WATERFORD COUNTY COUNCIL

COMHAIRLE CHONTAE PHORTLAIRGE

ANNUAL ENVIRONMENTAL REPORT 2012

DUNGARVAN WASTE DISPOSAL SITE

BALLYNAMUCK MIDDLE

DUNGARVAN CO. WATERFORD

Waste Licence Register No. W0032-2

Report Compiled by;
Mr David Regan, Facility Manager, Dungarvan Landfill
Mr Paul Carroll, Executive Scientific Officer, Adamstown Laboratory

Table of Contents

List of Appendices

Introduction

Waterford County Council was granted a Waste Licence (Ref 32-1) by the Environmental Protection Agency on the 29th 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 30th 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 application is currently being assessed by the Agency. This is the tenth Annual Environmental Report for the Facility and includes the monitoring period 1st January 2012 – 31st December 2012. The report has been prepared in accordance with Condition 11.7 and Schedule G of the Waste Licence.

1. Reporting Period

This is the ninth Annual Environmental Report for the Dungarvan Waste Disposal Site, which covers the period 1st January 2012 to 31st December 2012.

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 a lined leachate lagoon 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 1st January 2012 – 31st December 2012 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 30th June 2003, but still acts as a transfer station for recyclable material.

Monitoring of surface waters, groundwater's and leachate and landfill gas was carried out in accordance with the waste licence 32-2. EPA and Waterford County Council staff carried out sampling and field measurements. Analysis was carried out at EPA and Waterford County Council Laboratories. The macroinvertebrate survey was carried out by Waterford County Council Adamstown Laboratory Staff.

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
SW1*, SW2*, EPA station 280, EPA station 300 Also - Annual biological survey	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 this 2012 study.

5.1 SURFACE WATER.

5.1.1 Introduction

Sampling was carried out by EPA and Waterford County Council personnel at sites SW1, SW2, EPA site 300, EPA Site 280 and the landfill lagoon, as per attached map. Analysis was carried out at EPA Laboratories in Kilkenny and Dublin.

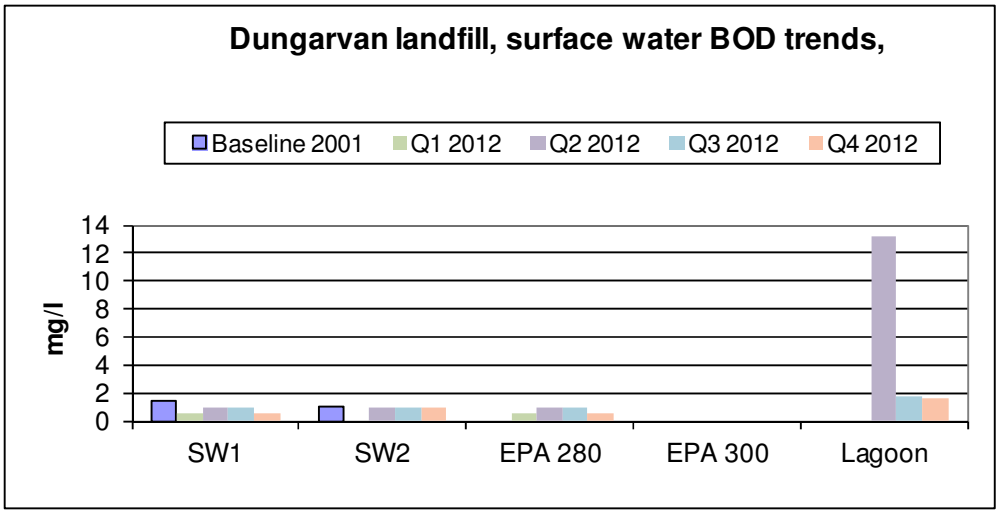
Sampling site EPA 300, at Ballyneety Bridge downstream of the landfill site, is subject to saline intrusion from Dungarvan Estuary. There are difficulties involved in monitoring surface water pollution from landfills adjacent to estuaries, as the salinity of the samples can interfere with many of the 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.



Discussion

BOD levels were low at river sites and in the lagoon throughout the year. Other water quality tests were also satisfactory.

Table 5.1.1 Dungarvan landfill surface water monitoring Q1 2012

Dungarvan surface waters sampled by EPA 20/3/12	Units	SW280	SW1	Water quality standards (Surface water regs 2009)	Comment	Environmental significance
Temperature	℃	9.8	9.8		Normal range	None
Dissolved Oxygen (as %Sat)	% Saturation	111	112	80-120% (95%ile)	Satisfactory	None
Chemical Oxygen Demand	mg/l O2	<20	<20		Satisfactory	None
Biological Oxygen Demand	mg/l O2	<1	<1		Satisfactory	
Suspended Solids	mg/l	<5	<5		Satisfactory	None
Comments:	SW300 no sample - tide out					

Table 5.1.2 Surface water quality Dungarvan landfill Q2 2012

EntityName	Dungarvan	Dungarvan	Dungarvan	Dungarvan	Comment	Environmental significance
StationName	Lagoon	SW1	SW2	SW280		
SamplePurpose	Landfill SW quarterly	Landfill SW quarterly	Landfill SW quarterly	Landfill SW quarterly		
SampleDate	18/06/2012	18/06/2012	18/06/2012	18/06/2012		
BOD	13.2	BLD	BLD	BLD	Slightly elevated in lagoon, likely due to algal activity	None
Fats, Oils and Greases	none visible	none visible	none visible	none visible		
Suspended Solids	13	BLD	BLD	BLD	Slightly elevated in lagoon, likely due to algal activity	None

Table 5.1.3 Surface water quality Dungarvan landfill Q3 2012

StationName	SampleDa	BO	Chemical Oxygen Deman	Dissolved Oxygen % Saturation	Suspended Soli	Temperatu	Comment	Environmental significance
Lagoon	06/09/2012	1.7	57	27	BLD	15.6	COD slightly elevated, BOD normal	None given normal BOD level
SW1	06/09/2012	BLD	22	116	BLD	12.9	None	None
SW2	06/09/2012	BLD	136	116	BLD	12.9	None	None
SW280	06/09/2012	BLD	47	118	BLD	12.7	None	None

Table 5.1.4 Dungarvan landfill surface water monitoring Q4 2012

EntityName	Dungarvan	Dungarvan	Dungarvan	Dungarvan	Comment	Environmental Significance
StationName	Lagoon	SW1	SW2	SW280		
SampleDate	10/12/2012	10/12/2012	10/12/2012	10/12/2012		
BOD	1.6	BLD	1	BLD	Low levels	None
Chemical Oxygen Demand	31	BLD	BLD	BLD	Low levels	None
Dissolved Oxygen % Saturation	70	99	99	98	Slightly low in lagoon, normal in river	None
Suspended Solids	BLD	BLD	BLD	BLD	Low levels	None
Temperature	3.7	6	6	5.9	Normal range	none

5.2 Groundwater

5.2.1 INTRODUCTION

Sites GW1, GW2a, RC3a, RC4, RC6a, RC7 and RC8 were sampled during 2012. RC1 is no longer in place.

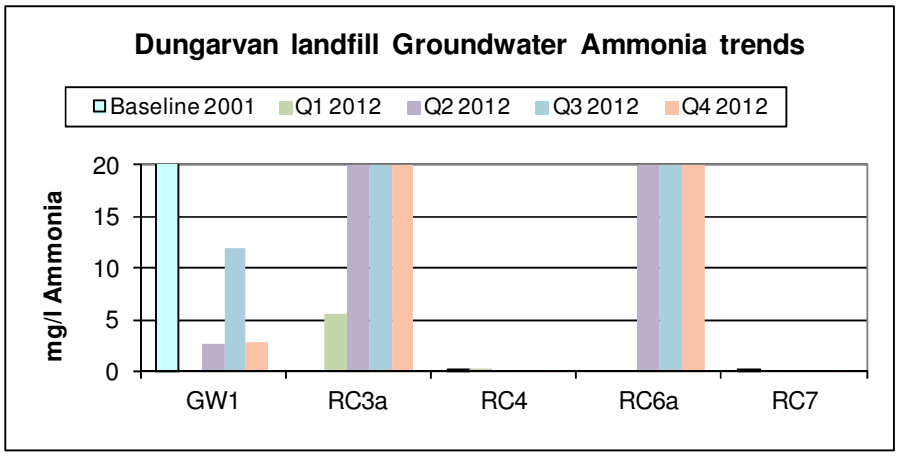
RC4 (south west of site) and RC7 (east of site) are outside the waste deposit area.

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 2012 are presented on tables 5.2.1 to 5.2.4 below, and appendices. High ammonia levels were detected at sites GW1, RC3a, and RC6a, within the landfill site. Metals levels were generally low, although high iron levels were detected at GW1, RC3 and RC7. Trace organics were not detected in groundwaters. Intermittently high conductivity levels detected at site RC7, outside the landfill boundary indicate likely saline intrusion from the estuary.

Key Parameter – Ammonia



5.2.3 DISCUSSION

Ammonia was elevated at sites GW1, RC3a and RC6a. RC4 and RC7, outside the landfill area, had relatively low *ammonia*. RC7 had a high ionic content at times, possibly indicating brackish water intrusion.

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 iron levels were elevated at times and saline intrusion was evident.

Table 5.2.1 Dungarvan landfill groundwater monitoring Q1 2012

Sampled 20/3/12 EPA	Units	RC4	RC3a	GW1	RC8	RC6a	RC7	Warning Level Groundwater threshold values (GTV) or Interim guideline Value (IGV)	Comment	Environmental significance
Temperature	℃	11.2	11.9						Normal range	None
Dissolved Oxygen (as %Sat)	% Saturation	55	23						Low levels at RC3a indicative of reducing conditions	None
pH	pH	nm	7.1						Normal range	None
Conductivity @25℃	µS/cm	653	1586					800	Elevated levels	None
Ammonia	mg/l N	0.33	5.6					0.175	Elevated RC3a and slightly elevated RC4. suspected source is landfill leachate.	Significant impact unlikely given dilution available in receiving waters
Chloride	mg/l Cl	27	143					24	Elevated levels RC3a, suspected source landfill leachate	Significant impact unlikely given dilution available in receiving waters
ortho-Phosphate (as P)	mg/l P	0.01	0.01					0.035	Low levels	None
Total Oxidised Nitrogen (as N)	mg/l N	11.05	0.2					8.48	Elevated at RC4 relative to GTV, source not determined	none
Alkalinity-total (as CaCO3)	mg/l CaCO3	237	584						Moderate levels	None
Fluoride	mg/l F	<0.25	0.66						Moderate levels	None
Sulphate	mg/l SO4	20	38					187.5	low levels	None
1,2-Dichloroethane	µg/l	<0.5	<0.5					2.25	low levels	None
Benzene	µg/l	<0.5	<0.5					0.75	low levels	None
Bromoform	µg/l	<0.5	<0.5					75	low levels	None
Chloroform	µg/l	<0.5	<0.5					75	low levels	None
Tetrachloroethene	µg/l	<0.5	<0.5					7.5	low levels	None
Vinyl Chloride	µg/l	<0.5	<0.5					0.375	low levels	None
Aluminium	ug/l	<25	130					150	low levels	None
Antimony	ug/l	0.7	0.8						low levels	None
Arsenic	ug/l	3.1	22					7.5	Slightly elevated RC3a, possible saline interference in test	None
Barium	ug/l	70	1100						Moderate levels	None
Beryllium	ug/l	<0.5	<0.5						low levels	None
Boron	ug/l	nm	nm					750	not tested	None
Cadmium	ug/l	<0.5	<0.5					3.75	low levels	None
Calcium	mg/l	65	62						Moderate levels	None
Chromium	ug/l	2.1	8					37.5	low levels	None
Cobalt	ug/l	0.7	4.7						low levels	None
Copper	ug/l	<0.5	1.6					1500	low levels	None
Iron	ug/l	1900	4700					200	Elevated RC3a, likely due to landfill leachate	Significant impact unlikely given dilution available in receiving waters
Lead	ug/l	2.2	0.7					18.75	low levels	None
Magnesium	mg/l	11	19						low levels	None
Manganese	ug/l	190	1300					50	Elevated RC3a, likely due to landfill leachate	Significant impact unlikely given dilution available in receiving waters
Mercury	ug/l	<0.5	<0.5					0.75	low levels	None
Molybdenum	ug/l	<0.5	3.2						low levels	None
Nickel	ug/l	2.4	28					15	Somewhat elevated RC3a	Significant impact unlikely given dilution available in receiving waters
Potassium	mg/l	<0.5	29						Moderate levels RC3a	None
Selenium	ug/l	1.4	3.3						low levels	None
Sodium	mg/l	12	110					150	Moderate levels RC3a	None
Thallium	ug/l	<0.5	<0.5						low levels	None
Tin	ug/l	nm	nm						low levels	None
Uranium	ug/l	0.6	1.5						low levels	None
Vanadium	ug/l	2.2	1.2						low levels	None
Zinc	ug/l	63	97						moderate levels	None
Comments:	RC8 no tubing									

Table 5.2.2. Groundwater quality Dungarvan landfill Q2 2012

EntityName	Dungarvan	Dungarvan	Dungarvan	Dungarvan	Dungarvan	Groundwater quality standards S.I. No. 9 of 2010	Comment	Environmental significance
StationName	GW1	RC3a	RC4	RC6a	RC7			
SampleDate	18/06/2012	18/06/2012	18/06/2012	18/06/2012	18/06/2012			
Ammonia(mg/l N)	2.7	54	0.07	26	0.03	0.175	Elevated levels at RC3a and RC6a, likely due to landfill leachate	None, given dilution available
Chloride mg/l	18	115	27	122	790	24	Elevated at RC3a, RC6a and RC7. Likely due to landfill at RC3a and RC6a and brackish water ingress at RC7.	None, given available dilution and estuarine nature of receiving environment.
Conductivity @ 25°C	1018	1565	659	1316	3110	800	As for chloride	As for chloride
Iron ug/l	6300	3000	890	10000	620	200	Elevated at GW1, RC3a, RC6a, likely due to landfill	None, given dilution available
pH	6.5	6.8	7.3	6.9	7.3		Normal range	None
Temperature	12.4	12.8	11.6	12.3	12.5		Normal range	None
Total Oxidised Nitrogen mg/l N	BLD	BLD	11.29	9.85	1.29	8.48	Slightly elevated at RC4 and RC6a	None, given dilution available

Denotes results in exceedance of groundwater quality standard SI 9, 2010

Denotes exceedance of action limit of mean + twice standard deviation

Table 5.2.3. Groundwater quality Dungarvan landfill Q3 2012

StationName	GW1	RC3a	RC4	RC6a	RC7	Groundwater quality standards S.I. No. 9 of 2010	Comment	Environmental significance
SampleDate	06/09/2012	06/09/2012	06/09/2012	06/09/2012	06/09/2012			
Ammonia(N)	12	48	BLD	27	0.01	0.175	Elevated levels at GW1, RC3a and RC6a, likely due to landfill leachate	None, given dilution available
Chloride	43	101	32	105	533	24	Elevated at RC3a, RC6a and RC7. Likely due to landfill at RC3a and RC6a and brackish water ingress at RC7.	None, given available dilution and estuarine nature of receiving environment.
Conductivity @ 25°C	1175	1496	694	1260	NT	800	As for chloride	As for chloride
Dissolved Oxygen % Saturation	14	19	56	25	64			
Iron	34000	3100	520	3500	6500	200	Elevated at GW1, RC3a, RC6a, likely due to landfill	None, given dilution available
pH	6.5	6.9	7.1	7.1	7.4		Normal range	None
Temperature	14.2	13.6	12	13.1	13.5		Normal range	None
Total Oxidised Nitrogen	BLD	1.32	15.74	11.79	1.18	8.48	Slightly elevated at RC4 and RC6a	None, given dilution available

Denotes result in exceedance of GW standard SI No 9, 2010

Result in exceedance of threshold level of mean + twice standard deviation

Table 5.2.4 Dungarvan landfill groundwater monitoring Q4 2012

StationName	GW1	RC3a	RC4	RC6a	RC7	Groundwater quality standards S.I. No. 9 of 2010	Comment	Environmental significance
SampleDate	10/12/2012	10/12/2012	10/12/2012	10/12/2012	10/12/2012			
Ammonia(N)	2.8	47	0.02	24	0.02	0.175	Elevated levels at GW1, RC3a and RC6a, likely due to landfill leachate	None, given dilution available
Chloride	14	102	30	95	684	24	Elevated at RC3a, RC6a and RC7. Likely due to landfill at RC3a and RC6a and brackish water	None, given available dilution and estuarine nature of receiving environment.
Conductivity @ 25℃	936	1517	685	1212	2810	800	As for chloride	As for chloride
Dissolved Oxygen % Saturation	38	22	50	31	20			
Faecal Coliforms	NT	NT	NT	NT	NT			
Iron	17000	3700	640	990	3500	200	Elevated at GW1, RC3a, RC6a, RC7	None, given dilution available
pH	6.8	6.9	7.5	7.1	7		Normal range	None
Phenols	NT	NT	NT	NT	NT		Normal range	None
Potassium	2.6	33	BLD	19	20			
Salinity	NT	NT	NT	NT	1.3			
Sodium	10	76	12	49	290			
Temperature	11.5	11.6	10.4	10.9	11.5			
Total Oxidised Nitrogen	BLD	0.29	15.12	13.26	1.31	8.48	Slightly elevated at RC4 and RC6a	None, given dilution available

5.3 LEACHATE

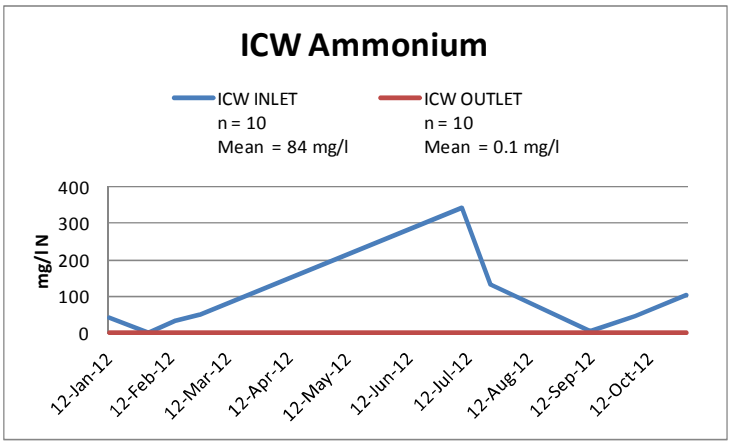
5.3.1 INTRODUCTION

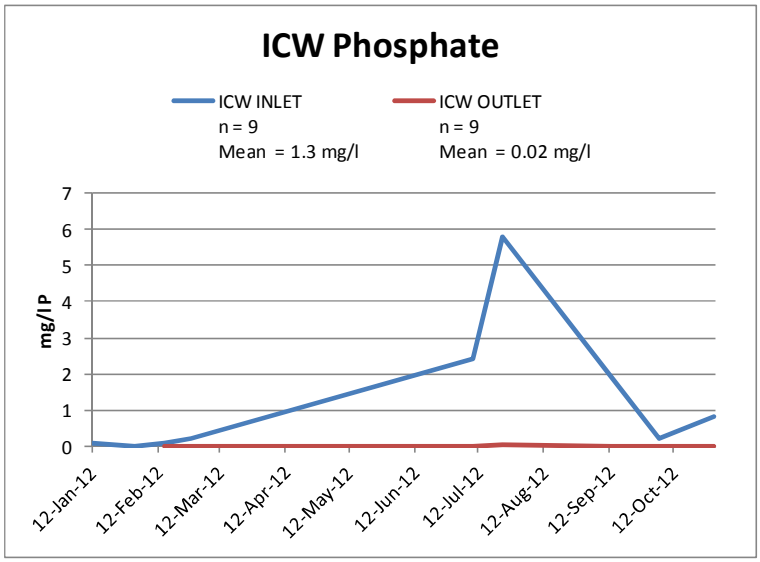
The leachate holding tank was sampled during 2012. Sampling from individual leachate boreholes was restricted due to access difficulties due to capping and landfill remediation works.

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 m2. 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/m2/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, phosphate 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 m2	5158
Total working wetland volume m3	1032
HYDRAULIC FLOWS	
Influent Volume m3 per Day	26.9 (50)
Hydraulic loading l/m2/day	5.2 (12)
Ammoniacal Nitrogen loading (g/m2/day)	0.5
Total Phosphorous loading (g/m2/day)	0.003
COD loading (g/m2/day)	0.6
Metals mg/m2/day	<0.1





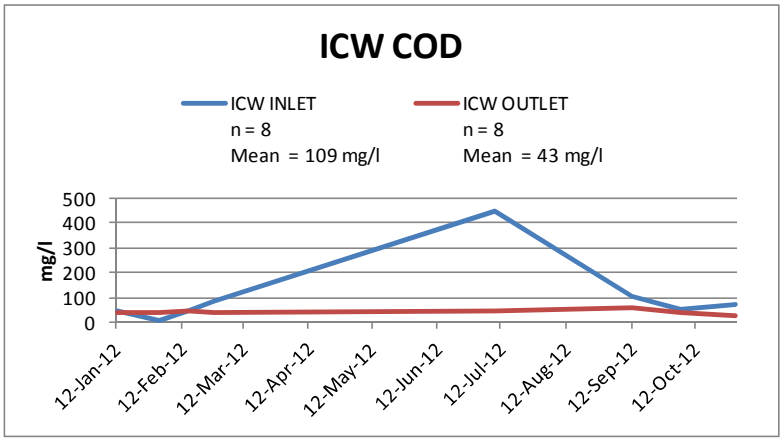


Figure 5.3.1: ICW inlet / outlet concentrations a) ammonium, b) phosphate and c) chemical oxygen demand.

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.

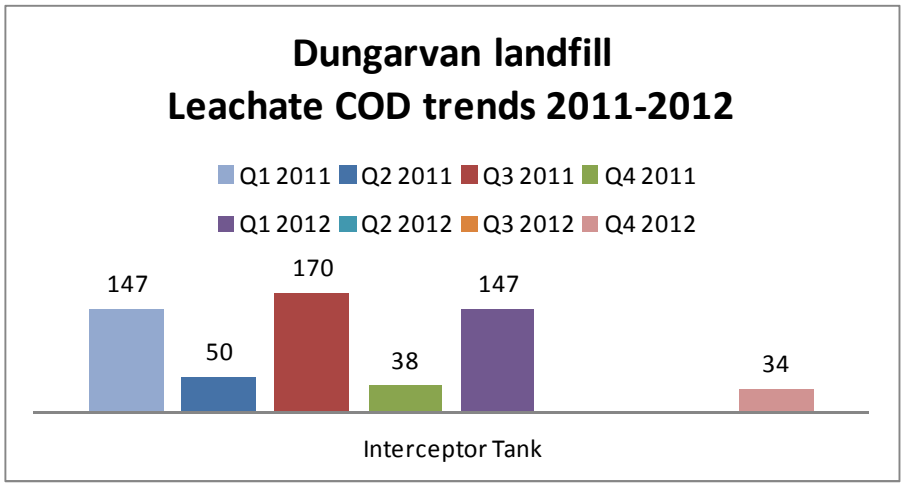


Figure 5.3.2 Leachate COD trends 2011 – 2012

DISCUSSION

The strength of leachate present in the holding/interceptor tank was quite low, with an average COD value of 100 mg/l, compared to typical landfill leachate. The 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 0.02 to 1.8 mg/l, with an average of 0.1 mg/l and were below the proposed discharge licence limit of 5 mg/l. Similarly, phosphate and COD values were low for the ICW outlet.

Table 5.3.3 Leachate quality Dungarvan landfill, Q1 2012

Dungarvan leachate sampled by EPA 14/3/11

Parameters	Units	Leachate interceptor tank	Typical leachate analysis (EPA 1997)	Comment	Environmental significance
Temperature	℃	8		Normal range	None
pH	pH	7.3	7.1	Normal range	None
Conductivity @25℃	µS/cm	1720	7180	Relatively low	None
Alkalinity-total (as CaCO3)	mg/l CaCO3	566	3580	Relatively low	None
Ammonia	mg/l N	59	453	Relatively low	Some elevation of ammonia levels in adjacent groundwaters possible, but - given the treatment in the constructed wetland and available dilution - no effect on surface waters expected.
Chloride	mg/l Cl	173	1140	Relatively low	None
ortho-Phosphate (as P)	mg/l P	0.23	1.1	Relatively low	None
Total Oxidised Nitrogen (as N)	mg/l N	<0.50	0.7	Relatively low	None
Chemical Oxygen Demand	mg/l O2	147	954	Relatively low	None
Fluoride	mg/l F	<0.5		Low	None
Sulphate	mg/l SO4	20	70	Low	None
Aluminium	ug/l	<25	<100	Low	None
Antimony	ug/l	1.7		Low	None
Arsenic	ug/l	3.6	7	Low	None
Barium	ug/l	27		Low	None
Beryllium	ug/l	1.4		Low	None
Boron	ug/l	170	2800	Low	None
Cadmium	ug/l	<0.5	<10	Low	None
Calcium	mg/l	43	155	Low	None
Chromium	ug/l	8.3	50	Low	None
Cobalt	ug/l	2.8		Low	None
Copper	ug/l	3.5	40	Low	None
Iron	ug/l	1300	12100	Low	None
Lead	ug/l	2.4	90	Low	None
Magnesium	mg/l	7.9	125	Low	None
Manganese	ug/l	510	500	Relatively low	None
Mercury	ug/l	<0.5	<0.1	Low	None
Molybdenum	ug/l	1		Low	None
Nickel	ug/l	5.1	70	Low	None
Potassium	mg/l	26	492	Low	None
Selenium	ug/l	3.7		Low	None
Sodium	mg/l	110	688	Relatively low	None
Thallium	ug/l	1.7		Low	None
Tin	ug/l	2	1800	Low	None
Uranium	ug/l	0.5		Low	None
Vanadium	ug/l	2.4		Low	None
Zinc	ug/l	13	160	Low	None

Table 5.3.4 Leachate Quality Dungarvan landfill, Q2 2012

EntityName	Dungarvan
StationName	Interceptor
StationLocalCode	1
SamplePurpose	LANDFILL LEACHATE QUARTERLY
SampleLabCode	1204L1Q2
SampleDate	18/06/2012
CompletionDate	25/07/2012
Northing	0
Easting	0
Ammonia(N)	NT
BOD	2.4
Dissolved Oxygen % Saturation	NT
Ortho-phosphate	NT
pH	NT
Total Oxidised Nitrogen	NT

Table 5.3.5 Leachate Quality Dungarvan landfill, Q3 2012

EntityName	Dungarvan
StationName	Interceptor
StationLocalCode	1
SamplePurpose	LANDFILL LEACHATE QUARTERLY
SampleLabCode	1250intercept0609
SampleDate	06/09/2012
Conductivity @ 25°C	549
pH	7.3

Table 5.3.6 Leachate Quality Dungarvan landfill, Q4 2012

EntityName	Dungarvan
StationName	Interceptor
SampleDate	10/12/2012
BOD	1.7
Chemical Oxygen Demand	34

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 2012

Date	Operator	RC7	RC6A	GW2A	L5A	L4	RC3A	RC4	L1A	L2B	RC 8	GW1
16/01/2012	DR	10.3	8.1	1.8		0.8	12.5	15.2			11.5	2.9
29/02/2012	DR	10.4	8.1	1.5		0.8	12.4	15.2			11.7	2.5
23/03/2012	DR	10.4	8.1	1.8		0.8	12.4	15.2			11.7	2.3
27/04/2012	DR	10.4	8	1.6		0.7	12.4	15.2			11.8	2.2
21/05/2012	DR	10.3	8	1.6		0.7	12.3	15.1			11.6	1.1
28/06/2012	DR	10.7	8.4	2		0.7	12.6	15.5			11.8	1.7
27/07/2012	DR	10.7	8.4	1.8		0.7	12.8	15.4			11.8	2.2
22/08/2012	DR	10.8	8.4	1.8		0.7	12.8	15.4			11.7	3.4
26/09/2012	DR	10.6	8	1.8		0.9	12.4	15.2			11.8	2.1
09/10/2012	DR	10.8	7.8	1.6		1	12.4	15.3			11.7	2.4
26/11/2012	DR	10.7	8	1.8		1	12.6	15.4			11.6	2.5
14/12/2012	DR	10.7	7.9	1.8		1	12.6	15.4			11.6	2.5

D=Damaged

Note new wells drilled at L1A, L2B and L5B in August 2011

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 tables 5.1 to 5.4 below.

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.

