



**ANNUAL ENVIRONMENTAL REPORT 2017**

**DUNGARVAN WASTE DISPOSAL SITE**

**BALLYNAMUCK MIDDLE**

**DUNGARVAN CO. WATERFORD**

**Waste Licence Register No. W0032-3**

Report Compiled by;

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## **Introduction**

Waterford County Council was granted a Waste Licence (Ref 32-1) by the Environmental Protection Agency on the 29<sup>th</sup> November 2002 for the continued acceptance of municipal waste within the existing footprint of the Dungarvan Landfill Facility at Ballynamuck Middle, Dungarvan Co. Waterford. The landfill ceased to accept waste on the 30<sup>th</sup> June 2003. This licence was updated by Waste Licence (Ref 32-2) which included permission for a Transfer Station and Composting facilities. A further licence (W032 – 03) was granted by the Agency in October, 2014. This is the fourteenth Annual Environmental Report for the Facility and includes the monitoring period 1<sup>st</sup> January 2017 – 31<sup>st</sup> December 2017. The report has been prepared in accordance with Condition 11.7 and Schedule E of the Waste Licence.

## **1. Reporting Period**

This is the thirteenth Annual Environmental Report for the Dungarvan Waste Disposal Site, which covers the period 1<sup>st</sup> January 2017 to 31<sup>st</sup> December 2017.

## **2. Waste Activities carried out at the Facility**

Part 1 of the Waste Licence details the activities authorised by the licence:

### **Waste Management Act 1996: Third Schedule**

#### **Class 4. Surface impoundment, including placement of liquid or sludge discards in to pits, ponds or lagoons:**

This activity is limited to the storage of leachate generated within the facility in lined Integrated Constructed Wetland Ponds and the storage of surface water runoff in surface water retention (s) ponds

#### **Class 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 was produced:**

This activity is limited to the storage of rejected waste in the waste Inspection and Quarantine area and the Construction and Demolition Recovery Area prior to the removal of such waste off site for the disposal at an appropriate facility

### **Waste Management Act, 1996, Fourth Schedule**

#### **Class 2. Recycling or reclamation of organic substances, which are not used as solvents (including composting and other biological transformation processes):**

This activity is limited to recycling of organic waste including cardboard and paper at the civic waste facility only and the acceptance and storage of waste oils in appropriate containers at the civic waste facility prior to removal offsite.

#### **Class 3. Recycling or reclamation of metals and metal compounds:**

This activity is limited to the acceptance of white goods within a designated Metal Recovery Area, the acceptance and storage of beverage cans in the appropriate containers at the civic waste facility prior to removal offsite.

**Class 4. Recycling or reclamation of other inorganic materials:**

This activity is limited to the acceptance and storage in appropriate containers of glass bottles, batteries and fluorescent tubes and the recovery of inert waste at the facility for use in site development and restoration works.

**Class 9. Use of any waste principally as a fuel or other means to generate energy**

**Class 11. Use of waste obtained from any activity referred to in a preceding paragraph of this Schedule:**

This activity is limited to the use of suitable inert waste in site development and restoration works.

**Class 13. Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than the temporary storage, pending collection, on the premises where such waste is produced:**

This activity is limited to the storage of wastes within designated areas and receptacles prior to recovery offsite and the storage of inert waste prior to restoration of the facility.

**3. Quantity and Composition of Waste received, disposed of and removed during the reporting period and each year previous**

The quantity and composition of waste received, disposed of and removed for the reporting period 1<sup>st</sup> January 2017 – 31<sup>st</sup> December 2017 is attached in **Appendix A.**

**4. Methods of deposition of inert waste for restoration**

All capping and restoration works have now been completed.

## 5.0 Environmental Monitoring

### Introduction

Dungarvan landfill is located in County Waterford approximately 2km north west of Dungarvan off the N25 road on the southern edge of the Colligan River. The total area of the landfill site is approximately 6.5 hectares, and has been in operation since 1968. The landfill closed on 30<sup>th</sup> June 2003, but a transfer station, which accepts residual household waste remains operational on site.

Monitoring of surface waters, groundwater's and leachate and landfill gas was carried out in accordance with the waste licence W032-03. EPA and Waterford City and County Council staff carried out sampling and field measurements. [Sampling was carried out by Jim McGarry, Brownstown, Kilkieran, Co. Kilkenny. Samples were analysed by ALcontrol Laboratories, Unit 7-8 Hawarden Business Park, Manor Road, Hawarden, Deeside, UK in each quarter of 2017.](#)

Sampling sites are as set out in Table 1 and attached Drawing, DUN-EIS-003.

Surface water stations	Groundwater station	Leachate station	Gas monitoring station	Noise	Dust
Upstream/ Downstream of Surface Water Emission Point to Colligan River Wetlands	GW1*, GW2a, RC3a, RC4*, RC6a, RC7*, RC8*	L1, L2a, L3*, L4*, L5a, L6*, Leachate tank	L1*, L2a, L3*, L4*, L5a, L6, RC1*, RC3, RC4*, RC6, RC7, RC8, GW1*, GW2a	Entrance	D1, D2, D2a

**Table 1: Monitoring locations, Dungarvan Landfill**

\*Baseline results available for these sites



## **Baseline Monitoring**

One of the purposes of compliance monitoring is to determine if there has been a release of contaminants to the environmental media, and to demonstrate compliance with landfill licence conditions. *Baseline monitoring* is monitoring which serves as a reference point to which later monitoring results are compared. While there is no data available preceding the landfill, for the purpose of this report, water quality results obtained during 2001 will be used as baseline monitoring data. Two new groundwater monitoring boreholes (RC7 and RC8) were installed since 2001, and results of tests carried out in 2002 at these sites are used as baseline. Noise measurements taken during the 1998 survey will also be used as comparison [with the most recent study](#). For all new sampling sites referred to in the new licence the 2016 figures included in this report will be used as baseline figures going forward.

## 5.1 SURFACE WATER.

### 5.1.1 Introduction

The surface water sampling sites are SWE1, SWE2, SWE3, SWE4, SWE5, SWE6 and SWE7 which relate to storm water discharge points from the landfill and the outfall to the Colligan River (SWE6). River water quality upstream and downstream of the outfall pipe is also measured.

Further surface water monitoring is carried out at the Constructed Wetland System at the outlets of Ponds 1a, 1b, 2,3,4 and 5. Sampling was carried out by Jim McGarry, Brownstown, Kilkieran, Co. Kilkenny. Samples were analysed by ALcontrol Laboratories, Unit 7-8 Hawarden Business Park, Manor Road, Hawarden, Deeside, UK in each quarter of 2016.

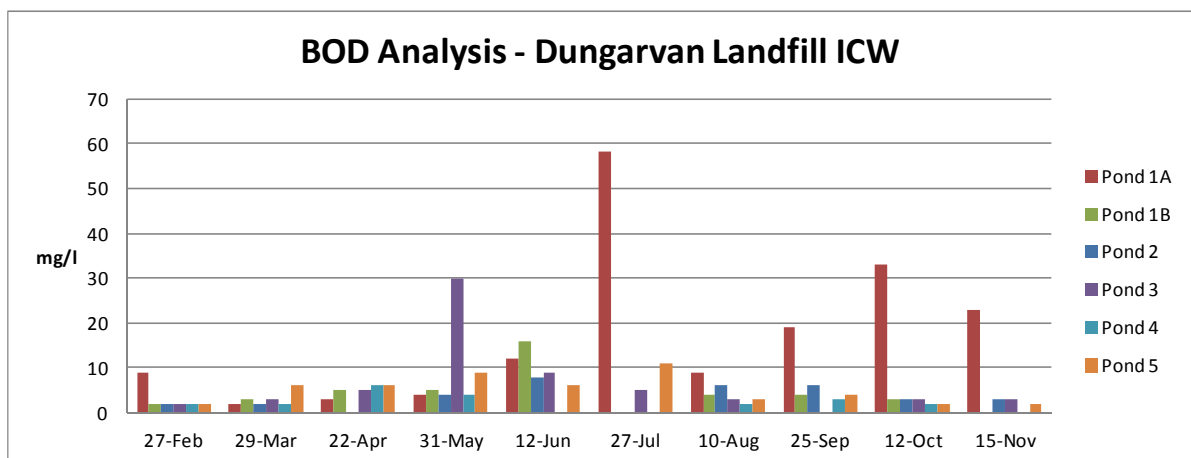
There are difficulties involved in monitoring surface water pollution from landfills adjacent to estuaries, as the salinity of the samples can interfere with many of the tests, (*ammonia, COD, arsenic, copper*). Additionally, many of the ions, which are considered indicators of leachate contamination, are also major components of sea/brackish water, (*chloride, sulphate, sodium, magnesium, calcium, boron*).

### 5.1.2 Results – see table 5.1.1 to 5.1.4 below.

River and lagoon water quality was satisfactory.

#### Key Parameter – BOD

The BOD test is a measure of the amount of oxygen consumed by microorganisms in breaking down organic matter in water. Respiration by phytoplankton or their decay, can also lead to oxygen depletion during the BOD test resulting in a high BOD value. Surface waters supporting fish life should have a BOD value < 4 mg/l BOD as was the case throughout this reporting period.



**Discussion**

BOD levels were low in the receiving waters throughout the year. All other water quality tests were satisfactory. All parameters referred to Schedule B.2 with regard to emissions to water were satisfactory.

**Table 5.1.1 Dungarvan landfill surface water monitoring Q1 2017**

<b>Parameters</b>	<b>Units</b>	<b>Dungarvan Landfill W0032-02 Qrt 1 2017</b>	
		<b>Surface Water</b>	
<b>LABORATORY NUMBER</b>		<b>2868</b>	<b>2869</b>
<b>Sampling Location</b>		<b>U/S</b>	<b>D/S</b>
<b>Date sampled</b>	20/02/2017	20-Feb	20-Feb
<b>Sampled by</b>	JMcGarry	JMcG	JMcG
<b>Time sampled</b>		13:30	13:45
Visual Inspection/Odour		clear/no	clear/no
Temperature	oC	10.6	10.8
Dissolved Oxygen	% Sat	100	98
pH	units	8.3	8.2
Cond	uS/cm	160	169
BOD	mg/l	<2	<2
COD	<7 mg/l	<7	<7
Sus Solids	<2 mg/l	<2	<2
Ammonia Total (as N)	<0.2 mg/l	<0.2	<0.2
TOC	<3 mg/l	<3	<3
Phosphate (ortho) as P	<0.02 mg/l	<0.02	<0.02
Nitrogen, total	<1 mg/l	3.33	3.41
FOG	<5 mg/l	n/a	n/a
Mineral Oils	<10 ug/l	<10	<10

**Table 5.1.2 Surface water quality Dungarvan landfill Q2 2017**

Parameters	Units	<b>Dungarvan Landfill W0032-02 Qrt 2 2017</b>	
<b>Surface Water</b>			
<b>LABORATORY NUMBER</b>		<b>3251</b>	<b>3252</b>
<b>Sampling Location</b>		<b>U/S</b>	<b>D/S</b>
<b>Date sampled</b>	01/06/2017	01-Jun	01-Jun
<b>Sampled by</b>	JMcGarry	JMcG	JMcG
<b>Time sampled</b>		14:25	14:55
Visual Inspection/Odour		clear/no	clear/no
Temperature	oC	13.6	13.8
Dissolved Oxygen	% Sat	100	99
pH	units	7.8	7.7
Cond	uS/cm	153	781
BOD	mg/l	<2	<2
COD	<7 mg/l	19.5	25.3
Sus Solids	<2 mg/l	<2	<2
Ammonia Total (as N)	<0.2 mg/l	<0.2	0.209
TOC	<3 mg/l	<3	<3
Phosphate (ortho) as P	<0.02 mg/l	<0.02	<0.02
Nitrogen, total	<1 mg/l	2.35	2.57
FOG	<5 mg/l	7.33	8
Mineral Oils	<10 ug/l	nm	nm

**Table 5.1.3 Surface water quality Dungarvan landfill Q3 2017**

Parameters	Units	Dungarvan Q3(Annual) Monitoring Report 2017 Surface Water	
<b>LABORATORY NUMBER</b>		<b>3760</b>	<b>3761</b>
<b>Sampling Location</b>		<b>U/S</b>	<b>D/S</b>
<b>Date sampled</b>	25/07/2017	25-Jul	25-Jul
<b>Sampled by</b>	JMcGarry	JMcG	JMcG
<b>Time sampled</b>		14:45	14:55
Visual Inspection/Odour		clear	clear
Temperature	o C	17.2	17.4
Dissolved Oxygen	% sat	118	120
pH	units	8.1	8.4
Cond	uS/cm	479	813
BOD	mg/l	<2	<2
Suspended solids, Total	<2 mg/l	<2	<2
Alkalinity, Total as CaCO3	<2 mg/l		
Organic Carbon, Total	<3 mg/l	<3	<3
Ammoniacal Nitrogen as N	<0.2 mg/l	<0.2	<0.2
Ammoniacal Nitrogen as NH3	<0.2 mg/l		
Fluoride	<0.5 mg/l		
COD, unfiltered	<7 mg/l	14.6	17.8
Aluminium	<2 ug/l		
Arsenic	<0.5 ug/l		
Boron	<5 ug/l		
Cadmium	< 0.08 ug/l		
Copper	<0.3 ug/l		
Lead	<0.2 ug/l		
Manganese	<1 ug/l		
Nickel	<0.4 ug/l		
Phosphorous	<10 ug/l		
Zinc	<1 ug/l		
Silver	<0.5 ug/l		
Mercury	<0.01 ug/l		
Sulphate	<2 mg/l		
Chloride	<2 mg/l		
Phosphate(ortho) as P	<0.02 mg/l	<0.02	<0.02
Total Oxidised Nitrogen as N	<0.1 mg/l		
Chromium, Total (total)	<3 ug/l		
Nitrogen, Total	<1 mg/l	2.84	2.88
Cyanide, Total	<0.05 mg/l		
Magnesium	<0.036 mg/l		
Potassium	<1 mg/l		
Iron	<0.019 mg/l		
Phenols, Total detected 5	<0.025 mg/l		
Fats, Oils and Greases	<5 mg/l	<5	<5
Mineral Oils	mg/l		

**Table 5.1.4 Surface water quality Dungarvan landfill Q4 2017**

Parameters	Units	Dungarvan Landfill W0032-02 Qrt 4 2017	
		Surface Water	
<b>LABORATORY NUMBER</b>		<b>4101</b>	<b>4102</b>
<b>Sampling Location</b>		<b>U/S</b>	<b>D/S</b>
<b>Date sampled</b>	06/11/2017	06-Nov	06-Nov
<b>Sampled by</b>	JMcGarry	JMcG	JMcG
<b>Time sampled</b>		14:00	14:35
Visual Inspection			
Clear- yes/no		yes	yes
Odour- yes/no		no	no
Temperature	oC	9.6	9.8
Dissolved Oxygen	% Sat	105	106
pH	units	7.4	7.3
Cond	uS/cm	167	194
BOD	mg/l	<2	<2
COD, unfiltered	<7 mg/l	<7	8.85
Sus Solids	<2 mg/l	<2	<2
Organic Carbon, Total	<3 mg/l	<3	<3
Ammoniacal Nitrogen As N	<0.2 mg/l	0.773	2.47
Free Ammonia	<0.2 mg/l	<2	<0.2
Phosphate (ortho) as P	<0.02 mg/l	<0.02	<0.02
Nitrogen, total	<1 mg/l	3.28	3.39
Fats, Oils and Greases	<5 mg/l	<5	<5
Mineral Oils	<10 ug/l	nm	nm

**Table 5.1.5 Integrated Constructed Wetlands Surface Water Quality Dungarvan landfill 2017**

Parameters	LOD/Units	Monthly Wetland Analysis 2017									
		February Ponds									
Sampling Location	Ponds	1A	1B	2(i)	2(o)	3(i)	3(o)	4(i)	4(o)	5(i)	5(o)
Date sampled		27-Feb	27-Feb	27-Feb	27-Feb	27-Feb	27-Feb	27-Feb	27-Feb	27-Feb	27-Feb
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
pH	units	7.7	7.5	7.5	8	8.8	8.4	7.9	7.6	8.1	8.2
Cond	uS/cm	1614	638	630	608	560	599	585	533	526	517
Ammonia Total (as N)	<0.2 mg/l	47	2.96	1.95	2.47	1.47	2.82	2.38	0.469	0.873	0.88
BOD	mg/l	12	<5	8	2	9	<5	<5	12	3	2
COD	<7 mg/l	31.1	21.5	56.2	27.7	836	32.1	29.7	32.9	29	25.8
Aluminium	<2 ug/l	9.76	<2	<2	<2	17.1	25.3	3.66	<2	<2	<2
Arsenic	<0.51 ug/l	1.55	1.51	0.951	1.21	1.44	1.65	1.53	1.08	1.21	1.19
Boron	<5 ug/l	304	57	68.8	65.7	98	75.9	59.3	63.7	65.7	50.2
Cadmium	<0.08 ug/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium, total	<1.2 ug/l	6.17	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
Copper	<0.3 ug/l	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm
Lead	<0.1 ug/l	1.08	<0.1	<0.1	<0.1	0.131	0.176	<0.1	<0.1	<0.1	<0.1
Manganese	<0.76 ug/l	394	839	713	234	1100	651	432	331	234	147
Nickel	<0.44 ug/l	7.18	1.48	1.3	1.5	1.77	1.69	1.33	1.34	1.5	1.12
Zinc	<1.3 ug/l	4.18	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3
Silver	<1 ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Mercury	<0.01 ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium	<0.012 mg/l	74.3	80.6	83.8	76.7	64.7	73.1	70.6	52.1	76.7	55.6
Sodium	<0.076 mg/l	130	27.3	27.9	28	32.6	33.5	28.9	27.6	28	28.2
Magnesium	<0.036 mg/l	19.8	9.93	10.3	9.74	9.3	10.2	9.28	8.61	9.74	9.03
Potassium	<1 mg/l	30.1	9.14	9.44	10.3	10.5	10.8	11	11.2	10.3	12
Iron	<0.019mg/l	0.11	<0.019	<0.019	<0.019	0.0722	<0.019	<0.019	<0.019	<0.019	0.0934
Comments:-		Sample mixed with sediment									



Parameters	LOD/Units	Monthly Wetland Analysis 2017									
		March Ponds									
Sampling Location	Ponds	1A	1B	2(i)	2(o)	3(i)	3(o)	4(i)	4(o)	5(i)	5(o)
Date sampled	29/03/2017	29-Mar	29-Mar	29-Mar	29-Mar	29-Mar	29-Mar	29-Mar	29-Mar	29-Mar	29-Mar
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
pH	units	7.8	8.2	7.9	8.2	8.1	8.6	8.3	7.7	7.9	8.7
Cond	uS/cm	2960	590	549	551	555	530	535	548	550	543
Ammonia Total (as N)	<0.2 mg/l	112	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
BOD	mg/l	9	2	2	2	3	2	2	2	<2	2
COD	<7 mg/l	81.2	15.5	14.3	27	18	18.8	22.7	18.1	19.1	17.7
Aluminium	<2 ug/l	18.7	10.9	6.22	14.6	3.12	14.6	12.9	2.77	4.28	4.01
Arsenic	<0.51 ug/l	2.68	0.75	0.525	1.03	0.71	1.17	0.813	0.985	0.895	0.853
Boron	<5 ug/l	645	38.8	44	57.8	61.4	57.7	58.4	55.4	55.7	66.1
Cadmium	<0.08 ug/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium, total	<1.2 ug/l	20.7	<3	<3	<3	<3	<3	<3	<3	<3	<3
Copper	<0.3 ug/l	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm
Lead	<0.1 ug/l	3.82	<0.1	<0.1	<0.1	<0.1	<0.1	0.13	<0.1	<0.1	<0.1
Manganese	<0.76 ug/l	1120	61.2	25.2	168	82.2	171	146	103	152	79.7
Nickel	<0.44 ug/l	17.6	0.575	0.48	1.02	0.984	0.891	0.97	0.865	0.94	1.2
Zinc	<1.3 ug/l	6.29	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3
Silver	<1 ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Mercury	<0.01 ug/l	<0.01	<0.01	0.0107	0.0108	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium	<0.012 mg/l	73.5	83.3	80.9	68.4	71.7	67.3	67.4	67.6	65.5	60.7
Sodium	<0.076 mg/l	289	17.2	16.2	24.9	23.5	24.4	23.9	25.9	26.5	31.1
Magnesium	<0.036 mg/l	33.3	11.6	11.4	11.5	11.6	11.3	11.6	11.5	11.3	11.3
Potassium	<1 mg/l	68.6	2.89	2.78	6.07	5.75	6.08	6.09	6.46	6.82	8.67
Iron	<0.019mg/l	0.445	0.0435	0.0283	0.0664	0.0747	0.0649	0.0723	0.0401	0.0438	0.103

Parameters	LOD/Units	Monthly Wetland Analysis 2017									
		April									
Sampling Location	Ponds	1A	1B	2(i)	2(o)	3(i)	3(o)	4(i)	4(o)	5(i)	5(o)
Date sampled	22/04/2017	22-Apr	22-Apr	22-Apr	22-Apr	22-Apr	22-Apr	22-Apr	22-Apr	22-Apr	22-Apr
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
pH	units	7.7	7.6	7.8	7.9	7.6	8.7	8.8	7.7	8.0	8.0
Cond	uS/cm	700	637	635	632	662	573	561	584	610	562
Ammonia Total (as N)	<0.2 mg/l	2.93	<0.2	<0.2	<0.2	<0.2	<0.2	0.202	<0.2	<0.2	<0.2
BOD	mg/l	2	3	4	2	2	3	4	2	3	6
COD	<7 mg/l	12.9	17.9	21.1	17	29	27.7	21.3	23.6	23.2	37
Aluminium	<2 ug/l	<2	6.48	<2	3.58	3.32	11.9	11.3	6.93	2.53	2.84
Arsenic	<0.51 ug/l	0.864	1.13	0.878	0.973	1.27	1.56	1.44	1.08	1.22	1.32
Boron	<5 ug/l	45.8	64.8	61.7	71	76.1	73.2	72.1	76.8	83.3	78.7
Cadmium	<0.08 ug/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium, total	<1.2 ug/l	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Copper	<0.3 ug/l	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm
Lead	<0.1 ug/l	<0.1	<0.1	<0.1	<0.1	0.119	0.229	0.199	<0.1	<0.1	<0.1
Manganese	<0.76 ug/l	59.2	40.5	39.8	27.7	81.9	91.7	85.9	45.1	139	261
Nickel	<0.44 ug/l	0.926	1.19	1.04	1.43	1.54	1.52	1.49	1.41	1.76	1.59
Zinc	<1.3 ug/l	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	2.1	<1.3	<1.3
Silver	<1 ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Mercury	<0.01 ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium	<0.012 mg/l	91.4	88.7	76.1	86.5	87.3	61.4	59.1	57	67.9	52.6
Sodium	<0.076 mg/l	23.7	35.5	30.1	37.1	43.8	33.1	32.5	37.6	47.3	36.5
Magnesium	<0.036 mg/l	12.3	15	12.6	15.4	15.6	13	12.7	13.2	15.8	11.8
Potassium	<1 mg/l	4.08	3.1	2.47	2.74	2.9	2.2	2.33	2.63	4.07	4.5
Iron	<0.019mg/l	<0.019	0.21	0.174	0.0905	0.172	0.258	0.263	0.0508	0.129	0.452

Parameters	LOD/Units	Monthly Wetland Analysis 2017									
		May Ponds									
Sampling Location	Ponds	1A	1B	2(i)	2(o)	3(i)	3(o)	4(i)	4(o)	5(i)	5(o)
Date sampled	31/05/2017	31-May	31-May	31-May	31-May	31-May	31-May	31-May	31-May	31-May	31-May
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
pH	units	7.4	7.3	7.4	7.8	7.3	7.8	8.0	7.3	8.8	7.6
Cond	uS/cm	7.9	603	601	527	556	510	514	530	473	517
Ammonia Total (as N)	<0.2 mg/l	3.11	<0.2	<0.2	<0.2	1.11	0.725	1.26	<0.2	0.392	<0.2
BOD	mg/l	3	<5	9	5	<5	5	3	6	36	6
COD	<7 mg/l	<7	18.9	485	17.1	19.4	25.8	27.8	26.7	46.1	29
Aluminium	<2 ug/l	<2	<2	7.26	3.25	<2	5.95	<2	2.32	29.6	8.33
Arsenic	<0.51 ug/l	0.75	1.25	1.76	1.21	1.13	1.63	1.23	1.75	1.98	1.47
Boron	<5 ug/l	25.5	35.3	37.8	36.2	39	47.7	42.5	51.2	50.7	54
Cadmium	<0.08 ug/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium, total	<1.2 ug/l	1.07	<1	<1	<1	<1	<1	<1	<1	<1	<1
Copper	<0.3 ug/l	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm
Lead	<0.1 ug/l	0.275	<0.2	<0.2	<0.2	<0.2	0.366	0.269	<0.2	<0.2	<0.2
Manganese	<0.76 ug/l	33.8	150	324	85.9	157	163	41.8	512	387	250
Nickel	<0.44 ug/l	1.15	0.913	1	0.969	0.856	1.18	1.14	1.12	1.2	1.21
Zinc	<1 ug/l	2.55	<1	1.15	<1	4.13	3.9	1.51	2.58	<1	<1
Silver	<0.5 ug/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Mercury	<0.01 ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium	<0.012 mg/l	92.4	81.5	81.5	68.6	75.3	71.1	70.5	71.8	55.6	61.5
Sodium	<0.076 mg/l	22.7	23	23.1	22.6	21.9	23.1	23	23.6	24.4	25.4
Magnesium	<0.036 mg/l	12.5	12.1	12.3	12	12	12.1	12.5	12.6	12.2	12.2
Potassium	<1 mg/l	3.77	<1	1.54	<1	<1	<1	<1	1.03	1.27	1.06
Iron	<0.019mg/l	<0.019	0.139	0.169	0.125	0.455	0.246	0.238	0.156	0.775	0.315

Parameters	LOD/Units	Monthly Wetland Analysis 2017									
		June Ponds									
Sampling Location	Ponds	1A	1B	2(i)	2(o)	3(i)	3(o)	4(i)	4(o)	5(i)	5(o)
Date sampled	12/07/2017	12-Jul	12-Jul	12-Jul	12-Jul	12-Jul	12-Jul	12-Jul	12-Jul	12-Jul	12-Jul
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
pH	units	7.2	7.2	7.3	7.3	7.4	7.5	7.4	7.1	7.6	7.4
Cond	uS/cm	703	671	668	640	644	491	486	528	518	502
Ammonia Total (as N)	<0.2 mg/l	4.28	<0.2	0.211	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
BOD	mg/l	4	5	16	4	7	30	11	4	21	9
COD, unfiltered	<7 mg/l	8.73	20.3	310	21.3	24.5	39.6	41.9	21.5	97.7	24.9
Aluminium (diss.filt)	<2 ug/l	<2	2.43	3.73	2.7	<2	5.75	<2	2.36	2.06	<2
Arsenic (diss.filt)	<0.51 ug/l	0.747	1.26	1.18	1.05	1.07	1.56	1.25	1.5	1.48	1.41
Boron (diss.filt)	<5 ug/l	47	52.2	51.3	51.8	53.3	51.3	53.7	64	57.3	61.9
Cadmium (diss.filt)	<0.08 ug/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium (tot.unfilt)	<1.2 ug/l	<3	<3	3.77	<3	<3	<3	<3	<3	<3	<3
Copper	<0.3 ug/l	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm
Lead (diss.filt)	<0.1 ug/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Manganese (diss.filt)	<0.76 ug/l	37.9	181	279	196	66.1	99.8	17.2	475	388	153
Nickel (diss.filt)	<0.44 ug/l	1.28	1.19	1.1	1.05	1.04	1	0.912	0.959	1.1	0.921
Zinc (diss.filt)	<1 ug/l	<1	<1	<1	<1	3.1	<1	<1	<1	1.92	<1
Silver (diss.filt)	<0.5 ug/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Mercury (diss.filt)	<0.01 ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium (diss.filt)	<0.012 mg/l	98	99.5	98.6	93	93.2	73.4	56.9	66	63.6	60.5
Sodium (diss.filt)	<0.076 mg/l	25.9	26.6	26.4	26.8	26.5	26.6	27.1	26.8	26.7	26.4
Magnesium (diss.filt)	<0.036 mg/l	12.8	13	12.9	13	13.2	13	12.7	12.8	12.8	12.8
Potassium (diss.filt)	<1 mg/l	4.94	4.25	4.21	3.32	2.68	<1	<1	<1	<1	<1
Iron (diss.filt)	<0.019mg/l	<0.019	0.113	0.12	0.167	0.173	0.683	0.0684	0.123	0.144	0.526

Parameters	LOD/Units	Monthly Wetland Analysis 2017									
		July Ponds									
Sampling Location	Ponds	1A	1B	2(i)	2(o)	3(i)	3(o)	4(i)	4(o)	5(i)	5(o)
Date sampled	27/07/2017	27-Jul	27-Jul	27-Jul	27-Jul	27-Jul	27-Jul	27-Jul	27-Jul	27-Jul	27-Jul
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
pH	units	8.2	7.6	6.8	7.2	7.1	7.3	7.4	6.9	7.1	7.7
Cond	uS/cm	540	598	760	622	558	454	457	515	518	460
Ammonia Total (as N)	<0.2 mg/l	0.54	<0.2	1.32	<0.2	0.285	<0.2	<0.2	<0.2	<0.2	<0.2
BOD	mg/l	12	16	1581	8	<5	9	5	<5	4	6
COD, unfiltered	<7 mg/l	55.1	35.4	4150	54.4	37.7	41.1	30.7	28.6	74	40.5
Aluminium (diss.filt)	<2 ug/l	31.7	5.51	4.32	3.42	<2	5.67	2.31	3.14	<2	3.92
Arsenic (diss.filt)	<0.51 ug/l	7.96	1.19	2.9	1.35	0.986	1.01	1.33	1.05	1.13	0.892
Boron (diss.filt)	<5 ug/l	47.5	50.7	52.7	46.4	43.2	45.9	51.5	52.4	54.8	48.6
Cadmium (diss.filt)	<0.08 ug/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium (tot.unfilt)	<1.2 ug/l	4.19	<3	36.8	<3	<3	<3	<3	<3	<3	<3
Copper	<0.3 ug/l	1.1	0.435	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Lead (diss.filt)	<0.1 ug/l	0.423	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Manganese (diss.filt)	<0.76 ug/l	299	1060	8790	5040	376	37.5	66.3	526	649	19.8
Nickel (diss.filt)	<0.44 ug/l	3.29	1.18	1.26	0.911	0.82	0.922	0.877	0.877	0.953	0.983
Zinc (diss.filt)	<1 ug/l	2.23	3.29	2.29	<1	<1	8.17	<1	1.85	<1	2.64
Silver (diss.filt)	<0.5 ug/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Mercury (diss.filt)	<0.01 ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium (diss.filt)	<0.012 mg/l	64.9	84.2	103	82.7	76.3	42.9	54.6	58.1	58.5	48.4
Sodium (diss.filt)	<0.076 mg/l	23.6	23	26.4	22.3	22.8	23.9	25.1	26.4	26.4	23.8
Magnesium (diss.filt)	<0.036 mg/l	11.9	10.8	8.41	8.68	10.7	11.1	12.4	12.6	12.8	11.3
Potassium (diss.filt)	<1 mg/l	8.13	4.63	2.04	8.06	3.61	2.97	2.78	<1	<1	<1
Iron (diss.filt)	<0.019mg/l	0.816	0.734	0.406	0.467	0.489	0.564	0.694	0.111	0.113	0.321

