

**Ballynagran Residual Landfill
EPA Waste Licence W0165-01**

Annual Environmental Report

January 2008 - December 2008



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APPENDICES

- Appendix A Site Map of Monitoring Locations**
- Appendix B Table of Incidents & Complaints**
- Appendix C Odour monitoring results**
- Appendix D Energy Audit Report**

1 REPORTING PERIOD

TOBIN Consulting Engineers have been commissioned by Greenstar to carry out environmental monitoring at the Ballynagran residual non-hazardous landfill site, Co. Wicklow, in accordance with condition 8.0 and Schedule D of Waste Licence No. W0165-01, issued by the Environmental Protection Agency. The reporting period for the AER 2008 is from the 1st January 2008 to 31st December 2008.

2 WASTE ACTIVITIES CARRIED OUT AT FACILITY ACCEPTANCE

Waste activities are licensed at the facility under the Third and Fourth Schedule of the Waste Management Acts 1996 to 2003 (See Tables 2.1 and 2.2). Waste activities carried out at Ballynagran Residual Landfill are in accordance with the waste licence (W0165-01) and are detailed in Tables 2.1 and 2.2.

Table 2.1 Licensed Waste Disposal Activities in accordance with the Third Schedule of Waste Management Acts 1996- 2003

Class 1	Deposit on, in or under land (including landfill). Thus activity is limited to the disposal of non-hazardous waste into lined cells.
Class 4	Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons. This activity is limited to the management of leachate and surface water at the facility.
Class 5	Specifically engineered landfill, including placement into discrete lined cells which are capped and isolated from one another and the environment: This is the principal activity. This activity is limited to the disposal of non-hazardous waste into lined cells.
Class 6	Biological treatment not referred to elsewhere in this Schedule which results in final compounds or mixtures which are disposed of by means of any activity referred to in paragraphs 1 to 10 of this Schedule. This activity is limited to potential future treatment of leachate at the facility
Class 13	Storage prior to submission of 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: This activity is limited to the temporary storage of unacceptable wastes in the waste quarantine area prior to dispatch off-site to an alternative facility.

Table 2.2 Licensed Waste Disposal Activities in accordance with the Fourth Schedule of Waste Management Acts 1996- 2003

Class 4	Recycling or reclamation of other inorganic materials: This activity is limited to the use of material reclaimed from construction and demolition waste for the purposes of fill, daily cover, road construction and other uses.
Class 9	Use of any waste principally as a fuel or other means to generate energy. This activity is limited to the utilisation of landfill gas at the facility.
Class 11	Use of waste obtained from any activity referred to in a preceding paragraph of the Schedule: This activity is limited to the use of material reclaimed from construction and demolition waste for the purposes of fill, daily cover, road construction and other uses.
Class 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: This activity is limited to the temporary storage prior to use of material reclaimed from construction and demolition waste for the purposes of fill, daily cover, road construction and other uses.

3 QUANTITY AND COMPOSITION OF WASTE RECEIVED

Table 3.1 Ballynagran Residual Landfill Waste Inputs 2008

Waste Description	EWC	Tonnage
Waste after mechanical treatment (MSW/C+I)	19 12 12	83,460.74
Agricultural Waste (Kennel Sweepings)	02 01 06	15.26
Plant tissue waste	02 01 03	3.10
Waste Plastics not suitable for recycling (except packaging)	02 01 04	314.82
Compost	19 05 03	705.46
Mixed municipal wastes	20 03 01	23,360.67
Street cleaning residues	20 03 03	450.69
Premixed wastes composed only of non-hazardous wastes	19 02 03	2,003.55
Material unsuitable for consumption – food processing waste	02 02 03	189.02
Healthcare - non-infectious	18 01 04	75.32
Spent Activated Carbon	06 13 99	11.42
Inorganic waste (non-hazardous)	16 03 04	26.94
Screenings from waste water treatment plant	19 08 01	247.40
Non-composted waste fraction	19 05 01	73.44
Filter Cake (non-hazardous)	07 05 14	23.24
Plastic - soiled - not suitable for recycling	20 01 39	7.82
Soils and fines used as engineering materials	19 12 09	12,641.63
Shredded wood used on site for engineering material	19 12 07	10,742.89
Imported stone for site access roads		10,027.92
C+I mixed	20 03 07	5.04
Total tonnes		144,386.37

4 CALCULATED REMAINING CAPACITY OF THE FACILITY

The remaining capacity of the facility is a function of time and available space on the site. The facility EIS states that the initial total void space available at the facility has been estimated at 2,770,000 m³.

It is estimated that the void space consumed to the 12th January 2009 is approximately 460,000m³. Therefore the remaining capacity of the facility has been calculated to be 2,310,000m³.

5 WASTE DEPOSITION METHODS & TREATMENT OF WASTE

5.1 Waste Acceptance

The waste accepted for disposal is residual waste from the County Wicklow and adjoining counties, from household, commercial and industrial sources. At present the majority of waste is delivered to the facility by waste contractors based in County Wicklow. Waste contractors have systems in place whereby the recyclable fraction is either collected separately, or else separation is carried out manually at their facilities.

All waste is delivered to the site in Heavy Goods Vehicles (HGV) provided with the appropriate covers to prevent loss of load. Each vehicle first proceeds to the incoming weighbridge where it is weighed. The weighbridge operator and/or the facility manager may at their own discretion request the load to be tipped in the Waste Inspection Area.

The vehicles then proceed to the active waste disposal area where waste is deposited under the direction of a banks man. The vehicles weigh out at the outgoing weighbridge and receive an individual weighbridge docket before exiting the site.

Each landfill cell is divided into a number of grids, which are used to identify the areas where waste is deposited. Each load is assigned the relevant grid number.

5.2 Working Face

Waste is deposited close to and above the advancing tipping face. In accordance with Condition 5.6.1 the active face is confined to a height of 2.5 metres after compaction, a width of 25 metres and a slope no greater than 1 in 3. Deposited waste is spread in shallow layers on the inclined surface and compacted. The steel-wheeled compactors operate on the gradient of the more shallow face, pushing thin layers of waste and applying compaction pressure to them. The site operatives inspect the deposited waste for items that are not acceptable under the Waste Licence, such as tyres, gas bottles, batteries etc. These are removed and stored in appropriate areas for later removal from the site.

Each day waste is deposited to form a block, which is compacted and covered as described above. The following day a new block of waste is deposited adjacent to the existing block. This ordered method of waste deposition enables areas, which have been filled and are to be left for a period to be progressively restored over the site life, minimising the areas of active waste deposition.

6 SUMMARY REPORT ON EMISSIONS

This summary report has been compiled in accordance with emission limit values (ELVs) for the following media as detailed in Condition 6 and Schedule C of the current Licence.

- Surface Water Discharge
- Landfill Gas
- Dust
- Noise

6.1 Surface Water Discharge at Lagoon Outlet

Surface water discharge emission limit values measured at the outlet from the surface water lagoon, as stipulated in Licence 165-1.

Table 6.1 Surface Water Discharge Limits

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

Discharge samples results were < 10 mg/L for quarter one, two and three. The quarter four sample at SW10 (surface water lagoon sample) gave a result of 55 mg/L and was reported as an incident as a breach of emission limit occurred. However, this surface water lagoon outlet point was not discharging at the time of sampling due to unsettled weather and no environmental impact occurred

6.2 Landfill Gas Emission limit values

Landfill gas emission limit values as given in Licence 165-1 are assigned to gas monitoring locations at the perimeter of the landfill. Results for these are described below.

Table 6.2 Landfill Gas Emission limit concentrations

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

6.2.1 Landfill Gas Vents

Methane and carbon dioxide was detected in these vents in meaningful quantities as detailed in the quarterly reports. Emission limit values apply to gas emissions from perimeter gas monitoring locations, but not from the in-waste gas vents.

6.2.2 Landfill Gas Monitoring Wells

Elevated levels of methane and carbon dioxide were recorded in MG 15, MG 16, MG 17 and MG 18 prior to the placement of any waste in the landfill recorded in October 2006. It is thought that organic matter in the clays and the presence of made ground in the vicinity of these wells is contributing to the natural background levels of methane and carbon dioxide. In addition to these factors, surface water ponding in this area is creating a suitable environment for anaerobic bacteria to generate methane. Gas monitoring at MG 15, MG 16, MG 17 and MG 18 through 2008 showed that this existing baseline trend continued in the concentrations of methane and carbon dioxide continued.

With the exception of these gas monitoring wells, none of the perimeter gas wells showed results for methane in excess of the 1.0 % v/v ELV. A number of perimeter gas wells showed concentrations of carbon dioxide on occasion in 2008 including; MG2, MG3, MG5, MG8, MG9, MG10 and MG11.

Analysis carried out on two occasions in 2007, and reported by Odour Monitoring Ireland (OMI), showed a VOC profile that is significantly different when comparing perimeter gas wells with active gas wells. In their report, they state that it is highly unlikely that methane and carbon dioxide concentrations in the perimeter gas wells are the results of lateral or horizontal landfill gas migration. They indicate that the most likely source of the high measurements is from disturbed ground from the construction phase and results represent natural degradation of organic material. The client has forwarded on these reports by Odour Monitoring Ireland to the agency for their consideration. Odour Monitoring Ireland carried out further VOC proling of these perimeter gas wells during March 2009.

6.3 Dust Deposition

Table 6.3 Dust Deposition

February	* Inorganic dust = 764 mg/m ² /day;	*Organic dust = 1303mg/m ² /day
March	* Inorganic dust = 701 mg/m ² /day;	*Organic dust = 429 mg/m ² /day
August	* Inorganic dust =654 mg/m ² /day;	*Organic dust = 2577 mg/m ² /day

Note: Results not associated as being landfill non compliances see discussion.

Three occasions dust concentrations in excess of the emission limit value at guage AD6 were reported in the environmental monitoring results through 2008. On those occasions (February, March and August) where concentrations were elevated at AD6, each of the remaining dust monitoring locations were below the licence emission value for dust.

The reported dust concentrations for each of monitoring locations AD7, AD8, AD9, AD10, AD11 and AD12, including those gauges most usually within the downwind exposure from the site were below the emission limit value of 350mg/m²/day during each monitoring event.

Due to the considerable distance from AD6 to any potential dust generation source, its location within a greenfield area upwind of the working landfill area, it can be concluded that the elevated results at AD6 were not due to dust generation from the site. Dust gauge AD6 is situated upwind of the prevailing wind direction at the site. In addition to this, AD6 is located to the extreme northwest of the site ownership area in a greenfield area and is a considerable distance from both the active landfill area and working areas surrounding the landfill.

6.4 Noise Emissions

Noise emission limit values as stipulated in Licence 165-1 are detailed below.

Table 6.4 Noise Emission limit values

Day Db(A) L _{Aeq} (15 minutes)	Night dB(A) L _{Aeq} (15 minutes)	NSL (Noise sensitive locations) given in Licence Table D.1.1
55	45	NSL1, NSL2, NSL3

Table D.1.1 of the licence lists the Noise Sensitive Locations at which the licence limit values, given in Table C1 of the licence, apply. There are three Noise Sensitive Locations surrounding the landfill; NSL1, NSL2, NSL3.

In addition, to the quarterly monitoring at NSLs, noise monitoring was conducted at three locations within the landfill. The completed monitoring reports were issued to the EPA as part of the 1st, 2nd, 3rd and 4th Quarterly monitoring reports.

Noise levels in excess of the emission limit values were measured at the Noise Sensitive Locations NSL2 and NSL 3 surrounding the landfill during each of the 2008 quarterly monitoring events. The quarterly monitoring reports submitted described the noise sources recorded during the monitoring events at each location. It was reported that at noise sensitive locations NSL2 and NSL3, the dominant noise source was road traffic. At NSL3 the landfill was completely inaudible at this location due to heavy road traffic noise.

7 SUMMARY ENVIRONMENTAL MONITORING RESULTS

Introduction

Monitoring was conducted at Ballynagran Landfill in accordance with Schedule D of the Waste Licence 165-1. Details of monitoring and reporting frequencies of environmental data are presented in Table 9.1 below. The locations of all environmental monitoring points are illustrated on Drawing 1322/101/01, Appendix A.

Table 7.0 Environmental Monitoring and Reporting Frequency

Environmental Monitoring Data	Monitoring Frequency	Reporting Frequency
Groundwater Levels	Monthly	Quarterly
Groundwater Quality	Quarterly	Quarterly
Surface Water Quality	Quarterly	Quarterly
Dust	Monthly	Quarterly
PM ₁₀	Quarterly	Quarterly
Noise	Quarterly	Quarterly
Leachate	Quarterly	Annually
Leachate Levels	Continuously	Quarterly
Landfill Gas Monitoring (Gas Boreholes)	Monthly	Quarterly
Landfill Gas Monitoring (Site Office)	Weekly	Quarterly
Meteorological Monitoring	Daily	Annually

7.1 Biological Monitoring – macroinvertebrate sampling

7.1.1 Biological Sampling Report

Biological sampling was carried out at 7(no.) monitoring points on the 3No. watercourses which flow within the site boundary, namely, the Kilcandra Stream, Ballynagran Stream and the Longford Stream. These watercourses are all tributaries of the Three Mile River, which flows downgradient of the landfill footprint, in a west-east direction under the N11 and east towards the townland of Newtown.

SW1 is upstream of the landfill footprint. SW4 is downstream of SW1, but upstream of phase 1 of the development; both are located within the sites boundary on the Ballynagran Stream. SW3 is located south of the landfill footprint on the Kilcandra Stream. SW2 is located upstream of the landfill footprint and SW5 is downsteam on the Longford Stream. SW6 and SW7 are both off-site monitoring locations downstream of the facility on the Three Mile River. The locations of these

monitoring points are shown in Drawing 3756/101/01.

All of these points were visited and sampled by TOBIN on the 28th August 2008. The locations of these monitoring points are shown in Drawing 1322/101/01, Appendix A.

7.1.2 Methodology

Samples were taken according to standard EPA methodology and the kick samples were taken in the most suitable gravel-stone substrate present using a net with a 1mm mesh for a duration of 2 minutes. The samples were then preserved with 70 % alcohol and delivered to Openfield Consultancy for identification and analysis.

The results were then analysed and values assigned using the EPA scheme of Biotic Indices or Quality (Q) Values and their relationship to water quality, as set out in Table 9.6 below.

Table 7.1.1 The Relationship between Q values and Water Quality.

Biotic Index	Quality Status	Quality Class
Q5, Q4-5, Q4	Unpolluted	Class A
Q3-4	Slightly Polluted	Class B
Q3, Q2-3	Moderately Polluted	Class C
Q2, Q1-2, Q1	Seriously Polluted	Class D

7.1.3 Invertebrate sampling results

The results of the invertebrate sampling are presented in Table 7.1.2. The upstream locations are shaded in yellow and include locations SW1 through to SW4. The biotic index assigned to the upstream locations is generally Q3, indicating a quality status of 'Moderately Polluted' upstream of the landfill. This shows no change to the results from the previous annual biological assessment.

SW5 is located on the Longford stream, downstream of the landfill. The quality index Q3 was assigned to downstream locations SW5 and SW7, indicating a quality status of 'Moderately Polluted'. These locations show no change relative to the previous monitoring event when they were characterised as Q3, i.e. 'Moderately Polluted'.

Table 7.1.2 Occurrence of Macroinvertebrate taxa at surface water points

	Group A Taxa		Group B Taxa		Group C Taxa		Group D Taxa		Group E Taxa		Q- Value Determination
	Total Numbers	Relative Abundance, %	Total Numbers	Relative Abundance, %	Total Numbers	Relative Abundance, %	Total Numbers	Relative Abundance, %	Total Numbers	Relative Abundance, %	
SW1	1	0.5	4	2	221	97.5	0	0	0	0	3
SW2	0	0	0	0	43	100	0	0	0	0	3
SW3	0	0	5	11	42	89	0	0	0	0	3-4
SW4	0	0	1	1	100	99	0	0	0	0	3
SW5	0	0	7	10	63	89	1	1	0	0	3
SW6	0	0	6	18	24	73	3	9	0	0	3-4
SW7	1	2	1	2	44	94	1	2	0	0	3

SW6 is located downstream of the landfill at the confluence of the Longford and Ballynagran streams. The quality index Q3-4 was assigned to downstream location SW6, indicating a quality status of 'Slightly Polluted' and again shows no change.

It may be noted that the quality status downstream (generally Q3, one location Q3-4) is the same as that found upstream (generally Q3, one location Q3-4). No deterioration in quality downstream of the landfill, relative to that upstream, was recorded. It can therefore be concluded that the facility is having no impact on the overall biological quality of the surface water.

7.2 Surface Water Monitoring

7.2.1 Introduction & Methodology

10 No. surface water monitoring points as defined in Schedule D of Waste Licence W0165-01. Surface water monitoring locations are illustrated in Appendix A. Table 9.5 details the co-ordinates for all surface water monitoring locations.

Water sampling was undertaken by TOBIN Consulting Engineers, using the "grab" sampling

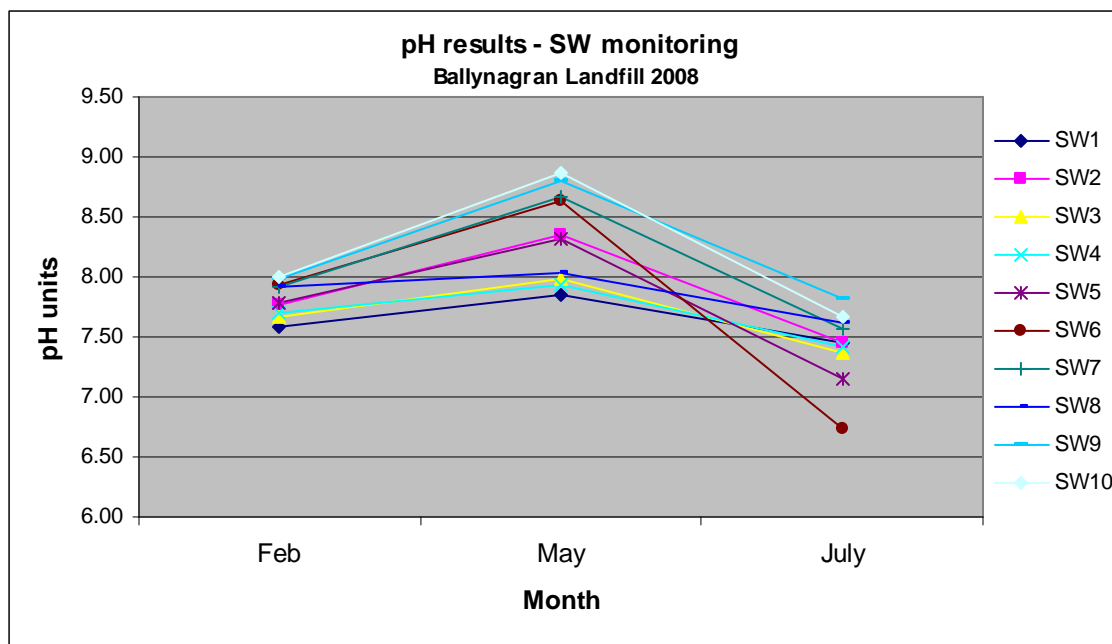
method. The laboratory-supplied containers were submerged beneath the surface of the water and squeezed gently when screwing on the cap to ensure an air tight seal. The filled sample containers were stored in a coolbox for transport to the laboratory. Visual and olfactory observations were recorded at each monitoring point. During the submergence every effort is made to keep the container steady so as to prevent sediment disturbance. Quarterly Surface water samples were analysed for parameters stipulated in D.5 of the Waste Licence and Quarterly reports submitted to the EPA.

