



**GREENSTAR LTD. - KNOCKHARLEY LANDFILL,
CO. MEATH**

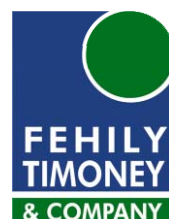
ANNUAL ENVIRONMENTAL REPORT:

Report Period: January 2012 – December 2012

WASTE LICENCE REF. NO. W0146-02

Original

May 2013





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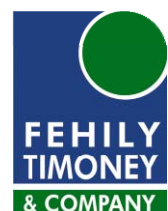
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User is Responsible for Checking the Revision Status of This Document

Rev. Nr.	Description of Changes	Prepared by:	Checked by:	Approved by:	Date:
0	Issue to Client	NM/TR/MT			29.05.13

Client: Greenstar

Keywords: Annual Environmental Report, landfill environmental monitoring, residual landfill

Abstract: This report details the Annual Environmental Report for the Knockharley Landfill, Co. Meath for the reporting period from 1st January 2012 to 31st December 2012. This report was prepared in order to fully comply with the requirements of the EPA Waste Licence Reg. No. W0146-02.

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Section 1

Introduction



1. INTRODUCTION

The Environmental Protection Agency (EPA) issued Greenstar with Waste Licence Reg. No. W0146-01 for a landfill at Knockharley, Navan, Co. Meath on 19th of March, 2003. A revision of the licence, W0146-02 was issued by the EPA on 23rd of March 2010.

The site is located in a rural area, approximately 1.5 km north of Kentstown Village and 7 km south of Slane, just off the N2 (Dublin to Derry Road). The licensed area encompasses 135.2 ha. The landfill footprint, where waste is deposited in engineered landfill cells, is located in the centre of the site and will eventually occupy an area of approximately 25 ha. A buffer of 100 m is maintained between the active landfill footprint and the site boundary.

The facility has been in operation since 2004 and is being developed on a phased basis. Final capping of the perimeter of Cells 1 to 4 was completed in 2009 with the remainder of Cells 1 to 4 capped in 2012, once final height had been achieved. Final capping of Cells 5 to 8 is scheduled for completion during 2013. Cells 11 and 12 were constructed during 2009 and waste placement commenced in Cell 12 during 2012. 9 additional landfill gas extraction wells were drilled and installed during 2012. Further well drilling is scheduled for April 2013.

Greenstar retained Fehily Timoney & Company (FTC) to compile the Annual Environmental Report (AER) for the facility for the reporting period January 2012 to December 2012. This report has been prepared in accordance with Condition 11.7 and Schedule E & F of the waste licence.

Greenstar was placed into receivership on 23rd of August 2012 and as a result there was some disruption to the environmental monitoring program in the latter part of 2012 that could not be submitted to the EPA. Table 1.1 outlines the specific areas that were not completed during the reporting period for 2012.

Table 1.1: Environmental Monitoring Not Completed – 2012

Monitoring	Period
Groundwater Quality	Quarter 3 and Annual
Leachate Quality	Quarter 3
Dust Emissions	Quarter 3
Biological Assessment	Annual

This report addresses Condition 11.7 of the waste licence for the facility.

Condition 11.7 states that:

11.7 Annual Environmental Report

11.7.1 The licensee shall submit to the Agency for its agreement by 31st March of each year an Annual Environmental Report (AER) covering the previous calendar year.

11.7.2 The AER shall include as a minimum the information specified in Schedule F: Content of Annual Environmental Report of this licence and shall be prepared in accordance with any relevant written guidance issued by the Agency.

This report addresses the items listed in *Schedule F: Content of Annual Environmental Report* of the waste licence for the facility.

1.1. Statement of compliance of facility with any updates of the relevant waste Management Plan

The facility considers itself compliant with the North East Waste Management Plan 2005-2010 and its extension to December 31st 2013.

1.2. Statement on the achievement of the waste acceptance and treatment obligations

In compliance with licence Condition 5.3 and in line with the facility's Environmental Management System (EMS) all waste accepted at this facility is in accordance with comprehensive waste acceptance procedures. Following a review of the facility licence in 2010, revised and updated Waste Acceptance Procedures were submitted to the Agency on 1st October 2010.

In compliance with Condition 1.6 only waste that has been subject to treatment is accepted for disposal at the facility. Furthermore, this facility submits quarterly summary reports to the Agency on the quantity of MSW and BMW accepted at the landfill during the preceding quarter and on a cumulative basis for the calendar year.

1.3. Reporting Period

The reporting period for the AER is 1st January to 31st December 2012.

Section 2

Waste Activities & Records



2. WASTE ACTIVITIES & RECORDS

2.1. Waste Activities Carried out at the Facility

Knockharley Landfill is a fully engineered and contained landfill site. It is licensed to accept 175,000 tonnes per annum of waste for disposal, as follows:

Table 2.1: Waste Acceptance Categories and Quantities

Waste Type	Maximum (Tonnes per Annum)
Household	100,000
Commercial	45,000
Industrial	30,000
Subtotal Total Waste for Disposal	175,000
Construction & Demolition for recovery at the facility	25,000
TOTAL	200,000

Waste activities at the facility are restricted to those outlined in *Part 1 - Activities Licensed* of the Waste Licence.

Licensed waste disposal activities, in accordance with the Third Schedule of the Waste Management Acts 1996 to 2010

- Class 1 Deposit on, in or under land (including landfill)**
This activity is limited to the disposal of non-hazardous wastes specified in Condition 1.4 in lined cells that are on, in and under land.
- Class 4 Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons.**
This activity is limited to the storage of leachate in a lagoon prior to disposal off-site at a suitable waste water treatment plant and the use of a surface water pond to control the quality and quantity of the surface water run-off from the site.
- Class 5 Specially engineered landfill, including placement into lined discrete cells which are capped and isolated from one another and the environment.**
This activity is limited to the deposition of non-hazardous waste into lined cell(s).
- Class 6 Biological treatment not referred to elsewhere in this Schedule which results in final compounds of 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 possible future biological pre-treatment of leachate subject to the agreement of the Agency.
- Class 13 Storage prior to submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where the waste concerned was produced.**
This activity is limited to the temporary storage of unacceptable wastes in the waste quarantine area prior to transport to another site .

Licensed waste recovery activities, in accordance with the Fourth Schedule of the Waste Management Acts 1996 to 2010

- Class 4 Recycling or reclamation of other inorganic materials:**
This activity is limited to the use of recycled construction and demolition waste as cover and/or construction material at the site.

- 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
- Class 11** **Use of waste obtained from any activity referred to in a preceding paragraph of this Schedule.**
This activity is limited to the use of construction and demolition waste on site.
- 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 storage of construction and demolition waste on site prior to reuse. .

2.2. Waste Quantities and Composition 2005 - 2012

The quantities and types of wastes accepted for disposal and recovery at Knockharley Landfill are presented in Table 2.2 for the years 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011 and 2012.