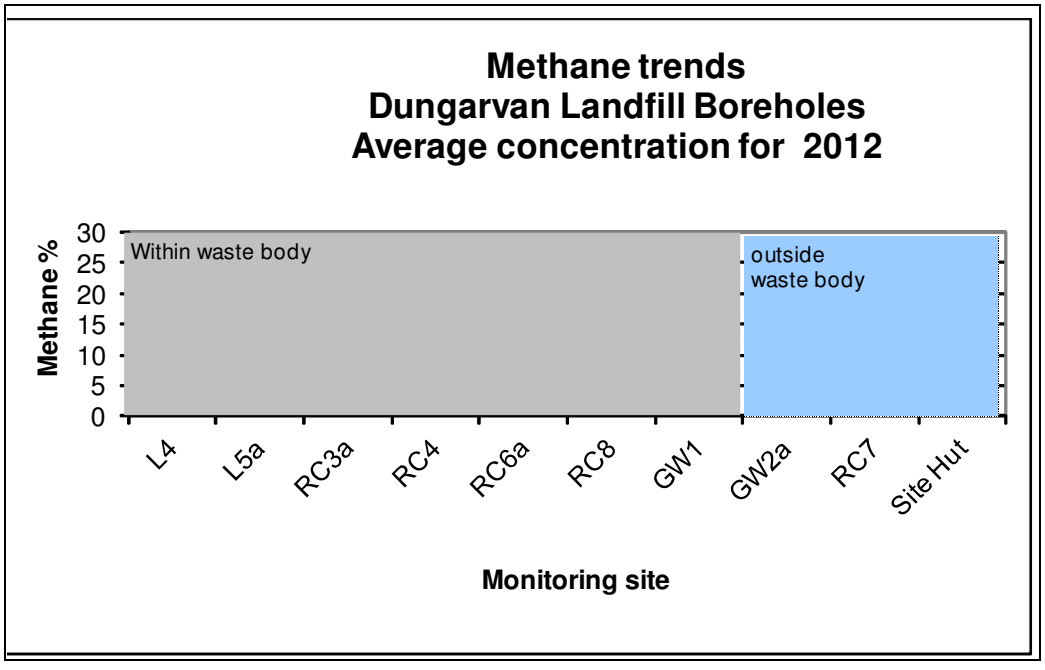


Figure 5.5.1 Methane spatial trends 2012

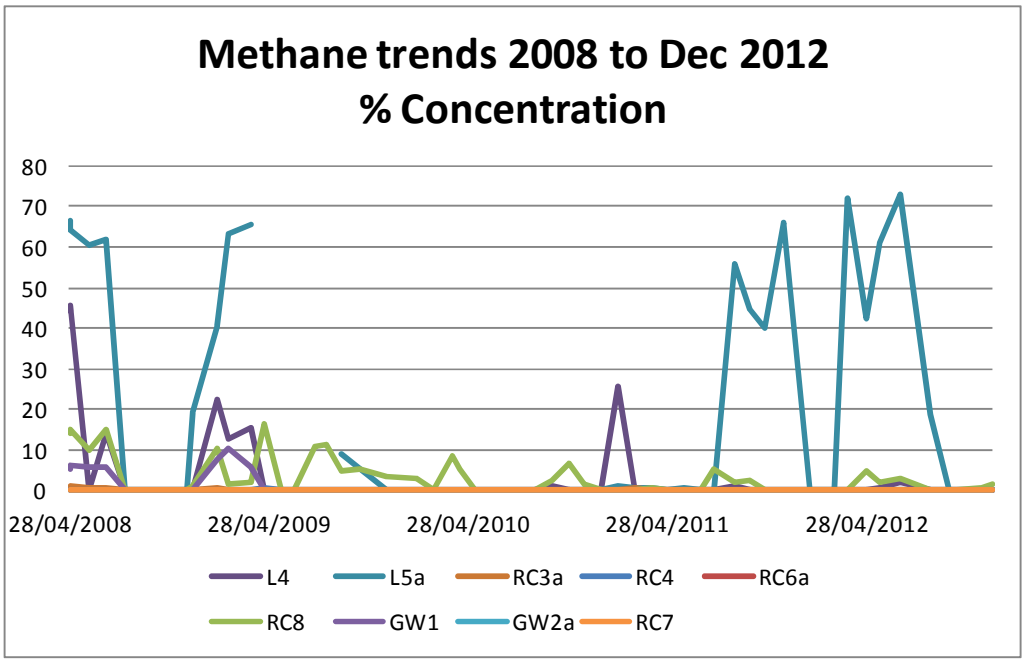


Figure 5.5.2 Methane temporal trends 2008 to 2012

Relatively low levels of methane were detected at most boreholes within the waste deposit area, and were lower compared to baseline levels in 2001.

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 2012

Week No	Date	Operator	Gas	Site Hut	GW 1	GW 2A	RC 3A	RC 4	RC 6A	LT 1	LT 2A	LT 4	LT 5A	RC 7	RC 8
1	04/01/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.69 1004											
2	12/01/2011	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1017											
3	16/01/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1021	0 0 20.9 1021	0 0 20.9 1021	0 0 20.9 1021	0 0 20.9 1021	0 0 20.9 1021	0 0 20.9 1021	0 0 20.9 1021	0 0 20.9 1021	0 0 20.9 1021	0 0 20.9 1021	0 0 20.9 1021
4	24/01/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1017											
5	31/01/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1035											
6	09/02/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1035											
7	17/02/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1024											
8	23/02/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1023											
9	29/02/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1024	0 0 20.9 1024	0 0 20.9 1024	0 0 20.9 1024	0 0 20.9 1024	0 0 20.9 1024	0 0 20.9 1024	0 0 20.9 1024	0 0 20.9 1024	0 0 20.9 1024	0 0 20.9 1024	0 0 20.9 1024
10	06/03/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1024											
11	16/03/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1030											
12	23/03/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1019	0 0 20.9 1019	0 0 20.9 1019	0 0 20.9 1019	0 0 20.9 1019	0 0 20.9 1019	66.1 25.6 0.9 1019	20.2 24.2 0.4 1019	0 0 20.9 1019	72.2 24.0 1.1 1019	0 0 20.9 1019	0 0 20.9 1019
13	29/03/2012	AOF	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1026											
Week No	Date	Operator	Gas	Site Hut	GW 1	GW 2A	RC 3A	RC 4	RC 6A	LT 1	LT 2A	LT 4	LT 5A	RC 7	RC 8

Table 5.5.2: Dungarvan Landfill Gas monitoring Q2 2012

Week No	Date	Operator	Gas	Site Hut	GW1	GW2A	RC 3A	RC 4	RC 6A	LT 1	LT 2A	LT 4	LT 5A	RC 7	RC 8
14	02/04/2012	DR	CH_4,	0											
			CO_2,	0											
			O_2	20.9											
			Air Pressure	1018											
15	12/04/2012	DR	CH_4,	0											
			CO_2,	0											
			O_2	20.9											
			Air Pressure	1018											
16	16/04/2012	DR	CH_4,	0											
			CO_2,	0											
			O_2	20.9											
			Air Pressure	1017											
17	27/04/2012	DR	CH_4,	0	0	0	0	0	0	63.5	5.0	0	42.3	0	5.0
			CO_2,	0	0	0	0	0	0	20.5	9.8	0	18.3	0	7.5
			O_2	20.9	20.9	20.9	20.9	20.9	20.9	6.7 1010	9.7 1009	20.9	4.3 1009	20.9	13.6
			Air Pressure	1009	1009	1009	1009	1010	1009			1009		1010	1010
18	04/05/2012	DR	CH_4,	0											
			CO_2,	0											
			O_2	20.9											
			Air Pressure	1001											
19	08/05/2012	DR	CH_4,	0											
			CO_2,	0											
			O_2	20.9											
			Air Pressure	1010											
20	14/05/2012	DR	CH_4,	0											
			CO_2,	0											
			O_2	20.9											
			Air Pressure	1010											
21	21/05/2012	DR	CH_4,	0	0	0	0	0	0	70.4	48.1	0.5	60.7	0	2.2
			CO_2,	0	0	0	0	0	0	26.9	26.7	0.3	25.0	0	1.1
			O_2	20.9	20.9	20.9	20.9	20.9	20.9	0.2 1010	0.4 1010	20.4	0.1 1010	20.9	19.3
			Air Pressure	1010	1010	1010	1010	1010	1010			1010		1010	1010
22	28/05/2012	DR	CH_4,	0											
			CO_2,	0											
			O_2	20.9											
			Air Pressure	1015											
23	06/06/2012	DR	CH_4,	0											
			CO_2,	0											
			O_2	20.9											
			Air Pressure	1021											
24	15/06/2012	AOF	CH_4,	0											
			CO_2,	0											
			O_2	20.9											
			Air Pressure	1003											
25	20/06/2012	DR	CH_4,	0											
			CO_2,	0											
			O_2	20.9											
			Air Pressure	1017											
26	28/06/2012	DR	CH_4,	0	0	0	0	0	0	73.9	65.0	2.2	73.2	0	3.1
			CO_2,	0	0	0	0	0	0	24.6	26.6	0.9	23.4	0	1.9
			O_2	20.9	20.9	20.9	20.9	20.9	20.9 996	0.7 996	0 996	19.8	1.6 996	20.9	19.3
			Air Pressure	996	996	996	996	996				996		996	996
Week No	**Date**	**Operator**	**Gas**	**Site Hut**	**GW1**	**GW2A**	**RC 3A**	**RC 4**	**RC 6A**	**LT 1**	**LT 2A**	**LT 4**	**LT 5A**	**RC 7**	**RC 8**

Table 5.5.3: Dungarvan Landfill Gas monitoring Q3 2012

Week No	Date	Operator	Gas	Site Hut	GW 1	GW 2A	RC 3A	RC 4	RC 6A	LT 1	LT 2A	LT 4	LT 5A	RC 7	RC 8
27	04/07/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1006											
28	10/07/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1011											
29	16/07/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1014											
30	27/07/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1010											
31	02/08/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1007											
32	06/08/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1012											
33	15/08/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 992											
34	22/08/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1015	0 0 20.9 1015	0 0 20.9 1015	0 0 20.9 1015	0 0 20.9 1015	0 0 20.9 1015	26.7 16.1 1.1 1015	0 0 20.9 1015	0 0 20.9 1015	18.7 14.0 0.1 1015	0 0 20.9 1015	0 0 20.9 1015
35	27/08/2012	LA	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1019											
36	07/09/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1025											
37	12/09/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1005											
38	17/09/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1006											
39	26/09/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 996	0 0 20.9 996	0 0 20.9 996	0 0 20.9 996	0 0 20.9 996	0 0 20.9 996	0 0 20.9 996	0 0 20.9 996	0 0 20.9 996	0 0 20.9 996	0 0 20.9 996	0 0 20.9 996
Week No	**Date**	**Operator**	**Gas**	**Site Hut**	**GW 1**	**GW 2A**	**RC 3A**	**RC 4**	**RC 6A**	**LT 1**	**LT 2A**	**LT 4**	**LT 5A**	**RC 7**	**RC 8**

Table 5.5.4: Dungarvan Landfill Gas monitoring Q4 2012

Week No	Date	Operator	Gas	Site Hut	GW 1	GW 2A	RC 3A	RC 4	RC 6A	LT 1	LT 2A	LT 4	LT 5A	RC 7	RC 8
40	01/10/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1007											
41	09/10/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014
42	19/10/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1006											
43	26/10/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1017											
44	02/11/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 989											
45	08/11/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1014											
46	14/11/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1025											
47	22/11/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1001											
48	26/11/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1012	0 0 20.9 1012	0 0 20.9 1012	0 0 20.9 1012	0 0 20.9 1012	0 0 20.9 1012	0 0 20.9 1012	0 0 20.9 1012	0 0 20.9 1012	0 0 20.9 1012	0 0 20.9 1012	0.8 0.7 19.9 1012
49	03/12/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1001											
50	14/12/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 987	0 0 20.9 987	0 0 20.9 987	0 0 20.9 987	0 0 20.9 987	0 0 20.9 987	0 0 20.9 987	0 0 20.9 987	0 0 20.9 987	0 0 20.9 987	0 0 20.9 987	1.6 1.2 18.4 987
51	20/12/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1002											
52	28/12/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1001											
Week No	**Date**	**Operator**	**Gas**	**Site Hut**	**GW 1**	**GW 2A**	**RC 3A**	**RC 4**	**RC 6A**	**LT 1**	**LT 2A**	**LT 4**	**LT 5A**	**RC 7**	**RC 8**

5.6 NOISE

5.6.1 Introduction

Daytime noise levels were recorded on 12th December 2012 at the site entrance. There are limits of 55 dB Leq(30) daytime, and 45 dB Leq(30) night-time imposed as a condition of the licence. Night-time measurements were not considered necessary as the landfill does not operate at night.

A Cirrus 800A Sound Level Meter was used. The meter was calibrated and checked with a 94 dB calibrator before and after each measurement. Broadband and Frequency Band analysis measurements were conducted at each location. A summary of results is presented in the table below. Octave band analysis is presented in figures 5.6 below.

5.6.2 Noise levels

Table 5.6.1 - 2012 Noise levels

1998 "Baseline" noise levels

Site	*Date of Monitoring*	*L(A)eq[30mins] dB*
Site entrance	12/12/12 *Baseline 1998*	**51.9** 54

5.6.3 Discussion

Noise level recorded in December 2012 was compliant with the noise emission requirement of 55 dB(A) LAeq (30 mins) and was lower than the baseline level of 54 dB recorded in 1998.

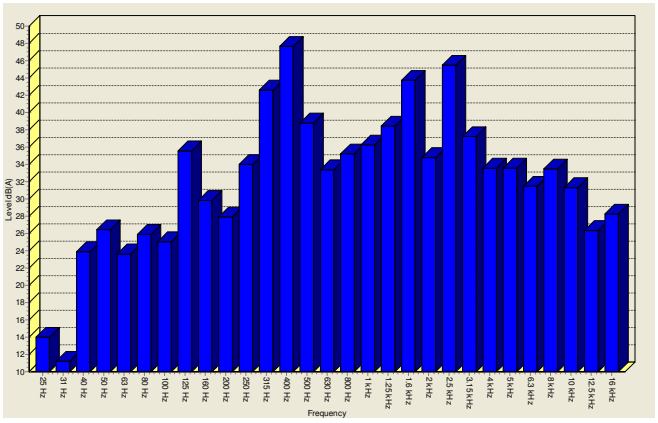


Fig 5.6 Dungarvan landfill noise monitoring 12/12/12, site entrance, octave band analysis, A weighting

5.7 DUST

5.7.1 Introduction / Methodology

Dust deposition rates were measured over 99 days in 2012/2013 at three locations (D1, D2 and D2A) at Dungarvan Landfill. The measurement method was the Bergerhoff deposition method.

5.7.2 Results

Dust Monitoring Dungarvan Landfill 2012

No Of Days 99

Location	Weight 1	Weight 2	No of Days	Deposition Rate mg/sq. m/day
D1	0.348	0.3563	99	38.1
D2	0.3483	0.3596	99	51.9
D2A	0.3471	0.3653	99	83.6

Table 5.7.1 - Dust Deposition at Dungarvan Landfill 2012

5.7.3 Discussion

Dust deposition rates were below the limit expected to give rise to nuisance (350 mg/m2/day).

5.8 MACROINVERTEBRATE SURVEY

INTRODUCTION

Sampling of macroinvertebrates was carried out at River Colligan sites SW1 and SW2 adjacent to Dungarvan Landfill on 16/1/12. 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 1. Macroinvertebrate counts 16/1/12

	Sample location	SW1 River Colligan	SW2 River Colligan
	Date sampled	16/01/2012	16/01/2012
GROUP	**Species**	**Count**	**Count**
	Mayflies EPHEMEROPTERA		
A1	Ecdyonurus	2	2
A2	Stenophylax	2	3
A2	Sericostoma	2	
C	Adult Beetles COLEOPTERA	2	
B	Limnius		2
C	Bithynia		2
D	Midge larvae	2	
D	Bloodworms	5	30
C	Water louse	105	20
B	Gammarus	95	80
	Water mites	2	2
	Flounder (Platichthys flesus)	1	
	TAXON RICHNESS	**10**	**8**

Table 2. Nominal Q-Ratings 16/1/12.

	SW1	SW2
A1	Sparse/absent	Sparse/Absent
A2	Sparse/absent	Sparse/Absent
B	Numerous/Dominant	Numerous
C	Numerous	Numerous
D	Small Number	Numerous/Dominant
Assigned Q Rating	3/4	3

Table 3. Macroinvertebrate counts 12/12/12

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

Table 4. 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)	Linephilidae	B	1		
	Polycentropodidae	C			4
Coleoptera (Beetles)	Elmidae	C	7	3	
Crustacea (Crustaceans)	Gammaridae	C	60	120	
Odonata (Damselflies)	Coenagrioniidae	-			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. A small Flounder fish, common to shallow water areas such as estuaries and tidal areas, was caught in the sample at SW1.

Nominal Q-scores are assigned for this survey (tables 2 and 4) 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 and it is seen that the species list of the surveys in January and December 2012 (tables 1 and 3) are similar and have identical taxon richness cores. Taxon richness was higher in the 2012 surveys compared to the Oct 2009 survey at SW1 (10_{2012} vs 5_{2009}) and slightly lower for SW2 (8_{2012} vs 11_{2009}). In the 2012 surveys 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 Ecological Report is included in APPENDIX K

5.11 CONCLUSIONS

Water quality, at the River Colligan surface water sites, in the vicinity of the landfill was satisfactory throughout 2012.

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.

No noise nuisance was indicated during the annual noise survey.

Dust deposition levels were below nuisance levels.

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 F.

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. 25m3 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 will 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.

Work on the completion of the Landfill Gas and Leachate Management system were hindered by financial restrictions encountered by the licensee during the previous reporting period, however a temporary leachate extraction system is now operational, with initial results proving to be successful.

A report on the operation of the leachate extraction system, along with a layout drawing and laboratory analysis results of treated leachate to date are included in Appendix L Financial sections of the report have been omitted in the interests of confidentiality.

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. 25m3 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 m3/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, and intensive field balancing over a three month period was completed.

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. However no data was downloaded during the reporting period. The first set of results will be forwarded to the Agency as part of the Landfill Gas Survey. The licensee will agree a period for residence time also in accordance with Schedule C.1.2. Flare Servicing Reports along with the 2012 EPA Landfill Gas survey are included in Appendix G

7. Topographical survey

No significant topographical changes have occurred on site since the previous survey was carried out. The survey is attached in Appendix H.

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.

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 8 and Schedule D of the Waste Licence.

Target 3.2 – To submit Monitoring Reports 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 10 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 complete Leachate Management System (permanent system)

Objective 9 – To complete Landscaping and Seeding of Landfill Cap (wildflower planting)

Objective 10 – Finalise tenders for SCADA dilution system

Objective 11 – Complete Contract for 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

This documentation will also be maintained as part of compliance requirements with Waterford County Council Environment Section's EMAS (Environmental Management and Audit Scheme) Certificate which was obtained in 2009.

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:

Facility Manager
Ballynamuck Waste Disposal Site
Dungarvan, Co. Waterford.

7. The Facility Manager shall copy all requests to:

Senior Engineer
Environment Section
Waterford 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 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 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 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 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 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 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 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 County Council employees.

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

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 tip head.

Rubble - Members of the Public place rubble waste in to an open skip. This is kept on site for use in the haul roads

Clay & Top soil - Members of the Public place clay & topsoil in to an open skip. This is kept on site for use in restoration works.

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 I.

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 as at the end of 2012 was €4,239,903 including VAT. The spend to end of year 2011 was €4,239,905.

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 2012 for monitoring was €21,316.25 and €16,175.35 for the licence. With regard to the details of financial provisions required under Condition 12.1.1 and 12.1.2 which are to be set aside in relation to the prevention of environmental damage and in order to underwrite the costs for remedial actions following anticipated events or incidents the following information is relevant.

Final closure Phase

At the end of 2012, the total project spend was €4,239,905 (incl. VAT). It will be necessary to apply for a supplementary payment of and €197,688 in order to coverpayments outstanding and various committed costs in 2012 (contract payments due, berm repair, consulting fees, RE fees, etc.). Therefore a total of €4,239,905 has been committed to date, which is the total project budget. As a consequence a further application will be required for the supplementary sum of €197,688.

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). The Environmental Liabilities Risk Assessment is included in Appendix M

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
	Total for 30 year period	**€ 5,100,000**
	Contingency set at 15% for increased scope on last three items.	**€ 765,000**
	Total for 30 years with contingency	**€ 5,865,000**

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	**Total**		**€22,842**

16. Slope Stability Assessment

No significant slope slippage has occurred since the previous assessment was carried out in 2010. The 2010 Slope Stability Assessment is included in Appendix N

APPENDIX A

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

Dungarvan Civic Amenity Site – Tonnages Accepted/Disposed January 1st – December 31st 2012

Waste Accepted	Type	EWC Code	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Total
Domestic	Domestic Bulky CoCo	20 03 01	4.80	9.90	4.38	2.84	4.50	0.94	8.98	6.94	4.12	6.14	4.10	3.40	61.04
	Bulky CoCo	20 03 01	1.44	8.00	0.56	0.22	0.12	0.34	0.28	2.00	4.70	2.70	0.10	3.86	24.32
	Domestic Bulky UDC	20 03 01	13.00	33.98	19.80	27.70	31.90	17.48	14.36	21.80	37.86	55.20	12.62	7.24	292.94
	Civic Skip	20 03 99	9.36	11.14	11.32	10.14	9.20	11.36	13.66	13.96	7.46	13.42	12.26	11.02	134.30
	WCC Housing	20 03 99	0.70	0.32	0.32	0.94	1.42	0.34	2.42	2.64	1.68	0.18	0.42	1.34	12.72
	Clean Up	20 03 99	0.00	0.00	0.00	22.06	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.28	22.52
	Domestic CoCo	20 03 99	301.22	158.88	310.98	198.38	291.52	221.16	217.36	249.80	162.72	302.36	176.84	225.06	2816.28
	Dom CoCo by DTC	20 03 99	29.14	9.76	29.50	13.66	31.70	18.32	12.50	21.56	11.62	31.12	11.76	16.06	236.70
	Film Farm Plastics	02 01 04	0.00	0.00	0.00	0.00	0.00	0.00	71.76	0.00	0.00	0.00	0.00	0.00	71.76
	UDC Domestic	20 03 99	74.92	34.50	69.92	35.24	52.62	43.02	56.28	57.88	38.46	60.62	36.46	51.70	611.62
MRF Plant	MRF Plant	20 03 99	0.00	0.00	1.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.74
Litter	Roadsweeper	20 03 99	42.32	36.94	38.40	38.62	46.22	39.88	49.74	50.54	40.74	57.90	51.14	32.44	524.88
	RoadsweeperUDC	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	19.68	15.02	18.02	20.04	17.36	16.78	22.76	21.74	8.86	19.28	16.30	18.36	214.20
	LitterbinsUDC	20 03 99	0.00	13.54	11.50	15.38	10.40	13.90	10.74	13.70	13.76	12.56	11.16	13.80	140.44
Total Accepted			**496.58**	**331.98**	**516.44**	**385.22**	**496.96**	**383.52**	**481.02**	**462.56**	**331.98**	**561.48**	**333.16**	**384.56**	**5165.46**

Dungarvan Civic Amenity Site – Tonnages Accepted/Disposed January 1st – December 31st 2012

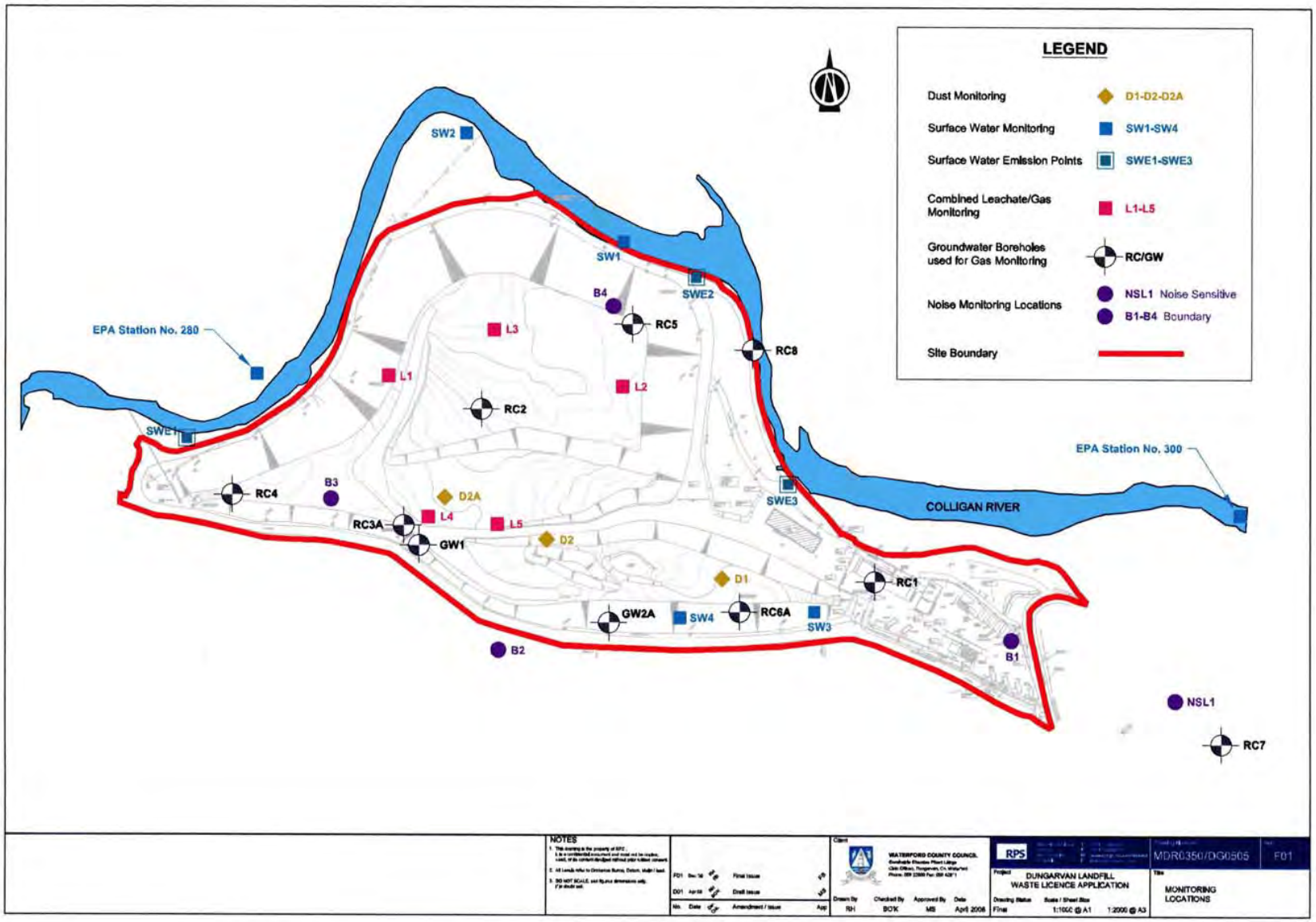
Waste Accepted	Type	EWC Code	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Total	WEEE Ireland Figures
Recycling	Dry Material	15 01 01	11.92	7.60	9.32	7.12	10.68	7.98	13.62	19.06	8.86	15.72	12.96	16.94	141.78	
	Textiles	04 02 22	0.10	0.42	0.14	0.20	0.20	0.16	0.22	0.18	0.40	0.22	0.08	0.06	2.38	
	Fridges	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	26.97
	Large Household	16 02 13	9.08	0.00	9.44	3.94	10.06	3.64	3.78	7.00	3.62	3.22	3.14	2.44	59.36	61.16
	Small Household (WEEE)	16 02 13	24.70	9.46	9.20	11.40	8.70	9.26	11.84	17.86	10.56	12.36	8.28	5.38	139.00	55.61
	TV's Monitors	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	47.37
Scrapmetal	Scrap metal	17 04 07	1.80	1.86	2.36	1.70	7.00	0.00	2.92	1.92	1.58	1.20	0.00	3.26	25.60	
Recovery	Clay	17 05 04	0.00	0.00	0.00	0.00	12.50	0.00	0.00	12.70	0.00	0.00	0.00	0.00	25.20	
	Rubble	17 01 07	0.00	0.00	9.38	11.52	0.00	0.00	16.30	17.90	0.00	9.30	8.94	0.00	73.34	
	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	
Glass	Flat Glass	17 02 02	0.00	2.54	0.00	0.00	0.00	2.02	0.00	0.00	0.00	1.90	0.00	0.00	6.46	
Compost	Compost	02 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	
	Brown Bin	02 01 07	131.14	143.30	132.32	114.42	172.06	107.38	193.32	95.34	181.60	81.64	153.44	78.74	1584.70	
	WCC Brown by DTC	02 01 07	12.40	14.24	15.14	14.72	20.56	10.64	22.78	8.08	10.14	7.62	22.06	7.54	165.92	
	Brown Bin UDC	02 01 07	27.72	33.32	37.22	29.34	50.28	28.74	56.68	26.18	67.58	21.92	43.46	21.00	**443.44**	
	Brown Bin Commercial	02 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	
	Garden CoCo	02 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	
	Garden UDC	02 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	
	Garden Private	02 01 07	0.00	0.00	0.00	3.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.32	
	Garden waste Lismore	02 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	
	Garden waste Tramore	02 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	
Timber	Timber	17 02 01	17.04	4.74	2.76	4.06	6.06	11.12	9.08	5.68	3.52	3.54	8.00	1.88	77.48	
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 (Small)		0.18	0.04	0.18	0.10	0.14	0.00	0.24	0.42	0.00	0.00	0.00	0.00	1.30	
	Batteries (Car)		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	
	Car Filters		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.12	
	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	0.52
	Engine Oil	13 02 06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.88	0.00	0.88	
	Paint	08 01 21	0.48	0.00	0.00	0.54	0.00	0.40	0.00	0.68	0.00	0.00	0.64	0.00	2.74	
Total Accepted			236.38	217.48	227.28	202.28	298.10	181.34	330.54	212.58	287.86	158.64	261.88	137.24	2753.02	191.63

Dungarvan Civic Amenity Site – Tonnages Accepted/Disposed January 1st – December 31st 2012

Waste Transferred/Disposed		EWC Code	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Total	WEEE Ireland Figures
Compost	Compost	02 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	
	CompostUDC	02 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	
	Civic Skip	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	3.56	3.56	
	Brown Bins	02 01 07	143.54	126.14	190.88	107.16	233.84	129.52	232.44	114.36	182.34	110.96	186.10	86.70	1843.98	
	Fridges	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	26.97
	Large Household	16 02 13	8.78	0.00	9.30	3.92	9.92	3.64	6.80	7.12	3.52	3.22	3.00	2.56	61.78	61.16
	Small Household (WEEE)	16 02 13	24.54	9.26	9.10	11.40	8.56	12.24	11.80	17.84	10.60	12.26	10.10	5.30	143.00	55.61
	TV's Monitors	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	47.37
Recycling*	Dry Materials	15 01 01	12.04	7.70	10.26	7.18	10.80	8.00	13.74	19.18	10.40	15.84	13.04	17.06	145.24	
	Textiles	04 02 22	0.00	0.22	0.12	0.20	0.30	0.20	0.22	0.10	0.40	0.22	0.10	0.06	2.14	
	Timber	17 02 01	2.64	4.66	2.76	4.10	6.00	11.10	9.12	5.72	3.50	3.54	8.02	1.88	63.04	
Scrapmetal	Scrapmetal	17 04 07	1.80	1.86	2.36	1.76	2.02	0.00	2.92	1.92	1.60	1.20	0.00	3.26	20.70	
Recovery	Clay	17 05 04	0.00	0.00	0.00	0.00	12.52	0.00	0.00	12.66	0.00	0.00	0.00	0.00	25.18	
	Rubble	17 01 07	0.00	0.00	9.40	11.56	7.00	0.00	16.26	17.84	1.50	9.30	8.96	0.00	81.82	
	Dom CoCo	20 03 99	521.50	352.92	438.62	462.98	469.86	370.68	439.62	487.14	407.50	539.00	370.28	360.40	5220.50	
	Garden Private	02 01 07	0.00	40.68	8.34	28.40	0.00	0.00	37.70	31.78	11.94	20.62	24.24	19.14	222.84	
	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	71.76	0.00	0.00	0.00	0.00	0.00	71.76	
Glass	Flat Glass	17 02 02	0.00	2.54	0.00	0.00	0.00	2.02	0.00	0.00	0.00	1.90	0.00	0.00	6.46	
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)		0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.52	
	Batteries (Small)		0.12	0.06	0.18	0.00	0.14	0.00	0.24	0.00	0.44	0.00	0.00	0.00	1.18	
	Car filters		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.12	
	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	0.52
	Engine Oil	13 02 06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.74	0.00	0.74	
	Paint	08 01 21	0.48	0.00	0.00	0.54	0.00	0.40	0.00	0.68	0.00	0.00	0.64	0.00	2.74	
Total Transferred/ Disposed			**715.32**	**545.98**	**681.14**	**639.20**	**760.82**	**537.80**	**842.38**	**716.34**	**633.30**	**718.06**	**625.22**	**496.36**	**7914.56**	191.63

