EAST CORK LANDFILL, ROSSMORE, CARRAIGTOHILL, CO. CORK

EPA LICENCE W022-01

Q2, QUARTERLY REPORT

APRIL TO JUNE 2016

Prepared For:

CORK COUNTY COUNCIL,
ENVIRONMENTAL PROTECTION DIRECTORATE

Prepared By:
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Contents

1.0 Introduction

1.1 This report details the results of the 2016 quarter 2 monitoring programme undertaken at East Cork Landfill (RRL) as specified by EPA waste licence W022-01 and as agreed with the Agency.

1.2 The 2016 quarter 2 monitoring programme consisted of the following:

A. Groundwater monitoring: quarterly parameters.
B. Surface water monitoring: quarterly parameters.
C. Leachate monitoring: quarterly parameters

2.0 Groundwater Assessment

2.1.0 Methodology

2.1.1 Waste Licence W022-01 includes a list of groundwater parameters which are measured each quarter. Table D.1 in the licence specifies that samples are to be taken from 5 monitoring wells (BH1/ BH2/ BH3/ BH4/ BH5). All wells are fitted with Waterra tubing and Delrin® ball foot-valves.

2.1.2 The Hydrogeological review, Technical Assessment carried out by IE consulting in 2015. There are currently 5 ground water wells. These bore holes are positioned up gradient, down gradient or cross gradient of the waste body. BH1 and BH4 provide adequate up gradient baseline hydrochemistry data. BH2 and BH3 intercept the leachate contaminated ground water plume flow to the south-west and preferential flow from the unlined landfill to the north. These ground water wells are considered adequate to monitor ground water quality in down gradient bedrock aquifer. The existing down gradient monitoring borehole BH2 is suitably positioned to act as a compliance monitoring borehole given its position immediately down gradient of the southern site boundary.

2.1.3 The second quarter sampling and testing for East Cork Landfill was carried out by Southern Scientific Services Ltd. on the 29th June 2016.

2.1.4 Ground water results will be compared to Interim Guideline Values (IGV) for Ground Water and the EC (Ground Water) Regulations 2010. Ground water trigger limits are as follows;

Boreholes	Ammonia mg/l	TOC mg/l
BH1	50	40
BH2	100	40
BH3	150	40

2.2.0 Groundwater Monthly

2.3.0 Ground Water: Q2

2.3.1 **pH** levels ranged from 6.8 to 6.9. All pH results are within the IGV.

2.3.2 **Electrical conductivity** values ranged from 3820 to 18580 µS/cm. Results of all samples exceeded the EC Groundwater Regulations limits and IGV.

2.3.3 **Chlorides** ranged from 946 to 7207 mg/l. Results of all samples exceeded the Groundwater Regulations limit for the test assessment for saline or other intrusions (24 mg/l) the IGV of 30 mg/l.

2.3.4 **Total Organic Carbon (TOC)** levels ranged from 2.61 to 8.09mg/l. Results from BH1 and BH3 were similar to previous results while BH2 was slightly higher. TOC level from BH4 was much lower than previous monitoring result. Trigger limits were not exceeded.

2.3.5 **Ammoniacal nitrogen** (NH4) concentrations ranged from 0.08 to 34.2 mg/l N. BH1, BH2 and BH4 exceeded the EC Groundwater Regulations limits. However, BH4 was below the IGV. Trigger limits were not exceeded.

2.3.6 **TON** ranged from 0.05 to 8.08 mg/l**. Potassium** ranged from 28.2 to 199mg/l. **Sodium** ranged from 517 to 4140 mg/l.

2.4.0 Summary

Electrical conductivity, chloride and ammoniacal nitrogen were non-compliant with groundwater regulations. Potassium and sodium levels were in exceedence of IGV and also higher than the previous quarters monitoring results (Q1 2016). Groundwater trigger limits for

ammonia and TOC were not exceeded. No groundwater wells are used for human consumption.