Table 2.2: Waste Quantities Accepted at Knockharley Landfill from 2004 – 2012

Waste Type – European Waste Code Categories	Description	Total Accepted 2004 (tonnes)	Total Accepted 2005 (tonnes)	Total Accepted 2006 (tonnes)	Total Accepted 2007 (tonnes)	Total Accepted 2008 (tonnes)	Total Accepted 2009 (tonnes)	Total Accepted 2010 (tonnes)	Total Accepted 2011 (tonnes)	Total Accepted 2012 (tonnes)
<i>Waste for disposal</i>										
EWC 02 02 03	Wastes from the preparation and processing of meat, fish and other foods of animal origin - materials unsuitable for consumption or processing		7							
EWC 02 06 01	Confectionary waste							17.08		
EWC 06 05 03	Effluent Sludge (Non Hazardous)						52.42			
EWC 06 13 99	Spent activated carbon								27.70	28.36
EWC 08 03 15	Ink sludges other than those mentioned in 08 03 14						147.38	113.9	96.92	55.58
EWC 10 03 05	Waste Alumina						10.48			
EWC 11 01 10	Industrial Filter Cake (Non Hazardous)						537.38	331.78	271.26	143.62
EWC 12 01 17	Waste Blasting Material						110.78	104.92	12.46	
EWC 16 03 04	Stabilised Inorganic Filter Cake						735.98			
EWC 17 06 04	Insulation Materials						1.7			
EWC 17 09 04	Mixed Construction and Demolition Waste							154.62	0.86	
EWC 18 02 03	Wastes from human or animal health care and/or related research		0.22							
EWC 19 02 03	Physio/Chemical Treated Waste						315.84	589.32	21.20	
EWC 19 03 05	Stabilised Inorganic Filter Cake						48.28	7.6		
EWC 19 05 99	Stabilised Waste - Residual Fraction								902.86	1,555.88
EWC 19 08 01	Screenings from waste water treatment plants									228.70
EWC 19 08 99	Bio Plant Residual Solids							2.7		
EWC 19 09 02	Filter cake from water treatment						17.24			
EWC 19 09 05	Filter cake from water treatment						39.88		27.16	
EWC 19 10 06	Shredding waste from ELV processing									3,017.80
EWC 19 12 09	Minerals-Fines/Stones and Concrete								8.36	
EWC 19 12 12	Residual municipal and commercial waste		98,125.18		92,009.82	101,380.76	92,304.54	75,116.59	38,887.24	44,878.17
EWC 19 13 02	Solid wastes from soil remediation					9,107.30				
EWC 20 01 01	Paper and Cardboard							38.02	2.36	
EWC 20 01 08	Biodegradable kitchen and canteen waste									2.06
EWC 20 01 11	Textiles								34.18	
EWC 20 01 39	Plastics							16.38	31.20	5.70
EWC 20 01 99	Other MSW not specified				27.5					
EWC 20 03 01	Mixed Municipal Waste	909.54	37,988.84	133,119.48	44,144.59	23,126.38	12,576.38	26,635.48	34,214.96	22,641.99
EWC 20 03 03	Street cleaning waste						69.46	99.84	2,603.22	11,271.13
EWC 20 03 07	Municipal Bulky Waste					144.44	27,105.50	32,700.70	12,435.36	4,658.48
Total waste for disposal		909.54	136,121.24	133,119.48	136,181.91	133,758.88	134,073.24	135,928.93	89,577.30	88,487.63
<i>Waste for recovery</i>										
EWC 11 01 10	Sludges and filter cakes				103.96	230.30				
EWC 16 03 04	Inorganic wastes					388.28				
EWC 17 01 01	Concrete					106.84				
EWC 17 05 04	Soil and Stone			26,622.46	22,314.04	17,800.62		2,930.56	7,544.66	11,965.80
EWC 17 09 04	Mixed Construction and Demolition wastes		768.88		2,743.12	1,814.24	514.76			
EWC 19 01 12	Incinerator Bottom Ash									790.34
EWC 19 05 03	Off specification compost		120.22	2,754.10	2,990.30	6,785.90	39,155.02	25,336.42		
EWC 19 05 99	Residual fraction from Aerobic Treatment (CLO)									4,091.44
EWC 19 09 02	Sludges from water clarification					8.12				6,236.68
EWC 19 12 02	Ferrous metal				176.06					
EWC 19 12 07	Woodchip	112.94	7,358.34	7,397.28	9,534.76	6,183.50	5,382.86	5,149.60	3,173.96	2,864
EWC 19 12 09	Minerals (including mineral fines)	371.24	25,434.80	22,924.03	24,926.73	16,821.46	23,292.02	28,749.24	25,831.03	22,399.74
EWC 19 12 12	Other waste from the mechanical treatment of waste					9,953.64				
EWC 20 01 38	Woodchip						38.70			
Total Waste for Recovery		484.18	33,682.24	59,697.87	62,788.97	60,092.90	68,383.36	62,165.82	36,549.65	48,347.96

Table 2.3: Waste Quantities Consigned from Knockharley Landfill, 2012

European Waste Code Categories	Description	Tonnes	Destination
EWC 19 07 03	Leachate	290.22	Dunshauglin WWTP
EWC 19 07 03	Leachate	8,298.88	EPS LTD
EWC 19 07 03	Leachate	11,918.86	Navan WWTP
EWC 19 07 03	Leachate	6,851.70	Rilta Environmental
<i>Total waste consigned</i>		27,359.66	

2.3. Calculated Remaining Capacity of the Facility

The total capacity of the facility is estimated to be 3,282,500m³. It is estimated that approximately 1,350,900m³ of void space has been used to January 2013. The remaining capacity is approximately 1,931,600m³. The most recent topographical survey, carried out on the 14th January 2013, is attached in Appendix II.

2.4. Methods of Deposition of Waste

The waste accepted for disposal is residual waste predominantly from the Northeast region, from household, commercial and industrial sources.

Waste is delivered to Knockharley Landfill facility in heavy goods vehicles (HGVs) with the appropriate covers in place to prevent any loss of load. Each HGV passes over the incoming weighbridge prior to proceeding to the active waste disposal area and the weight of the vehicle plus load is recorded. The weighbridge operator and/or facility manager may, at their discretion, request that the load be tipped in the Waste Inspection Area. Waste 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.

Waste is deposited close to the advancing tipping face. In accordance with Condition 5.6.1 of the Waste Licence, the active working face is confined to a height of 2.5 metres after compaction, a width of 25 metres, a length of 25m 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 compactor operates on the gradient of the more shallow face, pushing thin layers of wastes and applying compaction pressure to them. Waste is covered daily with recovered inert materials which have been approved by the Agency. Fabric cover systems are also utilised as appropriate.

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's waste input is deposited to form a 'block', which is compacted and covered. The following day a new 'block' of waste is deposited adjacent to this 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.