Parameters	LOD/Units	Monthly Wetland Analysis 2017										
		August Ponds										
Sampling Location	Ponds	1A	1B	2(i)	2(o)	3(i)	3(o)	4(i)	4(o)	5(i)	5(o)	
Date sampled	10/08/2017	10-Aug	10-Aug	10-Aug	10-Aug	10-Aug	10-Aug	10-Aug	10-Aug	10-Aug	10-Aug	
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	
pH	units	6.9	8.5	7.8	7.7	7.4	8.2	7.7	7.7	7.8	8.3	
Cond	uS/cm	528	397	691	717	579	342	448	498	476	435	
Ammonia Total (as N)	<0.2 mg/l	2.6	0.211	0.241	0.525	0.278	0.208	0.516	<0.2	<0.2	<0.2	
BOD	mg/l	58	<5	5	<5	<5	5	1	<5	35	11	
COD, unfiltered	<7 mg/l	278	52.7	67.8	64.6	26.7	43.6	34.7	23.9	1260	39	
Aluminium (diss.filt)	<2 ug/l	45.5	26.1	12	4.55	<2	<2	<2	<2	15.4	<2	
Arsenic (diss.filt)	<0.51 ug/l	13.7	2.63	1.68	1.58	0.908	1.1	0.728	0.855	2.33	0.821	
Boron (diss.filt)	<5 ug/l	92	69.9	72.4	60.5	46.1	46.9	63.8	49.4	52.5	46.1	
Cadmium (diss.filt)	<0.08 ug/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	
Chromium (tot.unfilt)	<1.2 ug/l	21.3	<3	<3	<3	<3	<3	<3	<3	<3	<3	
Copper	<0.3 ug/l	1.33	0.435	<0.3	<0.3	<0.3	<0.3	<0.3	0.412	<0.3	6.03	
Lead (diss.filt)	<0.1 ug/l	1.4	0.968	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.568	2.34	
Manganese (diss.filt)	<0.76 ug/l	207	98.5	880	1080	86.1	25.1	12.2	427	585	528	
Nickel (diss.filt)	<0.44 ug/l	4.56	1.7	1.28	1.41	1.04	0.856	0.844	0.912	1.25	1.2	
Zinc (diss.filt)	<1 ug/l	1.71	<1	<1	<1	<1	<1	<1	<1	<1	1.86	
Silver (diss.filt)	<0.5 ug/l				<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	
Mercury (diss.filt)	<0.01 ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Calcium (diss.filt)	<0.012 mg/l	60.3	43	92.8	97.9	80.8	35.9	48.5	58.9	48.8	48.3	
Sodium (diss.filt)	<0.076 mg/l	30.4	28.5	29.9	28.7	25.9	24.1	26.9	26.8	29	27	
Magnesium (diss.filt)	<0.036 mg/l	11.7	11.3	13.1	13.2	11.2	10.1	10.7	12.5	12.9	12	
Potassium (diss.filt)	<1 mg/l	13.1	1.49	7.92	8.92	<1	<1	1.32	<1	<1	<1	
Iron (diss.filt)	<0.019mg/l	1.32	0.879	0.289	0.277	0.37	0.468	0.068	0.205	2.76	0.391	

Parameters	LOD/Units	Monthly Wetland Analysis 2017										
		September Ponds										
Sampling Location	Ponds	1A	1B	2(i)	2(o)	3(i)	3(o)	4(i)	4(o)	5(i)	5(o)	
Date sampled	25/09/2017	25-Sep	25-Sep	25-Sep	25-Sep	25-Sep	25-Sep	25-Sep	25-Sep	25-Sep	25-Sep	
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	
pH	units	7.6	7.4	6.9	7.9	7.3	7.5	7.2	7.3	8.5	7.6	
Cond	uS/cm	3030	962	779	666	496	381	408	478	473	454	
Ammonia Total (as N)	<0.2 mg/l	91.2	6.08	1.71	0.946	0.247	0.558	0.491	1.06	0.64	0.786	
BOD	mg/l	9	4	113	6	13	3	12	2	16	3	
COD, unfiltered	<7 mg/l	94.7	50.1	2610	47.3	25.7	27.4	32.7	25.6	34	19.4	
Aluminium (diss.filt)	<2 ug/l	9.49	<2	<2	2.05	<2	<2	<2	<2	6.72	<2	
Arsenic (diss.filt)	<0.51 ug/l	2.54	1.34	1.89	1.21	0.909	1.19	1.43	1.14	1.22	0.896	
Boron (diss.filt)	<5 ug/l	610	93.6	65	60.8	53.6	45.6	47.4	55.7	49.8	48.1	
Cadmium (diss.filt)	<0.08 ug/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	
Chromium (tot.unfilt)	<1.2 ug/l	11	<3	34.6	<3	3.06	3.19	3.72	<3	<3	3.23	
Copper	<0.3 ug/l	1.9	<0.3	<0.3	<0.3	0.636	<0.3	<0.3	<0.3	<0.3	<0.3	
Lead (diss.filt)	<0.1 ug/l	0.842	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
Manganese (diss.filt)	<0.76 ug/l	767	1150	8420	608	128	8.03	19	409	229	68.4	
Nickel (diss.filt)	<0.44 ug/l	16.3	3.91	2.27	2.36	0.981	0.95	0.989	0.846	0.974	0.826	
Zinc (diss.filt)	<1 ug/l	2.52	<1	<1	2.23	6.88	<1	<1	<1	<1	<1	
Silver (diss.filt)	<0.5 ug/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Mercury (diss.filt)	<0.01 ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Calcium (diss.filt)	<0.012 mg/l	69.4	87	86.7	71.6	61.9	38	40.7	57.3	62.2	52.5	
Sodium (diss.filt)	<0.076 mg/l	310	76.2	45.7	43.8	24.3	23.3	24.3	25	24.3	24.3	
Magnesium (diss.filt)	<0.036 mg/l	40.2	14.2	7.82	12.2	9.78	9.68	10.5	9.97	10.2	10.6	
Potassium (diss.filt)	<1 mg/l	73.7	14.5	6.05	7.5	2.57	2.64	3.77	2.36	2.83	1.91	
Iron (diss.filt)	<0.019mg/l	0.442	1.17	0.916	0.558	0.748	0.724	1.13	0.267	0.351	0.274	

Parameters	LOD/Units	Monthly Wetland Analysis 2017										
		October Ponds										
Sampling Location	Ponds	1A	1B	2(i)	2(o)	3(i)	3(o)	4(i)	4(o)	5(i)	5(o)	
Date sampled	12/10/2017	12-Oct	12-Oct	12-Oct	12-Oct	12-Oct	12-Oct	12-Oct	12-Oct	12-Oct	12-Oct	
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	
pH	units	7.5	7.6	6.8	7.9	7.2	7.7	7	6.9	7.5	7.4	
Cond	uS/cm	3320	1147	1108	996	913	537	526	491	469	464	
Ammonia Total (as N)	<0.2 mg/l	139	13.7	3.97	5.42	1.75	<0.2	<0.2	0.653	<0.2	0.551	
BOD	mg/l	19	4	343	6	3	<5	3	3	117	4	
COD, unfiltered	<7 mg/l	100	46.2	6120	50.1	43	31.2	51.7	32.1	54.6	27.4	
Aluminium (diss.filt)	<2 ug/l	12.1	6.01	7.62	6.01	2.04	3.02	<2	<2	6.02	<2	
Arsenic (diss.filt)	<0.51 ug/l	1.98	1.36	2.03	0.912	1.1	1.07	1.1	0.829	1.29	0.943	
Boron (diss.filt)	<5 ug/l	632	151	108	110	92.9	65.4	60.9	44	46.1	41	
Cadmium (diss.filt)	<0.08 ug/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	
Chromium (tot.unfilt)	<1 ug/l	10.6	<1	<1	1.73	<1	<1	<1	<1	<1	<1	
Copper	<0.3 ug/l	0.776	<0.3	<0.3	0.351	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	
Lead (diss.filt)	<0.1 ug/l	1.64	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
Manganese (diss.filt)	<0.76 ug/l	1130	271	3850	633	416	5.14	42.2	557	515	39	
Nickel (diss.filt)	<0.44 ug/l	15.9	4.61	4.51	4.44	3.72	2.51	1.78	1.13	1.3	0.873	
Zinc (diss.filt)	<1 ug/l	4.63	<1	<1	<1	<1	<1	<1	<1	<1	1.29	
Silver (diss.filt)	<0.5 ug/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Mercury (diss.filt)	<0.01 ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Calcium (diss.filt)	<0.012 mg/l	64	75.8	78.3	72.7	73	28.9	42.5	51.3	53.3	57	
Sodium (diss.filt)	<0.076 mg/l	346	115	106	93.3	83.1	56.1	41	31.1	29.8	24.8	
Magnesium (diss.filt)	<0.036 mg/l	41.4	18.7	13.7	15	14	10.6	10.4	9.82	10.5	10.2	
Potassium (diss.filt)	<1 mg/l	78	19.8	14.2	14.3	14.4	8.61	6.95	2.06	2.74	3.55	
Iron (diss.filt)	<0.019mg/l	0.72	0.529	0.839	0.833	0.865	0.574	0.363	0.284	0.653	0.406	



Parameters	LOD/Units	Monthly Wetland Analysis 2017										
		November Ponds										
Sampling Location	Ponds	1A	1B	2(i)	2(o)	3(i)	3(o)	4(i)	4(o)	5(i)	5(o)	
Date sampled	15/11/2017	15-Nov	15-Nov	15-Nov	15-Nov	15-Nov	15-Nov	15-Nov	15-Nov	15-Nov	15-Nov	
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	
pH	units	7.4	7.6	7.4	7.4	7.3	7.3	7.4	7.4	7.7	7.7	
Cond	uS/cm	2220	629	622	633	617	637	634	625	623	625	
Ammonia Total (as N)	<0.2 mg/l	55.9	1.23	1.11	1.07	0.644	0.746	1.12	0.493	0.686	0.949	
BOD	mg/l	33	3	34	3	4	3	6	2	2	2	
COD, unfiltered	<7 mg/l	64.7	23.2	475	25.5	27.2	26.8	60.2	19.1	17.4	10.8	
Aluminium (diss.filt)	<2 ug/l	2.18	<2	<2	<2	<2	<2	<2	<2	<2	<2	
Arsenic (diss.filt)	<0.51 ug/l	1.52	0.812	0.747	0.69	0.677	0.706	0.791	0.788	0.879	0.756	
Boron (diss.filt)	<5 ug/l	361	51.4	48.9	51.5	50.4	52.8	50	55.3	47.2	51.7	
Cadmium (diss.filt)	<0.08 ug/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	
Chromium (tot.unfilt)	<3 ug/l	7.98	<3	4.56	3.76	4.19	4.51	<3	6.21	5.03	<3	
Copper	<0.3 ug/l	0.783	<0.3	0.518	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	
Lead (diss.filt)	<0.1 ug/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
Manganese (diss.filt)	<0.76 ug/l	1130	45.2	19.1	55.8	30.7	15.2	52.1	34.8	124	43.6	
Nickel (diss.filt)	<0.44 ug/l	9.21	1.12	1.12	1.11	1.03	1.02	1.14	1.01	1.01	1.1	
Zinc (diss.filt)	<1 ug/l	5.4	<1	<1	<1	<1	2	<1	1.19	1.09	1.21	
Silver (diss.filt)	<0.5 ug/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
Mercury (diss.filt)	<0.01 ug/l	<0.01	0.0331	0.0666	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	
Calcium (diss.filt)	<0.012 mg/l	81	67.7	68	69	71.1	70	71.5	70.5	70	67.7	
Sodium (diss.filt)	<0.076 mg/l	208	28.7	28.9	29.5	28.6	28.4	27.5	26.6	26.1	28.8	
Magnesium (diss.filt)	<0.036 mg/l	31.4	12	12	11.9	11.7	11.9	11.8	12	11.8	11.9	
Potassium (diss.filt)	<1 mg/l	40.6	8.62	8.91	8.66	8.2	8.79	8.65	8.34	8.07	8.7	
Iron (diss.filt)	<0.019mg/l	0.135	0.0652	0.0854	0.0823	0.111	0.101	0.102	0.0485	0.0602	0.0672	

Parameters	LOD/Units	Monthly Wetland Analysis 2017									
		December Ponds									
Sampling Location	Ponds	1A	1B	2(i)	2(o)	3(i)	3(o)	4(i)	4(o)	5(i)	5(o)
Date sampled	18/12/2017	18-Dec	18-Dec	18-Dec	18-Dec	18-Dec	18-Dec	18-Dec	18-Dec	18-Dec	18-Dec
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
pH	units	7.4	7.4	7.1	7.3	7.2	7.4	7.5	7.4	7.4	7.6
Cond	uS/cm	2490	552	602	586	534	517	532	531	532	531
Ammonia Total (as N)	<0.2 mg/l	84.8	2.87	2.84	2.45	1.86	2.46	3.06	0.872	2.68	2.66
BOD	mg/l	23	<2	143	3	1	3	1	<2	<2	2
COD, unfiltered	<7 mg/l	83.9	12.5	7530	14.8	19.5	19.1	18.5	11.7	18.3	13
Aluminium (diss.filt)	<2 ug/l	8.47	2.16	5.13	2.56	<2	10.2	2.57	<2	<2	<2
Arsenic (diss.filt)	<0.51 ug/l	1.42	<0.5	1.1	0.698	<0.5	<0.5	<0.5	<0.5	0.547	<0.5
Boron (diss.filt)	<5 ug/l	416	26	34.6	34	25	27.6	25.3	28.2	28.3	24.4
Cadmium (diss.filt)	<0.08 ug/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium (tot.unfilt)	<3 ug/l	11.3	<3	65.4	<3	<3	<3	<3	<3	<3	<3
Copper	<0.3 ug/l	1.26	<0.3	0.405	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Lead (diss.filt)	<0.1 ug/l	3.23	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Manganese (diss.filt)	<0.76 ug/l	881	52.9	1580	310	113	4.19	58.3	23.2	98	26.8
Nickel (diss.filt)	<0.44 ug/l	12.3	0.529	0.867	0.652	<0.4	<0.4	<0.4	0.517	0.641	0.409
Zinc (diss.filt)	<1 ug/l	8.79	1.34	2.17	<1	<1	<1	<1	<1	<1	9.56
Silver (diss.filt)	<0.5 ug/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Mercury (diss.filt)	<0.01 ug/l	0.0687	0.0186	0.0212	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium (diss.filt)	<0.012 mg/l	81.6	80.7	84.8	83.2	75.8	71.8	74.1	77	73.3	78.2
Sodium (diss.filt)	<0.076 mg/l	244	16.3	20.9	21.9	15.4	15.9	15.9	16.1	15.6	16
Magnesium (diss.filt)	<0.036 mg/l	32.8	10.7	11.1	11.5	9.89	10.2	10	10.6	10	10.5
Potassium (diss.filt)	<1 mg/l	55.1	4.92	5.61	5.44	3.92	4.64	4.72	4.59	4.51	4.53
Iron (diss.filt)	<0.019mg/l	0.251	0.0413	0.116	0.127	0.116	0.0846	0.0888	<0.019	<0.019	0.0471

## 5.2 Groundwater

### 5.2.1 INTRODUCTION

Sites GW1, GW2a, RC3a, RC4, RC6a, RC7 and RC8 were sampled during 2017. RC1 is no longer in place.

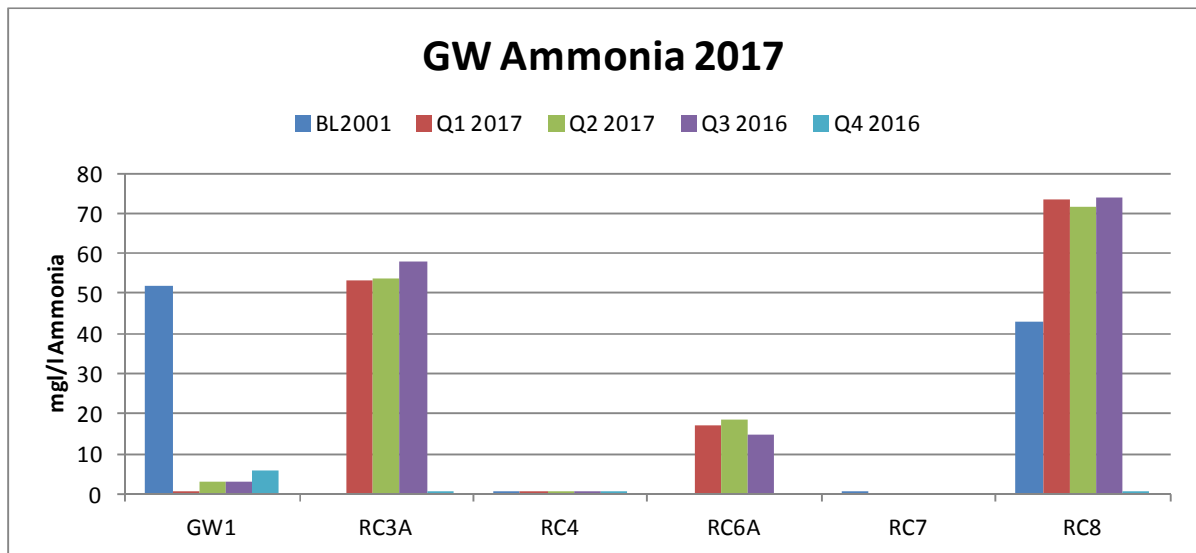
RC4 (south west of site) and RC7 (east of site) are outside the waste deposit area.

All the other ground water stations are within the site boundary, either within or immediately adjacent to waste deposit areas. Ground-water flow through the site has previously been described as south to north.

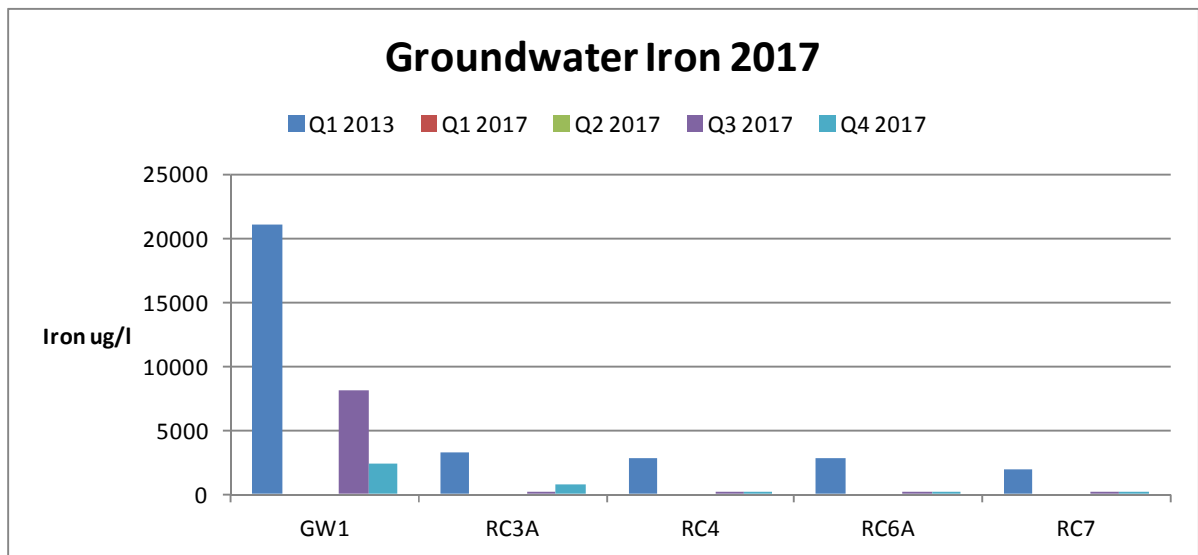
### 5.2.2 RESULTS

Results for 2017 are presented on tables 5.2.1 to 5.2.4 below, and appendices. High ammonia levels were detected at borewells RC3a, RC6a and RC8, within the landfill site, although these were down on the previous reporting year. Metals levels were generally low, although high iron levels were detected at GW1 in quarter 3. Trace organics were not detected in groundwaters. High conductivity levels detected at site RC7, outside the landfill boundary, when tested in Q4, which indicates likely saline intrusion from the estuary.

#### Key Parameter – Ammonia



## Key parameter - Iron



### 5.2.3 DISCUSSION

*Ammonia* was elevated at sites RC3a and RC6a. RC4 and RC7, outside the landfill area, had relatively low *ammonia*. Heavy metals and organics were not detected or else present in low concentrations.

The results of groundwater monitoring are in line with results from previous rounds of testing. The sites within and closely adjacent to the working area appear to be impacted by landfill leachate in terms of ammonia and iron concentration. Site RC4 at the south-western boundary had relatively good water quality. Site RC7, 200 metres east of the facility, and outside the landfill area, had generally satisfactory water quality though saline intrusion was evident.

**Table 5.2.1 Dungarvan Landfill Groundwater [monitoring Q1 2017](#)**

EntityName	Dungarvan	Dungarvan	Dungarvan	Dungarvan	Dungarvan	Dungarvan	Groundwater quality standards S.I. No. 9 of 2010	Comment	Environmental significance
StationName	GW1	RC3a	RC4	RC6a	RC7	RC8			
SampleDate	27/02/2017	27/02/2017	27/02/2017	27/02/2017	27/02/2017	27/02/2017			
Ammonia(N)	0.612	53.2	<0.2	17	<0.2	73.3	0.175	Elevated levels at GW1, RC3a and RC6a, likely due to landfill leachate.	None, given dilution available
Chloride	19.9	88	26.5	109	496	2220	800	Elevated at RC3a, RC6a and RC7. Likely due to landfill material at RC3a and RC6a and brackish water ingress at RC7.	None, given available dilution and estuarine nature of receiving environment.
Dissolved Oxygen % Saturation	55	53	69	56	71	58		Relatively low as to be expected	None
Iron	183	206	19	22.7	19		200	Elevated at GW1 and RC3A	None, given dilution available
pH	6.7	7	7.4	7.4	7.9	7.3			
Temperature	10.7	11.2	11.1	11.2	10.6	11.9			
Total Oxidised Nitrogen	0.363	<0.1	10.6	8.02	2.95	<0.1	8.48	Slightly elevated at RC4	None, given dilution available

**Table 5.2.2. Groundwater quality Dungarvan landfill Q2 2017**

EntityName	Dungarvan	Dungarvan	Dungarvan	Dungarvan	Dungarvan	Dungarvan	Groundwater quality standards S.I. No. 9 of 2010	Comment	Environmental significance
StationName	GW1	RC3a	RC4	RC6a	RC7	RC8			
SampleDate	01/06/2017	01/06/2017	01/06/2017	01/06/2017	01/06/2017	01/06/2017			
Ammonia(N)	2.8	53.8	<0.2	18.5	<0.2	71.7	0.175	Elevated levels at GW1, RC3a and RC6a, likely due to landfill leachate.	None, given dilution available
Chloride	20.7	95.5	28.2	107	4950	2250	24	Elevated at RC3a, RC6a and RC7. Likely due to landfill material at RC3a and RC6a and brackish water ingress at RC7.	None, given available dilution and estuarine nature of receiving environment.
Conductivity @ 25°C	1172	1484	641	1182	14950	8380	800	As for chloride	As for chloride
Dissolved Oxygen % Saturation	67	58	77	63	71	64		Relatively low as to be expected	None
Iron	NT	NT	NT	NT	NT		200	Elevated at GW1,RC3A,RC6a and RC7	None, given dilution available
pH	6.7	7.1	7.4	7.2	7.4	7.3			
Temperature	12.1	12.3	12.8	11.9	12.1	13.2			
Total Oxidised Nitrogen	<0.1	<0.1	9.65	8.26	0.405	0.305	8.48	Slightly elevated at RC4	None, given dilution available

**Table 5.2.3. Groundwater quality Dungarvan landfill Q3 2017**

EntityName	Dungarvan	Dungarvan	Dungarvan	Dungarvan	Dungarvan	Dungarvan	Groundwater quality standards S.I. No. 9 of 2010	Comment	Environmental significance
StationName	GW1	RC3a	RC4	RC6a	RC7	RC8			
SampleDate	25/07/2017	25/07/2017	25/07/2017	25/07/2017	25/07/2017	25/07/2017			
Ammonia(N)	3.12	58.1	<0.2	14.9	<0.2	73.9	0.175	Elevated levels at GW1, RC3a and RC6a, likely due to landfill leachate.	None, given dilution available
Chloride	19.6	98.8	27.5	108	3800	2380	24	Elevated at RC3a, RC6a and RC7. Likely due to landfill material at RC3a and RC6a and brackish water ingress at RC7.	None, given available dilution and estuarine nature of receiving environment.
Conductivity @ 25°C	1179	1501	657	1168	nm	8430	800	As for chloride	As for chloride
Dissolved Oxygen % Saturation	17	16	51	18	41	40		Relatively low as to be expected	None
Iron	807	109	<0.19	<0.19	<0.19	<0.19	200	Elevated at GW1,RC3A	None, given dilution available
pH	6.6	7	7.3	7.14	7.1	7.3			
Temperature	13.2	13.1	12.3	12.7	12.8	13.7			
Total Oxidised Nitrogen	BLD	BLD	10.2	8.17	0.234	BLD	8.48	Slightly elevated at RC4, RC6a	None, given dilution available

**Table 5.2.4 Dungarvan landfill groundwater monitoring Q4 2017**

EntityName	Dungarvan	Dungarvan	Dungarvan	Dungarvan	Dungarvan	Dungarvan	Groundwater quality standards S.I. No. 9 of 2010	Comment	Environmental significance
StationName	GW1	RC3a	RC4	RC6a	RC7	RC8			
SampleDate	06/07/2017	06/07/2017	06/07/2017	06/07/2017	06/07/2017	06/07/2017			
Ammonia(N)	<0.2	0.361	<0.2	<0.2	<0.2		0.175	Elevated levels at GW1, RC3a and RC6a, likely due to landfill leachate.	None, given dilution available
Chloride	29	84.8	27.4	105	922	2460	24	Elevated at RC3a, RC6a and RC7. Likely due to landfill material at RC3a and RC6a and brackish water ingress at RC7.	None, given available dilution and estuarine nature of receiving environment.
Conductivity @ 25°C	nm	nm	nm	nm	nm	nm	800	As for chloride	As for chloride
Dissolved Oxygen % Saturation	23	21	55	28	70	31		Relatively low as to be expected	None
Iron	2470	838	19	19	19	19	200	Elevated at GW1,RC3A, RC6a and RC7	None, given dilution available
pH	6.5	7	7.3	7.1	7.2	7.3			
Temperature	12.5	12	11.3	11.5	11.9	12.5			
Total Oxidised Nitrogen	nm	nm	nm	nm	nm	nm	8.48	Slightly elevated at RC4	None, given dilution available



## 5.3 LEACHATE

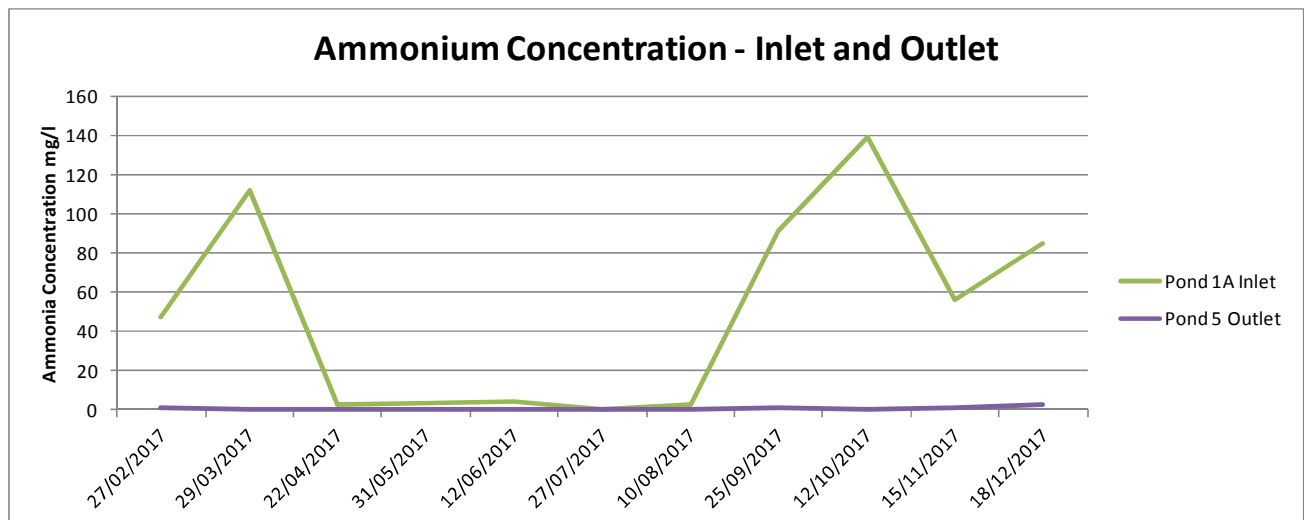
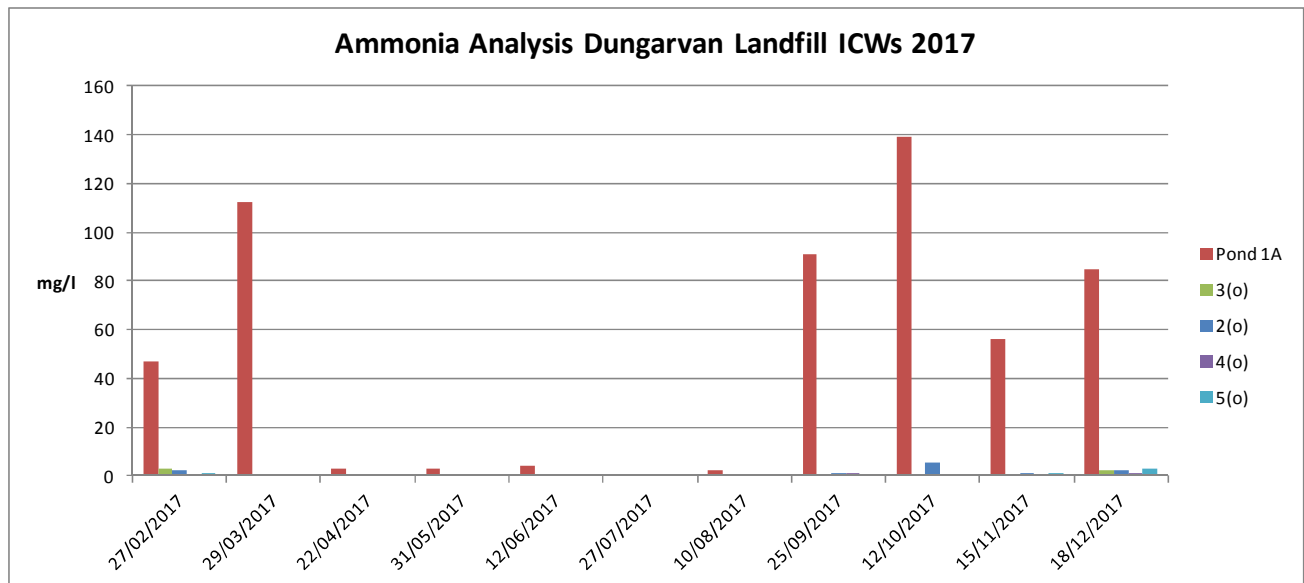
### 5.3.1 INTRODUCTION

In order to treat the leachate collected from the landfill an ICW consisting of five cells of varying size was constructed on top of the capped landfill. Each ICW cell was constructed by creating 1m x 3-4m wide perimeter bunds. Each cell was lined with HDPE to contain the leachate and each cell has a 500mm depth of subsoil to support the establishment of the wetland helophytic (emergent) vegetation. The wetlands have a total surface area of 18,000 m<sup>2</sup>. The ICW can be generally categorized as a surface flow wetland and strives to mimic natural wetlands of similar structure and vegetation. The dominant vegetation in the wetland consists of a range of helophytic genera (emergent plants) including amongst others Typha, Glyceria, Carex and Iris species. The sizing of the overall functional area of the ICW is based on an area loading of 0.2 litres of leachate per meter squared per day (0.2 l/m<sup>2</sup>/d). The leachate, after dilution, is pumped to the first ICW cell and thereafter flows by gravity sequentially from cell to cell where it is comprehensively treated prior to intermittent discharge to the on-site surface water lagoon.

Currently leachate from the interceptor tank and leachate boreholes 2 and 6 are mixed with groundwater from RC8 and pumped to the ICW for treatment. Flow and contaminant loadings to the wetland are presented in table 5.3.1. Inlet and outlet concentrations for ammonia and chemical oxygen demand are graphed in figure 5.3.1.

Table 5.3.1 Dungarvan landfill integrated constructed wetland estimated loadings – present and (future expected).

