E ATTACHMENTS

ATTACHMENT E.1 Emissions to Atmosphere

The landfill has been restored and the only emission to atmosphere is from the Gas Flare and the minor/fugitive emissions as reported to the EPA on an annual basis in the AER / PRTR Returns. Included with this attachment are the following:

- **Table E.1(i)** Landfill Gas Flare Emissions
- **Table E.1(ii)** Not Applicable
- **Table E.1(iii)** Not Applicable
- **Table E.1 (iv)** Emissions to Atmosphere – Minor/Fugitive

ATTACHMENT E.2 Emissions to Surface Water

Surface water on-site is collected through the subsurface drainage system within the capping layer and then to the surface water retention pond. From the retention pond the surface water drains downslope through a four-inch pipe connecting to the surface water drainage system from the Civic Amenity site. From this connection the surface water drains through a nine-inch pipe directly to the Avoca River. The surface water layout is presented on Attachment E.2 (i).

In 2006 and 2007 the EPA requested quality analysis of the surface water discharging to the river. The test results indicated that the quality of the surface water discharge was within EPA surface water quality standards and no further characteristic data was requested from the EPA. Included with this attachment are:

- **Attachment E.2(i)** Surface Water Drainage Layout Plan
- **Attachment E.2(ii)** Surface Water Quality Results for 2006 and 2007
- **Table E.2(i)** Emissions to Surface Waters
- **Table E.2(ii)** Emissions to Surface Waters - Characteristics

ATTACHMENT E.3 Not Applicable – No Emissions to Sewer

Sanitary facilities at the site is provided by mobile toileting units where effluent is removed and disposed off site.

- **Table E.3(i)** Not Applicable
- **Table E.3(ii)** Not Applicable

ATTACHMENT E.4 Emissions to Groundwater

The impact of the landfill on surface and groundwater is the principal purpose of this Waste Licence Review Application and is dealt with in detail in Section 7 of the accompanying EIS. The landfill was designed to operate under a 'disperse and dilute' method. The landfill included a bottom liner in the form of low-permeability mine tailings whose function would reduce or limit the risk of pollution to groundwater.

Groundwater pathways in the landfill area are complex. There is no specific emission point to groundwater. Under natural conditions, groundwater flow would be from topographically higher areas to lower areas. However, the underground mine workings beneath the landfill site have significantly altered the hydrogeological conditions in the West Avoca mining area. Groundwater in the Avoca mines area flows towards the Avoca River valley whether through the adit systems or diffusively in bedrock and subsoils.

A multivariate statistical method known as a Principal Component Analysis (PCA) has been carried out on water quality data collected since the mid-1990s, when long-term monitoring began at the landfill. The PCA was carried out to help distinguish between the impacts of the landfill from those of the mine workings. Details are provided in Section 7 of the EIS

- **Table E.4(i)** Not Applicable. See Section 7 of the EIS

ATTACHMENT E.5 Emissions of Noise

The landfill is restored and the last recorded complaint with regard to any emission from Ballymurtagh Landfill was in August 2005. Noise monitoring has continued at two noise sensitive locations NSL1 and NSL4 as agreed with the EPA in 2007. The most recent noise survey in March 2009 indicated that the only noise source at the site is from traffic on the main R752 road which runs adjacent to the site.

While gas flaring still occurs, the generator has been replaced by mains power and is no longer a source of noise. No noise emanating from the gas flare was audible at NSL1, the nearest noise sensitive location to the flare. The Civic Waste Facility continues at the site and occasional noise can be generated at low levels, which are not detectable at the noise sensitive locations NSL1 and 4.

- **Table E.5(i)** Not Applicable

ATTACHMENT E.6 Environmental Nuisances

The landfill is closed and restored. Environmental nuisances are therefore limited to:

- Litter Control
- Odour Control
- Vermin Control
- Fire Control
- Road Cleansing

For road cleansing, a suction sweeper is used to clean the road leading to the Civic Amenity site as required. Fire control falls under an Emergency Response Procedure and this is included with a copy of the control measures currently in place for nuisances from the AER and the EMP for 2008 for the facility with this attachment.

Attachment E.6(i) Nuisance Control Procedures

ANNEX 1 STANDARD FORMS

Standard forms are provided in this section for the recording and presentation of environmental monitoring and site investigation results

TABLE E.1(i) LANDFILL GAS FLARE EMISSIONS TO ATMOSPHERE
Emission Point:

Emission Point Ref. N^{o}:	Flare
Location :	Adjacent to the Site Offices
Grid Ref. (12 digit, 6E,6N):	X319604 Y181367
Vent Details Diameter: Height above Ground(m):	 1.0m 6.4m
Date of commencement of emission:	Original open flare commissioned in 1998. Replaced by an enclosed flare in Jan 2002

Characteristics of Emission : From analysis carried out in June 2008

CO	39mg/Nm^3
Total organic carbon (TOC)	Not analysed mg/m^3
Nox as NO_2	0 mg/Nm^3 0^{o}C. 3% O_2(Liquid or Gas), 6% O_2(Solid Fuel)
Maximum volume of emission	500m^3/hr
Temperature	1140 ^{o}C(max) 1040 ^{o}C(min) 1090^{o}C(avg)

(i) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up/shutdown to be included):*

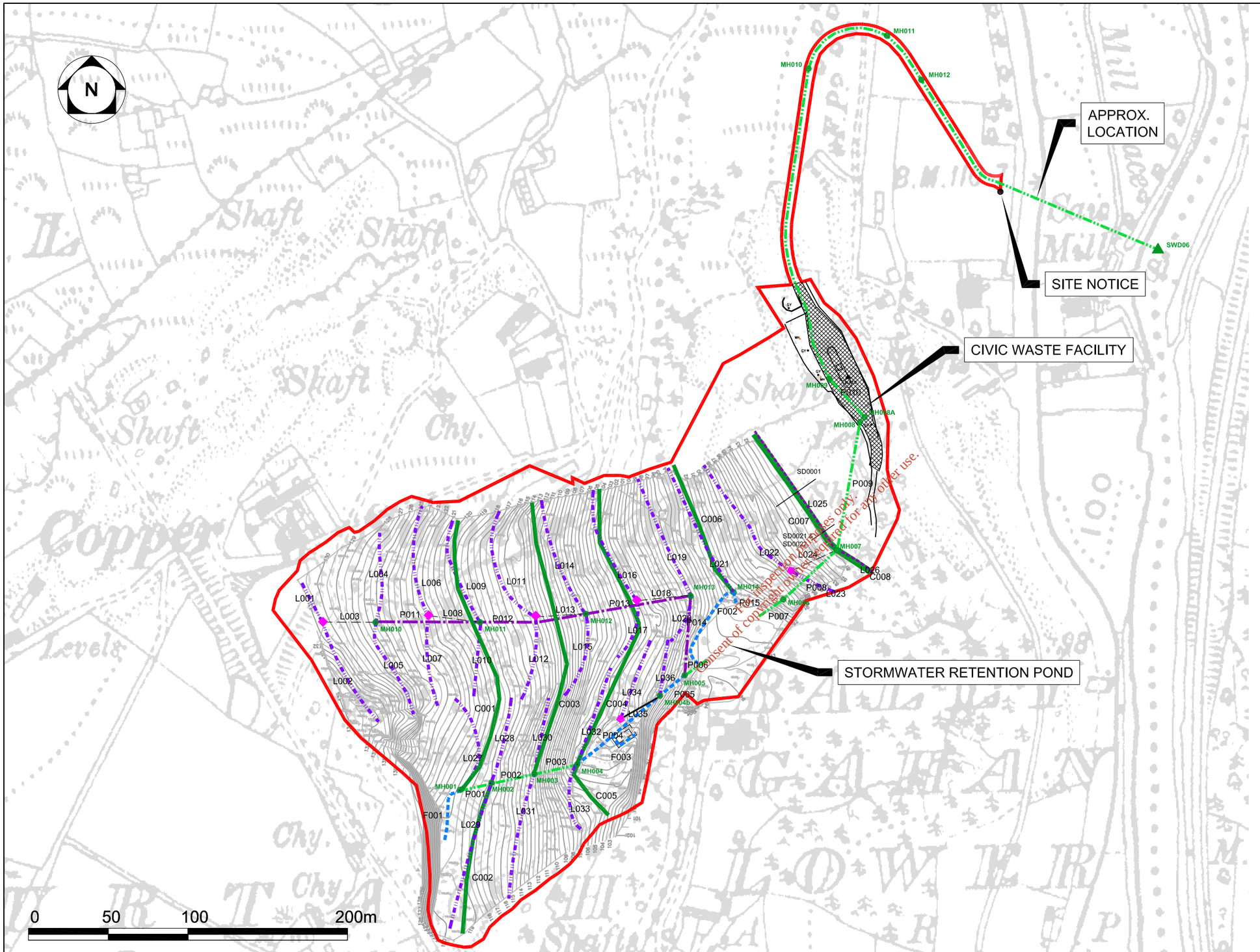
Periods of Emission (avg)	60 min/hr 24 hr/day ___day/yr Run Time 91%. Down Time 9%

TABLE E.1(iv): EMISSIONS TO ATMOSPHERE - Minor /Fugitive

See Attachment E.1

Emission point Reference Numbers	Description	Emission details[1]				Abatement system employed
		material	mg/Nm$^{3(2)}$	kg/h.	kg/year	
Gas Sim Model	Methane				7294.2	Active Flare draws gas from the landfill
	Carbon Dioxide				2263547	Active Flare draws gas from the landfill

1 The maximum emission should be stated for each material emitted, the concentration should be based on the maximum 30 minute mean.
2 Concentrations should be based on Normal conditions of temperature and pressure, (i.e. 0^{o}C101.3kPa). Wet/dry should be clearly stated. Include reference oxygen conditions for combustion sources.