Appendix B

Monitoring Locations


LEGEND
Dust Monitoring
D1-D2-D2A
Surface Water Monitoring
SW1-SW4
Surface Water Emission Points
SWE1-SWE3
Combined Leachate/Gas Monitoring
L1-L5
Groundwater Boreholes used for Gas Monitoring
RC/GW
Noise Monitoring Locations
NSL1 Noise Sensitive
B1-B4 Boundary
Site Boundary
SW2
SW1
SWE2
B4
RC5
RC8
L3
L1
L2
RC2
EPA Station No. 280
SWE1
EPA Station No. 300
RC4
B3
D2A
L4
L5
RC3A
GW1
D2
SWE3
COLLIGAN RIVER
D1
RC1
GW2A
SW4
RC6A
SW3
B2
B1
NSL1
RC7
NOTES
WATERFORD COUNTY COUNCIL
RPS
DUNGARVAN LANDFILL
WASTE LICENCE APPLICATION
MDR0350/DG0505
F01
MONITORING LOCATIONS
Drawn By RH
Checked By BOK
Approved By MB
Date April 2006
Final
1:1000 @ A1
1:2000 @ A3

Appendix C

Surface Water Results

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Test Report

Report of: Analysis of landfill site sample(s)
Report to: Environmental Management And Planning Division, EPA.
Report date: 10/05/12

Licensee: **Waterford County Council**
Facility: **Dungarvan Waste Disposal Site**
Ballynamuck Middle, Dungarvan, Co. Waterford
Reference No: W0032-01

Date collected: 20/03/2012 Date received: 20/03/2012

			Laboratory Ref:	1201280	1201281	1201282
			Type of sample:	Surface Water	Surface Water	Surface Water
			Location code:	WST-W0032-01-SW1	WST-W0032-01-SW280	WST-W0032-01-SW300
			Sampling point:	clear	clear	no sample, tide out
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry
			Time Sampled:	12:55	12:35	11:05
			Start/End - Dates of Analysis:	20-03-12/27-03-12	20-03-12/27-03-12	20-03-12/21-03-12
			Status of results:	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**			
F	Temperature	°C		9.8	9.8	-
F	Dissolved Oxygen (as %Sat)	% Saturation		112.0	111.0	-
L	Chemical Oxygen Demand	mg/l O2		<20	<20	-
L	Biochemical Oxygen Demand	mg/l O2		<1.0	<1.0	-
L	Suspended Solids	mg/l		<5	<5	-

Comments:

1) Results highlighted and in bold are outside specified limits.
2) nm "Not measured"
3) nd "None detected"
4) nt "No time" - Time not recorded
5) tntc "Too numerous to count"
6) F "Field measured parameters"
7) L "Lab measured parameters"

Signed: PP Date: 10/May/2012

Caroline Bowden, Regional Chemist

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	23/07/12

Facility:	**Dungarvan Waste Disposal Site** Ballynamuck Middle, Dungarvan, Co. Waterford
Reference No:	W0032-01

Date collected:	18/06/2012	Date received:	18/06/2012

			Laboratory Ref:	1202571	1202572	1202573	1202574	1202575
			Type of sample:	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
			Location code:	WST-W0032-01-SW300	WST-W0032-01-SW lagoon	WST-W0032-01-SW1	WST-W0032-01-SW2	WST-W0032-01-SW280
			Sampling point:	tide out, no sample	clear	clear	clear	clear
			Sampled by:	Eamon Holohan	Eamon Holohan	Eamon Holohan	Eamon Holohan	Eamon Holohan
			Time Sampled:	10:20	10:50	12:40	12:45	12:55
			Start/End - Dates of Analysis:	18-06-12/18-06-12	18-06-12/27-06-12	18-06-12/27-06-12	18-06-12/27-06-12	18-06-12/27-06-12
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**					
F	Temperature	°C		-	15.0	11.6	11.7	11.4
F	Dissolved Oxygen (as %Sat)	% Saturation		-	60.0	106.0	100.0	106.0
F	Conductivity @25°C	µS/cm		-	702	149	150	143
F	pH	pH		-	7.2	7.3	7.3	7.3
L	Chemical Oxygen Demand	mg/l O2		-	52	<20	<20	<20
L	Biochemical Oxygen Demand	mg/l O2		-	13.2	<1.0	<1.0	<1.0
L	Suspended Solids	mg/l		-	13	<5	<5	<5

Comments:

1) Results highlighted and in bold are outside specified limits.

2) **nm** "Not measured"
3) **nd** "None detected"
4) **nt** "No time" - Time not recorded
5) **tntc** "Too numerous to count"
6) **F** "Field measured parameters"
7) **L** "Lab measured parameters"

Signed: PP

Caroline Bowden, Regional Chemist

Date: 23/Jul/2012

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	28/09/12

Facility:	**Dungarvan Waste Disposal Site** Ballynamuck Middle, Dungarvan, Co. Waterford
Reference No:	W0032-01

Date collected:	06/09/2012	Date received:	06/09/2012

Report number:KK1201466/1

			Laboratory Ref:	1203853	1203854	1203855	1203856	1203857
			Type of sample:	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
			Location code:	WST-W0032-01-SW	WST-W0032-01-SW1	WST-W0032-01-SW2	WST-W0032-01-SW280	WST-W0032-01-SW300
			Sampling point:	Clear	Clear	Clear	Clear	No sample
			Sampled by:	DB/AT	DB/AT	DB/AT	DB/AT	DB/AT
			Time Sampled:	12:00	12:05	12:10	12:20	12:45
			Start/End - Dates of Analysis:	06-09-12/12-09-12	06-09-12/12-09-12	06-09-12/12-09-12	06-09-12/12-09-12	06-09-12/06-09-12
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**					
F	Temperature	°C		15.6	12.9	12.9	12.7	-
F	Dissolved Oxygen (as %Sat)	% Saturation		27.0	116.0	116.0	118.0	-
L	Chemical Oxygen Demand	mg/l O2		57	22	136	47	-
L	Biochemical Oxygen Demand	mg/l O2		1.7	<1.0	<1.0	<1.0	-
L	Suspended Solids	mg/l		<5	<6.3	<5	<5	-

Comments:

1) **Results hilighted and in bold are outside specified limits.**
2) **nm - "not measured".**
3) **nd - "none detected".**
4) **nt - "time not recorded".**
5) **nr - "not reported".**
6) **tntc - "too numerous to count".**
7) **F - Field measured parameter.**
8) **L - Lab measured parameter.**
9) **Test Reports relate only to the samples tested and as described on the report form.**
10) **Test Reports shall not be reproduced, except in full, without consent of the EPA.**

Signed: PP _____ Date: 28/Sep/2012

Caroline Bowden, Regional Chemist

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	25/01/13

Facility:	**Dungarvan Waste Disposal Site** Ballynamuck Middle, Dungarvan, Co. Waterford
Reference No:	W0032-01

Date collected:	10/12/2012	Date received:	10/12/2012

Report number:KK1202109/1

			Laboratory Ref:	1205342	1205343	1205344	1205345	
			Type of sample:	Surface Water	Surface Water	Surface Water	Surface Water	
			Location code:	WST-W0032-01-SW280	WST-W0032-01-SW lagoon	WST-W0032-01-SW1	WST-W0032-01-SW2	
			Sampling point:	clear	clear	clear	clear	
			Sampled by:	DB/EH	DB/EH	DB/EH	DB/EH	
			Time Sampled:	11:35	12:05	12:10	12:15	
			Start/End - Dates of Analysis:	10-12-12/17-12-12	10-12-12/17-12-12	10-12-12/17-12-12	10-12-12/17-12-12	
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	
Parameter		**Units**	**Limits**					
F	Temperature	°C		5.9	3.7	6.0	6.0	
F	Dissolved Oxygen (as %Sat)	% Saturation		98.0	70.0	99.0	99.0	
L	Chemical Oxygen Demand	mg/l O2		<20	31	<20	<20	
L	Biochemical Oxygen Demand	mg/l O2		<1.0	1.6	<1.0	1.0	
L	Suspended Solids	mg/l		<5	<5	<5	<5	

Comments:

1) **Results hilighted and in bold are outside specified limits.**
2) **nm - "not measured".**
3) **nd - "none detected".**
4) **nt - "time not recorded".**
5) **nr - "not reported".**
6) **tntc - "too numerous to count".**
7) **F - Field measured parameter.**
8) **L - Lab measured parameter.**
9) **Test Reports relate only to the samples tested and as described on the report form.**
10) **Test Reports shall not be reproduced, except in full, without consent of the EPA.**

Signed: PP _____ Date: 25/Jan/2013

Caroline Bowden, Regional Chemist

Report number:KK1202109/1

Appendix D

Ground Water Results

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Environmental Management And Planning Division, EPA.
Report date:	10/05/12

Licensee:	**Waterford County Council**
Facility:	**Dungarvan Waste Disposal Site** Ballynamuck Middle, Dungarvan, Co. Waterford
Reference No:	W0032-01

Date collected:	20/03/2012	Date received:	20/03/2012

			Laboratory Ref:	1201287	1201288	1201289	1201290	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0032-01-RC4	WST-W0032-01-RC3a	WST-W0032-01-RC8	WST-W0032-01-GW	
			Sampling point:	brownish	clear	no tubing, no sample	Pond 5 outlet, new sampling point,clear	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	11:50	12:00	13:00	12:20	
			Start/End - Dates of Analysis:	20-03-12/10-04-12	20-03-12/10-04-12	20-03-12/20-03-12	20-03-12/10-04-12	
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	
Parameter		**Units**	**Limits**					
F	Depth of Borehole	m		22.6	22.4	-	nm	
F	Water Level	m		15.1	12.2	-	nm	
F	Temperature	°C		11.2	11.9	-	10.0	
F	Dissolved Oxygen (as %Sat)	% Saturation		55.0	23.0	-	83.0	
F	pH	pH		nm	7.1	-	7.6	
F	Conductivity @25°C	µS/cm		653	1586	-	1003	
L	Ammonia	mg/l N		0.33	5.6	-	0.97	
L	Chloride	mg/l Cl		27	143	-	147	
L	Nitrite (as N)	mg/l N		0.013	0.002	-	<0.002	
L	ortho-Phosphate (as P)	mg/l P		0.01	<0.01	-	0.01	
L	Total Oxidised Nitrogen (as N)	mg/l N		11.05	<0.20	-	<0.20	
L	Alkalinity-total (as CaCO3)	mg/l CaCO3		237	584	-	282	
L	Fluoride	mg/l F		<0.25	0.66	-	0.59	
L	Sulphate	mg/l SO4		20	38	-	5.3	
L	1,1,1,2-Tetrachloroethane	µg/l		<0.5	<0.5	-	<0.5	
L	1,1,1-Trichloroethane	µg/l		<0.5	<0.5	-	<0.5	
L	1,1,2,2-Tetrachloroethane	µg/l		<1	<1	-	<1	
L	1,1,2-Trichloroethane	µg/l		<0.5	<0.5	-	<0.5	
L	1,1-Dichloroethane	µg/l		<0.5	<0.5	-	<0.5	
L	1,1-Dichloroethene	µg/l		<0.5	<0.5	-	<0.5	
L	1,1-Dichloropropene	µg/l		<0.5	<0.5	-	<0.5	
L	1,2,3-Trichlorobenzene	µg/l		<0.4	<0.4	-	<0.4	
L	1,2,3-Trichloropropane	µg/l		<0.6	<0.6	-	<0.6	

			Laboratory Ref:	1201287	1201288	1201289	1201290	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0032-01-RC4	WST-W0032-01-RC3a	WST-W0032-01-RC8	WST-W0032-01-GW	
			Sampling point:	brownish	clear	no tubing, no sample	Pond 5 outlet, new sampling point,clear	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	11:50	12:00	13:00	12:20	
			Start/End - Dates of Analysis:	20-03-12/10-04-12	20-03-12/10-04-12	20-03-12/20-03-12	20-03-12/10-04-12	
			Status of results:	Final Report	Final Report	Final Report	Final Report	
Parameter		Units	Limits					
L	1,2,4-Trichlorobenzene	µg/l		<0.4	<0.4	-	<0.4	
L	1,2,4-Trimethylbenzene	µg/l		<0.5	<0.5	-	<0.5	
L	1,2-Dibromo-3-Chloropropane	µg/l		<1.3	<1.3	-	<1.3	
L	1,2-Dibromoethane	µg/l		<0.5	<0.5	-	<0.5	
L	1,2-Dichlorobenzene	µg/l		<0.5	<0.5	-	<0.5	
L	1,2-Dichloroethane	µg/l		<0.5	<0.5	-	<0.5	
L	1,2-Dichloropropane	µg/l		<0.5	<0.5	-	<0.5	
L	1,3,5-Trimethylbenzene	µg/l		<0.5	<0.5	-	<0.5	
L	1,3-Dichlorobenzene	µg/l		<0.5	<0.5	-	<0.5	
L	1,3-Dichloropropane	µg/l		<0.5	<0.5	-	<0.5	
L	1,4-Dichlorobenzene	µg/l		<0.5	<0.5	-	<0.5	
L	2,2-Dichloropropane	µg/l		<0.5	<0.5	-	<0.5	
L	2-Chlorotoluene	µg/l		<0.5	<0.5	-	<0.5	
L	4-Chlorotoluene	µg/l		<0.5	<0.5	-	<0.5	
L	4-Isopropyltoluene	µg/l		<0.5	<0.5	-	<0.5	
L	Benzene	µg/l		<0.5	<0.5	-	<0.5	
L	Bromobenzene	µg/l		<0.5	<0.5	-	<0.5	
L	Bromochloromethane	µg/l		<0.5	<0.5	-	<0.5	
L	Bromodichloromethane	µg/l		<0.5	<0.5	-	<0.5	
L	Bromoform	µg/l		<0.5	<0.5	-	<0.5	
L	Bromomethane	µg/l		<0.5	<0.5	-	<0.5	
L	c-1,2-Dichloroethene	µg/l		<0.5	<0.5	-	<0.5	
L	c-1,3-Dichloropropene	µg/l		<0.5	<0.5	-	<0.5	
L	Carbon Tetrachloride	µg/l		<0.5	<0.5	-	<0.5	

			Laboratory Ref:	1201287	1201288	1201289	1201290	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0032-01-RC4	WST-W0032-01-RC3a	WST-W0032-01-RC8	WST-W0032-01-GW	
			Sampling point:	brownish	clear	no tubing, no sample	Pond 5 outlet, new sampling point,clear	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	11:50	12:00	13:00	12:20	
			Start/End - Dates of Analysis:	20-03-12/10-04-12	20-03-12/10-04-12	20-03-12/20-03-12	20-03-12/10-04-12	
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	
Parameter		**Units**	**Limits**					
L	Chlorobenzene	µg/l		<0.5	<0.5	-	<0.5	
L	Chloroform	µg/l		<0.5	<0.5	-	<0.5	
L	Dibromochloromethane	µg/l		<0.5	<0.5	-	<0.5	
L	Dibromomethane	µg/l		<0.5	<0.5	-	<0.5	
L	Dichlorodifluoromethane	µg/l		<0.5	<0.5	-	<0.5	
L	Dichloromethane	µg/l		<0.5	<0.5	-	<0.5	
L	Ethylbenzene	µg/l		<0.5	<0.5	-	0.6	
L	Hexachlorobutadiene	µg/l		<0.1	<0.1	-	<0.1	
L	Isopropylbenzene	µg/l		<0.5	<0.5	-	<0.5	
L	m,p-Xylene	µg/l		<0.5	<0.5	-	<0.5	
L	Naphthalene	µg/l		<0.5	<0.5	-	<0.5	
L	n-Butylbenzene	µg/l		<0.5	<0.5	-	<0.5	
L	n-Propylbenzene	µg/l		<0.5	<0.5	-	<0.5	
L	o-Xylene	µg/l		<0.5	<0.5	-	<0.5	
L	sec-Butylbenzene	µg/l		<0.5	<0.5	-	<0.5	
L	Styrene	µg/l		<0.5	<0.5	-	<0.5	
L	t-1,2-Dichloroethene	µg/l		<0.5	<0.5	-	<0.5	
L	t-1,3-Dichloropropene	µg/l		<0.5	<0.5	-	<0.5	
L	tert-Butylbenzene	µg/l		<0.5	<0.5	-	<0.5	
L	Tetrachloroethene	µg/l		<0.5	<0.5	-	<0.5	
L	Toluene	µg/l		0.8	<0.5	-	0.9	
L	Trichloroethene	µg/l		<0.5	<0.5	-	<0.5	
L	Trichlorofluoromethane	µg/l		<0.6	<0.6	-	<0.6	
L	Vinyl Chloride	µg/l		<0.5	<0.5	-	<0.5	

			Laboratory Ref:	1201287	1201288	1201289	1201290	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0032-01-RC4	WST-W0032-01-RC3a	WST-W0032-01-RC8	WST-W0032-01-GW	
			Sampling point:	brownish	clear	no tubing, no sample	Pond 5 outlet, new sampling point,clear	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	11:50	12:00	13:00	12:20	
			Start/End - Dates of Analysis:	20-03-12/10-04-12	20-03-12/10-04-12	20-03-12/20-03-12	20-03-12/10-04-12	
			Status of results:	Final Report	Final Report	Final Report	Final Report	
Parameter		Units	Limits					
L	Aluminium	ug/l		<25	130	-	<25	
L	Antimony	ug/l		0.7	0.8	-	0.7	
L	Arsenic	ug/l		3.1	22	-	1.5	
L	Barium	ug/l		70	1100	-	59	
L	Beryllium	ug/l		<0.5	<0.5	-	<0.5	
L	Cadmium	ug/l		<0.5	<0.5	-	<0.5	
L	Calcium	mg/l		65	62	-	43	
L	Chromium	ug/l		2.1	8	-	1.9	
L	Cobalt	ug/l		0.7	4.7	-	<0.5	
L	Copper	ug/l		<0.5	1.6	-	<0.5	
L	Iron	ug/l		1900	4700	-	410	
L	Lead	ug/l		2.2	0.7	-	<0.5	
L	Magnesium	mg/l		11	19	-	16	
L	Manganese	ug/l		190	1300	-	81	
L	Mercury	ug/l		<0.5	<0.5	-	<0.5	
L	Molybdenum	ug/l		<0.5	3.2	-	1	
L	Nickel	ug/l		2.4	28	-	4	
L	Potassium	mg/l		<0.5	29	-	21	
L	Selenium	ug/l		1.4	3.3	-	3.9	
L	Sodium	mg/l		12	110	-	110	
L	Thallium	ug/l		<0.5	<0.5	-	<0.5	
L	Uranium	ug/l		0.6	1.5	-	<0.5	
L	Vanadium	ug/l		2.2	1.2	-	6.9	
L	Zinc	ug/l		83	97	-	44	

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Test Report

Report of: Analysis of landfill site sample(s)
Report to: Waterford County Council
Report date: 23/07/12

Facility: **Dungarvan Waste Disposal Site**
Ballynamuck Middle, Dungarvan, Co. Waterford
Reference No: W0032-01

Sampling location: **WST-W0032-01-RC7, Dungarvan Landfill Site - W0032-01 -- RC7 - Groundwater**

Date collected: 18/06/2012 Date received: 18/06/2012

			Laboratory Ref:	1202583
			Type of sample:	Groundwater
			Sampling point:	clear
			Sampled by:	Eamon Holohan
			Time Sampled:	13:20
			Start/End - Dates of Analysis:	18-06-12/21-06-12
			Status of results:	**Final Report**
Parameter		**Units**	**Limits**	
F	Depth of Borehole	m		12
F	Water Level	m		10.8
F	Temperature	°C		12.5
F	Dissolved Oxygen (as %Sat)	% Saturation		44.0
F	pH	pH		7.3
F	Conductivity @25°C	µS/cm		3110
F	Salinity	‰		1.5
L	Ammonia	mg/l N		0.03
L	Chloride	mg/l Cl		790
L	Total Oxidised Nitrogen (as N)	mg/l N		1.29
L	Iron	ug/l		620
L	Potassium	mg/l		20
L	Sodium	mg/l		420

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	23/07/12

Facility:	**Dungarvan Waste Disposal Site** Ballynamuck Middle, Dungarvan, Co. Waterford
Reference No:	W0032-01

Date collected:	18/06/2012	Date received:	18/06/2012

Report number:KK1200947/1

				Laboratory Ref:	1202576	1202577	1202578	1202579	1202580	1202581	1202582
				Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
				Location code:	WST-W0032-01-RC6a	WST-W0032-01-GW2a	WST-W0032-01-RC3a	WST-W0032-01-GW1	WST-W0032-01-RC4	WST-W0032-01-GW pond outlet	WST-W0032-01-RC8
				Sampling point:	dark	no sample, (insufficient amount)	clear	brown	clear	clear, pond 5 outlet, taken at sampling point	no tubing, no sample
				Sampled by:	Eamon Holohan	Eamon Holohan	Eamon Holohan	Eamon Holohan	Eamon Holohan	Eamon Holohan	Eamon Holohan
				Time Sampled:	10:30	nm	11:35	11:45	12:10	12:30	12:35
				Start/End - Dates of Analysis:	18-06-12/21-06-12	18-06-12/18-06-12	18-06-12/21-06-12		18-06-12/21-06-12		18-06-12/18-06-12
				Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**
F	Depth of Borehole	m			12	11.8	22.4	10.2	22.6	nm	-
F	Water Level	m			8.5	1.6	13.1	3.5	7.3	nm	-
F	Temperature	°C			12.3	-	12.8	12.4	11.6	14.0	-
F	Dissolved Oxygen (as %Sat)	% Saturation			16.0	-	13.0	60.0	46.0	58.0	-
F	pH	pH			6.9	-	6.8	6.5	7.0	6.8	-
F	Conductivity @25°C	µS/cm			1316	-	1565	1018	659	599	-
L	Ammonia	mg/l N			26	-	54	2.7	0.07	0.05	-
L	Chloride	mg/l Cl			122	-	115	18	27	74	-
L	Total Oxidised Nitrogen (as N)	mg/l N			9.85	-	<0.20	<0.20	11.29	<0.20	-
L	Iron	ug/l			10000	-	3000	6300	890	810	-
L	Potassium	mg/l			18	-	30	3.8	0.8	11	-
L	Sodium	mg/l			70	-	97	18	14	49	-

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Test Report

Report of: Analysis of landfill site sample(s)
Report to: Waterford County Council
Report date: 28/09/12

Facility: **Dungarvan Waste Disposal Site**
Ballynamuck Middle, Dungarvan, Co. Waterford
Reference No: W0032-01

Sampling location: **WST-W0032-01-RC7, Dungarvan Landfill Site - W0032-01 -- RC7 - Groundwater**

Date collected: 06/09/2012 Date received: 06/09/2012

			Laboratory Ref:	1203865
			Type of sample:	Groundwater
			Sampling point:	Muddy Brown
			Sampled by:	DB/AT
			Time Sampled:	12:45
			Start/End - Dates of Analysis:	06-09-12/07-09-12
			Status of results:	**Final Report**
Parameter		**Units**	**Limits**	
F	Depth of Borehole	m		12
F	Water Level	m		10.8
F	Temperature	°C		13.5
F	Dissolved Oxygen (as %Sat)	% Saturation		64.0
F	pH	pH		7.4
F	Conductivity @25°C	µS/cm		<20
F	Salinity	‰		1.1
L	Ammonia	mg/l N		0.01
L	Chloride	mg/l Cl		533
L	Total Oxidised Nitrogen (as N)	mg/l N		1.18
L	Iron	ug/l		6500

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	28/09/12

Facility:	**Dungarvan Waste Disposal Site** Ballynamuck Middle, Dungarvan, Co. Waterford
Reference No:	W0032-01

Date collected:	06/09/2012	Date received:	06/09/2012

Report number:KK1201467/1

			Laboratory Ref:	1203858	1203859	1203860	1203861	1203862	1203863	1203864
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
			Location code:	WST-W0032-01-RC6a	WST-W0032-01-GW2a	WST-W0032-01-RC3a	WST-W0032-01-GW1	WST-W0032-01-RC4	WST-W0032-01-GW pond outlet	WST-W0032-01-RC8
			Sampling point:	Dark grey / black	no sample	clear	Muddy brown	Clear	Clear	No sample
			Sampled by:	DB/AT	DB/AT	DB/AT	DB/AT	DB/AT	DB/AT	DB/AT
			Time Sampled:	09:55	10:15	10:30	10:40	11:00	11:30	12:05
			Start/End - Dates of Analysis:	14-08-12/07-09-12	06-09-12/06-09-12	06-09-12/07-09-12	06-09-12/07-09-12	06-09-12/07-09-12	06-09-12/07-09-12	06-09-12/06-09-12
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report
	Parameter	Units	Limits							
F	Depth of Borehole	m		12	-	22.4	10.3	22.6	nm	-
F	Water Level	m		8.5	-	12.5	3.2	15.6	nm	-
F	Temperature	°C		13.1	-	13.6	14.2	12.0	14.7	-
F	Dissolved Oxygen (as %Sat)	% Saturation		25.0	-	19.0	14.0	56.0	22.0	-
F	pH	pH		7.1	-	6.9	6.5	7.1	6.9	-
F	Conductivity @25°C	µS/cm		1260	-	1496	1175	694	546	-
L	Ammonia	mg/l N		27	-	48	12	<0.01	0.02	-
L	Chloride	mg/l Cl		105	-	101	43	32	55	-
L	Total Oxidised Nitrogen (as N)	mg/l N		11.79	-	1.32	<0.20	15.74	<0.20	-
L	Iron	ug/l		3500	-	3100	34000	520	1800	-

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Test Report

Report of: Analysis of landfill site sample(s)
Report to: Waterford County Council
Report date: 25/01/13

Facility: **Dungarvan Waste Disposal Site**
Ballynamuck Middle, Dungarvan, Co. Waterford
Reference No: W0032-01

Sampling location: **WST-W0032-01-RC7, Dungarvan Landfill Site - W0032-01 -- RC7 - Groundwater**

Date collected: 10/12/2012 Date received: 10/12/2012

			Laboratory Ref:	1205353
			Type of sample:	Groundwater
			Sampling point:	brownish
			Sampled by:	DB/EH
			Time Sampled:	12:35
			Start/End - Dates of Analysis:	10-12-12/18-01-13
			Status of results:	**Final Report**
Parameter		**Units**	**Limits**	
F	Depth of Borehole	m		12
F	Water Level	m		10.5
F	Temperature	°C		11.5
F	Dissolved Oxygen (as %Sat)	% Saturation		20.0
F	pH	pH		7.0
F	Conductivity @25°C	µS/cm		2810
F	Salinity	‰		1.3
L	Ammonia	mg/l N		0.02
L	Chloride	mg/l Cl		684
L	Total Oxidised Nitrogen (as N)	mg/l N		1.31
L	Iron	ug/l		3500
L	Potassium	mg/l		20
L	Sodium	mg/l		290

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	25/01/13

Facility:	**Dungarvan Waste Disposal Site** Ballynamuck Middle, Dungarvan, Co. Waterford
Reference No:	W0032-01

Date collected:	10/12/2012	Date received:	10/12/2012

Report number:KK1202110/1

				Laboratory Ref:	1205346	1205347	1205348	1205349	1205350	1205351	1205352
				Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
				Location code:	WST-W0032-01-RC6a	WST-W0032-01-GW2a	WST-W0032-01-RC8	WST-W0032-01-GW1	WST-W0032-01-RC3a	WST-W0032-01-RC4	WST-W0032-01-GW pond outlet
				Sampling point:	brownish	no sample, dry	borehole damaged, no sample	MGW1,pumped by hand, brown	pumped by hand, clear	clear	clear
				Sampled by:	DB/EH	DB/EH	DB/EH	DB/EH	DB/EH	DB/EH	DB/EH
				Time Sampled:	10:40	10:55	12:20	11:10	11:20	11:30	11:55
				Start/End - Dates of Analysis:	10-12-12/18-01-13	10-12-12/10-12-12	10-12-12/10-12-12	10-12-12/18-01-13	10-12-12/18-01-13	10-12-12/18-01-13	10-12-12/18-01-13
				Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**
F	Depth of Borehole	m			12	-	-	10.3	22.4	22.6	-
F	Water Level	m			8.3	-	-	2.5	12.7	15.4	-
F	Temperature	°C			10.9	-	-	11.5	11.6	10.4	4.4
F	Dissolved Oxygen (as %Sat)	% Saturation			31.0	-	-	38.0	22.0	50.0	30.0
F	pH	pH			7.1	-	-	6.8	6.9	7.5	7.1
F	Conductivity @25°C	µS/cm			1212	-	-	936	1517	685	600
L	Ammonia	mg/l N			24	-	-	2.8	47	0.02	1.8
L	Chloride	mg/l Cl			95	-	-	14	102	30	55
L	Total Oxidised Nitrogen (as N)	mg/l N			13.26	-	-	<0.20	0.29	15.12	<0.20
L	Iron	ug/l			990	-	-	17000	3700	640	260
L	Potassium	mg/l			19	-	-	2.6	33	<0.5	19
L	Sodium	mg/l			49	-	-	10	76	12	34

Appendix E

Leachate Results

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	23/07/12

Facility:	**Dungarvan Waste Disposal Site** Ballynamuck Middle, Dungarvan, Co. Waterford
Reference No:	W0032-01

Date collected:	18/06/2012	Date received:	18/06/2012

			Laboratory Ref:	1202584	1202585	1202586	1202587	
			Type of sample:	Leachate	Leachate	Leachate	Leachate	
			Location code:	WST-W0032-01-L Interceptor	WST-W0032-01-L4	WST-W0032-01-L1	WST-W0032-01-L2a	
			Sampling point:	Taken at new point, brownish	no sample, dry	no sample, no tubing	no sample, no tubing	
			Sampled by:	Eamon Holohan	Eamon Holohan	Eamon Holohan	Eamon Holohan	
			Time Sampled:	11:00	11:25	12:20	12:25	
			Start/End - Dates of Analysis:	18-06-12/25-06-12	18-06-12/18-06-12	18-06-12/18-06-12	18-06-12/18-06-12	
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	
F	Depth of Borehole	m		nm	10.3	-	-	
F	Leachate Level	m		nm	nm	-	-	
F	Temperature	°C		13.5	nm	-	-	
L	Biochemical Oxygen Demand	mg/l O2		2.4	-	-	-	

Comments:

1) Results highlighted and in bold are outside specified limits.