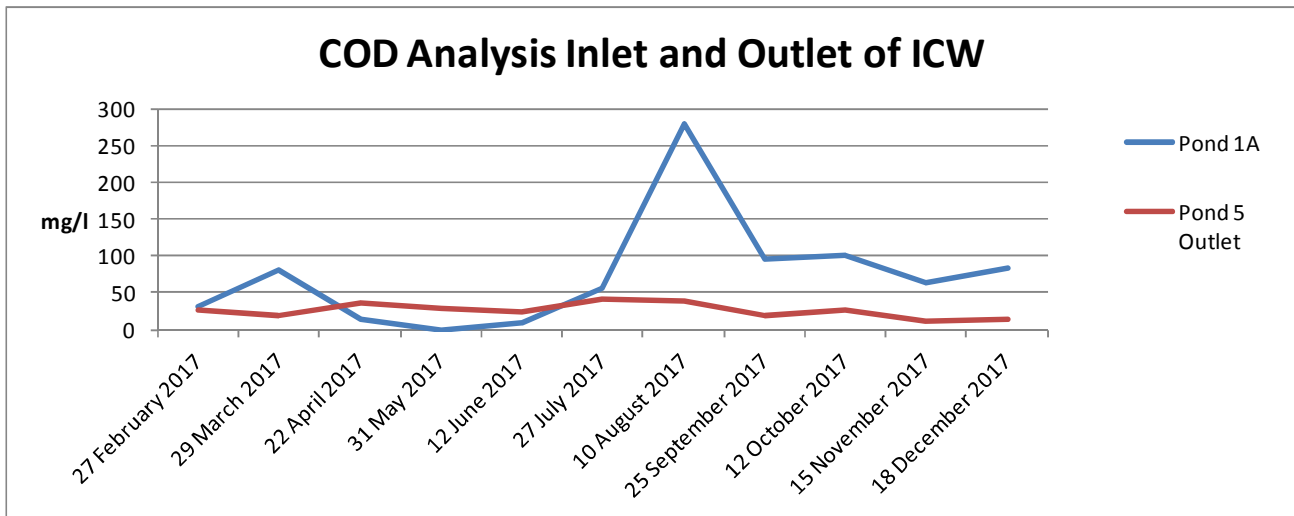
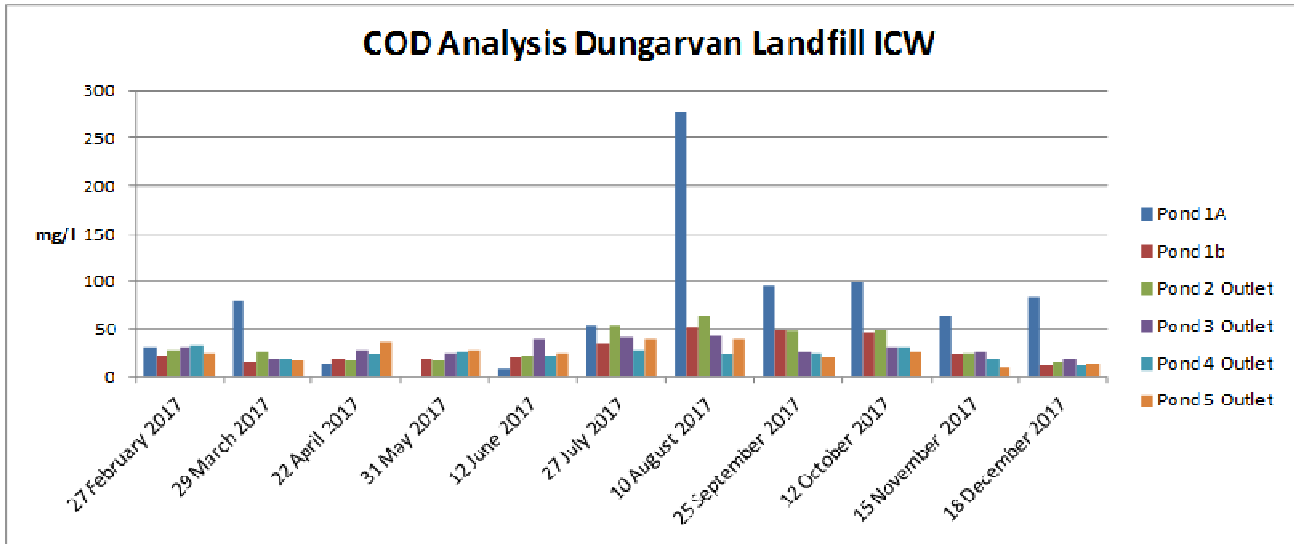
Number of ponds	6
Total working wetland area m <sup>2</sup>	5158
Total working wetland volume m <sup>3</sup>	1032
<b>HYDRAULIC FLOWS</b>	
Influent Volume m <sup>3</sup> per Day	26.9 (50)
Hydraulic loading l/m <sup>2</sup> /day	5.2 (12)
<b>Ammoniacal Nitrogen loading (g/m<sup>2</sup>/day)</b>	
Total Phosphorous loading (g/m <sup>2</sup> /day)	0.003
COD loading (g/m <sup>2</sup> /day)	0.6
Metals mg/m <sup>2</sup> /day	<0.1



Pond 1A Inlet	Pond 5 Outlet	Date Sampled
47	0.88	27/02/2017
112	<0.2	29/03/2017
2.93	<0.2	22/04/2017
3.11	<0.2	31/05/2017
4.28	<0.2	12/06/2017
0.54	<0.2	27/07/2017
2.6	<0.2	10/08/2017
91.2	0.786	25/09/2017
139	0.551	12/10/2017
55.9	0.949	15/11/2017
84.8	2.66	18/12/2017

**Key Parameter – leachate COD**

The COD test measures the organic matter in a sample that is amenable to chemical oxidation. The COD test is usually applied to polluted waters and waste-waters.



Pond 1A	Pond 5 Outlet	Date
31.1	25.8	27/02/2017
81.2	17.7	29/03/2017
12.9	37	22/04/2017
<7	29	31/05/2017
8.73	24.9	12/06/2017
55.1	40.5	27/07/2017
278	39	10/08/2017
94.7	19.4	25/09/2017
100	27.4	12/10/2017
64.7	10.8	15/11/2017
83.9	13	18/12/2017

Figure 5.3.2 Leachate COD Trends 2017

## DISCUSSION

The strengths of leachate present at the ICW outlet were low, with an average COD value of 25.86 being recorded. An interceptor tank receives leachate from a drain around the landfill and also from a waste transfer station. The contents of the interceptor tank and leachate boreholes 2 and 6 are treated in the on-site constructed wetland. Ammonium values at the ICW outlet ranged from <0.20 to 2.88 mg/l, with an average of 1.16 mg/l, and were below the proposed discharge licence limit of 5 mg/l. Similarly COD (mean 29 mg/l) values were low for the ICW outlet.

**Table 5.3.3 Leachate quality [Dungarvan landfill, Q1 2017](#)**

Parameters	Units	Dungarvan Landfill W0032-02 Qrt 1 2017					
		Leachates					
LABORATORY NUMBER		2877	2878	2879	2880	2881	2882
							Dilution
Sampling Location		L1	L2A	L4	L5A	Sump	Tank
<b>Date sampled</b>	27/02/2017	27-Feb	27-Feb	27-Feb	27-Feb	27-Feb	27-Feb
<b>Sampled by</b>	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
<b>Time sampled</b>				15:15	14:30	17:00	16:30
		no	no		no		
		tubing	tubing	dry	tubing	clear/no	clear/no
BOD	mg/l					7	3
COD	<7 mg/l					31.4	20.7

**Table 5.3.4 Leachate Quality Dungarvan landfill, Q2 2017**

Parameters	Units	Dungarvan Landfill W0032-02 Qrt 2 2017					
		Leachates					
LABORATORY NUMBER		3244	3245	3246	3247	3248	3249
							Dilution
Sampling Location		L1	L2A	L4	L5A	Sump	Tank
Date sampled	01/06/2017	01-Jun	01-Jun	01-Jun	01-Jun	01-Jun	01-Jun
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
Time sampled		nm	nm	nm	nm	15:40	14:25
Appearance/Odour		no	no		no	brown/	
		tubing	tubing	dry	tubing	no	clear/no
BOD	mg/l					<5	<2
COD	<7 mg/l					21.1	7.3

**Table 5.3.5 Leachate Quality Dungarvan landfill, Q3 2017**

<b>Date sampled</b>	25-27/07/2017	27-Jul	27-Jul	25-Jul	27-Jul	27-Jul	27-Jul
<b>Sampled by</b>	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
<b>Time sampled</b>		16:30	16:40	16:15	15:45	15:00	13:30
Visual Inspection/Odour		black/yes	black/yes	dry	black/yes	clear/no	clear/no
Leachate Level	m	6.3	4.8	0.6	3.9	n/a	n/a
Electrical Conductivity	us/cm	27800	13920		18240	617	3710
pH	units	7.7	7.4		7.8	8.4	7.9
BOD	mg/l	83	153		50	<5	15
Ammoniacal Nitrogen as N	<0.02 mg/l	2150	851		1470	<0.2	130
Fluoride	<0.5mg/l	1.75	1.48		1.49	<0.5	<0.5
COD, unfiltered	<7 mg/l	1510	1110		854	21.3	88.3
Aluminium	<2 ug/l	<2	<2		<2	23.4	5.4
Arsenic	<0.5 ug/l	31	6.2		18.5	3.3	2.78
Boron	<5 ug/l	<5	<5		<5	80.3	538
Cadmium	< 0.08 ug/l	<0.08	<0.08		<0.08	<0.08	0.184
Copper	<0.3 ug/l	<0.3	<0.3		<0.3	2.13	16.7
Lead	<0.2 ug/l	<0.2	<0.2		<0.2	<0.2	1.03
Manganese	<1 ug/l	<1	<1		<1	21.5	566
Nickel	<0.4 ug/l	<0.4	<0.4		<0.4	2.02	19.4
Zinc	<1 ug/l	1.19	1.01		<1	5.61	107
Silver	<0.5 ug/l	<0.5	<0.5		<0.5	<0.5	<0.5
Mercury	<0.01 ug/l	<0.1	<0.1		<0.1	<0.1	<0.1
Sulphate	<2 mg/l	<10	<10		<10	2.8	26.9
Chloride	<2 mg/l	2860	974		1990	61.4	321
Phosphate(ortho) as P	<0.02 mg/l	13.7	0.494		3.41	0.033	0.243
Total Oxidised Nitrogen as N	<0.1 mg/l	1.07	<0.5		0.708	1.36	8.87
Chromium, Total (total)	<3 ug/l	396	41.8		299	<3	12
Cyanide, Total	<0.05 mg/l	<0.05	<0.05		<0.05	<0.05	<0.05
Calcium	<0.012 mg/l	38.7	89.8		21.2	44.7	83.5
Sodium	<0.076 mg/l	3660	1570		1630	46	263
Magnesium	<0.036 mg/l	135	103		109	10.1	29.3
Potassium	<1 mg/l	1230	727		583	37.7	71.8
Iron	<0.019 mg/l	5.86	5.85		3.24	0.0417	0.229

**Table 5.3.6 Leachate Quality [Dungarvan landfill, Q4 2017](#)**

Parameters	Units	Dungarvan Landfill W0032-02 Qrt 4 2017						
		Leachates						
LABORATORY NUMBER		4110	4111	4112	4113	4114	4115	
							Dilution	
Sampling Location		L1	L2A	L4	L5A	Sump	Tank	
<b>Date sampled</b>	06/11/2017	06-Nov	06-Nov	06-Nov	06-Nov	06-Nov	06-Nov	
<b>Sampled by</b>	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	
<b>Time sampled</b>		15:10	15:30	13:30	16:30	16:50	nm	
Visual Inspection								
Clear- yes/no								
Odour- yes/no				dry				
BOD	mg/l	44	30		45	<2	<2	
COD	<7 mg/l	1410	977		805	18.5	12.3	



## 5.4. Groundwater and Leachate Levels

### 5.4.1 Introduction

Groundwater and leachate levels are determined monthly, by dip meter, at boreholes GW1, RC3a, RC4, RC6a, RC7, RC8, L4, and L5a.

### 5.4.2 Results

Results of monitoring are presented in table 4.1.

**Table 5.4.1 Dungarvan landfill [leachate levels 2016](#)**

Date	Operator	GW1	GW2A	L1	L2	L4	L5	RC3A	RC4	RC6A	RC7	RC 8
26/01/2016												
27/02/2017	JMcG	3.7	1.8	2.3	4.5	1.1	2.7	13.2	15.6	8.0	10.9	
30/03/2017	JMcG	6.3	2.0	7.6	4.9	0.9	3.7	13.6	15.8	8.1	10.8	12.5
27/04/2017	JMcG	2.1	2.2	6.2	4.9	1.8	3.2	13.0	15.4	5.8	10.5	11.8
31/05/2017	JMcG	2.5	1.0	4.1	7.6	1.1	4.0	13.0	16.0	8.1	10.6	12.0
22/06/2017	JMcG	2.6	1.6	2.6	5.0	0.8	4.0	13.4	16.0	7.8	10.8	12.5
27/07/2017	JMcG	2.1	1.5	6.4	4.9	2.6	3.0	12.9	15.4	7.9	10.6	11.6
10/08/2017	JMcG	2.1	1.7	6.2	4.7	0.8	2.4	12.9	16.0	7.7	10.5	11.9
25/09/2017	JMcG	3.1	1.6	6.2	4.8	0.8	2.9	13.0	16.1	7.9	10.6	11.9
12/10/2017	JMcG	2.5	1.6	5.4	4.6	3.3	4.1	13.1	15.5	8.0	10.7	13.4
15/11/2017	JMcG	3.3	1.6	5.7	4.6	0.9	2.1	13.2	15.7	5.8	10.7	13.0

### 5.4.3 Discussion

There was some fluctuation in levels in all boreholes. Some pumping of leachate to the on-site constructed wetlands was ongoing during this period and may have had an effect on leachate levels. Note new wells were drilled at L1A, L2B and L5B in August 2011.

## 5.5 LANDFILL GASES

### 5.5.1 Introduction

Gases (mainly methane –65% and carbon dioxide – 35%) are given off by the biodegradation of organic matter within the landfill waste. The rate of gas generation is dependent on waste type, moisture content and age of waste. Gas is monitored weekly at the site building, and monthly at the groundwater and leachate boreholes. Results of gas monitoring are presented in figures 5.5.1 and 5.5.2 and tables 5.1 to 5.4 below. A full review of all leachate borewells will be undertaken during the next reporting period.

### 5.5.2 Results

#### KEY PARAMETER –METHANE

Methane is a colourless, odourless gas generated by the biodegradation of organic matter. Landfill gas contains about 65% methane.

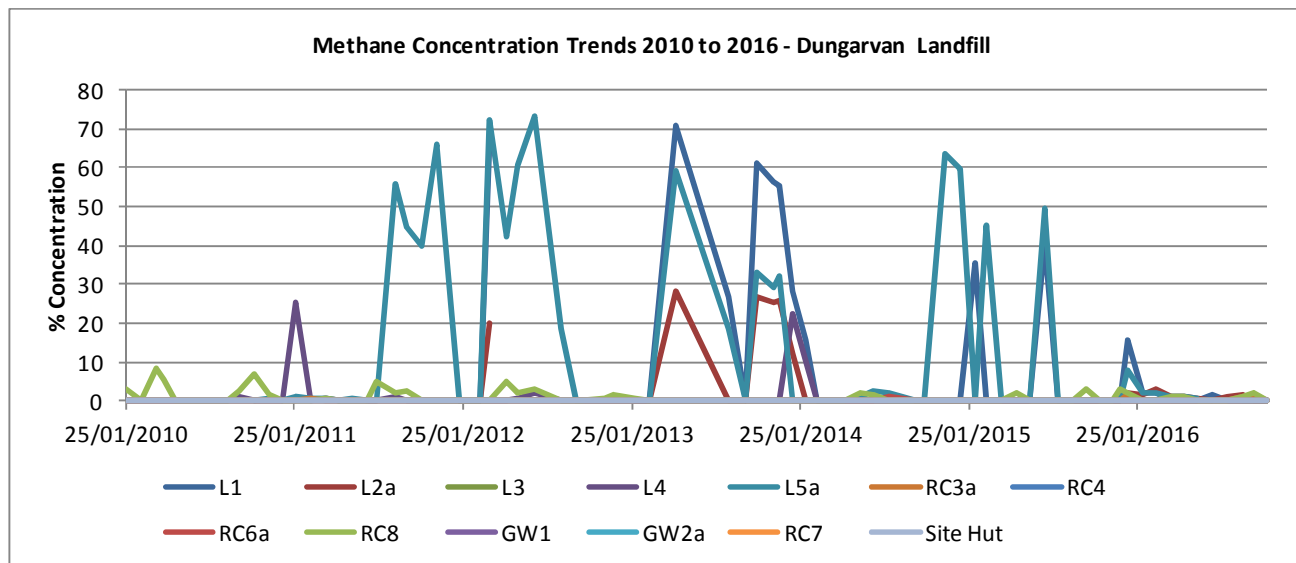


Figure 5.5.1 Methane temporal trends 2010 to 2017

No high levels of methane were detected throughout the year. No methane was detected in the site buildings or at monitoring points outside the landfill area.

**Table 5.5.1: Dungarvan Landfill Gas monitoring Q1 2017**

Week No	Date	Operator	Gas	Site Hut	GW 1	GW 2A	L1	L2	L4	L5	RC3A	RC4	RC6A	RC 7	RC 8
4	23/01/2017		CH <sub>4</sub>	0.00	0.50	0.20	35.50	0.00	1.20	66.80	2.33	0.20	0.30	0.50	1.40
			CO <sub>2</sub>	0.00	0.10	0.00	12.20	0.00	0.40	26.30	1.00	0.00	0.00	0.10	0.60
			O <sub>2</sub>	20.90	20.30	20.00	9.40	20.90	18.60	20.90	20.00	20.40	20.40	20.40	18.90
			Air Pressure	1006	1006	1006	1006	1006	1006	1006	1006	1006	1006	1006	1006
9	27/02/2017		CH <sub>4</sub>	0.00	1.2	0.0	7.0								
			CO <sub>2</sub>	0.00	0.8	0.0	22.3								
			O <sub>2</sub>	20.90	19.0	19.9	0.8								
			Air Pressure	985	985.0	985.0	989.0								
13	30/03/2017		CH <sub>4</sub>	0.00	5.9	0.3	25.2	0.3	0.3	77.8	0.4	0.7	0.3	0.3	0.3
			CO <sub>2</sub>	0.00	4.5	0.1	6.6	0.1	1.7	21.9	3.3	0.1	1.0	0.1	0.2
			O <sub>2</sub>	20.90	13.7	21.2	14.3	21.1	18.3	6.1	16.5	19.8	20.5	20.7	20.6
			Air Pressure	1007	1007	1007	1007	1007	1007	1007	1007	1007	1007	1007	1007
Week No	Date	Operator	Gas	Site Hut	GW 1	GW 2A	L1	L2	L4	L5	RC3A	RC4	RC6A	RC 7	RC 8

**Table 5.5.2: Dungarvan Landfill Gas monitoring Q2 2017**

Week No	Date	Operator	Gas	Site Hut	GW 1	GW 2A	L1	L2	L4	L5	RC3A	RC4	RC6A	RC 7	RC 8
17	27/04/2017		CH <sub>4</sub>	0.00					0.4		0.4				
			CO <sub>2</sub>	0.00					1.8		3.2				
			O <sub>2</sub>	20.90					18.8		17.1				
			Air Pressure	1018					1018		1019				
22	31/05/2017		CH <sub>4</sub>	0.00	0.1	0.0	0.0	43.9	0.1	72.7	1.0	0.0	0.0	0.0	0.0
			CO <sub>2</sub>	0.00	1.2	0.0	0.0	21.4	1.3	22.0	2.8	0.2	0.2	0.0	0.1
			O <sub>2</sub>	20.90	19.9	21.6	21.1	0.3	20.3	0.3	18.7	21.1	21.6	21.8	21.0
			Air Pressure	1020	1020	1018	1020	1018	1020	1018	1020	1020	1018	1018	1020
25	22/06/2017		CH <sub>4</sub>	0.00	0.2	0.0	0.0	52.8	2.9	62.0	0.0	0.0	0.0	0.0	0.0
			CO <sub>2</sub>	0.00	0.2	0.0	0.0	20.2	1.0	18.7	0.3	0.0	0.1	0.0	0.1
			O <sub>2</sub>	20.90	18.9	19.2	19.7	0.1	18.6	1.3	19.1	19.3	19.2	19.2	19.6
			Air Pressure	1014	1015	1015	1012	1012	1013	1013	1015	1015	1015	1013	1013
Week No	Date	Operator	Gas	Site Hut	GW 1	GW 2A	L1	L2	L4	L5	RC3A	RC4	RC6A	RC 7	RC 8

**Table 5.5.3: Dungarvan Landfill Gas monitoring Q3 2017**

Week No	Date	Operator	Gas	Site Hut	GW 1	GW 2A	L1	L2	L4	L5	RC3A	RC4	RC6A	RC 7	RC 8
30	25/07/2017		CH <sub>4</sub>	0.00	2.4	0.0	47.1	57.8	0.1	2.8	0.1	0.0	0.0	0.0	0.0
			CO <sub>2</sub>	0.00	2.3	0.0	18.4	26.0	1.2	3.1	0.1	0.0	0.7	0.2	0.0
			O <sub>2</sub>	20.90	18.2	20.5	3.3	0.2	19.5	17.1	20.3	21.0	20.1	20.5	20.6
			Air Pressure	1015	1016	1014	1014	1013	1014	1014	1016	1016	1015	1013	1016
33	10/08/2017		CH <sub>4</sub>	0.00	0.0	0.1	39.2	54.8	0.0	2.6	0.3	0.0	0.2	0.0	0.0
			CO <sub>2</sub>	0.00	0.0	0.0	16.9	25.7	0.1	4.5	0.7	0.0	0.4	0.0	0.0
			O <sub>2</sub>	20.90	20.4	20.9	4.2	0.7	20.9	14.9	20.1	20.6	20.5	20.6	20.6
			Air Pressure	1028	1028	1025	1025	1025	1026	1025	1028	1028	1025	1025	1028
39	25/09/2017		CH <sub>4</sub>	0.00	0.2	0.0	0.0	67.9	0.0	0.2	0.0	0.1	0.0	0.0	0.0
			CO <sub>2</sub>	0.00	0.3	0.0	0.0	26.6	0.0	3.0	0.1	0.2	0.0	0.2	0.1
			O <sub>2</sub>	20.90	20.5	20.9	20.8	0.2	21.0	17.5	20.8	19.9	20.9	20.6	20.4
			Air Pressure	1021	1021	1021	1021	1021	1021	1021	1021	1022	1022	1023	1022
Week No	Date	Operator	Gas	Site Hut	GW 1	GW 2A	L1	L2	L4	L5	RC3A	RC4	RC6A	RC 7	RC 8

**Table 5.5.4: Dungarvan Landfill Gas monitoring Q4 2017**

Week No	Date	Operator	Gas	Site Hut	GW 1	GW 2A	L1	L2	L4	L5	RC3A	RC4	RC6A	RC 7	RC 8
41	12/10/2017		CH <sub>4</sub>	0.00	0.0	0.2	0.0	48.5	0.0	47.6	0.0	0.0	0.2	0.1	0.0
			CO <sub>2</sub>	0.00	0.1	0.0	0.0	26.0	0.0	25.5	0.1	0.0	0.1	0.0	0.0
			O <sub>2</sub>	20.90	20.8	21.1	21.1	0.3	21.0	0.2	20.8	20.9	21.1	21.1	20.8
			Air Pressure	1017	1017	1015	1016	1015	1017	1015	1017	1017	1015	1015	1018
46	15/11/2017		CH <sub>4</sub>	0.1	0.2	10.2	63.7	4.8	65.0	0.1	0.1	0.2	0.2	0.0	
			CO <sub>2</sub>	0.3	0.0	7.9	26.4	2.6	26.6	0.5	0.7	0.0	0.0	0.0	
			O <sub>2</sub>	21.0	21.3	12.1	0.2	18.8	2.1	20.8	21.0	21.3	21.3	20.9	
			Air Pressure	1023	1023	1023	1023	1023	1023	1023	1023	1023	1023	1023	
Week No	Date	Operator	Gas	Site Hut	GW 1	GW 2A	L1	L2	L4	L5	RC3A	RC4	RC6A	RC 7	RC 8

## **5.6 NOISE**

### **5.6.1 Introduction**

Noise levels were not recorded during the reporting period as due to cessation of our kerbside collection noise levels on site have lessened considerably. There were no significant changes to on site practices that would lead to an increase in noise levels.

## **5.7 DUST**

### **5.7.1 Introduction / Methodology**

Dust levels were not recorded during the reporting period as due to the cessation of our kerbside collection dust levels on site have lessened considerably. There were no significant changes to on site practices that would have resulted in an increase in dust levels.

## 5.8 MACROINVERTEBRATE SURVEY

### INTRODUCTION

Sampling of macroinvertebrates was carried out at River Colligan sites SW1 and SW2 adjacent to Dungarvan Landfill on 12/12/12. Sampling was conducted on this date to take advantage of suitable river levels which could change on rainfall and prevent sampling on other dates. Sample procedure each time was two minute kick sampling in the riffle zones, plus 2 minute stone washing, with capture in biota net. The catch was returned to Adamstown Laboratory and kept aerated overnight in river water. Identification and counting of biota, using various freshwater macroinvertebrate identification keys, was carried out. The EPA Q-rating scheme was applied to the results in order to get a Q value for each site. However, it should be noted that both stations are subject to tidal influences and may at times be brackish, depending on flow of freshwater and extent of tide.

### RESULTS –

Table 5.8.1. Macroinvertebrate counts 12/12/12

	Sample location	SW1 River Colligan	SW2 River Colligan
	Date sampled	12/12/2012	12/12/2012
GROUP	<b>Species</b>	<b>Count</b>	<b>Count</b>
	<b>Mayflies EPHEMEROPTERA</b>		
B	Baetis	2	
A1	Ephemera	2	
A1	Ecdyonurus	3	3
	<b>Stoneflies PLECOPTERA</b>		
A1	Perla	1	
	<b>Caddis TRICOPTERA</b>		
B	Hydropsyche	1	
B	Rhyacophila	1	
B	Polycentropus	1	2
A2	Anabolia		1
A2	Stenophylax	1	
A2	Sericostoma	1	2
	<b>Other</b>		
B	Limnius		1
	Other Snails		1
B	Gammarus	125	200
	Water mites		1
	<b>TAXON RICHNESS</b>	<b>10</b>	<b>8</b>

Table 5.8.2 Nominal Q-Ratings 12/12/12.

	SW1	SW2
A1	Small Numbers	Small Numbers
A2	Small Numbers	Small Numberw
B	Numerous/Dominant	Numerous/Dominant
C	Absent	Absent
D	Absent	Absent
Assigned Q Rating	3/4	¾

Table 5. Species list of macroinvertebrates 2009 survey (Limosa 2009).

Order	Family	Tolerance	SW2	SW1	SW4 Pond
Ephemeroptera (Mayflies)	Heptageniidae	A	1		
	Baetidae	C	4		
Trichoptera (Cased caddis)	Seracostomatidae	B	2	*	
	Goeridae	B	4		
Trichoptera (Uncased caddis)	Linephiliidae	B	1		
	Polycentropodidae	C			4
Coleoptera (Beetles)	Elmidae	C	7	3	
Crustacea (Crustaceans)	Gammaridae	C	60	120	
Odonata (Damselflies)	Coenagrionidae	-			4
Diptera (Flies)	Chironomidae	C	1		
	Ceratopogonidae	C			1
	Chaoboridae	C			2
Gastropoda (Snails)	Lymnaeidae	D	2		59
	Hydrobiidae	C	20	11	
Fish	Pleuronectidae	-	3	4	
	Corixidae	-			11
Freshwater Worms	Oligochaeta	-			9
Cladocera (Water Flea)	Daphniidae	-			>500
Taxon Richness			11	5	8

## DISCUSSION

Both stations SW1 and SW2 are subject to tidal influences and may at times be brackish, depending on river flow and tidal range.

Nominal Q-scores are assigned for this survey (table 5.8.2) in order to comply with licence requirements, aid interpretation of the species count and to allow trends to be tracked. However, as the Q index system is designed for freshwaters, standard interpretation of the Q score is not possible for these tidal and possibly brackish stations.

Comparison with previous surveys and between stations is possible. Taxon richness was higher in the December 2012 survey compared to the Oct 2009 survey at SW1 (10<sub>2012</sub> vs 5<sub>2009</sub>) and slightly lower for SW2 (8<sub>2012</sub> vs 11<sub>2009</sub>). In the December 2012 survey here was a slight increase in taxon richness between the upstream station SW2 (8) and the downstream station SW1 (10).

Taxon richness and species present at both stations indicate good water quality.

A detailed Surface Water Biological Report is included in **APPENDIX L**.

## 5.11 CONCLUSIONS

Water quality, at the River Colligan surface water sites, in the vicinity of the landfill was satisfactory throughout 2015.

The results of groundwater monitoring are in line with results from previous rounds of testing carried out since 1999. As indicated in previous reports, some of the boreholes within the current working area appear to be impacted by leachate from the landfill in terms of ammonia and iron, however groundwater outside the landfill site was generally satisfactory.

Leachate quality was as expected for a landfill accepting mainly domestic and inert waste. Metal and trace organics concentrations were low. Based on leachate management, treatment in the on-site constructed wetlands, attenuation and dilution, no environmental effect from landfill leachate is expected.

Taxon richness and species present at both river stations' macroinvertebrate surveys indicated good water quality, in line with previous biological surveys.

Overall, water and ecological quality in the vicinity of the landfill were satisfactory and there was no indication that the landfill was having a detrimental impact on the surrounding environment.

## 5.12 Meteorological Data.

Monthly meteorological data is attached in [Appendix G](#)

## 6. Sequence and timescale for development and restoration of the facility

### a) Landfill Capping and Restoration

A Restoration and Aftercare Plan has been approved by the EPA. Capping was completed in 2008.

### b) Landfill Gas & Leachate Management

**Tank and pipeline testing and inspection report**



As part of the leachate and gas systems required under the licence, 1549m of leachate pipework (315mm, 225mm, 160mm, 90mm, 63mm), 3334m of gas pipework (250mm, 90mm), and 3 No. gas manifolds, were installed in 2009. All pipework was pressure tested in accordance with the contract and passed.

Two No. 25m<sup>3</sup> Glass lined steel leachate storage tanks were erected onsite in 2009, however works onsite were suspended before final testing and commissioning. In May 2010, one of these tanks was brought into use as a leachate storage tank, and was (water) tested prior to usage. The tank on the western side of the site is now fully operational and forms part of the leachate abstraction system.

### **Report on progress made and proposals being developed to minimise generation of leachate for disposal**

As per the information in the waste licence review submission (Dec-08), capping works were completed in mid 2008. The final capping system generally comprises of a gas collection layer, LLDPE liner, drainage layer, subsoil layer and topsoil layer as follows:

- 150-300mm layer of topsoil; underlain by
- Subsoil such that thickness of topsoil and subsoil is at least 1m thick; underlain by
- A surface water geocomposite layer; underlain by
- 1mm LLDPE liner (a low permeability geomembrane material).
- Geocomposite gas collection layer.

The capping layers provide protection from the ingress of rain into the site and thus minimise leachate generation.

Wetland ponds were constructed in 2008 for the purpose of treating leachate. Leachate extraction wells are located strategically across the site in order to maximise collection efficiency. Furthermore, rainwater will assist in the dilution of leachate within the constructed wetlands.

The leachate and gas collection pipework and ancillary items was completed in 2009.

## **Development / Infrastructural works summary (completed in previous year or prepared for current year)**

In 2009, as part of the leachate and gas systems required under the licence, 1549m of leachate pipework (315mm, 225mm, 160mm, 90mm, 63mm), 3334m of gas pipework (250mm, 90mm), and 3 No. gas manifolds, were installed. Two No. 25m<sup>3</sup> Glass lined steel leachate storage tanks were erected.

A flare trial was carried out in 2009 to confirm the size of permanent flare required. A closed permanent flare of 100 m<sup>3</sup>/hr capacity was assessed as required, and was installed.

Following the tender and recommendations in the Gas Flare Tender Assessment Report (May 2008), AFS was awarded the tender for the flare and associated works. The gas collection system was completed in June 2009, but the project was then put on hold due to funding issues. The permanent flare was installed and commissioned by AFS in July 2010.