Section 3

Report on Environmental Emissions



3. REPORT ON ENVIRONMENTAL EMISSIONS

This section of the AER has been compiled in accordance with emission limit values (ELVs) for the following media as detailed in Condition 6 and Schedule C of the waste licence for the facility.

3.1. Noise Emissions

Noise limits are stipulated in Schedule C.1 of the waste licence, as presented in Table 3.1.

Table 3.1: Noise Limits

Day dB L_{Aeq} (30 minutes)	Night dB L_{Aeq} (15 minutes)
55	45

Noise monitoring was conducted at four locations on a quarterly basis during the 2012 reporting period. The four locations are outlined in Drawing Number LW11-172-03-100-001, Appendix I. The results were issued to the Agency as part of the quarterly reports.

The measured noise levels, as represented by the L_{Aeq} over a 30-minute period, were breached on two occasions during the reporting period. During monitoring for Quarter 1, in March the L_{Aeq} was 55 dB at N2 and again at N2 during Quarter 3 in September when the L_{Aeq} was 57 dB. Vehicle movements on the close-by main road, the N2, and vehicle movements on the local road, adjacent to the noise monitoring locations, both off-site noise sources, contributed to the dominant noise at the monitoring location. Overall, the results indicate that background noise in the area is generally low. Therefore the activities of the landfill are generally not having an adverse impact on noise regime in the surrounding area.

Following monitoring, all measurements were subject to a one-third octave band analysis to identify potential tonal components in accordance with Annex D of ISO 1996-2: 2007 *Acoustics — Description, measurement and assessment of environmental noise — Part 2: Determination of environmental noise levels*. On occasions where tones are identified in the 1/3 octave analysis, a 5 dB penalty is applied to the L_{Aeq} as per the 'Guidance Note for Noise In Relation To Scheduled Activities, 2nd Edition', (2006).

On assessment, tonal elements were identified on five occasions during the monitoring period. During Quarter 1, tonal elements were identified at N1, N2 and N4 and during Quarter 2 at N1 and N3. The tonal elements identified are all in the lower frequencies, where the human ear is less sensitive to sound. The range of human hearing is generally considered to be 20 Hz to 20 kHz, but it is far more sensitive to sounds between 1 kHz and 4 kHz. All the tones identified during 1/3 octave analysis were in or under the 250 Hz octave band. A second tonal element was identified at 4kHz. No source of the tonal elements was identified by the observer during the monitoring periods.

3.2. Landfill Gas

Landfill gas trigger levels are stipulated in Condition 6.3.1 and landfill gas monitoring is referenced in Schedule D, Table D.1.1, Table D.2.1 of the waste licence, as presented in Table 3.2.

Table 3.2: Landfill Gas Trigger levels

Methane	Carbon Dioxide
1.0 % v/v	1.5% v/v

3.2.1. Landfill gas monitoring wells

Monthly monitoring of landfill gas (LFG) levels is carried out in the perimeter gas boreholes and in the in-waste gas boreholes, in accordance with Schedule D.2 of the waste licence. The wells are at 50m intervals around the landfill footprint and two per cell. Monitoring of landfill gas parameters was carried out at the locations indicated on Drawing Number LW11-172-03-100-001, Appendix I.

Measured methane concentrations were recorded above the emission limit value on 2 occasions at 1 no. well during the monitoring period. Namely in:

- in LG-03 in Quarter 4, in both October and December

This well has historically shown spikes in methane and it along with the elevated natural carbon dioxide levels in perimeter wells were discussed in a letter dated 5th December 2011, in a response to EPA Ref W0146-02/gcl13JH.doc. Increased incidences of gas spikes would be expected when the surrounding soil is saturated, pushing any naturally occurring gases out of the soil and into the monitoring well.

Concentrations of 0% were recorded for these wells in all other months.

Levels were not above the emission limit in any other well during the reporting period.

Elevated carbon dioxide concentrations were recorded during the reporting period. The levels of carbon dioxide exceeded the emission limit:

- on 31 occasions in 12 no. wells during Quarter 1 (LG01, LG02, LG03, LG04, LG15, LG16, LG20, LG50, LG51, LG52, LG53 and LG54)
- on 30 occasions in 11 no. wells during Quarter 2 (LG01, LG02, LG04, LG05, LG15, LG20, LG50, LG51, LG52, LG53 and LG54)
- on 29 occasions in 12 no. wells during Quarter 2 (LG01, LG02, LG03, LG04, LG12, LG15, LG20, LG23, LG50, LG51, LG52, LG53)
- on 36 occasions in 18 no. wells during Quarter 4 (LG01, LG02, LG03, LG04, LG05, LG06, LG15, LG16, LG17, LG20, LG22, LG 23, LG 24, LG50, LG51, LG52, LG53 and LG54)

Carbon dioxide is generally detected at some level in all perimeter monitoring wells during monthly monitoring at Knockharley Landfill. The occurrence of carbon dioxide at levels exceeding the 1.5% v/v trigger level is common and has been a regular occurrence since monitoring began in 2004.

This regular incidence of high concentrations of naturally occurring carbon dioxide is caused by the in-situ subsoils located throughout the site. Studies have shown high concentrations of carbon dioxide can occur naturally at shallow depths of up to 2m due to microbiological activity associated with the roots of many types of vegetation, providing concentrations of up to 7% by volume in certain soils such as the silty clays which underlie the site. Monitoring of perimeter wells in November 2004, prior to waste deposition, confirmed elevated naturally occurring concentrations of carbon dioxide in the subsoils.

3.3. Dust Deposition Limits

Dust deposition emission limit values (ELV) are stipulated in Schedule C.3 of the waste licence, as presented in Table 3.3.

Table 3.3: Dust Deposition Emission Limit Value

Level (mg/m ² /day)
350

Dust monitoring was conducted at eight locations on a monthly basis during the 2012 reporting period. Monitoring of dust was carried out at the locations shown on Drawing Number LW11-172-03-100-001, in Appendix I.

Oldcastle Laboratories Ltd. carried out the analysis of the dust deposition results from the facility for Quarters 1, 2 and 4. The certificates of analysis were included in the quarterly reports issued to the Agency.

Dust monitoring showed dust deposition at the facility was recorded below the ELV on all monitoring occasions during the reporting period.

3.4. Surface Water Discharge Limits (measured at SW9)

Surface water monitoring was carried out at 8 no. monitoring locations in accordance with Schedule D of the licence and these are shown on the Drawing Number LW11-172-03-100-001 in Appendix I.

Surface water discharge emission limit values at monitoring location SW9 are stipulated in Schedule C.4 of the waste licence, as follows:

Table 3.4: Surface water discharge Emission Limit Values

Level (Suspended Solids mg/l)
35

Suspended solids concentrations were under the limit of 35 mg/l specified for SW9 in the waste licence during the reporting period.

Section 4

Summary of Environmental Results



4. SUMMARY ENVIRONMENTAL RESULTS

Environmental monitoring was carried out at the facility throughout the reporting period in accordance with Schedule D of the waste licence. All monitoring results were presented to the Agency in the quarterly reports and a summary of the monitoring results is presented below. The locations of all monitoring points are illustrated in Drawing Number LW11-172-03-100-001, Appendix I.