Figures 7.2.2 to 7.2.6 give graphical results for the indicator parameters monitoring at the surface water locations.

Table 7.2.1 Surface Water Monitoring Locations

Media	Location	Watercourse	Comment
Surface Water	SW1	Ballynagran Stream	Upstream of Landfill
	SW2	Longford Stream	Upstream of Landfill
	SW3	Killcandra Stream	Upstream of Landfill
	SW4	Ballynagran Stream	Upstream of Phase 1
	SW5	Longford Stream	Downstream of Landfill
	SW6	Three Mile River	Downstream of Landfill
	SW7	Three Mile High	Downstream of Landfill
	SW8	Longford Stream	Upstream of Landfill
	SW9	Site Surface water runoff	Inlet to Lagoon
	SW10	Site Surface water runoff	Outlet form Lagoon

Figure 7.2.2 Surface Water pH results 2008

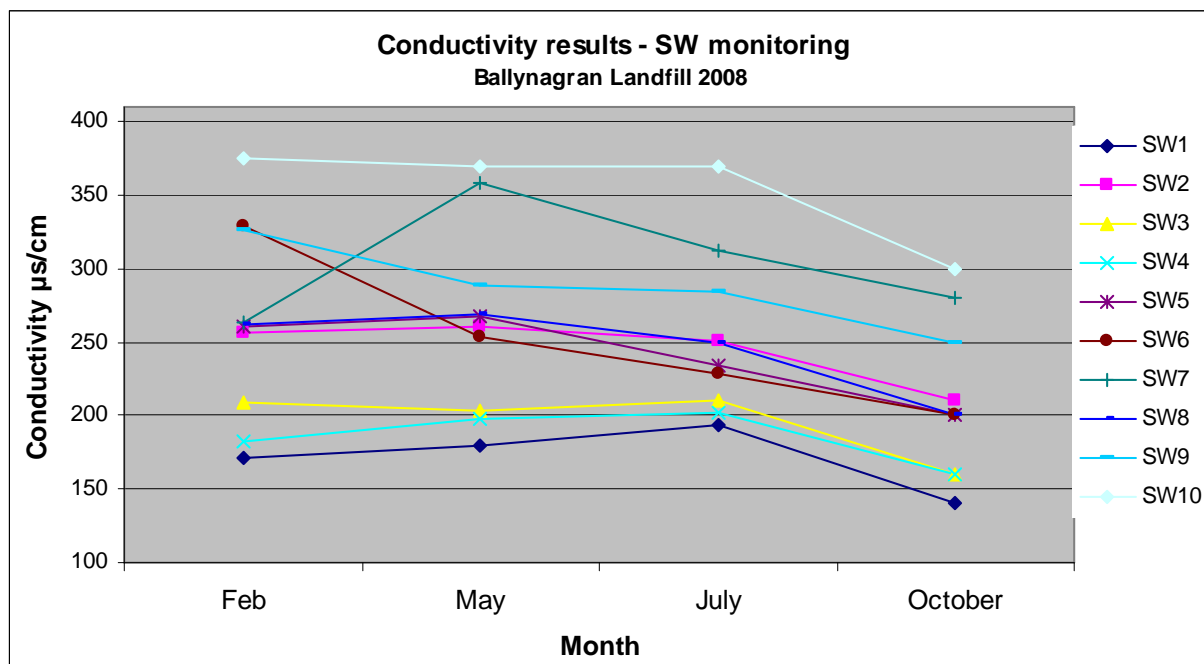


No measurement during Q4 due to instrument error

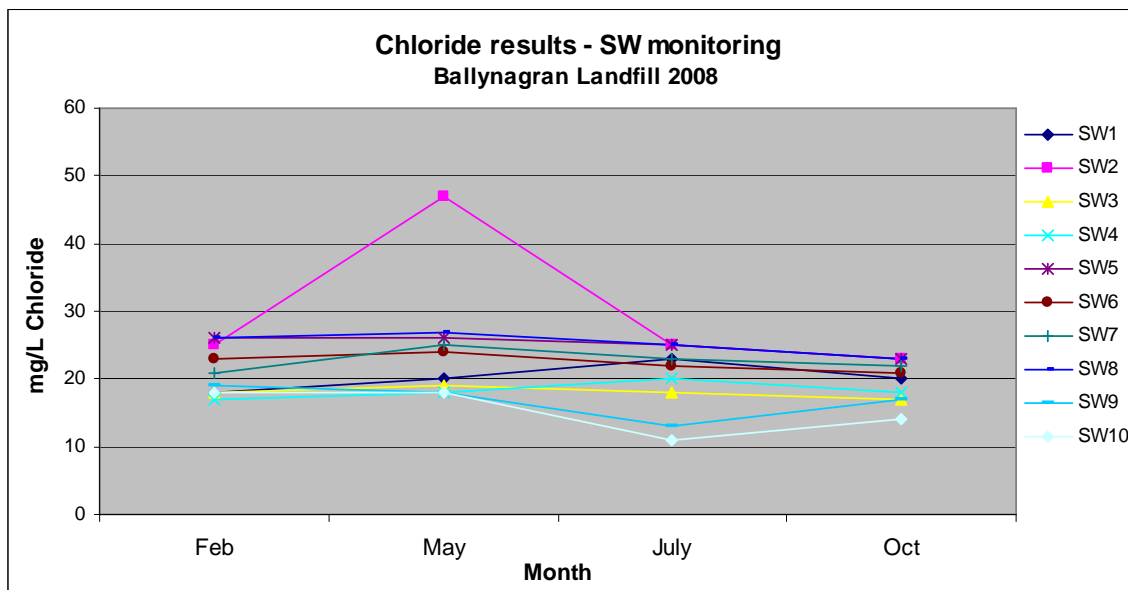
Table 7.2.2 Surface Water pH results 2008

pH units	Feb	May	July
SW1	7.59	7.85	7.45
SW2	7.76	8.35	7.45
SW3	7.67	7.98	7.36
SW4	7.70	7.93	7.42
SW5	7.78	8.32	7.15
SW6	7.93	8.64	6.74
SW7	7.91	8.66	7.56
SW8	7.92	8.04	7.61
SW9	7.98	8.80	7.82
SW10	8.00	8.87	7.66

No pH measurement during Q4 due to instrument error

Figure 7.2.3 Surface Water Conductivity results 2008**Table 7.2.3 Surface Water Conductivity results 2008**

Conductivity $\mu\text{s}/\text{cm}$	Feb	May	July	October
SW1	171	180	193	140
SW2	257	261	251	210
SW3	209	204	210	160
SW4	182	198	202	160
SW5	261	267	234	200
SW6	329	253	228	200
SW7	263	358	312	280
SW8	262	269	250	200
SW9	326	288	284	250
SW10	375	370	369	300

Figure 7.2.4 Surface Water Chloride results 2008**Table 7.2.4 Surface Water Chloride results 2008**

Chloride mg/L	Feb	May	July	Oct
SW1	18	20	23	20
SW2	25	47	25	23
SW3	18	19	18	17
SW4	17	18	20	18
SW5	26	26	25	23
SW6	23	24	22	21
SW7	21	25	23	22
SW8	26	27	25	23
SW9	19	18	13	17
SW10	18	18	11	14

Figure 7.2.5 Surface Water Ammoniacal Nitrogen results 2008

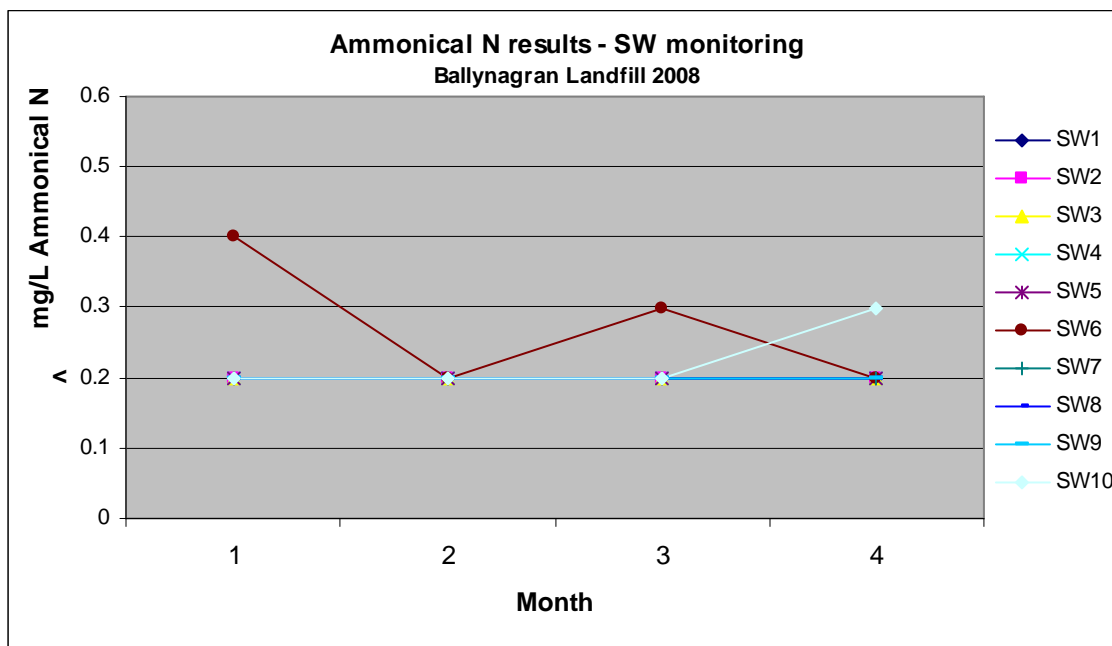


Table 7.2.5 Surface Water Ammoniacal Nitrogen results 2008

Ammoniacal N (mg/L N)	Feb	May	July	Oct
SW1	0.2	< 0.2	< 0.2	< 0.2
SW2	< 0.2	< 0.2	< 0.2	< 0.2
SW3	0.2	< 0.2	< 0.2	< 0.2
SW4	< 0.2	< 0.2	< 0.2	< 0.2
SW5	< 0.2	< 0.2	< 0.2	< 0.2
SW6	0.4	< 0.2	0.3	< 0.2
SW7	< 0.2	< 0.2	< 0.2	< 0.2
SW8	0.2	< 0.2	< 0.2	< 0.2
SW9	< 0.2	< 0.2	< 0.2	< 0.2
SW10	< 0.2	< 0.2	< 0.2	0.3

Figure 7.2.6 Surface Water Suspended Solids results 2008

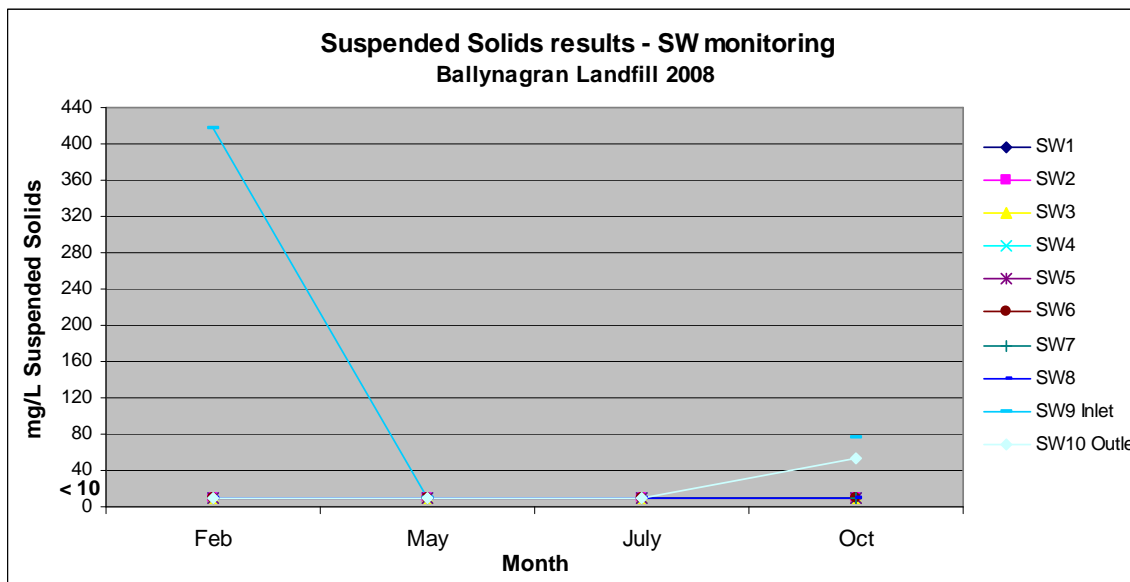


Table 7.2.6 Surface Water Suspended Solids results 2008

Suspended Solids mg/L	Feb	May	July	Oct
SW1	<10	<10	<10	<10
SW2	<10	<10	<10	<10
SW3	<10	<10	<10	<10
SW4	<10	<10	<10	<10
SW5	<10	<10	<10	<10
SW6	<10	<10	<10	<10
SW7	<10	<10	<10	<10
SW8	<10	<10	<10	<10
SW9 Inlet	417	<10	[note1] ND	77
SW10 Outlet	<10	<10	<10	53

Notes

[1] ND- No laboratory determination possible

7.2.2 pH

pH concentrations were all typical of surface waters.

7.2.3 Conductivity

Conductivity concentrations were all typical of surface waters.

7.2.4 Chloride

Chloride concentrations measured were typical of surface water and no irregular trends in Chloride levels were recorded from the monitoring events, with Chloride concentrations within the range 17 mg/l to 25 mg/l recorded at monitoring locations SW1, SW3, SW4, SW8 and locations SW4, SW5 and SW6. Chloride concentrations at the upstream location SW2 were similar to those at other locations with the exception of the concentration of 47 mg/l Chloride upstream at SW2 during the May monitoring.

7.2.5 Ammoniacal Nitrogen

Samples from the lagoon outlet monitoring point, SW 10, had concentrations of <0.2 mg/l Ammoniacal Nitrogen, excluding the October sample concentration of 0.3 mg/l as N.

Surface water monitoring at surrounding stream locations were completed during the quarterly events in February, May, August and October. Quarterly monitoring showed consistent water quality in all of the stream locations surrounding the landfill. At monitoring locations SW1, SW2, SW3, SW4 and SW8 Ammoniacal Nitrogen results of < 0.2 mg/l as N and 0.2 mg/l as N were measured during the quarterly monitoring events. At monitoring point SW6 slightly higher concentrations of Ammoniacal Nitrogen were measured during two quarters, with 0.4 mg/l as N in February and 0.3 mg/l as N in October; the concentration of Ammoniacal Nitrogen at SW6 and at SW4 and SW5 during the remainder of the monitoring events was < 0.2 mg/l as N. It is believed that slightly elevated ammoniacal nitrogen concentrations at SW6 may have been due to agricultural activity.

7.2.6 Suspended Solids

Quarterly monitoring showed consistent water quality for Suspended Solids in all of the stream locations surrounding the landfill, with all monitoring locations upstream and downstream of the landfill showing concentrations of Suspended Solids < 10 mg/l during all monitoring events.

Samples from the discharge monitoring point SW 10, had concentrations of <10 mg/l Suspended Solids, excluding the October monitoring where the sample was taken from the surface water lagoon and a concentration of 53 mg/l was measured. It was noted that there was no discharge

from the lagoon at the time of sampling.

Groundwater Monitoring

7.2.7 Introduction & sampling methodology

Co-ordinates for all groundwater monitoring locations are detailed in Table 7.3.1 with locations illustrated in Appendix A, on Drawing 1322/101/01. A Waterra inertial lift pump and dedicated hosing was used to purge 3(no.) well volumes from the borehole prior to sampling. The laboratory supplied sample containers were filled directly from the dedicated hosing. The filled sample containers were stored in a coolbox for transport to the laboratory. Samples were analysed in an accredited chemical laboratory (ALcontrol Geochem).

Table 7.3.1 Groundwater Monitoring Locations

Location	Eastings	Northings
MW1d	326578	191709
MW1s	326589	191706
MW2d	326641	191247
MW2s	326642	191258
MW3d	326942	190983
MW3s	326930	190988
MW4d	327295	190873
MW4s	327283	190875
MW5d	327551	190842
MW5s	327562	190843
MW6d	327672	190135
MW6s	327675	191148
MW7s	327231	191499
MW7d	327242	191500
MW8s	326796	191902
MW8d	326785	191904

7.2.8 Original Groundwater Trigger Levels per Licence

Trigger levels for groundwater measured at the monitoring boreholes specified in Condition 6.4.1 of the waste licence for the facility are shown below.

Table 7.3.2.1 – Groundwater Trigger Levels as per Licence

Parameter	Trigger Value Quoted in Licence
pH	<6>9
Chloride	40 mg/l
Ammonia	0.15 mg/l
Total Organic Carbon	>50 mg/l
Potassium	12 mg/l

Table 7.3.2.2 shows the Trigger levels as revised for 2007 results (from 2007 AER).

For the review giving Groundwater Trigger Levels Reviewed for 2008 from analysis results, See Table 7.3.10 below the graphs of groundwater monitoring results.

Table 7.3.2.2 – Trigger levels as revised for 2007 results (from 2007 AER)

Groundwater Monitoring Location	Trigger Level Review				
	pH	Ammoniacial Nitrogen	Potassium	Total Organic Carbon	Chloride
MW1s	9.1	6.8	0.9	1.1	28
MW1d	11.6	1.3	0.9	1.1	30
MW2s	12.3	1.2	3.2	1.1	39
MW2d	11.9	0.3	3.2	1.1	37
MW3s	8.8	1.2	2.8	3.3	21
MW3d	9	1.4	2.2	1.1	19
MW4s	8.8	0.1	1.9	1.1	20
MW4d	9.1	0.1	1.5	1.1	22
MW5s	8.6	0.1	1.3	1.1	26
MW5d	8.9	0.1	1.1	1.1	26
MW6s	7.9	1.0	1.1	1.1	31
MW6d	8.5	0.3	0.8	1.1	22
MW7s	9.5	0.6	*	1.1	28
MW7d	*	*	*	*	*
MW8s	*	*	*	*	*
MW8s	*	*	*	*	*

The graphs below give the groundwater monitoring results from upstream and downstream monitoring locations at the landfill.