2) **nm** "Not measured"
3) **nd** "None detected"
4) **nt** "No time" - Time not recorded
5) **tntc** "Too numerous to count"
6) **F** "Field measured parameters"
7) **L** "Lab measured parameters"

Signed: PP

Caroline Bowden, Regional Chemist

Date: 23/Jul/2012

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	28/09/12

Facility:	**Dungarvan Waste Disposal Site** Ballynamuck Middle, Dungarvan, Co. Waterford
Reference No:	W0032-01

Date collected:	06/09/2012	Date received:	06/09/2012

Report number:KK1201469/1

			Laboratory Ref:	1203866	1203867	1203868	1203869	1203870
			Type of sample:	Leachate	Leachate	Leachate	Leachate	Leachate
			Location code:	WST-W0032-01-L5a	WST-W0032-01-L4	WST-W0032-01-L1	WST-W0032-01-L2a	WST-W0032-01-L Interceptor
			Sampling point:	No sample - no tubing	No sample - went dry	No sample - no tubing	No sample - no tubing	Brown
			Sampled by:	DB/AT	DB/AT	DB/AT	DB/AT	DB/AT
			Time Sampled:	10:20	10:25	11:20	11:25	11:40
			Start/End - Dates of Analysis:	06-09-12/06-09-12	06-09-12/06-09-12	06-09-12/06-09-12	06-09-12/06-09-12	06-09-12/08-09-12
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**					
F	Temperature	°C		-	-	-	-	14.5
L	Conductivity @25°C	µS/cm		-	-	-	-	549
L	pH	pH		-	-	-	-	7.3

Comments:

1) **Results hilighted and in bold are outside specified limits.**
2) **nm - "not measured".**
3) **nd - "none detected".**
4) **nt - "time not recorded".**
5) **nr - "not reported".**
6) **tntc - "too numerous to count".**
7) **F - Field measured parameter.**
8) **L - Lab measured parameter.**
9) **Test Reports relate only to the samples tested and as described on the report form.**
10) **Test Reports shall not be reproduced, except in full, without consent of the EPA.**

Signed: PP _____ Date: 28/Sep/2012

Caroline Bowden, Regional Chemist

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	25/01/13

Facility:	**Dungarvan Waste Disposal Site** Ballynamuck Middle, Dungarvan, Co. Waterford
Reference No:	W0032-01

Date collected:	10/12/2012	Date received:	10/12/2012

Report number:KK1202113/1

			Laboratory Ref:	1205354	1205355	1205356	1205357	
			Type of sample:	Leachate	Leachate	Leachate	Leachate	
			Location code:	WST-W0032-01-L4	WST-W0032-01-L1	WST-W0032-01-L2a	WST-W0032-01-L Interceptor	
			Sampling point:	no sample, dry	no sample, dry, no tubing	no sample, dry, no tubing	Foam on surface, brownish, in sump	
			Sampled by:	DB/EH	DB/EH	DB/EH	DB/EH	
			Time Sampled:	11:00	11:45	11:50	12:00	
			Start/End - Dates of Analysis:	10-12-12/10-12-12	10-12-12/10-12-12	10-12-12/10-12-12	10-12-12/17-12-12	
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	
Parameter		**Units**	**Limits**					
F	Temperature	°C		-	-	-	5.9	
L	Chemical Oxygen Demand	mg/l O2		-	-	-	34	
L	Biochemical Oxygen Demand	mg/l O2		-	-	-	1.7	

Comments:

1) **Results hilighted and in bold are outside specified limits.**
2) **nm - "not measured".**
3) **nd - "none detected".**
4) **nt - "time not recorded".**
5) **nr - "not reported".**
6) **tntc - "too numerous to count".**
7) **F - Field measured parameter.**
8) **L - Lab measured parameter.**
9) **Test Reports relate only to the samples tested and as described on the report form.**
10) **Test Reports shall not be reproduced, except in full, without consent of the EPA.**

Signed: PP _____ Date: 25/Jan/2013

Caroline Bowden, Regional Chemist

Appendix F

Meteorological Data

	Johnstown Castle, Co. Wexford				
	date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
	01/01/2012 00:00	3.8	11.5	10.3	2.9
	02/01/2012 00:00	6.7	12.7	9.0	1.7
	03/01/2012 00:00	6.1	19.5	11.6	4.2
	04/01/2012 00:00	1.0	16.0	10.7	4.7
	05/01/2012 00:00	0.2	17.1	11.8	5.3
	06/01/2012 00:00	0.2	8.5	10.6	3.9
	07/01/2012 00:00	0.0	8.5	10.7	6.3
	08/01/2012 00:00	0.2	6.6	12.1	6.5
	09/01/2012 00:00	0.5	6.0	11.9	7.3
	10/01/2012 00:00	0.8	10.7	9.9	5.0
	11/01/2012 00:00	0.1	11.3	10.5	8.8
	12/01/2012 00:00	0.9	7.1	10.8	4.1
	13/01/2012 00:00	0.2	3.7	7.9	2.7
	14/01/2012 00:00	0.0	10.4	7.5	4.4
	15/01/2012 00:00	0.0	11.5	6.8	5.3
	16/01/2012 00:00	0.0	7.7	7.3	4.6
	17/01/2012 00:00	1.0	10.5	10.2	7.1
	18/01/2012 00:00	2.6	7.4	10.8	6.6
	19/01/2012 00:00	2.9	10.5	8.8	5.1
	20/01/2012 00:00	0.0	13.5	11.9	5.2
	21/01/2012 00:00	0.2	16.5	12.0	6.3
	22/01/2012 00:00	0.0	10.9	9.9	5.4
	23/01/2012 00:00	0.4	5.5	8.9	3.6
	24/01/2012 00:00	2.9	10.3	11.5	6.2
	25/01/2012 00:00	6.5	13.8	10.1	2.1
	26/01/2012 00:00	2.5	11.7	6.3	0.9
	27/01/2012 00:00	0.1	10.2	7.2	1.6
	28/01/2012 00:00	0.3	3.3	6.6	0.9
	29/01/2012 00:00	22.7	5.5	8.9	5.4
	30/01/2012 00:00	5.3	8.8	6.4	4.3
	31/01/2012 00:00	0.1	9.2	5.1	3.2

	Johnstown Castle, Co. Wexford				
	date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
	01/02/2012 00:00	0.0	7.6	4.1	1.4
	02/02/2012 00:00	0.0	4.2	3.4	-1.2
	03/02/2012 00:00	0.0	5.3	6.7	-0.2
	04/02/2012 00:00	8.7	8.7	9.0	5.0
	05/02/2012 00:00	1.5	4.4	7.5	3.1
	06/02/2012 00:00	0.4	2.2	8.0	5.3
	07/02/2012 00:00	0.2	5.4	7.4	2.5
	08/02/2012 00:00	0.0	10.1	5.2	3.3
	09/02/2012 00:00	1.8	7.3	9.4	4.7
	10/02/2012 00:00	3.6	5.9	9.6	6.0
	11/02/2012 00:00	5.4	8.1	6.2	5.1
	12/02/2012 00:00	0.0	5.4	9.7	6.1
	13/02/2012 00:00	0.1	9.2	9.0	4.8
	14/02/2012 00:00	0.0	12.3	9.2	5.7
	15/02/2012 00:00	0.0	9.2	10.4	6.7
	16/02/2012 00:00	0.0	9.3	10.8	5.2
	17/02/2012 00:00	0.0	11.4	11.1	8.2
	18/02/2012 00:00	1.7	14.1	8.8	1.5
	19/02/2012 00:00	0.0	7.8	8.4	1.1
	20/02/2012 00:00	0.7	11.1	8.7	3.2
	21/02/2012 00:00	0.8	14.2	10.5	8.5
	22/02/2012 00:00	6.5	15.6	13.0	9.0
	23/02/2012 00:00	0.0	11.2	13.4	9.7
	24/02/2012 00:00	0.1	6.4	12.2	8.1
	25/02/2012 00:00	0.0	3.6	11.2	3.8
	26/02/2012 00:00	0.2	5.8	9.7	3.1
	27/02/2012 00:00		7.7	10.4	8.4
	28/02/2012 00:00	0.0	5.6	11.7	8.5
	29/02/2012 00:00	0.0	9.1	10.6	8.1

Johnstown Castle, Co. Wexford				
date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
01/03/2012 00:00	0.0	8.1	12.7	9.0
02/03/2012 00:00	0.0	8.9	9.1	7.8
03/03/2012 00:00	5.7	9.9	11.1	4.9
04/03/2012 00:00	0.8	9.7	8.0	0.2
05/03/2012 00:00	0.0	8.4	9.9	2.5
06/03/2012 00:00	2.3	10.0	9.8	2.4
07/03/2012 00:00	4.4	13.7	10.1	3.5
08/03/2012 00:00	0.1	10.0	11.3	3.1
09/03/2012 00:00	0.0	11.4	11.9	8.5
10/03/2012 00:00	0.2	7.0	14.0	7.6
11/03/2012 00:00	0.0	4.1	13.8	8.1
12/03/2012 00:00	0.0	3.0	8.5	6.5
13/03/2012 00:00	0.0	2.4	8.4	5.9
14/03/2012 00:00	0.0	4.2	7.6	6.2
15/03/2012 00:00	0.0	6.9	10.7	6.2
16/03/2012 00:00	5.8	10.3	10.2	6.9
17/03/2012 00:00	6.1	5.0	9.6	3.3
18/03/2012 00:00	0.3	8.0	11.2	3.4
19/03/2012 00:00	0.0	8.6	10.5	2.2
20/03/2012 00:00	0.0	7.8	11.1	6.9
21/03/2012 00:00	0.0	5.2	10.0	5.2
22/03/2012 00:00	5.8	7.8	10.9	5.3
23/03/2012 00:00	0.2	6.9	11.9	5.9
24/03/2012 00:00	0.1	8.8	15.1	7.2
25/03/2012 00:00	0.0	4.5	14.0	8.3
26/03/2012 00:00	0.1	5.5	13.3	7.2
27/03/2012 00:00	0.0	5.4	14.1	7.1
28/03/2012 00:00	0.0	5.3	14.9	6.7
29/03/2012 00:00	0.0	5.8	18.1	7.5
30/03/2012 00:00	0.0	6.5	12.1	6.2
31/03/2012 00:00	0.0	8.5	10.5	5.2

	Johnstown Castle, Co. Wexford				
	date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
	01/04/2012 00:00	0.0	4.4	10.2	4.9
	02/04/2012 00:00	0.3	3.7	9.9	7.0
	03/04/2012 00:00	0.2	10.8	9.9	1.1
	04/04/2012 00:00	2.0	16.9	6.5	0.7
	05/04/2012 00:00	0.0	13.5	7.6	1.9
	06/04/2012 00:00	0.0	7.5	11.6	1.9
	07/04/2012 00:00	0.0	7.1	13.7	8.5
	08/04/2012 00:00	0.3	8.5	12.7	6.9
	09/04/2012 00:00	7.7	11.0	10.5	3.8
	10/04/2012 00:00	0.9	9.5	11.0	1.7
	11/04/2012 00:00	1.8	7.7	12.2	2.6
	12/04/2012 00:00	0.2	6.5	12.3	3.1
	13/04/2012 00:00	0.0	5.6	8.9	3.9
	14/04/2012 00:00	4.5	10.2	9.1	3.1
	15/04/2012 00:00	0.0	6.6	9.4	1.3
	16/04/2012 00:00	6.1	10.0	9.7	4.2
	17/04/2012 00:00	14.8	13.6	10.1	4.6
	18/04/2012 00:00	3.0	10.3	10.9	4.9
	19/04/2012 00:00	1.1	9.3	13.0	3.8
	20/04/2012 00:00	7.6	8.7	11.2	4.2
	21/04/2012 00:00	1.7	10.8	12.4	3.9
	22/04/2012 00:00	2.7	7.3	12.9	4.7
	23/04/2012 00:00	0.2	8.7	11.2	4.9
	24/04/2012 00:00	5.5	5.7	11.0	4.3
	25/04/2012 00:00	16.9	14.6	7.8	5.9
	26/04/2012 00:00	2.5	9.6	9.3	6.4
	27/04/2012 00:00	0.1	10.9	9.7	4.1
	28/04/2012 00:00	0.0	15.1	9.8	3.5
	29/04/2012 00:00	9.4	18.3	7.2	4.5
	30/04/2012 00:00	4.2	14.1	11.6	7.2

Johnstown Castle, Co. Wexford				
date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
01/05/2012 00:00	19.0	12.2	11.1	8.1
02/05/2012 00:00	0.3	8.4	12.8	7.7
03/05/2012 00:00	2.2	8.0	10.6	7.5
04/05/2012 00:00	0.0	8.3	11.0	6.3
05/05/2012 00:00	0.0	9.5	8.3	2.7
06/05/2012 00:00	0.0	6.8	9.6	1.4
07/05/2012 00:00	8.1	11.4	12.7	6.9
08/05/2012 00:00	0.0	7.6	13.2	7.7
09/05/2012 00:00	14.9	8.6	9.5	4.9
10/05/2012 00:00	7.9	8.7	13.0	8.2
11/05/2012 00:00	1.1	9.2	13.1	5.2
12/05/2012 00:00	0.1	6.9	13.4	1.6
13/05/2012 00:00	1.0	13.7	11.8	4.0
14/05/2012 00:00	0.7	11.2	13.5	5.6
15/05/2012 00:00	0.0	9.8	13.2	3.0
16/05/2012 00:00	0.0	5.8	12.4	2.5
17/05/2012 00:00	0.1	6.4	11.4	7.6
18/05/2012 00:00	8.5	11.6	11.2	8.3
19/05/2012 00:00	0.6	9.4	9.7	6.9
20/05/2012 00:00	0.1	5.1	13.9	6.6
21/05/2012 00:00	0.0	5.5	15.8	7.6
22/05/2012 00:00	0.3	5.7	13.9	9.5
23/05/2012 00:00	0.7	5.6	14.2	11.3
24/05/2012 00:00	0.0	6.0	16.2	9.5
25/05/2012 00:00	0.0	9.7	20.1	13.7
26/05/2012 00:00	0.0	10.9	18.9	12.2
27/05/2012 00:00	0.0	6.2	17.1	9.6
28/05/2012 00:00	0.0	7.0	16.4	9.8
29/05/2012 00:00	0.0	5.1	15.7	9.6
30/05/2012 00:00	1.1	7.5	16.8	11.5
31/05/2012 00:00	2.1	7.3	17.0	12.3

	Johnstown Castle, Co. Wexford				
	date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
	01/06/2012 00:00	0.0	5.5	18.4	10.7
	02/06/2012 00:00	21.0	8.7	14.6	10.4
	03/06/2012 00:00	5.7	10.5	13.0	8.5
	04/06/2012 00:00	0.0	6.7	12.7	6.4
	05/06/2012 00:00	7.2	6.5	12.8	9.1
	06/06/2012 00:00	8.0	5.4	15.8	9.5
	07/06/2012 00:00	24.4	9.7	14.6	10.8
	08/06/2012 00:00	9.5	17.7	12.9	9.3
	09/06/2012 00:00	0.0	9.1	15.1	7.2
	10/06/2012 00:00	0.0	3.4	15.6	8.7
	11/06/2012 00:00	0.0	3.6	15.9	9.7
	12/06/2012 00:00	16.6	3.6	14.2	9.2
	13/06/2012 00:00	3.3	4.0	16.6	9.4
	14/06/2012 00:00	12.0	11.0	12.8	10.3
	15/06/2012 00:00	19.4	16.3	12.9	11.5
	16/06/2012 00:00	8.1	12.3	16.2	10.6
	17/06/2012 00:00	0.0	5.6	15.2	8.6
	18/06/2012 00:00	0.0	7.1	15.1	7.2
	19/06/2012 00:00	0.1	6.5	16.0	8.8
	20/06/2012 00:00	13.3	5.2	15.5	9.9
	21/06/2012 00:00	7.8	7.7	15.1	11.7
	22/06/2012 00:00	2.6	13.5	17.0	10.3
	23/06/2012 00:00	4.8	11.3	15.0	10.6
	24/06/2012 00:00	0.1	8.6	18.1	10.2
	25/06/2012 00:00	0.0	5.8	15.7	10.6
	26/06/2012 00:00	5.7	10.2	17.4	12.4
	27/06/2012 00:00	5.7	8.2	16.0	13.5
	28/06/2012 00:00	17.2	10.9	16.1	12.9
	29/06/2012 00:00	0.5	14.0	16.9	12.2
	30/06/2012 00:00	3.3	10.0	15.9	8.4

Johnstown Castle, Co. Wexford				
date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
01/07/2012 00:00	2.6	10.8	15.2	8.5
02/07/2012 00:00	5.5	10.1	16.3	13.5
03/07/2012 00:00	6.5	8.8	14.4	13.4
04/07/2012 00:00	0.4	7.5	16.6	11.7
05/07/2012 00:00	0.8	5.3	17.3	11.1
06/07/2012 00:00	29.9	8.3	16.0	10.4
07/07/2012 00:00	0.1	10.2	18.3	13.0
08/07/2012 00:00	0.0	7.3	16.8	12.5
09/07/2012 00:00	2.0	5.4	15.0	10.8
10/07/2012 00:00	7.4	9.4	18.0	10.2
11/07/2012 00:00	1.5	7.3	16.6	9.0
12/07/2012 00:00	5.4	6.4	13.5	7.4
13/07/2012 00:00	5.0	5.3	14.9	10.8
14/07/2012 00:00	0.0	7.4	16.6	11.6
15/07/2012 00:00	0.2	9.7	16.4	10.0
16/07/2012 00:00	3.7	11.4	20.9	12.2
17/07/2012 00:00	0.4	11.0	17.4	11.9
18/07/2012 00:00	7.3	9.9	20.7	11.8
19/07/2012 00:00	0.0	7.7	17.2	11.2
20/07/2012 00:00	0.0	4.9	16.7	10.1
21/07/2012 00:00	0.0	5.9	17.6	8.7
22/07/2012 00:00	0.4	11.2	16.9	13.0
23/07/2012 00:00	0.6	11.6	17.3	15.4
24/07/2012 00:00	3.9	7.6	17.2	15.4
25/07/2012 00:00	0.3	7.1	18.1	14.3
26/07/2012 00:00	0.0	5.3	18.8	12.3
27/07/2012 00:00	0.0	8.4	19.1	10.5
28/07/2012 00:00	6.2	8.5	17.8	8.3
29/07/2012 00:00	5.4	7.0	16.5	8.1
30/07/2012 00:00	5.0	7.5	15.9	8.8
31/07/2012 00:00	8.0	8.4	16.4	11.9

Johnstown Castle, Co. Wexford				
date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
01/08/2012 00:00	4.6	13.3	17.8	12.6
02/08/2012 00:00	0.2	8.1	17.5	11.2
03/08/2012 00:00	33.9	10.3	17.6	13.2
04/08/2012 00:00	10.7	9.2	17.9	13.0
05/08/2012 00:00	11.3	4.9	17.9	12.6
06/08/2012 00:00	0.7	6.5	17.0	11.5
07/08/2012 00:00	2.1	4.8	16.3	12.4
08/08/2012 00:00	1.4	2.6	18.8	13.3
09/08/2012 00:00	0.0	3.2	22.1	13.6
10/08/2012 00:00	0.0	5.6	20.5	13.2
11/08/2012 00:00	0.6	7.6	21.3	15.2
12/08/2012 00:00	7.2	8.2	19.2	15.5
13/08/2012 00:00	6.0	10.0	19.1	14.3
14/08/2012 00:00	1.6	7.2	19.2	14.6
15/08/2012 00:00	17.1	16.6	18.2	14.8
16/08/2012 00:00	16.2	14.5	18.5	14.6
17/08/2012 00:00	12.0	9.3	17.4	15.3
18/08/2012 00:00	0.7	7.1	18.7	14.8
19/08/2012 00:00	1.5	6.8	17.6	14.4
20/08/2012 00:00	0.5	9.3	18.8	14.3
21/08/2012 00:00	1.8	9.1	18.1	11.9
22/08/2012 00:00	0.8	8.5	18.6	12.0
23/08/2012 00:00	0.2	5.3	16.9	12.2
24/08/2012 00:00	14.3	6.5	15.4	12.6
25/08/2012 00:00	2.7	8.5	18.8	11.7
26/08/2012 00:00	0.1	8.6	16.5	9.5
27/08/2012 00:00	30.0	14.0	16.9	12.9
28/08/2012 00:00	3.3	10.1	17.4	10.6
29/08/2012 00:00	6.9	11.5	17.0	12.2
30/08/2012 00:00	0.0	9.8	16.9	10.4
31/08/2012 00:00	0.0	6.3	16.0	9.5

Johnstown Castle, Co. Wexford				
date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
01/09/2012 00:00	0.0	11.4	17.6	11.2
02/09/2012 00:00	0.6	6.0	22.4	14.6
03/09/2012 00:00	0.0	8.4	17.7	13.3
04/09/2012 00:00	0.1	6.0	19.8	11.4
05/09/2012 00:00	0.0	5.5	16.6	9.0
06/09/2012 00:00	0.1	8.1	17.5	8.7
07/09/2012 00:00	0.1	7.0	18.1	10.6
08/09/2012 00:00	0.0	6.3	16.4	12.5
09/09/2012 00:00	2.8	10.4	17.3	13.9
10/09/2012 00:00	5.2	8.5	16.9	9.7
11/09/2012 00:00	0.1	10.2	14.5	8.0
12/09/2012 00:00	0.0	7.6	19.2	7.4
13/09/2012 00:00	0.0	9.5	17.1	6.3
14/09/2012 00:00	0.4	9.4	18.2	10.3
15/09/2012 00:00	0.0	6.5	15.7	10.1
16/09/2012 00:00	2.3	9.4	17.1	9.2
17/09/2012 00:00	0.1	8.2	15.2	7.7
18/09/2012 00:00	0.0	9.5	14.8	7.4
19/09/2012 00:00	0.0	8.4	15.2	6.7
20/09/2012 00:00	0.6	8.5	14.9	10.9
21/09/2012 00:00	0.6	6.9	13.3	7.0
22/09/2012 00:00	0.0	6.0	13.6	5.9
23/09/2012 00:00	0.1	8.2	13.2	9.5
24/09/2012 00:00	0.1	10.4	12.9	8.3
25/09/2012 00:00	8.9	10.6	11.0	8.1
26/09/2012 00:00	1.7	12.5	14.9	9.4
27/09/2012 00:00	0.4	7.6	14.4	7.7
28/09/2012 00:00	3.4	9.1	14.6	8.3
29/09/2012 00:00	0.0	9.4	15.5	6.2
30/09/2012 00:00	5.3	13.3	14.8	12.0

Johnstown Castle, Co. Wexford				
date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
01/10/2012 00:00	0.1	9.8	14.8	10.4
02/10/2012 00:00	6.1	12.2	14.2	8.0
03/10/2012 00:00	1.3	9.6	13.3	6.5
04/10/2012 00:00	8.4	7.5	13.5	5.1
05/10/2012 00:00	0.8	5.0	11.7	8.2
06/10/2012 00:00	0.0	5.8	14.0	5.8
07/10/2012 00:00	0.9	6.9	13.6	6.8
08/10/2012 00:00	14.4	8.9	12.3	10.1
09/10/2012 00:00	0.7	5.3	12.6	11.0
10/10/2012 00:00	6.5	7.7	14.2	11.3
11/10/2012 00:00	3.8	12.2	14.7	6.7
12/10/2012 00:00	0.8	8.3	12.3	5.6
13/10/2012 00:00	0.0	7.2	12.5	4.1
14/10/2012 00:00	1.1	6.9	11.4	3.4
15/10/2012 00:00	7.5	7.1	11.4	7.5
16/10/2012 00:00		10.7	13.7	6.2
17/10/2012 00:00	24.1	17.1	13.2	9.8
18/10/2012 00:00	6.3	8.6	13.4	8.6
19/10/2012 00:00	0.2	3.3	13.6	5.2
20/10/2012 00:00	0.1	4.8	15.0	9.0
21/10/2012 00:00	0.1	4.6	13.7	8.8
22/10/2012 00:00	0.1	5.6	13.4	10.0
23/10/2012 00:00	0.5	6.5	13.3	11.3
24/10/2012 00:00	0.8	11.3	13.2	12.3
25/10/2012 00:00	1.6	11.1	13.6	10.0
26/10/2012 00:00	1.2	13.3	10.2	2.1
27/10/2012 00:00	0.0	9.2	7.5	1.0
28/10/2012 00:00	3.1	10.3	9.4	5.4
29/10/2012 00:00	0.1	7.0	10.2	5.0
30/10/2012 00:00	0.0	8.0	9.5	2.6
31/10/2012 00:00	13.4	9.2	10.2	3.0

	Johnstown Castle, Co. Wexford				
	date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
	01/11/2012 00:00	0.2	10.6	7.8	1.3
	02/11/2012 00:00	0.0	9.1	10.0	2.4
	03/11/2012 00:00	0.6	8.8	8.4	1.1
	04/11/2012 00:00	14.2	11.3	10.2	6.0
	05/11/2012 00:00	2.5	9.9	9.8	3.8
	06/11/2012 00:00	0.0	8.9	11.0	4.4
	07/11/2012 00:00	0.0	9.2	11.5	6.8
	08/11/2012 00:00	0.1	6.8	11.2	7.5
	09/11/2012 00:00	13.0	9.9	10.6	5.6
	10/11/2012 00:00	0.2	6.8	8.6	1.5
	11/11/2012 00:00	2.3	6.7	9.8	1.5
	12/11/2012 00:00	7.4	12.5	12.7	7.1
	13/11/2012 00:00	1.1	14.3	12.2	11.5
	14/11/2012 00:00	0.0	6.0	11.8	10.2
	15/11/2012 00:00	0.0	2.7	11.6	5.6
	16/11/2012 00:00	0.1	3.5	10.2	5.2
	17/11/2012 00:00	0.1	7.1	8.8	2.9
	18/11/2012 00:00	9.6	10.5	11.0	0.4
	19/11/2012 00:00	12.5	16.8	11.9	10.4
	20/11/2012 00:00	4.5	12.0	12.2	7.2
	21/11/2012 00:00	0.8	8.3	11.4	5.9
	22/11/2012 00:00	22.0	13.6	12.0	5.0
	23/11/2012 00:00	0.2	7.6	9.4	3.0
	24/11/2012 00:00	13.6	8.2	8.4	1.8
	25/11/2012 00:00	31.3	7.1	8.9	-0.5
	26/11/2012 00:00	2.8	16.0	7.7	3.4
	27/11/2012 00:00	0.0	13.6	6.7	2.9
	28/11/2012 00:00	0.0	9.3	5.2	1.1
	29/11/2012 00:00	0.0	5.6	5.6	1.6
	30/11/2012 00:00	0.1	3.5	6.2	-0.4

Johnstown Castle, Co. Wexford				
date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
01/12/2012 00:00	0.1	6.5	6.1	0.8
02/12/2012 00:00	6.9	6.2	10.2	2.3
03/12/2012 00:00	0.5	10.1	10.0	2.7
04/12/2012 00:00	0.6	11.3	6.6	2.0
05/12/2012 00:00	0.0	8.1	5.1	-1.7
06/12/2012 00:00	2.6	11.6	7.3	-2.0
07/12/2012 00:00	0.2	14.3	7.8	2.2
08/12/2012 00:00	0.0	6.7	8.0	-0.4
09/12/2012 00:00	0.2	6.8	8.1	2.3
10/12/2012 00:00	0.1	6.2	6.6	1.2
11/12/2012 00:00	0.1	5.4	6.3	2.3
12/12/2012 00:00	0.4	9.7	7.3	2.3
13/12/2012 00:00	0.1	9.5	8.2	2.9
14/12/2012 00:00	10.8	13.0	9.6	5.7
15/12/2012 00:00	0.7	8.7	9.1	6.1
16/12/2012 00:00	0.4	8.8	10.2	5.6
17/12/2012 00:00	0.0	10.2	8.8	4.9
18/12/2012 00:00	0.1	5.7	8.5	3.9
19/12/2012 00:00	11.3	10.6	10.5	7.9
20/12/2012 00:00	0.5	5.3	8.8	6.1
21/12/2012 00:00	5.0	6.9	9.1	3.8
22/12/2012 00:00	15.6	14.5	11.7	8.6
23/12/2012 00:00	0.0	11.3	11.5	7.2
24/12/2012 00:00	7.0	8.7	9.5	6.5
25/12/2012 00:00	6.4	8.2	8.2	3.6
26/12/2012 00:00	5.6	11.7	9.9	4.8
27/12/2012 00:00	9.0	8.7	8.6	4.6
28/12/2012 00:00	9.8	18.2	11.5	6.8
29/12/2012 00:00	6.4	12.3	9.9	3.0
30/12/2012 00:00	0.6	16.1	10.5	3.1
31/12/2012 00:00	2.6	13.0	10.4	2.8

Appendix G

Flare Servicing Reports and EPA Landfill Gas Survey 2012

SERVICE SHEET

Page No 116

JOB NO

1659

Automatic Flare Systems Ltd
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: 13/04/2012

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

ENGINEERS NAME	Barry Cormican

FLARE OFF ON ARRIVAL

HOURS RUN						
BOOSTER 1	6667	CH4	9.0	CO2	15.4
BOOSTER 2	N/A	O2	2.1	PRESSURE	5 mbar

INLET VALVE SETTING % OPEN

NO 1	F/O	NO 2	F/O	NO 3	N/A	NO 4	N/A	NO 5	N/A	NO 6	N/A

MAIN CONTROL VALVE SETTING % OPEN

INLET VACUUM GAUGE READINGS STARING SIDE NEAREST KNOCKOUT POT (mbarg)

NO 1	0	NO 2	0	NO 3	N/A	NO4	N/A	NO 5	N/A	NO 6	N/A

INLET TEMP	17 °C	INLET VACUUM PRIOR TO KO POT FILTER	-0 MBAR
VACUUM AFTER KO POT FILTER	-0 MBAR	VACUUM AFTER INLET FLAME ARRESTER	N/A
OUTLET PRESSURE AFTER GAS BOOSTER	0 MBAR	OUTLET GAS TEMP	18 °C
PRESSURE AFTER SLAM SHUT	0 MBAR	PRESSURE AFTER OUTLET FLAME ARRESTER	N/A
TOTAL FLOW	481071 M^3	BLOWER SPEED	37%
FLOW RATE	0 M^3/hr	MEASURING INSTRUMENT	OPFM
FLAME TEMP	5 °C	MOTOR TEMP	NORMAL
FLAME QUALITY	N/A	AMBIENT TEMP	12.8 °C

MANOMETER LIQUID LEVEL WITH RIG SHUT DOWN

AMBIENT PRESSURE 1001

TYPE OF LIQUID: PERFLOW

RED SG - 0.8		EMISSIONS ANALYSER CO CELL	1.1	EMISSIONS ANALYSER NOX CELL	N/A

SERVICE SHEET Page No 2	Job No 1659		**Automatic Flare Systems Ltd** Unit 8, Ensign Business Centre Coventry CV4 8JA United Kingdom Tel: +44 (0)24 7647 4877 Fax: +44 (0)24 7647 4834

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 / 34-3 GX		
MOTOR & FAN SEAL GREASED	Yes	BOOSTER CORRECT ROTATION	Yes
NOTE: USE SHELL ALVANIA 3, GREASE EVERY SERVICE **IMPORTANT DO NOT OVERGREASE**			
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	OK	UV SENSOR FUNCTION	OK	EXTERIOR LIGHT	N/A
INTERIOR LIGHT	N/A	ELECTRICAL CONNECTIONS CHECKED FOR TIGHTNESS			Yes

ALL INDICATOR BULBS FUNCTION	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 Page No 3	Job No 1659	**Automatic Flare Systems Ltd** Unit 8, Ensign Business Centre Coventry CV4 8JA United Kingdom Tel: +44 (0)24 7647 4877 Fax: +44 (0)24 7647 4834

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
C02 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	

	REPAIRS	NEW PARTS FITTED
	None.	