4.1. Biological Assessment

No biological assessment was undertaken during the reporting period as commented on in section 1.

4.2. Surface Water

Surface water monitoring was carried out quarterly at 8 no. monitoring locations in accordance with Schedule D of the licence.

4.2.1. Monitoring Locations

Surface water monitoring was carried out at 8 no. monitoring locations. The locations are shown on the Drawing Number LW11-172-03-100-001 in Appendix I. Table 4.1 shows the location of the monitoring points in relation to the site.

Table 4.1: Surface Water Monitoring Locations

Monitoring Location	Easting	Northing	Description
SW1	296706	267600	Upstream
SW2	297464	267862	Upstream
SW3	298087	267634	Upstream
SW5	297764	267116	Upstream
SW6	297663	266562	Downstream
SW7	297510	266525	Downstream
SW8	297916	266029	Downstream
SW9	297587	266621	Discharge from the surface water wetland

4.2.2. Surface Water Monitoring Results – Visual Assessment

Greenstar carries out weekly inspections of the surface water drainage system. The inspections completed in the reporting period did not identify the presence of any impact on the drainage system associated with site activities. Detailed visual assessment results were reported to the Agency in the quarterly reports.

4.2.3. Surface water Monitoring Results - Chemical Assessment

Two surface water bodies are sampled on a quarterly basis, namely the Knockharley Stream and the Nanny River. Surface water samples were analysed for a range of parameters as specified in Schedule D of the waste licence.

The figures below present the summary results of the main surface water monitoring parameters undertaken during the three reporting periods. The baseline monitoring results are presented in Table 4.2. Annual surface water monitoring parameters are discussed below.

Table 4.2: Baseline Surface Water Quality

Parameter	Units	SW1	SW2	SW3	SW5	SW6	SW7	SW8
pH	pH Units	7.94- 8.20	7.7- 8.44	7.75- 7.98	7.61- 8.07	7.76- 8.06	7.42- 8.37	7.63- 8.02
Electrical Conductivity	µS/cm	613-730	653-682	593-688	549-726	625-698	590-694	662-720
Ammoniacal Nitrogen	mg/l	<0.2-0.6	<0.2	<0.2-1.1	<0.2-0.5	<0.2-0.5	<0.2-1.7	<0.2-0.4
Dissolved Oxygen	mg/l	5.3-9.4	4.7-8.9	5.1-8.6	4.4-8.4	5.0-8.9	5.0-8.7	4.6-8.5
Chloride	mg/l	21-31	23-56	29-36	29-35	28-33	24-36	30-54
Total Suspended Solids	mg/l	<10-48	<10-46	<10-34	<10	<10-11	<10-10	<10-15
BOD	mg/l	<2-2	<2-12	<2-5	<2-4	<2-3	<2-3	<2-3
COD	mg/l	<15-41	<15-25	<15-46	<15-43	<15-41	<15-29	<15-31
Potassium	mg/l	9	2.6	10.8	11.6	11.8	17.6	2.4
Sodium	mg/l	13.5	8.1	13	14	15	9.8	15
Total Oxidised Nitrogen	mg/l	4.1	7.9	5.4	5.1	5.3	3.7	4.3
Calcium	mg/l	95.44	99.93	77.87	74.7	72.58	99.99	93.66
Cadmium	µg/l	3.5	3.5	3.5	3.5	<0.4	<0.4	<0.4
Chromium	µg/l	4	4	3	4	<1	<1	<1
Copper	µg/l	10	8	8	9	6	6	<5
Iron	µg/l	75	47	112	132	123	38	55
Lead	µg/l	<5	<5	<5	<5	<5	<5	<5
Magnesium	mg/l	6.48	4.44	5.38	5.3	5.23	8.89	6.73
Manganese	µg/l	11	10	10	9	5	6	4
Mercury	µg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Sulphate	mg/l	25	24	29	29	30	30	29
Zinc	µg/l	<5	<5	<5	<5	<5	<5	<5
Total Alkalinity as CaCo3	mg/l	300	220	200	90	250	270	250
Total Phosphorous	mg/l	0.44	0.09	0.34	0.56	0.54	0.54	0.32

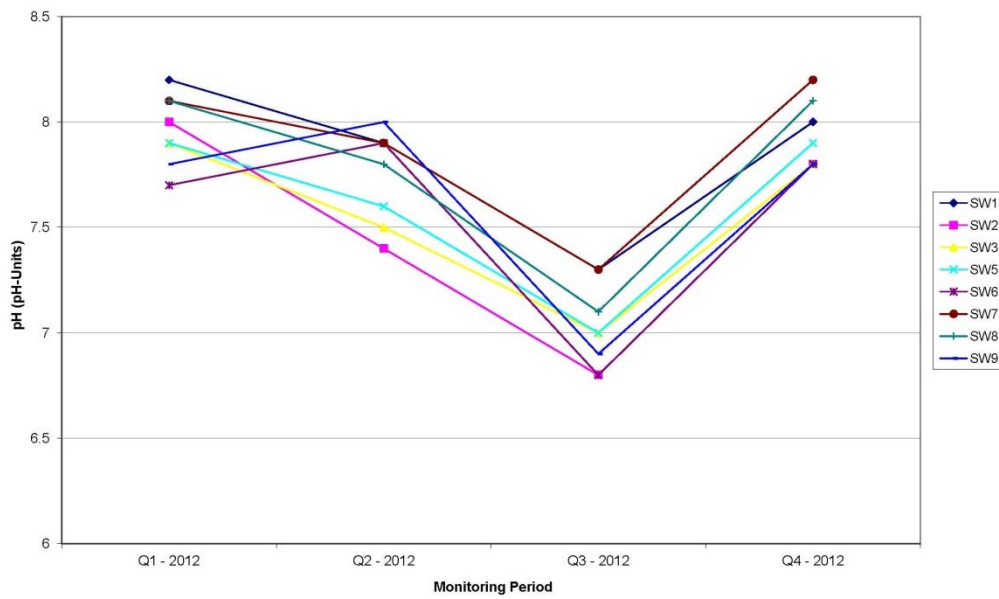


Figure 4.1: pH Results for Surface Water

The pH results, presented in Figure 4.1, are relatively consistent throughout the reporting period. The results are consistent across all monitoring locations.