Figure 7.3.3.1 pH results - upgradient wells

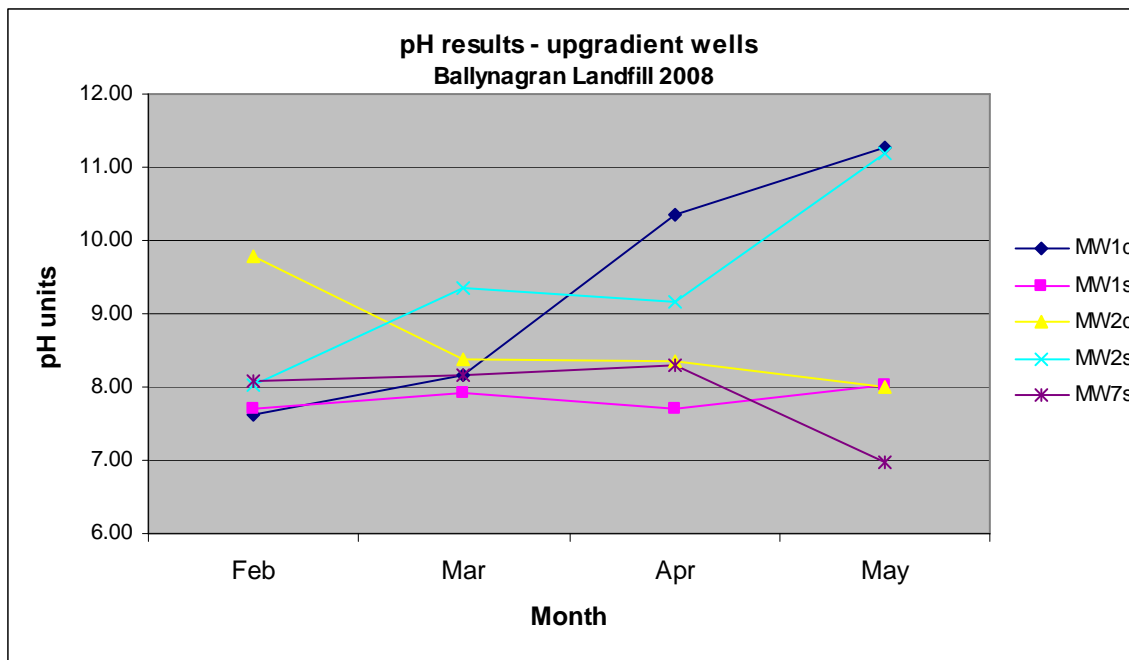


Table 7.3.3.1 pH results Upgradient of Landfill 2008

pH units	Feb	Mar	Apr	May
MW1d	7.61	8.15	10.36	11.28
MW1s	7.70	7.91	7.70	8.04
MW2d	9.79	8.38	8.35	8.00
MW2s	8.02	9.36	9.16	11.19
MW7s	8.09	8.16	8.31	6.98

Figure 7.3.3.2 pH Levels Downgradient of Landfill 2008

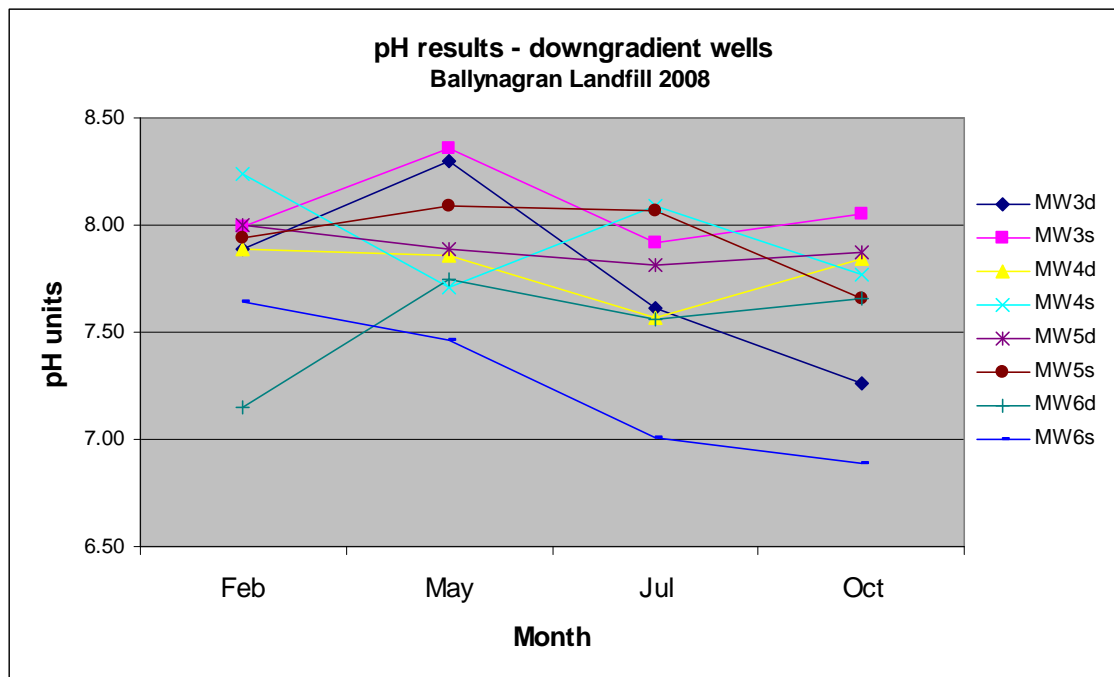
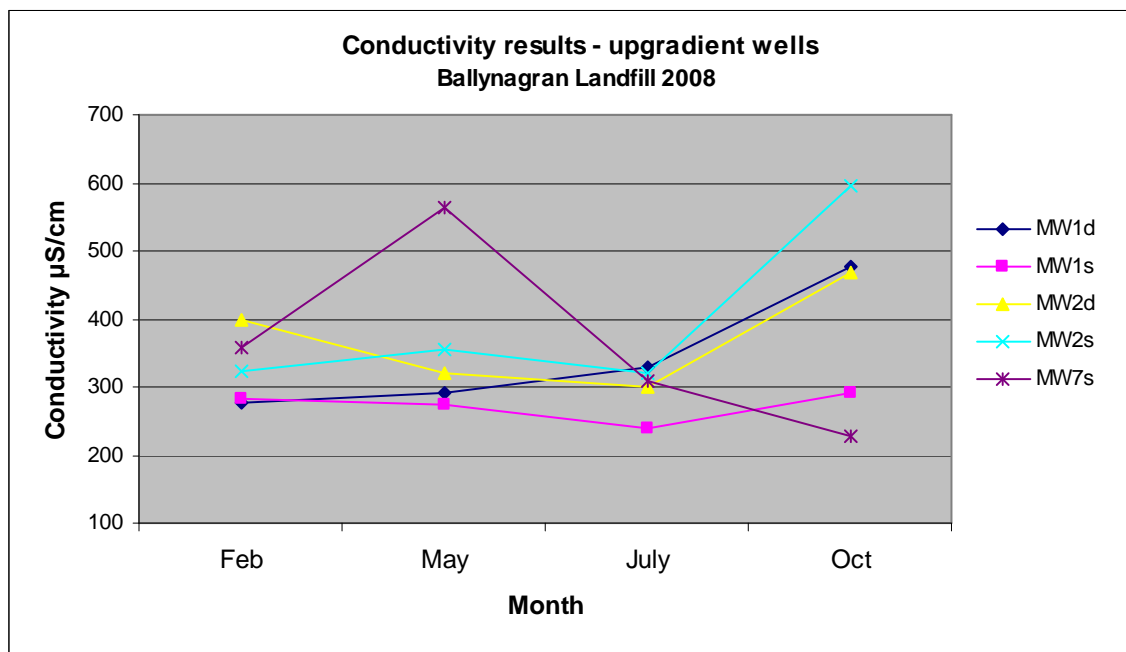
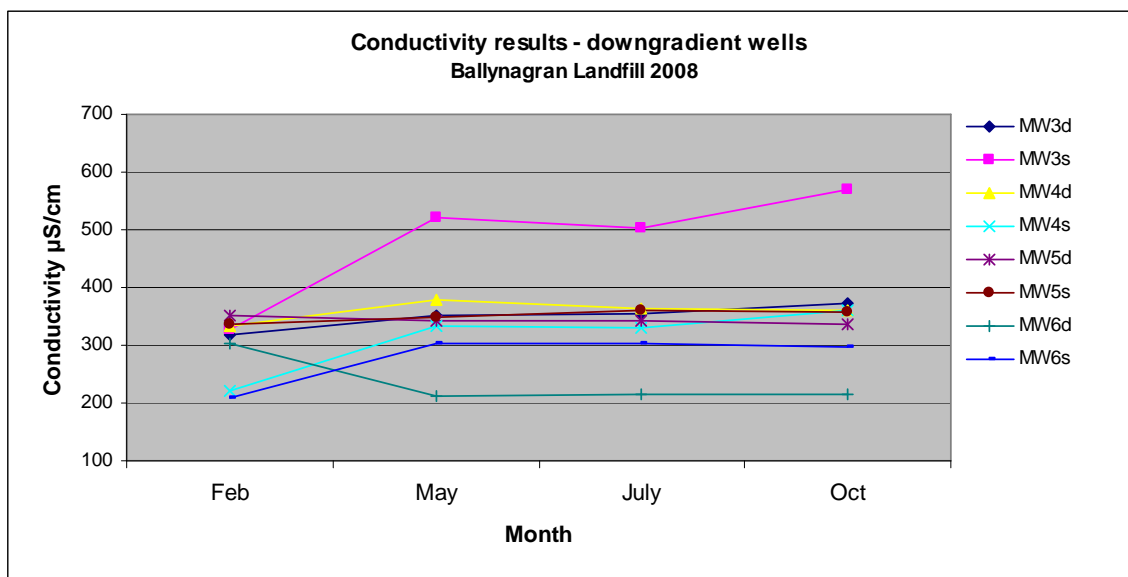


Table 7.3.3.2 pH results Downgradient of Landfill 2008

pH units	Feb	Mar	Apr	May
MW3d	7.89	8.30	7.61	7.26
MW3s	7.99	8.36	7.92	8.05
MW4d	7.89	7.86	7.57	7.84
MW4s	8.24	7.71	8.09	7.77
MW5d	8.00	7.89	7.81	7.87
MW5s	7.94	8.09	8.07	7.66
MW6d	7.15	7.75	7.56	7.66
MW6s	7.64	7.46	7.01	6.89

Figure 7.3.4.1 Conductivity results Upgradient of Landfill 2008**Table 7.3.4.1 Conductivity results Upgradient of Landfill 2008**

Conductivity $\mu\text{S}/\text{cm}$	Feb	May	July	Oct
MW1d	277	290	330	478
MW1s	284	274	240	292
MW2d	400	321	300	469
MW2s	324	354	320	596
MW7s	359	565	310	227

Figure 7.3.4.2 Conductivity results Downgradient of Landfill 2008**Table 7.3.4.2 Conductivity results Downgradient of Landfill 2008**

Conductivity $\mu\text{S}/\text{cm}$	Feb	May	July	Oct
MW3d	318	353	355	374
MW3s	328	522	503	570
MW4d	333	378	364	362
MW4s	221	333	330	361
MW5d	352	342	343	337
MW5s	337	350	361	357
MW6d	303	212	216	215
MW6s	210	303	303	298

Figure 7.3.5.1 Chloride results Upgradient of Landfill 2008

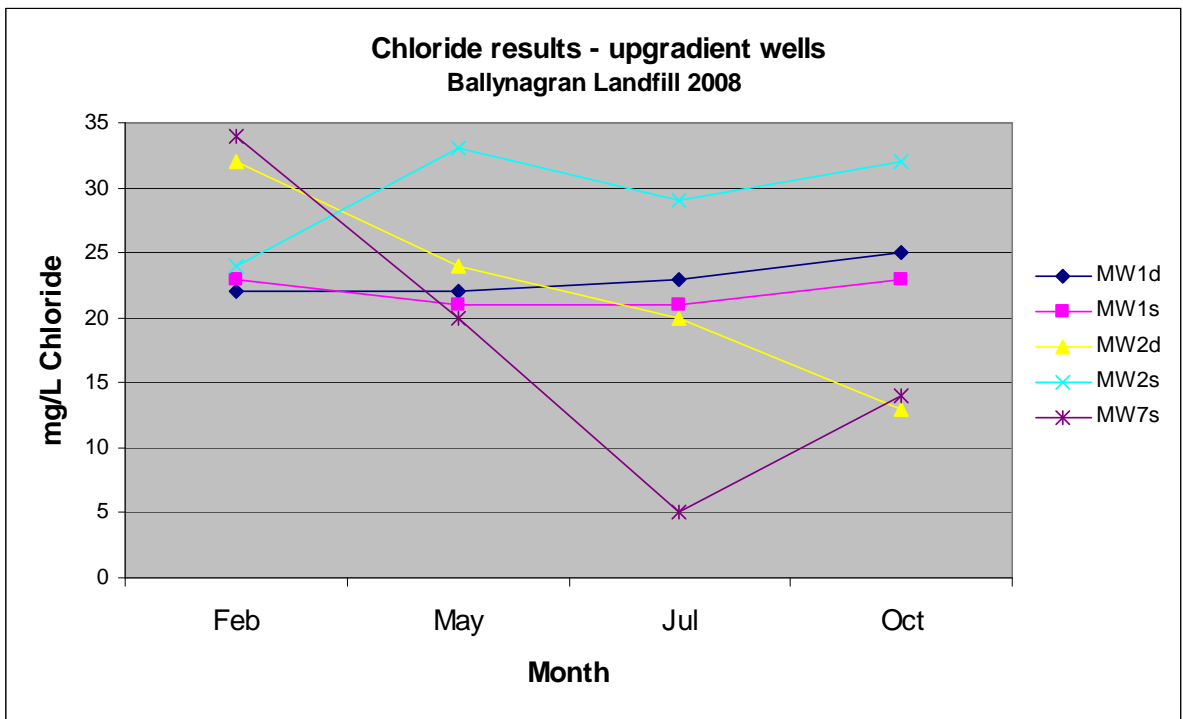


Table 7.3.5.1 Chloride results Upgradient of Landfill 2008

Chloride mg/L	Feb	May	July	Oct
MW1d	22	22	23	25
MW1s	23	21	21	23
MW2d	32	24	20	13
MW2s	24	33	29	32
MW7s	34	20	5	14

Figure 7.3.5.2 Chloride results Downgradient of Landfill 2008

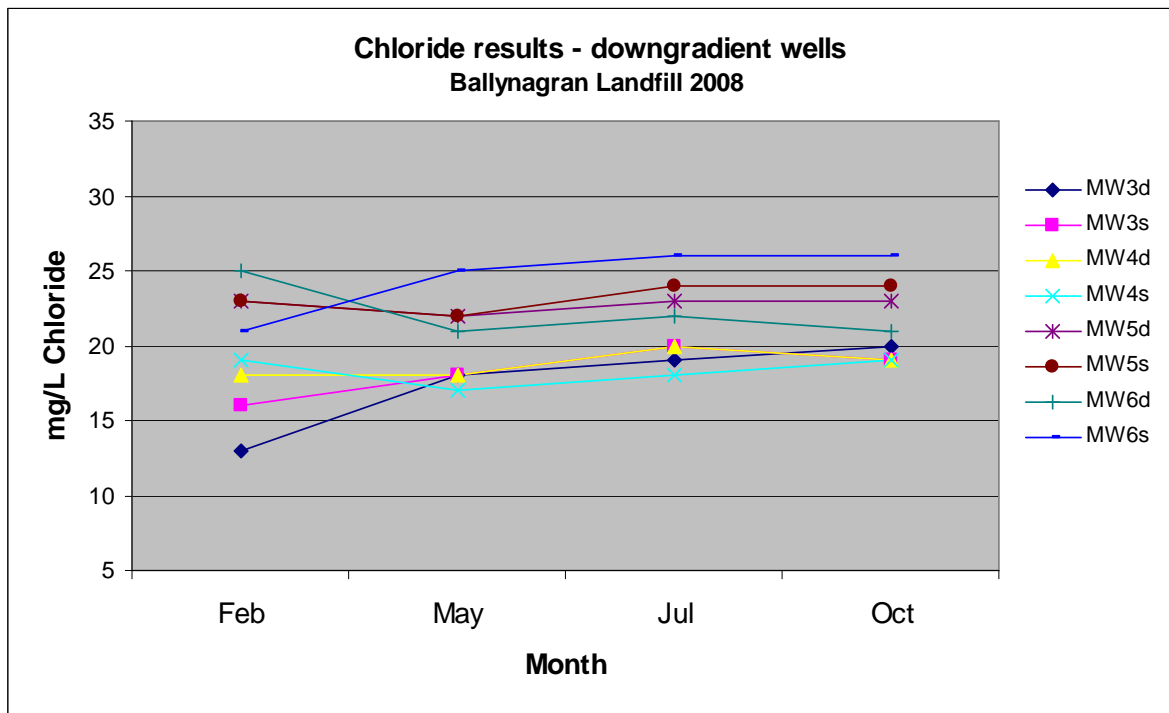


Table 7.3.5.2 Chloride results Downgradient of Landfill 2008

Chloride mg/L	Feb	May	Jul	Oct
MW3d	13	18	19	20
MW3s	16	18	20	19
MW4d	18	18	20	19
MW4s	19	17	18	19
MW5d	23	22	23	23
MW5s	23	22	24	24
MW6d	25	21	22	21
MW6s	21	25	26	26