The telemetry system associated with the flare is fully operational and monitoring data referred to in Schedule C.1.2 of the licence can be furnished to the Agency as required. The 2017 EPA Landfill Gas survey is included in **Appendix H**

In 2014 a 12kW thirty metre high micro wind turbine was erected at Dungarvan Civic Amenity site, in order to contribute towards attaining the 2020 targets for local authorities of reducing CO<sub>2</sub> emissions by 33% and the gross electrical consumption from renewable sources target of 40% as set out in government policy.

The wind turbine generated 13,000KWh in 2015, which equates to an annual saving of €2,600 in electricity supply costs at the facility.

### **7. Topographical survey**

No significant topographical changes have occurred on site since the previous survey was carried out. The previous survey has not been attached as it cannot be accommodated with an acceptable level of detail in this document.

## **8. Schedule of Environmental Objectives and Targets for the forthcoming year**

**Objective 1** – To maintain site infrastructure to the standards outlined in Condition 3 of the Waste Licence

**Target 1.1** - Any defect to the existing infrastructure will be repaired / replaced as quickly as possible on an ongoing basis.

**Objective 2** – That no specified emissions from the facility, shall exceed the limit values, set out in Condition 6 and Schedule C of the Waste Licence and that all measures referred to in Condition 6 of the licence are adhered to

**Objective 3** – To maintain the Monitoring Programme as outlined in Condition 8 and Schedule D of the Waste Licence.

**Target 3.1** – To carry out the monitoring programme as outlined in Condition 6 and Schedule C of the Waste Licence.

**Target 3.2** – To submit Annual Environmental Report to the Agency within the timescale as outlined in Schedule E of the Waste Licence.

**Objective 4** – To establish good record keeping and that all records are held at the facility office to comply with Condition 11 of the Waste Licence.

**Objective 5** – That no emergency situation occurs on the site.

**Target 5.1** – Ensure the contingency arrangements as outlined in Condition 9 of the Waste Licence are implemented throughout the year. A document entitled ‘Emergency Response Procedures’ forms the nucleus of the contingency arrangements and is currently with the Agency.

**Objective 6** – To restore the landfill on an ongoing basis in such a way that final works have a minimal impact on the surrounding environment.

**Objective 7** – To carry out regular maintenance of the Gas Management System including gas field balancing, telemetry maintenance and temperature control.

**Objective 8** – To maintain Leachate Management System

**Objective 9** – To maintain Landscaping of Landfill Cap

**Objective 10** – To maintain SCADA system

**9. Full title and a written summary of any procedures continued during the reporting period**

The European Council Directive 90/313/EEC on the *Freedom of Access to Information on the Environment* recognises the significance of the public's access to information relating to the environment. At present, copies of all documents and correspondence relating to Waste Licence 32-2 are on display at the Civic Offices, Dungarvan.

A communications programme will be put in place as required under condition 2.4.1 of the Waste Licence to ensure that members of the public can obtain information concerning the environmental performance of Ballynamuck Landfill. This in turn will address any local community concerns and allow the public the opportunity to provide feedback on the facility.

The Facility Manager will be responsible for the implementation of this programme, which shall form part of the routine operation and management of the facility. Further support will be provided from the Environment Section of Waterford County Council if required.

Programme

*Information to be provided at the Facility*

1. The following information will be available for inspection at the Site Office, and will be maintained by the Facility Manager.
  - Map of the Facility showing all environmental monitoring points
  - Current Waste Licence for the Facility
  - All records relating to the Facility
  - Civic Waste Records
  - Nuisance Inspection
  - Integrity Tests of Bunds
  - Complaints Register
  - Incidents Register

- Environmental Monitoring Records (Groundwater, Surface water, Leachate, Landfill Gas, Noise and Meteorological Data).
- Emergency Response Procedure
- Programme for the control and Eradication of Vermin and Flies
- The current EMS for the Facility
- Annual Environmental Report
- Visitors Book

2. The Waste Acceptance hours under condition 1.7.1.2 of the Waste Licence are

Monday – Friday	9.00am – 1.00pm and 1.30pm – 5.00pm,
Saturday’s	9.00am – 1.00pm.

3. All visitors are required to sign a Visitors Book at the site office outlining their reason for visiting. Unauthorised personnel are not allowed access to the site.

4. Members of the public may arrange a site visit by contacting the Facility Manager prior to their visit. For Health and Safety reasons all visitors must have appropriate clothing (High Vis-jacket, Walking boots/Wellingtons). The Facility Manager or Caretaker shall accompany all visitors on site visits. A number of school visits to the facility took place during the reporting period

5. If information is requested that is not available at the site, the interested party will be directed to the Environment Section of Waterford County Council at the Civic Offices in Dungarvan.

6. Written Requests for Information

All requests concerning the environmental performance of the facility should be made in writing to:

David Regan

Facility Manager

Ballynamuck Waste Disposal Site

Dungarvan, Co. Waterford.

7. The Facility Manager shall copy all requests to:
- Raymond Moloney  
Senior Executive Officer  
Environment Section  
Waterford City and County Council  
Civic Offices  
Dungarvan  
Co. Waterford
8. Each request should indicate the name, address and contact telephone number of the concerned party, an outline of the required information and the manner in which they require the information i.e. copy of record, e-mail etc.
9. Waterford City and County Council shall make replies in writing within twenty working days of receiving the written request.
10. The information required shall be issued in paper format unless otherwise requested by the concerned party. Requests that require information in digital format may require more time than the twenty working days as outlined previously.
11. If requested Waterford City and County Council will provide a clear explanation of the information provided.
12. If the concerned party requests the examination of a particular report/document relating to the facility, then it will be made available for viewing at the Landfill site office.

13. ***Media Requests***

The Director of Services within the Environment Section of Waterford City and County Council shall nominate a liaison person to respond to requests made by the media for information relating to the environmental performance of the facility.

14. ***Feedback from the public***

The Facility Manager will record any comments or suggestions made by the public during their visits and the opportunity will also be available to submit a written comment to the landfill site office. Copies of such minutes or submissions will be kept in a register by the Facility Manager and will also be copied to the Environment Section, for the attention of the Senior Engineer. If requested a reply will be provided by the Council within twenty working days.

## **Emergency Response Procedures**

### **Scope**

The Emergency Response Procedures apply but is not limited to the following incidents occurring:

- Fire / Explosions
- Spillages
- Migration of Landfill Gas
- Environmental Pollution
- Injury or serious accident to persons
- Any other incident, which may pose a significant threat to persons or the environment.

### **Responsibility**

1. The Facility Manager is responsible for the implementation of the Emergency Response Procedure and for the training of all landfill personnel and contractors in effective emergency response procedures.
2. In the event of a major fire or an explosion the Senior Rostered Fire Officer will be notified immediately via the Regional Fire
3. In the event of a serious accident or injury to a person the Ambulance service should be contacted
4. In the event of other incidents e.g. spillages or environmental pollution the Senior Environment Engineer will be notified and will assume responsibility along with the Facility Manager.

### **Procedure**

In the event of an accident occurring the following procedure will be adopted:

- Evacuate the immediate area within the site if necessary
- Inform other site users
- Remain upwind of any hazard area
- Contact site office and advise in detail of the emergency
- Ensure entrance/exit gate is not obstructed
- Contact fire Brigade, Ambulance, Gardaí, and / or Senior Engineer, Waterford County Council as required by dialing 999 or 112
- If incident occurs outside office hours an emergency telephone contact number will be provided on the site notice board

- Personnel shall report to the designated assembly point at the site office
- All areas affected by the incident shall remain closed until given the all-clear by an authorised person

In the event of landfill gas being detected in the site office the following procedure will be followed:

- Raise the alarm
- Evacuate the site office
- Notify relevant senior personnel in Waterford County Council or emergency services if necessary
- Immediately conduct gas survey to identify source
- Remedy cause of problem
- Document incident properly

In the event of a spillage, the Facility Manager shall apply a suitable absorbent material to contain and absorb any spillage at the facility. Once contained the Facility Manager shall have regard to the Corrective Action Procedure.

In the event of a serious threat to the environment, the Facility Manager shall take all necessary short-term action to minimise any further impact and allow the Corrective Action Procedure.

### **Records**

Details of any incident will be recorded in a written register, which will be maintained at the site office

### **Waste Characterisation & Acceptance Procedures for the Acceptance, Storage and Segregation of Waste**

The Civic Waste Facility at Dungarvan Landfill accepts waste from Domestic Householders only. The following items are accepted:

**Waste Electronic and Electrical Equipment** – Cages are provided for the collection and storage of small electrical goods. Members of the public are instructed to place all items into these cages by Waterford City and County Council Employees.

**Paint** – A 20ft container allows for the collection and storage of paint cans. Members of the public are instructed to place all items on the floor of the container where they are later packed in to steel drums by Waterford City and County Council Employees.



**White Goods** (Cookers, washing machines, driers, fridges, freezers) - A 20 ft container allows for the collection and storage of all White goods. Members of the public are instructed to leave all items near the door of the container where they are later double stacked by Waterford City and County Council Employees.

**Glass** – Bottle banks are in place to facilitate the disposal of green, brown and clear glass bottles. There is also a small skip in place for the collection of flat glass where it is removed off site for recovery at a later stage.

**Hazardous Materials** (These are collected and stored in a 40ft container)

**Cooking Oil** – Waterford City and County Council employees place all cooking oil in steel drums.

**Car oil** – Members of the public are instructed to leave all cans beside the oil collection unit where it is later emptied in to the unit by Waterford City and County Council employees.

**Fluorescent tubes** – Are collected and stored in a specifically made timber container.

**Domestic Batteries** – These are collected and stored in plastic barrels.

**Car Batteries** – These are collected are stored in specifically designed battery receptacles.

**Obsolete medicines** - These are collected and stored in plastic barrels.

**Aerosols** – These are collected and stored in plastic barrels (all aerosols are separated in to flammable, non – flammable, toxic prior to packing. The aerosols are stacked in layers and covered with vermiculite which is a fire proofing material)

**Pesticides** - These are collected and stored in plastic barrels.

**Scrap metal** – Members of the public are instructed to place all metal items in to an open skip where it is later removed off site for recovery

**Bulky Items** (Beds, Carpets, Mattresses, etc) - Members of the public dispose of these items in to a 20ft container where they are later disposed of to the tip head.

**Household Waste** – Members of the Public place domestic waste in to a closed skip where it is later disposed of to the Transfer Station.

**Rubble** - Members of the Public place rubble waste in to an open skip. It is transported offsite for recovery

**Clay & Top soil** - Members of the Public place clay & topsoil in to an open skip. It is transported offsite for recovery

**Household Dry Recyclables** – Members of the public dispose of recycling material in to a closed skip where it is later removed off site for recovery.

**Timber** - Members of the Public place timber products in to an open skip where it is later removed off site for recovery.

**10. Reported Incidents and Complaints**

There were no reported incidents or complaints for the reported period.

**11. Management and Staffing of the Facility**

Management and staffing of the facility is attached in **Appendix J**

**12. Programme for Public Information**

All files are held at the site office and at the Civic Offices Dungarvan Co. Waterford

**13. Report on training of staff**

Both the Facility Manager and Deputy Manager have attended the Fás Waste Management Training Course. Site personnel have attended the Fás Safe Pass program, Waste Facility Operative Course and site operatives attended a course in the handling, storage and removal of Waste from the Civic Amenity Site. All staff have received manual handling training, Waste Facility Operative Course, Fire Fighting and fire extinguisher training and a refresher First Aid Course.

**14. Statement on the costs of Landfill**

The project budget as submitted to the Department of the Environment and Local Government has not changed since the last reporting period.

## 15. Reports on Financial Charges and Provisions

Waterford County Council is responsible for providing annual fees to the Agency for monitoring and inspection of the site. The annual fee for 2017 for monitoring was €46,000.00 and €22704 for licences.

### Aftercare Phase (30yrs)

The original estimates for long term liabilities were contained in the CRAMP and detail €80,000, €70,000, and €20,000 for general management, leachate, and gas systems, respectively (as per extracted Table 7.3 below).

#### Costs of aftercare management proposals

Environmental Liability	Description	Cost Estimate
General Management and maintenance of site during aftercare phase (30 yrs – includes for 20 years of aftercare).	€ 80,000 per annum– monitoring contract with Laboratory, small maintenance works.	€ 2,400,000
Management and maintenance of Leachate Abstraction & Treatment Process and pumping system during aftercare phase (30 yrs – includes for 20 years of aftercare)	€ 70,000 per annum- maintain Leachate Abstraction & treatment Process and SCADA system and replace pumps, lines etc. where required; Power supply; Testing	€ 2,100,000
Management and maintenance of Gas Management System during aftercare phase (30 yrs – includes for 20 years of aftercare)	€ 20,000 per annum – Maintain & operate landfill gas extraction system	€ 600,000
	<b>Total for 30 year period</b>	<b>€ 5,100,000</b>
	Contingency set at 15% for increased scope on last three items.	<b>€ 765,000</b>
	<b>Total for 30 years with contingency</b>	<b>€ 5,865,000</b>

### Dungarvan landfill Maintenance costs

Item	Description	Details	Cost
1	Flare maintenance	As per contract	€3,400
2	Flare maintenance	Allow for 4 days callouts at contract rate	€3,000
3	Flare maintenance	Allow for parts replacement	€3,000
4	Leachate system maintenance	Current contract (to Oct-11, new contract needed thereafter)	€3,600
5	Leachate system maintenance	Allow for 4 days callouts at contract rate	€3,000
6	Leachate system maintenance	Allow for parts replacement	€1,500
7	Subtotal		€17,500
8	Contingencies at 15%		€2,625
9	Subtotal		€20,125
10	VAT		€2,717
11	<b>Total</b>		<b>€22,842</b>

### 16. Slope Stability Assessment

No significant slope slippage has occurred since the previous assessment was carried out in 2010.

As a consequence a revised Slope Stability Assessment has not been included in the report.

**APPENDIX A**

Quantity & Composition of Waste Received, Disposed of & Recovered  
during the reporting period.

**Total Waste received for Disposal at Dungarvan Civic Amenity Site and Transfer Station between January 1<sup>st</sup> and December 31<sup>st</sup> 2017**

Waste Disposed	Type	EWC Code	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Total
Domestic	Bulky - Areas	20 03 01	32.80	3.86	12.56	50.42	14.40	6.52	22.84	19.84	18.56	12.84	15.08	5.36	215.08
	Bulky - Greenstar Skip	20 03 01	6.76	2.58	2.58	1.26	2.36	1.72	0.00	8.02	1.78	1.28	2.16	0.00	30.50
	Civic Skip (Black Bag CA)	20 03 99	10.72	9.58	9.00	10.48	11.74	12.82	8.86	11.88	9.52	9.50	12.28	9.40	125.78
	Clean Ups (See notes)	20 03 99	0.00	0.00	0.00	5.64	0.00	1.12	0.00	0.00	0.00	0.00	0.00	0.00	6.76
Litter	Irish Water	20 03 99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Litterbins	20 03 99	32.36	27.22	30.78	31.78	36.34	37.08	38.24	53.42	35.60	34.22	33.64	34.38	425.06
	Mattresses	20 03 03	3.36	6.60	0.00	3.36	0.00	6.80	0.00	0.00	6.18	0.00	6.76	0.00	33.06
	Public Trailers	20 03 01	58.60	50.00	116.00	97.20	91.60	136.00	92.80	109.90	71.60	97.20	122.40	118.00	1161.30
	Roadsweeper	20 03 99	36.66	44.96	39.56	35.88	21.38	20.84	15.44	12.22	10.44	23.26	17.04	27.20	304.88
	WCCC Housing	20 03 99	12.26	3.52	4.46	11.94	4.00	2.22	8.28	3.52	3.48	9.96	4.72	0.50	68.86
<b>Total Disposed</b>			<b>193.52</b>	<b>148.32</b>	<b>214.94</b>	<b>247.96</b>	<b>181.82</b>	<b>225.12</b>	<b>186.46</b>	<b>218.80</b>	<b>157.16</b>	<b>188.26</b>	<b>214.08</b>	<b>194.84</b>	<b>2371.28</b>

**Total Waste received for Recovery at Dungarvan Civic Amenity Site and Transfer Station between January 1<sup>st</sup> and December 31<sup>st</sup> 2017**

Recycling	Dry Material	20 01 01	11.98	9.42	24.54	9.44	12.00	11.24	10.12	28.66	9.98	9.42	18.52	11.84	167.16
	Large Household	16 02 13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Small Household (WEEE)	16 02 13	17.66	12.88	23.76	16.38	20.62	15.70	18.22	16.72	10.66	12.68	18.06	13.46	196.80
	Textiles	04 02 22	0.46	0.32	0.26	0.64	0.52	0.54	0.40	0.42	0.40	0.30	0.24	0.40	4.90
Recovery	Clay	17 05 04	0.00	7.00	9.44	0.00	4.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.66
	Cooking Oil	02 02 99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Film Farm Plastics	02 01 04	0.00	0.00	0.00	0.00	0.00	0.00	12.38	0.00	0.00	0.00	0.00	0.00	12.38
	Flat Glass	17 02 02	2.46	3.56	4.18	0.00	3.66	1.34	2.24	1.48	3.10	1.88	3.40	1.94	29.24
	Garden Council	02 01 07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.74	0.00	0.00	0.00	25.74
	Garden Private (CA site)	02 01 07	18.40	19.22	0.00	36.17	18.32	54.80	35.78	62.68	0.00	56.78	34.74	34.28	371.17
	Rubble	17 01 07	0.00	8.68	0.00	0.00	19.76	12.30	0.00	12.36	22.42	0.00	0.00	0.00	75.52
	Scrap metal	17 04 07	2.12	2.76	3.80	5.74	4.48	4.82	4.46	5.30	2.24	3.40	3.92	3.60	46.64
	Timber	17 02 01	17.06	17.46	19.56	16.56	24.04	13.98	30.72	26.48	16.84	15.04	25.08	11.50	234.32
Hazardous	Aerosols	16 05 04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Batteries (Car)	16 06 01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Batteries (Small)	16 06 02	0.00	0.52	0.00	0.70	0.00	0.46	0.00	0.92	0.50	0.50	0.00	0.74	4.34
	Car Filters	16 01 07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Engine Oil	13 02 06	0.00	0.00	0.00	1.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.16	2.24
	Flourescent Lamps	16 02 11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Medicines	18 01 08	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13
	Paint	08 01 21	0.68	0.66	0.82	0.96	1.50	0.00	1.50	0.94	0.64	0.62	1.42	0.00	9.74
<b>Total Accepted</b>			<b>70.82</b>	<b>82.48</b>	<b>86.49</b>	<b>87.67</b>	<b>109.12</b>	<b>115.18</b>	<b>115.82</b>	<b>155.96</b>	<b>92.52</b>	<b>100.62</b>	<b>105.38</b>	<b>78.92</b>	<b>1200.98</b>

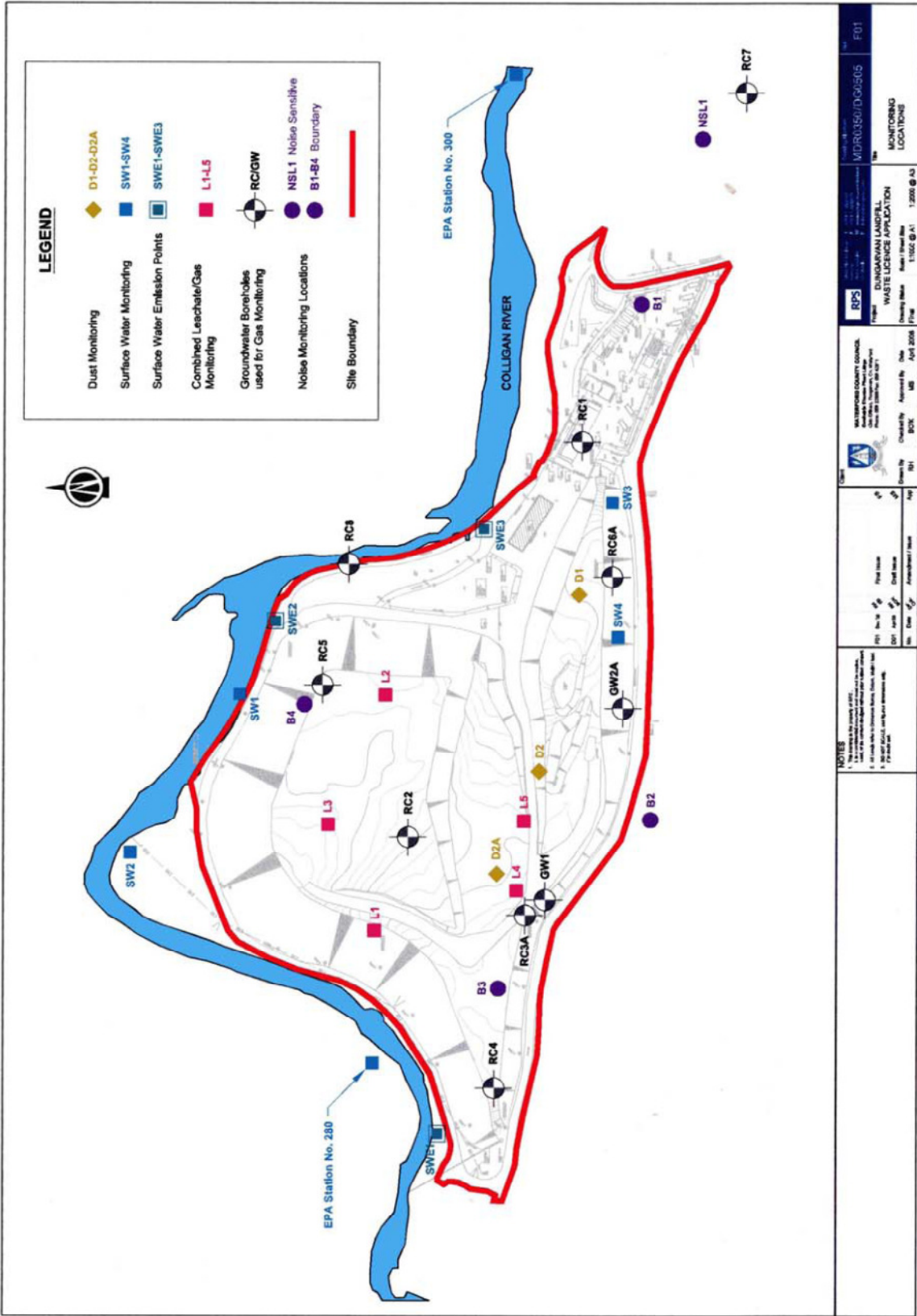
**Total Waste transferred off site from Dungarvan Civic Amenity Site and Transfer Station between January 1<sup>st</sup> and December 31<sup>st</sup> 2017**

Waste Transferred	EWC Code														
Recovery	Clay	17 05 04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Cooking Oil	02 03 99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Dry Materials	20 01 01	11.64	9.40	24.56	9.16	11.68	11.90	9.92	15.34	9.04	8.36	18.54	25.96	165.50
	Film Farm Plastics	20 01 39	0.00	0.00	0.00	0.00	0.00	6.06	12.38	0.00	0.00	0.00	0.00	0.00	18.44
	Flat Glass	20 01 02	2.34	3.64	4.18	0.00	3.54	1.36	2.24	1.48	3.10	1.88	3.40	1.94	29.10
	Garden Private (CA site)	02 03 99	18.40	19.22	10.74	23.43	29.64	54.70	29.06	61.42	25.76	56.54	34.62	17.14	380.67
	Large Household	16 02 13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Rubble	17 01 07	0.00	8.68	0.00	0.00	12.70	12.32	0.00	12.30	22.34	0.00	0.00	0.00	68.34
	Scrapmetal	17 04 07	2.10	4.28	3.86	5.76	4.42	2.64	2.62	4.18	2.34	3.40	3.92	3.58	43.10
	Small Household (WEEE)	16 02 13	17.68	12.76	23.76	16.40	20.52	15.60	18.22	16.60	10.58	12.68	18.08	13.46	196.34
	Textiles	04 02 22	0.46	0.32	0.26	0.56	0.54	0.44	0.42	0.42	0.24	0.32	0.24	0.40	4.62
	Timber	17 02 01	16.94	17.48	15.78	17.28	22.78	19.46	23.50	22.16	16.86	14.94	25.92	5.04	218.14
Domestic Residual	Mattresses	20 03 07	3.36	6.60	0.00	3.36	0.00	6.82	0.00	0.00	6.18	0.00	6.76	0.00	33.08
	Transfer Staion Waste	20 03 99	236.86	176.66	181.66	216.76	249.08	249.14	235.32	298.86	225.48	162.38	247.58	183.56	2663.34
Hazardous	Aerosols	16 05 04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Batteries (Car)	16 06 01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Batteries (Small)	16 06 02	0.00	0.52	0.00	0.70	0.70	0.46	0.00	0.92	0.50	0.50	0.00	0.76	5.06
	Car filters	16 01 07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Engine Oil	13 02 06	0.00	0.00	0.00	1.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.16	2.24
	Flourescent Lamps	16 02 11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Paint	08 01 21	0.68	0.68	0.82	0.96	1.50	0.00	1.50	0.94	0.54	0.62	1.30	0.00	9.54
	Medicines	18 01 08	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13
<b>Total</b>			<b>310.46</b>	<b>260.24</b>	<b>265.62</b>	<b>295.45</b>	<b>357.10</b>	<b>380.90</b>	<b>335.18</b>	<b>434.62</b>	<b>322.96</b>	<b>261.62</b>	<b>360.36</b>	<b>253.00</b>	<b>3837.51</b>

**Appendix B**

Monitoring Locations





**Appendix C**

Surface Water Results – Receiving Waters

<b>Parameters</b>	<b>Units</b>	<b>Dungarvan Landfill W0032-02 Qrt 1 2017</b>	
		<b>Surface Water</b>	

<b>LABORATORY NUMBER</b>		<b>2868</b>	<b>2869</b>
<b>Sampling Location</b>		<b>U/S</b>	<b>D/S</b>
<b>Date sampled</b>	20/02/2017	20-Feb	20-Feb
<b>Sampled by</b>	JMcGarry	JMcG	JMcG
<b>Time sampled</b>		13:30	13:45
Visual Inspection/Odour		clear/no	clear/no
Temperature	oC	10.6	10.8
Dissolved Oxygen	% Sat	100	98
pH	units	8.3	8.2
Cond	uS/cm	160	169
BOD	mg/l	<2	<2
COD	<7 mg/l	<7	<7
Sus Solids	<2 mg/l	<2	<2
Ammonia Total (as N)	<0.2 mg/l	<0.2	<0.2
TOC	<3 mg/l	<3	<3
Phosphate (ortho) as P	<0.02 mg/l	<0.02	<0.02
Nitrogen, total	<1 mg/l	3.33	3.41
FOG	<5 mg/l	n/a	n/a
Mineral Oils	<10 ug/l	<10	<10

<b>Parameters</b>	<b>Units</b>	<b>Dungarvan Landfill W0032-02 Qrt 2 2017</b>	
		<b>Surface Water</b>	

<b>LABORATORY NUMBER</b>		<b>3251</b>	<b>3252</b>
<b>Sampling Location</b>		<b>U/S</b>	<b>D/S</b>
<b>Date sampled</b>	01/06/2017	01-Jun	01-Jun
<b>Sampled by</b>	JMcGarry	JMcG	JMcG
<b>Time sampled</b>		14:25	14:55
Visual Inspection/Odour		clear/no	clear/no
Temperature	oC	13.6	13.8
Dissolved Oxygen	% Sat	100	99
pH	units	7.8	7.7
Cond	uS/cm	153	781
BOD	mg/l	<2	<2
COD	<7 mg/l	19.5	25.3
Sus Solids	<2 mg/l	<2	<2
Ammonia Total (as N)	<0.2 mg/l	<0.2	0.209
TOC	<3 mg/l	<3	<3
Phosphate (ortho) as P	<0.02 mg/l	<0.02	<0.02
Nitrogen, total	<1 mg/l	2.35	2.57
FOG	<5 mg/l	7.33	8
Mineral Oils	<10 ug/l	nm	nm

**Parameters**                      **Units**                      **Dungarvan Q3(Annual) Monitoring Report 2017**  
**Surface Water**

<b>LABORATORY NUMBER</b>		<b>3760</b>	<b>3761</b>
<b>Sampling Location</b>		<b>U/S</b>	<b>D/S</b>
<b>Date sampled</b>	25/07/2017	25-Jul	25-Jul
<b>Sampled by</b>	JMcGarry	JMcG	JMcG
<b>Time sampled</b>		14:45	<b>14:55</b>

Visual Inspection/Odour		clear	clear
Temperature	o C	17.2	17.4
Dissolved Oxygen	% sat	118	120
pH	units	8.1	8.4
Cond	uS/cm	479	813
BOD	mg/l	<2	<2
Suspended solids, Total	<2 mg/l	<2	<2
Alkalinity, Total as CaCO3	<2 mg/l		
Organic Carbon, Total	<3 mg/l	<3	<3
Ammoniacal Nitrogen as N	<0.2 mg/l	<0.2	<0.2
Ammoniacal Nitrogen as NH3	<0.2 mg/l		
Fluoride	<0.5 mg/l		
COD, unfiltered	<7 mg/l	14.6	17.8
Aluminium	<2 ug/l		
Arsenic	<0.5 ug/l		
Boron	<5 ug/l		
Cadmium	< 0.08 ug/l		
Copper	<0.3 ug/l		
Lead	<0.2 ug/l		
Manganese	<1 ug/l		
Nickel	<0.4 ug/l		
Phosphorous	<10 ug/l		
Zinc	<1 ug/l		
Silver	<0.5 ug/l		
Mercury	<0.01 ug/l		
Sulphate	<2 mg/l		
Chloride	<2 mg/l		
Phosphate(ortho) as P	<0.02 mg/l	<0.02	<0.02
Total Oxidised Nitrogen as N	<0.1 mg/l		
Chromium, Total (total)	<3 ug/l		
Nitrogen, Total	<1 mg/l	2.84	2.88
Cyanide, Total	<0.05 mg/l		
Magnesium	<0.036 mg/l		
Potassium	<1 mg/l		
Iron	<0.019 mg/l		
Phenols, Total detected 5	<0.025 mg/l		
Fats, Oils and Greases	<5 mg/l	<5	<5
Mineral Oils	mg/l		

<b>Parameters</b>	<b>Units</b>	<b>Dungarvan Landfill W0032-02 Qrt 4 2017</b>	
		<b>Surface Water</b>	

<b>LABORATORY NUMBER</b>		<b>4101</b>	<b>4102</b>
<b>Sampling Location</b>		<b>U/S</b>	<b>D/S</b>
<b>Date sampled</b>	06/11/2017	06-Nov	06-Nov
<b>Sampled by</b>	JMcGarry	JMcG	JMcG
<b>Time sampled</b>		14:00	14:35
Visual Inspection			
Clear- yes/no		yes	yes
Odour- yes/no		no	no
Temperature	oC	9.6	9.8
Dissolved Oxygen	% Sat	105	106
pH	units	7.4	7.3
Cond	uS/cm	167	194
BOD	mg/l	<2	<2
COD, unfiltered	<7 mg/l	<7	8.85
Sus Solids	<2 mg/l	<2	<2
Organic Carbon, Total	<3 mg/l	<3	<3
Ammoniacal Nitrogen As N	<0.2 mg/l	0.773	2.47
Free Ammonia	<0.2 mg/l	<2	<0.2
Phosphate (ortho) as P	<0.02 mg/l	<0.02	<0.02
Nitrogen, total	<1 mg/l	3.28	3.39
Fats, Oils and Greases	<5 mg/l	<5	<5
Mineral Oils	<10 ug/l	nm	nm