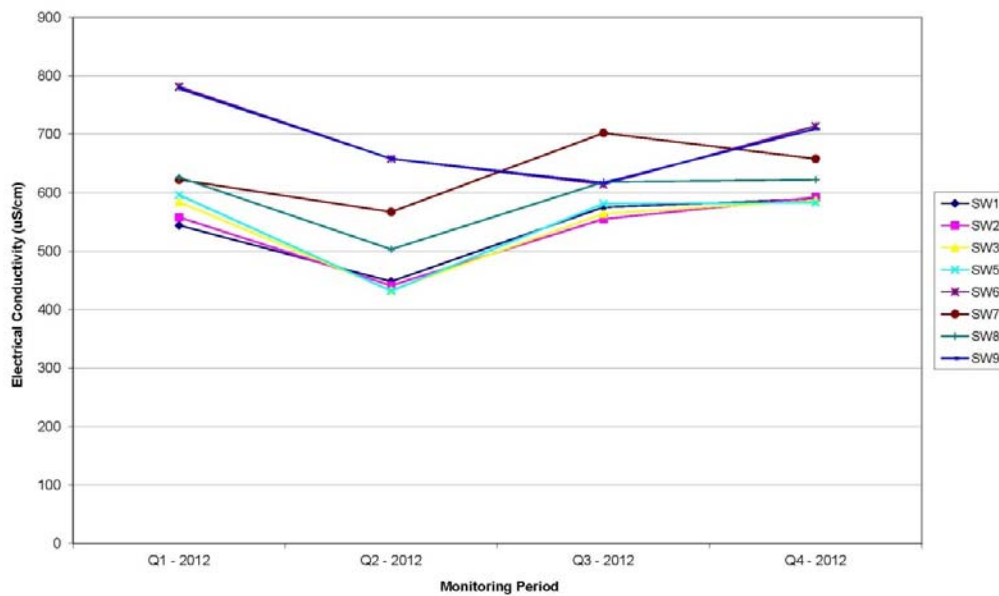


Figure 4.2: Electrical Conductivity Results for Surface Water

The electrical conductivity (EC) results, presented in Figure 4.2, were also relatively consistent throughout the reporting period. All pH and EC readings were within normal ranges for surface water.

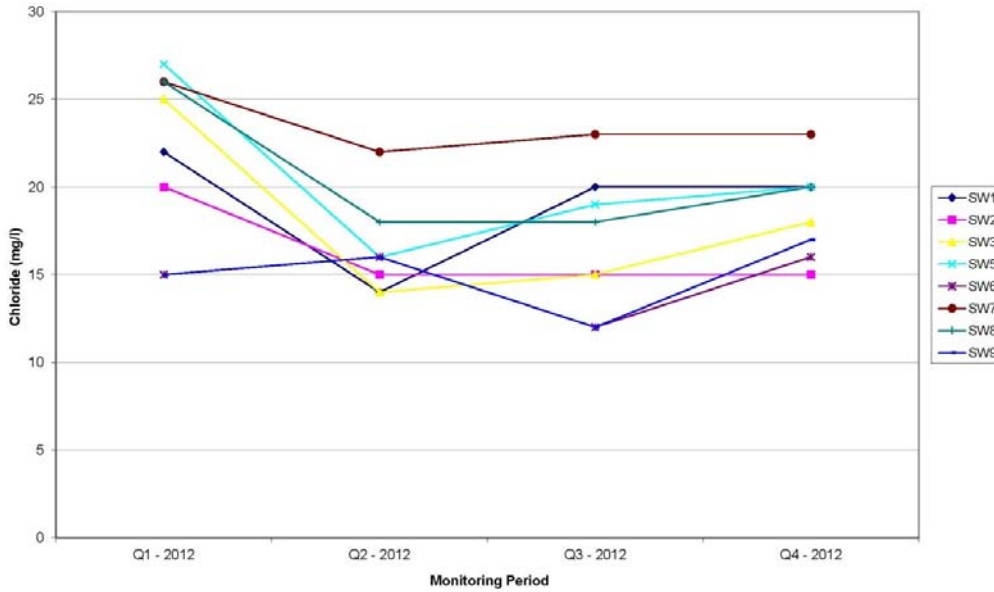


Figure 4.3: Chloride Results for Surface Water

The results for chloride (Cl) at surface water locations as presented in Figure 4.3, are consistent across all locations showing a similar trend during the reporting period. All Cl results are within or below the baseline ranges.

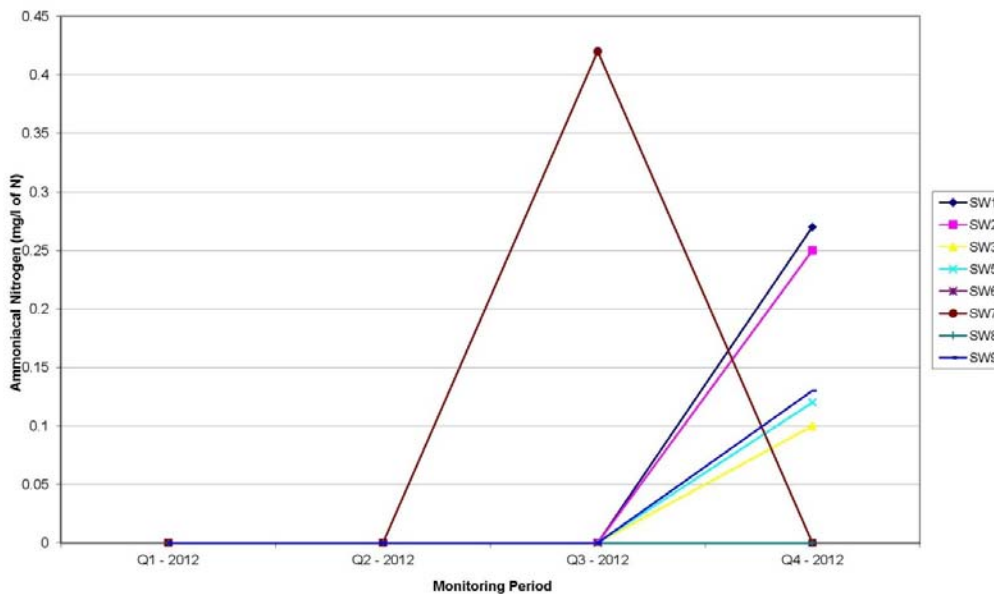


Figure 4.4: Ammoniacal Nitrogen Results for Surface Water

There is some variation in the ammoniacal nitrogen results (as shown in Figure 4.4) during the reporting period. Elevated results were recorded at all locations during Quarter 4 with levels at SW 2 exceeding the baseline ranges. Levels at SW7 also spiked during Quarter 3 but did not exceed baseline levels. All results from Quarter 4 were below 0.3 mg/l as N. Results at all monitoring locations were so low during Quarters 1, 2, 3 (SW1, SW2, SW3, SW5, SW6, SW8 and SW9) and 4 (SW7) that they were under the laboratory limit of detection.