3.0 Surface Water Assessment

3.1.0 METHODOLOGY

3.1.1 As specified by EPA waste licence W022-01, 3 surface water monitoring points (SW1/ SW2/ SW3) were sampled for the second quarter by Southern Scientific Services Ltd.

3.1.2 The surface water samples were analysed in accordance with table D.5 of the site waste licence. Surface water results will be compared to Environmental Quality Standards (EQSs) for surface water (Appendix 2).

3.1.3 The landfill site is located in the centre of a peninsula, which extends into the North Channel of Cork Harbour. The Surface water sampling locations are influenced by saline water due to their location.

3.2.0 Surface Water: Q2

3.2.1 Recorded values of **pH** ranged from 8.0 to 8.3 units. All pH results were within the 95%ile EQS and similar to previous results.

3.2.2 **Electrical conductivity** results ranged from 44.5 to 44.8 mS/cm. Conductivity was similar to previous results.

3.2.3 **Chlorides levels** ranged from 18014 to 18440 mg/l. Chloride levels were elevated in all samples in comparison to the previous quarter.

3.2.4 **Biochemical oxygen demand** (BOD) ranged from 2.27 to 2.70 mg/l. BOD results from SW2 exceed 95% EQS. **Chemical oxygen demand** (COD) levels ranged from 31 to 47 mg/l.

3.2.5 Concentrations of **total suspended solids** (TSS) ranged from 10 mg/l to 69 mg/l.

3.2.6 **Ammoniacal Nitrogen** (NH3) results ranged from <0.035 to 0.04 mg/l N. All results were below the 95%ile EQS for good status waters.

3.3.0 Summary

BOD exceeded the 95%ile EQS for good status waters at SW2. Electrical conductivity and chloride levels were high in all samples; however, this may be due to the location of the site and the influence of tidal waters.

4.0 Leachate Assessment

4.1 Methodology

4.1.1 As specified by EPA waste licence W022-01, 4 leachate bore holes monitoring points were sampled for the final quarter and annual sampling by Southern Scientific.

4.1.2 Three monitoring boreholes are located to the north of the landfill, in the old unlined section. In a previous Fehily Timoney report, March 2002, the borehole wells were determined not to be tidally influenced and the water within the boreholes C1 to C5 is perched within the waste body.

4.1.3 The final borehole monitoring point is located at the leachate lagoon.

4.1.4 Leachate results are compared to Table 1, which outlines a summary of analytes in the leachate in comparison to typical leachate composition of 30 samples from U.K./Irish landfills accepting mainly domestic waste.

Table 1: Summarises the concentration of analytes in the leachate in comparison to typical leachate composition of 30 samples from U.K./Irish landfills accepting mainly domestic waste.

Parameter	Typical Range
pH	6.4 - 8.0
Electrical conductivity EC (ms/cm)	503-19,200
Ammoniacal nitrogen NH_4-N	<0.2-1,700
Chemical Oxygen Demand mg/l	<10-33,700
Biochemical Oxygen Demand mg/l	<0.5->4,800
Cadmium Cd µg/l	<0.01-0.03
Chromium Cr µg/l	40-560
Chloride Cl	64-3,410
Copper Cu µg/l	20-160
Lead Pb µg/l	<0.04-0.28
Mercury Hg (µg/l)	<0.1-1.0

Total oxidised nitrogen (TON)	<0.01-6.7

4.2.0 Leachate Q2

4.2.1 **pH** levels ranged from 6.6 to 7.6. Similar to previous results.

4.2.2 **Conductivity** levels ranged from 5.2 to 10.23 mS/cm. The highest conductivity was recorded in C1.

4.2.3 **Biochemical Oxygen Demand** ranged from 7.9 to 55.7 mg/l. **Chemical Oxygen Demand** ranged from 183 to 730 mg/l.

4.2.4 **Ammoniacal Nitrogen** ranged from 181 to 647 mg/l.

4.2.5 **Total Suspended Solids** ranged from 80 to 218 mg/l.

4.3.0 Summary

Conductivity and ammoniacal nitrogen levels were elevated in comparison to the previous quarterly monitoring results (Q1). All other results were similar to previous quarterly monitoring results. All parameters were within the typical concentrations recorded in landfill leachate (Table 1).

