	11.05	13.35
			Start/End - Dates of Analysis:	11-05-11/27-05-11	11-05-11/27-05-11	11-05-11/27-05-11	/	11-05-11/27-05-11
			Status of results:	<b>Final</b>	<b>Final</b>	<b>Final</b>	<b>Final</b>	<b>Final</b>
Parameter	Units	Limits						
** Zinc	µg/l		10	2	2	-	-	1
** Cadmium	µg/l		0.24	<0.1	0.54	-	-	<0.1
** Mercury	µg/l		<0.05	<0.05	<0.05	-	-	<0.05
** Lead	µg/l		<1	<0.5	<0.5	-	-	<0.5

Signed: Ray Smith Date: 09/06/11  
 Ray Smith  
 Regional Chemist, EPA Castlebar

Appendix C2

## **Appendix D.1**

### ***Summary of Leachate Monitoring Requirements*** **Quarterly Results**

01



Monitoring and Testing Services

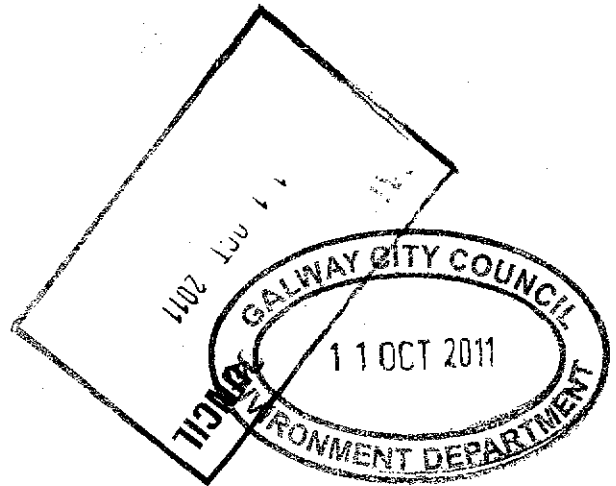
Unit 35,  
Boyne Business Park,  
Drogheda,  
Co. Louth  
Ireland  
Tel: +353 41 9845440  
Fax: +353 41 9846171  
Web: www.fitzsci.ie  
email: info@fitzsci.ie

<b>Customer</b>	Theo Mc Loughlin Galway City Council Liosban Ind. Est Galway	<b>Lab Report Ref. No.</b>	4910/020/01
		<b>Date of Receipt</b>	30/09/2011
		<b>Sampled On</b>	29/09/2011
		<b>Date Testing Commenced</b>	30/09/2011
	Galway	<b>Received or Collected</b>	By Fitz: Aadil
<b>Customer PO</b>		<b>Condition on Receipt</b>	Acceptable
<b>Customer Ref</b>	Carrowbrowne Landfill L2	<b>Date of Report</b>	07/10/2011
		<b>Sample Type</b>	Trade Effluent

Final Effluent

### CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Ammonia (Industrial Eff.)	114	Colorimetry	5.86	mg/L as N	UKAS
BOD (Industrial Eff.)	113	Electrometry	57	mg/L	UKAS
COD (Industrial Eff.)	107	Colorimetry	353	mg/L	UKAS
pH (Industrial Eff.)	110	Electrometry	7.4	pH Units	UKAS
Sulphate (Industrial Eff.)	119	Colorimetry	64.63	mg/L as SO4	UKAS
Suspended Solids (Industrial Eff.)	106	Gravimetry	464	mg/L	UKAS



Signed: A Harmon  
Aoife Harmon - Technical Supervisor

Date: 7/10/11

Acc. : Accredited Parameters by ISO 17025:2005

All organic results are analysed as received and all results are corrected for dry weight at 104 C  
Results shall not be reproduced, except in full, without the approval of Fitz Scientific  
Results contained in this report relate only to the samples tested

\*\*The analytical result for this parameter may not be reflective of the concentration present at the time of sampling. The maximum recommended preservation time for this parameter has been exceeded.