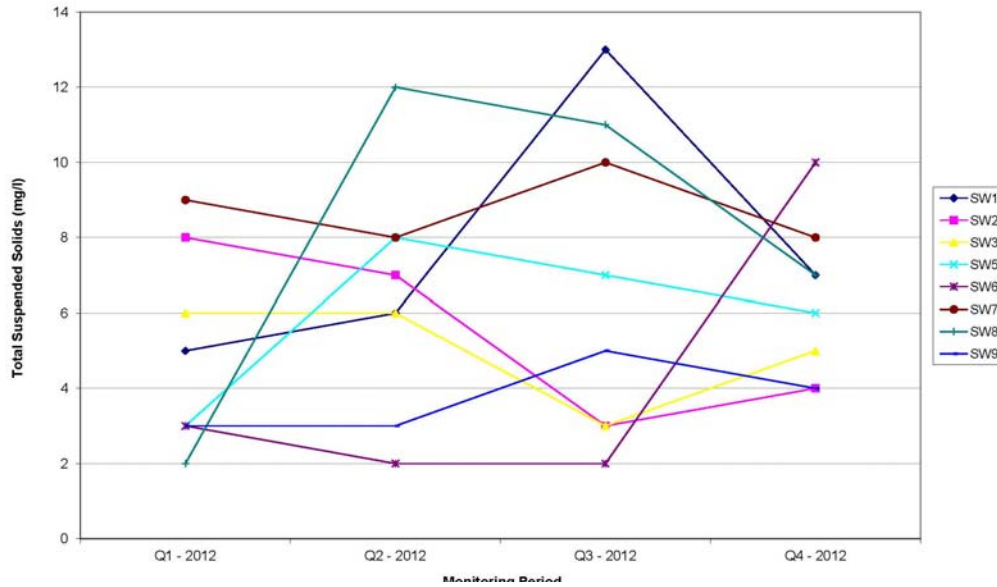


Figure 4.5: Total Suspended Solids Results for Surface Water

Levels of total suspended solids (TSS), Figure 4.5, were all within the normal range for surface waters.

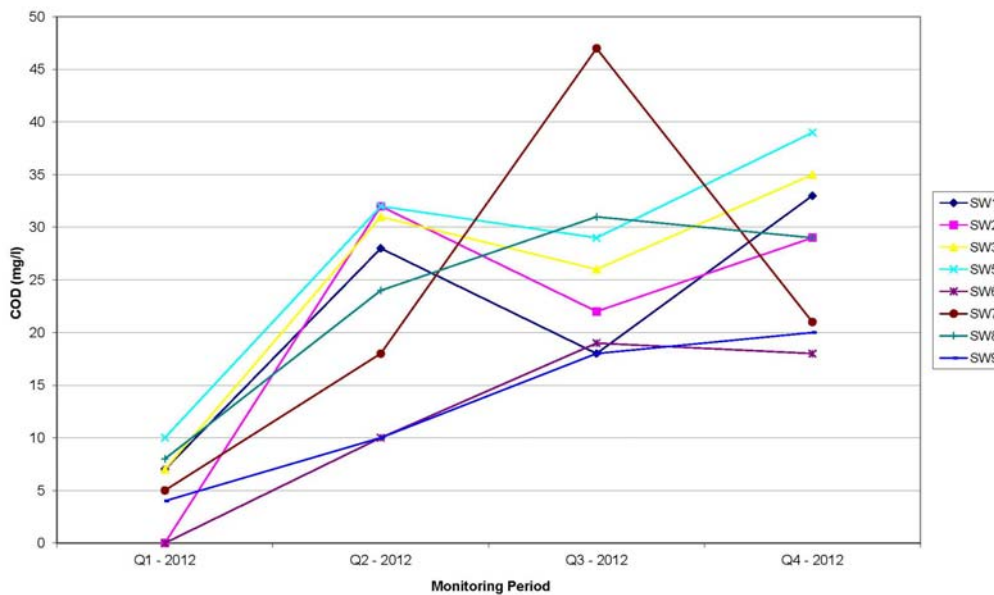


Figure 4.6: Chemical Oxygen Demand Results for Surface Water

COD levels, Figure 4.6, in general follow a similar upwards trend through Quarters 1 to 4 at all monitoring locations. Results for SW2 in Quarters 2 and 4 were above the baseline range and in Quarter 3 at SW7. All other results recorded were within the baseline range.

Regarding the annual surface water monitoring parameters, the results for total oxidised nitrogen, cadmium, chromium, iron, lead and zinc are all recorded under the baseline range of results for all monitoring locations. Mercury levels were all lower than the laboratory limit of detection at all monitoring locations.

Potassium results were under the baseline results at SW1, SW3, SW5, SW6 and SW7, while the recorded results at SW2 and SW8 were over the baseline results. Sodium levels range from 8 mg/l to 13 mg/l and were under baseline levels at all monitoring locations.

Sulphate levels range from 12 mg/l to 219 mg/l. The results are over the baseline results at SW6 whilst the results for all other locations are under the baseline levels. Baseline and annual monitoring data has been assessed to determine any trends in sulphate concentrations and the results show sulphate concentrations to be highly variable, both up and down stream, in the nine year period since monitoring began.

The total alkalinity levels are over the baseline at SW5 and SW7. The results at all other locations are within the baseline range of results.

The copper levels were all below the baseline levels at all locations, except at SW6 where the result was above the baseline level.

Total phosphorous and manganese results were all under the baseline at all other monitoring locations.

Magnesium and calcium results were all above the baseline levels at all monitoring locations.

4.2.4. Conclusion

In general, surface water quality in the surface water bodies surrounding the site is good and operations at the site have not resulted in any adverse impacts on the water quality during the reporting period.

4.3. Groundwater

Groundwater monitoring was undertaken at 7 no. groundwater wells on the site during the reporting period and the results were reported to the Agency as part of the quarterly reports for the facility. The wells were monitored in accordance with Schedule D.5.1 of the waste licence and shown on Drawing Number LW11-172-03-100-001, Appendix I. The direction of groundwater flow on the site is from northwest to southeast. Groundwater wells MW1d, MW2d, MW3d and MW7d are located up-gradient of the landfill and MW5d, MW6d and MW16d are located down gradient of the landfill.

The groundwater trigger levels (GWTL) were revised and forwarded to the EPA for approval on 17th August 2010. Approval was granted on 23rd December 2011. The revised GWTL were used in the assessment of groundwater quality from quarter 1 2012 onwards and are presented in Table 4.3.

Table 4.3: Groundwater Trigger Levels

Parameter	Units	Groundwater Trigger Level
pH (Field)	pH Units	8.28
Temperature (Field)	C	25
Ammoniacal Nitrogen as N	mg/l as N	1.96
Oxygen, dissolved (Field)	mg/l	NAC
Electrical Conductivity	mS/cm	0.95
Chloride	mg/l	31.28
Organic Carbon, Total	mg/l	12.99
Potassium (diss.filt)	mg/l	6.25
Sodium (diss.filt)	mg/l	112.33
Iron	mg/l	0.2
Total Oxidised Nitrogen as N	mg/l	NAC
Phenols, Total monohydric	mg/l	0.02
Coliforms, Total*	MPN/100ml	
Faecal Coliforms (W)*	CFU/100ml	
TSS	mg/l	

NAC = No abnormal change

4.3.1. Groundwater Monitoring Results – Levels

The groundwater levels were recorded on a monthly basis and the results are presented in Figure 4.7. The levels remained relatively stable throughout the reporting period. During September 2012 there was a drop in groundwater levels at MW1d and MW6d. Levels in these wells have since recovered and are being monitored closely.