5.0 Conclusion

Groundwater monitoring results for Q2 were generally higher than the previous quarterly monitoring results. Ammoniacal nitrogen, conductivity and chloride levels exceeded the limits set for groundwater in all samples. However, these exceedences are in line with previous monitoring results from this site.

Surface water monitoring results for Q2 were, in general, similar with previous quarterly monitoring results. BOD was in Exceedance of surface water limits in SW2. An improvement in ammoniacal nitrogen levels was observed in all samples in comparison to the previous quarterly results (Q1). Conductivity and chloride levels were elevated in all samples due to the influence of tidal waters.

Leachate monitoring results for Q2 saw an increase in conductivity, chloride and ammoniacal nitrogen levels in comparison to the previous quarterly monitoring results. All other results were similar to previous monitoring results.

Appendix 1: Results of analysis

Results exceeding relevant limits are highlighted in red

Table 2: Quarter 2 Groundwater Results

Parameter	Units	BH1	BH2	BH3	BH4	SI 9 2010 Threshold Value Range *	EPA IGV **
On site monitoring							
Depth of water	m	5.85	12.07	2.20	2.16	-	-
Temperature	ºC	12.8	15.9	15.0	17.6	-	25
Odour	-	Chemical Musty	Slightly Chemical Musty	Strong Chemical Musty	No odour	-	-
Visual	-	Clear	Clear	Dark Grey	Clear	-	-
Chemical Analysis							
pH	pH Unit	6.9	6.8	6.9	6.9	-	6.5 – 9.5
Conductivity	µS/cm	6410	3820	6950	18580	800 – 1875	1000
Chloride	mg/L	1967	946	2468	7207	24 – 187.5	30
Ammoniacal Nitrogen	mg/L N	-	34.2	-	-	0.065 – 0.175	0.15
Ammoniacal Nitrogen, Saline	mg/L N	3.10		-	0.08		
TON	mg/L N	0.16	8.08	0.05	4.36	-	-
Sodium	mg/L	1260	517	1417	4140	-	150
Potassium	mg/L	28.2	31.1	58.1	199	-	5
TOC	mg/L	2.61	8.09	3.54	7.93	-	-

*** S.I. 9. (2010). European Communities Environmental Objectives (Groundwater) Regulations**

**** EPA (2002). Towards setting guideline values for the protection of groundwater in Ireland**

Table 3: Quarter 2 Surface Water Results

Parameter	Units	SW1	SW2	SW3	SI 272 2009 Inland Waters EQS 95%ile (Good Status)
Chemical Analysis					
BOD	mg/L	2.56	2.70	2.27	2.6
COD	mg/L	40	31	47	-
pH	pH Unit	8.0	8.3	8.2	6 – 9
Conductivity	µS/cm	44.5	44.8	44.5	-
Suspended Solids	mg/L	69	46	10	-
Chloride	mg/L	18110	18440	18014	
Ammoniacal Nitrogen, Saline	mg/L N	<0.035	<0.035	0.04	0.140
On Site Monitoring					
Temperature	ºC	18.35	17.54	17.01	≤ 1.5 ºC rise outside mixing zone
DO	mg/L	8.33	10.40	8.96	-

Table 4: Quarter 2 Leachate Results

Parameter	Units	L1	C1	C2	C3
Chemical Analysis					
BOD	mg/L	55.7	27.6	7.9	34.9
COD	mg/L	730	481	183	195
pH	pH Unit	7.6	6.6	6.7	7.0
Conductivity	µS/cm	7720	10230	5200	3450
Suspended Solids	mg/L	80	160	118	218
Chloride	mg/L	891	2966	900	490
Ammoniacal Nitrogen	mg/L N	599	647	288	181
On Site Monitoring					
Visual	-	Yellow Brown	Green Grey	Green Grey	Brown Grey
Odour	-	Musty Chemical	Chemical Petroleum	Chemical Petroleum	Chemical Petroleum
Temperature	ºC	18.75	16.65	15.99	15.47
DO	mg/L	5.06	5.69	5.73	4.78
Levels	m	-	9.68	6.46	6.12