Figure 7.3.6.1 Ammoniacal Nitrogen results Upgradient of Landfill 2008

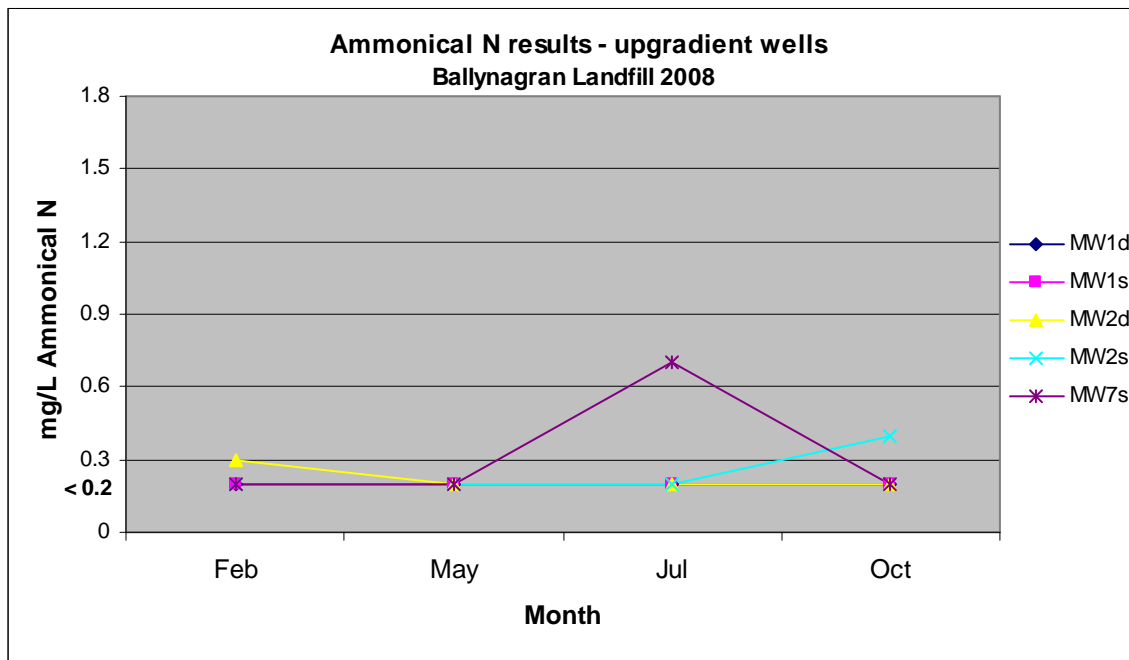
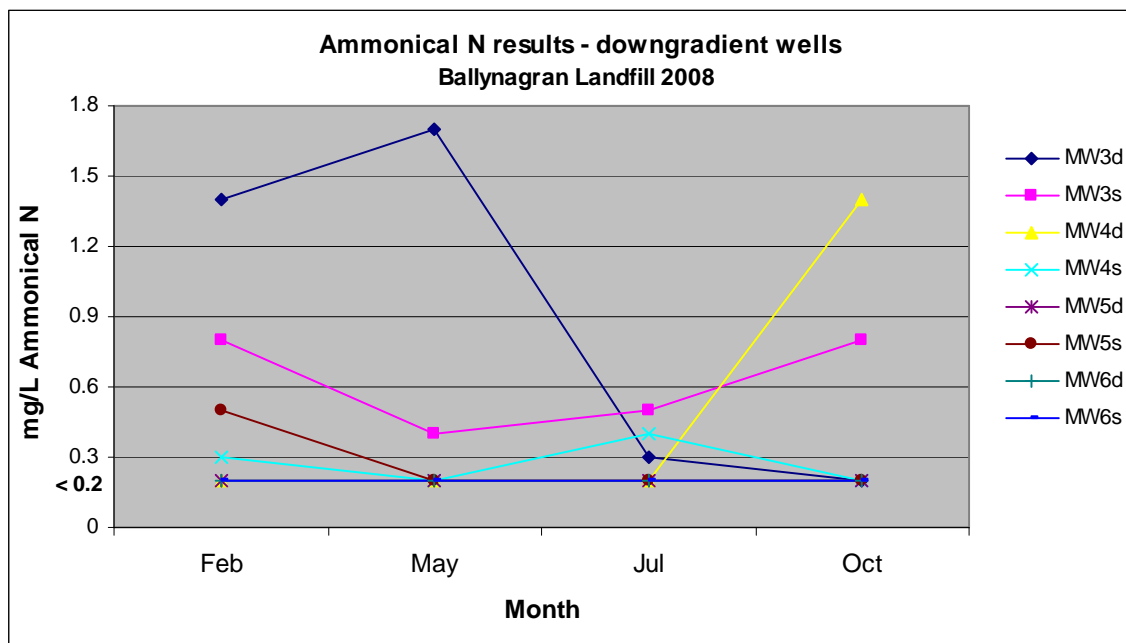


Table 7.3.6.1 Ammoniacal Nitrogen results Upgradient of Landfill 2008

Ammoniacal N (mg/L N)	Feb	May	Jul	Oct
MW1d	< 0.2	< 0.2	< 0.2	0.2
MW1s	< 0.2	< 0.2	< 0.2	< 0.2
MW2d	0.3	< 0.2	< 0.2	< 0.2
MW2s	< 0.2	0.2	0.2	0.4
MW7s	< 0.2	< 0.2	0.7	< 0.2

Figure 7.3.6.2 Ammoniacal results Levels Downgradient of Landfill 2008**Table 7.3.6.2 Ammoniacal results Levels Downgradient of Landfill 2008**

Ammoniacal N (mg/L N)	Feb	May	Jul	Oct
MW3d	1.4	1.7	0.3	< 0.2
MW3s	0.8	0.4	0.5	0.8
MW4d	< 0.2	< 0.2	< 0.2	1.4
MW4s	0.3	< 0.2	0.4	< 0.2
MW5d	< 0.2	< 0.2	< 0.2	< 0.2
MW5s	0.5	< 0.2	< 0.2	0.2
MW6d	< 0.2	< 0.2	< 0.2	< 0.2
MW6s	< 0.2	< 0.2	< 0.2	< 0.2

Figure 7.3.7.1 TOC results Upgradient of Landfill 2008

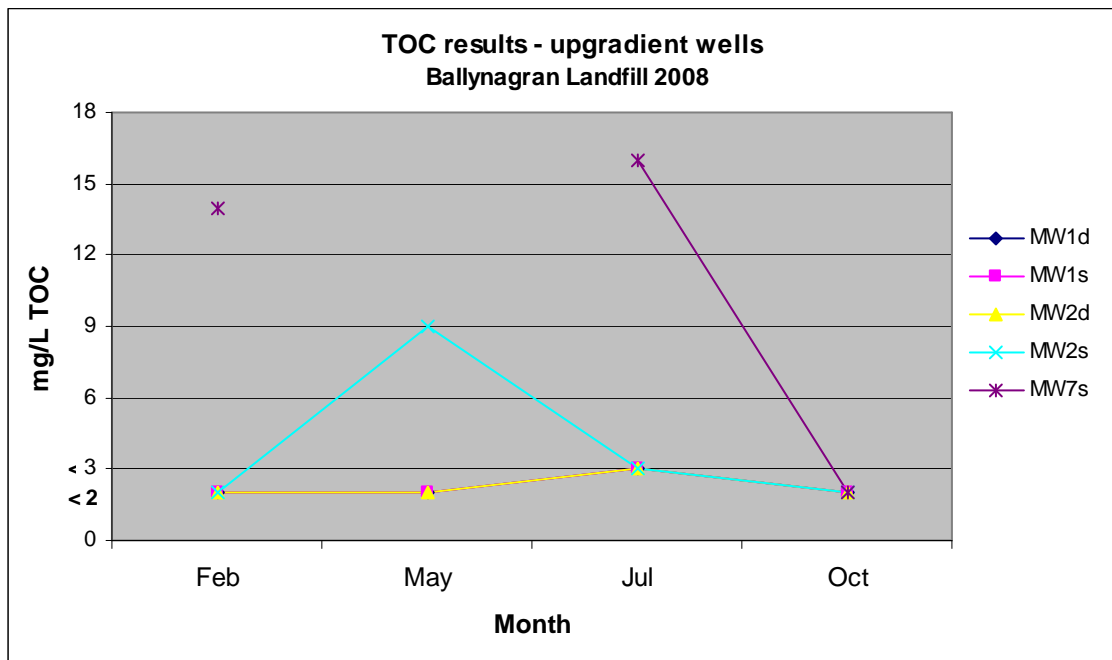


Table 7.3.7.1 TOC results Upgradient of Landfill 2008

TOC	Feb	May	Jul	Oct
MW1d	<2	<2	3	<2
MW1s	<2	<2	3	<2
MW2d	<2	2	3	2
MW2s	<2	9	3	<2
MW7s	14	ND	16	<2

Note: ND Lab determination not possible

Figure 7.3.7.2 TOC results Downgradient of Landfill 2008

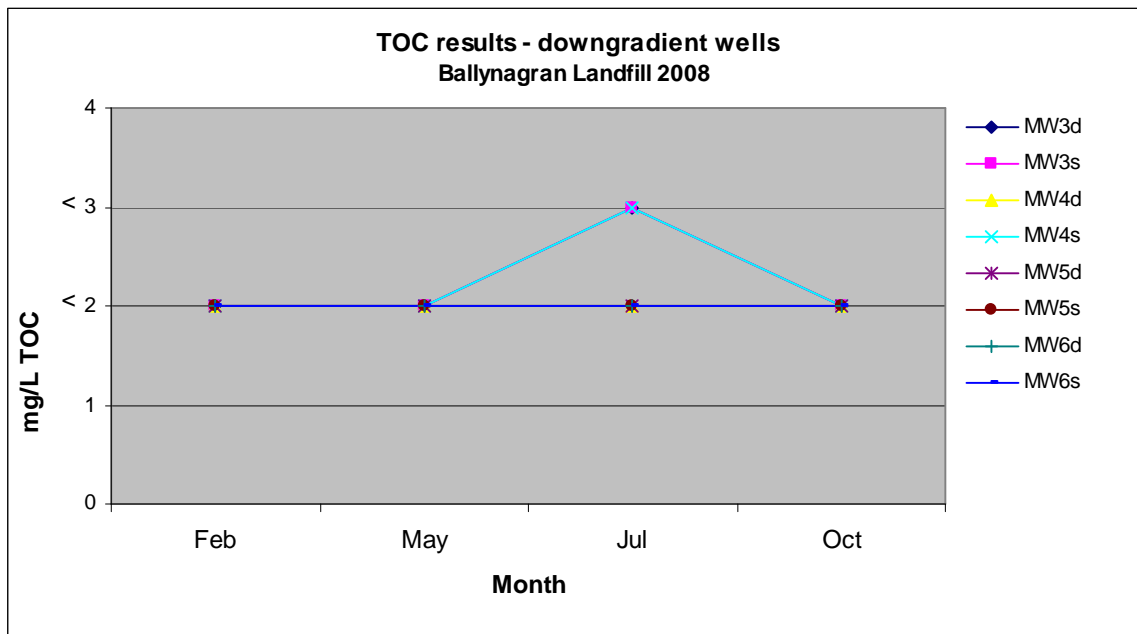


Table 7.3.7.2 TOC results Downgradient of Landfill 2008

TOC	Feb	May	Jul	Oct
MW3d	< 2	< 2	3	< 2
MW3s	< 2	2	< 3	< 2
MW4d	< 2	< 2	2	2
MW4s	< 2	< 2	< 3	< 2
MW5d	< 2	< 2	< 2	< 2
MW5s	< 2	2	< 2	< 2
MW6d	< 2	< 2	< 2	< 2
MW6s	< 2	< 2	2	< 2

7.2.9 pH

As noted in the previous annual report, elevated pH levels (in the range of pH 9 to pH 12) have been recorded in upgradient wells MW1 and MW2, but not in samples from wells located downgradient. This trend is again noted in the results from 2008. No significant trends are noted in the pH results from the downstream wells.

7.2.10 Conductivity

All conductivity measurements are below the Trigger Level of 1mS/cm and are typical of uncontaminated natural groundwaters.

7.2.11 Chloride

Results for Chloride upgradient of the landfill generally show concentrations in the range of 20 - 25mg/L. Chloride values in excess of the EPA Interim Guideline value of 30mg/l were recorded at MW2s (upgradient) during all two monitoring events this year and on one occasion at MW2d (upgradient). No noticeable trends in Chloride levels were recorded during 2008.

7.2.12 Ammoniacal Nitrogen

Ammoniacal Nitrogen concentration at the upgradient monitoring well MW7s during the quarter 3 monitoring event was 0.7 mg/L as N. Ammoniacal Nitrogen concentration exceeded the Interim Guideline Value of 0.15 mg/l at a number of wells during 2008; at MW3d during the first three quarterly events (1.4 mg/L as N; 1.7 mg/L as N; 0.3 mg/L as N), MW 3s during the four quarterly events (0.8 mg/L as N; 0.4 mg/L as N; 0.5 mg/L as N; 0.8 mg/L as N), MW 4d during the quarter 4 sample event (1.4 mg/L as N), MW4s during the first and third quarterly event (0.3 mg/L as N; 0.4 mg/L as N) and MW5s during the quarter one event (0.5 mg/l as N). Elevated ammoniacal nitrogen concentrations may be attributable to agricultural activity in the area.

7.2.13 TOC

Total Organic Carbon concentrations were 2 mg/L or < 2 mg/L at all downgradient wells sampled during 2008.

7.2.14 Potassium

Potassium concentrations ranged from 1.1 mg/L to 3 mg/L and were all less than the Interim Guideline value for groundwater of 5mg/L. Concentration of Potassium in samples from most wells showed an increase relative to the previous annual sampling event for the full groundwater analysis suite in 2007.

7.2.15 Groundwater Trigger Levels – review of 2008 concentrations

A review of the groundwater trigger levels for all monitoring boreholes was carried out. It was decided for reasons of clarity and interim guideline values to leave groundwater trigger levels as per the licence Condition 6.4.2.

Table 7.3.9 – Groundwater Trigger Level Review from 2008 monitoring results

Groundwater Monitoring Location	pH	Chloride	Ammoniacial Nitrogen	Total Organic Carbon	Potassium
	pH Units	mg/l	mg/l	mg/l	mg/l
MW1s	8.84	27.50	6.82	1.10	1.21
MW1d	11.56	29.70	1.32	1.10	3.30
MW2s	12.33	38.50	1.21	1.10	3.19
MW2d	11.87	37.40	0.33	1.10	1.76
MW3s	8.80	20.90	1.21	3.30	2.64
MW3d	9.00	18.70	1.43	1.10	3.30
MW4s	8.84	19.80	0.11	1.10	2.09
MW4d	9.11	22.00	0.11	1.10	2.64
MW5s	8.58	26.40	0.11	1.10	2.42
MW5d	8.91	26.40	0.11	1.10	1.43
MW6s	7.93	30.80	0.99	1.10	1.32
MW6d	8.50	22.00	0.33	1.10	1.32
MW7s	9.52	27.50	0.55	1.10	1.32
MW7d	*	*	*	*	*
MW8s	*	*	*	*	*
MW8s	*	*	*	*	*

* No data as well was dry at time of sampling

7.3 Leachate Monitoring

7.3.1 Sampling Methodology

A leachate sample was collected from each cell using the methodology set out below. Leachate samples were taken from automatically controlled pumping and sampling stations. The filled sample containers were stored in a coolbox for transport to the laboratory. Visual and olfactory observations were recorded on site.

Table 7.4 Leachate Monitoring Results

Quarter	Location	pH	Conductivity mS/cm	COD mg/l	BOD mg/l	Chloride mg/l	Ammonical Nitrogen mg/l
Q1	CELL 1	7.94	9.0	815	175	747	615.7
	CELL 3	7.86	11.0	1080	160	911	842.8
	CELL 4	7.80	9.0	873	133	452	629.5
	CELL 5/ CELL 2	6.61	8.0	11382	4357	427	259.3
	Lagoon	7.36	4.6	1887	1029	290	229.7
Q2	CELL 1	7.84	10.0	772	163	887	709.7
	CELL 3	7.63	11.0	1203	130	912	837.7
	CELL 5/ CELL 2	7.16	7.0	5371	2008	510	332.4
	Lagoon	7.37	4.3	1117	1171	337	237.5
Q3	CELL 1	7.94	8.0	650	86	720	520
	CELL 3	7.96	9.8	980	53	820	740
	CELL 5/ CELL 2	7.44	NDP	6200	>1018	570	410
	Lagoon	7.59	4.3	1100	410	320	250
Q4	Cell 1	7.62	9.0	923	115	758	736.8
	Cell 3	7.41	6.0	455	73	470	466.7
	Cell 5/ Cell 2	7.58	13.0	2187	535	1135	1168.3
	Lagoon	7.71	8.0	894	155	646	736.8

Notes NDP: no laboratory determination possible

7.3.2 Leachate Results and Discussion

Ammonical Nitrogen concentrations were generally greatest in cells 1 and cells 3 through the year, with the exception of quarter four – the highest concentrations ranged from 615 mg/L as N to 842 mg/L as N, other than quarter 4, where the highest concentration of 1168 mg/L as N was recorded in the leachate sampled from the Cell5/Cell 2 leachate tap. Both Chemical Oxygen Demand and Biological Oxygen Demand were highest in the samples from Cell5/Cell 2 throughout the year with concentrations of COD in the leachate samples from this sampling point ranging from 2,187 mg/L to 11,382 g/L. Leachate sample results are typical of acetogenic leachates sampled from large municipal landfills in Ireland and the UK.

7.4 Dust Monitoring

Dust monitoring was undertaken at 7(no.) locations (AD6, AD7, AD8, AD9, AD10, AD11, AD12) in accordance with D.1 and D.4 of the Waste Licence. Coordinates of the dust monitoring locations are presented in the table below.

Table 7.5.1 Dust Monitoring Locations

Media	Location	Eastings	Northings
Dust	AD6	327107	190974
	AD7	326347	191277
	AD8	327007	190968
	AD9	327540	190819
	AD10	327749	191038
	AD11	327326	191517
	AD12	327897	190950

7.4.1 Dust Monitoring Methodology

Bergerhoff gauges were used to determine total dust deposition, as specified in the German Engineering Institute VDI 2119 document “Measurement of Dustfall Using the Bergerhoff Instrument (Standard Method)”. Five gauges were set up so that the glass jars were at a height of 2m from the ground at the monitoring locations. The jars were set open during the monthly monitoring events. The samples were submitted to Alcontrol Laboratories for analysis.

7.4.2 Dust Monitoring Results

The depositional dust concentration emission limit value of 350mg/m²/day is detailed in Schedule C.3 of the Waste Licence. Prevailing wind conditions results in southwesterly and westerly winds. The dust monitoring locations which most usually occur downwind of the site are those gauges AD10, AD11 and AD12. The reported dust concentrations for each of monitoring locations AD7,

AD8, AD9, AD10, AD11 and AD12 were below the emission limit value of 350mg/m²/day, including those gauges most usually within the downwind exposure from the site.

Dust gauge AD6 is situated is upwind of the prevailing wind direction at the site. In addition to this, AD6 is located to the extreme northwest of the site ownership area in a greenfield area and is a considerable distance from both the active landfill area and working areas surrounding the landfill. Three occasions of elevated dust concentrations were recorded at gauge AD6 and reported in the environmental monitoring results through 2008. On those occasions (February, March and August) where concentrations were elevated at AD6, as noted above, each of the dust monitoring locations were below the licence emission value for dust. Due to the considerable distance from AD6 to any potential dust generation source, its location within a greenfield area upwind of the working landfill area, it can be concluded that the elevated results at AD6 were not due to dust generation from the site.