NOTES

1. Verifying Dimensions.
   The contractor shall verify dimensions against such other drawings or site conditions as pertain to this part of the work.
2. Existing Services.
   Any information concerning the location of existing services indicated on this drawing is intended for general guidance only. It shall be the responsibility of the contractor to determine and verify the exact horizontal and vertical alignment of all cables, pipes, etc. (both underground and overhead) before work commences.
3. Issue of Drawings.
   Hard copies, dwf and pdf will form a controlled issue of the drawing. All other formats (dwg, dxf etc.) are deemed to be an uncontrolled issue and any work carried out based on these files is at the recipients own risk. RPS will not accept any responsibility for any errors arising from the use of these files, either by human error by the recipient, listing of un-dimensioned measurements, compatibility issues with the recipient's software, and any errors arising when these files are used to aid the recipients drawing production, or setting out on site.
4. Datum: Ordnance Survey Datum, Malin Head

No.	Date	Drn. / Chk.	Amendment / Issue	App
A01	Oct '09	RH / PL	Issue for Approval	PL

Client: Wicklow County Council, County Buildings, Wicklow, Co. Wicklow

Drawn By	Checked By	Approved By	Date
RH	PL	PL	Oct. '09

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Project: **Ballymurtagh Landfill**

Drawing Status	Sheet Size	Scale
Approval	A3	NTS

Drawing Number:

Rev:

Title: DRAINAGE LAYOUT

Mde0046DG0003A01 DRAINAGE.dwg

Parameter	Units	Surface Water Regulations 1989 Max. Admissable Conc.	Environmental Quality Standards (proposed by EPA, 1997) Proposed Limits	SW6 Civic Amenity 2006 Sampled: 21/09/06 Analysed: 21/09/06	SW6 Civic Amenity 2007 Sampled: 21/09/07 Analysed: 21/09/07
pH		**5.5 < pH < 8.5**	**5.5 <pH < 9.0**	7.6	7.9
Temperature (on site)	^{o}C	**25**		8	6
Conductivity	uS/cm at 20^{o}C	**1,000**	**1,000**	629	483
C.O.D.	mg/l O_2	**40**	**None**	19	22
B.O.D.	mg/l O_2	**5**	**5**	<3	<2
Dissolved Oxygen (on site)	mg/l O_2	**<5**	**<9 (@ 50% of the time)**	6.8	9.3
Total Suspended Solids	mg/l SS	**35**		1	1
Total Oxidised Nitrogen	mg/l N	**5**	**11.36**	0.2	
Total Alkalinity	mg/l HCO_3		**None**	250	
Ammonium	mg/l NH_4	**0.2**	**20ug/l NH_3 un-ionised Ammonia**	<0.08	0.90
Calcium	mg/l Ca		**None**	144	
Cadmium	mg/l Cd	**0.005**	**0.005**	<0.03	
Chromium	mg/l Cr	**0.05**	**0.05**	<0.05	
Chloride	mg/l Cl	**250**	**250**	8	11
Copper	mg/l Cu	**0.05**	**0.005 - 0.112**	<0.05	
Iron	mg/l Fe	**0.2**	**1**	0.150	
Lead	mg/l Pb	**0.05**	**0.05**	<0.2	
Magnesium	mg/l Mg		**None**	11	
Manganese	mg/l Mn	**0.05**	**0.3**	0.100	
Mercury	mg/l Hg	**0.001**	**0.001**	<.00002	
Total Phosphorus as P	mg/l P	**-**	**-**	0.05	
Phosphate	mg/l P_2O_5	**0.5**	**0.07 mg/l P (0.32 mg/l P_2O_5) (for Seriously polluted river (Q<2)**	<1	
Potassium	mg/l K		**None**	2	
Sodium	mg/l Na		**None**	16	
Sulphate	mg/l SO_4	**200**	**200**	122	84
Zinc	mg/l Zn	**3**	**0.03 - 0.5**	0.03	

TABLE E.2(i): EMISSIONS TO SURFACE WATERS
(One page for each emission)

Emission Point: SWD6

Emission Point Ref. N^{o}:	SWD6
Source of Emission:	Landfill Retention Pond and Surface Water from the CA site
Location :	Outlet pipe to Avoca River on river bank, located across the road, opposite entrance to CA site
Grid Ref. (10 digit, 5E,5N):	X 319934 Y 181678
Name of receiving waters:	Avoca River
Flow rate in receiving waters:	Unknown Note $m^3.sec^{-1}$ Dry Weather Flow 1.2 Note $m^3.sec^{-1}$ 95%ile flow
Available waste assimilative capacity:	93.3 BOD kg/day

Emission Details:

Note: The Avoca River is ungauged. The 95%ile flow is calculated using simulated data, as presented in Section 6 of EIS.

(i) Volume to be emitted			
Normal/day	Unknown m^3	Maximum/day	43.2 m^3
Maximum rate/hour	1.8 m^3		

(ii) Period or periods during which emissions are made, or are to be made, including daily or seasonal variations (*start-up /shutdown to be included):*

Periods of Emission (avg)	_____min/hr _____hr/day _____day/yr

Note: Actual quantities of runoff that are generated over the landfill are not measured but are expected to vary significantly in any given year according to both rainfall amounts and rainfall intensities. Above are estimates of the maximum volume, see Section 6 of the EIS for details.

TABLE E.2(ii): EMISSIONS TO SURFACE WATERS - Characteristics of the emission (1 table per emission point)

Emission point reference number : **SWD6**
Note: The surface water is not treated prior to discharge.

Parameter	Prior to treatment				As discharged				% Efficiency
	Max. hourly average (mg/l)	Max. daily average (mg/l)	kg/day	kg/year	Max. hourly average (mg/l)	Max. daily average (mg/l)	kg/day	kg/year	
BOD	n/a	n/a	n/a	n/a	-	3	0.13	47.3	n/a

EMERGENCY RESPONSE PROCEDURES

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

- Fire/explosions
- Spillage
- 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 landfill personnel and contractors in effective emergency response procedures (including the use of booms in the event of an oil spillage).
2. In the event of a major fire or an explosion the Chief Fire Officer will be notified immediately and assume responsibility to deal with the emergency.
3. In the event of other incidents i.e. environmental pollution the Senior (Environment) Engineer will be notified and will assume responsibility along with the Facility Manager.
4. Ensure relevant emergency contact numbers are available at the site office next to the telephone.

PROCEDURE

In the event of an incident occurring the following procedure will apply:

1. If necessary evacuate immediate hazard area.
2. Inform other site users to remain upwind of any hazard area.
3. Contact site office and advise in detail of the emergency.
4. Contact Fire Brigade, Ambulance or Gardai as required.
5. Ensure entrance/exit gate is not obstructed.
6. Report to the designated assembly point at the entrance to the Civic Waste Facility or other safe area.
7. All areas affected by the incident will remain closed until given the 'all clear' by the Facility Manager or other authorised person.
8. Have regard to the Corrective Action Procedure.

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

1. Evacuate the site office.
2. Have regard to the Corrective Action Procedure.

In the event of a spillage at the facility, the Facility Manager/Operator will:

1. Apply suitable absorbent material to contain and absorb the spillage.
2. Have regard to the Corrective Action Procedure.
3. Dispose of absorbent material at a licensed facility.
4. Order a supply of containment booms.

In the event that monitoring indicates that the facility is having an adverse effect on the environment, the Facility Manager will have regard to the Corrective Action Procedure.

In the event that monitoring of the side slopes of the facility indicate that there may be a risk of slope failure, the Facility Manager will have regard to the Corrective Action Procedure and Environmental Incident Reporting Procedure.

All of the above incidents/emergencies will be reported to the Agency in accordance with the Environmental Incident Reporting Procedure.

RELEVANT DOCUMENTAITON

Details of all incidents will be recorded in accordance with the Environmental Incident Reporting Procedure.

CONTROL OF NUISANCE

To purpose of this procedure is to ensure that vermin, odour or litter do not give rise to nuisance at the Civic Waste Facility.

RESPONSIBILITY

The Facility Manager will be responsible for overseeing this procedure, however the site supervisor will implement the operational measures on a weekly basis at the Civic Waste Facility and ensure they do not cause environmental pollution:

PROCEDURE

The Site Supervisor will implement the following measures at the Civic Waste Facility on a weekly basis:

1. Inspect the facility and its immediate surrounds and record results on the Inspection Report Form.
2. Ensure that the facility is free of litter. In the event of fly tipping notify and organise for the correct disposal of the waste.
3. Apply 'Drat', a grain treated with a rodenticide if vermin are observed at the facility.
4. In the event of odour detection, the facility manager will have regard to the corrective Action Procedure.
5. Ensure that Bioverde Power Systems Limited visit the site on a weekly basis to ensure the correct functioning of the gas extraction system and minimisation of odour emissions.
6.

RELEVANT DOCUMENTAITON

1) Inspection Report Form.

File all documentation in Inspection Report File.

CORRECTIVE ACTION PROCEDURE

This procedure sets out the approach to take in the event of the following:

1. A non-compliance with W0011-01,
2. An incident as outlined in Condition 3.1 of W0011-01, and
3. That a corrective action is required at the facility for a reason other than an incident or non-compliance with W0011-01.

The aim of this procedure is to assist in resolving the matter and prevent its recurrence.

RESPONSIBILITIES

The Facility Manager is responsible for co-ordinating the corrective action procedure and retaining the Corrective Action File and forms. The Senior Executive Engineer/Senior Engineer will be responsible for the review of Corrective Action Forms and will also ensure that controls are applied to ensure that corrective actions are implemented and effective.

PROCEDURES

In the event of non-compliance, the Facility Manager will:

1. Take the necessary short-term action to prevent the immediate reoccurrence of the problem or minimise any further impact.
2. Notify the EPA of the incident as per the Environmental Incident Procedure in accordance with Condition 3.3 of W0011-01.
3. Conduct a thorough investigation of the root cause of the problem.
4. Document the results of investigation and propose a long-term corrective action to prevent recurrence of the problem on the Corrective Action Form.
5. Submit the completed Corrective Action Form to the Senior Executive Engineer/Senior Engineer who will review the recommendation and accept or require additional investigation. If additional investigation is required, the form and attachments will be returned to the Facility Manager, who will continue with the investigation as detailed by the Senior Executive Engineer/Senior Engineer on the Corrective Action Form. If the recommendation is acceptable, the Facility Manager will implement the corrective action.
6. Monitor the success of the corrective action to ensure that it is effective.
7. Document the evidence that was reviewed to determine the effectiveness of the corrective action on the Corrective Action Form.
8. File the original Corrective Action Form and any accompanying paperwork in the Corrective Action File and copy the completed form to the Senior Executive Engineer/Senior Engineer.
9. If necessary, implement changes to procedures resulting from the corrective action.
10. Arrange training of landfill personnel if required.

RELEVANT DOCUMENTATION

1. Corrective Action Form.

File all documentation in Corrective Action File.

F ATTACHMENTS

ATTACHMENT F.1 Emissions Control Systems

Emissions to Atmosphere

Abatement of emissions to atmosphere is through the active venting and on-site flaring system, consisting of a Hasse – TDN 500 with a maximum flow capacity of 500m3/hr. The current landfill gas control infrastructure and monitoring is in accordance with the existing Waste Licence for the facility. A Gas Flare Emissions Report is carried out biannually demonstrating the effectiveness of this abatement control system. A copy of the gas control infrastructure plan for the site is presented as Attachment F.1(i) and the gas flare emission report for June 2008 is presented in Attachment F.9(ii).

Emissions to Surface Water

The surface water retention pond provides abatement in terms of suspended solids for the one emission point to surface water. Water quality test results carried out in 2006 and 2007 of the surface water discharge show that this discharge was within the EPA surface water quality standards and therefore no further abatement measures are considered necessary.