SERVICE SHEET Page No 4	Job No 1659	**Automatic Flare Systems Ltd** Unit 8, Ensign Business Centre Coventry CV4 8JA United Kingdom Tel: +44 (0)24 7647 4877 Fax: +44 (0)24 7647 4834

REPORT ANY FURTHER REPAIRS OR ACTION NEEDED:
None.

DEPARTURE REPORT:							
HOURS RUN:		RUN RIG FOR 30 MINUTES BEFORE TAKING READINGS					
CH4	44.3	CO2	23.2	O2	0.8	CO	33

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

MAIN CONTROL VALVE SETTING % OPEN	

INLET VACUUM GAUGE READINGS STARTING SIDE NEAREST KNOCKOUT POT										(mbarg)	
NO 1	-3	NO 2	-3	NO 3	N/A	NO4	N/A	NO 5	N/A	NO 6	N/A

INLET TEMP	17	INLET VACUUM PRIOR TO KO POT FILTER	-3
VACUUM AFTER KO POT FILTER	-3	VACUUM AFTER INLET FLAME ARRESTER	N/A
OUTLET PRESSURE AFTER GAS BOOSTER	17	OUTLET GAS TEMP	18
PRESSURE AFTER SLAM SHUT	12	PRESSURE AFTER OUTLET FLAME ARRESTER	N/A
OTHER	BLOWER SPEED % 37		
	MANOMETER READING: 100 M3/hr		
FLOW RATE	101	FLAME QUALITY	OK
FLAME TEMP	1022	HAS RIG & COMPOUND BEEN LEFT CLEAN	Yes

NAMES OF ALL AFS & SUB CONTRACTOR STAFF CARRYING OUT WORK			
Barry Cormican			
REPORT WRITER	Barry Cormican		
SIGNATURE			
DATE	13/04/2012		

SERVICE SHEET

Page No 120

JOB NO

1659

Automatic Flare Systems Ltd
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: 22/10/2012

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

ENGINEERS NAME	Barry Cormican

HOURS RUN	BOOSTER 1	8246	CH4	24.6	CO2	18.8	
	BOOSTER 2	N/A	O2	3.5	PRESSURE	19 mbar	

INLET VALVE SETTING % OPEN

NO 1	F/O	NO 2	F/O	NO 3	N/A	NO 4	N/A	NO 5	N/A	NO 6	N/A

MAIN CONTROL VALVE SETTING % OPEN

INLET VACUUM GAUGE READINGS STARING SIDE NEAREST KNOCKOUT POT (mbarg)

NO 1	-7	NO 2	-7	NO 3	N/A	NO4	N/A	NO 5	N/A	NO 6	N/A

INLET TEMP	19 °C	INLET VACUUM PRIOR TO KO POT FILTER	-7 MBAR
VACUUM AFTER KO POT FILTER	-7 MBAR	VACUUM AFTER INLET FLAME ARRESTER	N/A
OUTLET PRESSURE AFTER GAS BOOSTER	12 MBAR	OUTLET GAS TEMP	20 °C
PRESSURE AFTER SLAM SHUT	12 MBAR	PRESSURE AFTER OUTLET FLAME ARRESTER	N/A
TOTAL FLOW	630571 M^3	BLOWER SPEED	37%
FLOW RATE	89 M^3/hr	MEASURING INSTRUMENT	OPFM
FLAME TEMP	20 °C	MOTOR TEMP	NORMAL
FLAME QUALITY	OK	AMBIENT TEMP	16.5 °C

MANOMETER LIQUID LEVEL WITH RIG SHUT DOWN	AMBIENT PRESSURE 1020

TYPE OF LIQUID: PERFLOW

RED SG - 0.8		EMISSIONS ANALYSER CO CELL	1.1	EMISSIONS ANALYSER NOX CELL	N/A

SERVICE SHEET Page No 2	Job No 1659	**Automatic Flare Systems Ltd** Unit 8, Ensign Business Centre Coventry CV4 8JA United Kingdom Tel: +44 (0)24 7647 4877 Fax: +44 (0)24 7647 4834

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 / 34-3 GX		
MOTOR & FAN SEAL GREASED	Yes	BOOSTER CORRECT ROTATION	Yes
NOTE: USE SHELL ALVANIA 3, GREASE EVERY SERVICE **IMPORTANT DO NOT OVERGREASE**			
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	OK	UV SENSOR FUNCTION	OK	EXTERIOR LIGHT	N/A
INTERIOR LIGHT	N/A	ELECTRICAL CONNECTIONS CHECKED FOR TIGHTNESS			Yes

ALL INDICATOR BULBS FUNCTION	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 Page No 3	Job No 1659		**Automatic Flare Systems Ltd** Unit 8, Ensign Business Centre Coventry CV4 8JA United Kingdom Tel: +44 (0)24 7647 4877 Fax: +44 (0)24 7647 4834

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
C02 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	

	REPAIRS	NEW PARTS FITTED
	New Headline Filter	New large Headline filter (AFS Supplied)
	New Igniter Cap	New igniter cap (AFS Supplied)

SERVICE SHEET Page No 4	Job No 1659	**Automatic Flare Systems Ltd** Unit 8, Ensign Business Centre Coventry CV4 8JA United Kingdom Tel: +44 (0)24 7647 4877 Fax: +44 (0)24 7647 4834

REPORT ANY FURTHER REPAIRS OR ACTION NEEDED:
None.

DEPARTURE REPORT:											
HOURS RUN: 8248		RUN RIG FOR 30 MINUTES BEFORE TAKING READINGS									
CH4	24.5	CO2	18.3	O2	4.1	CO	-1.1				
INLET VALVE SETTING % OPEN											
NO 1	F/O	NO 2	F/O	NO 3	N/A	NO 4	N/A	NO 5	N/A	NO 6	N/A
MAIN CONTROL VALVE SETTING % OPEN											
INLET VACUUM GAUGE READINGS STARTING SIDE NEAREST KNOCKOUT POT										(mbarg)	
NO 1	-5	NO 2	-5	NO 3	N/A	NO4	N/A	NO 5	N/A	NO 6	N/A

INLET TEMP	19	INLET VACUUM PRIOR TO KO POT FILTER	-5
VACUUM AFTER KO POT FILTER	-5	VACUUM AFTER INLET FLAME ARRESTER	N/A
OUTLET PRESSURE AFTER GAS BOOSTER	12	OUTLET GAS TEMP	20
PRESSURE AFTER SLAM SHUT	11	PRESSURE AFTER OUTLET FLAME ARRESTER	N/A
OTHER	BLOWER SPEED % 37		
	MANOMETER READING: 100 M3/hr		
FLOW RATE	91	FLAME QUALITY	OK
FLAME TEMP	1015	HAS RIG & COMPOUND BEEN LEFT CLEAN	Yes

NAMES OF ALL AFS & SUB CONTRACTOR STAFF CARRYING OUT WORK			
Barry Cormican			
REPORT WRITER	Barry Cormican		
SIGNATURE			
DATE	22/10/2012		

nvironmental Protection Agency

A survey of landfill sites to determine the quantity of methane flared and or recovered in utilisation plants for 2012

Please choose from the drop down menu the license number for your site	W0032
Please choose from the drop down menu the name of the landfill site	Dungarvan
Please enter the number of flares operational at your site in 2012	1
Please enter the number of engines operational at your site in 2012	0
Total methane flared	157,324 kg/year
Total methane utilised in engines	0 kg/year

Please note that the closing date for reciept of completed surveys is 31/03/2013

Introduction

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

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

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

Once completed please send the completed file as an attachment clearly stating the name and or license number of the landfill site (e.g. W000 Xanadu landfill_2012) to:
LFGProject@epa.ie

	to be filled in by licensee		calculated by spreadsheet	

Flare No. 1

Flare type ?	AFS HT150	**If "other" enter flare description here**	
Is the flare an open or enclosed flare ?	Enclosed	**Rated flare capacity ?**	250 **m3/hr**
Month /year comissioned ?	July 2010		
Month decomissioned if decomissioned in 2012 ?	Select		
What is the function of the flare ?	Extraction from capped area	**If "other" enter flare function here**	

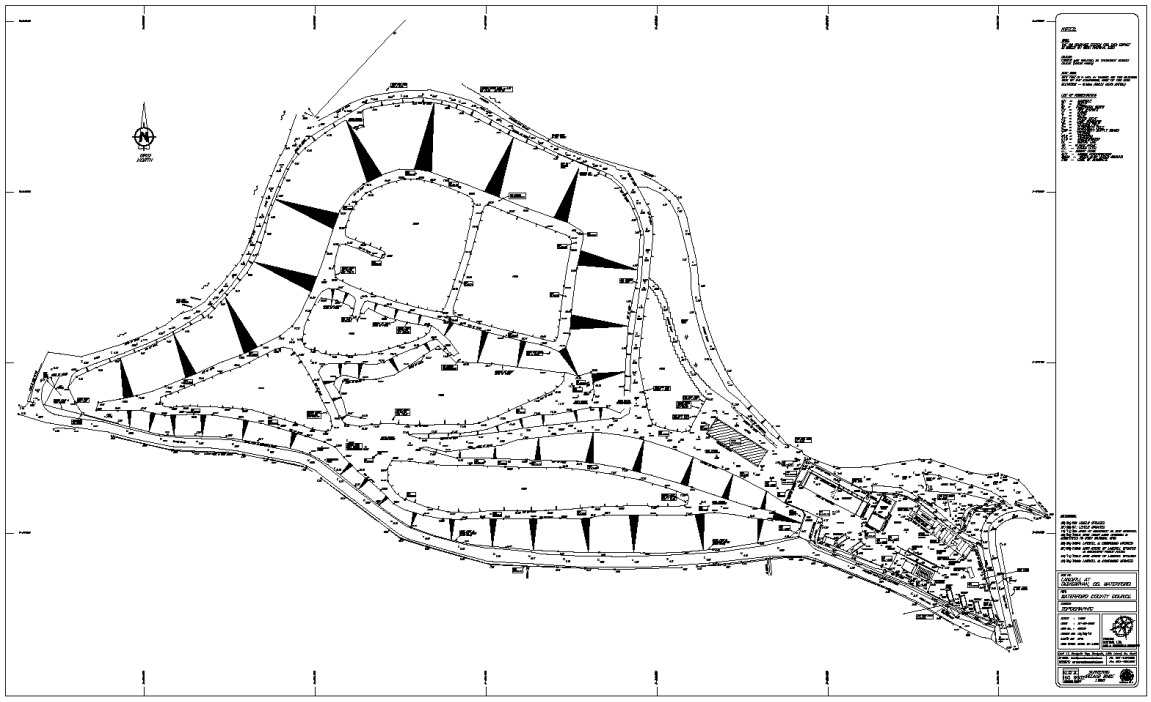
Monthly	Method M/C/E	Runtime days/month	Runtime hrs/day	Downtime hrs	Total runtime hrs/month	Average Inlet Pressure (mbg)	Average Flow Rate (m^3/hr)	Average CH_4 %v/v	Average CO_2 %v/v	Average O_2 %v/v	Combustion efficiency (%)	Total CH_4 m^3	Total CH_4 kgs
January	MCE	30	24.0	0.0	720	-21	95	29.50	19.80	2.70	98.0	19,774	13,370
February	MCE	27	24.0	0.0	648	-21	95	29.50	19.80	2.70	98.0	17,797	12,033
March	MCE	30	24.0	0.0	720	-21	95	29.50	19.80	2.70	98.0	19,774	13,370
April	MCE	29	24.0	0.0	696	-21	95	29.50	19.80	2.70	98.0	19,115	12,925
May	MCE	30	24.0	0.0	720	-21	95	29.50	19.80	2.70	98.0	19,774	13,370
June	MCE	29	24.0	0.0	696	-21	95	29.50	19.80	2.70	98.0	19,115	12,925
July	MCE	30	24.0	0.0	720	-21	95	29.50	19.80	2.70	98.0	19,774	13,370
August	MCE	30	24.0	0.0	720	-21	95	29.50	19.80	2.70	98.0	19,774	13,370
September	MCE	29	24.0	0.0	696	-21	95	29.50	19.80	2.70	98.0	19,115	12,925
October	MCE	30	24.0	0.0	720	-21	95	29.50	19.80	2.70	98.0	19,774	13,370
November	MCE	29	24.0	0.0	696	-21	95	29.50	19.80	2.70	98.0	19,115	12,925
December	MCE	30	24.0	0.0	720	-21	95	29.50	19.80	2.70	98.0	19,774	13,370
Total					8,472							232,679	157,324

Please note: Only fill the "Yearly" table if data is not availabe 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 Flow Rate m^3/hr	Average CH_4 %v/v	Average CO_2 %v/v	Average O_2 %v/v	Combustion efficiency (%)	Total CH_4 m^3	Total CH_4 kgs
2012					0						98.0	0	0

Appendix H

Topographical Survey



Appendix I

Management Structure

Management Structure of Waterford County Council

County Manager Mr Denis McCarthy

⇩

Director of Services

Environment & Planning Mr. Brian White

⇩

Senior Engineer Mr. Gabriel Hynes

⇩

Senior Executive Engineer

⇩

Executive Scientific Officer	Executive Engineer	Environmental Consultants
Mr. Paul Carroll	Ms. Aoife O Flaherty	MCOS

⇩

Civic Amenity Manager

Mr. David Regan

⇩ ⇩

Caretaker	1 – Site Operative
Mr. Bill O Keeffe	

Appendix J

Pollutant Release Transfer Register

Environmental Protection Agency

Guidance to completing the PRTR workbook

AER Returns Workbook

Version 1.1.16

REFERENCE YEAR	2012

1. FACILITY IDENTIFICATION

Parent Company Name	Waterford County Council
Facility Name	Dungarvan Waste Disposal Site
PRTR Identification Number	W0032
Licence Number	W0032-02

Waste or IPPC Classes of Activity

N	class_name
3.13	Storage prior to submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where the waste concerned is produced.
3.4	Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons.
4.11	Use of waste obtained from any activity referred to in a preceding paragraph of this Schedule.
4.13	Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced.
4.2	Recycling or reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes).
4.3	Recycling or reclamation of metals and metal compounds.
4.4	Recycling or reclamation of other inorganic materials.
4.9	Use of any waste principally as a fuel or other means to generate energy.
Address 1	Ballynamuck Middle
Address 2	Dungarvan
Address 3	Co. Waterford
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
AER Returns Contact Name	David Regan
AER Returns Contact Email Address	doregan@waterfordcoco.ie
AER Returns Contact Position	Executive Technician
AER Returns Contact Telephone Number	058 21112
AER Returns Contact Mobile Phone Number	086 8307065
AER Returns Contact Fax Number	058 45606
Production Volume	0.0
Production Volume Units	
Number of Installations	0
Number of Operating Hours in Year	2145
Number of Employees	2
User Feedback/Comments	
Web Address	www.waterfordcoco.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 ?	Yes
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

This question is only applicable if you are an IPPC or Quarry site

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

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

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

RELEASES TO AIR					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD			ADD EMISSION POINT	QUANTITY		
			Method Used					
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
01	Methane (CH4)	E	ESTIMATE	Estimated from Landgem Model and Flare Data	442676.0	442676.0	0.0	0.0
03	Carbon dioxide (CO2)	E	ESTIMATE	Estimated from Landgem Model	1650000.0	1650000.0	0.0	0.0
07	**Non-methane volatile organic compounds (NMVOC)**	E	ESTIMATE	USA Landgem Model	26000.0	26000.0	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)

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

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: Method Code**	**Method Used: Designation or Description**	**Facility Total Capacity m3 per hour**	
Total estimated methane generation (as per site model)	600000.0	E	Estimated	Estimated from Flare Data	N/A	
Methane flared	157324.0	E	Estimated	Estimated from Flare Data	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)	442676.0	E	Estimated	Estimated from Flare Data	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

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

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

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

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)

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

4.3 RELEASES TO WASTEWATER OR SEWER

Link to previous years emissions data

SECTION A : PRTR POLLUTANTS

OFFSITE TRANSFER OF POLLUTANTS DESTINED FOR WASTE-WATER TREATMENT OR SEWER					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD			ADD EMISSION POINT	QUANTITY		
			Method Used					
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0

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 POLLUTANT EMISSIONS (as required in your Licence)

OFFSITE TRANSFER OF POLLUTANTS DESTINED FOR WASTE-WATER TREATMENT OR SEWER					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD			ADD EMISSION POINT	QUANTITY		
			Method Used					
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0

4.4 RELEASES TO LAND Link to previous years emissions data | PRTR# : W0032 | Facility Name : Dungarvan Waste Disposal Site | Filename : Dungarvan Landfill PRTR W0032_2012(1).xlsm | Return Year : 17/04/2013 16:02

SECTION A : PRTR POLLUTANTS

RELEASES TO LAND					Please enter all quantities in this section in KGs		
POLLUTANT		METHOD			ADD EMISSION POINT	QUANTITY	
			Method Used				
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year
					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 POLLUTANT EMISSIONS (as required in your Licence)

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

Please enter all quantities on this sheet in Tonnes

0

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	229.16	wastes not otherwise specified (Organic and Garden)	R3	M	Weighed	Offsite in Ireland	Miltown Composting Ltd,W0270-01	Fethard,Co. Tipperary,,,,Ireland		
Within the Country	08 01 21	Yes	2.74	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	0.88	synthetic engine, gear and lubricating oils	R9	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	15 01 01	No	141.78	paper and cardboard packaging	R3	M	Weighed	Offsite in Ireland	Waterford Co. Council,W189-01	Shandon,Dungarvan,Co. Waterford,,,Ireland		
Within the Country	15 01 07	No	16.45	glass packaging	R5	M	Weighed	Offsite in Ireland	Rehab Recycling Ltd,Reg no. 635 Permit No. 03/07	Monaghan Road,Cork,,,,Ireland		
Within the Country	16 01 07	Yes	0.12	oil filters	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
To Other Countries	16 02 11	Yes	26.97	discarded equipment containing chlorofluorocarbons, HCFC, HFC - FRIDGES	R4	M	Weighed	Abroad	KMK Metals Recycling,WCP/KK/069(A)/06	Cappincur Industrial Estate,Daingean 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	0.51	discarded equipment containing chlorofluorocarbons, HCFC, HFC - Flourescent Tubes	R4	M	Weighed	Abroad	KMK Metals Recycling,WCP/KK/069(A)/06	Cappincur Industrial Estate,Daingean 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	61.16	discarded equipment containing hazardous components (16) other than those mentioned in 16 02 09 to 16 02 12 - Large Household Items	R4	M	Weighed	Abroad	KMK Metals Recycling,WCP/KK/069(A)/06	Cappincur Industrial Estate,Daingean 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	47.37	discarded equipment containing hazardous components (16) other than those mentioned in 16 02 09 to 16 02 12 - TV Monitors	R4	M	Weighed	Abroad	KMK Metals Recycling,WCP/KK/069(A)/06	Cappincur Industrial Estate,Daingean 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	55.61	discarded equipment containing hazardous components (16) other than those mentioned in 16 02 09 to 16 02 12 - Small Household Items	R4	M	Weighed	Abroad	KMK Metals Recycling,WCP/KK/069(A)/06	Cappincur Industrial Estate,Daingean 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	1.3	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	73.74	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	Unit 6 Ballylogan Industrial Park,Ballylogan Road,Dublin 13,,,Ireland		
Within the Country	17 05 04	No	25.2	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		
Within the Country	20 01 02	No	6.46	glass	R5	M	Weighed	Offsite in Ireland	Greenstar Ltd,WCP-KK-11-54-02	Unit 6 Ballylogan Industrial Park,Ballylogan Road,Dublin 13,,,Ireland		
Within the Country	20 01 11	No	2.38	textiles (clothing)	R5	M	Weighed	Offsite in Ireland	Textile Recycling Ltd,WCP-DC-08-1225-01	Glenabbey Complex,Belgard Road,Tallaght,Dublin 14,Ireland		
Within the Country	20 01 38	No	77.48	wood other than that mentioned in 20 01 37	R3	M	Weighed	Offsite in Ireland	Greenstar Ltd,WCP-KK-11-54-02	Unit 6 Ballylogan Industrial Park,Ballylogan Road,Dublin 13,,,Ireland		
Within the Country	20 01 39	No	72.0	plastics	R5	M	Weighed	Offsite in Ireland	Irish film Farm Plastics Group,WMP044B	Waverley Office Park,Old Naas Road,Dublin 12,,,Ireland		
Within the Country	20 01 40	No	25.6	metals	R5	M	Weighed	Offsite in Ireland	Greenstar Ltd,WCP-KK-11-54-02	Unit 6 Ballylogan Industrial Park,Ballylogan Road,Dublin 13,,,Ireland		
Within the Country	20 03 01	No	478.8	mixed municipal waste (grey bin)	D1	M	Weighed	Offsite in Ireland	Wexford Co. Council,W0191-02	Holmestown Waste Management Facility,Barntown,Co. Wexford,,,Ireland		
Within the Country	20 03 03	No	56.82	street-cleaning residues	D1	M	Weighed	Offsite in Ireland	Wexford Co. Council,W0191-02	Holmestown Waste Management Facility,Barntown,Co. Wexford,,,Ireland		
Within the Country	20 03 07	No	29.34	bulky waste	D1	M	Weighed	Offsite in Ireland	Wexford Co. Council,W0191-02	Holmestown Waste Management Facility,Barntown,Co. Wexford,,,Ireland		
Within the Country	02 03 99	No	2187.74	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	20 03 01	No	3454.4	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	469.8	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	322.54	bulky waste	D1	M	Weighed	Offsite in Ireland	Bord na Mona Ltd,W0201-01	Drehid Landfill,Kilnagh Upper,Carbury,Co. Kildare,Ireland		

Appendix K

Ecological Report

Ecological Survey of Dungarvan Landfill 2012 Reporting Period

Waterford County Council
Comhairle Chontae Phort Láirge

Table of Contents

EXECUTIVE SUMMARY

Dungarvan Landfill site is located at Ballynamuck Middle, Dungarvan, Co Waterford. It is mostly surrounded by agricultural land although wetland habitats occur in association with the River Colligan which flows in a west to east direction along the northern perimeter of the site before flowing down the River Colligan Estuary into Dungarvan Harbour.

The landfill site is comprised of seven principal habitats: artificial lakes and ponds (FL8), Grassland (GA/GS), spoil and bare ground (ED2), buildings and artificial surfaces (BL3), scrub (WS1), wet grassland (GS4) and reed and large sedge swamps (FS1). The series of constructed wetlands established in autumn 2008 on the landfill cap to treat leachate are now well established with full growth of wetland vegetation.

This Ecological Report comprises a habitat and fauna survey, freshwater biological survey of the River Colligan, and the assessment of the avian fauna of the landfill and nearby Dungarvan harbour.

The results of the 2012 biological assessment of the River Colligan indicated good water quality status at the upstream sampling site (Site 1) following analysis of both the surface water quality and biological water quality data recorded. An improvement of the water quality at Site 1 (in comparison with 2006) and the increase in the diversity of species at downstream connecting sites, coupled with the review of water quality measurements taken on site and EPA chemical water quality data between 2007 and 2008, reflects good water quality indicating that Dungarvan Landfill site is not negatively impacting the River Colligan.

Dungarvan landfill and its environs support a fairly wide diversity of birds. The establishment of constructed wetlands has provided feeding and nesting grounds for a number of wetland birds such as Snipe and Moor Hen. The Colligan river corridor, with its many trees, is particularly species-rich, and it provides a good feeding area for many passerine species. It is also an ideal feeding habitat for those species that rely on the water column directly (e.g. Little Grebe, Little Egret, Common Sandpiper, Kingfisher and Dipper). Of note is the presence of Little Egret and Kingfisher, both of which are Annex I species under the EU Birds Directive. The Kingfisher is considered an indicator species or 'bioindicator' of the health of river ecosystems and will rapidly disappear from polluted waters. Its continued presence in the same area is therefore a positive sign as to the health of the river. Likewise, the presence of Little Egrets suggests a healthy and adequate fish supply.

During the winter months, Dungarvan Harbour supports four species that are listed on Annex I of the EU Birds Directive: Great Northern Diver, Little Egret, Golden Plover and Bar-tailed Godwit. Current data from the Irish Wetland Bird Survey (I-WeBS) shows that the harbour supports two species in internationally important numbers (Light-Bellied Brent Goose and Black-tailed Godwit) and a further 10 species in nationally important numbers. Review of recent and previous I-WeBS data suggests a possible trend for increase in Curlew and Black-tailed Godwits. The data also shows a trend for increase in Redshank, Little Egret and Light-bellied Brent Geese.

Mammal species previously recorded from the site include: Rabbit, Brown rat, Fox, Otter and Mink. Small mammals such as the Pygmy shrew, Field mouse, House mouse, and Bank vole are also likely to be present, but because of their small size and nocturnal habits are easily overlooked. Stoat, Hedgehog and Badger are also likely to be present in the area, although it is unlikely that they occur within the landfill site itself. Bat species such as Daubentons also probably use the river corridor as a feeding habitat.

The River Colligan is an important habitat for Otters which are protected under both Irish and

European legislation. Numerous sprainting sites, some of which are obviously in long-term use, indicate that otters are resident and successful there. The high level of otter activity from previous surveys indicates that the River Colligan contains a healthy and reliable population of fish, again highlighting the biological health of the River Colligan.

1.0 INTRODUCTION

1.1 Background

An Ecological Report on Dungarvan Landfill has been prepared by Waterford County Council, as part of on- going requirements of Condition 8.11 of the Dungarvan Waste Disposal Site waste licence (Reg. No. 32-1) and updated licence Reg. No. 32-2 (2005).

After 30 years of operation, Dungarvan landfill was closed and capped in 2003. The site now operates as an integrated waste management facility and closed landfill under EPA Licence Reg. No. 32-2.

Ecological surveys and assessment are required involving the following elements;

1. Habitat quality at landfill and environs. Mapping of main habitat types and identification of main flora and fauna present. Interpretation of findings with regard to previous studies.

2. Flora (macroalgae) and fauna (including macroinvertebrtaes) at five River Colligan sites, (locations as previous years/map attached). Application of appropriate rating systems, such as the EPA-Q rating system, and estuarine evaluation systems. Interpretation of results in light of previous studies.

3. Interpretation and comment on bird count-data to be obtained from annual IWeBs counts by Birdwatch Ireland, and the landfill bird control contractor

1.2 Study Area

Dungarvan Landfill site is located at Ballynamuck Middle, Dungarvan, Co Waterford (Figure 1), north-east of the town of Dungarvan. The principal land use around the landfill site is agricultural. The River Colligan flows in a west to east direction along the northern perimeter of the site before flowing beneath a bridge (Ballyneety Bridge) down the River Colligan Estuary into Dungarvan Harbour.

For the purpose of this study, the ecological study area comprises the landfill site and its immediate surrounding habitats including the corridor of the River Colligan downstream as far as Ballyneety Bridge.

1.3 Report Format

The results of the 2013 ecological surveys are presented in the following sections of this report, separated into the various subject areas as required by the scope of works. Section 2 gives a general site overview, describes areas designated for nature conservation that occur in close proximity to the landfill site and reports on the habitat study undertaken in January 2013. Section 3 presents the results of a freshwater biological (freshwater macroinvertebrate) survey along the River Colligan. Section 4 discusses the bird communities recorded at the landfill and reviews data for Dungarvan Harbour from the Irish Wetland Bird Survey (I-WeBS).

2.0 TERRESTRIAL ECOLOGY

2.1 General Site Overview

Dungarvan Landfill site is located at Ballynamuck Middle, Dungarvan, Co Waterford (Grid ref X 245 948) to the north-east of the main settlement of Dungarvan Town. The main land use in the vicinity of the landfill site is agricultural comprising arable and grazing pasture. The major landscape feature in the vicinity of the landfill is the River Colligan which flows along the northern perimeter of the site in a west to east direction. The river enters the Colligan Estuary south of Ballyneety Bridge eventually flowing into the wider expanse of Dungarvan Harbour. The Colligan is the largest of three rivers that enters Dungarvan Harbour. The Colligan River and estuary has considerable wildlife interest and the river is a valuable fisheries resource.

2.1.1 Designated sites for nature conservation

Dungarvan Landfill Site lies in close proximity to areas that are recognised for their ecological conservation interest. Areas designated under national and/or European laws in order to conserve habitats and species of national or international importance include the following :

Proposed Natural Heritage Areas (NHA): a national designation legally provided for by the Wildlife (Amendment) Act 2000.

Special Areas of Conservation (SAC): areas considered of international and national importance whose legal basis is the EU Habitats Directive (92/43/EEC), transposed into Irish law through the European Union (Natural Habitats) Regulations, 1997 as amended.

Special Protection Areas (SPA) sites of international conservation importance for birds for birds whose legal basis is the EU Birds Directive (79/409/EEC).

Dungarvan Harbour is proposed for designation as a Natural Heritage Area. The pNHA boundary extends above Ballyneety Bridge and adjacent to the landfill site boundary. Appendix 1 details the site synopsis for the pNHA.

Dungarvan Harbour is a designated Special Protection Area (SPA) under the EU Birds Directive. The designated area (code 4032) covers an area of 1,041 hectares and extends along the River Colligan estuary as far upstream as Ballyneety Bridge A similar area to the SPA is a designated Ramsar Site (Site Code 835). Appendix 1 details the site synopsis.