Table 7.5.2 Dust Monitoring Results

Location	AD6	AD7	AD8	AD9	AD10	AD11	AD12
January	61	95	109	122	119	60	55
February	* [Note 1]	86	245	51	64	35	27
March	* [Note 1]	205	91	124	129	74	44
April	56	100	25	27	39	37	43
May	345	252	20	14	94	5	111
June	71	240	41	53	35	12	12
July	48	197	75	69	346	43	284
August	* [Note 1]	69	49	67	114	90	<5
September	350	181	80	296	109	170	165
October	24	79	59	47	48	31	65
November	66	36	18	70	70	62	120
December	34	64	31	34	37	105	38

Note 1

February: * Inorganic dust = 764 mg/m²/day; *Organic dust = 1303mg/m²/day

March: * Inorganic dust = 701 mg/m²/day; *Organic dust = 429 mg/m²/day

August: * Inorganic dust =654 mg/m²/day; *Organic dust = 2577 mg/m²/day

7.5 PM₁₀ Monitoring

PM₁₀ monitoring was conducted at the facility in accordance with Schedule D.3 of the Licence. In order to quantify the baseline levels of PM₁₀ in the area, 4 locations (PM1 – PM4) were monitored for a period of 24 hours each on a quarterly basis throughout 2007. Table 7.6.1 details the coordinates of each of the monitoring locations. The PM₁₀ monitoring locations are shown on Drawing 1322/01/101, Appendix A.

The results and interpretations of the monitoring exercise were reported to the Agency in the quarterly reports. The trigger level for PM₁₀ under Condition 6.6 of the Licence states that PM₁₀ from the facility measured at any location on or outside the boundary of the facility can not exceed 50µg/m³ for a daily sample.

Table 7.6.1 PM₁₀ Monitoring Locations

Media	Location	Eastings	Northings
PM ₁₀	PM1	326302	191358
	PM2	326803	191064
	PM3	327310	191526
	PM4	327540	190798

7.5.1 Methodology

In order to obtain ambient air PM10 concentration levels for the landfill site, a battery operated gravimetric particulate sampler (Partisol) was used (as no power source is available at any of the monitoring points). Published data demonstrates strong correlation with the reference technique. This monitoring technique was used by the Irish EPA to perform PM10 monitoring of regional zones as part of the Air Quality monitoring program (EPA 2002).

7.5.2 PM₁₀ Standard

PM₁₀ is described as particulate matter that is less than 10µm in diameter. PM₁₀ can come from a number of different sources such as industrial processes, refuse incineration, construction, agriculture, diesel and fuel oil combustion and wood burning. As all of the PM₁₀ levels are below the trigger level concentration of 50 µg/m³, it is concluded that this parameter is compliant with the limits of the licence and no PM₁₀ impact currently exists for the landfill site. PM₁₀ monitoring results for each quarter are presented in the table below.

Table 7.6.2 PM₁₀ (ug/m³) Monitoring Results for 2008

Location	Q1	Q2	Q3	Q4
PM1	22	11	15.0	18
PM2	19.20	13.80	19.0	23
PM3	10.4	14.40	11.0	19
PM4	18.4	9.60	20.0	24

7.6 Noise Monitoring

7.6.1 Noise Monitoring Locations

Noise monitoring was conducted at the facility on a quarterly basis throughout the reporting period in accordance with Schedule D.4 of the Licence. Noise measurements were taken at seven monitoring locations in order to determine the existing noise climate at site boundary positions (NL1, NL2, NL3, NL4) and local noise sensitive receptors NSL1, NSL2 and NSL3.

The noise monitoring locations are presented in Drawing 3756/101/01, Appendix A. The results and interpretations of the monitoring exercise were reported to the Agency as part of the quarterly reports.

Table 7.7.1 Noise Monitoring Locations

Media	Location	Eastings	Northings
Noise	NL1	326531	192095
	NL2	327147	190916
	NL3	327222	191612
	NL4	326326	191311
	NSL1	326707	191000
	NSL2	327476	190742
	NSL3	327968	190869

7.6.2 Sampling Methodology

The following instrumentation was used in the baseline survey:

- One Larson Davis 824 Precision Integrating Sound Level Analyser/Data logger with Real-

Time Frequency Analyser Facility

- Wind Shield Type: Larson Davis 2120 Windscreen.
- Calibration Type: Larson Davis Precision Acoustic Calibrator Model CA200.

The following conditions were adhered to in undertaking the survey:

- Measurement of noise levels was undertaken using Type 1 instrumentation;
- Cognisance was taken of the EPA's 'Environmental Noise Survey Guidance Document' 2003;

All the environmental noise analysers had data logging facilities set on real-time, the logged data was later downloaded via a personal computer using software. One third octave frequency analyses were taken at the locations using the 824 Precision Integrating Sound Level Analyser/Data logger with real-time frequency analyser facility.

The measurement locations were all away from reflecting surfaces and at 1.5m height above local ground. All acoustic instrumentation was calibrated before and after the survey period and no drift of calibration was observed (calibration level 114dB at 1000Hz).

7.6.3 Standards and Guidance

The measurements were made according to the requirements of ISO 1996: Acoustics – Description and Measurement of Environmental Noise, parts 1, 2 and 3 and the EPA “Environmental Noise Guidance Document” (EPA 2003).

7.6.4 Tonal and Impulsive Characteristics

Tonal and impulsive characteristics elements of the noise were determined in accordance with ISO 1996 – 2. A source is described as having a tonal element at a particular frequency when it is clearly audible or exceeds the level of the adjacent band by 5dB or more. For example, a fan running inefficiently can often exhibit a tonal noise as a hum or drone. An impulsive noise is of short duration (typically less than 1 second). It is brief and abrupt; its startling effect causes greater annoyance than would be expected from a simple measurement of sound pressure level. An example is an instantaneous bang/thud that may be associated with pile driving/hammering etc.

7.6.5 Survey implementation

As required under Schedule D.4 of Waste Licence 165-1, the primary measurement parameter was the equivalent continuous A-Weighted Sound Pressure level, LAeq, T, over 30-minute

measurement intervals for the duration of the day-time monitoring survey. A statistical analysis of the measurement results was also completed so that the percentile levels, LAN, T, for N = 90% and 10% over 30-minute measurement intervals were also recorded. The percentile levels represent the noise level in dB(A) exceeded for N% of the measurement time. LA10 values are used to describe intermittent, high-energy noise events whereas LA90 values are representative of background noise levels.

In addition, frequency was measured in the 1/3-octave band at each of the four noise monitoring locations to assess the potential tonal components of ambient noise generated in the vicinity of the site. All sources of noise were noted, recorded and where possible, identified during the course of this survey.

7.6.6 Noise Monitoring Results

The noise monitoring results conducted at the facility during the reporting period are summarised below in Table 7.7.2. Noise emissions recorded during 2008 and emission limit values are detailed in Schedule C.1 of the Licence are discussed in Section 6.

Table 7.7.2 Noise Monitoring Results - 2008

	DATE & TIME	L _{Aeq} dB(A)	L _{A10} dB(A)	L _{A90} dB(A)	DATE & TIME	L _{Aeq} dB(A)	L _{A10} dB(A)	L _{A90} dB(A)	DATE & TIME	L _{Aeq} dB(A)	L _{A10} dB(A)	L _{A90} dB(A)	DATE & TIME	L _{Aeq} dB(A)	L _{A10} dB(A)	L _{A90} dB(A)
NL1	19/02/08	9.50	46.7	47.8	30/05/08	10:09	46.3	50.2	30/05/08	10:09	46.3	50.2	28/11/08	15.10	54.4	51
NL2	19/02/08	11.54	52.1	51.6	30/05/08	12:05	48.9	46.6	30/05/08	12:05	48.9	46.6	28/11/08	12.30	48.1	47.1
NL3	19/02/08	14.30	45.2	46.9	30/05/08	14:15	47.6	49.5	30/05/08	14:15	47.6	49.5	28/11/08	09.35	43.1	42.1
NL4	19/02/08	10.39	49.4	44.5	30/05/08	10:55	51	47.3	30/05/08	10:55	51	47.3	28/11/08	14:20	48.3	44.2
NSL1	19/02/08	11.17	47.0	49.1	30/05/08	11:34	52.2	47.6	30/05/08	11:34	52.2	47.6	28/11/08	13:45	50.5	45.5
NSL2	19/02/08	12.33	64.9	62.9	30/05/08	12:41	61.9	62	30/05/08	12:41	61.9	62	28/11/08	13:10	63.7	64.8
NSL3	19/02/08	13.12	65.3	68.2	30/05/08	13:17	64	66.2	30/05/08	13:17	64	66.2	28/11/08	15:50	64.9	67.4

8 RESOURCE AND ENERGY CONSUMPTION SUMMARY

The principal energy resources consumed at the landfill facility are electricity, water for potable supply oil, vehicle wheel cleaning and dust suppression, diesel fuel and hydraulic oils. Site vehicles are fuelled by diesel oil. The details are listed below in Table 8.1.

Table 8.1 Resource Use and Energy Consumption

PARAMETER	UNITS	Consumption in 2008
Electricity	(kWh)	181,174
Diesel Oil	(Litres)	199,031
Total Water	M ³	1,200
Water, Potable Supply	L	50,000
Water, Dust Suppression	L	2,160,000
Water, Wheelwash	L	100,000
Hydraulic Oils	L	1,000
Terram for road base	M ³	3,000

Appendix D contains an Energy Audit Report carried out on December 4th 2008.

9 DEVELOPMENT, RESTORATION & LANDSCAPING WORKS

9.1 Development & restoration of the facility & report on works undertaken

The detailed Restoration and Aftercare Plan for the facility was submitted to the Agency in 2007.

During 2008 Cells 6 and 7 were constructed. Construction of Cell 7 was completed during October 2008. The CQA report for Cell 7 was approved during December 2008 and waste placement in Cell 7 commenced during mid-December 2008. Cell 6 construction was completed during January 2009 and this Cell was approved for waste placement during early March 2009.

During 2008 waste placement was focused in Cells 1 – 5. One part of this area is now close to finished level. An SEW proposal was submitted to and approved by the Agency for capping works in this area.

Construction of Cells 9 and 10 is scheduled to commence during summer 2009 pending approval of the design by the Agency.

9.2 Progress & Implementation of Landscaping

There were two phases of tree planting during 2008.

June 2008 -This phase involved the planting of large (3m high, 10 -12 year old) in the vicinity of the site offices, site access road and reed bed. The trees were planted in order to improve the aesthetic appearance and help screen the main infrastructure area of the site. Trees planted in the reed bed area were willow and common alder. The trees will provide shelter and habitat for wildlife in the reed bed area. They will also help to screen the site offices and weighbridge from the public highway.

Trees planted during June 2008 were as follows –

Table 9.1 Trees planted during 2008 landscaping

Type	Quantity
MOUNTAIN ASH 50L 8-10 year old	25
WILD CHERRY 10-12 year old	25
SILVER BIRCH 35L 8-10 year old	25
LIME 50L 8-10 year old	25
WILLOW (Salix babylonica) 8-10 year old	30
COMMON ALDER 10-12 year old	30

December 2008 and January 2009 – This phase of planting involved planting on the newly constructed area of the landfill embankment, replacement of any failed trees on the embankment, replacement of wind damaged Leylandi on the southern screening bund, completion of tree planting on the southern screening bund and also planting of more mature trees in order to improve the appearance of the site entrance.

Trees planted during January 2009 were as follows –

Table 9.2 Trees planted during January 2009 landscaping

Location	Type	Quantity	Min.Height
Southern perimeter road side screening bund	alder	200	1.5m
	beech	100	1.5m
	ash	100	1.5m
	scots pine	100	1.5m
	black (austrian) pine	100	1.5m
	oak	50	1.5m
	sycamore	100	1.5m
	cherry	150	1.5m
Southern perimeter road side screening bund	Leylandi	25	2.5m
Outside Site Gates	Wild Cherry	4	2.5-3m
	Mountain Ash	4	2.5-3m
Big Screening Embankment – Cell 5	alder	100	1.5m
	beech	100	1.5m
	ash	100	1.5m
	cherry	100	1.5m

10 VOLUME OF LEACHATE GENERATED/ TRANSPORTED OFF SITE

At Ballynagran leachate generated on-site is collected in the leachate storage lagoon prior to removal off-site for treatment. The volume of leachate transported off-site during the reporting period was 12,104 m³.

Table 10.1: Volume of Leachate Transported Off Site

2008	Volume (m³)
January	1270
February	192
March	341
April	475
May	361
June	253
July	648
August	2725
September	1629
October	1613
November	1459
December	1138
Total 2007	12,104(m³)

11 ESTIMATED AND ANNUAL CUMULATIVE QUANTITIES OF LANDFILL GAS EMITTED FROM THE FACILITY

The enclosed landfill gas flare was installed in February 2008 and is connected to 30 vertical drilled/passive gas wells, 9 spike gas wells and 14 horizontal gas wells.

Landfill gas infrastructure such as the different variety of wells, is installed progressively as the waste is placed and the different types of gas wells are chosen to meet the specific needs of that landfill area.

The enclosed flare is extracting on average 1500m³/hour of landfill gas presently. Provision to install an open flare in the area adjacent to Cells 6 and 7 was approved by the agency in December 2008. This flare is extracting poor quality landfill gas from Cell 5 and will further improve collection efficiency in the areas of Cells 6 and 7. This open flare is extracting on average 250m³/hour presently.

Typical composition of gas flared is 40% CH₄, 40% CO₂ and 1.5% O₂. An additional six horizontal gas wells were installed in January 2009

12 ESTIMATED ANNUAL AND CUMULATIVE QUANTITY OF INDIRECT EMISSIONS TO GROUNDWATER

The potential sources of indirect emissions from the facility into the groundwater are:

- **Landfill Base:** The landfill site has a composite base lining system comprising a HDPE geomembrane and a half metre thick layer of compacted Bentonite Enhanced Soil. A leak detection survey of the HDPE geomembrane after placement of the drainage stone layer was completed and defects to the HDPE liner were repaired in accordance with industry standards.
- **Surface Water Collection & Treatment System:** Surface water from the paved access roads and landfill cell swale drain is collected and discharged into the surface water lagoon along with groundwater collected at the interceptor sump located below the landfill cells. Water from the lagoon discharges to a reed bed, which further filters the water before it is finally discharged to Longford Stream.
- **Treated Sewage Effluent:** There is a BioCycle wastewater treatment plant located adjacent to the weighbridge which treats the canteen and office waste water prior to being pumped to the leachate holding tank via the foul-water sump. Leachate (containing foul water) is tankered off-site to a waste water treatment plant via a vacuum tanker.

In summary, as the landfill is fully contained there will be no indirect emissions to groundwater.

13 METEOROLOGICAL DATA & POTENTIAL LEACHATE GENERATION

13.1 Meteorological Report

The site is equipped with a Skye mini-weather station, which produces climatological data comprising wind speed (km/hr) and wind direction, rain (mm) and temperature (° C), relative humidity (%) and Atmospheric pressure (mbar). Daily meteorological data was collected onsite as well as potential Evapotranspiration data collected from the Casement Synoptic Station in south Co. Dublin. Daily rainfall and temperature data shown in Table 13.2 are taken from Ashford Climatological Station, 16 km to the north of the landfill.

Total annual precipitation levels at Ballynagran for 2007 were 786.23mm [P]. Evapotranspiration mm [PE] at Casement Weather Station was estimated as 550.96mm [PE]. Therefore, overall Effective Precipitation [EP] for 2007 has been estimated as 207.43mm.

Table 13.2 – Meteorological data in 2008

Ashford Climatological Station					Casement Synoptic Station				
Month	Rainfall (mm)	Max. Temp. (°C)	Min. Temp. (°C)	Average Monthly Temperature (°C)	Wind Speed (Knots)	Wind Direction (Degrees from North)	MSL Pressure (hPa)	Relative Humidity (%)	Potential Evapotranspiration mm (Penman)
January	124.6	15.0	-3.1	7.0	14.3	214.5	1006.5	81.4	22.6
February	33.6	14.9	-5.6	6.2	11.8	191.7	1018.7	77.1	25.5
March	104.2	14.0	0.0	7.5	13.1	227.4	1006.0	68.3	39.7
April	35.7	16.7	-1.8	8.2	10.1	199.5	1010.2	65.1	56.3
May	28.0	20.7	0.6	11.9	8.1	95.8	1015.4	63.2	89.1
June	97.8	25.1	4.3	13.2	9.1	222.8	1015.2	65.9	82.8
July	121.9	23.6	5.3	15.7	9.1	184.2	1011.3	72.8	80.6
August	154.8	23.6	6.8	15.6	9.4	221.8	1006.6	76.9	63.2
September	107.8	19.7	4.1	12.9	8.0	178.5	1015.6	73.4	43.3
October	119.3	17.9	1.3	9.8	12.1	211.0	1011.8	80.0	27.0
November	50.2	14.7	-4.0	8.2	10.7	224.8	1014.0	85.4	11.3
December	41.4	14.3	-4.6	5.1	9.3	197.4	1017.4	89.3	5.2

13.2 Estimation of potential Leachate generation within waste mass

Climate data from Casement Synoptic Weather Station and Ashford Climatogical Station was used in the estimation of potential leachate generation at the site during the period January 2008 to December 2008. Total annual precipitation was taken from data at Ashford weather station, as 1019.3 mm [P]. Evapotranspiration mm as [PE] was taken from data at Casement weather station as 546.6mm [PE]. Therefore, overall Effective Precipitation [EP] for has been estimated as 472.7mm.

Table 13.1 Annual Water Balance Ballynagran Residual Landfill

Landfill cell	Area (m ²)	Effective Rainfall (rainfall less ET)	Potential leachate
Cell 1	15000	0.472	7080
Cell 2	6900	0.472	3256.8
Cell 3	Temporary capping	0.472	0
Cell 4 (half area; half capped)	2950	0.472	1392.4
Cell 5	8400	0.472	3964.8
Cell 6	Not in use till approx Apr09	0.472	0
Cell 7(Exposure Dec 08 only)	8400	-0.012	-100.8
Potential volume (m³)			15,593
Absorptive capacity Estimate aW m³ 0.025Aw/t; for 145,000 tonnes waste			3,625 aW m³
<u>Estimated Leachate Production</u>			11,968 m³

14 SCHEDULE OF ENVIRONMENTAL OBJECTIVE AND TARGETS FROM 2008

Table 14.1 Review of Environmental Objective and Targets

Ref.	Objective	Target	Progress
1	Awareness & Training Programme.	Assistant Facility Manager and Site Chargehand to complete FAS Waste Management Training Course.	Assistant Facility Manager and Site Chargehand have completed FAS Waste Management Training Course.
2	Assess & Review resource & Energy consumption at the site.	Carry out energy efficiency and resource use audit.	The energy audit was completed and a copy of the report was forwarded to the Agency.
3	Review & Assess the Effectiveness of Nuisance control procedures.	Continually review and assess all nuisance control procedures to ensure minimal impact on surrounding area. Update reports on bird control and odour abatement measures. Prepare and implement odour nuisance management plan.	Nuisance control procedures are reviewed on a daily basis. Nuisance control measures at the site proved very effective during 2008. Additional bird control measures were implemented during the summer season which proved effective at preventing birds from congregating at the facility.
4	Develop landfill gas management infrastructure.	Construct compound and install an enclosed flare. Upgrade gas extraction ring main and monitor gas production/quality for energy utilisation viability.	2,500m ³ /hr HAASE HT Enclosed Flare installed during early 2008. 355mm gas ring main installed to Phase I embankment.