Emissions to Groundwater

The impact of the landfill on surface and groundwater is the principal purpose of this Waste Licence Review Application and is dealt with in detail in Section 7 of the accompanying EIS. The landfill was designed to operate under a 'disperse and dilute' method. The landfill included a base liner in the form of low-permeability mine tailings whose function was to reduce or limit the risk of pollution to groundwater.

Included with this attachment are the following:

- **Attachment F.1(i)** Gas Management System Plan
- **Table F.1** Abatement of Emissions to Atmosphere

ATTACHMENT F.2 to ATTACHMENT F.8 Monitoring and Sampling Points

All environmental monitoring and sampling is carried out in accordance with Schedule E and F of the existing Waste Licence of the facility. This Schedule lists parameters to be monitored and the frequencies as shown in Attachment F.2(i). The monitoring programme has been modified over the years with authorisation from the Agency. The current monitoring points at the closed landfill are listed with associated grid references in Attachment F.2(ii). The corresponding monitoring locations are presented on the Monitoring Points Plan in Attachment F.2(iii) and on the Location of Private Wells Plan F2.(iv).

Dust monitoring ceased when the restoration of the landfill was complete and noise monitoring was reduced to two noise sensitive locations in accordance with EPA letter W0011-1/gc06e.doc

Included with this attachment are the following:

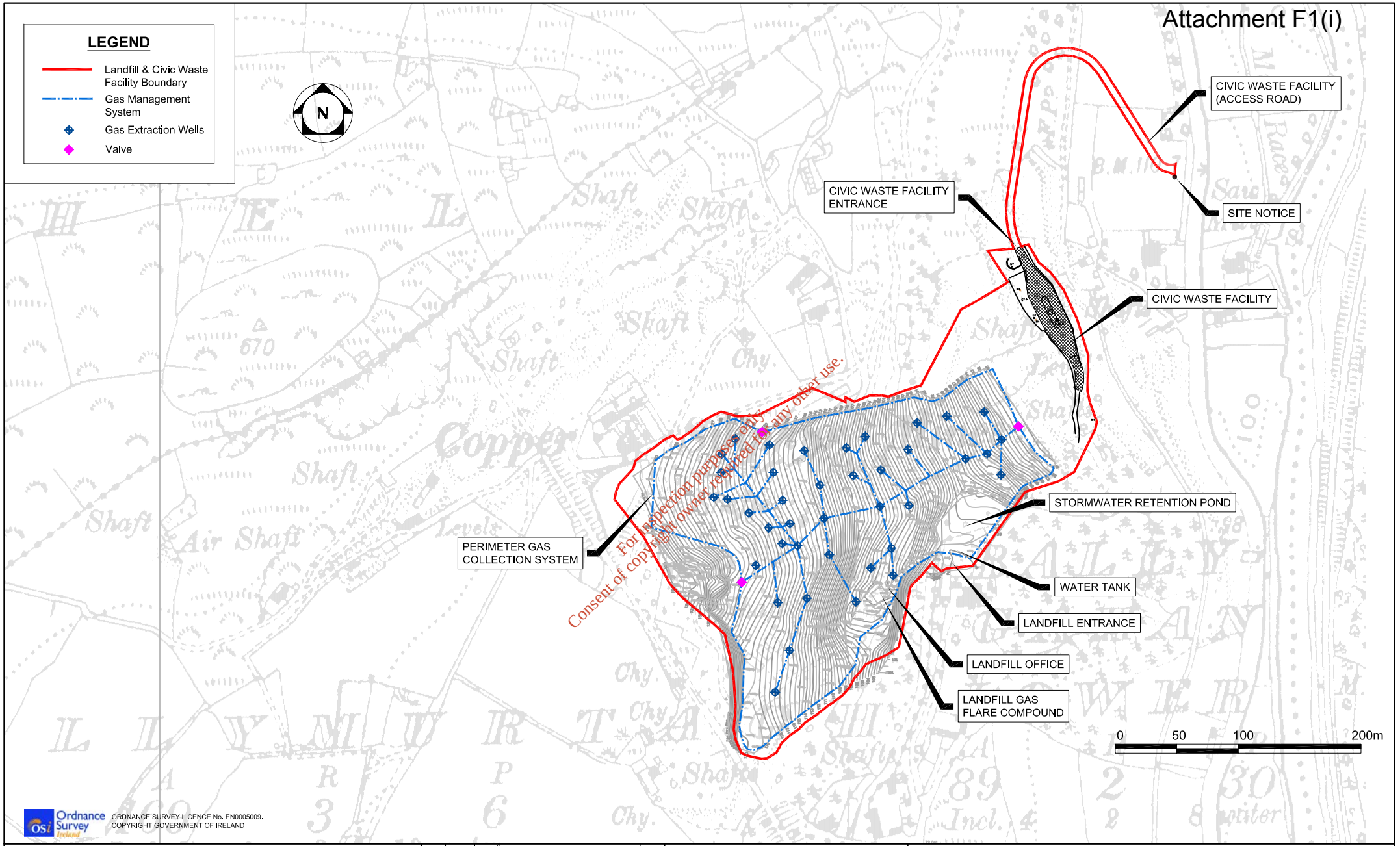
- **Attachment F.2(i)** Schedule E and F from the current Waste Licence
- **Attachment F.2(ii)** Current Monitoring Identification List with 12-figure Grid References
- **Attachment F.2(iii)** Monitoring Points Plan
- **Attachment F.2(iv)** Location of Private Wells Plan
- **Table F2 to F8** See the above attachments

ATTACHMENT F.9 Landfill Gas

Landfill Gas monitoring is carried out daily at the inlet to the flare and weekly at the site office. Monthly monitoring is undertaken at all of the gas monitoring locations as indicated on the Monitoring Points Plan presented on Attachment F.2(iii). All monthly and weekly gas monitoring for 2008 are presented on Attachment F.9(i). The Gas Flare Emissions report for June 2008 is included in Attachment F.9(ii).

Attachment F.9(i) Landfill Gas Monitoring for 2008
Attachment F.9(ii) Gas Flare Emissions Report for June 2008

Attachment F1(i)



NOTES

1. Verifying Dimensions.
   The contractor shall verify dimensions against such other drawings or site conditions as pertain to this part of the work.
2. Existing Services.
   Any information concerning the location of existing services indicated on this drawing is intended for general guidance only. It shall be the responsibility of the contractor to determine and verify the exact horizontal and vertical alignment of all cables, pipes, etc. (both underground and overhead) before work commences.
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4. Datum: Ordnance Survey Datum, Malin Head

No.	Date	Drn. / Chk.	Amendment / Issue	App
A01	Oct '09	RH / PL	Issue for Approval	PL

Client: Wicklow County Council, County Buildings, Wicklow, Co. Wicklow

Drawn By	Checked By	Approved By	Date
RH	PL	PL	Oct. '09

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Project: **Ballymurtagh Landfill**

Drawing Number:

Rev:

Title: GAS MANAGEMENT SYSTEM PLAN

Drawing Status	Sheet Size	Scale
Approval	A4	NTS

Mde0046DG0004A01 GAS MANAGEMENT PLAN.dwg

TABLE F.1: ABATEMENT / TREATMENT CONTROL

Emission point reference number : **Flare Emission to Atmosphere.**

Control[1] parameter	Equipment [2]	Equipment maintenance	Equipment calibration	Equipment back-up
Temperature	Enclosed Flare	As per manufacturers instructions	As per manufacturers instructions	Flare Servicing Report submitted with Attachments D5(v) and D5 (vi)

Control[1] parameter	Monitoring to be carried out[3]	Monitoring equipment	Monitoring equipment calibration
Methane (CH4)	Weekly	Infrared Analyser / flame ionisation detector	As per manufacturers instructions
Carbon Dioxide (CO2)	Weekly	Infrared Analyser / flame ionisation detector	As per manufacturers instructions
Oxygen (O2)	Weekly	Electrochemical cell	As per manufacturers instructions
Volumetric Flow	Biannually	Pitot Tube Method	As per manufacturers instructions
SO2, NOx, CO	Biannually	Flue Gas Analyser	As per manufacturers instructions
TA Luft Class I, ii, iii organics	Annually	Adsorption / Desorption / GC / GCMS	As per manufacturers instructions
Hydrochloric Acid	Annually	Impinger / Ion Chromatography	As per manufacturers instructions
Hydrogen Fluoride	Annually	Impinger / Ion Chromatography	As per manufacturers instructions

[1] List the operating parameters of the treatment / abatement system which control its function.
[2] List the equipment necessary for the proper function of the abatement / treatment system.
[3] List the monitoring of the control parameter to be carried out.

SCHEDULE E : Monitoring

Monitoring to be carried out as specified below.

E.1 Landfill Gas

Landfill gas monitoring locations shall be those as set out in Ball-Mon-001 Rev. B and Ball-EIS-004 of the application.

Table E.1.1 Perimeter Monitoring Locations

STATION
G1
G2
G3.
G4
G5
MW
86/9 (V5)
Deep Ballygahan Adit
Ballymurtagh Road Adit

Table E.1.2 Landfill Gas Monitoring Frequency and Technique

Parameter	Monitoring Frequency		Analysis Method[Note1]/Technique[Note2]
	Gas Boreholes/ Vents/Wells	Site Office	
Methane (CH_4) % v/v	Monthly	Weekly	Infrared analyser/flame ionisation detector
Carbon dioxide (CO_2)%v/v	Monthly	Weekly	Infrared analyser/flame ionisation detector
Oxygen(O_2) %v/v	Monthly	Weekly	Electrochemical cell
Atmospheric Pressure	Monthly	Weekly	Standard
Temperature	Monthly	Weekly	Standard

Note 1: All monitoring equipment used should be intrinsically safe.
Note 2: Or other methods agreed in advance with the Agency.

E.2 Dust

Dust monitoring locations to be agreed with the Agency

Table E.2.1 Dust Monitoring Frequency and Technique

Parameter ($mg/m^2/day$)	Monitoring Frequency	Analysis Method/Technique
Dust	Three times a year [Note 2]	Standard Method [Note 1]

Note 1: Standard method VDI2119 (Measurement of Dustfall, Determination of Dustfall using Bergerhoff Instrument (Standard Method) German Engineering Institute). A modification (not included in the standard) which 2 methoxy ethanol may be employed to eliminate interference due to algae growth in the gauge.

Note 2: Twice during the period May to September, or as otherwise specified in writing by the Agency. With the agreement of the Agency monitoring can cease once landfill restoration is complete.

E.3 Noise

Noise monitoring locations to be agreed with the Agency.