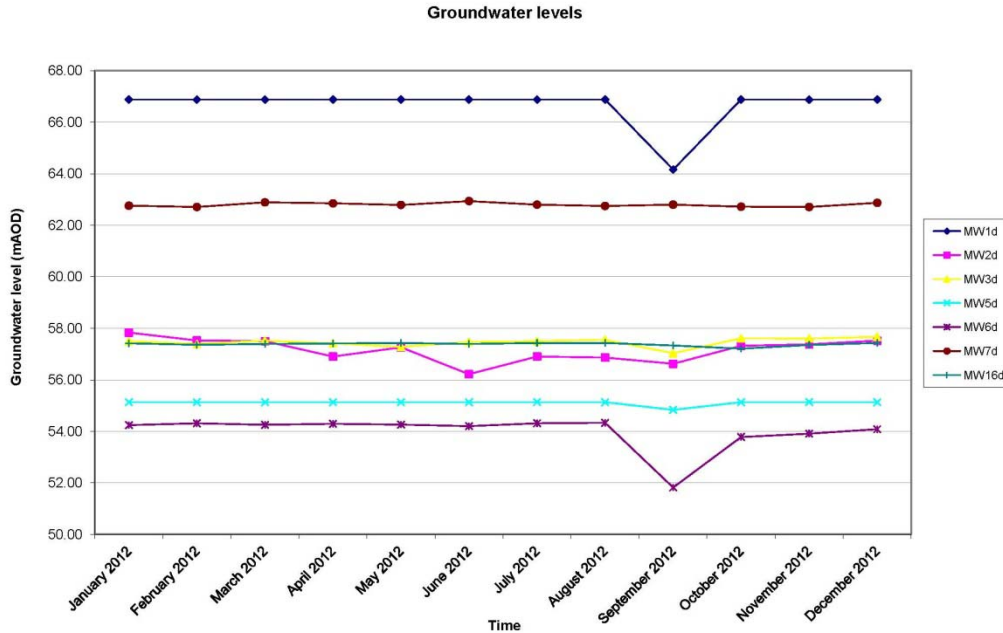


Figure 4.7: Groundwater Levels

4.3.2. Groundwater Monitoring Results – Chemical Assessment

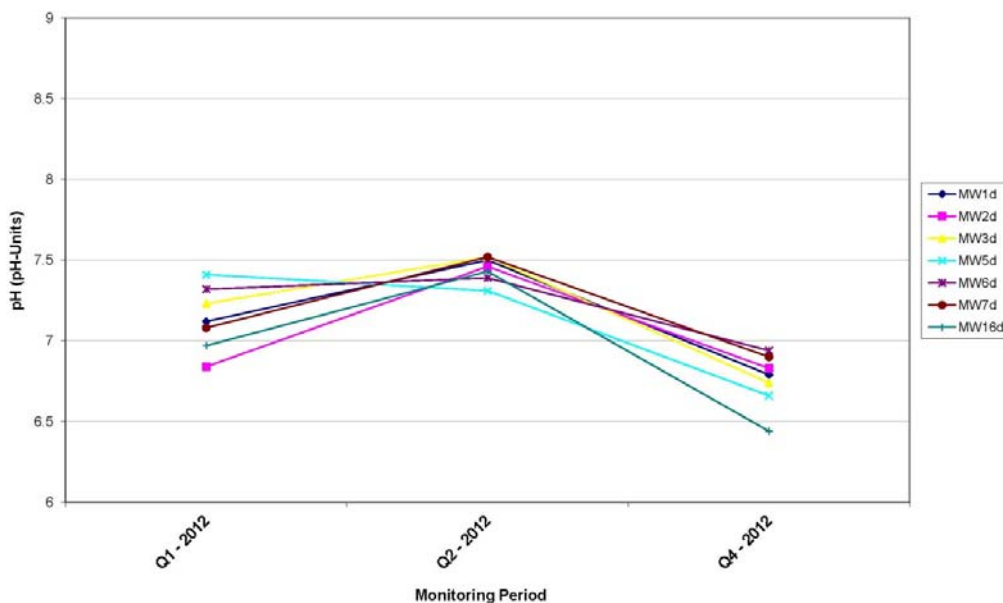


Figure 4.8: pH Results for Groundwater

The pH levels recorded in the groundwater were under the GWTL for all samples. The pH levels, presented in Figure 4.8, in general rose from quarter 1 to quarter 2 and fell again into quarter 4. The pH results range from 6.44 to 7.52 pH units.

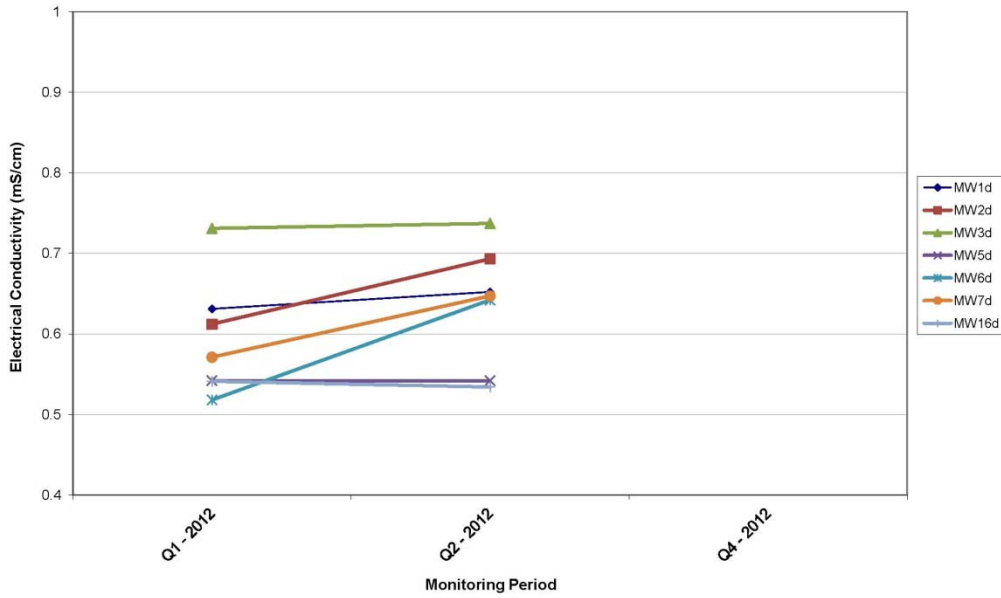


Figure 4.9: Electrical Conductivity Results for Groundwater

Electrical conductivity levels, presented in Figure 4.9, show that all readings remain consistent through quarters 1 and 2, ranging from 0.531 to 0.737 mS/cm, and are below the GWTL for all samples. The electrical conductivity levels are all consistent with unpolluted groundwater. Electrical conductivity for quarter 4 was not available due to faults with the monitoring equipment during sampling.