87



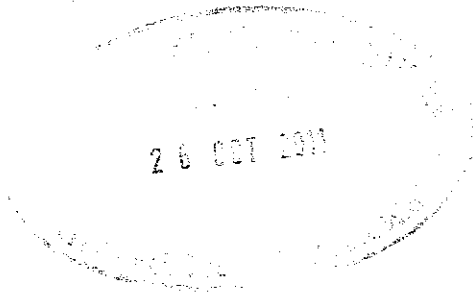
Monitoring and Testing Services

Unit 35,  
Boyne Business Park,  
Drogheda,  
Co. Louth  
Ireland  
Tel: +353 41 9845440  
Fax: +353 41 9846171  
Web: www.fitzsci.ie  
email info@fitzsci.ie

<b>Customer</b>	Theo Mc Loughlin Galway City Council Liosban Ind. Est Galway	<b>Lab Report Ref. No.</b>	4910/024/01
		<b>Date of Receipt</b>	14/10/2011
		<b>Sampled On</b>	14/10/2011
		<b>Date Testing Commenced</b>	14/10/2011
	Galway <i>Final Effluent</i>	<b>Received or Collected</b>	By Fitz: Aadil
<b>Customer PO</b>		<b>Condition on Receipt</b>	Acceptable
<b>Customer Ref</b>	Carrobrowne L2 12/10/11	<b>Date of Report</b>	24/10/2011
		<b>Sample Type</b>	Trade Effluent

### CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Ammonia (Industrial Eff.)	114	Colorimetry	1.05	mg/L as N	UKAS
BOD (Industrial Eff.)	113	Electrometry	20	mg/L	UKAS
COD (Industrial Eff.)	107	Colorimetry	596	mg/L	UKAS
pH (Industrial Eff.)	110	Electrometry	7.6	pH Units	UKAS
Sulphate (Industrial Eff.)	119	Colorimetry	55.29	mg/L as SO4	UKAS
Suspended Solids (Industrial Eff.)	106	Gravimetry	770	mg/L	UKAS



Signed: *A Harmon*  
**Aoife Harmon - Technical Supervisor**

Date: 24/10/11

Acc. : Accredited Parameters by ISO 17025:2005

All organic results are analysed as received and all results are corrected for dry weight at 104 C  
Results shall not be reproduced, except in full, without the approval of Fitz Scientific  
Results contained in this report relate only to the samples tested

\*\*The analytical result for this parameter may not be reflective of the concentration present at the time of sampling. The maximum recommended preservation time for this parameter has been exceeded.

D1



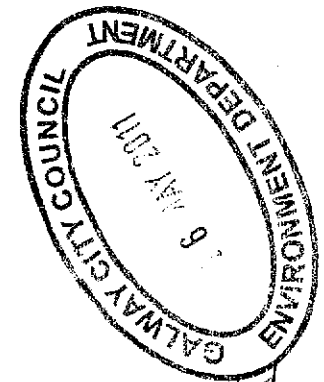
Unit 35,  
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 Tel: +353 41 9845440  
 Fax: +353 41 9846171  
 Web: www.fitzsci.ie  
 email: info@fitzsci.ie

Monitoring and Testing Services

<b>Customer</b>	Theo Mc Loughlin Galway City Council Liosban Ind. Est Galway	<b>Lab Report Ref. No.</b>	4910/016/01
		<b>Date of Receipt</b>	17/05/2011
		<b>Sampled On</b>	16/05/2011
		<b>Date Testing Commenced</b>	17/05/2011
	<i>Trade Effluent</i>	<b>Received or Collected</b>	by Fitz:Paul
		<b>Condition on Receipt</b>	Acceptable
<b>Customer PO</b>	400101319	<b>Date of Report</b>	24/05/2011
<b>Customer Ref</b>	Carrowbrowne L2 Sewer Emission 16/5/11	<b>Sample Type</b>	Trade Effluent

### CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
**Ammonia (Industrial Eff.)	114	Colorimetry	73.80	mg/L as N	
BOD (Industrial Eff.)	113	Electrometry	215	mg/L	UKAS
COD (Industrial Eff.)	107	Colorimetry	3295	mg/L	UKAS
pH (Industrial Eff.)	110	Electrometry	7.8	pH Units	UKAS
Sulphate (Industrial Eff.)	119	Colorimetry	164.40	mg/L as SO4	UKAS
Suspended Solids (Industrial Eff.)	106	Gravimetry	7473	mg/L	



Signed: *Katherine McQuillan*  
**Katherine McQuillan - Technical Manager**

Date: 24/5/11

Acc. : Accredited Parameters by ISO 17025:2005

All organic results are analysed as received and all results are corrected for dry weight at 104 C  
 Results shall not be reproduced, except in full, without the approval of Fitz Scientific  
 Results contained in this report relate only to the samples tested

\*\*The analytical result for this parameter may not be reflective of the concentration present at the time of sampling. The maximum recommended preservation time for this parameter has been exceeded.