**Appendix D**

Monitoring of Constructed Wetland System – Monthly Monitoring Results

Parameters	LOD/Units	Monthly Wetland Analysis 2017									
		February Ponds									
LABORATORY NUMBER		2883	2884	2885	2886	2887	2888	2889	2890	2891	2892
Sampling Location	Ponds	1A	1B	2(i)	2(o)	3(i)	3(o)	4(i)	4(o)	5(i)	5(o)
Date sampled		27-Feb	27-Feb	27-Feb	27-Feb	27-Feb	27-Feb	27-Feb	27-Feb	27-Feb	27-Feb
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
Time sampled		14:00									
pH	units	7.7	7.5	7.5	8	8.8	8.4	7.9	7.6	8.1	8.2
Cond	uS/cm	1614	638	630	608	560	599	585	533	526	517
Ammonia Total (as N)	<0.2 mg/l	47	2.96	1.95	2.47	1.47	2.82	2.38	0.469	0.873	0.88
BOD	mg/l	12	<5	8	2	9	<5	<5	12	3	2
COD	<7 mg/l	31.1	21.5	56.2	27.7	836	32.1	29.7	32.9	29	25.8
Aluminium	<2 ug/l	9.76	<2	<2	<2	17.1	25.3	3.66	<2	<2	<2
Arsenic	<0.51 ug/l	1.55	1.51	0.951	1.21	1.44	1.65	1.53	1.08	1.21	1.19
Boron	<5 ug/l	304	57	68.8	65.7	98	75.9	59.3	63.7	65.7	50.2
Cadmium	<0.08 ug/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium, total	<1.2 ug/l	6.17	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
Copper	<0.3 ug/l	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm
Lead	<0.1 ug/l	1.08	<0.1	<0.1	<0.1	0.131	0.176	<0.1	<0.1	<0.1	<0.1
Manganese	<0.76 ug/l	394	839	713	234	1100	651	432	331	234	147
Nickel	<0.44 ug/l	7.18	1.48	1.3	1.5	1.77	1.69	1.33	1.34	1.5	1.12
Zinc	<1.3 ug/l	4.18	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3
Silver	<1 ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Mercury	<0.01 ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium	<0.012 mg/l	74.3	80.6	83.8	76.7	64.7	73.1	70.6	52.1	76.7	55.6
Sodium	<0.076 mg/l	130	27.3	27.9	28	32.6	33.5	28.9	27.6	28	28.2
Magnesium	<0.036 mg/l	19.8	9.93	10.3	9.74	9.3	10.2	9.28	8.61	9.74	9.03
Potassium	<1 mg/l	30.1	9.14	9.44	10.3	10.5	10.8	11	11.2	10.3	12
Iron	<0.019mg/l	0.11	<0.019	<0.019	<0.019	0.0722	<0.019	<0.019	<0.019	<0.019	0.0934

Comments:- Sample mixed with sediment



Parameters	LOD/Units	Monthly Wetland Analysis 2017									
		March Ponds									
Sampling Location	Ponds	1A	1B	2(i)	2(o)	3(i)	3(o)	4(i)	4(o)	5(i)	5(o)
Date sampled	29/03/2017	29-Mar	29-Mar	29-Mar	29-Mar	29-Mar	29-Mar	29-Mar	29-Mar	29-Mar	29-Mar
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
Time sampled		14:30									
pH	units	7.8	8.2	7.9	8.2	8.1	8.6	8.3	7.7	7.9	8.7
Cond	uS/cm	2960	590	549	551	555	530	535	548	550	543
Ammonia Total (as N)	<0.2 mg/l	112	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
BOD	mg/l	9	2	2	2	3	2	2	2	<2	2
COD	<7 mg/l	81.2	15.5	14.3	27	18	18.8	22.7	18.1	19.1	17.7
Aluminium	<2 ug/l	18.7	10.9	6.22	14.6	3.12	14.6	12.9	2.77	4.28	4.01
Arsenic	<0.51 ug/l	2.68	0.75	0.525	1.03	0.71	1.17	0.813	0.985	0.895	0.853
Boron	<5 ug/l	645	38.8	44	57.8	61.4	57.7	58.4	55.4	55.7	66.1
Cadmium	<0.08 ug/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium, total	<1.2 ug/l	20.7	<3	<3	<3	<3	<3	<3	<3	<3	<3
Copper	<0.3 ug/l	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm
Lead	<0.1 ug/l	3.82	<0.1	<0.1	<0.1	<0.1	<0.1	0.13	<0.1	<0.1	<0.1
Manganese	<0.76 ug/l	1120	61.2	25.2	168	82.2	171	146	103	152	79.7
Nickel	<0.44 ug/l	17.6	0.575	0.48	1.02	0.984	0.891	0.97	0.865	0.94	1.2
Zinc	<1.3 ug/l	6.29	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3
Silver	<1 ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Mercury	<0.01 ug/l	<0.01	<0.01	0.0107	0.0108	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium	<0.012 mg/l	73.5	83.3	80.9	68.4	71.7	67.3	67.4	67.6	65.5	60.7
Sodium	<0.076 mg/l	289	17.2	16.2	24.9	23.5	24.4	23.9	25.9	26.5	31.1
Magnesium	<0.036 mg/l	33.3	11.6	11.4	11.5	11.6	11.3	11.6	11.5	11.3	11.3
Potassium	<1 mg/l	68.6	2.89	2.78	6.07	5.75	6.08	6.09	6.46	6.82	8.67
Iron	<0.019mg/l	0.445	0.0435	0.0283	0.0664	0.0747	0.0649	0.0723	0.0401	0.0438	0.103

Parameters	LOD/Units	Monthly Wetland Analysis 2017									
		April									
Sampling Location	Ponds	1A	1B	2(i)	2(o)	3(i)	3(o)	4(i)	4(o)	5(i)	5(o)
Date sampled	22/04/2017	22-Apr	22-Apr	22-Apr	22-Apr	22-Apr	22-Apr	22-Apr	22-Apr	22-Apr	22-Apr
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
pH	units	7.7	7.6	7.8	7.9	7.6	8.7	8.8	7.7	8.0	8.0
Cond	uS/cm	700	637	635	632	662	573	561	584	610	562
Ammonia Total (as N)	<0.2 mg/l	2.93	<0.2	<0.2	<0.2	<0.2	<0.2	0.202	<0.2	<0.2	<0.2
BOD	mg/l	2	3	4	2	2	3	4	2	3	6
COD	<7 mg/l	12.9	17.9	21.1	17	29	27.7	21.3	23.6	23.2	37
Aluminium	<2 ug/l	<2	6.48	<2	3.58	3.32	11.9	11.3	6.93	2.53	2.84
Arsenic	<0.51 ug/l	0.864	1.13	0.878	0.973	1.27	1.56	1.44	1.08	1.22	1.32
Boron	<5 ug/l	45.8	64.8	61.7	71	76.1	73.2	72.1	76.8	83.3	78.7
Cadmium	<0.08 ug/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium, total	<1.2 ug/l	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Copper	<0.3 ug/l	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm
Lead	<0.1 ug/l	<0.1	<0.1	<0.1	<0.1	0.119	0.229	0.199	<0.1	<0.1	<0.1
Manganese	<0.76 ug/l	59.2	40.5	39.8	27.7	81.9	91.7	85.9	45.1	139	261
Nickel	<0.44 ug/l	0.926	1.19	1.04	1.43	1.54	1.52	1.49	1.41	1.76	1.59
Zinc	<1.3 ug/l	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	2.1	<1.3	<1.3
Silver	<1 ug/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Mercury	<0.01 ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium	<0.012 mg/l	91.4	88.7	76.1	86.5	87.3	61.4	59.1	57	67.9	52.6
Sodium	<0.076 mg/l	23.7	35.5	30.1	37.1	43.8	33.1	32.5	37.6	47.3	36.5
Magnesium	<0.036 mg/l	12.3	15	12.6	15.4	15.6	13	12.7	13.2	15.8	11.8
Potassium	<1 mg/l	4.08	3.1	2.47	2.74	2.9	2.2	2.33	2.63	4.07	4.5
Iron	<0.019mg/l	<0.019	0.21	0.174	0.0905	0.172	0.258	0.263	0.0508	0.129	0.452

Parameters	LOD/Units	Monthly Wetland Analysis 2017									
		May Ponds									
Sampling Location	Ponds	1A	1B	2(i)	2(o)	3(i)	3(o)	4(i)	4(o)	5(i)	5(o)
Date sampled	31/05/2017	31-May	31-May	31-May	31-May	31-May	31-May	31-May	31-May	31-May	31-May
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
Time sampled			15:30	15:35	15:40	16:00	16:20	16:30	16:35	16:40	16:50
pH	units	7.4	7.3	7.4	7.8	7.3	7.8	8.0	7.3	8.8	7.6
Cond	uS/cm	7.9	603	601	527	556	510	514	530	473	517
Ammonia Total (as N)	<0.2 mg/l	3.11	<0.2	<0.2	<0.2	1.11	0.725	1.26	<0.2	0.392	<0.2
BOD	mg/l	3	<5	9	5	<5	5	3	6	36	6
COD	<7 mg/l	<7	18.9	485	17.1	19.4	25.8	27.8	26.7	46.1	29
Aluminium	<2 ug/l	<2	<2	7.26	3.25	<2	5.95	<2	2.32	29.6	8.33
Arsenic	<0.51 ug/l	0.75	1.25	1.76	1.21	1.13	1.63	1.23	1.75	1.98	1.47
Boron	<5 ug/l	25.5	35.3	37.8	36.2	39	47.7	42.5	51.2	50.7	54
Cadmium	<0.08 ug/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium, total	<1.2 ug/l	1.07	<1	<1	<1	<1	<1	<1	<1	<1	<1
Copper	<0.3 ug/l	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm
Lead	<0.1 ug/l	0.275	<0.2	<0.2	<0.2	<0.2	0.366	0.269	<0.2	<0.2	<0.2
Manganese	<0.76 ug/l	33.8	150	324	85.9	157	163	41.8	512	387	250
Nickel	<0.44 ug/l	1.15	0.913	1	0.969	0.856	1.18	1.14	1.12	1.2	1.21
Zinc	<1 ug/l	2.55	<1	1.15	<1	4.13	3.9	1.51	2.58	<1	<1
Silver	<0.5 ug/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Mercury	<0.01 ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium	<0.012 mg/l	92.4	81.5	81.5	68.6	75.3	71.1	70.5	71.8	55.6	61.5
Sodium	<0.076 mg/l	22.7	23	23.1	22.6	21.9	23.1	23	23.6	24.4	25.4
Magnesium	<0.036 mg/l	12.5	12.1	12.3	12	12	12.1	12.5	12.6	12.2	12.2
Potassium	<1 mg/l	3.77	<1	1.54	<1	<1	<1	<1	1.03	1.27	1.06
Iron	<0.019mg/l	<0.019	0.139	0.169	0.125	0.455	0.246	0.238	0.156	0.775	0.315

Parameters	LOD/Units	Monthly Wetland Analysis 2017									
		June Ponds									
Sampling Location	Ponds	1A	1B	2(i)	2(o)	3(i)	3(o)	4(i)	4(o)	5(i)	5(o)
Date sampled	12/07/2017	12-Jul	12-Jul	12-Jul	12-Jul	12-Jul	12-Jul	12-Jul	12-Jul	12-Jul	12-Jul
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
Time sampled		14:40	14:55						16:15		16:35
pH	units	7.2	7.2	7.3	7.3	7.4	7.5	7.4	7.1	7.6	7.4
Cond	uS/cm	703	671	668	640	644	491	486	528	518	502
Ammonia Total (as N)	<0.2 mg/l	4.28	<0.2	0.211	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
BOD	mg/l	4	5	16	4	7	30	11	4	21	9
COD, unfiltered	<7 mg/l	8.73	20.3	310	21.3	24.5	39.6	41.9	21.5	97.7	24.9
Aluminium (diss.filt)	<2 ug/l	<2	2.43	3.73	2.7	<2	5.75	<2	2.36	2.06	<2
Arsenic (diss.filt)	<0.51 ug/l	0.747	1.26	1.18	1.05	1.07	1.56	1.25	1.5	1.48	1.41
Boron (diss.filt)	<5 ug/l	47	52.2	51.3	51.8	53.3	51.3	53.7	64	57.3	61.9
Cadmium (diss.filt)	<0.08 ug/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium (tot.unfilt)	<1.2 ug/l	<3	<3	3.77	<3	<3	<3	<3	<3	<3	<3
Copper	<0.3 ug/l	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm
Lead (diss.filt)	<0.1 ug/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Manganese (diss.filt)	<0.76 ug/l	37.9	181	279	196	66.1	99.8	17.2	475	388	153
Nickel (diss.filt)	<0.44 ug/l	1.28	1.19	1.1	1.05	1.04	1	0.912	0.959	1.1	0.921
Zinc (diss.filt)	<1 ug/l	<1	<1	<1	<1	3.1	<1	<1	<1	1.92	<1
Silver (diss.filt)	<0.5 ug/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Mercury (diss.filt)	<0.01 ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium (diss.filt)	<0.012 mg/l	98	99.5	98.6	93	93.2	73.4	56.9	66	63.6	60.5
Sodium (diss.filt)	<0.076 mg/l	25.9	26.6	26.4	26.8	26.5	26.6	27.1	26.8	26.7	26.4
Magnesium (diss.filt)	<0.036 mg/l	12.8	13	12.9	13	13.2	13	12.7	12.8	12.8	12.8
Potassium (diss.filt)	<1 mg/l	4.94	4.25	4.21	3.32	2.68	<1	<1	<1	<1	<1
Iron (diss.filt)	<0.019mg/l	<0.019	0.113	0.12	0.167	0.173	0.683	0.0684	0.123	0.144	0.526

Parameters	LOD/Units	Monthly Wetland Analysis 2017									
		July Ponds									
Sampling Location	Ponds	1A	1B	2(i)	2(o)	3(i)	3(o)	4(i)	4(o)	5(i)	5(o)
Date sampled	27/07/2017	27-Jul	27-Jul	27-Jul	27-Jul	27-Jul	27-Jul	27-Jul	27-Jul	27-Jul	27-Jul
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
Time sampled		15:10	15:25	15:10	13:50	13:55	14:00	14:20	14:35	14:40	14:55
pH	units	8.2	7.6	6.8	7.2	7.1	7.3	7.4	6.9	7.1	7.7
Cond	uS/cm	540	598	760	622	558	454	457	515	518	460
Ammonia Total (as N)	<0.2 mg/l	0.54	<0.2	1.32	<0.2	0.285	<0.2	<0.2	<0.2	<0.2	<0.2
BOD	mg/l	12	16	1581	8	<5	9	5	<5	4	6
COD, unfiltered	<7 mg/l	55.1	35.4	4150	54.4	37.7	41.1	30.7	28.6	74	40.5
Aluminium (diss.filt)	<2 ug/l	31.7	5.51	4.32	3.42	<2	5.67	2.31	3.14	<2	3.92
Arsenic (diss.filt)	<0.51 ug/l	7.96	1.19	2.9	1.35	0.986	1.01	1.33	1.05	1.13	0.892
Boron (diss.filt)	<5 ug/l	47.5	50.7	52.7	46.4	43.2	45.9	51.5	52.4	54.8	48.6
Cadmium (diss.filt)	<0.08 ug/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium (tot.unfilt)	<1.2 ug/l	4.19	<3	36.8	<3	<3	<3	<3	<3	<3	<3
Copper	<0.3 ug/l	1.1	0.435	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Lead (diss.filt)	<0.1 ug/l	0.423	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Manganese (diss.filt)	<0.76 ug/l	299	1060	8790	5040	376	37.5	66.3	526	649	19.8
Nickel (diss.filt)	<0.44 ug/l	3.29	1.18	1.26	0.911	0.82	0.922	0.877	0.877	0.953	0.983
Zinc (diss.filt)	<1 ug/l	2.23	3.29	2.29	<1	<1	8.17	<1	1.85	<1	2.64
Silver (diss.filt)	<0.5 ug/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Mercury (diss.filt)	<0.01 ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium (diss.filt)	<0.012 mg/l	64.9	84.2	103	82.7	76.3	42.9	54.6	58.1	58.5	48.4
Sodium (diss.filt)	<0.076 mg/l	23.6	23	26.4	22.3	22.8	23.9	25.1	26.4	26.4	23.8
Magnesium (diss.filt)	<0.036 mg/l	11.9	10.8	8.41	8.68	10.7	11.1	12.4	12.6	12.8	11.3
Potassium (diss.filt)	<1 mg/l	8.13	4.63	2.04	8.06	3.61	2.97	2.78	<1	<1	<1
Iron (diss.filt)	<0.019mg/l	0.816	0.734	0.406	0.467	0.489	0.564	0.694	0.111	0.113	0.321

Parameters	LOD/Units	Monthly Wetland Analysis 2017									
		August Ponds									
Sampling Location	Ponds	1A	1B	2(i)	2(o)	3(i)	3(o)	4(i)	4(o)	5(i)	5(o)
Date sampled	10/08/2017	10-Aug	10-Aug	10-Aug	10-Aug	10-Aug	10-Aug	10-Aug	10-Aug	10-Aug	10-Aug
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
Time sampled		15:55	16:05			14:40	14:55				15:20
pH	units	6.9	8.5	7.8	7.7	7.4	8.2	7.7	7.7	7.8	8.3
Cond	uS/cm	528	397	691	717	579	342	448	498	476	435
Ammonia Total (as N)	<0.2 mg/l	2.6	0.211	0.241	0.525	0.278	0.208	0.516	<0.2	<0.2	<0.2
BOD	mg/l	58	<5	5	<5	<5	5	1	<5	35	11
COD, unfiltered	<7 mg/l	278	52.7	67.8	64.6	26.7	43.6	34.7	23.9	1260	39
Aluminium (diss.filt)	<2 ug/l	45.5	26.1	12	4.55	<2	<2	<2	<2	15.4	<2
Arsenic (diss.filt)	<0.51 ug/l	13.7	2.63	1.68	1.58	0.908	1.1	0.728	0.855	2.33	0.821
Boron (diss.filt)	<5 ug/l	92	69.9	72.4	60.5	46.1	46.9	63.8	49.4	52.5	46.1
Cadmium (diss.filt)	<0.08 ug/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium (tot.unfilt)	<1.2 ug/l	21.3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Copper	<0.3 ug/l	1.33	0.435	<0.3	<0.3	<0.3	<0.3	<0.3	0.412	<0.3	6.03
Lead (diss.filt)	<0.1 ug/l	1.4	0.968	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.568	2.34
Manganese (diss.filt)	<0.76 ug/l	207	98.5	880	1080	86.1	25.1	12.2	427	585	528
Nickel (diss.filt)	<0.44 ug/l	4.56	1.7	1.28	1.41	1.04	0.856	0.844	0.912	1.25	1.2
Zinc (diss.filt)	<1 ug/l	1.71	<1	<1	<1	<1	<1	<1	<1	<1	1.86
Silver (diss.filt)	<0.5 ug/l				<0.5	<0.5	<0.5		<0.5	<0.5	<0.5
Mercury (diss.filt)	<0.01 ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium (diss.filt)	<0.012 mg/l	60.3	43	92.8	97.9	80.8	35.9	48.5	58.9	48.8	48.3
Sodium (diss.filt)	<0.076 mg/l	30.4	28.5	29.9	28.7	25.9	24.1	26.9	26.8	29	27
Magnesium (diss.filt)	<0.036 mg/l	11.7	11.3	13.1	13.2	11.2	10.1	10.7	12.5	12.9	12
Potassium (diss.filt)	<1 mg/l	13.1	1.49	7.92	8.92	<1	<1	1.32	<1	<1	<1
Iron (diss.filt)	<0.019mg/l	1.32	0.879	0.289	0.277	0.37	0.468	0.068	0.205	2.76	0.391

Parameters	LOD/Units	Monthly Wetland Analysis 2017									
		September Ponds									
Sampling Location	Ponds	1A	1B	2(i)	2(o)	3(i)	3(o)	4(i)	4(o)	5(i)	5(o)
Date sampled	25/09/2017	25-Sep	25-Sep	25-Sep	25-Sep	25-Sep	25-Sep	25-Sep	25-Sep	25-Sep	25-Sep
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
Time sampled		14:20			15:20	15:30	15:40		16:10	16:15	
pH	units	7.6	7.4	6.9	7.9	7.3	7.5	7.2	7.3	8.5	7.6
Cond	uS/cm	3030	962	779	666	496	381	408	478	473	454
Ammonia Total (as N)	<0.2 mg/l	91.2	6.08	1.71	0.946	0.247	0.558	0.491	1.06	0.64	0.786
BOD	mg/l	9	4	113	6	13	3	12	2	16	3
COD, unfiltered	<7 mg/l	94.7	50.1	2610	47.3	25.7	27.4	32.7	25.6	34	19.4
Aluminium (diss.filt)	<2 ug/l	9.49	<2	<2	2.05	<2	<2	<2	<2	6.72	<2
Arsenic (diss.filt)	<0.51 ug/l	2.54	1.34	1.89	1.21	0.909	1.19	1.43	1.14	1.22	0.896
Boron (diss.filt)	<5 ug/l	610	93.6	65	60.8	53.6	45.6	47.4	55.7	49.8	48.1
Cadmium (diss.filt)	<0.08 ug/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium (tot.unfilt)	<1.2 ug/l	11	<3	34.6	<3	3.06	3.19	3.72	<3	<3	3.23
Copper	<0.3 ug/l	1.9	<0.3	<0.3	<0.3	0.636	<0.3	<0.3	<0.3	<0.3	<0.3
Lead (diss.filt)	<0.1 ug/l	0.842	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Manganese (diss.filt)	<0.76 ug/l	767	1150	8420	608	128	8.03	19	409	229	68.4
Nickel (diss.filt)	<0.44 ug/l	16.3	3.91	2.27	2.36	0.981	0.95	0.989	0.846	0.974	0.826
Zinc (diss.filt)	<1 ug/l	2.52	<1	<1	2.23	6.88	<1	<1	<1	<1	<1
Silver (diss.filt)	<0.5 ug/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Mercury (diss.filt)	<0.01 ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium (diss.filt)	<0.012 mg/l	69.4	87	86.7	71.6	61.9	38	40.7	57.3	62.2	52.5
Sodium (diss.filt)	<0.076 mg/l	310	76.2	45.7	43.8	24.3	23.3	24.3	25	24.3	24.3
Magnesium (diss.filt)	<0.036 mg/l	40.2	14.2	7.82	12.2	9.78	9.68	10.5	9.97	10.2	10.6
Potassium (diss.filt)	<1 mg/l	73.7	14.5	6.05	7.5	2.57	2.64	3.77	2.36	2.83	1.91
Iron (diss.filt)	<0.019mg/l	0.442	1.17	0.916	0.558	0.748	0.724	1.13	0.267	0.351	0.274

Parameters	LOD/Units	Monthly Wetland Analysis 2017									
		October Ponds									
Sampling Location	Ponds	1A	1B	2(i)	2(o)	3(i)	3(o)	4(i)	4(o)	5(i)	5(o)
Date sampled	12/10/2017	12-Oct	12-Oct	12-Oct	12-Oct	12-Oct	12-Oct	12-Oct	12-Oct	12-Oct	12-Oct
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
Time sampled		14:40		15:05	14:20	14:15	13:50	12:55	13:05	13:15	13:25
pH	units	7.5	7.6	6.8	7.9	7.2	7.7	7	6.9	7.5	7.4
Cond	uS/cm	3320	1147	1108	996	913	537	526	491	469	464
Ammonia Total (as N)	<0.2 mg/l	139	13.7	3.97	5.42	1.75	<0.2	<0.2	0.653	<0.2	0.551
BOD	mg/l	19	4	343	6	3	<5	3	3	117	4
COD, unfiltered	<7 mg/l	100	46.2	6120	50.1	43	31.2	51.7	32.1	54.6	27.4
Aluminium (diss.filt)	<2 ug/l	12.1	6.01	7.62	6.01	2.04	3.02	<2	<2	6.02	<2
Arsenic (diss.filt)	<0.51 ug/l	1.98	1.36	2.03	0.912	1.1	1.07	1.1	0.829	1.29	0.943
Boron (diss.filt)	<5 ug/l	632	151	108	110	92.9	65.4	60.9	44	46.1	41
Cadmium (diss.filt)	<0.08 ug/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium (tot.unfilt)	<1 ug/l	10.6	<1	<1	1.73	<1	<1	<1	<1	<1	<1
Copper	<0.3 ug/l	0.776	<0.3	<0.3	0.351	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Lead (diss.filt)	<0.1 ug/l	1.64	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Manganese (diss.filt)	<0.76 ug/l	1130	271	3850	633	416	5.14	42.2	557	515	39
Nickel (diss.filt)	<0.44 ug/l	15.9	4.61	4.51	4.44	3.72	2.51	1.78	1.13	1.3	0.873
Zinc (diss.filt)	<1 ug/l	4.63	<1	<1	<1	<1	<1	<1	<1	<1	1.29
Silver (diss.filt)	<0.5 ug/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Mercury (diss.filt)	<0.01 ug/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium (diss.filt)	<0.012 mg/l	64	75.8	78.3	72.7	73	28.9	42.5	51.3	53.3	57
Sodium (diss.filt)	<0.076 mg/l	346	115	106	93.3	83.1	56.1	41	31.1	29.8	24.8
Magnesium (diss.filt)	<0.036 mg/l	41.4	18.7	13.7	15	14	10.6	10.4	9.82	10.5	10.2
Potassium (diss.filt)	<1 mg/l	78	19.8	14.2	14.3	14.4	8.61	6.95	2.06	2.74	3.55
Iron (diss.filt)	<0.019mg/l	0.72	0.529	0.839	0.833	0.865	0.574	0.363	0.284	0.653	0.406



Parameters	LOD/Units	Monthly Wetland Analysis 2017									
		November Ponds									
Sampling Location	Ponds	1A	1B	2(i)	2(o)	3(i)	3(o)	4(i)	4(o)	5(i)	5(o)
Date sampled	15/11/2017	15-Nov	15-Nov	15-Nov	15-Nov	15-Nov	15-Nov	15-Nov	15-Nov	15-Nov	15-Nov
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
Time sampled						14:40	14:50				
pH	units	7.4	7.6	7.4	7.4	7.3	7.3	7.4	7.4	7.7	7.7
Cond	uS/cm	2220	629	622	633	617	637	634	625	623	625
Ammonia Total (as N)	<0.2 mg/l	55.9	1.23	1.11	1.07	0.644	0.746	1.12	0.493	0.686	0.949
BOD	mg/l	33	3	34	3	4	3	6	2	2	2
COD, unfiltered	<7 mg/l	64.7	23.2	475	25.5	27.2	26.8	60.2	19.1	17.4	10.8
Aluminium (diss.filt)	<2 ug/l	2.18	<2	<2	<2	<2	<2	<2	<2	<2	<2
Arsenic (diss.filt)	<0.51 ug/l	1.52	0.812	0.747	0.69	0.677	0.706	0.791	0.788	0.879	0.756
Boron (diss.filt)	<5 ug/l	361	51.4	48.9	51.5	50.4	52.8	50	55.3	47.2	51.7
Cadmium (diss.filt)	<0.08 ug/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium (tot.unfilt)	<3 ug/l	7.98	<3	4.56	3.76	4.19	4.51	<3	6.21	5.03	<3
Copper	<0.3 ug/l	0.783	<0.3	0.518	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Lead (diss.filt)	<0.1 ug/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Manganese (diss.filt)	<0.76 ug/l	1130	45.2	19.1	55.8	30.7	15.2	52.1	34.8	124	43.6
Nickel (diss.filt)	<0.44 ug/l	9.21	1.12	1.12	1.11	1.03	1.02	1.14	1.01	1.01	1.1
Zinc (diss.filt)	<1 ug/l	5.4	<1	<1	<1	<1	2	<1	1.19	1.09	1.21
Silver (diss.filt)	<0.5 ug/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Mercury (diss.filt)	<0.01 ug/l	<0.01	0.0331	0.0666	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium (diss.filt)	<0.012 mg/l	81	67.7	68	69	71.1	70	71.5	70.5	70	67.7
Sodium (diss.filt)	<0.076 mg/l	208	28.7	28.9	29.5	28.6	28.4	27.5	26.6	26.1	28.8
Magnesium (diss.filt)	<0.036 mg/l	31.4	12	12	11.9	11.7	11.9	11.8	12	11.8	11.9
Potassium (diss.filt)	<1 mg/l	40.6	8.62	8.91	8.66	8.2	8.79	8.65	8.34	8.07	8.7
Iron (diss.filt)	<0.019mg/l	0.135	0.0652	0.0854	0.0823	0.111	0.101	0.102	0.0485	0.0602	0.0672

Parameters	LOD/Units	Monthly Wetland Analysis 2017									
		December Ponds									
Sampling Location	Ponds	1A	1B	2(i)	2(o)	3(i)	3(o)	4(i)	4(o)	5(i)	5(o)
Date sampled	18/12/2017	18-Dec	18-Dec	18-Dec	18-Dec	18-Dec	18-Dec	18-Dec	18-Dec	18-Dec	18-Dec
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
pH	units	7.4	7.4	7.1	7.3	7.2	7.4	7.5	7.4	7.4	7.6
Cond	uS/cm	2490	552	602	586	534	517	532	531	532	531
Ammonia Total (as N)	<0.2 mg/l	84.8	2.87	2.84	2.45	1.86	2.46	3.06	0.872	2.68	2.66
BOD	mg/l	23	<2	143	3	1	3	1	<2	<2	2
COD, unfiltered	<7 mg/l	83.9	12.5	7530	14.8	19.5	19.1	18.5	11.7	18.3	13
Aluminium (diss.filt)	<2 ug/l	8.47	2.16	5.13	2.56	<2	10.2	2.57	<2	<2	<2
Arsenic (diss.filt)	<0.51 ug/l	1.42	<0.5	1.1	0.698	<0.5	<0.5	<0.5	<0.5	0.547	<0.5
Boron (diss.filt)	<5 ug/l	416	26	34.6	34	25	27.6	25.3	28.2	28.3	24.4
Cadmium (diss.filt)	<0.08 ug/l	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Chromium (tot.unfilt)	<3 ug/l	11.3	<3	65.4	<3	<3	<3	<3	<3	<3	<3
Copper	<0.3 ug/l	1.26	<0.3	0.405	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Lead (diss.filt)	<0.1 ug/l	3.23	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Manganese (diss.filt)	<0.76 ug/l	881	52.9	1580	310	113	4.19	58.3	23.2	98	26.8
Nickel (diss.filt)	<0.44 ug/l	12.3	0.529	0.867	0.652	<0.4	<0.4	<0.4	0.517	0.641	0.409
Zinc (diss.filt)	<1 ug/l	8.79	1.34	2.17	<1	<1	<1	<1	<1	<1	9.56
Silver (diss.filt)	<0.5 ug/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Mercury (diss.filt)	<0.01 ug/l	0.0687	0.0186	0.0212	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium (diss.filt)	<0.012 mg/l	81.6	80.7	84.8	83.2	75.8	71.8	74.1	77	73.3	78.2
Sodium (diss.filt)	<0.076 mg/l	244	16.3	20.9	21.9	15.4	15.9	15.9	16.1	15.6	16
Magnesium (diss.filt)	<0.036 mg/l	32.8	10.7	11.1	11.5	9.89	10.2	10	10.6	10	10.5
Potassium (diss.filt)	<1 mg/l	55.1	4.92	5.61	5.44	3.92	4.64	4.72	4.59	4.51	4.53
Iron (diss.filt)	<0.019mg/l	0.251	0.0413	0.116	0.127	0.116	0.0846	0.0888	<0.019	<0.019	0.0471

**Appendix E**

Groundwater Results

**Parameters**                      **Units**                      **Dungarvan Landfill W0032-02 Qrt 1 2017**  
**Ground Water**

<b>LABORATORY NUMBER</b>		<b>2870</b>	<b>2871</b>	<b>2872</b>	<b>2873</b>	<b>2874</b>	<b>2875</b>	<b>2876</b>
<b>Sampling Location</b>		<b>GW 1</b>	<b>GW 2A</b>	<b>RC 3A</b>	<b>RC 4</b>	<b>RC 6A</b>	<b>RC 7</b>	<b>RC 8</b>
<b>Date sampled</b>	27/02/2017	27-Feb	27-Feb	27-Feb	27-Feb	27-Feb	27-Feb	27-Feb
<b>Sampled by</b>	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
<b>Time sampled</b>		15:10	14:25	15:00	16:00	14:35	17:30	16:35

		liht						
		brown/					brown/	
Visual Inspection/Odour		no	dry	clear/no	clear/no	clear/no	no	clear/no
Groundwater Level	m	3.7	1.8	13.2	15.6	8	10.9	nm
Temp	oC	10.7		11.2	11.1	11.2	10.6	11.9
Dissolved Oxygen	% sat	55		53	69	56	71	58
pH	units	6.7		7	7.4	7.4	7.9	7.3
Cond	uS/cm	920		1424	654	1979	2080	8300
Salinity	o/000	nm		nm	nm	nm	nm	nm
Ammonia Total (as N)	<0.02 mg/l	0.612		53.2	<0.2	17	<0.2	73.3
Chloride( asCl)	<2 mg/l	19.9		88	26.5	109	496	2220
Total Oxidised Nitrogen	<0.1 mg/l	0.363		<0.1	10.6	8.02	2.95	<0.1
Iron	mg/l	nm		nm	nm	nm	nm	nm