Table E.3.1 Noise Monitoring Locations

STATION
NSL 1
NSL 2
NSL 3
NSL 4

Table E.3.2 Noise Monitoring Frequency and Technique

Parameter	Monitoring Frequency	Analysis Method/Technique
$L(A)_{EQ}$ [30 minutes]	Annual	Standard [Note 1]
$L(A)_{10}$ [30 minutes]	Annual	Standard [Note 1]
$L(A)_{90}$ [30 minutes]	Annual	Standard [Note 1]
Frequency Analysis(1/3 Octave band analysis)	Annual	Standard [Note 1]

Note 1: "International Standards Organisation. ISO 1996. Acoustics – description and Measurement of Environmental noise. Parts 1, 2 and 3."

E.4 Surface Water, Groundwater and Leachate

Surface water monitoring locations shall be those as set out in Figure Ball-Mon-001 Rev. B of the application and of the parameters and frequencies outlined in Table E.4.4.

Table E.4.1 Surface Water Monitoring Locations

STATION
SW1
SW2
SW3
SW4
SW5

Groundwater monitoring locations shall be those as set out in Figure Ball-Mon-001 Rev. B of the application and of the parameters and frequencies outlined in Table E.4.4.

Table E.4.2 Groundwater Monitoring Locations

STATION
BH86/9 (V5)
BH96/3
BH96/5A
BH96/6
MW
Twin Shafts
RC1
RC2
RC3
RC4
RC5
RC6

Leachate monitoring locations shall be agreed with the Agency and of the parameters and frequencies outlined in Table E.4.4.

Table E.4.3 Leachate Monitoring Locations

LEACHATE INSPECTION MANHOLES
RC2
RC3
RC4
RC5
V9

Table E.4.4 Water and Leachate - Parameters /Frequency

Parameter [Note 1]	SURFACE WATER Monitoring Frequency	GROUNDWATER Monitoring Frequency	LEACHATE Monitoring Frequency
Visual Inspection/Odour [Note 2]	Weekly	Quarterly	Quarterly
Groundwater Level	Not Applicable	Quarterly	Not Applicable
Leachate Level	Not Applicable	Not Applicable	Weekly
Ammoniacal Nitrogen	Quarterly [Note 6]	Quarterly	Quarterly
BOD	Quarterly [Note 6]	Not Applicable	Quarterly
COD	Quarterly	Not Applicable	Quarterly
Chloride	Quarterly	Quarterly	Quarterly
Dissolved Oxygen	Quarterly	Quarterly	Not Applicable
Electrical Conductivity	Quarterly [Note 6]	Quarterly	Quarterly
pH	Quarterly [Note 6]	Quarterly	Quarterly
Total Suspended Solids	Quarterly [Note 6]	Not Applicable	Not Applicable
Temperature	Quarterly [Note 6]	Quarterly	Quarterly
Boron	Not Applicable	Annually	Annually
Cadmium	Annually	Annually	Annually
Calcium	Annually	Annually	Annually
Chromium (Total)	Annually	Annually	Annually
Copper	Annually	Annually	Annually
Cyanide (Total)	Not Applicable	Annually	Annually
Fluoride	Not Applicable	Annually	Annually
Iron	Annually	Quarterly	Annually
Lead	Annually	Annually	Annually
List I/II organic substances [Note 3]	Note 7	Annually	Note 7
Magnesium	Annually	Annually	Annually
Manganese	Annually	Annually	Annually
Mercury	Annually	Annually	Annually
Potassium	Annually	Quarterly	Annually
Sulphate	Annually	Annually	Annually
Sodium	Annually	Quarterly	Annually
Total Alkalinity	Annually	Annually	Annually [Note 5]
Total Phosphorus / orthophosphate	Annually [Note 6]	Annually	Annually
Total Oxidised Nitrogen	Annually	Quarterly	Quarterly
Total Organic Carbon	Not Applicable	Quarterly	Not Applicable
Residue on evaporation	Not Applicable	Annually	Not Applicable
Zinc	Annually	Annually	Annually
Phenols	Not Applicable	Quarterly	Not Applicable
Faecal Coliforms [Note 4]	Not Applicable	Quarterly	Annually
Total Coliforms [Note 4]	Not Applicable	Quarterly	Annually

Note 1: All the analysis shall be carried out by a competent laboratory using standard and internationally accepted procedures. The testing laboratory and the testing procedures shall be agreed with the Agency in advance.

Note 2: Where there is evident gross contamination of leachate, additional samples should be analysed.

Note 3: Samples screened for the presence of organic compounds using Gas Chromatography / Mass Spectrometry (GC/MS) or other appropriate techniques and using the list I/II Substances from EU Directive 76/464/EEC and 80/68/EEC as a guideline. Recommended analytical techniques include: volatiles (US Environmental Protection Agency method 524 or equivalent), semi-volatiles (US Environmental Protection Agency method 525 or equivalent), and pesticides (US Environmental Protection Agency method 608 or equivalent).

Note 4: In the case where groundwater is extracted for drinking water, if there is evidence of bacterial contamination, the analysis at up gradient and downgradient monitoring points should include enumeration of total bacteria at 22°C and 37°C and faecal streptococci.

Note 5: Only to be analysed in instances of on-site treatment of leachate.

Note 6: Discharge of diverted surface water/groundwater, at a monitoring location to be agreed in accordance with Condition 9.7, shall be monitored on a monthly basis for these parameters unless flow in that month does not allow such monitoring.

Note 7: Once off for List I/II organic substances and thereafter as required by the Agency.

E.5 Meteorological Monitoring

Table E.5.1 Meteorological Monitoring:
Data to be obtained from a climatological station to be agreed with the Agency

Parameter	Monitoring Frequency	Analysis Method/Technique
Precipitation Volume	Daily	Standard
Temperature (min/max.)	Daily	Standard
Wind Force and Direction	Daily	Standard
Evaporation	Daily	Standard
Evapotranspiration	Daily	Standard
Humidity	Daily	Standard
Atmospheric Pressure	Daily	Standard

E.6 Landfill Gas Flare / Combustion Plant

Monitoring of the landfill gas flare or combustion plant under Condition 4.15 shall be carried out at monitoring points to be agreed with the Agency prior to the operation of the plant.

Table E.6.1 Landfill Gas Flare / Combustion Plant Monitoring

Parameter	Monitoring Frequency	Analysis Method[Note1]/Technique[Note2]
Inlet		
Methane (CH_4) % v/v	Weekly	Infrared analyser/flame ionisation detector
Carbon dioxide (CO_2)%v/v	Weekly	Infrared analyser/ flame ionisation detector
Oxygen (O_2) %v/v	Weekly	Infrared analyser
Outlet		
Volumetric Flow rate	Biannually	Pitot Tube Method
SO_2	Biannually	Flue gas analyser
NOx	Biannually	Flue gas analyser
CO	Continuous	Flue gas analyser
Particulates	Annually	Isokinetic/Gravimetric
TA Luft Class I, II, III organics	Annually	Adsorption/Desorption / GC /GCMS (Note 3)
Hydrochloric acid	Annually	Impinger / Ion Chromatography
Hydrogen fluoride	Annually	Impinger / Ion Chromatography

Note 1: All monitoring equipment used should be intrinsically safe.
Note 2: Or other methods agreed in advance with the Agency.
Note 3: Test methods should be capable of detecting acetonitrile, dichloromethane, tetrachlorethylene and vinyl chloride as a minimum.

SCHEDULE F : Emission Limits

F.1 Noise Emissions: (Measured at the monitoring points to be agreed with the Agency).

Day dB(A) L_{Aeq}(30 minutes)	Night dB(A) L_{Aeq}(30 minutes)
55	45

F.2 Landfill Gas Concentration Limits: (Measured in any building on or adjacent to the facility).

Methane	Carbon Dioxide
20 % LEL (1% v/v)	1.5 % v/v

F.3 Dust Deposition Limits: (Measured at the monitoring points to be agreed with the Agency).

Level (mg/m^2 /day)[Note 1]
350

Note 1: 30 day composite sample with the results expressed as mg/m^2 /day.

F.4 Surface Water Discharge Limits: Measured at the monitoring points identified on Drawing BALL-MON-002

Level (Suspended Solids mg/l)
35 mg/l

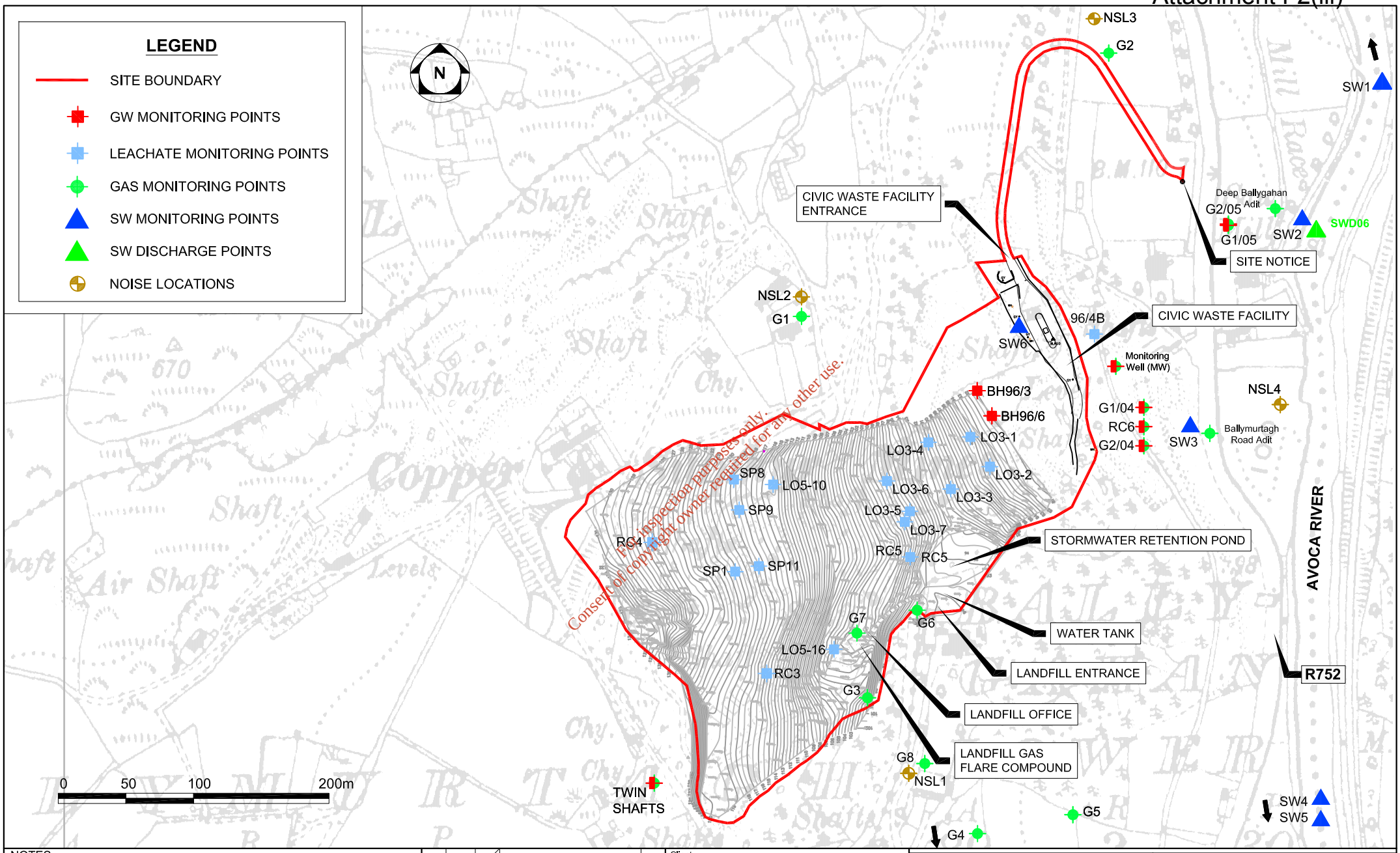
F.5 Emission Limits Values for Landfill Gas Flare and/or Utilisation Plant