## **Appendix D.2**

### ***Summary of Leachate Monitoring Requirements*** **Annual Results**



Environmental Protection Agency  
Regional Inspectorate  
John Moore Road, Castlebar



Appendix D2

### Test Report

Report of: Analysis of landfill site sample(s)  
Report to: Galway City Council  
Report date: 09/06/11

Facility: **Carrowbrowne Landfill Site**  
Carrowbrowne, Headford Road, Galway  
Reference No: W0013-01

Date collected: 11/05/2011      Date received: 11/05/2011

Comments:

- |   |  |
|---|--|
| 1) All Metals Analysed in the EPA, Dublin Laboratory  | 10) nr "not reported"  |
| 2) Cyanide Analysed by Alcontrol Laboratories, Dublin | 11) no "none observed"   |
| 3) Phenolic Compounds Analysed by Alcontrol Labs.     | 12) VOB "Visible On Bottom"  |
| 4) TOC Analysed by Alcontrol Laboratories, Dublin     | 13) tntc "Too numerous to count"   |
| 5) VOCs Analysed by EPA, Kilkenny                     | 14) F "Field measured parameters"  |
| 6) Solvents Analysed by EPA, Dublin                   | 15) Total Kjeldahl Nitrogen = Total Nitrogen - Total Oxidised Nitrogen                       |
| 7) nm "Not measured"                                  | 16) Colour Analysis: Hazen units = mg/l Pt Co  |
| 8) nd "None detected"                                 | 17) The scope and accuracy of the analysis is shown on the reverse side of each report sheet |
| 9) nt "No time" - Time not recorded                   | 18) (**) Indicates parameters / results produced from non-accredited analytical methods      |

Laboratory Ref:			1101643	1101644	1101645	1101646	1101647
Type of sample:			Leachate	Leachate	Leachate	Leachate	Leachate
Sampling point:			L1 - no sample	L3 - no sample	L4	L5	L6 - no sample
Sampled by:			Cathal Ruane	Cathal Ruane	Cathal Ruane	Cathal Ruane	Cathal Ruane
Time Sampled:			12.15	12.15	12.25	12.20	12.15
Start/End - Dates of Analysis:			/	/	11-05-11/27-05-11	11-05-11/27-05-11	/
Status of results:			Final	Final	Final	Final	Final
Parameter	Units	Limits					
F** Temperature	°C		-	-	15.3	15.9	-
B4 pH	pH Units		-	-	7.2	6.3	-
B5 Conductivity @25°C	µS/cm		-	-	5510	7930	-
B2 Biochemical Oxygen Demand	mg/l O2		-	-	2550	14800	-
B1 Chemical Oxygen Demand	mg/l O2		-	-	5350	16340	-
C1 Ammonia	mg/l N		-	-	290	380	-
C1 ortho-Phosphate (as P)	mg/l P		-	-	6.39	39.7	-
C1 Total Oxidised Nitrogen (as N)	mg/l N		-	-	0.5	2.3	-
C1 Chloride	mg/l Cl		-	-	580	660	-
D1 Fluoride	mg/l F		-	-	<0.03	<0.03	-
D1 Sulphate	mg/l SO4		-	-	76	290	-
** Cyanide	mg/l CN		-	-	0.06	<0.05	-
** Total coliforms	No/100 ml		-	-	nm	nm	-
** Faecal coliforms	No/100 ml		-	-	nm	nm	-
** Boron	µg/l		-	-	375	350	-
** Sodium	mg/l		-	-	300	340	-
** Magnesium	mg/l		-	-	43	83	-
** Potassium	mg/l		-	-	460	520	-
** Calcium	mg/l		-	-	198	625	-
** Chromium	µg/l		-	-	20	26	-
** Iron	µg/l		-	-	4640	25912	-
** Manganese	µg/l		-	-	590	2800	-
** Nickel	µg/l		-	-	53	96	-
** Copper	µg/l		-	-	23	45	-



			Laboratory Ref:	1101643	1101644	1101645	1101646	1101647
			Type of sample:	Leachate	Leachate	Leachate	Leachate	Leachate
			Sampling point:	L1 - no sample	L3 - no sample	L4	L5	L6 - no sample
			Sampled by:	Cathal Ruane	Cathal Ruane	Cathal Ruane	Cathal Ruane	Cathal Ruane
			Time Sampled:	12.15	12.15	12.25	12.20	12.15
			Start/End - Dates of Analysis:	/	/	11-05-11/27-05-11	11-05-11/27-05-11	/
			Status of results:	<b>Final</b>	<b>Final</b>	<b>Final</b>	<b>Final</b>	<b>Final</b>
Parameter	Units	Limits						
** Zinc	µg/l		-	-	310	870	-	-
** Cadmium	µg/l		-	-	0.91	1.18	-	-
** Mercury	µg/l		-	-	<0.05	0.1	-	-
** Lead	µg/l		-	-	31	41	-	-