Figures 1&2 . Location of Dungarvan Landfill in relation to the River Colligan and Ballyneety Bridge showing boundaries of sites designated for nature conservation – Dungarvan Harbour SPA and pNHA

SPA boundary pNHA boundary

Dungarvan Bay is a shellfish growing areas as delineated by the Sea-Fisheries Protection Authority. The Sea Fisheries Protection Authority is responsible for classifying shellfish production areas as required under Directive 991/492/EEC) and by the 1996 Regulations (SI No 147 of 1996). Dungarvan Bay is classified as Class B – requiring purification for 48 hours before shellfish can be placed on the market. The DoEHLG published a Pollution Reduction Programme for Dungarvan Bay in 2010 to ensure compliance with the standards and objectives established by the Quality of Shellfish Waters Regulations 2006 (S.I. No. 268) of 2001 as amended for the designated Shellfish growing waters.

2.2 Habitat survey of Dungarvan Landfill & environs

The habitat cover of Dungarvan Landfill was surveyed in 2013 to compare findings with the 2010 and 2008 habitat surveys. The 2008 survey area included the landfill site and adjacent habitats such as some farmland and the corridor of the River Colligan to the north of the site. The survey followed standard Phase 1 methodology (JNCC 2003, Heritage Council 2002).

Habitats were classified using habitat description and codes set out in Fossitt (2000). Plant species lists were compiled i previous surveys in 2008 and 2010. . The 2008 survey was carried out on 22nd October i.e. well after the flowering period for most species and thus an underestimation of species may have been recorded. The 2010 botanical survey was carried out on 14th June 2010 by Paul Green BSBI[1] recorder for County Waterford. Table 1 details the species list recorded in both years. A detailed plant survey was not carried out in February 2013 due to the unsuitability of the season for recording botanical information and a survey will be carried out in early summer instead.

The landfill site (inside fenced area) comprises seven main habitat types: artificial lakes and ponds (FL8), Grassland (GA/GS), spoil and bare ground (ED2), buildings and artificial surfaces (BL3), scrub (WS1) wet grassland (GS4) and reed and large sedge swamps (FS1).

The landfill site is bordered to the north and south by agricultural lands, including improved agricultural grassland (GA1), wet grassland (GS4) and arable crops (BC1). Scrub (WS1) and hedgerows and treelines (WL1 & WL2) occur throughout the agricultural landscape. Upper saltmarsh (CM2) and mud shores (LS4) occur above Ballyneety Bridge (just east of the landfill site). Figure 3 details the habitat cover of the landfill site.

Habitat Types

Dungarvan landfill consists of a capped mound that is now completely vegetated. The series of constructed wetland cells installed to treat leachate in autumn 2008 now exhibit dense growth of submerged and emergent wetland vegetation.

Other artificial lakes and Ponds (FL8)

A series of 6 constructed wetlands were established on the landfill cap and are designed to collect and treat residual leachate from the landfill. The wetlands installed in autumn 2008 were planted with a mix of wetland vegetation such as reeds and sedges. Another artificial pond occurs in the south east of the landfill site and supports some submerged and emergent vegetation and has an extensive reedbed behind it. Artificial lakes and ponds occupy approximately 45% of the site area.

Grassland (GA/GS)

In 2008 spoil and bare ground (ED2) were the dominant habitat in the landfill. By 2010 recolonising bare ground accounted for approximately 36% of the site when colonisation of vegetation on the landfill cap had progressed well and contained a mixture of ruderal species

[1] Botanical Society of the British Isles

(Charlock, Broad-leaved Dock and Ragwort) grasses and rush species. At this stage the extent of recolonisation varied over the profile of the landfill cap with the eastern-north eastern slopes showing the least vegetation cover with up to 80% bare ground in places. The north- north western slopes had 40% bare ground while the southern slopes had 20-30% bare ground. Reprofiling works in June 2010 also resulted in more exposed soil along access paths worked by machinery but these areas gradually recolonised in 2011. An area of .75 ha at the south eastern end of the landfill was sown with native wildflower seed in May 2010 to enhance the biodiversity of the site. Monitoring of the site in 2011 showed an increase in variety of flora on the eastern facing slopes. However, poaching by horses had also impacted on the seed mix taking hold. Monitoring of the site in 2013 showed full cover of grassland on the capped mound with some small patches of bare ground due to traffic access.

Spoil and bare ground (ED2)

Spoil and bare ground are now limited to the exposed soil in access paths around the constructed wetland ponds and a 3m gravel access track from the artificial pond adjacent to the shed running along the south of the landfill between wetlands 4 and 5, 3 and 5 and ending between wetlands 2 and 3. This habitat accounts for approximately 1% of the site.

Wet Grassland (GS4)

Patches of wet grassland occur on the western and northern side of the site with a frequent presence of *Juncus* species. Wet grassland accounts for 2% of habitat cover.

Scrub (WS1)

Some small areas of scrub occur around the periphery of the landfill site. The most extensive area of scrub is found on the riverbank along the north-eastern edge of the site. This area has developed from other habitats particularly recolonising bare ground (ED3). A narrow strip of scrub also occurs along the southern boundary. Scrub habitat accounts for 4% of the site area. The ability of Gorse to spread quickly will likely mean a rapid succession from grassland to scrub cover on the landfill cap. The presence of willow around the wetland margins and eastern slopes will also encourage the acceleration of scrub cover.

Reed and large sedge swamps (FS1)

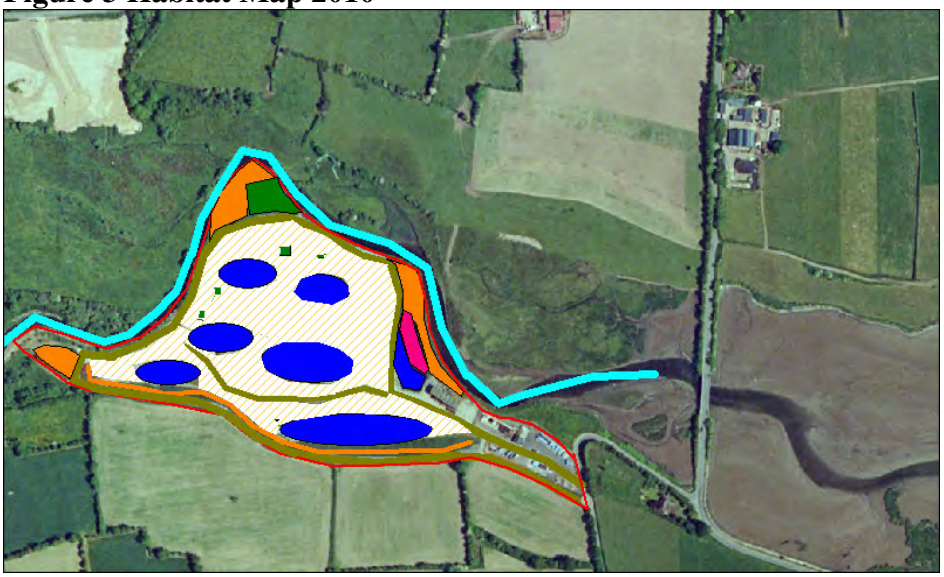
Reed swamp habitat occurs between the leachate pond and the river. This habitat is almost a monodominant stand of Common Reed. Several stands of Common Reed also occur in places along the southern riverbank outside the site. This habitat covers 1% of the landfill site.

Buildings and artificial surfaces (BL3)

This habitat category comprises areas of concrete and tarmacadam, metal storage containers, offices and ancillary structures and the road leading to the site. Due to the bare and artificial nature of this habitat plant life is scarce. This habitat covers approximately 11% of the landfill site.

Figures 3 and 4 below illustrate the habitat cover of the landfill site in 2010 and 2013

Figure 3 Habitat Map 2010



Habitat Key

Artificial lakes and ponds
Recolonising bare ground
Spoil and bareground
Reed and large sedge swamps
Scrub
Wet Grassland
River Colligan

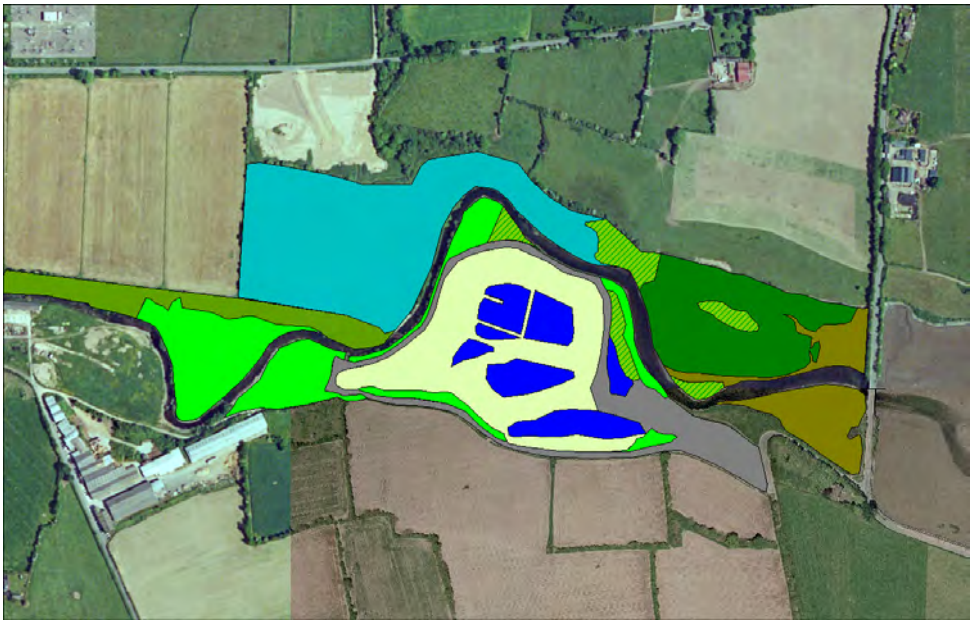


Figure 4 Habitat Map 2013

Habitat Key

Artificial lakes and ponds
Grassland
Spoil and bareground
Scrub
Reed and large sedge swamps
Wet Grassland
River Colligan

Table 1. Plant species list recorded in 2008 and 2010 (x denotes occurrence of species)

Species		2008 (Oct 22nd)	2010 (14 June)
Taxon	**Vernacular**		
Acer pseudoplatanus	Sycamore	x	x
Achillea millefolium	Yarrow	x	x
Aethusa cynapium	Fool's Parsley		x

Agrostis capillaris	Common Bent	x	
Agrostis stolonifera	Creeping Bent	x	x
Alisma plantago-aquatica	Water-plantain		x
Alnus glutinosa	Alder	x	x
Alopecurus geniculatus	Marsh Foxtail		x
Anagallis arvensis subsp. arvensis	Scarlet Pimpernel	x	x
Anthriscus sylvestris	Cow Parsley		x
Aphanes arvensis	Parsley-piert		x
Apium nodiflorum	Fool's-water-cress	x	x
Arabidopsis thaliana	Thale Cress		x
Arctium nemorosum	Wood Burdock	x	x
Arrhenatherum elatius	False Oat-Grass	x	x
Aster trifolium	Sea Aster	x	
Athyrium filix-femina	Lady-fern		x
Barbarea vulgaris	Winter-cress		x
Bellis perennis	Daisy	x	x
Berula erecta	Lesser Water-parsnip		x
Bolboschoenus maritimus	Sea Clubrush	x	
Brassica nigra	Black Mustard		x
Brassica rapa subsp. campestris	Wild Turnip	x	x
Bromus hordeaceus	Soft-brome		x
Callitriche obtusangula	Blunt-fruited Water-starwort		x
Calystegia sepium subsp. sepium	Hedge Bindweed	x	x
Calystegia silvatica	Large Bindweed		x
Capsella bursa-pastoris	Shepherd’s purse	x	
Carex sp	Sedges	x	x
Carex divulsa subsp. divulsa	Grey Sedge		x
Carex echinata	Star Sedge		x
Carex flacca	Glaucous Sedge		x
Carex otrubae	False Fox-sedge		x
Carex riparia	Greater Pond-sedge		x
Centaurea nigra	Common Knapweed	x	x
Centaurium erythraea	Common Centaury		x
Cerastium fontanum	Common Mouse-ear	x	x
Cerastium glomeratum	Sticky Mouse-ear		x
Chamerion angustifolium	Rosebay Willowherb	x	x
Chenopodium album	Fat-hen	x	x
Cirsium arvense	Creeping Thistle	x	x
Cirsium palustre	Marsh Thistle	x	
Cirsium vulgare	Spear Thistle	x	x
Cochleria officinale	Common Scurvey-Grass	x	

Conium maculatum	Hemlock		x
Crataegus monogyna	Hawthorn	x	x
Crepis capillaris	Smooth Hawk's-beard		x
Crocosmia x crocosmiiflora	Montbretia (C. aurea x pottsii)	x	x
Cynosurus cristatus	Crested Dog's-tail		x
Dactylis glomerata	Cock's-foot	x	x
Daucus carota subsp. carota	Wild Carrot	x	x
Eleocharis palustris	Common Spike-rush		x
Elodea canadensis	Canadian Waterweed		x
Elytrigia repens	Common Couch	x	x
Epilobium ciliatum	American Willowherb		x
Epilobium hirsutum	Great Willowherb	x	x
Epilobium obscurum	Short-fruited Willowherb		x
Epilobium palustre	Marsh Wilowherb	x	
Epilobium parviflorum	Hoary Willowherb		x
Equisetum arvense	Field Horsetail	x	x
Equisetum fluviatile	Water Horsetail	x	x
Euphorbia helioscopia	Sun Spurge	x	x
Fallopia japonica	Japanese Knotweed	x	x
Festuca rubra agg.	Red Fescue	x	x
Filipendula ulmaria	Meadowsweet	x	x
Fraxinus excelsior	Ash	x	x
Fuchsia magellanica	Fuchsia	x	x
Galium aparine	Cleavers	X	
Galium palustre subsp. palustre	Common Marsh-bedstraw	x	x
Geranium dissectum	Cut-leaved Crane's-bill	x	x
Geranium robertianum	Herb-Robert	x	x
Geum urbanum	Wood Avens		x
Glyceria declinata	Small Sweet-grass		x
Glyceria fluitans	Floating Sweet-grass		x
Glyceria maxima	Reed Sweet-grass		x
Groenlandia densa	Opposite-leaved Pondweed		x
Hedera helix subsp. hibernica	Atlantic Ivy	x	x
Heracleum sphondylium	Hogweed	x	x
Holcus lanatus	Yorkshire-fog	x	x
Hypericum maculatum subsp. obtusiusculum	Imperforate St John's-wort		x
Hypericum perforatum	Perforate St John's-wort		x
Hypericum tetrapterum	Square-stalked St John's-wort		x
Hypochaeris radicata	Cat's-ear		x

Iris pseudacorus	Yellow Iris	x	x
Juncus acutiflorus	Sharp-flowered Rush		x
Juncus articulatus	Jointed Rush	x	x
Juncus bufonius	Toad Rush		x
Juncus conglomeratus	Compact Rush		x
Juncus effusus	Soft-rush	x	x
Juncus inflexus	Hard Rush	x	x
Lapsana communis subsp. communis	Nipplewort		x
Lathyrus pratensis	Meadow Vetchling	x	x
Lemna minor	Common Duckweed		x
Leucanthemum vulgare	Oxeye Daisy	x	x
Ligustrum vulgare	Privet	x	
Linum catharticum	Fairy Flax		x
Lolium multiflorum	Italian Rye-grass		x
Lolium perenne	Perennial Rye-grass	x	x
Lonicera periclymenum	Honeysuckle	x	
Lotus corniculatus	Common Bird's-foot-trefoil	x	x
Lotus pedunculatus	Greater Bird's-foot-trefoil		x
Lychnis flos-cuculi	Ragged-Robin		x
Lythrum salicaria	Purple Loosestrife	x	
Matricaria discoidea	Pineappleweed	x	x
Medicago lupulina	Black Medick	x	x
Mentha aquatica	Water Mint	x	
Mimulus guttatus	Monkeyflower		x
Myosotis scorpiodes	Water Forget-me-knot	x	
Odontites vernus	Red Bartsia		x
Oenanthe crocata	Hemlock Water-dropwort		x
Persicaria amphibia	Amphibious Bistort		x
Persicaria maculosa	Redshank	x	x
Petasites fragrans	Winter Heliotrope		x
Phalaris arundinacea	Reed Canary-grass		x
Phragmites australis	Common Reed	x	x
Phyllitis scolopendrium	Hart’s Tongue Fern	x	
Plantago lanceolata	Ribwort Plantain	x	x
Plantago major	Greater Plantain	x	x
Poa annua	Annual Meadow-grass	x	x
Poa pratensis	Smooth Meadow-grass		x
Poa trivialis	Rough Meadow-grass		x
Polygonum aviculare	Knotgrass	x	x

Polystichum setiferum	Soft Shield-fern	x	x
Potamogeton natans	Broad-leaved Pondweed		x
Potentilla anserina	Silverweed	x	x
Potentilla palustris	Marsh Cinquefoil	x	
Potentilla reptans	Creeping Cinquefoil	x	x
Primula vulgaris	Primrose		x
Prunella vulgaris	Selfheal	x	x
Prunus spinosa	Blackthorn	x	
Pteridium aquilinum	Bracken	x	x
Pulicaria dysenterica	Common Fleabane	x	x
Ranunculus acris	Meadow Buttercup		x
Ranunculus hederaceus	Ivby-leaved crowfoot	x	
Ranunculus repens	Creeping Buttercup	x	x
Ranunculus sceleratus	Celery-leaved Buttercup		x
Reseda luteola	Weld	x	x
Rorippa nasturtium-aquaticum	Water-cress	x	x
Rosa canina	Dog-rose	x	x
Rubus fruticosus agg.	Bramble	x	x
Rubus ulmifolius	Elm-leaved Bramble		x
Rumex acetosa subsp. acetosa	Common Sorrel	x	x
Rumex conglomeratus	Clustered Dock		x
Rumex crispus subsp. crispus	Curled Dock		x
Rumex obtusifolius	Broad-leaved Dock	x	x
Rumex sanguineus	Wood Dock		x
Sagina apetala	Annual Pearlwort		x
Sagina procumbens	Procumbent Pearlwort		x
Salix cinerea subsp. oleifolia	Rusty Willow	x	x
Sambucus nigra	Elder	x	x
Schoenoplectus tabernaemontani	Grey Club-rush	x	x
Scrophularia auriculata	Water Figwort	x	x
Scrophularia nodosa	Common Figwort	x	x
Senecio aquaticus	Marsh Ragwort	x	x
Senecio jacobaea	Common Ragwort	x	x
Senecio vulgaris	Groundsel	x	x
Sinapis alba	White Mustard		x
Sinapis arvensis	Charlock	x	x
Sisymbrium officinale	Hedge Mustard	x	x
Solanum dulcamara	Bittersweet	x	
Sonchus asper	Prickly Sow-thistle	x	x
Sonchus oleraceus	Smooth Sow-thistle	x	x
Sparganium erectum	Branched Bur-reed		x
Stachys palustris	Marsh Woundwort	x	x
Stachys sylvatica	Hedge Woundwort	x	x

Stellaria graminea	Lesser Stitchwort			x
Stellaria media	Common Chickweed		x	x
Taraxacum officinale	Dandeloin		x	
Trifolium dubium	Lesser Trefoil			x
Trifolium pratense		x		x
Trifolium repens	White Clover			
Tussilago farfara	Colt's-foot			x
Triglochin maritium	Sea Arrowgrass		x	
Tripleurospermum inodorum	Scentless Mayweed		x	
Typha latifolia	Bulrush		x	x
Ulex europaeus	Gorse		x	x
Urtica dioica	Common Nettle		x	x
Veronica anagallis-aquatica	Blue Water-speedwell			x
Veronica arvensis	Wall Speedwell			x
Veronica beccabunga	Brooklime			x
Veronica chamaedrys	Germander Speedwell		x	x
Veronica persica	Common Field-Speedwell		x	
Veronica serpyllifolia subsp. serpyllifolia	Thyme-leaved Speedwell			x
Vicia cracca	Tufted Vetch		x	x
Vicia hirsuta	Hairy Tare			x
Vicia sativa subsp. segetalis	Common Vetch			x
Vicia sepium	Bush Vetch		x	x
Zea Mays	Maize		x	
Total no. of Species			103	162

2.3 Mammals in Dungarvan Landfill and environs

The River Colligan is an important habitat for Otters which are protected under both Irish and European legislation. Numerous sprainting sites, some of which are obviously in long-term use, indicate that otters are resident and successful there. The high level of otter activity from previous surveys indicates that the River Colligan contains a healthy and reliable population of fish, again highlighting the biological health of the River Colligan. The abundance of frogspawn provides a food source for Otter along the River Colligan. Surveys of Otter activity along the Colligan commissioned by the MISE[2] project in 2011 and 2012 indicate active use along this waterway corridor.

Bat species such as Daubentons also probably use the river corridor as a feeding habitat.

[2] Mammals in s Sustainable Environment

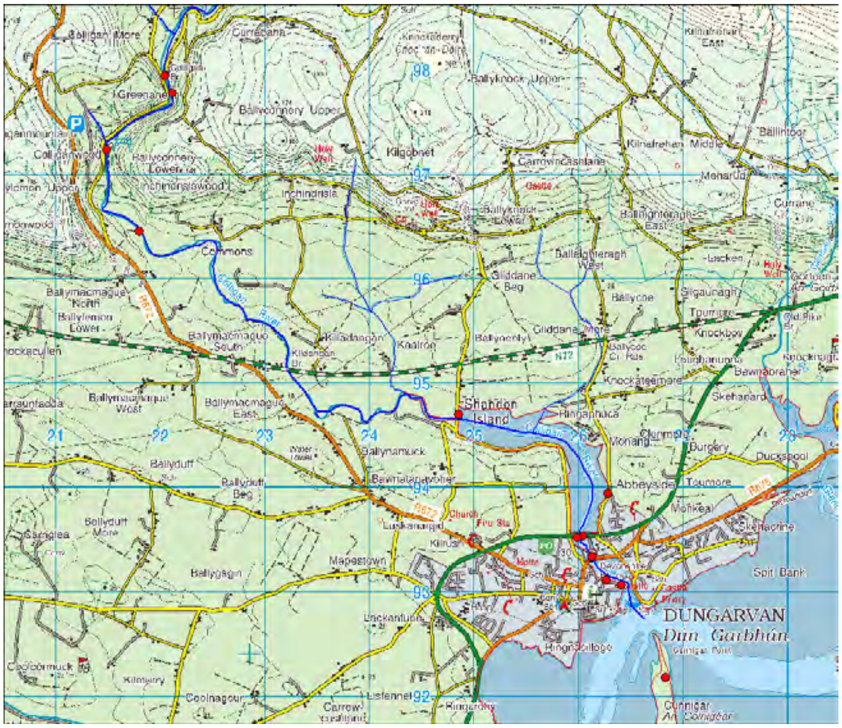


Figure 5. Evidence of Otter activity along the Colligan River (red dots) based on collection of Otter Spraints from the MISE Otter Survey 2012.

3.0 BIOLOGICAL ASSESSMENT OF THE RIVER COLIGAN

4.0 AVIAN FAUNA OF DUNGARVAN LANDFILL AND ENVIRONS

4.1 Field Survey

A bird survey of Dungarvan landfill and environs was undertaken in January 2011 mid way between high tide and low tide. The survey involved;

A survey of wetland birds of the river corridor adjacent to the Dungarvan landfill and extending downstream to approximately 500m below Ballyneety Bridge (undertaken midway between low tide and high tide high-tide).

A species list was compiled for all birds seen during a walk over survey at Dungarvan landfill.

A review was undertaken of annual count data for Dungarvan Harbour, from the Irish Wetland Bird Survey (Birdwatch Ireland).

Table 4.1 Bird species recorded during the survey downstream of Ballyneety Bridge

Species	Numbers
Little Grebe *Tachybaptus ruficollis*	4
Brent Goose *Branta bernicla*	3
Oystercatcher *Haematopus ostralegus*	5
Lapwing *Vanellus vanellus*	>220
Curlew *Numenius arquata*	6

Redshank *Tringa totanus*	8
Gull species *Larus*	67

Table 4.2 Bird species recorded from Dungarvan landfill site

Species	Numbers
Moorhen *Gallinula chloropus*	4
Snipe *Gallinago gallinago*	1
Jackdaw *Corvus monedula*	20
Hooded Crow *Corvus cornix*	2
Robin *Erithacus rubecula*	1
Dunnock *Prunella modularis*	2
Wood Pigeon *Columba palumbus*	1

4.2 Review of I-WeBs data

Dungarvan Harbour is a large, south-east facing circular bay, sheltered at its eastern extent, by Helvick Head to the south and Ballinacourty point to the north. The inner harbour is almost completely enclosed by the Cunnigar – a linear sand spit extending from Ballynacourty North creating a sheltered environment. The Colligan, Brickey and Glendine rivers drain into Dungarvan Harbour. The absence of a large river system entering the harbour results in a mainly marine habitat in the area.

Large expanses of intertidal mudflat and associated wetland habitats of Dungarvan harbour are important feeding and roosting areas for migratory wintering wading birds and wildfowl. The presence of "internationally" important populations of wintering waterbirds resulted in Dungarvan Harbour being designated a Special Protection Area. The qualifying interests for designation are internationally important wintering populations of Brent Goose, Black-tailed Godwit and Bar-tailed Godwit along with a range of other over wintering waterbird species.

Dungarvan Harbour is also a Ramsar site (Ramsar Convention) and recognised as an Important Bird Area (Birdlife International).

Waterbirds in Dungarvan Harbour are counted annually during winter as part of the Irish Wetland Bird Survey (I-WeBS). The count area includes the Colligan estuary as far upstream as Ballyneety Bridge. The review assesses recent waterbird data (2002/03- 20010/11) obtained from Birdwatch Ireland.

Waterbirds that occur in internationally important numbers

Internationally important numbers of birds are those that correspond to 1% or more of the individuals in a population and threshold levels are based on population status as published in Wetlands International (2006).

Current data shows that Dungarvan Harbour supports two species in internationally important numbers- Light-bellied Brent Goose and Black-tailed Godwit. The average number of Bar-tailed Godwits is close to the International threshold. Although numbers show great variety between years the majority of years show wintering populations that surpass the international threshold.

	2002/03	2004/05	2005/06	2006/07	2008/09	2009/10	2010/11	Mean
Light Bellied Brent Goose (International Threshold 260)	531	948	1009	728	1,767	1,867	1,110	1,137
Black-tailed Godwit (International Threshold 470)	1608	559	800	155	1,248	1,458	1,648	1,068

Table 4.3 Bird species that occur in numbers of international importance

Waterbirds that occur in nationally important numbers

A species that occurs in numbers that correspond to 1% or more of the individuals in the national population of a species or subspecies is said to occur in nationally important numbers. The current national threshold is defined by Birdwatch Ireland.

I-WeBS data (2002/03- 2008/09) shows that Dungarvan Harbour continues to support 10 species in nationally important numbers (based on average numbers over the past five available count years). Great-crested Grebe, Golden Plover, Grey Plover, Knot, Sanderling, Dunlin, Bar-tailed Godwit, Redshank, Greenshank and Turnstone. Average numbers of Red-breasted Merganser, Oystercatcher, Ringed Plover, Lapwing and Curlew are close to the national threshold.

Waterbirds that occur that are listed on Annex 1 of the EU Birds Directive (EU/709/409)

During the winter months, Dungarvan Harbour supports four species that are listed on Annex 1 of the EU Birds Directive; Great Northern Diver, Little Egret, Golden Plover and Bar-tailed Godwit.

Total waterbird numbers across Dungarvan Harbour

The average number of total waterbirds found at Dungarvan Harbour (based on the six most recent winter counts) is 19,103. Dungarvan Harbour is currently considered the 14th most important wetland site in Ireland and the second most important wetland site in the south-east after Wexford Harbour.

	2001/02	2002/03	2004/05	2005/06	2006/07	2008/09
Total wildfowl	1,260	1,868	2,196	2,137	1,532	2,667
Total waders	18,115	21,196	18,943	16,817	12,208	15,599
Total waterbirds	19,375	23,064	21,140	19,136	13,743	18,266

Waterbirds showing a trend for decrease and increase at Dungarvan Harbour

The most recent I-WeBS data (2002/03-2010/11) show a possible trend for increase in Curlew and Bar-tailed Godwits. The data also shows a trend for decrease in Redshank and Little Egret, the latter having naturally colonised the south coast of Ireland and been steadily increasing in terms of both breeding and wintering numbers ever since. Similarly, Light-bellied Brent Geese have appeared to increase steadily in numbers in recent years having shown a decline in previous years.

	1998/99	1999/00	2001/02	2002/03	2003/04	2005/06	2006/07	2008/09	2009/2010	2010/2011
Light-bellied Brent Goose	381	527	556	531	948	1009	728	1,767	1,867	1,110
Shelduck	335	573	176	560	371	376	333	314	269	399
Little Egret	4	6	14	5	17	14	12	9	9	
Oystercatcher	952	538	994	360	789	658	780	1,055	827	1,011

Lapwing	2323	910	3542	4092	2702	3125	1246	2,345	1,768	1,564
Dunlin	4923	1905	2737	5546	5050	3118	2138	3,763	3,150	1,381
Black-tailed Godwit	944	325	1129	1608	559	800	155	1,248	1,458	1,648
Bar-tailed Godwit	899	658	797	1892	1083	905	834	621	1,023	1,000
Curlew	659	935	926	507	566	461	481	502	659	763
Redshank	654	502	724	502	951	717	1206	1,339	1,023	802

5.DISCUSSION AND CONCLUSION

Habitats occurring in the Dungarvan landfill site can be categorised as either semi-natural (e.g. scrub (WS1); wet grassland (GS4); reed and large sedge swamps, (FS1) or artificial and modified e.g. amenity grassland (GA2) recolonising bare ground (ED3), spoil and bare ground, ED2; artificial lakes and ponds (Fl8); buildings and artificial surfaces (BL3). These habitats initially had relatively low ecological value, as they were subject to intermittent disturbance. However, since 2008 with succession of habitats including establishment of 6 wetland cells, grassland and increasing scrub cover it is apparent that the site is demonstrating increased biodiversity value providing good feeding grounds for a variety of birds and some mammal and invertebrate species along with amphibians. The 2013 site visit observed an abundance of frogspawn in the wetland cells and 8 Snipe and 5 Moor Hen were noted whilst walking the site. The development of wetlands and grassland on the landfill also serves to enhance the ecological network of natural habitats surrounding the landfill including the River Colligan and adjacent areas of wet grassland, marsh, brackishwater and estuarine habitats.

The majority of plant species recorded on the landfill site is considered abundant and widespread throughout Ireland. However one of the recorded plant species is listed on the Flora Protection) Order, 1999- Opposite-leaved Pondweed (*Groenlandia densa)* which is only known to occur in a couple of places in the county.

Light-bellied Brent Goose – has shown a trend for progressive increase at Dungarvan Harbour. This is consistent with the national trend (Crowe et al. 2008).