Emission Point reference nos: (to be agreed with the Agency)
Location: Landfill Gas Combustion Plant and flarestacks
Minimum discharge height:5m

Parameter	Emission Limit Value
Nitrogen oxides as (NO_2)	500 mg/m^3
CO	650 mg/m^3
Particulates	130 mg/m^3
TA Luft Organics Class I (Note 1)	20 mg/m^3 (at mass flows > 0.1 kg/hr)
TA Luft Organics Class II (Note 1)	100 mg/m^3 (at mass flows > 2 kg/hr)
TA Luft Organics Class III (Note 1)	150 mg/m^3 (at mass flows > 3kg/hr)
Hydrogen Chloride	50 mg/m^3 (at mass flows > 0.3 kg/h)
Hydrogen Fluoride	5 mg/m^3 (at mass flows > 0.05 kg/h)

Note 1: In addition to the above individual limits, the sum of the concentrations of Class I, II and III shall not exceed the Class III limits.

Monitoring Type		Description	X Coordinate	Y Coordinate
Surface Water				
SW1	Quality	Avoca River - Upstream	319755	182056
SW2	Quality	Avoca River - Upstream	319932	181680
SW4	Quality	Avoca River - Downstream	319946	181136
SW5	Quality	Avoca River - Downstream	320020	180799
Groundwater				
Twin Shafts	Quality	Shaft	319453	181265
G1/04	Quality	Borehole	319806	181519
G2/04	Quality	Borehole	319814	181501
G1/05	Quality	Borehole	319878	181676
G2/05	Quality	Borehole	319878	181677
RC6	Quality	Borehole	319813	181511
SW3	Quality	Ballymurtagh Road Adit	319849	181528
Thomas Merrigan	Quality	Private well	319190	181100
Donal O'Leary	Quality	Private well	319557	180869
Eddie Coleman	Quality	Private well	319386	182074
Jeffery Green	Quality	Private well	319326	182023
Leachate				
BH96/3	Quality	Borehole	319696	181552
L05/10	Quality	Borehole	319543	181485
L05/16	Quality	Borehole	319585	181363
L03/1	Levels	Borehole	319689	181517
L03/2	Levels	Borehole	319702	181494
L03/6	Levels	Borehole	319673	181481
Landfill Gas				
G1		Borehole	319561	181607
G2		Borehole	319789	181801
G3		Borehole	319621	181311
G4		Borehole	319678	181039
G1/05		Borehole	319878	181676
G2/05		Borehole	319878	181677
Twin Shafts		Borehole	319453	181265
RC6		Borehole	319814	181528
G1/04		Borehole	319816	181537
G2/04		Borehole	319817	181514
Deep Ballygahan Adit		Adit	319932	181680
Deep Ballymurtagh Adit		Adit	320020	180799
G6		Borehole	319816	181537
G7		Borehole	319817	181514
Site Office (CWF)		Building		
Landfill Gas Flare				
Flare	Quality	Inlet and Outlet	319604	181367
Noise				
NSL1			319641	181271
NSL4			319916	181543



NOTES

1. Verifying Dimensions.
The contractor shall verify dimensions against such other drawings or site conditions as pertain to this part of the work.

2. Existing Services.
Any information concerning the location of existing services indicated on this drawing is intended for general guidance only. It shall be the responsibility of the contractor to determine and verify the exact horizontal and vertical alignment of all cables, pipes, etc. (both underground and overhead) before work commences.

3. Issue of Drawings.
Hard copies, dwf and pdf will form a controlled issue of the drawing. All other formats (dwg, dxf etc.) are deemed to be an uncontrolled issue and any work carried out based on these files is at the recipients own risk. RPS will not accept any responsibility for any errors arising from the use of these files, either by human error by the recipient, listing of un-dimensioned measurements, compatibility issues with the recipient's software, and any errors arising when these files are used to aid the recipients drawing production, or setting out on site.

4. Datum: Ordnance Survey Datum, Malin Head

No.	Date	Dm. / Chk.	Amendment / Issue	App
A01	Oct '09	RH / PL	Issue for Approval	PL

Client: Wicklow County Council, County Buildings, Wicklow, Co. Wicklow

Drawn By	Checked By	Approved By	Date
RH	PL	PL	Oct. '09

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Project: **Ballymurtagh Landfill**

Drawing Status	Sheet Size	Scale
Approval	A4	NTS

Drawing Number | Rev

Title: MONITORING POINTS PLAN

Mde0046DG0002A01.dwg

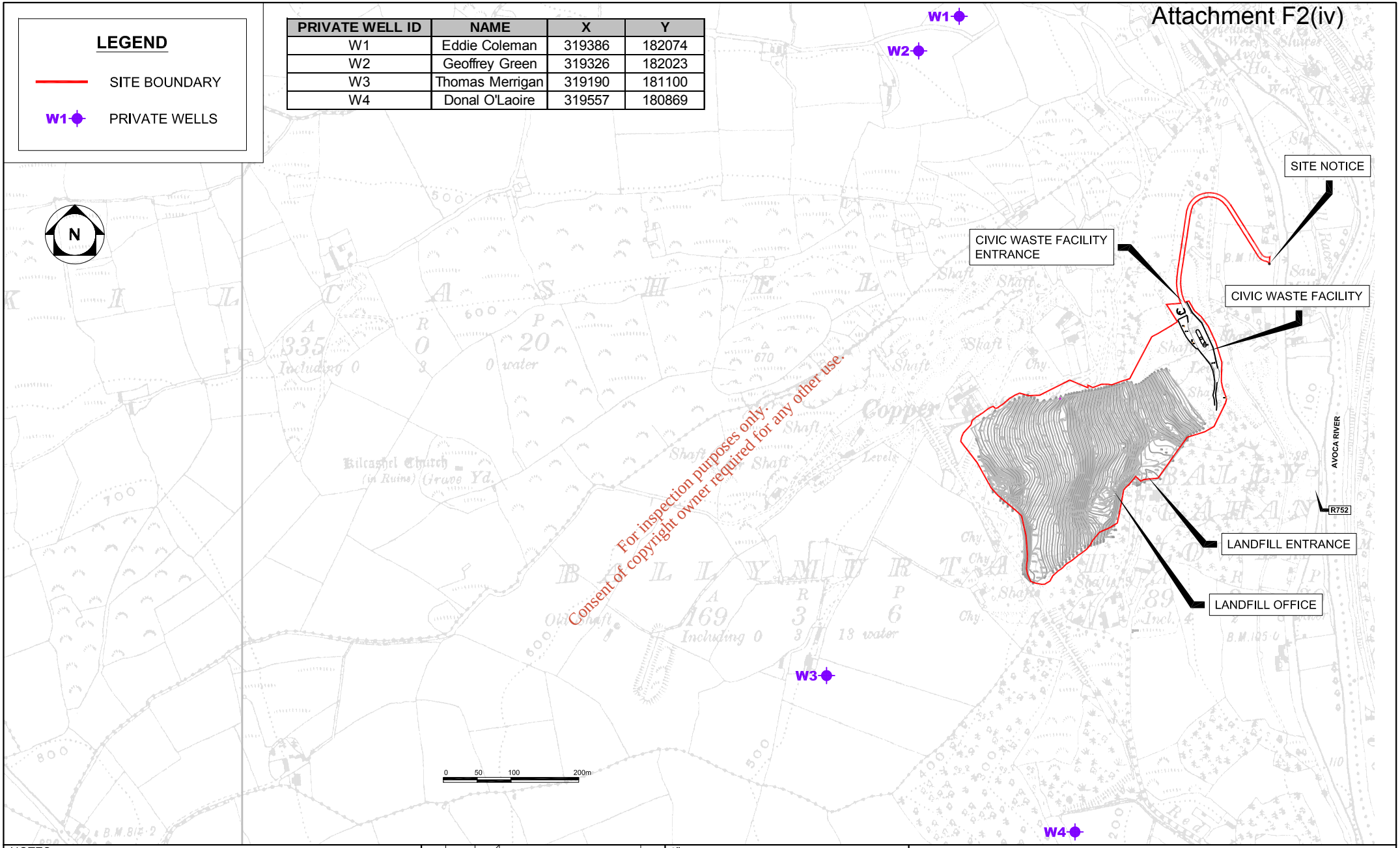
Attachment F2(iv)

LEGEND

SITE BOUNDARY

W1 PRIVATE WELLS

PRIVATE WELL ID	NAME	X	Y
W1	Eddie Coleman	319386	182074
W2	Geoffrey Green	319326	182023
W3	Thomas Merrigan	319190	181100
W4	Donal O'Laoire	319557	180869



NOTES

1. Verifying Dimensions.
The contractor shall verify dimensions against such other drawings or site conditions as pertain to this part of the work.

2. Existing Services.
Any information concerning the location of existing services indicated on this drawing is intended for general guidance only. It shall be the responsibility of the contractor to determine and verify the exact horizontal and vertical alignment of all cables, pipes, etc. (both underground and overhead) before work commences.

3. Issue of Drawings.
Hard copies, dwf and pdf will form a controlled issue of the drawing. All other formats (dwg, dxf etc.) are deemed to be an uncontrolled issue and any work carried out based on these files is at the recipients own risk. RPS will not accept any responsibility for any errors arising from the use of these files, either by human error by the recipient, listing of un-dimensioned measurements, compatibility issues with the recipient's software, and any errors arising when these files are used to aid the recipients drawing production, or setting out on site.