Appendix 2: Legislation

Table 3.1: Interim Guideline Values for Characterisation List of Parameters

PARAMETER	*List I or List II*	*Drinking Water Standards (units)*	*GSI Trigger Values*	*EQSs for Surface Waters*	***Interim Guideline Value***	*Source of Interim GVs*
CORE PARAMETERS or NATURAL SUBSTANCES						
Physicochemical-Microbiological						
Coliforms (faecal)		0 counts per 100ml	0 counts per 100ml		0 counts per 100ml	B, I
Coliforms (total))		0 counts per 100ml	0 counts per 100ml		0 counts per 100ml	B, I
Electrical Conductivity		1500 µS/cm		1000µS/cm	1000µS/cm	K
Temperature		25°C			25°C	B
TOC		*No abnormal change*			*No abnormal change*	-
Colour					*No abnormal change*	A
pH (pH units)		≥ 6.5 and ≤ 9.5			≥ 6.5 and ≤ 9.5	A
Inorganic						
Alkalinity					*No abnormal change*	-
Ammonia (as ammonium)	*II*	0.30 mg/l	0.15 mg/l	0.02 NH_3	0.15 mg/l	F
Bicarbonate		*No abnormal change*			*No abnormal change*	-
Calcium		200 mg/l			200 mg/l	B
Carbonate		*No abnormal change*			*No abnormal change*	-
Chloride		250 mg/l	30 mg/l	250 mg/l	30 mg/l	E
Dissolved Oxygen		*No abnormal change*			*No abnormal change*	-
Hardness (as $CaCO_3$)		200 mg/l			200 mg/l	G
Iron		0.2 mg/l		1.0 mg/l	0.2 mg/l	A
Magnesium		50 mg/l			50 mg/l	B
Manganese		0.05 mg/l		0.3 mg/l	0.05 mg/l	A
Nitrate (as NO_3)		50 mg/l	25 mg/l	50 mg/l	25 mg/l	E
Nitrite (as NO_2)	*II*	0.1 mg/l		0.2 mg/l	0.1 mg/l	A
Orthophosphate		0.03 mg/l			0.03 mg/l	F
Potassium		5 mg/l	5 mg/l		5 mg/l	I
Sodium		150 mg/l			150 mg/l	B
Sulphate mg/l		250 mg/l		200 mg/l	200 mg/l	K
Metals						
Aluminium		0.2 mg/l		0.2 mg/l	0.2 mg/l	A, K
Arsenic and its compounds	*II*	0.01 mg/l		0.025mg/l *	0.01 mg/l	A
Boron	*II*	1.0 mg/l		2.0 mg/l	1.0 mg/l	A
Cadmium and its compounds	*I*	0.005 mg/l		0.005 mg/l	0.005 mg/l	A, K
Chromium and its compounds	*II*	0.05 mg/l		0.03 mg/l *	0.03 mg/l *	J
Copper and its compounds	*II*	2.0 mg/l		0.03 mg/l *	0.03 mg/l *	J
Mercury and its compounds	*I*	0.001 mg/l		0.001 mg/l	0.001 mg/l	A, K
Nickel and its compounds	*II*	0.02 mg/l		0.05 mg/l *	0.02 mg/l	A
Zinc and its compounds	*II*	5.0 mg/l		0.1 mg/l *	0.1 mg/l *	J
Organics						
TON mg/l		*No abnormal change*			*No abnormal change*	-
Total Hydrocarbons to include mineral oil by GC** mg/l	*I*	0.01 mg/l		0.01 mg/l	0.01 mg/l	B, K

** TPH by Gas Chromatography: This analysis can serve as a 'catch-all' and will present results for the general term 'Gasoline Range Organics' and the separate 'BTEX' parameters including MTBE. 'Diesel Range Organics' (DRO) should also be specified in order to determine mineral oil concentration.