5	Minimise nuisance from vehicle movements and unloading/tipping	Ensure noise, dust, odour from vehicle movements are minimised by correct implementation of relevant operational protocols.	Dust suppression measures were effectively implemented at the facility during 2008. Acoustic screening bunds were constructed when tipping at high levels to minimise noise impact on local residents.
6	Operation in Adverse Weather conditions	Ensure that procedures for operation in adverse weather conditions are followed correctly, minimising impact on the surrounding area.	The site was closed promptly during adverse weather conditions during 2008 and litter picking at the facility was carried out on a daily basis. There were no incidents of windblown litter escaping from the facility during 2008.
7	Continue to improve relationships with neighbouring communities/Reduce Environmental Complaints	Develop communications with site neighbours and respond to queries as quickly as reasonably practicable, ensuring that any complaints are followed up in writing as soon as possible after receipt of complaint.	Complaints were responded to promptly during 2008. All complaints were investigated as soon as possible (normally within ½ hour) and results of the investigation followed up in writing within one week. All requests for site visits were accommodated and encouraged. The facility held a very successful open day on the 16 th July 2008.
8	Environmental Monitoring	Ensure monitoring results comply with licence limits, & investigate any exceedances of Emission limit values.	Any exceedances were investigated and notified to the Agency during 2008.
9	Monitor Progress of planting programme on a regular basis.	Regularly review planted woodland area, and ensure the replacement of any failed trees to ensure visual impact of site is minimised.	Additional tree planting was carried out during summer 2008 and early 2009.

10	Maintain & Develop the Environmental Management System.	Maintain and Continually improve the Environmental Management System.	The facility was awarded ISO 14001 Certification during early January 2009.
11	Health & Safety/ Emergency Preparedness & Response Procedures.	Update and improve health & safety awareness, and training during 2008.	Health and Safety training was carried out on a monthly basis. See training matrix for details. Refresher training in the Emergency Response Procedure was carried out during 2008 and several emergency drills were also carried out.

15 ENVIRONMENTAL OBJECTIVES AND TARGETS FOR YEAR AHEAD

Table 15.1 – Environmental Objectives and Targets for 2009

Originated from	Objective	Target including timescale	Project no.
AER 2008	Awareness and training programme	Carry out continued ISO and Health and Safety Training	1
AER 2008	Assess and review resource and energy consumption at the site	Carry out energy efficiency and resource use audit during Autumn 2009.	2
AER 2008	Review and assess the effectiveness of nuisance control procedures	Continually review and assess all nuisance control procedures to ensure minimal impact on surrounding area. Update reports on bird control and odour abatement measures.	3
AER 2008	Minimise nuisance from vehicle movements and uploading / tipping	Ensure noise, dust, odour from vehicle movements are minimised by correct implementation of relevant operational protocols (for timescale see project sheet)	4
AER 2008	Continue to improve relationships with neighbouring communities / reduce environmental complaints	Develop communications with site neighbours and respond to queries as quickly as reasonably practicable, ensuring that any complaints are followed up in writing as soon as possible after receipt of complaint (for timescale see project sheet).	5
AER 2008	Develop Landfill Gas Collection Infrastructure and gas utilisation plant.	Extend gas collection infrastructure to Cells 6 and 7. Install additional back up flare. Progress LFG utilisation plant set up.	6
AER 2008	Monitor progress of planting programme on a regular basis	Regularly review planted woodland area and ensure the replacement of any failed trees to ensure visual impact of site is minimised (for timescale see project sheet).	7

16 PROCEDURES DEVELOPED BY THE LICENCEE IN THE YEAR WHICH RELATES TO THE FACILITY OPERATION

Work procedures developed during the reporting period with respect to the operation of the facility are detailed below.

Table 16.1 Work procedures developed at the facility

Title	Date	Description
F09 Managing landfill gas	06/12/08	This procedure ensures that the landfill gas is managed effectively to prevent odours emanating from the site including during adverse weather conditions.
F09a(ix) Engineering purposes	06/12/08	This procedure has been established as a guide to determining engineering, restoration or remediation purposes for wastes.
F09r Boundary odour monitoring procedure	01/04/08	The purpose of this procedure is to ensure that boundary odour monitoring is carried out in an effective and efficient manner to avoid environmental non-compliances or nuisance impact or pollutants and in accordance with regulatory and BAT requirements.
F09s Optimisation of the odour suppression system	01/04/08	The purpose of this procedure is to ensure that, when utilising the odour suppression system at Ballynagran, it operates in a safe and controlled manner while complying with Condition 7.1 of the licence which states " <i>any method used by the licensee to control any such nuisance shall not cause environmental pollution</i> ".
F09w Procedure for the construction of landfill gas vents	28/05/08	This procedure details the health and safety requirements and procedure for construction of landfill gas passive vents.
F09x Gas collection pipework fusion welding	13/08/08	Methodology and safe practice for use of fusion welder and associated equipment for landfill gas collection pipework welding.
F09y Drilling and installation of gas extraction points	13/08/08	Method for drilling and installation of gas extraction points on the landfill.
F09z Acceptance of healthcare waste	06/12/08	This procedure provides specific instructions for acceptance of non-infectious and non-risk healthcare wastes to minimise the already low risks in managing these wastes.

17 SITE TESTING REPORTS

17.1 Tank, Pipeline & Bund Testing & Inspection Reports

No testing required during 2008 for the following which are scheduled for 3 yearly testing.

Table 17.1 Bund Integrity Test Summary

Description	Contractor	Service Interval	Next Service / Calibration Due
Wheelwash Bund Test	SLR Consulting Ltd	3 yearly	13.10.09
Fuel Tank Bund	SLR Consulting Ltd	3 yearly	13.10.09
4 x 250 litre spill pallets	Bunzl Safety Ltd	3 yearly	12.06.10
227 litre spill pallet	Bunzl Safety Ltd	3 yearly	12.06.10
25 litre containment sump for odour neutralising chemical	Bunzl Safety Ltd	3 yearly	12.06.10

17.2 Slope Stability Testing

A slope stability test report was submitted to the Agency separately to the AER report.

18 REPORTED INCIDENTS AND COMPLAINTS SUMMARIES

The site had four minor incidents of Non Urgent Category 3 level with regard to trigger levels specified in condition 6.4.2 of the licence and five minor incidents of Non Urgent Category 3 level excess emissions specified in Schedule C of the licence. These were reported to the agency as soon as the licensee was notified.

The site received 62 complaints during 2008. The table of complaints is included in Appendix C.

A summary of the overall number of complaints and issues are:

- 61 complaints with regards to odour.
- 1 complaint with regards to flooding.

Complaints were responded to via the complaints procedure.

19 REVIEW OF NUISANCE CONTROLS

In accordance with Condition 7 of the waste licence, Greenstar is committed to ensure that the facility does not give rise to nuisance at the facility or in the immediate area of the facility. The potential sources of nuisance at a landfill facility are odour, vermin, birds, flies, mud, dust and litter. A procedure, BRL 23 Completion of Daily Site Condition Reports has been drawn up to comply with Condition 7 and is being carried out at the facility. To adhere with procedure BRL 23, a form GS001 is completed daily. This is completed as part of the standard site operating procedures.

Odour

In accordance with Condition 8.12.2 of the waste licence, Greenstar has submitted a programme to the Agency for the monitoring and assessment of odours emissions

arising from the facility. An odour control and monitoring procedure (BRL 30) has been drawn up and carried out in 2008.

Good operational practices on site are the main controls to avoid odour nuisances. Procedures on the Operation Start-Up and Shut-Down (BRL 15) and Waste Acceptance (BRL 26) deal with the handling, depositing and covering of waste at Ballynagran Residual Landfill. These procedures have been written in accordance with the Landfill Manual .Landfill Operational Practices., published by the Environmental Protection Agency and are incorporated into the odour control and monitoring procedure onsite.

Landfill gas extraction wells and a landfill gas flare are currently in operation. This active gas extraction system allows for the long term control of any potential odours. Independent experts Odour Ireland conducted monitoring on behalf of the Office of Environmental Enforcement in September. The PID/FID survey highlighted areas where there could be potential for VOC escape, by measuring VOC levels around the landfill area. Recommendations from their study of the site have been implemented.

In accordance with daily condition reports (GS 001) odour inspections have been carried out on a daily basis by site staff at the facility, agreed locations in the surrounding areas with the agency and also in response to any odour complaints. In the monitoring period there have been 61 complaints in relation to odours and these are dealt more specifically in Reported Incidents and Complaints.

Litter

Litter is controlled by fencing which was installed around the landfill footprint as specified in the waste licence. Portable litter fencing is also used at the working face, which can be moved to various points around the working face depending on the wind direction. Litter inspections are carried out and recorded as part of the daily inspection, which is outlined in the Completion of Daily Site Condition Reports (BRL 23) and the Procedure for Litter Prevention & Assembly/Disassembly of Nets (BRL 18). The presence of litter shall be noted on the Inspection Form and removed immediately if practicable. Any litter noted at or outside the boundary fence, which appears to be illegally dumped, shall be inspected

for any indications of identity if possible and reported to the Facility Manager.

Vermin and Birds

Inspections for vermin shall be carried out on a weekly basis for rodents etc. and on a daily basis for birds, in particular crows. Specialist contractors are employed by Greenstar to control vermin and birds on the facility. Vermin control measures used as part of this programme includes internal and external bait boxes, rodenticides and insect control measures. The specialist contractor visits the site at regular intervals throughout the year to inspect the control measures and assess their effectiveness. These control measures have found to be successful. Any observations made during inspections shall be recorded on the Daily Site Condition Report (GS 001).

Flies

Particularly during the warmer months, attention shall be paid to observations of flies. Any observations shall be recorded on the Daily Site Condition Report (GS 001). The Facility Manager or the Site Supervisor shall be notified immediately in order to take measures to eliminate any fly populations from establishing.

Mud and Dust

The site roads shall be inspected on a daily basis for mud or dust and any observations recorded on the Daily Site Condition Report (GS 001). Special attention shall be paid to dust during the dry months and mud during the wet months and the Site Supervisor or the Facility Manager will be notified immediately in order to take measures to minimise or eliminate any potential nuisances arising from mud or dust accumulating on site roads. Some measures include the use of a wheelwash, road sweeper and the use of a water bowser to dampen access roads and stockpiles during periods of dry weather.

20 FINANCIAL PROVISION, STAFF TRAINING & LOCAL ENTERPRISE PROJECTS

20.1 Financial Provisions made under licence

During 2008 the EPA Bank Guarantee was reviewed and is in place for € 1,662,504. A copy of the bond was sent to the Agency during January 2009.

20.2 Management and Staffing Structure

The management and staff structure is given in Table 20.1 following.

20.3 Report on staff training

The report on staff training is presented in the table below. See Table 20.2 following.

20.4 Programme for Public Information

Ballynagran Residual Landfill pursues an active programme of disseminating information on its operations to interested parties. This is undertaken through a variety of means including site tours, the company website, presentations and open days.

During 2008 a number of specific information activities were undertaken:

In July 2008, the facility held an open day which was attended by many local residents. During 2008 a short film was also produced which detailed how the facility was constructed and is operated. The film is shown to anybody visiting the facility. The site accommodated all requests for site visits and tours.

The overall communications programme contains the following objectives:

- To promote public awareness of the Company's activities and environmental policies.
- To maintain an ongoing dialogue with authorities that have direct involvement with waste disposal activities.
- To make available Environmental Performance Data relating to the site

- To disseminate information relating to the operation and management of the site as appropriate.
- To encourage liaison between the site and local residents and those who may be affected by the site operations.
- To provide general information on Waste Management Issues.
- To ensure all users and customers of the site are conversant with the requirements of the Site Licence.
- To ensure that all objectives are, where possible, measurable and quantifiable.

The objectives of the programme are met through the following elements as appropriate:

- Personal Contact
- Residents Meetings/Liaison Groups
- Information Displays
- Information Packs
- Site Visits
- Web Page
- Educational Links
- Published Information

20.5 Report on use of gate charges in Local Improvement Projects

The liaison committee for allocating these funds is in the process of being established by Wicklow County Council at the moment. In the meantime funds are being accrued on a daily basis. Once the committee is established these funds will be distributed accordingly. It is expected that Wicklow County Council will establish the committee during 2009 and that distribution of funds will also commence during 2009.

21 REPORT ON PROGRESS IN MEETING LANDFILL DIRECTIVE TARGETS REQUIREMENTS

The site is fully compliant with the requirements of the Landfill Directive.

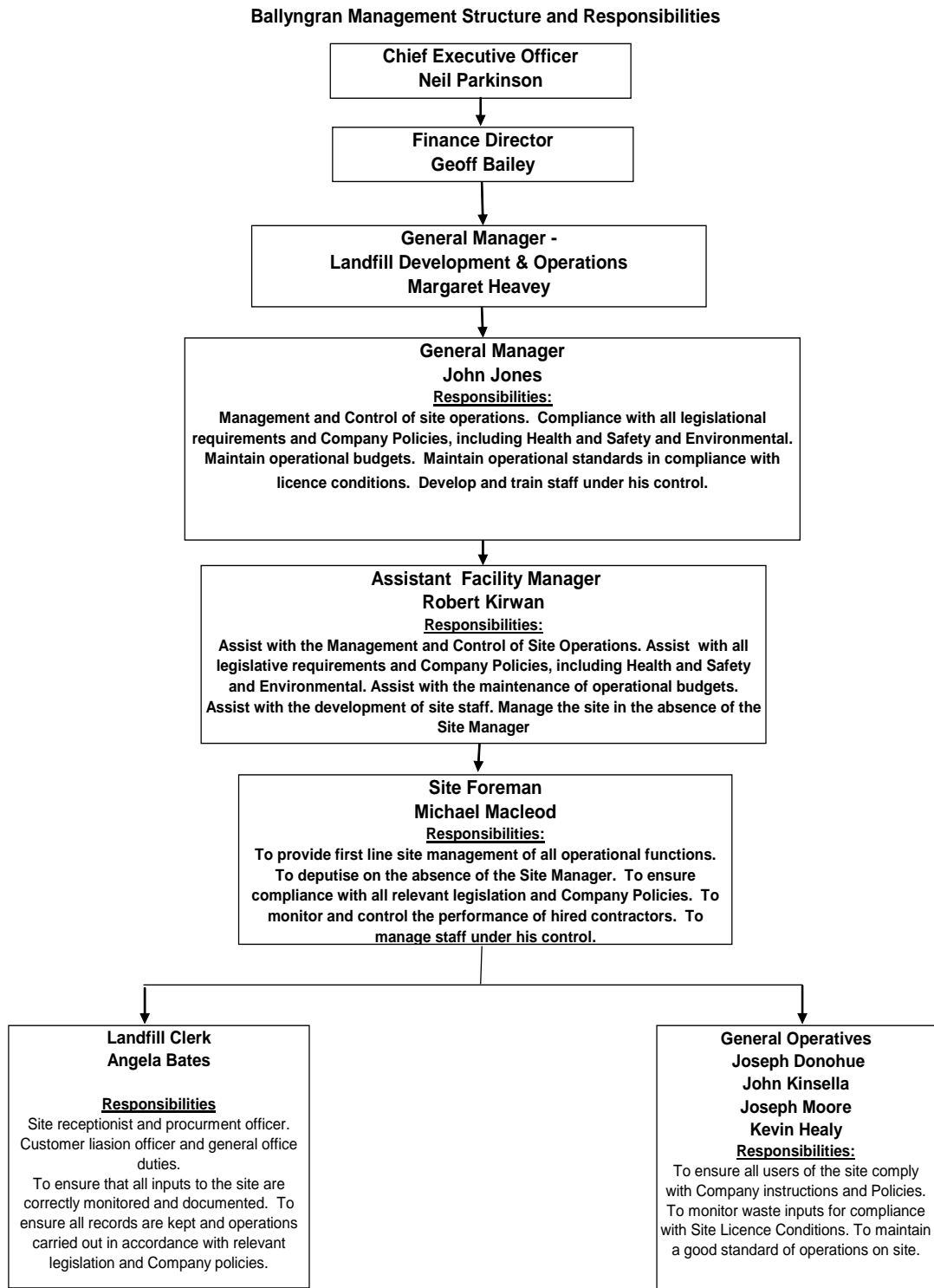
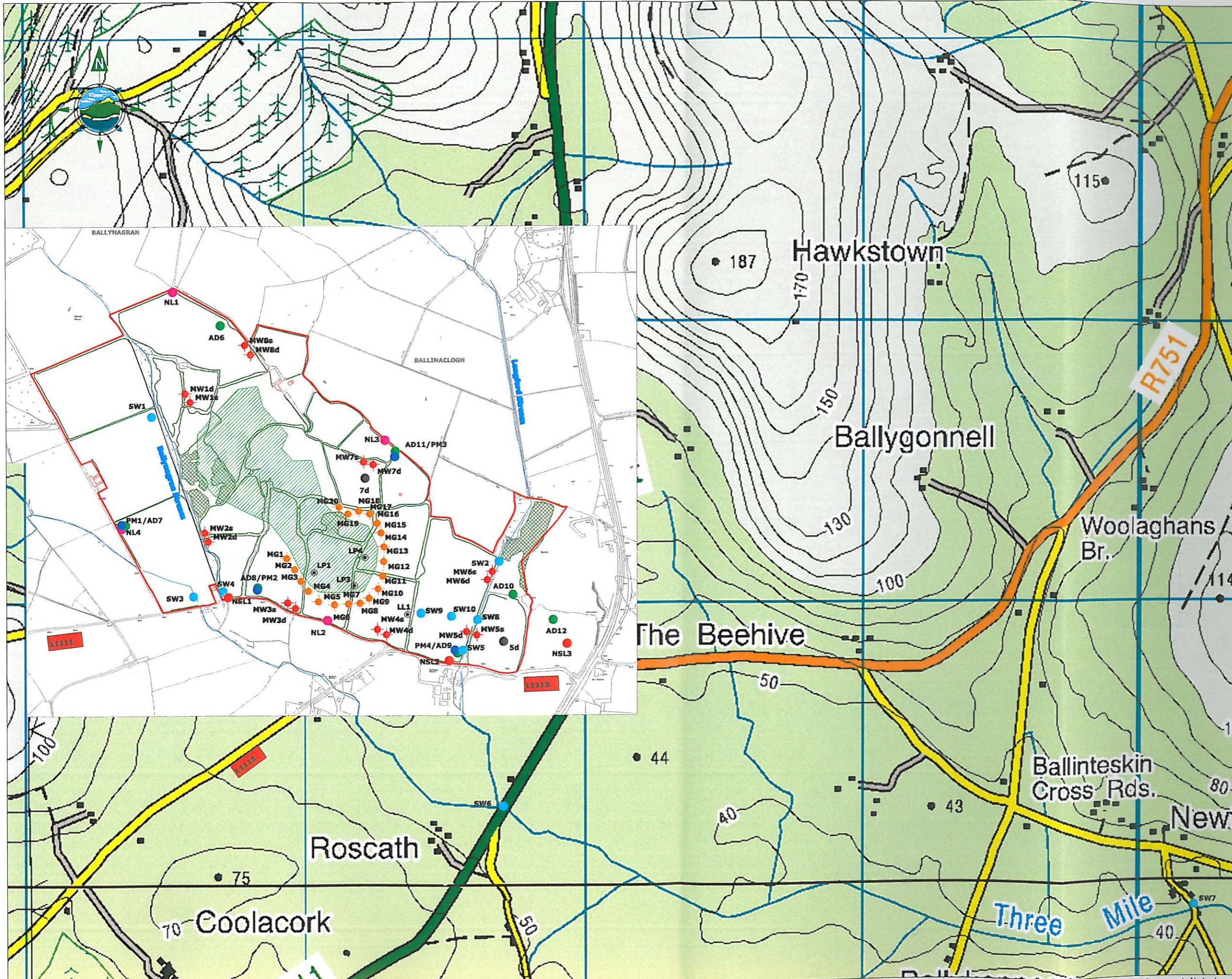
Table 20.1 Management & Staff structure at Ballynagran Landfill