4. Datum: Ordnance Survey Datum, Malin Head

No.	Date	Drn. / Chk.	Amendment / Issue	App
A01	Oct '09	RH / PL	Issue for Approval	PL

Client: Wicklow County Council, County Buildings, Wicklow, Co. Wicklow

Drawn By	Checked By	Approved By	Date
RH	PL	PL	Oct. '09

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Project: **Ballymurtagh Landfill**

Drawing Status	Sheet Size	Scale
Approval	A4	NTS

Drawing Number | Rev

Title: PLAN SHOWING PRIVATE WELLS

Mde0046DG0005A01 PRIVATE WELLS.dwg

LANDFILL GAS MONITORING FORM				
Facility Name: Ballymurtagh Landfill	**Facility Address:** Ballymurtagh, Avoca, Co. Wicklow			
Licence no.: W0011-01				
Licensee: Wicklow Co. Co.				
Date of Licensing:	**Date of sampling:** 30/01/2008		**Time of Sampling:**	
Instrument used: G A 2000	**Date Next Full Calibration:** November 2008			
	Last Field Calibration: (include date and gases)			
	November 2007			
Monitoring Personnel: Seamus Breslin	**Weather:**		**Barometric pressure:** 1010 - 1022	
			Mean Temperature: 4.9 C	
Results				
Sample Station Number	**CH_4 (%v/v)**	**CO_2 (%v/v)**	**O_2 (%v/v)**	**Comments:**
G1	0.0	0.6	20.1	
G2	0.0	**1.6**	17.6	
G3	0.0	0.0	20.9	
G4	0.0	**4.5**	13.1	
G6	0.0	**2.9**	16.1	
Ballygahan Adit (SW2)	0.0	0.0	20.9	
Ballymurtagh Adit (SW3)	0.0	0.1	20.8	
G7	0.0	**3.1**	20.3	
G8	0.0	0.3	20.3	
GW2/04	0.0	0.4	20.4	
RC6	0.0	0.0	20.8	
G1/04	0.0	0.0	20.7	
G1/05	0.0	0.6	20.4	
G2/05	0.0	1.0	19.6	
flare	26.5	26.0	0.9	
Twin Shafts	0.0	0.1	20.7	

LANDFILL GAS MONITORING FORM				
Facility Name: Ballymurtagh Landfill	**Facility Address:** Ballymurtagh, Avoca, Co. Wicklow			
Licence no.: W0011-01				
Licensee: Wicklow Co. Co.				
Date of Licensing:	**Date of sampling:** 29/2/2008		**Time of Sampling:**	
Instrument used: G A 2000	**Date Next Full Calibration:** November 2008			
	Last Field Calibration: (include date and gases)			
	November 2007			
Monitoring Personnel: Seamus Breslin	**Weather:**		**Barometric pressure:** 987 - 998	
			Mean Temperature: 8.5C	
Results				
Sample Station Number	**CH_4 (%v/v)**	**CO_2 (%v/v)**	**O_2 (%v/v)**	**Comments:**
G1	0.0	0.3	20.3	
G2	0.0	**2.4**	16.0	
G3	0.0	0.2	20.6	
G4	0.0	1.2	18.1	
G6	0.0	**3.5**	14.2	
Ballygahan Adit (SW2)	0.0	0.0	20.9	
Ballymurtagh Adit (SW3)	0.0	0.0	20.8	
G7	0.0	**3.6**	14.0	
G8	0.0	0.8	20.3	
GW2/04	0.0	0.3	20.4	
RC6	0.0	0.0	20.9	
G1/04	0.0	0.0	20.7	
G1/05	0.0	0.4	20.8	
G2/05	0.0	0.7	19.7	
flare	27.5	27.0	0.7	
Twin Shafts	0.0	0.0	20.8	

LANDFILL GAS MONITORING FORM				
Facility Name: Ballymurtagh Landfill	**Facility Address:** Ballymurtagh, Avoca, Co. Wicklow			
Licence no.: W0011-01				
Licensee: Wicklow Co. Co.				
Date of Licensing:	**Date of sampling:** 31/03/2008		**Time of Sampling:**	
Instrument used: G A 2000	**Date Next Full Calibration:** November 2008			
	Last Field Calibration: (include date and gases)			
	November 2007			
Monitoring Personnel: Seamus Breslin	**Weather:**		**Barometric pressure:** 997 - 1008	
			Mean Temperature: 12.8C	
Results				
Sample Station Number	**CH_4**	**CO_2**	**O_2**	**Comments:**
	(%v/v)	**(%v/v)**	**(%v/v)**	
G1	0.0	0.0	20.8	
G2	0.0	0.0	20.5	
G3	0.0	0.3	20.6	
G4	0.0	**4.8**	13.4	
G6	0.0	**3.6**	15.2	
Ballygahan Adit (SW2)	0.0	0.1	20.7	
Ballymurtagh Adit (SW3)	0.0	0.0	20.8	
G7	0.0	**3.5**	15.7	
G8	0.0	0.0	20.5	
GW2/04	0.0	0.4	20.6	
RC6	0.0	0.0	20.7	
G1/04	0.0	0.0	20.7	
G1/05	0.0	1.2	19.9	
G2/05	0.0	**1.9**	18.1	
flare	21.4	26.4	1.5	
Twin Shafts	0.0	0.0	20.9	

LANDFILL GAS MONITORING FORM	
Facility Name: Ballymurtagh Landfill	**Facility Address:** Ballymurtagh, Avoca, Co. Wicklow
Waste Licence no.: W0011-01	
Licensee: Wicklow Co. Co.	
Instrument used: G A 2000	**Date Next Full Calibration:** November 2007
	Last Field Calibration: November 2006
Monitoring Personnel: Seamus Breslin	

Results

Date	Sample Station Number	CH_4 (%v/v)	CO_2 (%v/v)	O_2 (%v/v)	Pressure ATM	Temp C
04/01/2008	Site Office	0.00	0.0	20.7	981	0.5
11/01/2008	Site Office	0.00	0.0	20.7	980	3.3
18/01/2008	Site Office	0.00	0.0	20.8	985	14
25/01/2008	Site Office	0.00	0.1	20.9	1015	11.3
01/02/2008	Site Office	0.00	0.0	20.8	987	4.2
08/02/2008	Site Office	0.00	0.1	20.8	1009	11.1
15/02/2008	Site Office	0.00	0.1	20.4	1022	5.5
22/02/2008	Site Office	0.00	0.0	20.8	1004	12.9
29/02/2008	Site Office	0.00	0.0	20.8	990	8.5
07/03/2008	Site Office	0.00	0.0	20.7	995	11.3
14/03/2008	Site Office	0.00	0.0	20.8	997	10.1
21/03/2008	Site Office	0.00	0.0	20.7	1002	8.3
28/03/2008	Site Office	0.00	0.0	20.8	975	9.6

LANDFILL GAS MONITORING FORM				
Facility Name: Ballymurtagh Landfill	**Facility Address:**			
Licence no.: W0011-01				
Licensee: Wicklow Co. Co.				
Date of Licensing:	**Date of sampling:** 29/04/08		**Time of Sampling:**	
Instrument used: G A 2000	**Date Next Full Calibration:** November 2008			
	Last Field Calibration: (include date and gases)			
Monitoring Personnel: Seamus Breslin	**Weather:**		**Barometric pressure:** 976 - 988	
			Mean Temperature: 12.9C	
Results				
Sample Station Number	**CH_4 (%v/v)**	**CO_2 (%v/v)**	**O_2 (%v/v)**	**Comments:**
G1	0.0	0.1	20.8	
G2	0.0	1.0	19.1	
G3	0.0	0.2	20.5	
G4	0.0	**6.3**	11.4	
G6	0.0	**2.7**	14.8	
Ballygahan Adit	0.0	0.0	20.8	
Ballymurtagh Adit	0.0	0.1	20.6	
G7	0.0	**3.3**	16.2	
G8	0.0	0.2	20.6	
GW2/04	0.0	0.3	19.6	
RC 6	0.0	0.0	20.8	
GW1/04	0.0	0.0	20.7	
GW1/05	0.0	1.3	19.3	
GW2/05	0.0	**1.7**	18.4	
FLARE	**24.8**	**26.6**	1.1	
TWIN SHAFTS	0.0	0.0	20.6	

LANDFILL GAS MONITORING FORM				
Facility Name: Ballymurtagh Landfill	**Facility Address:** Ballymurtagh, Avoca, Co. Wicklow			
Licence no.: W0011-01				
Licensee: Wicklow Co. Co.				
Date of Licensing:	**Date of sampling:** 29/5/08		**Time of Sampling:**	
Instrument used: G A 2000	**Date Next Full Calibration:** November 2008			
	Last Field Calibration: (include date and gases)			
Monitoring Personnel: Seamus Breslin	**Weather:**		**Barometric pressure:** 987 - 999	
			Mean Temperature: 14.8C	
Results				
Sample Station Number	**CH_4 (%v/v)**	**CO_2 (%v/v)**	**O_2 (%v/v)**	**Comments:**
G1	0.0	0.1	20.7	
G2	0.0	0.0	20.8	
G3	0.0	1.3	19.0	
G4	0.0	**2.7**	17.1	
G6	0.0	**3.4**	14.7	
Ballygahan Adit	0.0	0.0	20.7	
Ballymurtagh Adit	0.0	0.0	20.9	
G7	0.0	**3.1**	16.2	
G8	0.0	0.2	20.5	
GW2/04	0.0	0.1	20.3	
RC 6	0.0	0.0	20.7	
GW1/04	0.0	0.0	20.7	
GW1/05	0.0	1.1	19.6	
GW2/05	0.0	1.3	19.1	
FLARE	**24.9**	**26.8**	2.3	
TWIN SHAFTS	0.0	0.0	20.9	

LANDFILL GAS MONITORING FORM				
Facility Name: Ballymurtagh Landfill	**Facility Address:** Ballymurtagh, Avoca, Co. Wicklow			
Licence no.: W0011-01				
Licensee: Wicklow Co. Co.				
Date of Licensing:	**Date of sampling:** 30/06/2008		**Time of Sampling:**	
Instrument used: G A 2000	**Date Next Full Calibration:** November 2008			
	Last Field Calibration: (include date and gases)			
Monitoring Personnel: Seamus Breslin	**Weather:**		**Barometric pressure:** 1001 - 1013	
			Mean Temperature: 17.1C	