Signed: pp Ray O'Sullivan Date: 09/06/11  
 Ray Smith  
 Regional Chemist, EPA Castlebar

Appendix B2



Environmental Protection Agency  
Regional Inspectorate  
John Moore Road, Castlebar



### Test Report

Report of: Analysis of landfill site sample(s)  
Report to: Galway City Council  
Report date: 09/06/11

Facility: **Carrowbrowne Landfill Site**  
Carrowbrowne, Headford Road, Galway  
Reference No: W0013-01

Date collected: 11/05/2011      Date received: 11/05/2011

**Comments:**

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>1) All Metals Analysed in the EPA, Dublin Laboratory</li> <li>2) Cyanide Analysed by Alcontrol Laboratories, Dublin</li> <li>3) Phenolic Compounds Analysed by Alcontrol Labs.</li> <li>4) TOC Analysed by Alcontrol Laboratories, Dublin</li> <li>5) VOCs Analysed by EPA, Kilkenny</li> <li>6) Solvents Analysed by EPA, Dublin</li> <li>7) nm "Not measured"</li> <li>8) nd "None detected"</li> <li>9) nt "No time" - Time not recorded</li> </ul> | <ul style="list-style-type: none"> <li>10) nr "not reported"</li> <li>11) no "none observed"</li> <li>12) VOB "Visible On Bottom"</li> <li>13) tnt: "Too numerous to count"</li> <li>14) F "Field measured parameters"</li> <li>15) Total Kjeldahl Nitrogen = Total Nitrogen - Total Oxidised Nitrogen</li> <li>16) Colour Analysis: Hazen units = mg/l Pt Co</li> <li>17) The scope and accuracy of the analysis is shown on the reverse side of each report sheet</li> <li>18) (**) Indicates parameters / results produced from non-accredited analytical methods</li> </ul> |
|---|---|

<b>Laboratory Ref:</b>			1101648
<b>Type of sample:</b>			Leachate
<b>Sampling point:</b>			L2
<b>Sampled by:</b>			Cathal Ruane
<b>Time Sampled:</b>			12.30
<b>Start/End - Dates of Analysis:</b>			11-05-11/26-05-11
<b>Status of results:</b>			<b>Final</b>
Parameter	Units	Limits	
F ** Temperature	°C		14.5
B4 pH	pH Units		8.0
B2 Biochemical Oxygen Demand	mg/l O2		855
B1 Chemical Oxygen Demand	mg/l O2		2560
B7 Suspended Solids	mg/l		2870
C1 Ammonia	mg/l N		110
D1 Sulphate	mg/l SO4		120

Signed: Ray Smith      Date: 09/06/11  
Ray Smith  
Regional Chemist, EPA Castlebar

Eluent Ratio 10:1

Parameter	Unit	7.74	5.91	9.91	0	0	0
% Dry Matter	%	7.74	5.91	9.91	0	0	0
Antimony (Leachate)	ug/Kg	60	700	5000			
Arsenic (Leachate)	ug/Kg	380.6	386.3	224	500	2000	25000
Barium (Leachate)	ug/Kg	220.4	127.3	177	20000	100000	300000
Benzene (Solid)	mg/Kg	<0.5	<0.5	<0.5	0	0	0
BTEX (Solid)	mg/Kg	6	0	0	6	0	0
Cadmium (Leachate)	ug/Kg	0.536	0.733	0.199	40	1000	5000
Chloride (Leachate WAC)	mg/Kg	13.2	17.7	100	800	15000	25000
Chromium (Leachate)	ug/Kg	80.51	115.4	73.1	500	10000	70000
Copper (Leachate)	ug/Kg	582.6	1057	742.8	2000	50000	100000
Dissolved Organic Carbon	mg/Kg	582.6	1057	742.8	500	800	1000
Ethylbenzene (Solid)	mg/Kg	<0.5	<0.5	<0.5	0	0	0
Fluoride (Leachate WAC)	mg/Kg	7.96	5.99	6.47	10	150	500
Lead (Leachate)	ug/Kg	22.11	20.71	9.395	500	10000	50000
Loss on Ignition	%	29.9	30.71	27.64	0	0	10
m- & p-Xylene (Solid)	mg/Kg	<1	<1	<1	0	0	10
Mercury (Leachate)	ug/Kg	4.997	1.552	1.083	10	200	2000
Mineral oil by Calculation (solid)	mg/Kg	271.11	72.75	87.85	500	0	0
Molybdenum (Leachate)	ug/Kg	441.1	72.75	417.3	500	10000	30000
Nickel (Leachate)	ug/Kg	400	10000	40000	400	10000	40000
o-Xylene (Solid)	mg/Kg	<0.5	<0.5	<0.5	0	0	0
PAH Solid (Sum of 17)	mg/Kg	<0.05	<0.05	<0.05	100	0	0
PCBs (Solid)	mg/Kg	<0.005	<0.005	<0.005	1	0	0
pH (Solid)	pH Units	7.1	7.2	7.3	0	>6	0
Phenol Index (Leachate)	mg/Kg	1	0	0	1	0	0
Selenium (Leachate)	ug/Kg	31.87	49.12	42.36	100	500	7000
Solids (Total Dissolved)	mg/L	100	500	7000	100	500	7000
Sulphate (Leachate WAC)	mg/Kg	38.21	116.7	144.54	1000	20000	50000
TOC (Solid)	%	3	5	8	3	5	8
Toluene (Solid)	mg/Kg	8.462	<0.5	<0.5	0	0	0
Zinc (Leachate)	ug/Kg	752.8	961.9	742.8	4000	50000	200000