Golden Plover – despite wide variation in annual indices, the site trend was reasonably stable or slightly increasing up to 2004/05. However, since 2004 numbers have dropped sharply.

Dunlin – numbers have declined progressively at Dungarvan Harbour. This is in line with the national trend (Crowe et al.2008) and that evident in Northern Ireland and Britain (Calbrade et al. 2010).

Bar-tailed Godwit – site numbers showed a slight increase up to 2004/05 then declined and have showed an increase since 2008/09.

Redshank – although numbers fluctuated widely between some years, the smoothed trend highlights the relatively consistent increase in numbers across the data period.

Red-breasted Merganser – numbers of this species have fluctuated widely between years. A period of higher numbers in the years 1997/98 to 1999/00 was followed by a decline. However the short-term trend suggests some recovery.

Oystercatcher – exhibits a trend for consistent increase in numbers across the data period. Numbers recorded in 2008/09 and 2010/11were the highest since the data period began.

Lapwing – numbers have declined steadily which is consistent with the all-Ireland trend (Crowe et al. 2008).

Knot – numbers have fluctuated widely between years but the smoothed trend indicates a relatively stable site population across time with a recent increase; numbers recorded in 2007/08 and 2008/09 were the highest since the data period began.

Comparison of 2013 survey with 2010 survey

- The lagoons are now fully established in terms of wetland vegetation cover and in operation treating the leachate. Margins of the lagoons show full vegetation cover with mosses, grasses and vascular plant species. Willow has also set foot in a few locations around the wetland margins. The presence of wetland birds roosting and feeding in the wetland cells was noted in 2013. Eight Snipe and five Moor Hen were observed on site in March 2013 during a 1 hour visit.

- Grassland cover is now the dominant habitat on the landfill with an increase in botanical diversity on the site.

- Abundant frogspawn was noted in the wetland areas reflecting an increasing biodiversity of the site. Data is being collected on Otter activity in the area and indicates active use along the River Colligan. Frogspawn will be an important food source for Otters in the area. The presence of Otter indicates favourable ecological status of the River Colligan water corridor

- The development of wetlands and grassland on the landfill serves to enhance the ecological network of natural habitats surrounding the landfill including the River Colligan.

- The presence of Gorse continues to increase indicating (along with encroaching willow) a rapid succession to scrub cover over time. The presence of Gorse provides for increasing biodiversity being an important nectar source in early spring and early winter,

when little else is in flower. A number of invertebrates are dependent on it. The shrub also provides food and cover for passerine birds.

- The wetlands in the landfill contain Opposite-leaved Pondweed (*Groenlandia densa)* a plant species listed on the Flora Protection) Order, 1999.
- Review of I-WeBs data indicates continuing favourable conservation status of Dungarvan Bay SPA for qualifying interests including Brent Geese and Bar-tailed Godwits.

Appendix 1

SITE SYNOPSIS

SITE NAME: DUNGARVAN HARBOUR pNHA

SITE CODE: 000663

In landscape terms Dungarvan Harbour lies at the eastern end of the Blackwater valley, though this river now turns south at Cappoquin, vacating its more obvious (and former) course. All that remains to the Harbour is the small Colligan River, running south from the Comeragh Mountains to enter the bay by Dungarvan itself. The absence of the larger river means that the bay is essentially a marine habitat though it dries out at low tide to give extensive mud and sand flats. It is extremely sheltered, the linear Cunnigar spit (which almost closes the bay on the east) adding to the effect of hills in the south and south-west.

The rock type of most of the area is limestone though this is only exposed on flat rocks at Ballynacourty. Elsewhere saltmarsh, glacial drift and sand form the shore with a narrow stony beach in places. The most natural saltmarsh occurs at Kilminnin on the north shore and west of the Cunnigar on the south. It is a community in which Sea Purslane (*Atriplex portulacoides*), Sea Lavendar (*Limonium humile*), rushes (*Juncus gerardii*, *J.maritimus*) and sedges (*Carex distans, C.otrubae*) are prominent along with other typical species like Sea Spurrey (*Spergularia* spp.), Sea Arrowgrass (*Triglochin maritimum*) and, in the upper parts, Parsley Water Dropwort (*Oenanthe lachenalii*). In several places the saltmarshes, having been reclaimed for a period, have been flooded again and are reverting to their natural vegetation. There is an abundance of Sea Rush (*Juncus maritimus*) in such places often mixed with grasses, with Reed (*Phragmites australis*) or Sea Clubrush (*Bolboschoenus maritimus*) in drains. Sometimes this community gradually blends with a freshwater marsh including Tufted Hair Grass (*Deschampsia maritimus*) in drains. Sometimes this community gradually blends with a freshwater marsh including Tufted Hair Grass (*Deschampsia cespitosa*), Soft rush *(J.effusus*), Brown Sedge (*Carex disticha*) and Fleabane (*Pulicaria dysenterica*). Eelgrass (*Zostera* sp.) has been recorded in the area.

There are two beach and dune systems in the area, a tiny one where the old railway line crosses the bay at Skehacrine, and the major (2.6km) Cunnigar running north from the southern shore. The latter consists of narrow and low ridges separated at the southern end to give marshy `slacks' between them but running together to the north. The beach plants include such species as Yellow Horned Poppy (*Glaucium flavum*), Sea Holly (*Eryngium maritimum*), Sea Radish (*Raphanus raphanistrum*) and Sand Sedge (*Carex arenaria*) while the large Sharp Rush (*Juncus acutus*) as well as Knotted Pearlwort (*Sagina nodosa*) occur in wetter sites.

A major part of the ecological importance of the bay is the wintering birdlife which is present in large numbers. Surveys in the winters l984/85 - 86/87 showed that Brent Goose (694), Black-tailed Godwit (l329) and Bar-tailed Godwit (l029) occurred in numbers of international importance, while thirteen other species were nationally important. These are Shelduck (l72l), Wigeon (l0l5), Red-breasted Merganser (50), Grey Plover (359), Golden Plover (l095), Lapwing (2748), Knot (705), Sanderling (83), Dunlin (4559), Redshank (930) and Turnstone (254). All figures are average peak populations. A further ten species were found in numbers of regional or local importance emphasising that Dungarvan supports a greater diversity of species than any other site on the south coast except for Wexford Harbour. It is now a Special Protection Area under the E.U. Birds Directive.

The sand flats to the east of the Cunnigar support an extensive oyster farming operation so there are clearly possible grounds for impact between these shellfish and the invertebrates on which

some of the bird species depend. There is also concern that displacement of water fowl and disturbance may be a problem on the shellfish farming area. At present the bird numbers are higher than in the previous survey (l97l-75).

13 February, 1995.

Appendix 2 Dungarvan Harbour SPA Site Synopsis

In landscape terms Dungarvan Harbour lies at the eastern end of the River Blackwater valley, though this river now turns south at Cappoquin, vacating its more obvious (and former) course. The Colligan River, running south from the Comeragh Mountains, enters the bay by Dungarvan itself. The River Brickey flows from the west while the Glendine River flows into the harbour from the north. The absence of a large river means that the bay is essentially a marine habitat though it dries out at low tide to give extensive mud and sand flats. The inner bay is extremely sheltered, the linear Cunnigar spit (which almost closes the bay on the east) adding to the effect of hills in the south and south-west.

The rock type of most of the area is limestone though this is only exposed on flat rocks at Ballynacourty. Elsewhere saltmarsh, glacial drift and sand form the shore with a narrow stony beach in places. The most natural saltmarsh occurs at Kilminnin on the north shore and west of the Cunnigar on the south. In several places the saltmarshes, having been reclaimed for a period, have been flooded again and are reverting to their natural vegetation. There is an abundance of Sea Rush (*Juncus maritimus*) in such places often mixed with grasses, with Reed (*Phragmites australis*) or Sea Club-rush (*Scirpus maritimus*) in drains. Sometimes this community gradually blends with a freshwater marsh including Tufted Hair Grass (*Deschampsia cespitosa*), Soft rush (*Juncus effusus*), Brown Sedge (*Carex disticha*) and Fleabane (*Pulicaria dysenterica*). Eelgrass (*Zostera* sp.) has been recorded in the area.

A major part of the ecological importance of the bay is the wintering birdlife which is present in large numbers. Surveys in the winters l984/85 - 1986/87 and from 1994/95

onwards showed that Brent Goose (616 in 1995), Black-tailed Godwit (l329 [952 in 1996]) and Bar-tailed Godwit (1593 in 1996) occurred in numbers of international importance, while thirteen other species were nationally important. These are Shelduck (l72l [995 in 1995]), Wigeon (l0l5), Red-breasted Merganser (50), Grey Plover (359), Golden Plover (6100 in 1996), Lapwing (3775 in 1996), Knot (996 in 1996), Sanderling (83), Dunlin (6100 in 1996), Redshank (930 [910 in 1996]) and Turnstone (254). A further ten species were found in numbers of regional or local importance emphasising that Dungarvan supports a greater diversity of species than any other site on the south coast except for Wexford Harbour. The sand flats to the east of the Cunnigar support an extensive oyster farming operation. There is concern that displacement of waterfowl and disturbance may be a problem in the shellfish farming area.

Dungarvan Harbour SPA is of major conservation significance for the large numbers of many species of waterfowl that use it. The site regularly holds over 20,000 waterfowl and this qualifies the site as of International Importance. Two species that occur in important numbers are listed on Annex I of the E.U. Birds Directive, i.e. Bartailed Godwit and Golden Plover.

I-WeBS

Dungarvan Harbour 2010/11

Species	1% National	1% International	Jan	Feb	Annual peak
Mute Swan	110			2	2
Barnacle Goose	90	710	3		3
Light-bellied Brent Goose		400	1,110	917	1,110
Shelduck	150	3,000	399	371	399
Wigeon	820	15,000	135	203	203
Teal	450	5,000	414	290	414
Mallard	380	20,000	77	50	77
Pintail	20	600	9	5	9
Shoveler	25	400	5		5
Ring-necked Duck		1,470,000	10		10
Goldeneye	95	11,500	4	1	4
Red-breasted Merganser	35	1,700	27	31	31
Red-throated Diver	20	3,000		1	1
Great Northern Diver		50	1	4	4
Unidentified Diver			2		2
Little Grebe	25	4,000	13	5	13
Great Crested Grebe	55	3,500	36	58	58
Cormorant	140	1,200	39	37	39
Shag		2,000	1	15	15
Grey Heron	30	2,700	17		17
Moorhen	20	20,000	1		1
Oystercatcher	680	8,200	1,011	726	1,011
Ringed Plover	150	730	84	86	86
Golden Plover	1,700	9,300	692	68	692
Grey Plover	65	2,500	56	243	243
Lapwing	2,100	20,000	1,564	428	1,564
Knot	190	4,500	340	551	551
Sanderling	65	1,200	7	12	12
Dunlin	880	13,300	1,212	1,381	1,381
Jack Snipe		20,000		1	1
Snipe		20,000	9	17	17
Black-tailed Godwit	140	610	1,648	223	1,648
Bar-tailed Godwit	160	1,200	1,000	979	1,000
Curlew	550	8,400	564	763	763
Greenshank	20	2,300	10	22	22
Redshank	310	3,900	576	802	802
Turnstone	120	1,400	251	300	300

Appendix L

Report on Leachate Extraction System and Wetlands Treatment Analysis/Results

Dungarvan Landfill Remediation Works

Site Progress Report October-November 2012

DOCUMENT CONTROL SHEET

Client	Waterford County Council					
Project Title	Dungarvan Landfill Remediation Works					
Document Title	Site Progress Report – October-November 2012					
Document No.	MDR0450Rp1024					
This Document Comprises	DCS	TOC	Text	List of Tables	List of Figures	No. of Appendices
	1	i	14	-	-	1

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
A01	Issue	J Bennett			Tramore Site Office	Dec 2012

Table of contents

1 INTRODUCTION

RPS Consulting Engineers have been appointed by Waterford County Council to supervise the remediation works, including the main contracts "Dungarvan Landfill Capping Works", and "Dungarvan Landfill Gas / Leachate Extraction System".

FLI were awarded the lining element of the capping works, while Waterford County Council resources, under the management of the RPS appointed RE/Project Manager were responsible for the earthworks elements of the contract. Main contract capping works commenced in July 2007 and the landfill site was capped completely by September 2008. Construction Quality Assurance (CQA) for lining was carried out by Geotesting Ltd. FLI were also awarded the gas / leachate borehole drilling and pipework contract, which was completed in June 2009. The gas flare contract was awarded to AFS in competitive tender, and a 100 m^3/hr gas flare was completed and operational in July 2010. A series of five wetland ponds was constructed on the cap as a leachate treatment system.

A partial leachate extraction system was installed in 2010, discharging to the wetlands treatment system, and this had been monitored and was performing successfully until ceased in March 2012.

The final phase of the project was to install a full leachate extraction system, and a contract titled *Dungarvan Landfill Leachate Abstraction & Pumping System* was awarded to Electrical and Pump Services Ltd. (EPS) in October 2011, commencing onsite in early December 2011, reaching substantial completion in July 2012, and cat the time of writing only a limited number of minor snags remain.

Thus all works required to remediate the landfill are complete. A detailed description of the overall remediation works from commencement in 2007 to completion in 2012 is contained in the *Final Construction Report 2012 (*RPS, November 2012).

The purpose of this report is to update Waterford County Council on the progress of the final two months of the works, covering progress in the period October and November 2012.

2 PROGRESS REPORT

2.1 SCOPE OF WORKS

The only remaining item of significance towards completing the overall remediation project is the completion of the leachate extraction system. This involves M&E equipment to equip 9 leachate wells, together with associated dilution water and monitoring provisions. The works are divided into advance works (dilution/monitoring/leachate wells), and M&E contract works subject to open tender. Advance works were completed in 2011 by FSWS. The final works package contract titled *Dungarvan Landfill Leachate Abstraction & Pumping System* was awarded to Electrical and Pump Services Ltd. (EPS) in October 2011.

2.2 WORKS PROGRAMME

The programme of works for the EPS M&E contract was as follows:

- WCC review and award (Contract date)– 14th October 2011
- Pre-contract formalities and mobilisation – October-November 2011
- Formal Starting date: 14th November 2011
- Commencement onsite as per contractors programme: 19th December 2011
- Contractor onsite - commenced 5th December 2011
- Contract duration - 14 weeks
- Date of Completion as per Contract Documents: 19th February 2012
- Actual Date of Completion: 21st July 2012
- Thereafter: accounts and snagging, post commissioning testing and adjustments, 12 month maintenance period – as discussed below

EPS did not provide a revised programme upon commencement of the works, and thus the tender programme was deemed to be the contractor's relevant programme. This was confirmed and minuted at the Pre-start meeting. In any event, the various change orders rendered this programme largely irrelevant as discussed below.

The following impacts on programme are notable since commencement of the contract:

1) In accordance with Clause 9.1.1 of the contract, the starting date must be no more than 20 working days after the Contract Date (14/10/2011), resulting in a Starting date of 14/11/2011. However, it is notable that the contractors programme shows commencement onsite in week 9 of the contract, 19th December 2011.
2) Change Order No.1 – this CO was discussed initially at the pre-start meeting and issued to EPS for pricing on 3rd November and approved on 30th November 2011. No delay or extension to the

Date for Substantial Completion, nor a revised programme, was expected or received from EPS. Works commenced onsite on 5th December 2011 well within the programme date of 19th December 2011.

3) Change Order No.2 – this proposed CO was discussed initially in w/e 22/01/2012, and following meetings and development, was issued for pricing on 08/02/2012. A final price was received on 12/03/2012 (after protracted technical and price negotiation), the CO was approved on 23/03/2012, and works recommenced on 02/04/2012.
   a) This CO delayed the programme and required an extension to the Date for Substantial Completion.
   b) Works recommenced on 02/04/2012, and the contractor had indicated that works would be complete by mid May, however, various delays saw the system switched on 28/06/2012
   c) EPS applied for substantial completion on 27/08/2012, following testing and inspections completed on 21/08/2012, and the date granted was 21/07/2012
4) Change Order No.3 – this CO was approved and implemented in June, July, and August 2012. The CO would not have delayed the programme taking into account the extended programme required under CO02, as it was done in the same period (the effort is estimated at 3-4 days).
5) Change Order No.4 – this CO was approved in August 2012 and is due to be implemented in September 2012. The CO would not have delayed the programme taking into account the extended programme required under CO02, as it was done in the same period (the effort is estimated at 2 days).
6) Change Order No.5 – this CO is not yet formally awarded pending a final price for one item, but the majority has been priced and instructed as of 28/09/12, and all works are due to be implemented in October 2012. The CO is post substantial completion and is for minor works, and thus has not delayed the programme.

Post commissioning proving, testing and adjustments commenced on 28/06/2012, and the initial phase was scheduled to take approximately 1 month (end of July), but was dependant on satisfactory M&E function, and also the abstraction and treatment system response. The period from start-up on 28/06/2012 to 24/09/2012 was beset with various snag issues that prevented correct operation and/or monitoring of the system, and thus can be considered as a snagging period only with no effective treatment process proving.

Substantial completion was achieved on 21/07/2012, approximately 8-9 weeks behind the revised dates expected, and 5 months later than the original contract completion date.

Treatment process proving commenced on 24/09/2012 albeit still with snags still affecting the operation and/or monitoring of the system, but nonetheless allowing for ramp-up of loadings to the treatment system and monitoring thereof.

2.3 PROGRESS

The works had been largely completed by late June, and the entire system was commissioned and commenced operation on the 28/06/2012. There were no installation or construction works of significance in the period of this report, but there was some snagging as described following. The weather station was completed in early October, and works to connect the flare to the SCADA were completed in mid-October.

Snag lists were issued on 25/07/2012, and 27/08/2012, with some updates in the interim, and a substantial completion snag list was issued on 17/09/2012, reflecting the net list at that time, and an update is attached at the end of this report. The faulty ammonium sensor heads (pond 4, pond 5, and tank) were replaced on the 16/10/2012. Calibration meters and materials to allow onsite calibration

were purchased and installed/delivered in the third week of October (ammonia pocket colorimeter, spectrometer, various solutions), together with the compressed air cleaning system for the ammonium sensors.

RC8A pump has been tripped since September and is not yet remedied by EPS. The dilution well pump was also tripping intermittently but is now remedied.

2.4 PROGRESS PHOTOGRAPHS

A full set of project photographs are kept on the digital file.

2.5 SAFETY

There were no incidents to report in the period.

EPS are appointed PSCS and notified the HSA following award of contract. The project safety file was prepared by EPS and a copy kept onsite. The sub-contractor Murlyn has provided all relevant safety documentation required to date. WCC has also sent their formalities to the HSA.

The wells confined space entry issue and rectification proposal described in the June-July 2011 progress report is noted again and a note for the safety file is due to be issued in December 2012.

The safety file has been compiled and is to be delivered to WCC in the first week of December.

2.6 OPERATION OF THE NEW LEACHATE SYSTEM

A separate report is produced regularly detailing the operation and performance of the new leachate abstraction and treatment system. This section summarises operation and performance issues with a focus on snags and troubleshooting.

The following summarises the issues and function of the system to date:

- The period from start-up on 28/06/2012 to 24/09/2012 was beset with various snag issues that prevented correct operation and/or monitoring of the system, and thus can be considered as a snagging period only with no effective treatment process proving
- Treatment process proving commenced on 24/09/2012 albeit still with snags still affecting the operation and/or monitoring of the system, but nonetheless allowing for ramp-up of loadings to the treatment system and monitoring thereof
- Fully functional operation of the control and SCADA systems including rectification of the ammonia sensors snags was achieved on 16/10/2012, although weekly grab sampling-testing from the start of the process proving period referred to above allows viable proving since 24/09/2012

2.7 FURTHER WORKS

The latest snag list is attached at the end of this report.

The following contract and overall project tasks are pending:

Contract tasks:

1. Tramore Flare SCADA connection – issue in progress, to be completed in December/January (EPS)
2. Snag list – as attached
3. EPS final account and report - expected December
4. Safety file - has been compiled and is to be delivered to WCC in the first week of December

Project tasks (to finalise project):

5. Conduct review of well chamber access safety and arrange minor works to adjust where necessary - a note for the safety file is due to be issued by ER in December 2012
6. SCADA testing and adjustments - support for abstraction and treatment system ramp-up and adjustments - involving gradual build up of leachate loads based on treatment system response, analysis of data and trends, reporting, etc. - to end of year
7. Monthly short report on performance of the system, plus 6 month review report - ongoing
8. Preparation updates for EPA on performance of the system - six month and twelve month report, (EPA's acceptance of this system affects DELG funding)
9. Support for WCC in project financial reporting and returns (annual and end of project) - ongoing
10. Support for audits in early 2013 (provisional)

5 APPENDIX

Dungarvan Landfill Leachate Abstraction & Pumping System

Substantial Completion Snag List for Electrical and Pump Services Ltd. (EPS)

Issued 17th September 2012

Item	Status as of 30th November 2012
1. Complete weather station installation	Complete except data connection/software
2. Complete leachate well CW1 installation	complete
3. Address solution to insufficient freeboard at recycle sump (recommended solution is an additional 0.5m chamber ring or similar for approval)	pending
4. All exposed pvc pipework will need to be painted or lagged (Armalfex insulation) to provide protection form sunlight and freezing temperatures	pending
5. Ammonia Analysers	
a. require compressed air cleaning system to Spec Clause 3.6	complete
b. replace ammonia sensor heads and any other required work to remedy sensor issues as per Hach site visit and recommendations	complete
c. provide 3 No. spare sensor heads and a calibration sensor head (additional works)	pending
6. Provide test/calibration kits for all sensors (additional works)	complete
7. Automatic sampler – to be linked to flowmeter	complete
8. Gas valves – 5 No. not replaced in manifold nearest to flare – perhaps as some of the replacements were fitted to spare rather than live pipework – please liaise with Mr David Regan, WCC	pending
9. Provide barrier at control hut (additional works)	complete
10. Copy of all PLC and SCADA Programmes to be provided on Disk.	pending
11. Clarify that the alarm dial out operates from the SCADA and is protected by the SCADA UPS or provide a UPS for the HMI/PLC	pending
12. Flare Connection to SCADA system to be completed	complete
13. The SMS alarms require agreement on the number of alarms to be sent and the phone numbers (pending flare hook up and re-use of sim card from flare)	pending
14. Earthing – Provide confirmation of earthing including records of same in accordance with ETCI regs, Specification. Certificates demonstrating same to be provided.	pending
15. Dilution logic:	
a. High Level. When reached in tank transfer to pond 1A regardless of Ammonia. If Ammonia above transfer setpoint then incremental drop in tank volume and dilute again to try and bring ammonia levels down.	complete

b. tank/pond1 - if the 'high' setpoint is set a on the allowable ammonia recycle to the tank (for dilution), it recycles to the tank only, but not to pond 1B while not called from the tank (i.e. the recycle should operate to the tank when called and to pond 1B otherwise, unless the timer says otherwise)	complete
16. Retrieval of data for external application analysis (e.g. excel) to be setup	complete
17. Recycle to pond 1B requires ability to set a daily limit on pumping	complete
18. The site overview screen - change the background to the one provided	complete
19. Dilution Water Sump screen - to be renamed 'Dilution Water Well'	complete
20. Dilution Water Well - Graphic be changed to a borehole well rather than a tank	complete
21. Leachate wells - Graphics be changed to a borehole well rather than a tank	complete
22. Instrument Summary Screen to be provided on HMI & SCADA listing all flowmeters and ammonia analysers listing the flow total for the current day and total flows for the previous day and previous month, ammonia levels Max & Min & Current for the current day, previous day and previous month.	Complete (possible on HMI only, also see 44)
23. Plant Summary Screen for Dilution Water Well, Storage/Dilution Tank, Recycle Sump, Leachate Wells, Leachate Collector Sump & Condensate Pumps providing a summary of daily hours run, hours run yesterday and hours run in the last month.	Complete possible on HMI only, also see 44)
24. The dilution water screen on the HMI is going to 'info' mode repeated at times (not consistently)	complete
25. Outlet valve:	
a. operating even when the level in the sump is less than 1m, what is the logic controlling this?	complete
b. How is it adjusted using the setpoint(s)?	complete
26. There is still a scale issue on certain trends (e.g. pH shows several 6's but no decimals)	pending
27. The outlet ammonia meter range seems to high (would be expected to be 0-300 or 0-1000 at most), and should read to one decimal point when set to new range	complete
28. There is a variation between the outlet ammonia sensor and the SCADA reading, and also pond 4 to be checked for same	complete
29. Recycle outlet valve not operating on hand (this is ambiguous, it is the pond 5 / dilution tank valvework)	pending
30. Flowmeters logic – please clarify the meaning of the 'daily' readings (start time, previous 24 hours?)	complete
31. The trends average (on trend 1) doesn't seem to be actual	complete
32. Font sizes on trend pens are still difficult to read, to be made larger	complete
33. ER needs remote access to all setpoints	complete
34. Tank SCADA vs flowmeter readings – the tank flowmeter is showing a different increment over time than the SCADA	complete
35. Please clarify the condensate pump 1 level indicator status (blue?)	complete

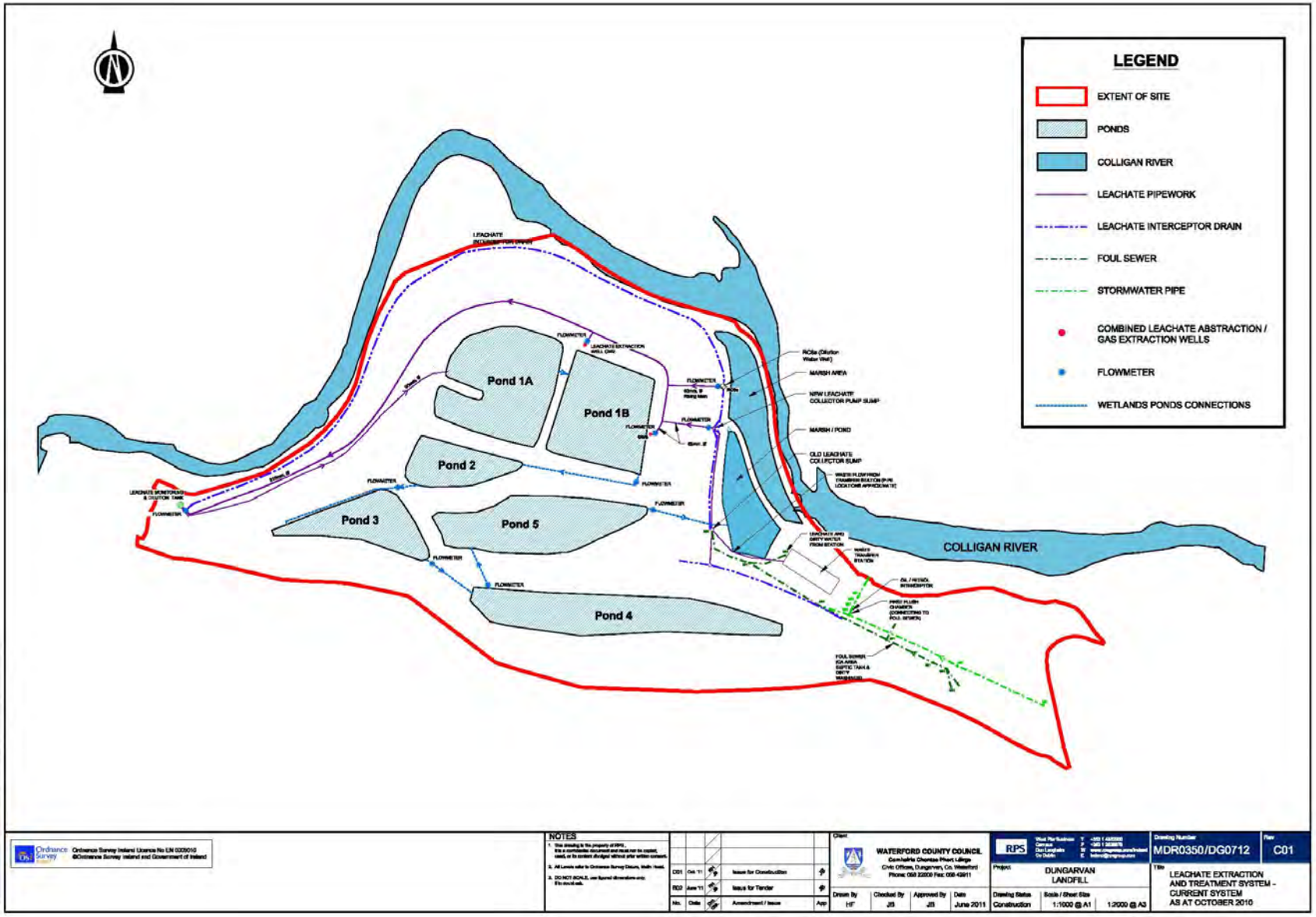
Additional snags communicated to EPS on 26th September 2012

Item	Status as of 30th November 2012
36. Regarding the leachate wells selection logic. Currently, the pumps to be used in each cycle can't be selected, they can only be turned on or off, nor can the volume/time per pump be adjusted. The current setup with 4-5 pumps on one cycle and 4 pumps on another could overwhelm the dilution system, and recently caused the tank to go to over 400 mg/l. Turning off certain pumps is an option in the short term, but if the high concentrations continue then it could compromise areal abstraction by leaving pumps off. a. It is better to be able to select each pump to be used on each cycle, and also the minutes to be run, to give complete control. An alternative may be to re-setup so that each cycle has two pumps (a list of couples can be provided).	complete
37. In the event that the concentration in the tank exceeds the setpoint, could you confirm that abstraction ceases, and the tank seems to currently pump down all contents rather than incrementally lowering/diluting?	complete
38. GW2 level is off scale, and AV1 on the recycle screen is partially obstructed.	pending

Additional snags communicated to EPS in October-November 2012

Item	Status as of 30th November 2012
39. Dilution query: recycle not operating to tank unless dilution well pump deactivated: a. The intention is that the recycle should pump to the dilution tank provided conditions are suitable, and should pump to pond 1B at all other times unless conditions are un-suitable. This is provided that the valves have not been manually set otherwise. The dilution well should operate if recycle water is unavailable.	complete
40. Well RC8A tripped and connot be rest	pending
41. Intermittent trips on dilution well	pending
42. SCADA 'freezing'	complete
43. Recycle daily limit – override limit if ammonia or pH exceed discharge setpoint standards	pending
44. Change leachate wells previous days flows to minutes	pending
45. Tramore flare SCADA (additional works)	With ER