Results				
Sample Station Number	**CH_4**	**CO_2**	**O_2**	**Comments:**
	(%v/v)	**(%v/v)**	**(%v/v)**	
G1	0.0	0.2	20.7	
G2	0.0	0.0	20.9	
G3	0.0	1.4	18.4	
G4	0.0	2.5	17.6	
G6	0.0	2.0	15.5	
Ballygahan Adit	0.0	0.0	19.8	
Ballymurtagh Adit	0.0	0.1	19.7	
G7	0.0	3.4	15.1	
G8	0.0	0.2	20.5	
GW2/04	0.0	0.3	19.6	
RC 6	0.0	0.0	20.5	
GW1/04	0.0	0.1	20.6	
GW1/05	0.0	1.2	19.4	
GW2/05	0.0	1.3	19.6	
FLARE	21.4	25.9	1.8	
TWIN SHAFTS	0.0	0.0	20.9	

LANDFILL GAS MONITORING FORM	
Facility Name: Ballymurtagh Landfill	**Facility Address:** Ballymurtagh, Avoca, Co. Wicklow
Waste Licence no.: W0011-01	
Licensee: Wicklow Co. Co.	
Instrument used: G A 2000	**Date Next Full Calibration:** November 2007
	Last Field Calibration: November 2006
Monitoring Personnel: Seamus Breslin	

Results

Date	Sample Station Number	CH_4 (%v/v)	CO_2 (%v/v)	O_2 (%v/v)	Pressure ATM	Temp C
04/04/2008	Site Office	0.00	0.0	20.9	1015	14.6
11/04/2008	Site Office	0.00	0.0	20.8	979	8.2
18/04/2008	Site Office	0.00	0.0	20.7	986	12.7
25/04/2008	Site Office	0.00	0.0	20.8	1008	10.9
02/05/2008	Site Office	0.00	0.0	20.8	1003	14.1
09/05/2008	Site Office	0.00	0.0	20.7	999	18.7
16/05/2008	Site Office	0.00	0.0	20.8	997	16.6
23/05/2008	Site Office	0.00	0.0	20.8	999	16.5
30/05/2008	Site Office	0.00	0.0	20.8	1002	20.2
06/06/2008	Site Office	0.00	0.0	20.8	1006	17.6
13/06/2008	Site Office	0.00	0.0	20.9	1006	17.9
20/06/2008	Site Office	0.00	0.0	20.8	1003	15.1
27/06/2008	Site Office	0.00	0.0	20.8	1000	14.9

LANDFILL GAS MONITORING FORM				
Facility Name: Ballymurtagh Landfill	**Facility Address:**			
Licence no.: W0011-01				
Licensee: Wicklow Co. Co.				
Date of Licensing:	**Date of sampling:** 24/07/08		**Time of Sampling:**	
Instrument used: G A 2000	**Date Next Full Calibration:** November 2008			
	Last Field Calibration: (include date and gases)			
Monitoring Personnel: Seamus Breslin	**Weather:**		**Barometric pressure:** 999 - 1011	
			Mean Temperature: 20C	
Results				
Sample Station Number	**CH_4**	**CO_2**	**O_2**	**Comments:**
	(%v/v)	**(%v/v)**	**(%v/v)**	
G1	0.00	0.00	20.8	
G2	0.00	0.00	20.9	
G3	0.00	**1.90**	17.9	
G4	0.00	**5.10**	10.3	
G6	0.00	**2.80**	14.3	
Ballygahan Adit	0.00	0.00	20.8	
Ballymurtagh Adit	0.00	0.00	20.9	
G7	0.00	**5.30**	11.9	
G8	0.00	0.00	20.8	
GW2/04	0.00	0.20	20.1	
RC 6	0.00	0.00	20.9	
GW1/04	0.00	0.00	20.9	
GW1/05	0.00	1.40	19.1	
GW2/05	0.00	0.90	19.4	
FLARE				
TWIN SHAFTS	0.00	0.00	20.9	

LANDFILL GAS MONITORING FORM				
Facility Name: Ballymurtagh Landfill	**Facility Address:** Ballymurtagh, Avoca, Co. Wicklow			
Licence no.: W0011-01				
Licensee: Wicklow Co. Co.				
Date of Licensing:	**Date of sampling: 28/08/08**		**Time of Sampling:**	
Instrument used: G A 2000	**Date Next Full Calibration:** November 2008			
	Last Field Calibration: (include date and gases)			
Monitoring Personnel: Seamus Breslin	**Weather:**		**Barometric pressure:** 1003 - 1018	
			Mean Temperature: 20.5C	
Results				
Sample Station Number	**CH_4**	**CO_2**	**O_2**	**Comments:**
	(%v/v)	**(%v/v)**	**(%v/v)**	
G1	0.0	0.2	20.5	
G2	0.0	0.0	20.6	
G3	0.0	0.0	20.9	
G4	0.0	**5.3**	8.7	
G6	0.0	**3.1**	13.2	
Ballygahan Adit	0.0	0.0	20.8	
Ballymurtagh Adit	0.0	0.1	20.6	
G7	0.0	**4.1**	13.3	
G8	0.0	0.2	20.6	
GW2/04	0.0	0.0	20.9	
RC 6	0.0	0.2	20.5	
GW1/04	0.0	0.0	20.8	
GW1/05	0.0	1.4	18.8	
GW2/05	0.0	**2.8**	16.2	
FLARE		**29.0**	0.3	
TWIN SHAFTS	0.0	0.0	20.9	

LANDFILL GAS MONITORING FORM				
Facility Name: Ballymurtagh Landfill	**Facility Address:** Ballymurtagh, Avoca, Co. Wicklow			
Licence no.: W0011-01				
Licensee: Wicklow Co. Co.				
Date of Licensing:	**Date of sampling:** 25/09/08		**Time of Sampling:**	
Instrument used: G A 2000	**Date Next Full Calibration:** November 2008			
	Last Field Calibration: (include date and gases)			
Monitoring Personnel: Seamus Breslin	**Weather:**		**Barometric pressure:** 1016 - 1029	
			Mean Temperature: 25/9/08	
Results				
Sample Station Number	**CH_4** (%v/v)	**CO_2** (%v/v)	**O_2** (%v/v)	**Comments:**
G1	0.0	0.0	20.8	
G2	0.0	0.0	21.0	
G3	0.0	0.7	20.3	
G4	0.0	0.2	20.4	
G6	0.0	4.6	12.9	
Ballygahan Adit	0.0	0.0	20.8	
Ballymurtagh Adit	0.0	0.0	20.7	
G7	0.0	2.8	16.3	
G8	0.0	0.2	20.7	
GW2/04	0.0	0.1	20.8	
RC 6	0.0	0.0	20.9	
GW1/04	0.0	0.2	20.5	
GW1/05	0.0	0.7	19.7	
GW2/05	0.0	0.0	20.8	
FLARE	21.5	30.0	0.7	
TWIN SHAFTS	0.0	0.0	20.9	

LANDFILL GAS MONITORING FORM	
Facility Name: Ballymurtagh Landfill	**Facility Address:** Ballymurtagh, Avoca, Co. Wicklow
Waste Licence no.: W0011-01	
Licensee: Wicklow Co. Co.	
Instrument used: G A 2000	**Date Next Full Calibration:** November 2007
	Last Field Calibration: November 2006
Monitoring Personnel: Seamus Breslin	

Results

Date	Sample Station Number	CH_4 (%v/v)	CO_2 (%v/v)	O_2 (%v/v)	Pressure ATM	Temp C
04/07/2008	Site Office	0.00	0.0	20.9	1002	17.2
11/07/2008	Site Office	0.00	0.0	20.8	993	17.0
18/07/2008	Site Office	0.00	0.0	20.8	996	17.9
25/07/2008	Site Office	0.00	0.0	20.9	994	18.6
01/08/2008	Site Office	0.00	0.0	20.8	989	14.3
08/08/2008	Site Office	0.00	0.0	20.8	1001	17.8
15/08/2008	Site Office	0.00	0.0	20.8	1000	16.8
22/08/2008	Site Office	0.00	0.0	20.8	1005	17.9
29/08/2008	Site Office	0.00	0.0	20.9	1007	17.6
05/09/2008	Site Office	0.00	0.0	20.7	971	13.7
12/09/2008	Site Office	0.00	0.0	20.9	1001	15.3
19/09/2008	Site Office	0.00	0.0	20.8	1013	15.1
26/09/2008	Site Office	0.00	0.0	20.9	1020	12.5

LANDFILL GAS MONITORING FORM				
Facility Name: Ballymurtagh Landfill	**Facility Address:**			
Licence no.: W0011-01				
Licensee: Wicklow Co. Co.				
Date of Licensing:	**Date of sampling:** 30/10/08		**Time of Sampling:**	
Instrument used: G A 2000	**Date Next Full Calibration:** August 2009			
	Last Field Calibration: August 2008			
Monitoring Personnel: Seamus Breslin	**Weather:**		**Barometric pressure:** 999 - 1011	
			Mean Temperature: 20C	
Results				
Sample Station Number	**CH_4** (%v/v)	**CO_2** (%v/v)	**O_2** (%v/v)	**Comments:**
G1	0.0	0.6	20.6	
G2	0.0	0.0	20.9	
G3	0.0	0.3	20.6	
G4	0.0	**4.6**	11.2	
G6	0.0	**3.7**	13.7	
Ballygahan Adit	0.0	0.0	21.0	
Ballymurtagh Adit	0.0	0.0	21.0	
G7	0.0	**2.5**	18.0	
G8	0.0	0.1	20.9	
GW2/04	0.0	0.1	20.9	
RC 6	0.0	0.0	20.9	
GW1/04	0.0	0.1	20.6	
GW1/05	0.0	0.9	19.6	
GW2/05	0.0	**2.2**	18.4	
FLARE	24.0	**28.0**	0.6	
TWIN SHAFTS	0.0	0.0	20.9	

LANDFILL GAS MONITORING FORM				
Facility Name: Ballymurtagh Landfill	**Facility Address:** Ballymurtagh, Avoca, Co. Wicklow			
Licence no.: W0011-01				
Licensee: Wicklow Co. Co.				
Date of Licensing:	**Date of sampling: 28/11/08**		**Time of Sampling:**	
Instrument used: G A 2000	**Date Next Full Calibration:** August 2009			
	Last Field Calibration: August 2008			
Monitoring Personnel: Seamus Breslin	**Weather:**		**Barometric pressure:** 1003 - 1018	
			Mean Temperature: 20.5C	
Results				
Sample Station Number	**CH_4** (%v/v)	**CO_2** (%v/v)	**O_2** (%v/v)	**Comments:**
G1	0.0	0.3	20.6	
G2	0.0	0.0	20.9	
G3	0.0	0.3	20.6	
G4	0.0	**6.8**	7.9	
G6	0.0	**3.8**	14.2	
Ballygahan Adit	0.0	0.0	20.8	
Ballymurtagh Adit	0.0	0.1	20.7	
G7	0.0	**5.7**	12.1	
G8	0.0	0.4	20.2	
GW2/04	0.0	0.6	19.5	
RC 6	0.0	0.0	20.9	
GW1/04	0.0	0.0	20.7	
GW1/05	0.0	0.7	20.2	
GW2/05	0.0	**2.3**	17.9	
FLARE	23.0	**29.0**	0.5	
TWIN SHAFTS	0.0	0.2	20.7	