**Parameters**                      **Units**                      **Dungarvan Landfill W0032-02 Qrt 2 2017**  
**Ground Water**

<b>LABORATORY NUMBER</b>		<b>3233</b>	<b>3234</b>	<b>3235</b>	<b>3236</b>	<b>3237</b>	<b>3238</b>	<b>3239</b>
<b>Sampling Location</b>		<b>GW 1</b>	<b>GW 2A</b>	<b>RC 3A</b>	<b>RC 4</b>	<b>RC 6A</b>	<b>RC 7</b>	<b>RC 8</b>
<b>Date sampled</b>	01/06/2017	01-Jun	01-Jun	01-Jun	01-Jun	01-Jun	01-Jun	01-Jun
<b>Sampled by</b>	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
<b>Time sampled</b>		13:55	13:20	14:00	14:15	13:20	16:05	14:40
<b>Visual Inspection/Odour</b>		brown /pungent	dry	clear/no	clear/no	clear/no	brown/no	clear/no
<b>Groundwater Level</b>	m	2.5	1	13.3	16	8.1	9.1	12
<b>Temp</b>	oC	12.1		12.3	12.8	11.9	12.1	13.2
<b>Dissolved Oxygen</b>	% sat	67		58	77	63	71	64
<b>pH</b>	units	6.7		7.1	7.4	7.2	7.4	7.3
<b>Cond</b>	uS/cm	1172		1484	641	1182	14590	8380
<b>Salinity</b>	o/000	nm		nm	nm	nm	8.3	nm
<b>Ammonia Total (as N)</b>	<0.02 mg/l	2.8		53.8	<0.2	18.5	<0.2	71.7
<b>Chloride( asCl)</b>	<2 mg/l	20.7		95.5	28.2	107	4590	2250
<b>Total Oxidised Nitrogen</b>	<0.1 mg/l	<0.1		<0.1	9.65	8.26	0.405	0.305
<b>Nitrogen,Total</b>	<1 mg/l	3.17		57.1	10.4	23.9	2.16	75.4
<b>Fluoride</b>	<0.5 mg/l	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5
<b>Nitrite</b>	<0.0152 mg/	<0.0152		<0.0152	0.0183	0.0642	<0.0152	0.15

## Parameters

## Units

## Dungarvan Q3(Annual) Monitoring Report 2017

## Ground Water

LABORATORY NUMBER		3762	3763	3764	3765	3766	3767	3768
Sampling Location		GW 1	GW 2A	RC 3A	RC 4	RC 6A	RC 7	RC 8
Date sampled	25/07/2017	25-Jul	25-Jul	25-Jul	25-Jul	25-Jul	25-Jul	25-Jul
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
Time sampled		14:05	15:50	14:10	14:40	15:50	17:05	15:10
Visual Inspection/Odour		blackish/ no	dry	clear/no	clear/no	clear/no	light brown/no	clear/no
Grounwater Level	m	2.2	1.7	13	16	7.8	12.2	12
Temperature	0 C	13.2		13.1	12.3	12.7	12.8	13.7
Dissolved Oxygen	% sat	17		16	51	18	41	40
pH	units	6.6		7	7.3	7.14	7.1	7.3
Electrical Conductivity	uS/cm	1179		1501	657	1168	nm	8430
Salinity	0/000						7.4	
BOD	mg/l							
Suspended solids, Total	<2 mg/l							
Alkalinity, Total as CaCO3	<2 mg/l	565		600	280	375	160	650
Organic Carbon, Total	<3 mg/l							
Ammoniacal Nitrogen as N	<0.2 mg/l	3.12		58.1	<0.2	14.9	<0.2	73.9
Ammoniacal Nitrogen as NH3	<0.2 mg/l	3.79		70.5	<0.2	18	<0.2	89.8
Fluoride	<0.5 mg/l	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5
COD, unfiltered	<7 mg/l	66.1		30.8	<7	14.6	144	217
Aluminium	<2 ug/l							
Arsenic	<0.5 ug/l							
Boron	<5 ug/l							
Cadmium	<0.08 ug/l	<0.08		<0.08	<0.08	<0.08	0.0873	<0.08
Copper	<0.3 ug/l	0.595		<0.3	<0.3	0.4	2.74	0.304
Lead	<0.2 ug/l	<0.2		<0.2	<0.2	<0.2	<0.2	<0.2
Manganese	<1 ug/l	5170		3950	13.8	64.1	5.31	4340
Nickel	<0.4 ug/l	2.69		33.6	0.563	1.63	<0.4	41.9
Phosphorous	<10 ug/l	10		<10	<10	<10	24.6	<10
Zinc	<1 ug/l	2.57		<1	1.38	3.1	2.04	1.4
Silver	<0.5 ug/l							
Mercury	<0.01 ug/l	<0.01		<0.01	<0.01	<0.01	<0.01	<0.01
Sulphate	<2 mg/l	26.1		22.8	21.2	37.3	514	301
Chloride	<2 mg/l	19.6		98.8	27.5	108	3800	2380
Phosphate(ortho) as P	<0.02 mg/l	<0.02		<0.02	<0.02	<0.02	<0.02	<0.02
Total Oxidised Nitrogen as N	<0.1 mg/l	<0.1		<0.1	10.2	8.17	0.234	<0.1
Chromium, Total (total)	<3 ug/l	3.08		6.23	<3	3.28	<3	6.6
Nitrogen, Total	<1 mg/l	3.24		62.6	10.5	22.7	2.23	82.1
Cyanide, Total	<0.05 mg/l	<0.05		<0.05	<0.05	<0.05	<0.05	<0.05
Magnesium	<0.036 mg/l	13.3		17.5	11.6	22.6	243	161
Potassium	<1 mg/l	7.34		21.9	2.06	14.2	79.4	112
Iron	<0.019 mg/l	8.07		0.109	<0.019	<0.019	<0.19	<0.19
Phenols, Total detected 5	<0.025 mg/l	<0.025		<0.025	<0.025	<0.025	<0.025	<0.025
Fats, Oils and Greases	<5 mg/l							
Mineral Oils	mg/l							

## Parameters

## Dungarvan Landfill W0032-02 Qrt 4 2017

## Units

## Ground Water

LABORATORY NUMBER		4103	4104	4105	4106	4107	4108	4109
Sampling Location		GW 1	GW 2A	RC 3A	RC 4	RC 6A	RC 7	RC 8
Date sampled	06/11/2017	06-Nov	06-Nov	06-Nov	06-Nov	06-Nov	06-Nov	06-Nov
Sampled by	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
Time sampled		13:10	16:10	13:15	13:50	16:20	17:10	14:30
Visual Inspection								
Clear- yes/no		black		cloudy	yes	yes	no	yes
Odour- yes/no		no	dry	no	no	no	no	no
Groundwater Level	m	2.9	1.7	13.2	16.2	7.9	12.4	12
Temp	oC	12.5		12	11.3	11.5	11.9	12.5
Dissolved Oxygen	% sat	23		21	55	28	70	31
pH	units	6.5		7	7.3	7.1	7.2	7.3
Cond	uS/cm	1269		1364	662	1133	3440	8620
Salinity	o/000	nm		nm	nm	nm	nm	nm
Ammoniacal Nitrogen as N	<0.2 mg/l	6.01		51.4	0.875	10.8	<0.2	73.9
Free Ammonia N	<0.2 mg/l	<0.2		0.361	<0.2	<0.2	<0.2	0.887
Fluoride	<0.5 mg/l	<0.5		<0.5	<0.5	<0.5	<0.5	<0.5
COD, unfiltered	<7 mg/l	490		37.3	<7	8.07	43	112
Chloride	<2 mg/l	29		84.8	27.4	105	922	2460
Nitrate as NO3	<0.3 mg/l	<0.3		<0.3	46.7	35.3	13.8	<0.3
Nitrogen, Total	<1 mg/l	6.07		52	10.9	17.3	2.85	77.7
Iron	<0.019 mg/l	24.7		0.838	<0.019	<0.019	<0.019	<0.019

**Appendix F**

Leachate Results



**Parameters**                      **Units**                      **Dungarvan Landfill W0032-02 Qrt 1 2017**  
**Leachates**

<b>LABORATORY NUMBER</b>		<b>2877</b>	<b>2878</b>	<b>2879</b>	<b>2880</b>	<b>2881</b>	<b>2882</b>
							<b>Dilution</b>
<b>Sampling Location</b>		<b>L1</b>	<b>L2A</b>	<b>L4</b>	<b>L5A</b>	<b>Sump</b>	<b>Tank</b>
<b>Date sampled</b>	27/02/2017	27-Feb	27-Feb	27-Feb	27-Feb	27-Feb	27-Feb
<b>Sampled by</b>	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
<b>Time sampled</b>				15:15	14:30	17:00	16:30
		no	no		no		
		tubing	tubing	dry	tubing	clear/no	clear/no
<b>BOD</b>	mg/l					7	3
<b>COD</b>	<7 mg/l					31.4	20.7

**Parameters****Units****Dungarvan Landfill W0032-02 Qrt 2 2017  
Leachates****LABORATORY NUMBER**

3244	3245	3246	3247	3248	3249
					Dilution
L1	L2A	L4	L5A	Sump	Tank

Sampling Location

**Date sampled**

01/06/2017

**Sampled by**

JMcGarry

**Time sampled**

nm	nm	nm	nm	15:40	14:25
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no	no		no	brown/	
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**Appearance/Odour**

tubing	tubing	dry	tubing	no	clear/no
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BOD

mg/l

&lt;5 &lt;2

COD

&lt;7 mg/l

21.1 7.3

**Dungarvan Q3(Annual) Monitoring Report 2017**  
**Leachates**

Parameters	Units						
LABORATORY NUMBER		3769	3770	3771	3772	3773	3774
		Leachate					Dilution
Sampling Location		L1	L2A	L4	L5A	Sump	Tank
<b>Date sampled</b>	25-27/07/2017	27-Jul	27-Jul	25-Jul	27-Jul	27-Jul	27-Jul
<b>Sampled by</b>	JMcGarry	JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
<b>Time sampled</b>		16:30	16:40	16:15	15:45	15:00	13:30
Visual Inspection/Odour		black/yes	black/yes	dry	black/yes	clear/no	clear/no
Leachate Level	m	6.3	4.8	0.6	3.9	n/a	n/a
Electrical Conductivity	us/cm	27800	13920		18240	617	3710
pH	units	7.7	7.4		7.8	8.4	7.9
BOD	mg/l	83	153		50	<5	15
Ammoniacal Nitrogen as N	<0.02 mg/l	2150	851		1470	<0.2	130
Fluoride	<0.5mg/l	1.75	1.48		1.49	<0.5	<0.5
COD, unfiltered	<7 mg/l	1510	1110		854	21.3	88.3
Aluminium	<2 ug/l	<2	<2		<2	23.4	5.4
Arsenic	<0.5 ug/l	31	6.2		18.5	3.3	2.78
Boron	<5 ug/l	<5	<5		<5	80.3	538
Cadmium	< 0.08 ug/l	<0.08	<0.08		<0.08	<0.08	0.184
Copper	<0.3 ug/l	<0.3	<0.3		<0.3	2.13	16.7
Lead	<0.2 ug/l	<0.2	<0.2		<0.2	<0.2	1.03
Manganese	<1 ug/l	<1	<1		<1	21.5	566
Nickel	<0.4 ug/l	<0.4	<0.4		<0.4	2.02	19.4
Zinc	<1 ug/l	1.19	1.01		<1	5.61	107
Silver	<0.5 ug/l	<0.5	<0.5		<0.5	<0.5	<0.5
Mercury	<0.01 ug/l	<0.1	<0.1		<0.1	<0.1	<0.1
Sulphate	<2 mg/l	<10	<10		<10	2.8	26.9
Chloride	<2 mg/l	2860	974		1990	61.4	321
Phosphate(ortho) as P	<0.02 mg/l	13.7	0.494		3.41	0.033	0.243
Total Oxidised Nitrogen as N	<0.1 mg/l	1.07	<0.5		0.708	1.36	8.87
Chromium, Total (total)	<3 ug/l	396	41.8		299	<3	12
Cyanide, Total	<0.05 mg/l	<0.05	<0.05		<0.05	<0.05	<0.05
Calcium	<0.012 mg/l	38.7	89.8		21.2	44.7	83.5
Sodium	<0.076 mg/l	3660	1570		1630	46	263
Magnesium	<0.036 mg/l	135	103		109	10.1	29.3
Potassium	<1 mg/l	1230	727		583	37.7	71.8
Iron	<0.019 mg/l	5.86	5.85		3.24	0.0417	0.229

**Parameters****Units****Dungarvan Landfill W0032-02 Qrt 4 2017  
Leachates****LABORATORY NUMBER**

4110	4111	4112	4113	4114	4115
					Dilution

Sampling Location

L1	L2A	L4	L5A	Sump	Tank
----	-----	----	-----	------	------

**Date sampled**

06/11/2017

06-Nov	06-Nov	06-Nov	06-Nov	06-Nov	06-Nov
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**Sampled by**

JMcGarry

JMcG	JMcG	JMcG	JMcG	JMcG	JMcG
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**Time sampled**

15:10	15:30	13:30	16:30	16:50	nm
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Visual Inspection

Clear- yes/no

Odour- yes/no

dry

BOD

mg/l

44	30		45	<2	<2
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COD

&lt;7 mg/l

1410	977		805	18.5	12.3
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**Appendix G**

Meteorological Data

**JohnstownII**

date: 00 to 00 utc

rain: Precipitation Amount (mm)

maxtp: Maximum Air Temperature (C)

mintp: Minimum Air Temperature (C)

gmin: 09utc Grass Minimum Temperature (C)

soil: Mean 10cm soil temperature (C)

date	rain	maxtp	mintp	gmin	soil
01-jan-2017	10.2	9.8	2.5	0.7	7.225
02-jan-2017	0.7	6.0	1.2	0.0	5.578
03-jan-2017	0.0	5.4	-0.4	-4.5	4.309
04-jan-2017	0.0	6.9	1.9	-4.8	4.684
05-jan-2017	0.0	9.2	4.5	0.9	5.815
06-jan-2017	17.1	10.9	8.3	4.9	7.666
07-jan-2017	0.2	10.9	7.7	4.3	8.453
08-jan-2017	0.1	10.0	6.9	1.4	8.278
09-jan-2017	1.3	9.9	4.9	6.6	8.110
10-jan-2017	0.2	11.9	4.3	0.6	7.113
11-jan-2017	0.0	11.6	4.9	3.7	7.332
12-jan-2017	1.7	5.5	0.7	1.7	5.450
13-jan-2017	0.0	4.7	0.6	-2.0	3.708
14-jan-2017	0.0	7.9	1.4	-2.4	3.987
15-jan-2017	0.0	10.7	5.3	1.9	6.010
16-jan-2017	0.0	10.8	6.8	2.0	6.920
17-jan-2017	0.3	9.4	7.1	2.0	7.384
18-jan-2017	0.2	9.1	7.2	4.7	7.524
19-jan-2017	0.0	8.4	4.6	-2.6	7.198
20-jan-2017	0.0	7.6	2.3	-3.3	5.990
21-jan-2017	0.0	4.9	1.2	-6.8	4.404
22-jan-2017	0.0	8.7	3.2	0.6	5.150
23-jan-2017	0.0	10.1	4.7	-3.0	5.378

24-jan-2017	2.3	9.6	8.4	-0.2	6.943
25-jan-2017	0.0	10.1	7.4	6.1	7.390
26-jan-2017	0.0	7.6	5.1	4.3	6.204
27-jan-2017	3.8	9.6	5.3	4.4	6.556
28-jan-2017	0.1	7.7	2.0	-1.3	5.828
29-jan-2017	13.2	8.6	1.9	-4.5	5.423
30-jan-2017	4.0	10.8	7.0	4.9	7.237
31-jan-2017	8.2	10.9	7.8	7.9	8.718

**JohnstownII**

date: 00 to 00 utc

rain: Precipitation Amount (mm)

maxtp: Maximum Air Temperature (C)

mintp: Minimum Air Temperature (C)

gmin: 09utc Grass Minimum Temperature (C)

soil: Mean 10cm soil temperature (C)

date	rain	maxtp	mintp	gmin	soil
01-feb-2017	3.4	10.5	6.2	2.4	8.088
02-feb-2017	4.5	11.0	8.4	6.7	8.985
03-feb-2017	12.4	8.5	2.0	2.0	7.182
04-feb-2017	2.9	5.8	0.5	-4.5	5.125
05-feb-2017	0.0	8.2	0.2	-6.5	4.447
06-feb-2017	14.7	10.8	1.5	-6.1	5.163
07-feb-2017	0.2	7.0	3.0	-1.1	5.573
08-feb-2017	0.0	8.7	1.2	-3.3	4.835
09-feb-2017	0.0	6.6	3.1	-2.6	5.180
10-feb-2017	0.1	4.4	2.3	0.5	4.367
11-feb-2017	3.7	5.8	1.3	-0.7	4.189
12-feb-2017	1.5	5.9	3.0	1.2	4.501
13-feb-2017	0.6	9.2	4.7	1.9	5.489
14-feb-2017	4.7	9.2	6.1	5.1	6.358
15-feb-2017	0.5	11.2	5.4	5.5	7.494
16-feb-2017	1.5	9.5	4.5	-1.3	6.977
17-feb-2017	2.2	10.3	8.4	6.9	7.988
18-feb-2017	0.0	10.3	7.2	8.6	8.577
19-feb-2017	0.6	12.6	6.7	5.3	8.780
20-feb-2017	0.0	13.8	9.7	7.5	9.690
21-feb-2017	0.5	13.4	9.7	7.0	9.898
22-feb-2017	4.4	11.1	9.2	8.6	9.932
23-feb-2017	1.7	9.7	2.8	3.9	8.370



24-feb-2017	0.5	8.5	2.6	-0.2	6.694
25-feb-2017	3.8	10.1	6.8	6.1	8.238
26-feb-2017	2.6	11.0	5.1	1.5	8.292
27-feb-2017	2.3	7.5	0.5	-1.3	6.785
28-feb-2017	0.3	9.5	-0.0	-4.6	5.504

**JohnstownII**

date: 00 to 00 utc

rain: Precipitation Amount (mm)

maxtp: Maximum Air Temperature (C)

mintp: Minimum Air Temperature (C)

gmin: 09utc Grass Minimum Temperature (C)

soil: Mean 10cm soil temperature (C)

date	rain	maxtp	mintp	gmin	soil
01-mar-2017	4.0	9.5	2.8	-1.3	6.008
02-mar-2017	0.0	9.8	2.6	-1.2	5.674
03-mar-2017	4.7	10.1	6.1	5.0	7.133
04-mar-2017	1.0	7.0	4.2	3.8	7.041
05-mar-2017	8.2	8.5	2.9	0.9	6.236
06-mar-2017	7.0	8.8	3.0	-1.3	6.077
07-mar-2017	3.3	10.2	1.8	-1.5	6.164
08-mar-2017	0.5	11.1	7.9	5.9	8.435
09-mar-2017	1.4	12.8	6.7	2.9	9.027
10-mar-2017	1.0	10.5	9.1	5.7	9.350
11-mar-2017	1.3	11.4	8.2	8.4	9.632
12-mar-2017	2.4	12.5	3.1	7.0	9.580
13-mar-2017	0.0	14.5	4.3	-2.9	9.266
14-mar-2017	0.0	15.1	7.9	2.7	10.285
15-mar-2017	0.6	12.4	4.5	-1.4	9.708
16-mar-2017	3.2	10.8	3.2	7.0	9.695
17-mar-2017	0.1	12.5	2.9	-1.0	8.098
18-mar-2017	0.0	14.7	10.0	8.2	10.295
19-mar-2017	0.1	12.7	9.8	8.6	10.510
20-mar-2017	5.4	11.6	1.9	6.8	10.042
21-mar-2017	3.8	6.8	1.0	-1.1	7.089
22-mar-2017	3.0	7.4	1.3	0.6	7.158
23-mar-2017	0.5	9.7	4.2	2.5	7.826
24-mar-2017	0.0	9.7	5.4	2.5	8.278

25-mar-2017	0.0	12.2	4.4	0.1	8.541
26-mar-2017	0.0	12.3	7.1	1.8	8.747
27-mar-2017	0.0	11.9	6.6	-0.3	9.516
28-mar-2017	2.0	11.9	7.0	2.7	9.642
29-mar-2017	8.0	11.5	10.2	7.9	10.380
30-mar-2017	11.9	11.2	10.3	10.0	10.653
31-mar-2017	5.4	11.9	7.5	8.4	10.903

JohnstownII  
date: 00 to 00 utc  
rain: Precipitation Amount (mm)

**maxtp: Maximum Air Temperature (C)**  
**mintp: Minimum Air Temperature (C)**  
**gmin: 09utc Grass Minimum Temperature (C)**  
**soil: Mean 10cm soil temperature (C)**

date	rain	maxtp	mintp	gmin	soil
01-apr-2017	1.7	13.1	6.2	1.4	10.212
02-apr-2017	0.0	12.2	3.7	-1.7	9.998
03-apr-2017	2.6	10.8	7.8	4.8	9.775
04-apr-2017	0.1	11.9	6.0	2.5	10.240
05-apr-2017	0.0	11.4	4.8	-0.9	9.575
06-apr-2017	0.0	11.1	7.7	4.1	10.438
07-apr-2017	0.0	12.0	4.4	4.0	11.355
08-apr-2017	0.0	13.8	3.6	-3.0	11.033
09-apr-2017	0.1	13.9	7.3	1.1	11.017
10-apr-2017	0.0	12.6	3.6	-1.1	10.260
11-apr-2017	0.0	12.4	4.3	-1.1	9.843
12-apr-2017	0.0	15.1	7.0	4.1	10.573
13-apr-2017	0.0	11.9	7.1	4.9	10.850
14-apr-2017	2.6	13.0	7.5	6.7	11.270
15-apr-2017	0.0	12.2	6.6	2.7	10.545
16-apr-2017	0.1	14.2	5.1	2.5	10.452
17-apr-2017	0.0	12.3	6.6	4.4	11.130
18-apr-2017	0.0	12.6	4.2	-0.0	11.870
19-apr-2017	0.0	13.5	7.2	1.0	12.577
20-apr-2017	0.0	14.2	10.4	8.2	12.927
21-apr-2017	0.0	13.7	10.2	8.4	12.833
22-apr-2017	0.0	12.4	9.4	7.0	12.677
23-apr-2017	0.0	12.5	7.3	3.4	12.895
24-apr-2017	0.5	13.2	2.2	4.4	12.163
25-apr-2017	1.2	11.6	2.0	-2.0	9.903

26-apr-2017	0.0	9.0	0.9	-1.9	9.414
27-apr-2017	0.0	11.7	3.3	-0.5	10.172
28-apr-2017	0.0	10.0	6.8	5.4	10.983
29-apr-2017	1.2	11.5	7.0	5.0	10.800
30-apr-2017	7.4	10.9	4.1	7.5	10.420

**JohnstownII**

date: 00 to 00 utc  
rain: Precipitation Amount (mm)  
maxtp: Maximum Air Temperature (C)  
mintp: Minimum Air Temperature (C)  
gmin: 09utc Grass Minimum Temperature (C)  
soil: Mean 10cm soil temperature (C)

date	rain	maxtp	mintp	gmin	soil
01-may-2017	0.1	14.8	4.1	-1.7	10.950
02-may-2017	0.1	13.3	7.0	2.3	13.030
03-may-2017	0.0	13.4	8.0	3.3	13.147
04-may-2017	0.0	13.0	8.8	5.5	12.628
05-may-2017	0.0	12.7	8.1	6.8	12.688
06-may-2017	0.0	11.9	8.3	8.3	12.698
07-may-2017	0.0	15.0	7.8	3.8	14.750
08-may-2017	0.0	12.2	6.7	2.2	14.645
09-may-2017	0.0	12.6	5.1	-0.6	15.070
10-may-2017	0.0	14.9	3.2	-3.1	15.290
11-may-2017	0.3	13.8	5.1	-0.1	14.375
12-may-2017	9.8	12.2	9.0	7.4	13.530
13-may-2017	7.4	13.5	8.6	7.7	12.773
14-may-2017	0.2	14.2	7.5	3.3	12.908
15-may-2017	30.8	13.4	11.2	10.0	13.050
16-may-2017	1.8	14.9	9.3	12.0	14.193
17-may-2017	0.0	14.1	7.0	3.0	13.597
18-may-2017	0.0	13.9	4.2	-0.7	13.632
19-may-2017	0.0	14.0	6.2	0.9	13.815
20-may-2017	0.5	14.4	8.2	6.7	14.703
21-may-2017	0.6	14.4	10.9	7.2	14.613
22-may-2017	0.0	15.8	10.5	8.1	15.080
23-may-2017	0.1	18.8	12.4	11.5	16.403
24-may-2017	0.0	16.7	10.2	9.9	16.495
25-may-2017	0.1	21.0	10.1	5.9	18.298
26-may-2017	0.0	22.2	12.6	7.9	19.070
27-may-2017	9.9	17.3	11.6	8.0	16.888
28-may-2017	1.9	13.6	10.2	6.9	15.300

29-may-2017	3.6	17.0	10.6	9.9	15.717
30-may-2017	0.1	17.4	12.7	11.5	16.948
31-may-2017	0.3	17.1	11.2	6.6	16.677

**JohnstownII**

**date:** 00 to 00 utc

**rain:** Precipitation Amount (mm)

**maxtp:** Maximum Air Temperature (C)

**mintp:** Minimum Air Temperature (C)

**gmin:** 09utc Grass Minimum Temperature (C)

**soil:** Mean 10cm soil temperature (C)

<b>date</b>	<b>rain</b>	<b>maxtp</b>	<b>mintp</b>	<b>gmin</b>	<b>soil</b>
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01-jul-2017	0.0	18.9	8.6	4.0	16.038
02-jul-2017	0.0	16.9	8.9	3.1	17.443
03-jul-2017	0.0	18.6	13.5	11.8	18.560
04-jul-2017	0.0	18.4	14.4	14.1	19.290
05-jul-2017	0.0	18.0	12.3	9.6	19.677
06-jul-2017	0.0	20.6	11.9	8.5	20.080
07-jul-2017	0.6	18.5	13.3	10.3	19.105
08-jul-2017	0.0	19.3	13.2	9.4	19.475
09-jul-2017	0.0	19.7	13.8	12.6	20.897
10-jul-2017	0.4	17.6	13.4	12.4	19.575
11-jul-2017	7.4	14.7	11.5	11.9	17.882
12-jul-2017	0.0	19.2	10.4	7.9	18.380
13-jul-2017	0.1	18.6	9.9	5.0	17.802
14-jul-2017	0.0	17.7	11.6	9.6	18.163
15-jul-2017	1.0	19.4	14.5	13.7	19.028
16-jul-2017	0.3	19.5	13.1	15.6	20.153
17-jul-2017	0.0	19.4	11.7	8.9	20.895
18-jul-2017	0.0	21.6	13.8	10.4	21.170
19-jul-2017	10.4	18.0	10.6	14.3	19.100
20-jul-2017	5.9	16.5	9.8	8.3	16.870
21-jul-2017	10.2	16.1	10.6	10.9	16.615
22-jul-2017	1.6	17.3	10.6	8.6	18.140
23-jul-2017	0.0	20.0	13.5	12.7	17.958
24-jul-2017	0.0	23.0	14.3	10.2	19.320
25-jul-2017	0.9	19.9	13.6	11.0	20.080
26-jul-2017	10.1	19.0	11.1	15.6	18.525
27-jul-2017	0.6	17.1	10.6	7.3	16.695
28-jul-2017	7.6	18.1	11.9	10.9	15.635
29-jul-2017	0.0	17.2	11.9	9.5	16.360



30-jul-2017	3.1	16.6	10.8	8.7	15.993
31-jul-2017	0.0	16.8	11.6	9.4	16.253

JohnstownII

date: 00 to 00 utc

rain: Precipitation Amount (mm)

maxtp: Maximum Air Temperature (C)

mintp: Minimum Air Temperature (C)

gmin: 09utc Grass Minimum Temperature (C)

soil: Mean 10cm soil temperature (C)

date	rain	maxtp	mintp	gmin	soil
01-aug-2017	0.0	17.0	11.4	9.1	17.003

02-aug-2017	6.5	18.0	13.3	12.7	17.272
03-aug-2017	4.3	18.3	12.4	13.1	16.865
04-aug-2017	11.2	17.1	11.7	7.8	16.318
05-aug-2017	0.4	18.0	11.2	9.4	16.110
06-aug-2017	3.7	15.7	9.1	4.8	14.948
07-aug-2017	1.1	16.8	11.1	9.5	15.500
08-aug-2017	4.2	17.0	10.4	9.5	15.983
09-aug-2017	0.1	18.5	10.3	6.7	15.753
10-aug-2017	0.0	17.8	9.3	6.4	15.855
11-aug-2017	0.5	18.0	11.5	8.2	16.130
12-aug-2017	0.0	19.0	11.6	9.2	16.103
13-aug-2017	4.1	18.4	10.3	6.6	16.612
14-aug-2017	13.2	17.0	11.8	12.9	16.565
15-aug-2017	0.2	18.0	10.3	8.0	16.085
16-aug-2017	9.1	16.2	12.9	11.1	15.892
17-aug-2017	1.4	17.7	11.3	11.3	16.612
18-aug-2017	3.1	15.8	9.8	7.9	14.685
19-aug-2017	0.0	17.0	10.2	8.1	14.205
20-aug-2017	4.0	15.9	9.5	5.2	14.220
21-aug-2017	2.7	17.3	14.6	14.3	16.243
22-aug-2017	0.4	19.0	14.1	14.3	16.827
23-aug-2017	0.1	17.8	12.4	10.9	16.890
24-aug-2017	0.1	17.9	11.8	9.3	16.460
25-aug-2017	1.0	17.6	13.0	10.9	16.450
26-aug-2017	0.0	19.6	13.5	11.6	17.350
27-aug-2017	0.1	19.1	14.9	14.0	17.825
28-aug-2017	0.7	17.9	14.3	14.8	17.635
29-aug-2017	0.0	15.6	10.4	8.1	16.097
30-aug-2017	0.0	17.1	10.4	8.7	16.235

31-aug-2017	3.0	17.1	8.9	6.2	15.863
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**JohnstownII**

date: 00 to 00 utc

rain: Precipitation Amount (mm)

maxtp: Maximum Air Temperature (C)

mintp: Minimum Air Temperature (C)

gmin: 09utc Grass Minimum Temperature (C)

soil: Mean 10cm soil temperature (C)

date	rain	maxtp	mintp	gmin	soil
01-sep-2017	0.1	18.8	9.0	6.9	15.790
02-sep-2017	10.5	16.3	9.2	4.9	15.380

03-sep-2017	32.4	19.5	13.9	12.9	17.160
04-sep-2017	5.1	17.0	13.1	15.5	17.380
05-sep-2017	10.6	18.1	11.6	13.0	16.372
06-sep-2017	0.0	17.4	11.2	8.7	15.658
07-sep-2017	1.5	17.0	11.9	9.9	15.523
08-sep-2017	5.7	16.6	10.4	11.7	15.443
09-sep-2017	0.3	17.6	9.1	7.4	14.347
10-sep-2017	2.0	16.8	10.7	10.1	14.210
11-sep-2017	2.4	16.2	10.0	8.5	13.665
12-sep-2017	7.6	14.9	8.4	6.5	13.012
13-sep-2017	4.6	14.4	7.5	7.1	12.413
14-sep-2017	0.0	15.6	7.8	5.7	11.960
15-sep-2017	0.0	15.6	9.2	7.6	12.783
16-sep-2017	1.3	12.1	8.2	7.2	11.845
17-sep-2017	0.1	15.0	7.5	7.0	12.783
18-sep-2017	0.0	17.0	8.4	5.6	12.752
19-sep-2017	0.0	16.0	8.5	5.9	13.343
20-sep-2017	16.5	15.7	11.4	13.1	14.475
21-sep-2017	4.9	15.1	9.6	8.2	13.712
22-sep-2017	7.1	16.1	11.4	6.5	13.760
23-sep-2017	10.0	15.7	12.9	9.9	14.352
24-sep-2017	1.0	18.8	11.0	13.0	15.325
25-sep-2017	0.1	16.5	9.9	5.9	14.400
26-sep-2017	0.0	15.6	11.3	10.5	14.885
27-sep-2017	24.3	14.8	10.9	11.8	14.175
28-sep-2017	5.2	15.2	8.5	5.1	13.675
29-sep-2017	2.3	14.5	9.3	9.6	13.515