Table 20.3 : Report on staff training	JONES, John	MACLEO D, Michael	KIRWAN, Robbie	DONOHU E, Joseph	MOORE, Joseph	HEALY, Kevin	KINSELLA , John	BATES, Angela
Cherry Picker Operation Course / Aerial Platform Hire Ltd		May-08		May-08				
Communication Skills / LGR Training	Aug-08	Aug-08						
Dumptruck Operation / T Duignan					Jan-08	Jan-08	Jan-08	
Emergency Response Drill / John Jones	Oct-08	Oct-08	Oct-08	Oct-08	Oct-08	Oct-08	Oct-08	Oct-08
Environmental Awareness training / Robert Kirwan	Jun-08	Jun-08	Jun-08	Jun-08	Jun-08	Jun-08	Jun-08	
FAS Waste Management Course								Autumn 08
Gas Management / CIWM	Jul-07	Jul-08	Mar-08					
Gas System Checks and Balancing / John Jones			Jan-08					
Refresher H&S Statement and Risk Assessments / Jim Duff	Apr-08	Apr-08	Apr-08	Apr-08	Apr-08	Apr-08	Apr-08	
IOSH Managing Safety Course	Jan-08		Jan-08					
ISO Training / Robbie Kirwan	Apr-08	Apr-08	Apr-08	Apr-08	Apr-08	Apr-08	Apr-08	Apr-08
KNK EMS system / R Wilkes								Apr-08
Senior Management Legal Briefing / Ray Byrne NIFAST	Nov-08							
TBT Banksmans Procedures / John Jones	Oct-08	Oct-08	Oct-08	Oct-08	Oct-08	Oct-08	Oct-08	Oct-08
TBT Compaction of covering waste / John Jones	Mar-08	Mar-08			Mar-08	Mar-08	Mar-08	Mar-08
TBT Fire Safety DVD / J Jones	Aug-08		Aug-08	Aug-08	Aug-08	Aug-08	Aug-08	Aug-08
TBT Horrific Accidents DVD / J Jones	Apr-08	Apr-08	Apr-08		Apr-08	Apr-08	Apr-08	Apr-08
TBT Manual handling DVD / J Jones	Sep-08	Sep-08	Sep-08		Sep-08	Sep-08	Sep-08	Sep-08
TBT Safe use of Pressure Washer / Micheal Macleod	Feb-08	Feb-08	Feb-08	Feb-08	Feb-08	Feb-08	Feb-08	Feb-08
TBT Slips, Trips and Falls / DVD Safety Media	Jun-08	Jun-08		Jun-08	Jun-08	Jun-08		Jun-08
TBT Litter prevention and litter cages assembly / disassembly / MM	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08
TBT Suppression of dust / MM	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08
TBT Vermin control / MM	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08
TBT Handling tipping vehicles / MM	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08
TBT Random inspection of incoming loads / MM	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08
TBT Lone working process / MM	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08
TBT Handling and storage of batteries / MM	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08
TBT Record of tipping location / MM	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08
TBT Procedure for construction of landfill gas vents / MM	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08	Nov-08

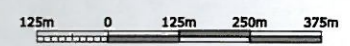
APPENDIX A

Site Location Map



- LEGEND**
- LL/P Leachate Monitoring location
 - MG Gas Well Monitoring location
 - MW Ground Water Monitoring location
 - NL3 Boundary Noise Location
 - NSL1 Noise Sensitive Location
 - AD7 Dust Monitoring Location
 - PM1 PM10 Monitoring Location
 - 7d Groundwater Monitoring Location
 - SW1 Surface Water Monitoring / Rock Sampling Location
 - Landfill Footprint
 - Site Boundary

- NOTES**
1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING
 2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
 3. ENGINEER TO BE INFORMED BY THE CONTRACTOR OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES
 4. ALL LEVELS SHOWN RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD



Rev	Date	Description	By	Chkd.
D02	19/02/08	ISSUED FOR REVIEW	DA	BT
D01	02-07-07	ISSUED FOR REVIEW	MN	BT

Client:  **greenstar**
verifying the standard

Project: **BALLYNAGRAN RESIDUAL LANDFILL**

Title: **ENVIRONMENTAL MONITORING LOCATIONS**

Scale @ A3: **ST**

Prepared by: **M. Nolan** Checked: **S. Tinnelly** Date: **July 2007**

Project Director: **D. Grehan**

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Drawing No.: **3756-101-01D02** Revision:

APPENDIX B

Complaints register



BALLYNAGRAN RESIDUAL LANDFILL
COOLBEG, WICKLOW, COUNTY WICKLOW
Tel : 0404 25540
Fax : 0404 25515

COMPLAINTS REGISTER 2008

Complaint No.	Date Received	Complainant	Issue	Corrective Action	Number of Complaints	Date Closed
51	03.01.08	Mr Mulvihill	Odour	Site Inspection carried out. No odour at boundary	1	03.01.08
52	11.02.08	Mr Mulvihill	Odour	Site Inspection carried out. No odour at boundary	1	11.02.08
53	12.02 – 15.02.08	Mr Mulvihill	Odour	Site Inspection carried out. No odour at boundary	3	12.02 – 15.02.08
54	17&18.02.08	Mr Mulvihill and Mr Vincent Mulvihill	Odour	Site Inspection carried out. No odour at boundary	2	17&18.02.08
55	16.03, 18.03 & 19.03.08	Mr Mulvihill	Odour	Site Inspection carried out. No odour at boundary	3	16.03, 18.03 & 19.03.08
56	22.03, 23.03 & 24.03.08	Mr Mulvihill	Odour	Site Inspection carried out. No odour at	3	22.03, 23.03 & 24.03.08

				boundary		
57	05.04 - 08.04.08	Mr Mulvihill	Odour	Site Inspection carried out. No odour at boundary	4	05.04 - 08.04.08
58	14.04.08	Mr Mulvihill	Odour	Site Inspection carried out. No odour at boundary	1	14.04.08
59	21.04.08	Mr Mulvihill	Odour	Site Inspection carried out. No odour at boundary	1	21.04.08
60	07.05 to 15.05.08	Mr Mulvihill	Odour	Site Inspection carried out. No odour at boundary	7	07.05 to 15.05.08
61	23&28.05.08	Mr Mulvihill	Odour	Site Inspection carried out. No odour at boundary	2	23&28.05.08
62	26&28.05.08	Mrs Joanne Verdes	Odour	Site Inspection carried out. No odour at boundary	2	26&28.05.08
63	01.06 to 12.06.08	Mr Mulvihill	Odour	Site Inspection carried out. No odour at boundary	5	01.06 to 12.06.08
64	05.07 to 07.07.2008	Mr Mulvihill	Odour	Site Inspection carried out.	2	05.07 to 07.07.2008

				No odour at boundary		
65	24.07 to 28.07.2008	Mr Mulvihill and Mr Vincent Mulvihill	Odour	Site Inspection carried out. No odour at boundary	2	24.07 to 28.07.2008
66	05.08 to 07.08.2008	Mr Mulvihill	Odour	Site Inspection carried out. No odour at boundary	2	05.08 to 07.08.2008
67	21.08.2008	Mr Mulvihill	Odour	Site Inspection carried out. No odour at boundary	1	21.08.2008
68	18.08.2008	Mr Mulvihill	Flooding	Site Inspection carried out. Landfill activity not responsible for flooding. Surface water samples taken	1	18.08.2008
69	16.09.08, 22.09.08, 23.09.08, 28.09.08	Mr Mulvihill	Odour	Site Inspection carried out. No odour at boundary	4	16.09.08, 22.09.08, 23.09.08, 28.09.08
70	05.10.08	Mr Mulvihill	Odour	Site Inspection carried out. No odour at boundary	1	05.10.08
71	11.10 to	Mr Mulvihill	Odour	Site	2	11.10 to

	13.10.08			Inspection carried out. No odour at boundary		13.10.08
72	16.08.08	Mr Mulvihill	Flooding	Site Inspection carried out. No odour at boundary	1	16.08.08
73	30.10.08 31.10.08 01.11.08 02.11.00 03.11.08 04.11.08	Mr & Mrs Mulvihill	Odour	Site Inspection carried out. No odour at boundary	6	30.10.08 31.10.08 01.11.08 02.11.00 03.11.08 04.11.08
74	05.11.00 15.11.08 16.11.08	Mr Mulvihill	Odour	Site Inspection carried out. No odour at boundary	3	05.11.00 15.11.08 16.11.08
75	24.11.08	Mr Mulvihill	Odour	Site Inspection carried out. No odour at boundary	1	24.11.08
76	06.12.08	Mr Mulvihill	Odour	Site Inspection carried out. No odour at boundary	1	06.12.08

Incident Register 2008 for Greenstar Ballynagran Residual Landfill

Incident no.	Type of incident	Date of incident	Date of incident report	Details of incident
I-005	Excess Emission	Feb - March 08	17-Apr-08	Ambient dust limit 350 mg/m ³ at AD6
I-006	Excess Trigger Level	01-May-08	22-May-08	Elevated Ammonia levels at monitoring wells MW3d
I-007	Excess Trigger Level	03-Apr-08	17-Jul-08	Elevated Ammonia levels at monitoring wells MW3d, elevated Chloride and pH at MW2s, elevated pH at MW2d and MW1d
I-008	Excess Trigger Level	30-Jul-08	14-Oct-08	Elevated Ammonia at MW 3d, 2s, 3s, 4s and 7s and pH at MW1d
I-009	Excess Emission	30-Aug-08	14-Oct-08	Ambient dust limit 350 mg/m ³ at AD6
I-010	Excess Emission	30-Aug-08	16-Oct-08	NSL2 and NSL3 over 55dB limit
I-011	Excess Trigger Level	29/30-Oct-08	16-Jan-09	Elevated Ammoniacal N at MW1d, 3s, 2s, 4d, 5s. pH at MW 1d and 2s
I-012	Excess Emission	28-Nov-08	16-Jan-09	NL1, NSL2 and NSL3 over 55dB limit
I-013	Excess Emission	20-Nov-08	16-Jan-09	Suspended Solids over 35mg/l at SW9 and SW10

APPENDIX C

Odour Monitoring results

Date **30th September 2008**

GA2000 Reading

Location	Time	FID Reading	CH4	CO2	O2	Odour detected by Olfactory Means
OD2	12.15	0.0	0.0	0.1	20.8	None
OD3	12.25	0.0	0.0	0.1	20.8	None
OD4	12.35	0.0	0.0	0.1	20.8	None
OD5	12.45	0.0	0.0	0.1	20.8	None
OD6	12.55	0.0	0.0	0.1	20.8	None
OD7	13.05	0.0	0.0	0.1	20.8	None
OD8	13.15	0.0	0.0	0.1	20.8	None
OD9	13.25	0.0	0.0	0.1	20.8	None
OD10	13.35	0.0	0.0	0.1	20.8	None
OD11	13.45	0.0	0.0	0.1	20.8	None

Wind Speed 17km/hr - 23 km/hr
Wind Direction west south west



Date **22nd December 2008**

GA2000 Reading

Location	Time	CH4	CO2	O2	Odour detected by Olfactory Means
OD2	8.15	0.0	0.1	20.8	None
OD3	8.25	0.0	0.1	20.8	None
OD4	8.35	0.0	0.1	20.8	None
OD5	8.45	0.0	0.1	20.8	None
OD6	8.55	0.0	0.1	20.8	None
OD7	9.05	0.0	0.1	20.8	None
OD8	9.15	0.0	0.1	20.8	None
OD9	9.25	0.0	0.1	20.8	None
OD10	9.35	0.0	0.1	20.8	None
OD11	9.45	0.0	0.1	20.8	None

Wind Speed 14 km/hr
Wind Direction SW 243 degrees



APPENDIX D

Energy Audit Report

ENERGY AUDIT
GREENSTAR LTD.
BALLYNAGRAN RESIDUAL LANDFILL
WASTE LICENCE NO. W0165-01

Prepared For: -

Greenstar Ltd.,
Ballynagran Residual Landfill,
Ballynagran,
Co Wicklow

Prepared By: -

O' Callaghan Moran & Associates,
Granary House,
Rutland Street,
Cork

23rd February 2009

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APPENDIX 1 - Energy Consumption Information

1. INTRODUCTION

O’Callaghan Moran & Associates (OCM) was appointed by Greenstar Ltd. (Greenstar) to undertake an energy efficiency audit of their landfill facility at Ballynagran County Wicklow. The facility is a non-hazardous residual landfill and operates under Waste Licence (W0165-01) issued by the Environmental Protection Agency (Agency).

The objective of the audit, which was carried out in accordance with the guidance published by the Agency - “Guidance Note on Energy Efficiency Auditing (2003)” was to identify all opportunities for energy use reduction and efficiency.

1.1 Audit Process

The audit was carried out in accordance with the Agency’s Guidance Note and included a site visit on 4th December 2008. At the time of the site visit the facility was fully operational. The weather was cold, with intermittent rain showers and a moderate south easterly breeze.

The Facility Deputy Manager, Mr. Robert Kirwan, was interviewed and provided information on facility activities, energy usage and resource consumption. A site inspection was carried out, which included the administration buildings, maintenance building, operational areas, landfill gas flare, leachate storage lagoon and surface water storage lagoon.

The Guidance Note recommends at least twelve months of data on the various energy using systems. Electricity meter records for the period between the beginning of November 2007 and beginning of November 2008 and records of diesel use from January to December 2008 formed the basis for the assessment of consumption levels.

2. SITE LAYOUT & ACTIVITIES

2.1 Site Location

The site, which encompasses approximately 128 ha, is located on the eastern side of the Wicklow Mountains in the townlands of Ballynagran, Coolbeg and Kilcandra. It is approximately 5 km to the south west of Wicklow Town and 1.5 km to the south east of Glenealy. It is on the southern side of an east-west ridge at an elevation between 52 and 147 m Ordnance Datum (OD).

The setting is predominantly rural, with dispersed residential dwellings. The site is bounded to the south by a country road (L1111 / L1113), to the east by a green waste composting facility, and to the north and west by agricultural lands – a mix of pasture and tillage. There is a former concrete batching plant to the east of the composting facility and further east is the N11 national primary route.

2.2 Site Layout and Description

The facility is a non-hazardous waste residual landfill, which is licensed to accept up to 175,000 tonnes of Household, Commercial and Industrial Non-Hazardous waste per annum for disposal and up to 28,000 tonnes of Construction and Demolition Waste for recovery purposes. The site layout is shown on Drawing No. 3 and the facilities used include: -

- Waste Reception Area;
- Weighbridges (2 No.);
- Wheel Wash;
- Waste Quarantine & Inspection Areas;
- Landfill Cells;
- Leachate Storage lagoon;
- Surface Water Pond;
- Administration Block (offices, stores, canteen, toilets and showers);
- Standby Generator (Diesel);
- Oil Storage Tank & Bund;
- Security Fencing.

The facility will be developed in five phases. The initial phase involved the provision of five (5) landfill cells (1, 2, 3, 4 and 5A/B), and the entire supporting infrastructure. In 2007 the Agency approved the development of two additional cells (Cells 6 and 7), which were constructed in 2008 but were not active during the reporting period. An active gas abstraction and flaring system was commissioned in April 2007. Subsequent phases will involve the provision of additional landfill cells and the associated expansion of leachate, landfill gas and surface water control measures.

2.3 Activities:

2.3.1 Overview

All waste delivery vehicles are inspected and recorded at the weighbridge. Following acceptance at the weighbridge, waste carrying vehicles drive to the active landfill cell, where they discharge their load. The waste is then spread and compacted using a steel-wheeled diesel fuelled landfill compactor. There are two diesel fuelled excavators and a dozer which are used mainly to place daily cover material, which is delivered by road vehicles and stockpiled adjacent to the active fill area. The excavators, dozer and compactor are the most significant users of diesel at the facility.

Landfill gas is actively abstracted from the fill areas using electrically powered pumps. The gas was initially flared in an open flare between November 2007 and March 2008. The open flare was replaced by an enclosed flare in March 2008. This is discussed in more detail in Section 2.2.4. Leachate is pumped from the cells and sanitary wastewater is pumped from the Administration Block to the leachate storage lagoon using electrically powered pumps. Further details are provided in Section 2.2.5.

2.3.2 Weighbridge & Administration Block

The Weighbridge Office and Administration Block contain offices, meeting room, welfare and canteen facilities and a supervisory control and data acquisition system (SCADA) room, all of which are provided with lighting and electrically powered heating units. A list of the electrically powered items in the buildings is shown on Tables 2.2.-2.3.

Table 2.2 – Weighbridge

No.	Item
1	Electric Wall Mounted Heater
1	Microwave
1	Air Conditioner
2	PCs & Screens
1	Photocopier & Printer
3	Double Fluorescent Lights

Table 2.3 – Main Administration Block including Canteen

No.	Item
9	Electric Wall Mounted Heaters
5	Air Conditioners
3	PCs & Screens
3	Printers
1	Shredder
7	Halogen Lights
17	Double Fluorescent Lights
3	Single Fluorescent Lights
2	Toaster
1	Microwave
1	Dishwasher
1	Fridge
1	Clothes Washer
2	Electric Showers
3	Hand dryers
1	Kettle
1	SCADA System
1	Photo copier

2.3.3 Maintenance Garage

Maintenance of the fixed and mobile plant is carried out in the on-site garage. The garage is provided with electrical lighting, but there is no heating system. There is a skid steer road sweeper, quad bike and a small diesel generator stored at the garage, which use small amounts of diesel.

2.3.4 Gas Flares

In 2008 the active gas extraction and flaring system comprised thirty (30 No.) vertical gas wells, twelve (12) spike wells and nine (9) horizontal wells in the body of the waste, one (1) condensate knockout pot and two (2) flares. The flares used included an open 500m³/hour flare, which was operated between November 2007 and March 2008 and a new 2,500m³/hour enclosed flare which was commissioned in March 2008 and ran continuously for the rest of the reporting period. The open flare is retained on site as a back-up and was only used occasionally.