LANDFILL GAS MONITORING FORM				
Facility Name: Ballymurtagh Landfill	**Facility Address:** Ballymurtagh, Avoca, Co. Wicklow			
Licence no.: W0011-01				
Licensee: Wicklow Co. Co.				
Date of Licensing:	**Date of sampling:** 22/12/08		**Time of Sampling:**	
Instrument used: G A 2000	**Date Next Full Calibration:** August 2009			
	Last Field Calibration: August 2008			
Monitoring Personnel: Seamus Breslin	**Weather:**		**Barometric pressure:** 1016 - 1029	
			Mean Temperature: 25/9/08	

Results				
Sample Station Number	**CH_4 (%v/v)**	**CO_2 (%v/v)**	**O_2 (%v/v)**	**Comments:**
G1	0.0	0.2	20.7	
G2	0.0	0.0	20.8	
G3	0.0	0.5	20.5	
G4	0.0	**7.5**	8.1	
G6	0.0	**4.1**	14.5	
Ballygahan Adit	0.0	0.0	20.9	
Ballymurtagh Adit	0.0	0.0	20.8	
G7	0.0	**3.4**	15.6	
G8	0.0	0.0	20.9	
GW2/04	0.0	0.2	20.6	
RC 6	0.0	0.0	20.8	
GW1/04	0.0	0.1	20.6	
GW1/05	0.0	0.9	19.6	
GW2/05	0.0	1.3	19.4	
FLARE	22.0	**28.0**	0.4	
TWIN SHAFTS	0.0	0.2	20.8	

LANDFILL GAS MONITORING FORM	
Facility Name: Ballymurtagh Landfill	**Facility Address:** Ballymurtagh, Avoca, Co. Wicklow
Waste Licence no.: W0011-01	
Licensee: Wicklow Co. Co.	
Instrument used: G A 2000	**Date Next Full Calibration:** August 2009
	Last Field Calibration: August 2008
Monitoring Personnel: Seamus Breslin	

Results

Date	Sample Station Number	CH_4 (%v/v)	CO_2 (%v/v)	O_2 (%v/v)	Pressure ATM	Temp C
03/10/2008	Site Office	0.00	0.00	20.90	982	8.60
10/10/2008	Site Office	0.00	0.00	20.80	1007	14.40
17/10/2008	Site Office	0.00	0.00	20.80	1006	10.40
24/10/2008	Site Office	0.00	0.00	20.90	1005	9.10
31/10/2008	Site Office	0.00	0.00	20.80	999	8.30
07/11/2008	Site Office	0.00	0.00	20.90	982	9.80
14/11/2008	Site Office	0.00	0.00	20.80	1009	11.50
21/11/2008	Site Office	0.00	0.00	20.80	1008	9.90
28/11/2008	Site Office	0.00	0.00	20.90	984	4.00
05/12/2008	Site Office	0.00	0.00	20.80	978	7.80
12/12/2008	Site Office	0.00	0.00	20.90	993	3.70
19/12/2008	Site Office	0.00	0.00	20.90	1000	10.80
30/12/2008	Site Office	0.00	0.00	20.90	1013	5.20

Monitoring of Flare Emissions at Ballymurtagh Landfill June 2008

DOCUMENT CONTROL SHEET

Client	Wicklow County Council					
Project Title	Monitoring of Flare Emissions at Ballymurtagh Landfill					
Document Title	Emissions Monitoring June 2008					
Document No.	MDE0725Rp003					
This Document Comprises	DCS	TOC	Text	List of Tables	List of Figures	No. of Appendices
	1	1	6	1	0	1

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
D01	Draft	Ronan Murphy	Ross Daly	Paul Chadwick	Dublin Environment	03.07.2008
F01	Final	Ronan Murphy	Ross Daly	Paul Chadwick	Dublin Environment	15.07.2008

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1 INTRODUCTION

This report presents the results of the flare monitoring undertaken at Ballymurtagh Landfill in accordance with Schedule E.6 of Waste Licence No. W0011-01.

Wicklow County Council commissioned RPS Group to monitor emissions to atmosphere from a Haase flare unit at Ballymurtagh Landfill, Ballygahan Upper, Ballygahan Lower, Tinnahinch, Co. Wicklow. The flare system is used to burn off landfill gas emitted from the decaying landfill waste and was sampled for emissions of:

- NO_X, CO, SO_2 (Biannual)
- Inorganic Acids: Hydrogen Chloride and Hydrogen Fluoride (Annual)
- TA Luft Class Volatile Organic Compounds (VOC's) (Annual)

Volumetric flow was also measured and compared to the manufacturers specifications.

This report will be submitted to the Environmental Protection Agency (EPA) on behalf of Wicklow County Council in order to satisfy the biannual monitoring requirements as laid out in Schedule E.6 of Waste Licence No. W0011-01.

2 MONITORING

Suitably qualified personnel from RPS Group conducted the monitoring on the flare unit on 20th June 2008. The sampling and analytical methodologies employed are outlined below.

2.1 FLUE GAS ANALYSIS

Flue gas emissions were measured using a Testo 350 XL flue gas analyser. This is a specialised flue gas analysis system fully equipped with electrochemical sensors. The Flue Gas Analyser measures the following parameters:

- Temperature
- Nitrogen Oxides (NO_x)
- Carbon Monoxide (CO)
- Sulphur Dioxide (SO_2)

Sampling rounds were conducted over a 30-minute period.

2.2 INORGANIC ACIDS

A sample of air was extracted using a low flow, intrinsically safe pump at a flow rate of 200 ml/min over 30 minute periods. The pump was calibrated before and after sampling. Sample air was then passed through a specialised silica gel absorbent glass (SKC) tube (226-119). This adsorption tube was analysed for hydrogen chloride and hydrogen fluoride by Gas Chromatography connected to Mass Spectrometer (GC-MS) using a UKAS accredited laboratory (RPS Laboratories, Manchester).

2.3 TA LUFT CLASS VOLATILE ORGANIC COMPOUNDS

Samples of the gas stream were extracted using low flow, intrinsically safe pumps at a flow rate of 200 ml/min. The pumps were calibrated before and after sampling. Organics in the gas stream were collected through specialised charcoal sorbent tubes (SKC tube 226-09). The sorbent tubes were analysed using a UKAS accredited laboratory (RPS Laboratories Manchester).

2.4 VOLUMETRIC FLOWS

All volumetric airflows were measured using an “L-type” pitot tube, a digital manometer and the Testo 350xl flue gas analyser with integrated temperature probe.

3 RESULTS

3.1 FLUE GAS ANALYSIS

The results of flue gas emissions monitoring from the flare unit at Ballymurtagh Landfill are presented in Table 3.1 below and compared with the emission limit values outlined in Schedule F.5 of the Waste Licence:

Table 3.1 Results of Flue Gas Monitoring from the Flare Unit

Parameter	Units	Emission Value[1]	Emission Limit[2]
Nitrogen Oxides (NO_x) as NO_2	(mg/Nm^3)	0	500
Carbon Monoxide (CO)	(mg/Nm^3)	39	650
Sulphur Dioxide (SO_2)	(mg/Nm^3)	14	-
Temperature	(°C)	1092.27	N/a

Note: 1 Normalised to 273K, 101.3 kPa and $\%O_2$ reference of 3
Note: 2 As stated in Schedule F.5. of Waste Licence 11-1

3.2 INORGANIC ACIDS

The results of Hydrogen Chloride (HCL) and Hydrogen Fluoride (HF) emissions monitoring from the Flare Unit at Ballymurtagh Landfill are presented in Table 3.3 below.

Table 3.3 Results of Inorganic Acids monitoring from the Flare Unit

Parameter	(mg/Nm^3)	
	Emission Value	Emission Limit
HF	0.18	5
HCL	0.91	50

3.3 TA LUFT CLASS VOLATILE ORGANIC COMPOUNDS

Results of previous monitoring work at the site indicated that volatile organic emissions to atmosphere were consistently below the prescribed emission limit values for class I, II and III TA Luft organics. Results of monitoring carried out during June 2008, show that total volatile organic compounds were

below the laboratory detection limit of 10µg. The emission limit value for TA Luft Class I organics is 20mg/m^3 or 20000µg/m^3. As the ELV for Class I organics is the lowest emission limit value for volatile organics it can be assumed therefore that Class I, II and III organics were all within the relevant emission limit value.

Table 3.2 Results of Total TA Luft Organics monitoring from the Flare Unit

Parameter	Emission Value (mg/Nm^3)	Class I TA Luft Organic Emission Limit (mg/m^3)
Total TA Luft Organics (VOCs)	13.34	20

3.4 VOLUMETRIC FLOW

The results of temperature and volumetric flow monitoring from the Flare Unit at Ballymurtagh Landfill are presented in the table 3.4 below.

Table 3.4 Results of Volumetric Flow & Temperature Monitoring from the Flare Unit

Parameter	Emission Value
Flow Rate (Nm^3/hr)	255
Stack Temperature (^{0}C)	1092.27

4 CONCLUSIONS

The level determined for Nitrogen Oxides (NOx as NO_2) from the Flare Unit are within the emission limit value stated in Schedule F.5 of Waste Licence W0011-01.

The level determined for Carbon Monoxide (CO) emissions from the Flare Unit are within the emission limit value stated in Schedule F.5 of Waste Licence W0011-01.

The levels determined for Hydrochloric acid (HCL) and Hydrofluoric acid (HF) were within the emission limit values stated in Schedule F.5 of Waste Licence W0011-01.

The levels determined for volatile organic compounds were within the emission limit values stated in Schedule F.5 of Waste Licence W0011-01.

The findings of the flare test show that all Waste Licence parameters listed in Waste Licence W0011-01 are within the limits specified in schedule F.5. These findings show that efficient combustion in taking place within the combustion chamber of the Ballymurtagh flare and in general, is operating under the original manufacturers specification.

Appendix A - Survey Details

Location

Ballymurtagh Landfill Site
Ballygahan Upper, Ballygahan Lower,
Tinnahinch,
Co. Wicklow

Personnel Present

Ronan Murphy – Environmental Consultant RPS

Date and Time

Tuesday 20th June 2008

12:30 – 14:30

Equipment

High Temperature Probe and Atmospheric Pressure Probe
Stackmite Isokinetic Sampler and Probe
Testo 350 xl Flue Gas Analyser
SKC Isokinetic Air Sampling Pump
SKC Sampling Media, Deionised Water and Glass Impingers