ICW	Lab no.	New Code	Old Code	Sampling point (Inlet/Mid /Outlet)	Date sampled	pH	Ammonium mg/l N	Molybdate Reactive Phosphate mg/l P	Total Phosphate mg/l P	Nitrite mg/lN	Nitrate mg/l N	Total Oxidised Nitrogen + Amm	Total Nitrogen mg/l N	Op TSS (< or >)	Suspended solids mg/l	Op COD (< or >)	COD mg/l	Op BOD (< or >)	BOD mg/l	Chloride mg/l Cl	Conductivity
DLF	**20120021**	RC8	RC8		12-Jan-12		48.884	0.453		0.001	-0.101				5.3		35			338.787	2310
DLF	**20120022**	RC8A	RC8A		12-Jan-12		20.813	0.146		0.012	0.039				9.8		34			144.593	1319
DLF	**20120023**	DLFL	Dungarvan Landfill Leachate Pond		12-Jan-12		0.396	0.045		0.046	0.124				10.8		43			167.902	1027
DLF	**20120024**	DLF100	Dungarvan Landfill Pond 1	INLET	12-Jan-12		41.466	0.113		0.063	0.778				9.0		47			157.785	1596
DLF	**20120025**	DLF200	Dungarvan Landfill Pond 2	INLET	12-Jan-12		3.649	0.113		0.134	3.122				-3.0		63			149.976	1144
DLF	**20120026**	DLF300	Dungarvan Landfill Pond 3	INLET	12-Jan-12		0.633	0.067		0.120	3.174				0.4		63			163.194	1165
DLF	**20120027**	DLF400	Dungarvan Landfill Pond 4	INLET	12-Jan-12		0.066	0.024		0.023	1.805				55.2		66			167.798	1143
DLF	**20120028**	DLF500	Dungarvan Landfill Pond 5 IN	INLET	12-Jan-12		0.092	0.02		0.011	-0.037				-2.2		37			183.653	1133
DLF	**20120029**	DLF580	Dungarvan Landfill Pond 5 OUT	OUTLET	12-Jan-12		0.277	0.018		0.025	0.024				2.8		42			169.574	1042
			Tramore Landfill SW																		
DLF	**20120071**	RC8	RC8		1-Feb-12	7.26	50.675	0.568	0.569	0.004	0.128	50.807	51.88		0.2		35			351.539	1910
DLF	**20120072**	RC8A	RC8A		1-Feb-12	7.35	1.651	0.026	0.063	0.035	0.745	2.431	3.26	<	2.0		12			32.454	874
DLF	**20120073**	DLFL	Dungarvan Landfill Leachate Pond		1-Feb-12	7.87	0.157	0.043	0.094	0.021	0.407	0.585	1.52	<	2.0		52			125.083	795
DLF	**20120074**	DLF100	Dungarvan Landfill Pond 1	INLET	1-Feb-12	6.95	1.623	0.026	0.054	0.042	0.643	2.308	3.22		0.8		10			29.521	904
DLF	**20120075**	DLF200	Dungarvan Landfill Pond 2	INLET	1-Feb-12	7.44	3.619	0.167	0.211	0.090	2.523	6.232	8.83	<	2.0		59			127.406	1057
DLF	**20120076**	DLF300	Dungarvan Landfill Pond 3	INLET	1-Feb-12	7.37	1.892	0.131	0.207	0.051	1.257	3.2	5.59	<	2.0		60			135.187	938
DLF	**20120077**	DLF400	Dungarvan Landfill Pond 4	INLET	1-Feb-12	7.55	0.117	0.059	0.106	0.037	0.983	1.137	2.48		0.2		48			127.151	843
DLF	**20120078**	DLF500	Dungarvan Landfill Pond 5 IN	INLET	1-Feb-12	7.43	0.078	0.029	0.067	0.006	0.118	0.202	1.43		0.4		43			137.700	844
DLF	**20120079**	DLF580	Dungarvan Landfill Pond 5 OUT	OUTLET	1-Feb-12	7.76	0.075		0.077	0.005	0.032	0.112	1.06	<	2.0		42	<	2	128.956	902
DLF	**20120124**	RC8	RC8		15-Feb-12	7.47	47.487	0.430	0.580	0.001	-0.003	47.485	52.88		-3.5		48			336.943	2080
DLF	**20120125**	RC8A	RC8A		15-Feb-12	7.39	53.812	0.321	1.200	0.023	0.346	54.181	66.62		24.5		74			156.307	1782
DLF	**20120126**	DLFL	Dungarvan Landfill Leachate Pond		15-Feb-12	7.59	0.184	0.031	0.100	0.005	0.059	0.248	1.15		1.0		41			133.452	810
DLF	**20120127**	DLF100	Dungarvan Landfill Pond 1	INLET	15-Feb-12	7.33	32.834	0.091	0.550	0.130	1.656	34.62	34.68		16.7		47		13.6	124.627	1403
DLF	**20120128**	DLF200	Dungarvan Landfill Pond 2	INLET	15-Feb-12	7.79	1.457	0.095	0.210	0.069	3.511	5.037	7.01		0.3		59			129.022	921
DLF	**20120129**	DLF300	Dungarvan Landfill Pond 3	INLET	15-Feb-12	7.63	0.141	0.067	0.170	0.019	2.778	2.938	6.68		-1.0		61			145.827	953
DLF	**20120130**	DLF400	Dungarvan Landfill Pond 4	INLET	15-Feb-12	7.83	0.082	0.004	0.170	0.000	0.197	0.279	1.79		24.0		49			143.154	1034
DLF	**20120131**	DLF500	Dungarvan Landfill Pond 5 IN	INLET	15-Feb-12	7.83	0.131	0.004	0.700	0.002	-0.038	0.095	1.43		4.7		40			147.452	938
DLF	**20120132**	DLF580	Dungarvan Landfill Pond 5 OUT	OUTLET	15-Feb-12	7.53	0.108	0.006	0.050	-0.001	0.173	0.28	1.27		-0.3		43		3.8	141.240	884
DLF	**20120163**	RC8	RC8		27-Feb-12	6.97	48.464	0.400	0.493	0.000	-0.085	48.379		<	2.0		40			349.394	2310
DLF	**20120164**	RC8A	RC8A		27-Feb-12	7.20	40.44	0.163	0.279	0.043	1.960	42.443			2.0		49			115.165	1381
DLF	**20120165**	DLFL	Dungarvan Landfill Leachate Pond		27-Feb-12	7.45	0.278	0.020	0.139	0.004	-0.063	0.219			0.4		37			135.845	912
DLF	**20120166**	DLF100	Dungarvan Landfill Pond 1	INLET	27-Feb-12	7.24	49.874	0.204	0.664	0.411	4.430	54.715			3.0		87			160.588	1689
DLF	**20120167**	DLF200	Dungarvan Landfill Pond 2	INLET	27-Feb-12	7.86	0.788	0.065	0.212	0.041	2.595	3.424			1.5		63			131.792	1062
DLF	**20120168**	DLF300	Dungarvan Landfill Pond 3	INLET	27-Feb-12	7.75	0.167	0.070	0.196	0.021	0.590	0.778			6.8		64			145.864	1087
DLF	**20120169**	DLF400	Dungarvan Landfill Pond 4	INLET	27-Feb-12	7.74	0.168	-0.001	0.180	0.002	-0.066	0.104			30.0		59			144.664	1048
DLF	**20120170**	DLF500	Dungarvan Landfill Pond 5 IN	INLET	27-Feb-12	7.82	0.09	0.004	0.112	0.001	-0.083	0.008			8.5		46			143.406	1020
DLF	**20120171**	DLF580	Dungarvan Landfill Pond 5 OUT	OUTLET	27-Feb-12	7.67	0.181	0.001	0.223	0.001	-0.058	0.124			2.0		40			145.939	996
DLF	**20120682**	DLFL	Dungarvan Landfill Leachate Pond		09-Jul-12	7.64	0.91	0.032	0.328	0.039	-0.072	-0.033			45.0		64			58.687	647
DLF	**20120676**	DLF100	Dungarvan Landfill Pond 1	INLET	09-Jul-12	7.97	341.76	2.444	3.776	-0.006	0.050	0.044			58.0		447			334.446	4650
DLF	**20120677**	DLF200	Dungarvan Landfill Pond 2	INLET	09-Jul-12	7.88	0.329	0.048	0.133	-0.003	-0.051	-0.054			3.0		53			59.958	524
DLF	**20120678**	DLF300	Dungarvan Landfill Pond 3	INLET	09-Jul-12	7.20	0.047	0.056	0.131	-0.004	-0.047	-0.050			5.7		59			59.983	525
DLF	**20120679**	DLF400	Dungarvan Landfill Pond 4	INLET	09-Jul-12	7.19	0.042	0.037	0.185	-0.002	-0.077	-0.079			12.0		57			59.884	523
DLF	**20120680**	DLF500	Dungarvan Landfill Pond 5 IN	INLET	09-Jul-12	7.13	0.03	0.034	0.169	-0.003	-0.082	-0.085			8.3		55			60.895	528
DLF	**20120681**	DLF580	Dungarvan Landfill Pond 5 OUT	OUTLET	09-Jul-12	7.38	0.044	0.021	0.137	-0.003	-0.090	-0.092			3.5		49			60.246	527
DLF	**20120717**	RC8	RC8		23-Jul-12	7.28	58.801	0.765		-0.002	0.017									389.307	4270
DLF	**20120718**	RC8A	RC8A		23-Jul-12	6.66	103.183	2.368		-0.038	-0.019									145.584	2620
DLF	**20120719**	DLFL	Dungarvan Landfill Leachate Pond		23-Jul-12	6.60	5.957	1.634		-0.001	0.036									60.588	759
DLF	**20120720**	DLF100	Dungarvan Landfill Pond 1	INLET	23-Jul-12	7.67	134.015	5.778		0.051	0.122									371.383	9870
DLF	**20120721**	DLF200	Dungarvan Landfill Pond 2	INLET	23-Jul-12	6.96	2.27	0.042		-0.002	0.063									56.327	524
DLF	**20120722**	DLF300	Dungarvan Landfill Pond 3	INLET	23-Jul-12	6.99	2.669	0.067		0.010	0.010									56.281	587
DLF	**20120723**	DLF400	Dungarvan Landfill Pond 4	INLET	23-Jul-12	6.97	0.377	0.037		-0.002	0.036									55.915	523
DLF	**20120724**	DLF500	Dungarvan Landfill Pond 5 IN	INLET	23-Jul-12	6.91	0.196	0.024		-0.003	0.008									56.329	524
DLF	**20120725**	DLF580	Dungarvan Landfill Pond 5 OUT	OUTLET	23-Jul-12	6.93	0.251	0.043		-0.002	0.010									56.959	521
DLF	**20120717**	RC8	RC8		12-Sep-12	7.61	56.46	0.392		0.000	1.820						29			372.500	4310
DLF	**20120718**	RC8A	RC8A		12-Sep-12	6.70											>1500				4810
DLF	**20120719**	DLFL	Dungarvan Landfill Leachate Pond		12-Sep-12	7.25	0.74	0.154		0.050	0.526						>150			44.500	504
DLF	**20120720**	DLF100	Dungarvan Landfill Pond 1	INLET	12-Sep-12	7.33	5.44	1.940		0.000	0.014						104			58.100	662
DLF	**20120721**	DLF200	Dungarvan Landfill Pond 2	INLET	12-Sep-12	7.18	2.85	0.038		0.000	-0.134						67			54.200	575
DLF	**20120722**	DLF300	Dungarvan Landfill Pond 3	INLET	12-Sep-12	6.95	0.07	0.093		0.000	-0.146						176			54.100	534
DLF	**20120723**	DLF400	Dungarvan Landfill Pond 4	INLET	12-Sep-12	7.17	0.82	0.066		0.000	-0.150						74			54.000	537
DLF	**20120724**	DLF500	Dungarvan Landfill Pond 5 IN	INLET	12-Sep-12	7.07	0.04	0.017		0.000	-0.158						55			51.300	511
DLF	**20120725**	DLF580	Dungarvan Landfill Pond 5 OUT	OUTLET	12-Sep-12	7.19	0.03	0.021		0.000	-0.153						59			50.300	523
DLF	**20120930**	RC8	RC8		5-Oct-12	7.22	107.652	4.578		-0.002	-0.104	-0.106			32.3		162			533.821	3670
DLF	**20120931**	RC8A	RC8A		5-Oct-12	7.45	149.317	7.172		-0.012	-0.023	-0.035			163.0		508			280.185	4340
DLF		DLFL	Dungarvan Landfill Leachate Pond		5-Oct-12																
DLF	**20120932**	DLF100	Dungarvan Landfill Pond 1	INLET	5-Oct-12	7.63	44.848	0.208		0.153	3.979	4.132			15.2		53			77.691	1144
DLF	**20120933**	DLF200	Dungarvan Landfill Pond 2	INLET	5-Oct-12	7.45	1.984	0.033		0.547	0.504	1.051		<	2.0		30			42.914	637
DLF	**20120934**	DLF300	Dungarvan Landfill Pond 3	INLET	5-Oct-12	7.33	0.844	0.022		0.247	0.381	0.628		<	2.0		25			41.837	624
DLF	**20120935**	DLF400	Dungarvan Landfill Pond 4	INLET	5-Oct-12	7.30	0.415	0.017		0.301	0.286	0.586			2.0		30			41.199	612
DLF	**20120936**	DLF500	Dungarvan Landfill Pond 5 IN	INLET	5-Oct-12	7.13	0.058	0.011		0.003	-0.131	-0.128			1.4		32			45.354	607
DLF	**20120937**	DLF580	Dungarvan Landfill Pond 5 OUT	OUTLET	5-Oct-12	7.03	0.031	0.015		0.001	-0.132	-0.130			5.4		42			51.791	612


LEGEND
EXTENT OF SITE
PONDS
COLLIGAN RIVER
LEACHATE PIPEWORK
LEACHATE INTERCEPTOR DRAIN
FOUL SEWER
STORMWATER PIPE
COMBINED LEACHATE ABSTRACTION / GAS EXTRACTION WELLS
FLOWMETER
WETLANDS PONDS CONNECTIONS
Pond 1A
Pond 1B
Pond 2
Pond 3
Pond 5
Pond 4
COLLIGAN RIVER
MARSH AREA
MARSH / POND
NEW LEACHATE COLLECTOR PUMP SUMP
OLD LEACHATE COLLECTOR SUMP
FLOWMETER
NOTES
Issue for Construction
Issue for Tender
WATERFORD COUNTY COUNCIL
DUNGARVAN LANDFILL
MDR0350/DG0712
C01
LEACHATE EXTRACTION AND TREATMENT SYSTEM - CURRENT SYSTEM AS AT OCTOBER 2010
1:1000 @ A1
1:2000 @ A3
June 2011

Appendix M

Environmental Liability Risk Assessment

REVIEW OF ENVIRONMENTAL LIABILITIES

1 A. IDENTIFICATION OF ENVIRONMENTAL RECEPTORS

The term ‘environmental receptors’ describes those parts of the surroundings likely to be affected by
the processes that are ongoing at Dungarvan Landfill. The significant environmental receptors identified are listed below. These receptors are used as a starting point to ensure that all
significant risks are identified and all major aspects of the environment are taken into account.

Environmental Receptors:

- Groundwater
- Surface water
- Adjacent National Heritage Area (NHA)
- Human Beings
- Air Quality

1 B. IDENTIFICATION OF PROCESSES

A number of processes associated with the operation of a public civic amenity facility, and other
processes associated with the restoration and aftercare period of the Landfill site were identified
during the course of the workshop and afterwards and are listed below:

Processes:

- General Facility Operations – including nuisance control, traffic management, routine maintenance, monitoring and other site operations.
- Civic Amenity Facility Operations – including the temporary storage and transfer of waste.
- Landfill Gas – including landfill gas generation, migration, and control.
- Leachate – including leachate generation, collection, storage and transfer off site.

These current processes have been identified to cover all activities on site that may result in a risk to
the environmental receptors. Each environmental receptor was assessed against the list of processes
in order to identify potential hazards.

1 C. IDENTIFICATION OF RISKS ASSOCIATED WITH RECEPTORS AND PROCESSES

1 Improper handling of waste by staff and members of the public
2 Vehicles and/or person accidents in the Civic amenity area
3 Overfilling of storage containers in the Civic Amenity area
4 Risk of hazardous material passing inspection and being accepted at Civic Amenity
5 Member of public slipping/tripping in civic amenity area
6 Improper storage of permitted household hazardous waste
7 Escape of contaminated liquid from the Civic Amenity containment system
8 Off site migration of litter causing nuisance
9 Vermin carrying disease out of the landfill
10 Odours causing a nuisance
11 H&S Accident during environmental monitoring
12 Drowning in Colligan River or Leachate Wetlands System of staff or unauthorised member of public
13 Human exposure to leachate and /or landfill gas during general maintenance operations
14 Fire in the CA or landfill
15 Landfill gas migration off site and accumulation in structures.
16 Escape of gas to the atmosphere
17 Degradation of capping.
18 Leachate break out due to breach in liner
19 Failure of leachate collection infrastructure leading to groundwater contamination
20 Escape of leachate from leachate storage tank to ground
21 Intrusion / Vandalism at flare compound
22 Dust causing a nuisance, blown off site.

2.A - ASSESSMENT OF RISKS

These risks were assessed against the risk classification table below. The risk classification table was designed to reflect the critical levels of risk appropriate to the landfill. Risk ratings were applied to each risk. The severity rating adopted for each risk reflected the highest severity rating of the severity
parameters (safety, environment).

A risk score was calculated for each risk using the selected severity and occurrence ratings. The risks
were then ranked and compared based on the risk scores. The risks were placed in a risk matrix to

illustrate the ranking and level of each risk, and allow the risks to be visually prioritised. The risk matrix
is a particularly useful tool for tracking changes in risk levels over time. The level of management
required for each risk is identified from the risk matrix.

Table 2 A. - RISK CLASSIFICATION TABLE

Rating	Description	Likelihood of Occurance (%)	Severity	
			Safety	Environment
1	Nil	0%	No injury	No Effect
2	Very Low	0-5%	First aid injury	Slight effect, temporary
3	Low	5-10%	Medically treated injury	Minor effect, temporary
4	Medium	10-20%	Lost time injury to 1 week	Local impact, recoverable losses
5	High	20-50%	Lost time injury > 1 week	Major Impact, severe damage
6	Very High	>50	Permanent Disabilty Fatality	Massive impact, severe long term damage

Table 2.B - RISK RANKING

Risk	Potential Failure Mode	Risk Score
2	Vehicles and/or person accidents in the Civic amenity area	20
12	Drowning in Colligan River or Leachate Treatment Wetlands of staff or unauthorised member of public	18
21	Intrusion / Vandalism at flare compound	18
18	Leachate break out due to breach in capping	16
8	Off site migration of litter causing nuisance	15
3	Overfilling of storage containers in the Civic Amenity area	12
5	Member of public slipping/tripping in civic amenity area	12
11	H&S Accident during environmental monitoring	12
13	Human exposure to leachate and /or landfill gas during general maintenance	12
14	Fire in the CA or landfill	12
15	Landfill gas migration off site and accumulation in structures	12
17	Degradation of capping	12

20	Escape of leachate from leachate storage tank to ground	12
4	Risk of hazardous material passing inspection and being accepted	9
6	Improper storage of permitted household hazardous waste	9
7	Escape of contaminated liquid from the Civic Amenity containment	9
10	Odours causing a nuisance	9
1	Improper handling of waste by staff and members of the public	8
9	Vermin carrying disease out of the landfill	6
16	Escape of gas to the atmosphere	6
19	Failure of leachate collection infrastructure leading to groundwater contamination	6
22	Dust causing a nuisance, blown off site	6

2.B RISK MATRIX

The Risk Matrix has been developed to allow the risks to be easily displayed and prioritised. The severity and occurrence ratings are used in the matrix; with the level of severity forming the x-axis and the likelihood of occurrence forming the y-axis. This matrix will provide a visual tool for regular risk reviews since the success of mitigation can be easily identified. The risk matrix is displayed below. The risks have been colour coded in the matrix to provide a broad indication of the critical nature of each risk. The colour code is as follows:

 Red (deep red and light red) – These are considered to be high-level risks requiring priority attention. These risks have the potential to be catastrophic and as such should be addressed quickly.

 Amber / Yellow – These are medium-level risks requiring action, but are not as critical as a red coded risk.

 Green (light and dark green) – These are lowest-level risks and indicate a need for continuing awareness and monitoring on a regular basis. Whilst they are currently low or minor risks, some have the potential to increase to medium or even high-level risks and must

therefore be regularly monitored and if cost effective mitigation can be carried out to reduce
the risk even further this should be pursued.

Risk Matrix – Current Risk Status

	V. High	6						
	High	5			8	2		
Occurrence	Medium	4		1	3	18		
	Low	3			4,6,7,10	5		21,12
	V.Low	2			9,16,19, 22			11,13,14, 15,17,20
	Nil	1						
			1	2	3	4	5	6
			Nil	V.Low	Low	Medium	High	V.High
					Severity			

The risk matrix indicates that there are three risks in the red zone that requires priority attention. Two
risks are in the yellow/amber zone indicating that these risk requires action as soon as possible. All
remaining risks are located in the green zone indicating a need for continuing awareness and
monitoring on a regular basis.

2.C - DISCUSSION OF RISK LEVELS

The following risk lies in the red zone and require priority attention:

 Risk 2 - Vehicles and/or person accidents in the Civic amenity area

 Risk 12 - Drowning in Colligan river or Leachate Treatment Wetlands of staff or unauthorised member of public

 Risk 21 - Intrusion / Vandalism at flare compound

The following risks lie in the amber / yellow zone and require attention as soon as possible:

 Risk 8 – Off site migration of litter causing nuisance

 Risk 18 – Leachate break out due to breach in capping

All remaining risks lie in the green zone. These risks require continuing awareness and monitoring on a regular basis. As these risks may have the potential to increase to yellow or red zone risks, additional risk management measures should be put in place to manage them at their current levels, or preferably to reduce them further, if required.

3.A - IDENTIFICATION AND ASSESSMENT OF MITIGATION ACTIONS

Risks requiring additional mitigation actions were identified in Section 2.C. These are comprised of three
risks located in the red zone and two risks located in the amber / yellow zone. All remaining risks
were found to be in the green zone.

Additional risk mitigation measures were identified for the three risks in the red zone, reducing the risk for one to green, one to yellow, and one remains unchanged at red, but a possible future mitigation was identified for the third (the risk level remains unchanged until monitoring indicates the mitigation is warranted). The three risks that are in the red zone are inherently risky, and thus procedures and monitoring is necessary on an ongoing basis. A review should be carried out regularly identifying any

further opportunities to reduce these risks, and to ensure that the risk level does not increase.

One of the risks in the yellow zone have a certain level of risk by its nature, and the risk cannot
be readily reduced as mitigation measures are already in place. These measures will reduce these
risks to more acceptable levels. One yellow zone risk was reduced to a green risk by mitigation
measures. Again, a review should be carried out regularly identifying any further opportunities to
reduce these risks, and to ensure that the risk level does not increase.
Since green zone risks may have the potential to increase to yellow or red zone risks, these risk mitigation measures should be implemented since they are considered cost-effective.

3.B - EFFECTIVENESS OF MITIGATION MEASURES IN RISK REDUCTION

The risk scores have been re-calculated on the basis that the additional mitigation measures are fully implemented. **Table 3.1** provides the revised risk scores after the implementation of the risk mitigation measures, and compares them to the current risk score. **Table 3.2** provides a revised risk matrix following the implementation of the risk mitigation measures.

Table 3.1 indicates that the risk scores for 4 of the risks are reduced by the implementation of the measures, whilst there would be no significant change to 18 of the risks. However, recommended mitigation measures have been proposed and assessed for 6 of the 18 risks which do not exhibit improved risk scores, and these measures should increase the robustness of the risk controls already in place.

In addition, the risk matrix indicates that two of red code risks have been reduced to a yellow
yellow/amber code risk, and one to green. One yellow/amber code risk has been reduced to a green zone risk, and one of the green code risks have moved to the lower green zone.

The recommended mitigation measures therefore show a real reduction in risk at the landfill and since they are considered cost-effective, should be implemented.

Table 3.2 – Revised Risk matrix – Post Recommended Mitigation Measures

	V. High	6						
	High	5						
Occurrence	Medium	4		1	3,8	18,2		
	Low	3			4,6,7,10	5,12		21
	V.Low	2			9,16,19, 22		20	11,13,14, 15,17
	Nil	1						
			1	2	3	4	5	6
			Nil	V.Low	Low	Medium	High	V.High
					Severity			

Appendix N

Site Slope Stability Assessment

Dungarvan Landfill Slope Stability Assessment 2010

A slope stability assessment was carried out for the facility during the 2010 AER reporting period, Jan 1st 2010 – December 31st 2010, by the facility manager. It was noted that generally slope stabilty has not been affected by construction work undertaken in the course of the remediation process and construction of the leachate treatment wetlands on site. Works to augment slope stability during the construction phase are included below. Individual slopes referred to are outlined on the attached site plan.

1. Eastern Slope, north of Haul Road

A surface water drainage channel and channel for leachate pumping have been dug along the base of this slope and a pump/sump for dilution of leachate have also been installed along with gravel pathways to the sump pump and existing monitoring well. These works have not destabilised the slope in any way. Vegetation thereon is thriving.

2. Northern Slope on eastern end of landfill, adjacent to Colligan River

A section of river gabions providing bank protection at Dungarvan landfill collapsed in October 2008, caused by heavy construction traffic during capping works. Substantial works involving the replacement of 20m length of damaged gabions, approx 4m deep, strengthening the gabions structure by deepening the extent, and raising the gabions retaining to track level were subsequently carried out. The above photos illustrate the work. The works that were undertaken have proved to be successful as No slippage has taken place in the area since the works have been carried out.

3. Former Haul Road

Slopes along both sides of the former landfill haul road remain stable and vegetation is thriving thereon. This will be augmented during the next reporting period with suitable wild flowers.

4. Northern slope at western end of landfill

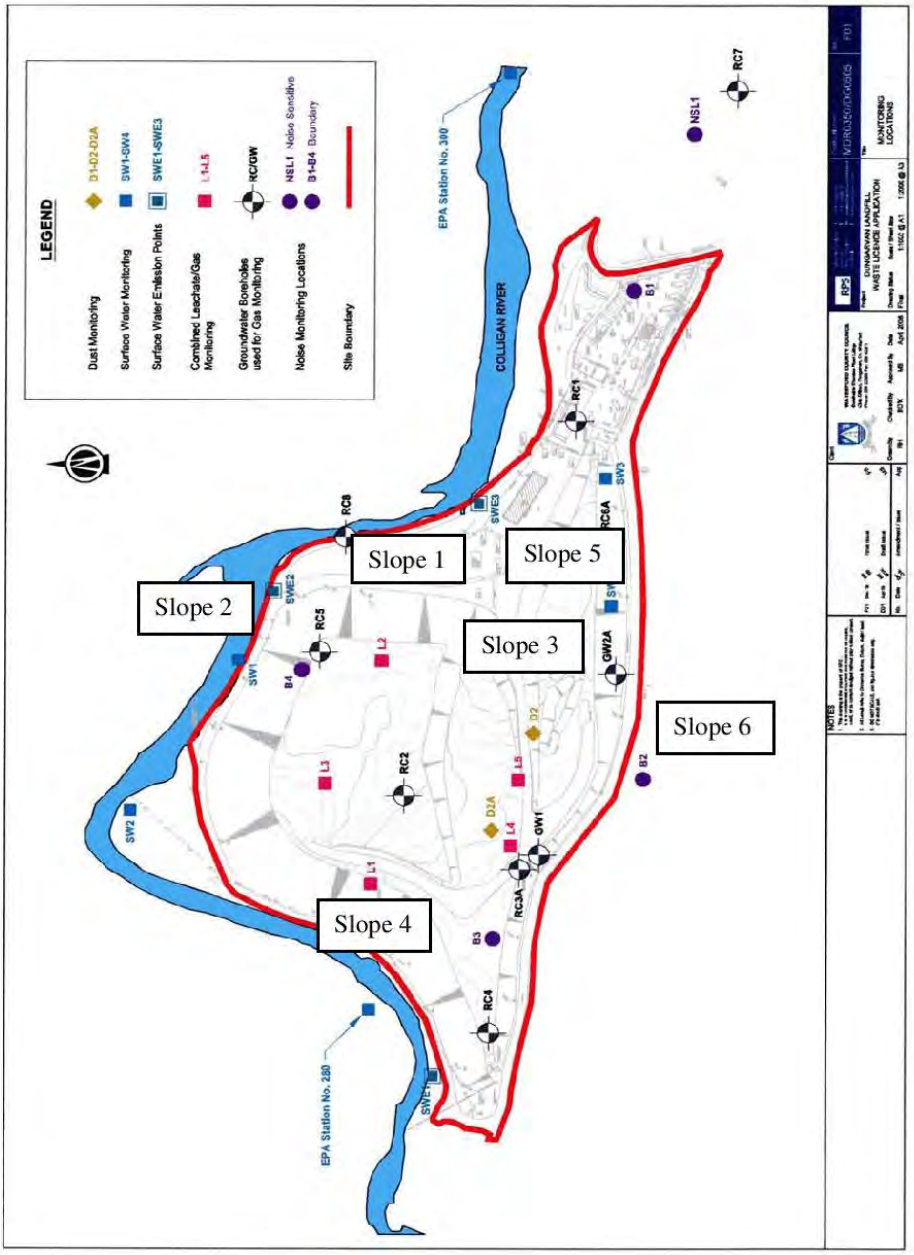
A channel which forms part of the leachate extraction system has been dug along the base of this slope. The channel has had No adverse effect on the stability of the slope. Vegetation in this area is thriving.

5. Northern facing slope on southern side of haul road

This is the largest slope on the landfill. The largest wetland pond in the leachate extraction system has been formed at the top of this slope. Despite this there is No sign of shrinkage or instability as a result of the works carried out in this area. Vegetation on this slope is strong.

6. Southern Slope of Landfill

Generally there are No stability issues on this slope aside from a small area that needs attention in around monitoring points RC3A and GW1 where a gravel access path has been formed and has caused some instability. This will be addressed under the remediation contract and repair works in this area will be carried out by Waterford County Council staff.


LEGEND
Dust Monitoring
D1-D2-D2A
Surface Water Monitoring
SW1-SW4
Surface Water Emission Points
SWE1-SWE3
Combined Leachate/Gas Monitoring
L1-L5
Groundwater Boreholes used for Gas Monitoring
RC/GW
Noise Monitoring Locations
NSL1 Noise Sensitive
B1-B4 Boundary
Site Boundary
COLLIGAN RIVER
EPA Station No. 280
EPA Station No. 290
Slope 1
Slope 2
Slope 3
Slope 4
Slope 5
Slope 6
RC1
RC2
RC3A
RC4
RC4A
RC5
RC6
RC7
GW1
GW2A
SW1
SW2
SW3
SWE1
SWE2
SWE3
B1
B2
B3
B4
D2
D2A
L1
L2
L3
L4
L5
NSL1