As the facility only began accepting waste at the end of 2006, the volume of landfill gas is not yet sufficient to generate electricity. It is expected that a gas utilisation plant will be installed in 2010. The size of the utilisation plant will depend on the outcome of pumping and flaring trials. The utilisation plant will be benchmarked against the systems used at Greenstar's KTK and Knockharley landfills.

2.3.5 Leachate Management

The facility is designed to minimise leachate generation. Surface water run-off and groundwater flow is directed away from the fill area by means of interceptor drains installed outside the landfill cells.

The leachate collection system in the individual landfill cells drains by gravity to leachate collection sumps. Leachate accumulating in the cells is pumped from the collection sumps located inside the cells via side risers to the leachate main, from where it flows to a leachate storage lagoon.

In the reporting period there were four (4 No.) electrically powered (1.5 kW) submersible leachate pumps in operation within the cells. These pumps are ATEX rated to operate in explosive atmospheres. There is also a pump (1.5kW) used to collect composite samples of leachate for environmental monitoring purposes, which is used once per month for ten minutes.

Sanitary wastewater from the Administration Block is pumped using one (1 No.) electrically powered 1.5kW pump to the leachate storage tank.

2.3.6 Surface Water Pumping

There is one pump (2.2 kW) used to discharge surface water from the surface water storage lagoon to a wetland.

2.3.7 Ground Water Pumping

Groundwater intercepted by a drainage layer beneath the cells is directed to a sump, from where it is pumped using three 1.5kW pumps to surface water swails. The pumps operate approximately once per week.

2.3.8 External Lighting

Area lighting comprising fourteen (14 No.) halogen lights fitted to standards are provided from the site entrance to the maintenance shed. They are all fitted with photocell daylight sensors and time clocks. There are also twelve (12) area lights around the weighbridge which are fitted with photocell daylight sensors and time clocks. These are turned off when not required. There are three (3) small safety lights around the lagoons, which are fitted with photocell daylight sensors and motion detectors.

3. CURRENT ENERGY USE

3.1 Electricity Consumption November 2007 – November 2008

The following electricity consuming energy systems were operational in the reporting period:-

- Landfill gas abstraction and flaring;
- Leachate/Waste water pumping;
- Surface water pumping;
- Groundwater Pumping,
- Office lighting;
- Office heating;
- Area lighting;
- Office IT.

There is only one electricity meter on-site, which provides data for the entire facility and therefore a breakdown of the usage by the individual energy systems is not available. A copy of the electricity bills between November 2007 and November 2008 are included in Appendix 1. Electricity consumption was estimated where possible using the kW/hr rating and operational hours. The estimates are presented in Table 3.1.

Table 3.1 – Electricity Consumption

Energy System	kWh/year	% of total	Cost (€)	Comments
Enclosed Flare (9kw)	59,400	33	6,568	In operation 6,600 hours at 9kw
Open Flare (5kw)	25,620	15	2,985	In operation 5,124 Hours at 5kw
Leachate Pumps	18,118	10	1,990	14,128 m ³ pumped by four 1.5kw. Sanitary 1.5kw. Sampler pump.
Outdoor Lights	7,247	4	796	14 outdoor halogen lights used and provided with daylight sensors. 12 area lights, 3 motion sensor lights
Offices Lights	9,059	5	995	No time/daylight controls
Offices Electrical Heating	36,235	20	3,980	Wall mounted storage heaters. Manually controlled, individual thermostat
Groundwater Pumps	7,247	4	796	3 1.5kw pumps operated approximately once per week
Surface Water Pump	9,636	6	1,194	1 pump (2.2kw) lagoon to wetland Assumed to operate six months per annum
Other	5,435	3	597	PCs, printer, photocopier, SCADA, CCTV Maintenance Shed. Misc
Total	181,174	100	€19,905	

The total consumption of electricity at the facility was 181,174 kWh, which cost €19,905 (excluding VAT, capacity and standing charges). The average cost is 0.10c per unit, which comprises a daytime kWh cost of approximately 0.1384c and 0.0680c for night time.

3.2 Diesel

A breakdown on diesel usage in 2008 is presented in Table 3.2 and Appendix 1. The volume was calculated from fuel delivery logs. Some of the diesel fuelled equipment used in day to day operations are owned and operated by a separate contracting company - Rentons. Table 3.2 includes all of diesel used on site by both Greenstar and the contractor. The average cost of diesel was 0.70c per litre.

Table 3.2 – Onsite Day to Day Diesel Usage Totals 2008

User	Volume (litre)	Cost € 0.70c/l	Comments
Contractor	125,011	87,507	Compactor & Excavator - Rentons
Greenstar	35,020	24,514	Greenstar Vehicles

3.3 Carbon Footprint

The total carbon footprint for the facility is estimated at 428 tonnes of Carbon Dioxide (CO₂) per annum, which is negligible in the context of national CO₂ emissions per annum. The carbon emissions are from diesel energy consumption (2.68kg/litre) (plant, equipment and vehicles) at the facility in 2008.

The electricity supplier is Airtricity, who generate power from renewable sources. This means there is zero carbon emissions from this source, which has resulted in a reduction of an estimated 260 tonnes of CO₂ released to the air in the reporting period. The Airtricity summary of consumption sheet is included in Appendix 1.

4. EXISTING ENERGY MANAGEMENT SYSTEM

The Agency's Guidance Note is targeted at industrial sites, which typically have multiple and complex energy systems and high consumption rates of different energy sources (e.g. electricity, natural gas, fuels). A landfill, while it can occupy a large physical footprint, has more simple energy systems and relatively low consumption rates.

A landfill is a significant source of greenhouse gas emissions, not through the use of fossil fuels, but as a result of the production, capture and flaring of landfill gas. It is intended to install a landfill gas utilisation plant at the facility in 2009, which will generate electricity and thereby achieve a negative carbon footprint.

4.1 Energy Management System

The objective of an Energy Management System is to make the best possible use of the energy consumed at a particular facility. An energy management system may include the following elements: relevant policies, procedures, action plans, responsibility chains, training, awareness and motivation, data collection and monitoring systems.

The Agency's Guidance Document presents an energy management matrix to assist in the assessment of the status of the different key elements that comprise the system. The facility's existing management system is assessed below using the categories set out in the Matrix.

4.2 Energy Policy

The facility operates an Environmental Management System and has achieved ISO 14001 accreditation. This EMS includes the adoption of an environmental policy. The facility management team is aware of the importance of energy savings and does apply unwritten guidelines. However a facility specific documented energy policy has not yet been prepared.

The purpose of the policy is to provide the supporting framework for the implementation of measures to ensure that energy is actively managed in day to day activities and that the assessment of energy efficiency is an integral part of the procurement process for plant items during the lifetime of the facility.

4.3 Organising

Facility management is already aware of the need for energy efficiency in the operation of the facility. The areas of responsibility have been clearly defined and are to be documented in job descriptions. The Facility Manager is scheduled to receive formal training in energy management issues.

4.4 Motivation

At present the need for efficient energy management is not communicated to the facility staff. However, given the relatively small number of site staff and the active involvement of the Facility Manager and Deputy Manager in day to day operations, it is considered that there are adequate channels of communication to ensure that facility staff can be adequately informed of energy management measures.

4.5 Information Systems

There is one electricity meter on-site, which provides data for the entire facility. There are no sub meters so a breakdown of the actual usage by individual energy systems (flares, lighting, pumps storage heaters) is not available.

The data provided by Airtricity allows an assessment of total consumption, broken down into daily and night time on a bi-monthly basis which allows seasonal changes in usage patterns to be determined. Less electricity was used in the summer months (20,080 units May- June 35,056 units September-October), as would be expected with reduced demand for lighting and heating.

4.6 Marketing

Although termed marketing this element actually relates to the communication and 'selling' the concept of energy management within an organisation. At present there is no formal site specific training/awareness programmes on energy management for site staff. In the context of the energy usage and employee numbers it is considered that a formal training/awareness programme is not required; however there is the potential to improve awareness among staff members about good housekeeping practices. This can be done informally by the Facility Manager and Deputy Manager.

4.7 Investment

While at present only low cost measures have been applied (e.g. storage heaters using night time electricity units) the Facility Management is aware of the need for future investment to contribute to energy efficiencies. It is also intended to install a landfill gas utilisation plant in 2010. This measure will achieve a negative carbon footprint for the facility.

4.8 Overall Assessment

An overall assessment of the current level of performance of the facility's energy management system is included in Table 4.1. The Table, which is based on the Matrix in the Agency Guidance, includes levels (0 to 4) that represent the possible range of performance. Level 4 represents Best Practice; however the Agency Guidance recognises that this level of development may not be appropriate for all sites.

While at present the facility is at the lowest level in the Energy Matrix, the Facility Management Team is aware of the need for the implementation of an energy management system. The framework to allow for the effective communication and promotion of an energy management system is in place. It should also be borne in mind that the energy systems at the facility are simple and that, at this stage in the development of the facility, the energy costs comprise a small percentage of the overall operational costs.

Table 4.1 Energy Management Matrix

Level	Energy Policy	Organising	Motivation	Information systems	Marketing	Investment
4	Energy policy, Action Plan and regular review have commitment of top management as part of an environmental strategy	Energy management fully integrated into management structure. Clear delegation of responsibility for energy consumption.	Formal and informal channels of communication regularly exploited by energy manager and energy staff at all levels.	Comprehensive system sets targets, monitors consumption, identifies faults, quantifies savings and provides budget tracking.	Marketing the value of energy efficiency and the performance of energy management both within the organisation and outside it.	Positive discrimination in favour of 'green' schemes with detailed investment appraisal of all new-build and refurbishment opportunities.
3	Formal energy policy, but no active commitment from top management for energy.	Energy manager accountable to energy committee representing all users, chaired by a member of the managing board.	Energy committee used as main channel together with direct contact with most users.	M&T reports for individual premises based on sub-metering, but savings not reported effectively to users.	Programme of staff awareness and regular publicity campaigns.	Same pay back Criteria employed as for all other investment.
2	Un-adopted energy policy set by energy manager or senior departmental manager.	Energy manager in post, reporting to ad-hoc committee, but line management and authority are unclear.	Contact with most users through ad-hoc committee chaired by senior departmental manager.	Monitoring and targeting reports based on supply meter data. g.	Some ad-hoc staff awareness training.	Investment using short-term payback criteria only.
1	An unwritten set of guidelines	Energy management is the part-time responsibility of an office staff.	Informal contacts with a few users.	Cost reporting based on invoice data. Engineer compiles reports for internal use within technical department.	Informal contacts used to promote energy efficiency.	Only low cost measures taken.
0	No explicit policy	No energy management or any formal delegation of responsibility for energy consumption	No contact with users.	No information system. No accounting for energy consumption.	No promotion of energy efficiency.	No investment in increasing energy efficiency in premises.

5. CONCLUSIONS & RECOMMENDATIONS

The current energy management practices are described in Sections 3 and 4 and an assessment of the main elements presented in Table 4.1. Although there is no need, based on the nature of the facility, to achieve Level 4 there is a requirement to introduce measures to improve performance. The necessary actions required to achieve a satisfactory level of performance are presented below.

As the facility is in the early stages of its life, all of the energy management systems, with the exception of the heating and lighting in the Administration Block and the mobile plant, are not fully developed. There will be a progressive expansion of the two main energy systems - leachate pumping and landfill gas utilisation over the operational lifetime of the facility. Therefore, it is not yet possible to provide benchmarks against which targets can be set and improvements measured. However, it is the objective of the energy management system to avoid unnecessary costs by ensuring that the expansion of the energy systems is done in the most efficient manner.

5.1 Energy Policy

A documented energy policy statement has not been prepared for the facility. A policy statement is fundamental to the successful implementation of any management system as it provides the framework for the introduction and maintenance of energy efficiency and conservation measures in the day to day operation of the facility.

An energy policy statement should be prepared and communicated to all staff members. The policy should emphasise a commitment, at corporate level, to reduce energy consumption at the facility. As the facility is not involved in any unique energy using activities the policy can be modelled on that developed at other Greenstar facilities. This Statement should be referenced in the facility's Environmental Management System.

5.2 Organising

Effective energy management requires the assignment of responsibility to a senior member of the Facility Management Team for the implementation of the Energy Policy and monitoring performance. It is recommended that the Facility Manager should be assigned overall responsibility for energy management at the facility. Responsibility for the day to day implementation of energy management issues can be delegated to the Deputy Manager.

The responsible person should receive appropriate training. The level of training can be assessed using the training and awareness matrix included in the facility's Environmental Management System. It is likely that the training can be provided by staff at other Greenstar landfills and that there is no need for external trainers.

The responsible person should prepare a list of objectives and targets based on the recommendations contained in this report. These should be incorporated into the overall Schedule of Objectives and Targets set out in the facility's Environmental Management Programme.

The responsible person should conduct annual reviews of energy usage; assess progress towards achieving objectives and targets and prepare a summary report for inclusion in the Annual Environmental Report. The responsible person should be involved at the initial stage of the procurement of all items of plant and equipment to ensure that energy efficiency is one of the key elements assessed.

It is expected that, given the relatively simple energy systems that will be in use during the facility lifetime, energy management will take approximately 5% of the responsible person's time annually. The cost of the time invested should be quickly recouped from efficiencies in the existing energy management system and the avoidance of unnecessary costs during the planned expansion of these systems.

5.3 Motivation

The Facility Manager or Deputy Manager should be responsible for the communication of energy management issues to all facility staff. This can be done informally through direct discussion with individual staff members and by posting memoranda and notices on office notice boards and in the canteen and changing areas. It is not possible to predict the energy cost savings from this measure.

5.4 Information Systems

At present there is only one electricity meter on-site. This provides data on total consumption, but does not allow an accurate assessment of usage by the different energy systems. Airtricity provides a spreadsheet of the bi-monthly electricity consumption figure and comparisons can be made on a bi-monthly basis.

Electricity usage at the facility will increase significantly in the future due to the installation of the landfill gas utilisation plant and the expansion of gas pumping however electricity will be generated from this activity. These will comprise the largest of the individual energy systems at the facility. There is a need to monitor energy usage so as to target particular areas where improvements can be achieved.

It is recommended that the sub-meters be installed to record usage on the gas abstraction/utilisation plant and the leachate pumping systems. An integral energy metering system should be part of the specification for the landfill gas utilisation plant.

Electricity consumption should be monitored on a bi-monthly basis. The data should be analysed in context of the site operations, and information recorded by the SCADA system, to identify possible opportunities for efficiencies. These may include the following: -

- Identification of unnecessary loads e.g. excessive leachate pumping from the landfill cells; use of storage heaters in the summer;
- Load shifting to lower tariff periods, and
- Reducing peak demand.

In the absence of accurate data on electricity usage it is not possible to predicate precise energy savings, but it could be in the range of 10 - 20% with a pay back period of 3 years.

5.5 Marketing

At present energy awareness training is not provided to staff members. Such awareness is crucial in the implementation of an effective energy management system and the achievement of targets and objectives.

The Facility Manager or nominated Deputy should be responsible for the implementation of the awareness programme. Given the size of the facility formal training is not necessary. There are adequate lines of communication between the facility management and the staff to achieve the necessary increase in awareness.

The awareness training should start after the adoption of the energy policy statement and the provision of the monitoring and targeting system so that it is possible to monitor the success or otherwise of the programme. The results of the programme should be communicated regularly to the staff in order to maintain the requisite level of awareness and avoid the development of indifference.

5.6 Investment

The external lighting system is provided with daylight and motion sensors, which represent best practice.

The office lighting is not fitted with time or daylight sensors. It is recommended that consideration be given to the installation of daylight/time controls. These could achieve up to 30% savings with a pay back time of 2 - 3 years.

The mobile plant uses diesel. There is the potential to change to biodiesel, which would reduce the facilities carbon footprint.

It is intended to provide the landfill gas utilisation plant in 2010. This will be a significant user of electricity. It is recommended that the system be benchmarked against the systems in operation at the KTK landfill and operated by Irish Power Systems Ltd to ensure that the most energy efficient system is procured.

5.7 Summary Recommendations

A summary of the recommendations is presented in Table 5.1. The table, which follows the format set out in the Agency's Guidance Document, includes projected cost savings and reductions in CO₂ emissions.

Table 5.1

	Action	Investment Cost Category	Payback (years)	Annual Energy Savings (kWh)	Annual Energy Savings (€)	Annual CO₂ Emissions Savings (Tonnes)
Energy Policy	1. Prepare Energy Policy Statement	No Cost	NA	NA	NA	NA
Organising	2. Appoint responsible person	No Cost	NA			
	3. Provide appropriate training	Low Cost	NA			
	4. Prepare targets and objectives	Low Cost	NA			
	5. Annual summary on performance in AER	Low Cost	NA			
	6. Assessment of energy efficiency of future plant and equipment	Low Cost	Immediate	*		
Motivation	7. Communicate policy objectives to staff	Low Cost	Immediate	**		
Information Systems	8. Provide sub meters for gas utilisation plants	Moderate Cost	3 years	*		
	9. Bi-Monthly data analyses and identification of efficiency opportunities.	Low Costs	NA	*		
	10. Annual summary report in AER	Low Cost	NA	NA		
Marketing	11. Provide awareness training to staff	Low Cost	Immediate	**		
	12. Provide feed back to staff.	Low Cost	Immediate	**		
Investment	13. Provide time sensors for office lighting	Low Cost	2-3 years	2128	274.51	1.65
	14. Consider introducing bio-diesel for mobile plant.	No Cost	NA			
	15. Benchmark gas utilisation plant against KTK and IPS systems	No Cost	NA			


NA: Not Applicable

* : Not possible to quantify as benchmark not established.

** : Costs incorporated into savings associated with Recommendations 13 and 14.

APPENDIX 1

Energy Consumption Information

Document type	FORM	 <small>setting the standard</small>
Title	Fuel delivery register	
Document No.	F09c(i)	

Fuel delivery register

Resource Description (eg. diesel)	Quantity Used	Time period
Green Diesel	5010 litres	8 Jan 08 to 18 Feb 08
Green Diesel	5010 litres	19 Feb to 13 April 08
Green Diesel	4000 litres	14 April to 21 July 08
Green Diesel	4000 litres	21 July to 22 Aug 08
Green Diesel	5000 litres	22 Aug to 13 Oct 08
Green Diesel	4000 litres	14 Oct to 5 Nov 08
Green Diesel	5000 litres	5 Nov to 17 Dec
Green Diesel	3000 litres	18 Dec to

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Diesel Usage at Ballynagran Landfill Site Wicklow		
Rentons - Compactor & Excavator		
Month	Litres	
Jan-08	15093	
Feb-08	10809	
Mar-08	12687	
Apr-08	14894	
May-08	6801	
Jun-08	11829	
Jul-08	7905	
Aug-08	8921	
Sep-08	8031	
Oct-08	8195	
Nov-08	10465	
Dec-08	9381	
Total	125011	