30-sep-2017 5.2 11.8 9.7 7.7 12.932

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**JohnstownII**

**date:** 00 to 00 utc

**rain:** Precipitation Amount (mm)

**maxtp:** Maximum Air Temperature (C)

**mintp:** Minimum Air Temperature (C)

**gmin:** 09utc Grass Minimum Temperature (C)

**soil:** Mean 10cm soil temperature (C)

date	rain	maxtp	mintp	gmin	soil
01-oct-2017	0.9	17.2	10.9	11.1	14.000
02-oct-2017	0.0	13.9	6.9	8.2	12.615
03-oct-2017	0.0	13.6	6.4	4.4	11.243

04-oct-2017	0.0	14.3	8.4	5.8	11.833
05-oct-2017	0.3	15.5	6.7	8.5	12.680
06-oct-2017	0.1	13.7	4.6	0.6	11.278
07-oct-2017	0.0	15.1	8.6	11.7	12.845
08-oct-2017	0.1	14.2	8.7	6.0	12.352
09-oct-2017	0.5	14.4	8.9	4.8	12.665
10-oct-2017	1.1	15.2	13.1	12.8	13.658
11-oct-2017	5.3	15.9	9.1	12.8	13.622
12-oct-2017	1.3	15.3	7.6	4.2	12.235
13-oct-2017	12.4	15.6	15.0	12.7	14.472
14-oct-2017	1.9	16.0	13.8	14.8	14.740
15-oct-2017	0.1	15.6	13.7	12.8	14.350
16-oct-2017	1.4	17.2	11.1	13.2	13.762
17-oct-2017	0.0	14.1	6.6	5.5	11.635
18-oct-2017	1.8	13.6	6.3	0.0	11.198
19-oct-2017	7.4	13.7	10.4	10.4	12.680
20-oct-2017	13.0	13.7	4.6	-0.4	11.005
21-oct-2017	2.8	14.6	8.2	9.8	11.597
22-oct-2017	0.5	13.0	6.6	3.8	10.230
23-oct-2017	1.9	14.7	11.7	9.3	12.618
24-oct-2017	9.9	14.5	11.5	11.4	13.283
25-oct-2017	0.3	14.0	8.3	2.5	12.203
26-oct-2017	1.7	13.6	11.2	9.9	12.717
27-oct-2017	0.1	14.7	7.2	3.9	11.885
28-oct-2017	0.0	14.1	7.9	3.6	11.790
29-oct-2017	0.0	14.2	6.5	10.4	12.260
30-oct-2017	0.0	12.8	5.7	1.7	10.465
31-oct-2017	0.0	13.1	11.3	9.1	11.653

**JohnstownII**

**date:** 00 to 00 utc

**rain:** Precipitation Amount (mm)

**maxtp:** Maximum Air Temperature (C)

**mintp:** Minimum Air Temperature (C)

**gmin:** 09utc Grass Minimum Temperature (C)

**soil:** Mean 10cm soil temperature (C)

<b>date</b>	<b>rain</b>	<b>maxtp</b>	<b>mintp</b>	<b>gmin</b>	<b>soil</b>
01-nov-2017	0.0	13.6	7.8	5.9	11.065
02-nov-2017	0.0	13.0	7.8	3.2	10.680
03-nov-2017	0.0	11.0	9.0	4.0	11.177
04-nov-2017	0.0	10.2	3.8	4.0	9.528
05-nov-2017	0.0	10.2	2.6	1.7	7.540

06-nov-2017	0.8	12.7	2.8	-2.6	8.767
07-nov-2017	9.6	12.4	3.5	4.6	9.224
08-nov-2017	1.2	10.6	2.0	-2.6	7.488
09-nov-2017	0.6	12.1	7.6	-0.0	9.657
10-nov-2017	6.8	12.0	8.3	3.4	9.600
11-nov-2017	10.6	12.5	5.9	6.4	10.892
12-nov-2017	0.4	8.0	3.0	-0.5	8.024
13-nov-2017	0.6	10.2	1.6	-1.7	6.911
14-nov-2017	0.4	12.9	9.3	5.3	9.733
15-nov-2017	0.0	12.6	9.0	6.2	10.222
16-nov-2017	0.2	11.4	3.7	7.9	9.469
17-nov-2017	0.0	8.4	1.4	-4.1	6.777
18-nov-2017	1.9	10.9	6.7	-0.4	8.572
19-nov-2017	0.3	11.8	6.2	4.7	8.887
20-nov-2017	2.1	12.9	11.0	7.1	10.852
21-nov-2017	7.3	12.8	11.1	9.9	11.350
22-nov-2017	26.7	13.7	4.3	11.6	11.680
23-nov-2017	0.1	8.3	2.9	0.5	7.948
24-nov-2017	0.0	7.3	0.5	-3.9	5.931
25-nov-2017	0.0	5.7	-0.2	-4.6	4.437
26-nov-2017	0.3	10.5	1.6	-1.0	5.163
27-nov-2017	2.4	10.6	4.4	3.2	7.024
28-nov-2017	0.0	6.4	2.6	-0.5	5.100
29-nov-2017	0.1	4.7	1.4	-0.6	4.086
30-nov-2017	0.0	6.1	1.6	-1.1	4.158



JohnstownII

date: 00 to 00 utc

rain: Precipitation Amount (mm)

maxtp: Maximum Air Temperature (C)

mintp: Minimum Air Temperature (C)

gmin: 09utc Grass Minimum Temperature (C)

soil: Mean 10cm soil temperature (C)


date	rain	maxtp	mintp	gmin	soil
01-dec-2017	0.0	5.4	0.9	-1.7	3.418
02-dec-2017	0.1	8.6	3.6	-0.8	5.039
03-dec-2017	0.0	9.3	4.7	3.2	6.640
04-dec-2017	0.0	8.5	4.0	-2.1	6.093
05-dec-2017	0.1	10.4	5.5	3.3	6.876
06-dec-2017	7.5	12.3	10.0	3.4	8.648
07-dec-2017	5.4	12.3	1.1	2.8	7.675

08-dec-2017	0.0	4.2	0.6	-1.9	3.901
09-dec-2017	2.4	5.6	0.1	-4.8	3.751
10-dec-2017	34.3	6.4	-0.2	-0.4	4.924
11-dec-2017	0.0	4.5	-1.9	-3.7	2.933
12-dec-2017	4.7	8.0	-0.0	-4.6	3.513
13-dec-2017	3.9	8.2	1.6	-0.0	5.009
14-dec-2017	0.6	5.5	1.4	-0.3	3.623
15-dec-2017	0.0	6.8	1.4	1.1	4.113
16-dec-2017	0.0	7.3	-0.6	-5.9	3.671
17-dec-2017	0.3	11.3	5.6	0.0	6.456
18-dec-2017	0.0	9.9	3.0	-2.3	5.714
19-dec-2017	2.3	10.6	8.7	-0.2	7.902
20-dec-2017	1.2	11.8	10.0	9.6	9.180
21-dec-2017	5.1	10.7	9.1	9.0	9.380
22-dec-2017	0.2	12.5	8.5	6.3	9.592
23-dec-2017	0.1	9.9	7.0	7.5	8.908
24-dec-2017	1.1	10.7	9.5	7.5	9.477
25-dec-2017	9.4	10.7	2.3	9.2	8.319
26-dec-2017	3.6	5.7	1.8	-0.7	5.292
27-dec-2017	0.0	4.2	1.2	-0.9	3.747
28-dec-2017	0.9	6.8	-2.1	-8.0	3.108
29-dec-2017	17.6	10.1	4.3	-3.9	4.769
30-dec-2017	4.3	11.6	7.7	2.6	7.077
31-dec-2017	2.5	11.5	4.2	4.4	6.797



## Appendix H

### Flare Servicing Records and Landfill Gas Survey

<h1 style="margin: 0;">SERVICE SHEET</h1> <p style="margin: 0;">Page No 19</p>	JOB NO Dungarvan		<b>Automatic Flare Systems Ltd</b> Unit 8, Ensign Business Centre Coventry CV4 8JA United Kingdom Tel: +44 (0)24 7647 4877 Fax: +44 (0)24 7647 4834 www.afs-group.co.uk								
SITE: Dungarvan Landfill site, Co Waterford		DATE: 26-04-2017									
HEALTH AND SAFETY NOTICE WEAR A HEAD HAT AND REFLECTIVE VEST OR JACKET ON OPERATIVE SITES WEAR A PROTECTIVE FACE MASK WHEN WORKING IN AN AREA WHERE THERE IS ANY POSSIBILITY OF BREATHING IN CERAMIC INSULATING DUST											
TO BE COMPLETED FOR ALL HIRE INSTALLATION, SERVICE AND REPAIR VISITS 1. RECORD ALL INSTRUMENT READINGS AND VALVE SETTINGS ON ARRIVAL 2. RECORD ALL CHANGES AND REPAIRS MADE 3. RECORD ALL PARTS, MATERIALS & COMPONENTS FITTED OR USED 4. CHECK THAT PRESSURE AND VACUUM GAUGES ARE ZEROED 5. RECORD ALL INSTRUMENT READINGS AND VALVE SETTINGS ON DEPARTURE 6. LEAVE SITE CLEAN AND TIDY 7. NOTE FUTURE REMEDIAL ACTION NEEDED AND SEE THAT IT IS CARRIED OUT		FLARE AUTO TIMER SETTINGS									
		DAY	START	STOP							
		SUNDAY	11:00	17:00							
		MONDAY	11:00	17:00							
		TUESDAY	11:00	17:00							
		WEDNESDAY	11:00	17:00							
		THURSDAY	11:00	17:00							
		FRIDAY	11:00	17:00							
		SATURDAY	11:00	17:00							
ENGINEERS NAME	Steve Hindle		Flare type HT100								
ARRIVAL: <b>FLARE RUNNING on Auto Timer</b>											
HOURS RUN	BOOSTER 1	21611	CH4	52.4 (hmi 106%)	%	CO2	32.6	%			
	BOOSTER 2	N/A	O2	0.7	%	PRESSURE	17.2	mbar			
INLET VALVE SETTING % OPEN											
NO 1	100%	NO 2	N/A	NO 3	N/A	NO 4	N/A	NO 5	N/A	NO 6	N/A
MAIN CONTROL VALVE SETTING % OPEN									100%		

INLET VACUUM GAUGE READINGS STARING SIDE NEAREST KNOCKOUT POT									(mbarg)		
NO 1	-15.0	NO 2	N/A	NO 3	N/A	NO4	N/A	NO 5	N/A	NO 6	N/A
INLET TEMP	12	°C	INLET VACUUM PRIOR TO KO POT FILTER		-15.0		MBAR				
VACUUM AFTER KO POT FILTER	-14	MBAR	VACUUM AFTER INLET FLAME ARRESTER		-14		MBAR				
OUTLET PRESSURE AFTER GAS BOOSTER	3.9	MBAR	OUTLET GAS TEMP		14		°C				
PRESSURE AFTER SLAM SHUT	3	MBAR	PRESSURE AFTER OUTLET FLAME ARRESTER		N/A						
TOTAL FLOW	1657344	m <sup>3</sup>	BLOWER SPEED		40 %						
DAMPER POSTION	26.2	%									
FLOW RATE	46.2	m <sup>3</sup> /hr	MEASURING INSTRUMENT		OPFM						
FLAME TEMP	1022	°C	MOTOR TEMP (drive bearing)		20		°C				
FLAME QUALITY	OK		AMBIENT TEMP		12.6		°C				
MANOMETER LIQUID LEVEL WITH RIG SHUT DOWN			AMBIENT PRESSURE		1020		MBAR				
TYPE OF LIQUID: PERFLOW											
RED SG - 0.8			EMISSIONS ANALYSER CO CELL		0.4		EMISSIONS ANALYSER NOX CELL		N/A		

# SERVICE SHEET

Page No 2

Job No  
Dungarvan



**Automatic Flare Systems Ltd**  
Unit 8, Ensign Business Centre  
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CHECK FOR LEAKS WITH GAS DETECTOR		None	
CONDENSATE DRAIN SYSTEM CHECK		Yes	
DRAINS CORRECTLY	Yes	KNOCKOUT POT FILTER CLEAN	N/A
COMMENTS			
BOOSTER MODEL AND SERIAL NO		BG 30 / 34-3GX	
MOTOR & FAN SEAL GREASED	Yes	BOOSTER CORRECT ROTATION	Yes
NOTE: USE SHELL ALVANIA 3, GREASE EVERY SERVICE <b><u>IMPORTANT DO NOT OVERGREASE</u></b>			
BOOSTER OIL CHANGED (EVERY 5000 HOURS, USE 20W50 ENGINE OIL IN DONKIN V50)			N/A
BOOSTER FLEXIBLE CONNECTORS	OK	MOUNTINGS	OK
BEARING NOISE	OK	BOILER NOISE	
BOLTS TIGHT	Yes	SLAMSHUT SPRING	OK
GAUGES ZEROED	Yes	PILOT	
FLAME ARRESTER INLET	OK	OUTLET	OK
PILOT LIGHT FUNCTION	Cleaned & set	UV SENSOR FUNCTION	Cleaned
CONDITION OF THERMOCOUPLER	OK	CONDITION OF FLARE LINING	
DAMPER OPERATION	OK	CONDITION OF BURNER CUPS	OK
LOUVERS CONDITION	OK	INTERIOR LIGHT	N/A
EXTERIOR LIGHT	N/A	ELECTRICAL CONNECTIONS CHECKED FOR TIGHTNESS	
ALL INDICATOR BULBS FUNCTION	Yes	Yes	
HINGES & VALVES LUBRICATED	Yes		
PRESSURE SWITCH FUNCTION			
SUCTION	N/A	SETTING	N/A
VENT	N/A	SETTING	N/A
BOOSTER	Yes	SETTING	1.0 mbar
OTHER (specify)	N/A	SETTING	N/A
BURNER	N/A	SETTING	N/A
COMMENTS			

# SERVICE SHEET

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Job No  
Dungarvan



## Automatic Flare Systems Ltd

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CHECK SIGNAL, CONTROL AND TELEMETRY FUNCTION		OK
SIGNAL, CONTROL & TELEMETRY REPORT FILLED OUT AS APPROPRIATE		N/A
REPORT ALL & ANY CHANGES MADE TO TELEMETRY SYSTEM		None
REPORT ALL & ANY CHANGES MADE TO CONTROL PROGRAMME		None
CH4 ANALYSER OPERATION		Replace ch4 sensor card
O2 ANALYSER OPERATION		OK
CO2 ANALYSER OPERATION		OK
CO EMISSION ANALYSER		OK
REPORT ALL & ANY REPAIRS		None
REPORT ALL & ANY PARTS REPLACED OR NEW PARTS FITTED INCLUDING PART NOS & SUFFICIENT DETAIL FOR THEM TO BE INVOICED		
	COMMENTS	NEW PARTS FITTED
	Serviced KOP 1 Condensate air pump. Modified Leachate discharge line with fitting 2 elbows to reduce strain on pipe.	1 x Foot ball valve (afs supplied) 2 x 32mm compression elbow (afs supplied)
	investigated HMI screen displaying CH4 at 106% and found CH4 analyser sensor card display output faulty.	1 x CH4 analyser sensor card (warranty fitted 18-11-16)

<b><u>GAS ANALYSER CALIBRATION REPORT:</u></b>					
GAS USED: 1954 Compressed Gas.		Methane (CH4) 50 % concentration		Carbon Dioxide: Remaining Balance	
Before Calibration:	CH4	N/A %	CO2	N/A %	
After Calibration:	CH4	N/A %	CO2	N/A %	
Comments:	None				
GAS USED: 1954 Compressed Gas.		Oxygen (O <sub>2</sub> ) 20.9% Concentration		Nitrogen: Remaining Balance	
Before Calibration:	O <sub>2</sub>	N/A %			
After Calibration:	O <sub>2</sub>	N/A %			
Comments:	None				

# SERVICE SHEET

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Job No  
Dungarvan



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REPORT ANY FURTHER REPAIRS OR ACTION NEEDED:

None

DEPARTURE REPORT:

HOURS RUN: 21612	RUN RIG FOR 30 MINUTES BEFORE TAKING READINGS									
CH4	51.6	%	CO2	31.9	%	O2	0.1	%	CO	2.6

INLET VALVE SETTING % OPEN											
NO 1	100%	NO 2	N/A	NO 3	N/A	NO 4	N/A	NO 5	N/A	NO 6	N/A

MAIN CONTROL VALVE SETTING % OPEN								100%			
-----------------------------------	--	--	--	--	--	--	--	------	--	--	--

INLET VACUUM GAUGE READINGS STARTING SIDE NEAREST KNOCKOUT POT										(mbarg)	
NO 1	-15	NO 2	N/A	NO 3	N/A	NO 4	N/A	NO 5	N/A	NO 6	N/A

INLET TEMP	12	°C	INLET VACUUM PRIOR TO KO POT FILTER	-15	MBAR
VACUUM AFTER KO POT FILTER	-14.0	MBAR	VACUUM AFTER INLET FLAME ARRESTER	-14.0	MBAR
OUTLET PRESSURE AFTER GAS BOOSTER	4.0	MBAR	OUTLET GAS TEMP	14	°C
PRESSURE AFTER SLAM SHUT	4.0	MBAR	PRESSURE AFTER OUTLET FLAME ARRESTER	N/A	
OTHER			BLOWER SPEED %	40	%
DAMPER POSITION	28.4	%	MANOMETER READING	45	m <sup>3</sup> hr
FLOW RATE	45.0	m <sup>3</sup> hr	FLAME QUALITY	OK	
FLAME TEMP	1021	°C	HAS RIG & COMPOUND BEEN LEFT CLEAN	Yes	

NAMES OF ALL AFS & SUB CONTRACTOR STAFF CARRYING OUT WORK			
Steve Hindle			
REPORT WRITER	Steve Hindle		
SIGNATURE			
DATE	26-04-2017		



## GAS FIELD BALANCING SHEET



<b>Site:</b>	Dungarvan	<b>Total Flare Hrs</b>	21611
<b>Date:</b>	26/04/2017	<b>Flare Operating Hrs</b>	6hrs/day
<b>Name:</b>	Steve Hindle	<b>Flare Temperature °C</b>	1020
<b>Equipment Used :</b>	GA5000	<b>Blower motor setting</b>	40%
<b>Serial No :</b>	G500854	<b>Flow Arrival m<sup>3</sup>hr</b>	83m <sup>3</sup> hr
<b>Last Calibration Date :</b>	23/03/2016	<b>Flow after balance m<sup>3</sup>hr</b>	44m <sup>3</sup> hr
<b>Calibration Due Date :</b>	24/03/2017	<b>Flow Leaving m<sup>3</sup>hr</b>	44m <sup>3</sup> hr

1	2	3	4	5	6	7	8	9	10	11	12	13	14
ID	Date/Time	CH4 %	CO2 %	O2 %	BALANCE %	RESIDUAL NITROGEN %	CO ppm	H2S ppm	BARO mb	SUCTION PRESSURE mb	COMMENTS	START VALVE POSITION %	FINISH VALVE POSITION %
DV_FLARE	26/04/2017 10:30	31.1	21.8	1.2	45.9	41.36	0	2	1030	-6.57		100	100
DV_GW13	26/04/2017 11:08	0	0.1	18.3	81.6	12.43	0	0	1028	1.32	Line flooded	0	0
DV_CW06	26/04/2017 11:12	16.9	12.6	10.3	60.2	21.27	0	0	1028	-0.27		0	0
DV_GW14	26/04/2017 11:14	69.5	29.9	0.4	0.2	0	0	56	1028	-0.28		0	10
DV_CW08	26/04/2017 11:16	31.1	23	0.2	45.7	44.94	0	4	1028	-2.99	Valve not closing	10	0
DV_GW11	26/04/2017 11:17	37.8	19.5	0.9	41.8	38.4	3	2	1027	-6	Valve not closing	10	0
DV_GW12	26/04/2017 11:21	20.5	12.4	12.5	54.6	7.35	7	0	1027	0		0	0
DV_MAN01	26/04/2017 11:23	61.1	25.9	0.8	12.2	9.18	0	83	1027	-6.55		10	10
DV_GW07	26/04/2017 11:30	64.1	25.9	0.1	9.9	9.52	0	11	1026	-0.8		100	100
DV_GW03	26/04/2017 11:31	72.1	22.2	0.4	5.3	3.79	0	91	1026	-0.79		100	100
DV_CW04	26/04/2017 11:32	1.4	2.1	18.9	77.6	6.16	2	7	1026	-0.12		0	0
DV_GW01	26/04/2017 11:35	35.4	15	9.2	40.4	5.62	0	2	1026	-1.35		10	0
DV_CW01	26/04/2017 11:37	55.6	22.6	0.9	20.9	17.5	0	11	1026	-0.81		10	50
DV_GW08	26/04/2017 11:40	46.8	20.3	4.2	28.7	12.82	0	25	1026	-1.74		0	10
DV_GW04	26/04/2017 11:42	67.4	21.7	1	9.9	6.12	0	2	1026	-0.83		100	100
DV_GW09	26/04/2017 11:43	54.4	22.7	1	21.9	18.12	0	2	1026	-0.84		10	50
DV_CW07	26/04/2017 11:46	34.8	23.5	0.3	41.4	40.27	0	5	1026	-0.84		100	0
DV_MAN02	26/04/2017 11:47	67	23.7	0.5	8.8	6.91	0	23	1026	-1.16		100	100
DV_GW02	26/04/2017 11:53	25.6	25.2	0	49.2	49.2	0	38	1026	-3.11		0	0
DV_CW02	26/04/2017 11:54	53.2	23.9	0.8	22.1	19.08	0	5	1026	-6.92		100	100
DV_GW06	26/04/2017 11:56	0.1	3.9	17.1	78.9	14.26	0	1	1026	-0.16		0	0
DV_CW03	26/04/2017 11:57	28.9	22.7	0.6	47.8	45.53	4	3	1026	-6.68		100	0
DV_CW05	26/04/2017 12:00	10.3	8.2	13	68.5	19.36	6	1	1026	0		0	0
DV_GW05	26/04/2017 12:01	41.8	20	4	34.2	19.08	0	9	1026	-3.16		10	10
DV_CW09	26/04/2017 12:03	33.2	22	0.7	44.1	41.45	0	6	1026	-8.28		25	10
DV_GW10	26/04/2017 12:05	22	13.7	8.7	55.6	22.71	0	1	1026	-15.54		10	0
DV_MAN03	26/04/2017 12:14	32.2	15.7	7.7	44.4	15.29	0	6	1025	-15.59		100	10
DV_END	26/04/2017 14:27	52.7	21.7	2.7	22.9	12.69	0	30	1026	-15.15		100	100

a  
**SERVICE SHEET**

Page No 1

JOB NO  
Dungarvan



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www.afs-group.co.uk

SITE: Dungarvan Landfill site, Co Waterford

DATE: 04-10-2017

**HEALTH AND SAFETY NOTICE**

WEAR A HEAD HAT AND REFLECTIVE VEST OR JACKET ON OPERATIVE SITES

WEAR A PROTECTIVE FACE MASK WHEN WORKING IN AN AREA WHERE THERE IS ANY POSSIBILITY OF BREATHING IN CERAMIC INSULATING DUST

- TO BE COMPLETED FOR ALL HIRE INSTALLATION, SERVICE AND REPAIR VISITS
1. RECORD ALL INSTRUMENT READINGS AND VALVE SETTINGS ON ARRIVAL
  2. RECORD ALL CHANGES AND REPAIRS MADE
  3. RECORD ALL PARTS, MATERIALS & COMPONENTS FITTED OR USED
  4. CHECK THAT PRESSURE AND VACUUM GAUGES ARE ZEROED
  5. RECORD ALL INSTRUMENT READINGS AND VALVE SETTINGS ON DEPARTURE
  6. LEAVE SITE CLEAN AND TIDY
  7. NOTE FUTURE REMEDIAL ACTION NEEDED AND SEE THAT IT IS CARRIED OUT

**FLARE AUTO TIMER SETTINGS**

DAY	START	STOP
SUNDAY	11:00	17:00
MONDAY	11:00	17:00
TUESDAY	11:00	17:00
WEDNESDAY	11:00	17:00
THURSDAY	11:00	17:00
FRIDAY	11:00	17:00
SATURDAY	11:00	17:00

ENGINEERS NAME Steve Hindle Flare type HT100

**ARRIVAL: FLARE RUNNING on Auto Timer**

HOURS RUN	BOOSTER 1	22572	CH4	50.4	%	CO2	44.4	%
	BOOSTER 2	N/A	O2	0.9	%	PRESSURE	5.1	mbar

**INLET VALVE SETTING % OPEN**

NO 1	100%	NO 2	N/A	NO 3	N/A	NO 4	N/A	NO 5	N/A	NO 6	N/A
------	------	------	-----	------	-----	------	-----	------	-----	------	-----

MAIN CONTROL VALVE SETTING % OPEN 100%

**INLET VACUUM GAUGE READINGS STARING SIDE NEAREST KNOCKOUT POT**

NO 1	-14.0	NO 2	N/A	NO 3	N/A	NO 4	N/A	NO 5	N/A	NO 6	N/A
------	-------	------	-----	------	-----	------	-----	------	-----	------	-----

INLET TEMP	12	°C	INLET VACUUM PRIOR TO KO POT FILTER	-14.0	MBAR
VACUUM AFTER KO POT FILTER	-14.0	MBAR	VACUUM AFTER INLET FLAME ARRESTER	-15.0	MBAR
OUTLET PRESSURE AFTER GAS BOOSTER	4.9	MBAR	OUTLET GAS TEMP	14	°C
PRESSURE AFTER SLAM SHUT	4.0	MBAR	PRESSURE AFTER OUTLET FLAME ARRESTER	N/A	
TOTAL FLOW	1686942	m <sup>3</sup>	BLOWER SPEED	40	%
DAMPER POSITION	26.6	%			
FLOW RATE	52	m <sup>3</sup> /hr	MEASURING INSTRUMENT	OPFM	
FLAME TEMP	1024	°C	MOTOR TEMP (drive bearing)	20	°C
FLAME QUALITY	OK		AMBIENT TEMP	15.2	°C
MANOMETER LIQUID LEVEL WITH RIG SHUT DOWN			AMBIENT PRESSURE	1022	MBAR

**TYPE OF LIQUID: PERFLOW**

RED SG - 0.8		EMISSIONS ANALYSER CO CELL	3.7	EMISSIONS ANALYSER NOX CELL	N/A
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# SERVICE SHEET

Page No 2

Job No  
Dungarvan



**Automatic Flare Systems Ltd**  
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CHECK FOR LEAKS WITH GAS DETECTOR		None					
CONDENSATE DRAIN SYSTEM CHECK		Yes					
DRAINS CORRECTLY	Yes	KNOCKOUT POT FILTER CLEAN				N/A	
COMMENTS							
BOOSTER MODEL AND SERIAL NO		BG 30 / 34-3GX					
MOTOR & FAN SEAL GREASED	Yes	BOOSTER CORRECT ROTATION				Yes	
NOTE: USE SHELL ALVANIA 3, GREASE EVERY SERVICE <b><u>IMPORTANT DO NOT OVERGREASE</u></b>							
BOOSTER OIL CHANGED (EVERY 5000 HOURS, USE 20W50 ENGINE OIL IN DONKIN V50)						N/A	
BOOSTER FLEXIBLE CONNECTORS	OK	MOUNTINGS	OK	BEARING NOISE	OK		
BOLTS TIGHT	Yes	SLAMSHUT SPRING	OK	GAUGES ZEROED	Yes		
FLAME ARRESTER INLET	OK	OUTLET	OK	PILOT	OK		
PILOT LIGHT FUNCTION	Cleaned & set	UV SENSOR FUNCTION	Cleaned	CONDITION OF THERMOCOUPLER	OK		
DAMPER OPERATION	OK	CONDITION OF BURNER CUPS	OK	CONDITION OF FLARE LINING	OK		
LOUVERS CONDITION	OK	INTERIOR LIGHT	N/A	EXTERIOR LIGHT	N/A		
ALL INDICATOR BULBS FUNCTION	Yes	ELECTRICAL CONNECTIONS CHECKED FOR TIGHTNESS				Yes	
HINGES & VALVES LUBRICATED	Yes						
PRESSURE SWITCH FUNCTION							
SUCTION	N/A	SETTING	N/A	VENT	N/A	SETTING	N/A
BOOSTER	Yes	SETTING	1.0 mbar	OTHER (specify)	N/A	SETTING	N/A
BURNER	N/A	SETTING	N/A			SETTING	
COMMENTS							

# SERVICE SHEET

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Job No  
Dungarvan



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CHECK SIGNAL, CONTROL AND TELEMETRY FUNCTION	OK
SIGNAL, CONTROL & TELEMETRY REPORT FILLED OUT AS APPROPRIATE	N/A
REPORT ALL & ANY CHANGES MADE TO TELEMETRY SYSTEM	None
REPORT ALL & ANY CHANGES MADE TO CONTROL PROGRAMME	None
CH4 ANALYSER OPERATION	OK
O2 ANALYSER OPERATION	OK
CO2 ANALYSER OPERATION	OK
CO EMISSION ANALYSER	OK
REPORT ALL & ANY REPAIRS	None
REPORT ALL & ANY PARTS REPLACED OR NEW PARTS FITTED INCLUDING PART NOS & SUFFICIENT DETAIL FOR THEM TO BE INVOICED	
COMMENTS	NEW PARTS FITTED
	2 x tefan valves fitted during gas balance (afs supplied)
KOP 1: - 4616 pulse count. Working ok	

### GAS ANALYSER CALIBRATION REPORT:

GAS USED: 1954 Compressed Gas.		Methane (CH4) 50 % concentration		Carbon Dioxide: Remaining Balance	
Before Calibration:	CH4	N/A %	CO2	N/A %	
After Calibration:	CH4	N/A %	CO2	N/A %	
Comments:	None				
GAS USED: 1954 Compressed Gas.		Oxygen (O2) 20.9% Concentration		Nitrogen: Remaining Balance	
Before Calibration:	O2	N/A %			
After Calibration:	O2	N/A %			
Comments:	None				

# SERVICE SHEET

Page No 4

Job No  
Dungarvan



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REPORT ANY FURTHER REPAIRS OR ACTION NEEDED:

DEPARTURE REPORT:

HOURS RUN: 22575	RUN RIG FOR 30 MINUTES BEFORE TAKING READINGS									
CH4	56.1	%	CO2	42.4	%	O2	0.6	%	CO	3.6

INLET VALVE SETTING % OPEN											
NO 1	100%	NO 2	N/A	NO 3	N/A	NO 4	N/A	NO 5	N/A	NO 6	N/A

MAIN CONTROL VALVE SETTING % OPEN								100%			
-----------------------------------	--	--	--	--	--	--	--	------	--	--	--

INLET VACUUM GAUGE READINGS STARTING SIDE NEAREST KNOCKOUT POT										(mbarg)	
NO 1	-14	NO 2	N/A	NO 3	N/A	NO 4	N/A	NO 5	N/A	NO 6	N/A

INLET TEMP	18	°C	INLET VACUUM PRIOR TO KO POT FILTER				-14	MBAR
VACUUM AFTER KO POT FILTER	-14.0	MBAR	VACUUM AFTER INLET FLAME ARRESTER				-15.0	MBAR
OUTLET PRESSURE AFTER GAS BOOSTER	4.5	MBAR	OUTLET GAS TEMP				20	°C
PRESSURE AFTER SLAM SHUT	4.5	MBAR	PRESSURE AFTER OUTLET FLAME ARRESTER				N/A	
OTHER	BLOWER SPEED %					40	%	
DAMPER POSITION	28.4	%	MANOMETER READING				45	m <sup>3</sup> hr
FLOW RATE	39	m <sup>3</sup> hr	FLAME QUALITY				OK	
FLAME TEMP	1021	°C	HAS RIG & COMPOUND BEEN LEFT CLEAN				Yes	