Please refer to the relevant waste licence conditions at the proposed disposal site.

Note 1: Either TOC or LOI must be used for hazardous wastes

Note 2: UK PAH limit values are being consulted upon (Draft Landfill Amendment Regulations 2005)

Note 3: If inert waste does not meet the SO4 L/S 10 limit, alternative limit values of 1500 mg/L SO4 and Co (initial eluate from the percolation test (prCEN/TS 14405:2003)) and 6000mg/Kg SO4 at L/S10 (either from percolation test or batch test GC EN 12457-3), can be used to demonstrate compliance with the acceptance criteria for inert wastes

Note 4: The values for TDS can be used instead of the values for Cl and SO4

Note 5: DOC at pH 7.5-8.0 and L/S 10 can be determined on the eluate derived from a modified version of the pH dependence test, prCEN/TS 14429:2003, if the limit value at own pH (BS EN 12457 eluate) is not met.

Note 6: In the case of soils, a higher TOC limit value may be permitted by the Environment Agency at an inert waste landfill, provided the DOC value of 500mg/Kg is achieved at L/S 10/Kg, either at the soil's own pH or at a pH value between 7.5 and 8.0

Note 7: For determining the total of PAH, the following 17 compounds must be added to a sum:

- |                         |                        |                         |
|-------------------------|------------------------|-------------------------|
| Flouranthene            | Naphthalene            | Pyrene                  |
| Benzo(a)pyrene          | Acenaphthylene         | Chrysene                |
| Benzo(b)flouranthene    | Acenaphthene           | Benzo(a)anthracene      |
| Benzo(k)flouranthene    | Fluorene (9H-Fluorene) | Dibenzo (a,h)anthracene |
| Benzo(g,h,i)perylene    | Phenanthrene           | Coronene                |
| Indeno(1,2,3-c,d)pyrene | Anthracene             |                         |

Signed: A. Harman

Date: 17/11/11

**Appendix E.1**

***Summary of Annual Bioaerosol Monitoring***

Not available at time of writing

## **Appendix E.2**

### ***Odour – Composting facility***

Not available at time of writing

## **Appendix F.1**

### ***Noise***

## 8.0 Day Time Monitoring

Monitoring Point	Date / Time	Sampling Interval (Minutes)	L(A)eq	L(A)10	L(A)90	Comments
N1	12/10/2011 12:06	30	41	43	36	Main source of noise was produced by continuous ambient traffic noise from the Headford Road. No audible noise from the landfill site.
N2	12/10/2011 11:00	30	50	52	43	Main source of noise was produced by machinery operating in the composting facility including reverse sirens. Continuous ambient traffic noise from the Headford road.
N3	12/10/2011 14:34	30	51	53	49	Main source of noise was produced by machinery operating in the composting facility including reverse sirens. Continuous ambient traffic noise from the Headford road.
N4	12/10/2011 11:05	30	48	48	43	Continuous ambient traffic noise from the Headford Road. No audible noise from the landfill site.
N5	12/10/2011 15:35	30	66	70	48	Main source of noise was produced by the continuous traffic movements on the Headford Road and from trucks entering and leaving the car dismantlers on the opposite side of the road. No audible noise from the landfill site.
N6	12/10/2011 16:10	30	53	55	49	Main source of noise was produced by continuous traffic movements on the Headford Road. No audible noise from the Carrowbrowne composting facility.