NAMES OF ALL AFS & SUB CONTRACTOR STAFF CARRYING OUT WORK			
Steve Hindle			
REPORT WRITER	Steve Hindle		
SIGNATURE			
DATE	04-10-2017		

## GAS FIELD BALANCING SHEET



<b>Site:</b>	Dungarvan	<b>Total Flare Hrs</b>	22572
<b>Date:</b>	04/10/2017	<b>Flare Operating Hrs</b>	6hrs/day
<b>Name:</b>	Steve Hindle	<b>Flare Temperature °C</b>	1024
<b>Equipment Used :</b>	GA2000	<b>Blower motor setting</b>	40%
<b>Serial No :</b>	GA12884	<b>Flow Arrival m<sup>3</sup>hr</b>	50m <sup>3</sup> hr
<b>Last Calibration Date :</b>	29/09/2016	<b>Flow after balance m<sup>3</sup>hr</b>	45m <sup>3</sup> hr
<b>Calibration Due Date :</b>	29/09/2017	<b>Flow Leaving m<sup>3</sup>hr</b>	45m <sup>3</sup> hr

1	2	3	4	5	6	7	8	9	10	11	12	13	14
ID	Date/Time	CH4 %	CO2 %	O2 %	BALANCE %	RESIDUAL NITROGEN %	CO ppm	H2S ppm	BARO mb	SUCTION PRESSURE mb	COMMENTS	START VALVE POSITION %	FINISH VALVE POSITION %
DV_FLARE	04/10/2017 09:58	50.4	24.4	0.9	24.3	20.9	0	10	1025	-14.73		100	100
DV_GW13	04/10/2017 11:08	0.1	0.1	20.1	79.7	3.72	0	0	1024	0.74	Extraction pipe full of water	0	0
DV_CW06	04/10/2017 11:12	29.8	17.1	7.5	45.6	17.25	0	0	1024	0.38	sample valve broken. fit new	0	0
DV_GW14	04/10/2017 11:13	68.2	27.2	0.2	4.4	3.64	0	93	1024	0.84		0	5
DV_CW08	04/10/2017 11:15	38	23.8	0.2	38	37.24	0	23	1024	-2.03	Control valve seized	10	10
DV_GW11	04/10/2017 11:18	47.7	22.4	0.2	29.7	28.94	0	7	1023	-3.22		10	10
DV_GW12	04/10/2017 11:20	16.4	11.5	10.4	61.7	22.39	9	1	1023	0.82	sample valve broken. fit new	0	0
DV_MAN01	04/10/2017 11:22	60.8	25.9	0.7	12.6	9.95	0	115	1023	-14.6		10	10
DV_GW07	04/10/2017 11:29	70.1	26.2	0.2	3.5	2.74	0	16	1023	0.87		25	50
DV_GW03	04/10/2017 11:31	69.7	23.8	0.3	6.2	5.07	0	48	1023	-1.18		25	50
DV_CW04	04/10/2017 11:33	5.7	5	15.7	73.6	14.25	10	3	1023	0.51	High O2 needs investigating	0	0
DV_GW01	04/10/2017 11:35	37.6	14.2	8	40.2	9.96	6	1	1023	0.43		0	0
DV_CW01	04/10/2017 11:37	58	24.3	0.4	17.3	15.79	0	1	1023	-1.38		25	50
DV_GW08	04/10/2017 11:38	18	9.1	11.3	61.6	18.89	3	1	1023	0.82	High O2 needs investigating	0	0
DV_GW04	04/10/2017 11:39	67.7	23.3	0.3	8.7	7.57	0	18	1023	-1.36		100	100
DV_GW09	04/10/2017 11:41	66.7	28.3	0	5	5	0	20	1023	-1.46		100	100
DV_CW07	04/10/2017 11:43	55.4	25.7	0.1	18.8	18.42	0	7	1023	0.88		10	10
DV_MAN02	04/10/2017 11:46	66.1	25.1	0.2	8.6	7.84	0	21	1023	-1.49		100	100
DV_GW02	04/10/2017 11:55	42.8	24.6	0	32.6	32.6	0	43	1023	-1.91		10	10
DV_CW02	04/10/2017 11:57	60.9	23.6	0.2	15.3	14.54	0	11	1023	-14.71		100	100
DV_GW06	04/10/2017 11:59	25.8	14.2	5.1	54.9	35.62	0	1	1023	0.87	High O2 needs investigating	0	0
DV_CW03	04/10/2017 12:02	67.4	31	0.1	1.5	1.12	4	26	1023	-0.36		10	25
DV_CW05	04/10/2017 12:03	14.4	14.6	7	64	37.54	1	2	1023	0.87	High O2 needs investigating	0	0
DV_GW05	04/10/2017 12:05	48	19.8	2.7	29.5	19.29	2	7	1023	1.05	High O2 needs investigating	0	0
DV_CW09	04/10/2017 12:07	65.3	26.4	0.9	7.4	4	0	1	1023	0.92		10	25
DV_GW10	04/10/2017 12:08	50.3	25.9	1	22.8	19.02	2	10	1023	-13.26		10	10
DV_MAN03	04/10/2017 12:10	53.9	27.1	0.6	18.4	16.13	3	35	1022	-7.19		30	20
DV_END	04/10/2017 13:04	56.6	25.2	0.8	17.4	14.38	1	21	1023	-14.43		100	

to be filled in by licensee      calculated by spreadsheet

**Flare No. 1**

Flare type ? If "other" enter flare description here

Is the flare an open or enclosed flare ? Rated flare capacity ? 250 m3/hr

Month /year comissioned ? 2010

Month decomissioned if decomissioned in 2017 ? Select

What is the function of the flare ? If "other" enter flare function here

Monthly	Method M/C/E	Runtime days/month	Runtime hrs/day	Downtime hrs	Total runtime hrs/month	Average Inlet Pressure (mbg)	Average Inlet Temp ° C	Average Flow Rate (m <sup>3</sup> /hr)	Average CH <sub>4</sub> %v/v	Average CO <sub>2</sub> %v/v	Average O <sub>2</sub> %v/v	Combustion efficiency (%)	Total CH <sub>4</sub> m <sup>3</sup>	Total CH <sub>4</sub> kgs
January	E	30	10.0	14.0	286	-21	10	80	34.40	16.00	3.00	98.0	7,713	5,215
February	E	27	10.0	14.0	256	-21	10	80	34.40	16.00	3.00	98.0	6,904	4,668
March	E	30	10.0	14.0	286	-21	10	80	34.40	16.00	3.00	98.0	7,713	5,215
April	E	29	10.0	14.0	276	-21	10	80	34.40	16.00	3.00	98.0	7,444	5,033
May	E	30	10.0	14.0	286	-21	10	80	34.40	16.00	3.00	98.0	7,713	5,215
June	E	29	10.0	14.0	276	-21	10	80	34.40	16.00	3.00	98.0	7,444	5,033
July	E	30	10.0	14.0	286	-21	10	80	34.40	16.00	3.00	98.0	7,713	5,215
August	E	30	10.0	14.0	286	-21	10	80	34.40	16.00	3.00	98.0	7,713	5,215
September	E	29	10.0	14.0	276	-21	10	80	34.40	16.00	3.00	98.0	7,444	5,033
October	E	30	10.0	14.0	286	-21	10	80	34.40	16.00	3.00	98.0	7,713	5,215
November	E	29	10.0	14.0	276	-21	10	80	34.40	16.00	3.00	98.0	7,444	5,033
December	E	30	10.0	14.0	286	-21	10	80	34.40	16.00	3.00	98.0	7,713	5,215
<b>Total</b>					<b>3,362</b>								<b>90,672</b>	<b>61,307</b>

**Please note: Only fill the "Yearly" table if data is not available or cannot be calculated nor estimated on a monthly basis**

Yearly	Method M/C/E	Runtime days/year	Runtime hrs/day	Downtime hrs	Total runtime hrs/year	Average Inlet Pressure (mbg)	Average Inlet Temp ° C	Average Flow Rate m <sup>3</sup> /hr	Average CH <sub>4</sub> %v/v	Average CO <sub>2</sub> %v/v	Average O <sub>2</sub> %v/v	Combustion efficiency (%)	Total CH <sub>4</sub> m <sup>3</sup>	Total CH <sub>4</sub> kgs
<b>2017</b>					<b>0</b>		10					98.0	<b>0</b>	<b>0</b>

## Appendix J

### Management Structure



**Management Structure of Waterford  
City and County Council**

**CEO** Mr Michael Walsh



**Director of Services**

**Environment, Roads & Water Services** Mr. Fergus Galvin



**Senior Executive Officer** Mr. Raymond Moloney



**Senior Executive Engineer** Niall Kane



**Executive Scientific Officer**

**Executive Engineer**

**Assistant Engineer**

Mr. Paul Carroll

John McKeown

Sean Gormley



**Landfill and Civic Amenity Manager**

Mr. David Regan



**Caretakers**

Mr. Bill O Keeffe, Mr. Pat Earley

**Appendix K**

Pollutant Release Transfer Register

# PRTR Returns Workbook

Version 1.1.19

<b>REFERENCE YEAR</b>	2017
-----------------------	------

## 1. FACILITY IDENTIFICATION

Parent Company Name	Waterford City & County Council
Facility Name	Dungarvan Waste Disposal Site
PRTR Identification Number	W0032
Licence Number	W0032-03

### Classes of Activity

No.	class name
-	Refer to PRTR class activities below

Address 1	Ballynamuck Middle
Address 2	Dungarvan
Address 3	
Address 4	
	Waterford
Country	Ireland
Coordinates of Location	-7.64444 52.104
River Basin District	IESE
NACE Code	3821
Main Economic Activity	Treatment and disposal of non-hazardous waste
<b>AER Returns Contact Name</b>	David Regan
<b>AER Returns Contact Email Address</b>	dregan@waterfordcouncil.ie
<b>AER Returns Contact Position</b>	Executive Technician
<b>AER Returns Contact Telephone Number</b>	058 22112
<b>AER Returns Contact Mobile Phone Number</b>	086 8307065
<b>AER Returns Contact Fax Number</b>	058 45606
<b>Production Volume</b>	0.0
<b>Production Volume Units</b>	
<b>Number of Installations</b>	1
<b>Number of Operating Hours in Year</b>	2184
<b>Number of Employees</b>	3
<b>User Feedback/Comments</b>	50%+/- value in releases to water section is a result of the value being placed in the incorrect row in last years retuen
<b>Web Address</b>	www.waterfordcouncil.ie

## 2. PRTR CLASS ACTIVITIES

Activity Number	Activity Name
50.1	General
50.1	General

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

Is it applicable?	No
Have you been granted an exemption ?	
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**

POLLUTANT		RELEASES TO AIR			Please enter all quantities in this section in KGs			
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

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

**SECTION B : REMAINING PRTR POLLUTANTS**

POLLUTANT		RELEASES TO AIR			Please enter all quantities in this section in KGs			
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
01	Methane (CH4)	E	ESTIMATE	Estimated from Flare data and Landgem Model	90675.0	90675.0	0.0	0.0
03	Carbon dioxide (CO2)	E	ESTIMATE	Estimated from Flare data and Landgem Model	1395000.0	1395000.0	0.0	0.0
07	Non-methane volatile organic compounds (NMVOC)	E	ESTIMATE	Estimated from Flare data and Landgem Model	16500.0	16500.0	0.0	0.0

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

**EMISSIONS (As required in your Licence)**

POLLUTANT		RELEASES TO AIR			Please enter all quantities in this section in KGs			
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

ADD NEW ROW    DELETE ROW \*    \* 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:**

Dungarvan Waste Disposal Site

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)	408000.0	E	OTH	Landgem	N/A
Methane flared	368500.0	E	OTH	Landgem	250.0 (Total Flaring Capacity)
Methane utilised in engine/s	0.0				0.0 (Total Utilising Capacity)
Net methane emission (as reported in Section A above)	90675.0	E	OTH	Landgem	N/A

4.2 RELEASES TO WATERS

[Link to previous years emissions data](#)

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

Data on ambient monitoring of storm/surface water or groundwater, conducted as part of your licence requirements, should NOT be submitted under AER / PRTR

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

ADD NEW ROW | DELETE ROW \* \* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button

SECTION B : REMAINING PRTR POLLUTANTS

POLLUTANT					Please enter all quantities in this section in KGs				
No. Annex II	Name	M/C/E	Method Used		Emission Point 1	QUANTITY			
			Method Code	Designation or Description		T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year	
79	Chlorides (as Cl)	E	ESTIMATE			0.0	0.0	0.0	0.0
71	Phenols (as total C)	E	ESTIMATE			0.0	0.0	0.0	0.0

ADD NEW ROW | DELETE ROW \* \* 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)

POLLUTANT					Please enter all quantities in this section in KGs				
Pollutant No.	Name	M/C/E	Method Used		Emission Point 1	QUANTITY			
			Method Code	Designation or Description		T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year	
372	Nitrite (as N)	E	ESTIMATE			0.0	0.0	0.0	0.0
351	Total Organic Carbon (as C)	E	ESTIMATE			0.0	0.0	0.0	0.0
306	COD	E	ESTIMATE			610.0	610.0	0.0	0.0
303	BOD	E	ESTIMATE			55.0	55.0	0.0	0.0
240	Suspended Solids	E	ESTIMATE			75.0	75.0	0.0	0.0
363	Total Dissolved Solids	E	ESTIMATE			0.0	0.0	0.0	0.0
374	Boron	E	ESTIMATE			0.0	0.0	0.0	0.0
305	Calcium	E	ESTIMATE			0.0	0.0	0.0	0.0
357	Iron	E	ESTIMATE			0.0	0.0	0.0	0.0
320	Magnesium	E	ESTIMATE			0.0	0.0	0.0	0.0
321	Manganese (as Mn)	E	ESTIMATE			0.0	0.0	0.0	0.0
338	Potassium	E	ESTIMATE			0.0	0.0	0.0	0.0
341	Sodium	E	ESTIMATE			0.0	0.0	0.0	0.0
355	Aluminium	E	ESTIMATE			0.0	0.0	0.0	0.0
354	Silver	E	ESTIMATE			0.0	0.0	0.0	0.0
343	Sulphate	E	ESTIMATE			0.0	0.0	0.0	0.0
387	Ortho-phosphate (as P)	E	ESTIMATE			22.0	22.0	0.0	0.0
238	Ammonia (as N)	E	ESTIMATE			60.0	60.0	0.0	0.0

5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE

PRTR : W0032 | Facility Name : Dungarvan Waste Disposal Site | Filename : Dungarvan PRTR W0032\_2017.xlsm | Return Year : 2017

29/06/2018 16:31

Please enter all quantities on this sheet in Tonnes

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Transfer Destination	European Waste Code	Hazardous	Quantity (Tonnes per Year)	Description of Waste	Waste Treatment Operation	Method Used		Location of Treatment	Haz Waste : Name and Licence/Permit No of Next Destination Facility Non Haz Waste: Name and Licence/Permit No of Recover/Disposer	Haz Waste : Address of Next Destination Facility Non Haz Waste: Address of Recover/Disposer	Name and License / Permit No. and Address of Final Recoverer / Disposer (HAZARDOUS WASTE ONLY)	Actual Address of Final Destination i.e. Final Recovery / Disposal Site (HAZARDOUS WASTE ONLY)
						M/C/E	Method Used					
Within the Country	02 03 99	No	380.67	wastes not otherwise specified (Organic and Garden Waste)	R3	M	Weighed	Offsite in Ireland	O Toole Composting Ltd,W0284-01	Ballintrane,Fenagh,Co. Carlow,..Ireland		
Within the Country	08 01 21	Yes	9.54	waste paint or varnish remover	D5	M	Weighed	Offsite in Ireland	ENVA Ireland,WCP/KK/059(A)06	Clonmanim Industrial Estate,Portlaoise,Co. Laois,..Ireland	ENVA Ireland,WCP/KK/059(A)06 Clonmanim Industrial Estate,Portlaoise,Co. Laois,..Ireland	Clonmanim Industrial Estate,Portlaoise,Co. Laois,..Ireland
Within the Country	13 02 06	Yes	2.24	synthetic engine, gear and lubricating oils	R1	M	Weighed	Offsite in Ireland	ENVA Ireland,WCP/KK/059(A)06	Clonmanim Industrial Estate,Portlaoise,Co. Laois,..Ireland	ENVA Ireland,WCP/KK/059(A)06 Clonmanim Industrial Estate,Portlaoise,Co. Laois,..Ireland	Clonmanim Industrial Estate,Portlaoise,Co. Laois,..Ireland
Within the Country	20 01 01	No	165.5	paper and cardboard	R3	M	Weighed	Offsite in Ireland	Waterford Co. Council,W189-01	Shandon,Dungarvan,Co. Waterford,..Ireland		
Within the Country	15 01 07	No	36.42	glass packaging	R5	M	Weighed	Offsite in Ireland	Rehab Recycling Ltd,Reg no. 635 Permit No. 03/07	Road,Cork,..Ireland		
To Other Countries	16 02 11	Yes	27.906	discarded equipment containing chlorofluorocarbons, HCFC, HFC - FRIDGES	R4	M	Weighed	Abroad	KMK Metals Recycling,WCP/KK/069(A)/06	Road,Tullamore,Co. Offaly,Ireland	Varies,Varies,Varies,Contact Laurence Kieran WEEE Ireland,EPA Auditor Dermot Burke,..Ireland	Varies,Contact Laurence Kieran WEEE Ireland,EPA Auditor Dermot Burke,..Ireland
To Other Countries	16 02 11	Yes	0.985	discarded equipment containing hazardous components (16) other than those mentioned in 16 02 09 to 16 02 12 - Large	R4	M	Weighed	Abroad	KMK Metals Recycling,WCP/KK/069(A)/06	Road,Tullamore,Co. Offaly,Ireland	Varies,Varies,Varies,Contact Laurence Kieran WEEE Ireland,EPA Auditor Dermot Burke,..Ireland	Varies,Contact Laurence Kieran WEEE Ireland,EPA Auditor Dermot Burke,..Ireland
To Other Countries	16 02 13	Yes	61.123	discarded equipment containing hazardous components (16) other than those mentioned in 16 02 09 to 16 02 12 - TV	R4	M	Weighed	Abroad	KMK Metals Recycling,WCP/KK/069(A)/06	Road,Tullamore,Co. Offaly,Ireland	Varies,Varies,Varies,Contact Laurence Kieran WEEE Ireland,EPA Auditor Dermot Burke,..Ireland	Varies,Contact Laurence Kieran WEEE Ireland,EPA Auditor Dermot Burke,..Ireland
To Other Countries	16 02 13	Yes	38.166	discarded equipment containing hazardous components (16) other than those mentioned in 16 02 09 to 16 02 12 - Small	R4	M	Weighed	Abroad	KMK Metals Recycling,WCP/KK/069(A)/06	Road,Tullamore,Co. Offaly,Ireland	Varies,Varies,Varies,Contact Laurence Kieran WEEE Ireland,EPA Auditor Dermot Burke,..Ireland	Varies,Contact Laurence Kieran WEEE Ireland,EPA Auditor Dermot Burke,..Ireland
To Other Countries	16 02 13	Yes	69.909	discarded equipment containing hazardous components (16) other than those mentioned in 16 02 09 to 16 02 12 - Large	R4	M	Weighed	Abroad	KMK Metals Recycling,WCP/KK/069(A)/06	Road,Tullamore,Co. Offaly,Ireland	Varies,Varies,Varies,Contact Laurence Kieran WEEE Ireland,EPA Auditor Dermot Burke,..Ireland	Varies,Contact Laurence Kieran WEEE Ireland,EPA Auditor Dermot Burke,..Ireland
Within the Country	16 06 01	Yes	5.06	lead batteries	D5	M	Weighed	Offsite in Ireland	ENVA Ireland,WCP/KK/059(A)06	Clonmanim Industrial Estate,Portlaoise,Co. Laois,..Ireland	ENVA Ireland,WCP/KK/059(A)06 Clonmanim Industrial Estate,Portlaoise,Co. Laois,..Ireland	Clonmanim Industrial Estate,Portlaoise,Co. Laois,..Ireland
Within the Country	17 05 04	No	68.34	soil and stones other than those mentioned in 17 05 03 - Rubble	R3	M	Weighed	Offsite in Ireland	Greenstar Ltd,WCP-KK-11-54-02	Park,Ballylogan Industrial Road,Dublin 13,..Ireland		
Within the Country	17 05 04	No	0.0	soil and stones other than those mentioned in 17 05 03 - Clay	R3	M	Weighed	Offsite in Ireland	Greenstar Ltd,WCP-KK-11-54-02	Unit 6 Ballylogan Industrial Park,Ballylogan Road,Dublin 13,..Ireland		
<b>Within the Country</b>	<b>20 01 02</b>	<b>No</b>	<b>29.1</b>	<b>glass</b>	<b>R5</b>	<b>M</b>	<b>Weighed</b>	<b>Offsite in Ireland</b>	<b>Greenstar Ltd,WCP-KK-11-54-02</b>	<b>Park,Ballylogan Industrial Road,Dublin 13,..Ireland</b>		
Within the Country	20 01 10	No	4.62	clothes	R5	M	Weighed	Offsite in Ireland	Eco Environmental,Unknown	Mill River Business Park,Carrick on Suir,County Tipperary,Ireland		
Within the Country	20 01 38	No	218.14	wood other than that mentioned in 20 01 37	R3	M	Weighed	Offsite in Ireland	Greenstar Ltd,WCP-KK-11-54-02	Park,Ballylogan Industrial Road,Dublin 13,..Ireland		
To Other Countries	20 01 39	No	18.44	plastics	R5	M	Weighed	Abroad	Eco Sky,Unknown	Unit A/2 Varis Business Park,Challenge Way,Blackburn,BB1 5QB,United Kingdom		
Within the Country	20 01 40	No	43.1	metals	R5	M	Weighed	Offsite in Ireland	Greenstar Ltd,WCP-KK-11-54-02	Park,Ballylogan Industrial Road,Dublin 13,..Ireland		
Within the Country	20 02 03	No	33.08	Mattresses	D1	M	Weighed	Offsite in Ireland	Bord na Mona Ltd,W0201-01	Drehid Landfill,Kilnagh Upper,Carbury,Co. Kildare,Ireland		
Within the Country	20 03 01	No	1787.76	mixed municipal waste	D1	M	Weighed	Offsite in Ireland	Bord na Mona Ltd,W0201-01	Drehid Landfill,Kilnagh Upper,Carbury,Co. Kildare,Ireland		
Within the Country	20 03 03	No	304.88	street-cleaning residues	D1	M	Weighed	Offsite in Ireland	Bord na Mona Ltd,W0201-01	Drehid Landfill,Kilnagh Upper,Carbury,Co. Kildare,Ireland		
Within the Country	20 03 07	No	245.58	bulky waste	D1	M	Weighed	Offsite in Ireland	Bord na Mona Ltd,W0201-01	Drehid Landfill,Kilnagh Upper,Carbury,Co. Kildare,Ireland		



**Dungarvan Civic Amenity Site  
Surface Water Biological Monitoring**

*Prepared for Jim McGarry  
by:*

*Pascal Sweeney,  
Sweeney Consultancy,*

*Rahan,*

*Mallow,*

*Co. Cork.*

August 2017



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## **1. INTRODUCTION**

Sweeney Consultancy was commissioned by Jim McGarry carry out biological assessments of surface waters adjacent to Dungarvan Civic Amenity Site. The site is located in the townland of Ballinamuck Middle, on the southern bank of the estuary of the River Colligan (see Location Map, Appendix 1). This estuary is included in the Dungarvan Harbour Special Protection Area (SPA 004032), designated for the protection of 15 species of wetland birds, under the EU Birds Directive (2009/147/EC). The purpose of the present report is to establish whether there is any discernible difference between the upstream and downstream invertebrate fauna in the estuary that might indicate a negative impact arising from the Civic Amenity Site. The data collected can serve as a baseline for future surveys.

## **2. METHODOLOGY**

### **2.1 Sampling Sites**

Two sampling sites were specified (see Appendix 2) for biological water quality assessment.

Grid references of these sites, recorded by GPS handset are:

Site 1 (upstream of the facility): X24546 94694

Site 2 (downstream of the facility): X24840 94641

Photographs of the sites are presented in Appendix 2.

### **2.2 Assessment Procedures**

As there are no established methodologies for the assessment of biological water quality of Irish estuaries similar to the Q-scheme method that is applied to the invertebrate fauna of Irish rivers, full identification and direct comparison of the fauna at the two sites was undertaken.

Field work was carried out on August 29<sup>th</sup>, 2017. At each sampling site, a general assessment of the relevant physical conditions was made prior to macroinvertebrate sampling. Physical conditions recorded are presented in Appendix 3. A dredge sample was taken, using an extension-handled net with an angled head. Samples were sieved and hand-sorted in a white tray for 30 minutes. Invertebrates were preserved in alcohol and identified under dissecting and compound microscopes, using the identification guides listed in Appendix 4.

### 3. RESULTS

#### 3.1 Physical Data

The physical data recorded at each site are presented in Table 1.

**TABLE 1: Physical Data**

	<b>Site 1</b>	<b>Site 2</b>
<b>Watercourse</b>	Colligan Estuary	Colligan Estuary
<b>Grid Ref.</b>	X24546 94694	X24840 94641
<b>Location description</b>	Upstream of surface discharge pipe	Downstream of road bridge, right hand side.
<b>Sampling Depth (m.)</b>	1.2	0.3
<b>Substrate (in order of occurrence)</b>	Silt Gravel Plant debris	Gravel Silt Cobble

#### 3.2 Biological Data

Plants recorded are presented in Table 2 and invertebrates recorded are presented in Table 3.

Abundance for both plants and invertebrates is expressed using the SACFOR scale:

Super-abundant (S): >80%

Abundant (A): 40-79%

Common (C): 20-39%

Frequent (F): 10-19%

Occasional (O): 5-9%

Rare (R): <5%

**TABLE 2: Plants**

TAXON	Site 1	Site 2
<i>Ulva intestinalis</i>	R	O
<i>Fucus spiralis</i>	F	A

**TABLE 3: Macroinvertebrates**

TAXON	Site 1	Site 2
<i>Heterochaeta costata</i>	R	
<i>Paranais litoralis</i>	O	O
<i>Tubificoides benedii</i>	O	R
<i>Carcinus maenas</i>		R
<i>Crangon crangon</i>	A	S
<i>Gammarus locusta</i>	R	R
<i>Sphaeroma serratum</i>	R	R
<i>Chironomus sp. salinarius type</i>	R	
<i>Orthocladus sp</i>	R	
<i>Enochrus bicolor</i>	R	

**Assessment of Biological Data Collected.**

The biota recorded at the two sampling sites is fairly typical of Irish estuaries.

The differences in the relative abundances of the plants between the two sites can be attributed to the depth of water and the more suitable substrate for attachment of seaweeds at Site 2.

The macroinvertebrate fauna at both sites is dominated by the brown shrimp, *Crangon crangon*, with very high densities found at Site 2. Three other typical estuarine crustaceans, *Gammarus locusta*, *Sphaeroma serratum* and the shore crab *Carcinus maenas*, were found in low numbers.

The three oligochaete species, *Heterochaeta costata*, *Paranais litoralis* and *Tubificoides benedii*, found in low numbers are typical of brackish water habitats.

Chironomid larvae can generally not be identified with certainty further than genus. Sixteen species of the genus *Chironomus* have been identified from adult specimens collected in Ireland (Ashe, O'Connor & Murray, 1998), one of which is *Chironomus salinarius*. Larval chironomid specimens from Site 1 conform to the description of *Chironomus sp. salinarius type* as given by Orendt, Dettinger-Klemm & Spies (2012). A few specimens of the genus *Orthocladius* were also found at Site 1. Fifteen species of this genus, some of which are tolerant of slightly saline conditions, are known from Ireland (Ashe, O'Connor & Murray, 1998).

A single specimen of the beetle *Enochrus bicolor* was found at Site 1. This species typically occurs in brackish waters (Friday, 1988).

Any differences in the fauna of the two sampling sites can be attributed to a slight increase in salinity, going down the estuary.

#### 4. CONCLUSIONS

The biological data collected upstream and downstream of the Dungarvan Civic Amenity Site indicates that the facility is currently not causing any deterioration in the biological quality of surface waters in the estuary of the River Colligan.

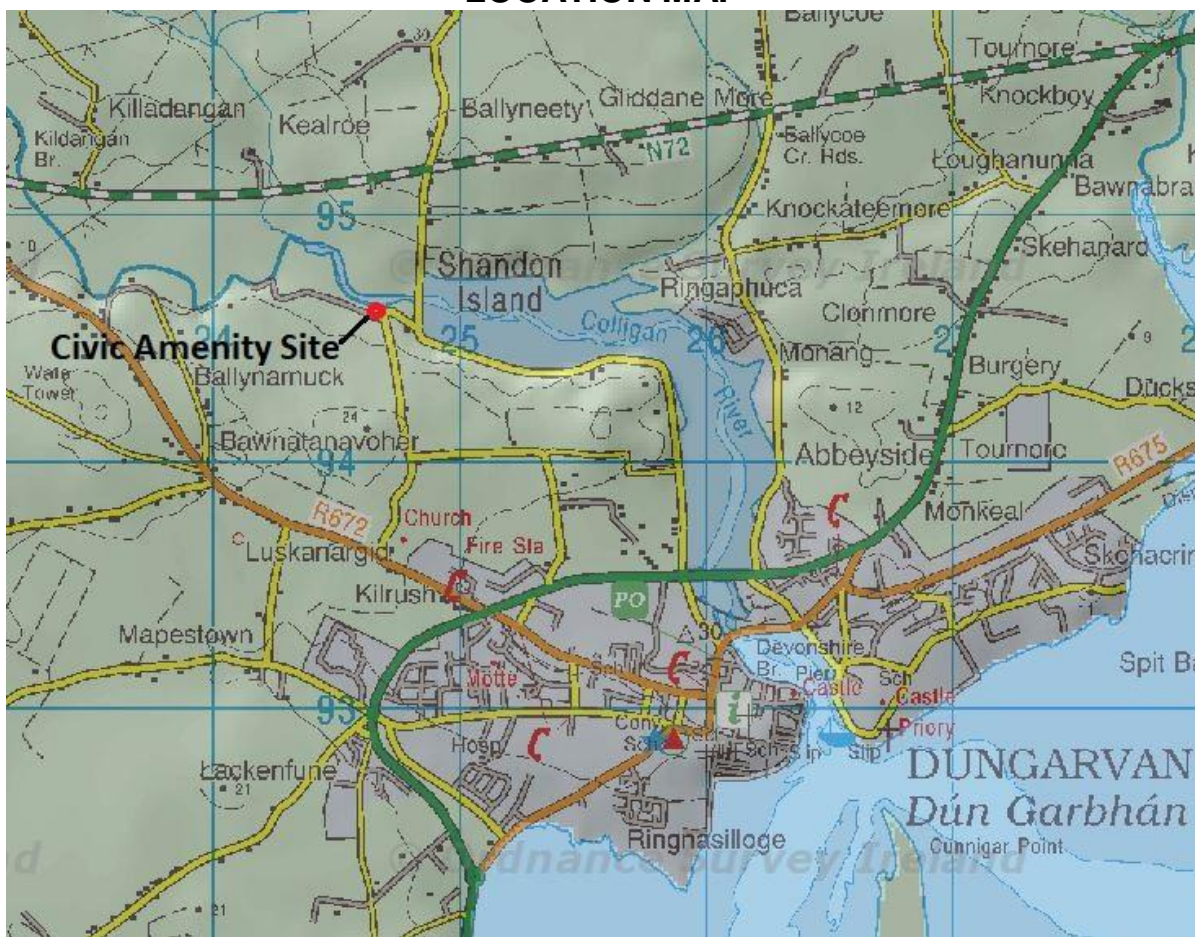
Signed on behalf of Sweeney Consultancy



Pascal Sweeney B.Sc., M.Sc. MCIEEM

12<sup>th</sup> September, 2017

### APPENDIX 1 LOCATION MAP



## APPENDIX 2 SAMPLING SITES





### APPENDIX 3 PHOTOGRAPHS OF SAMPLING SITES

**Photo 1: Site 1**



**Photo 2: Site 2**



## APPENDIX 4 REFERENCES

- Ashe, P., O'Connor, J.P. & Murray, D. (1998). A checklist of Irish aquatic insects. Occasional Publication of the Irish Biogeographical Society No. 3.
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