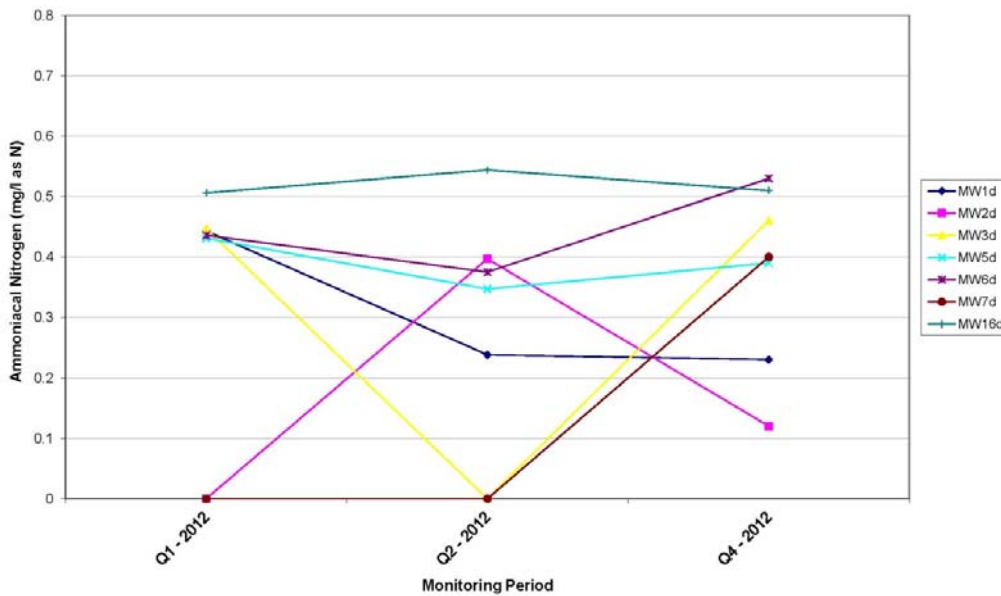


Figure 4.10: Ammoniacal Nitrogen Results for Groundwater

The levels of ammoniacal nitrogen are presented below in Figure 4.10. The ammoniacal nitrogen results are relatively consistent over the reporting period and are below the GWTL, ranging from <0.2 to 0.544 mg/l as N.

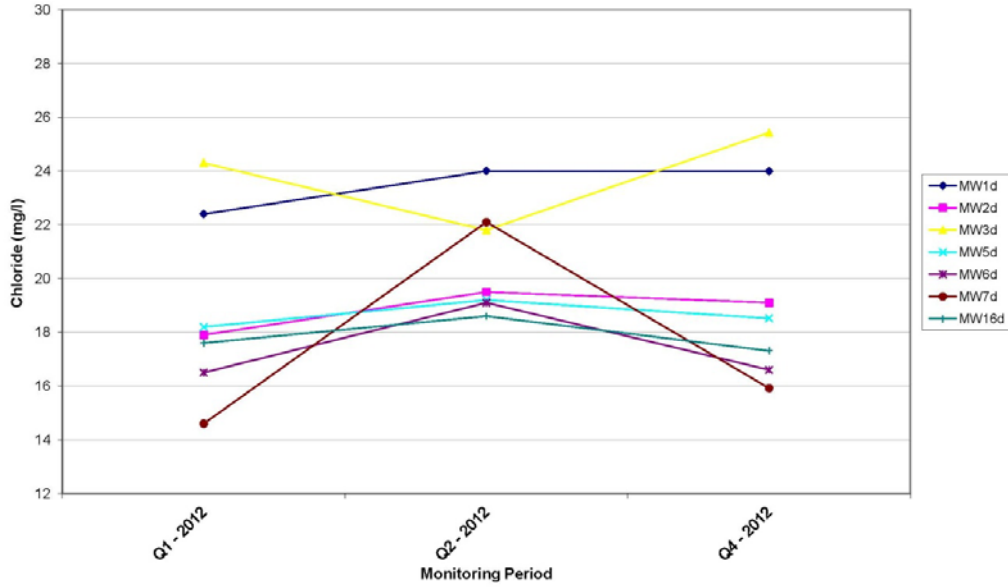


Figure 4.11: Chloride Results for Groundwater

Chloride (Cl) levels, presented in Figure 4.11, show that levels are consistent during the reporting period and all samples fell below the GWTL. The results range from 14.6 to 25.43 mg/l. All Cl levels recorded during the reporting period are also within the Interim Guideline Values, (IGV) set out in the Environmental Protection Agency, (EPA) Groundwater "Towards Setting the Guideline Values for the Protection of Groundwater in Ireland".

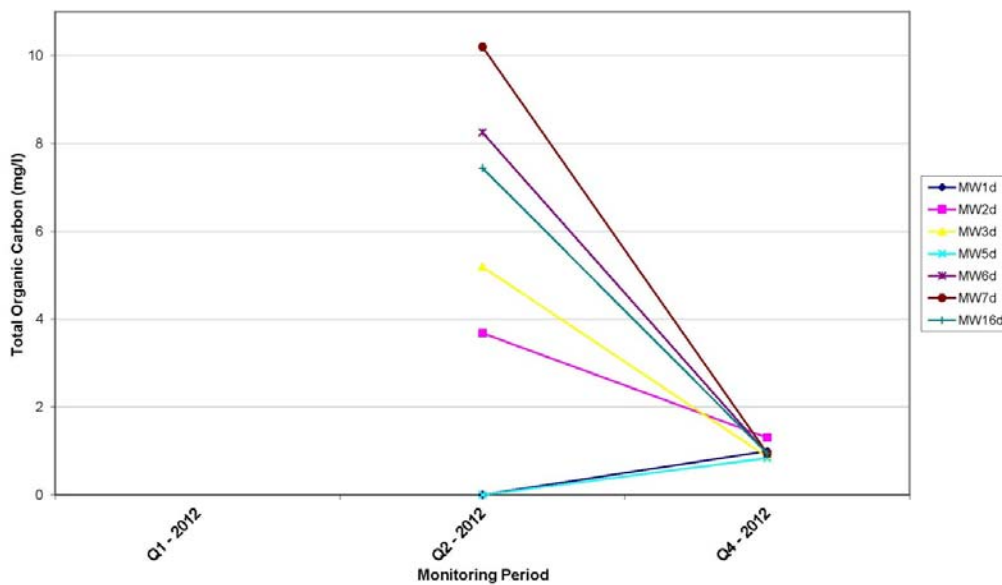


Figure 4.12: TOC Results for Groundwater

The total organic carbon (TOC), presented in Figure 4.12, levels during quarter 1 were so low the levels were under the laboratories limit of detection and not represented by any value on the graph. TOC levels for quarters 2 and 4 were all below the GWTL and ranged from 0.83 to 10.2 mg/l.

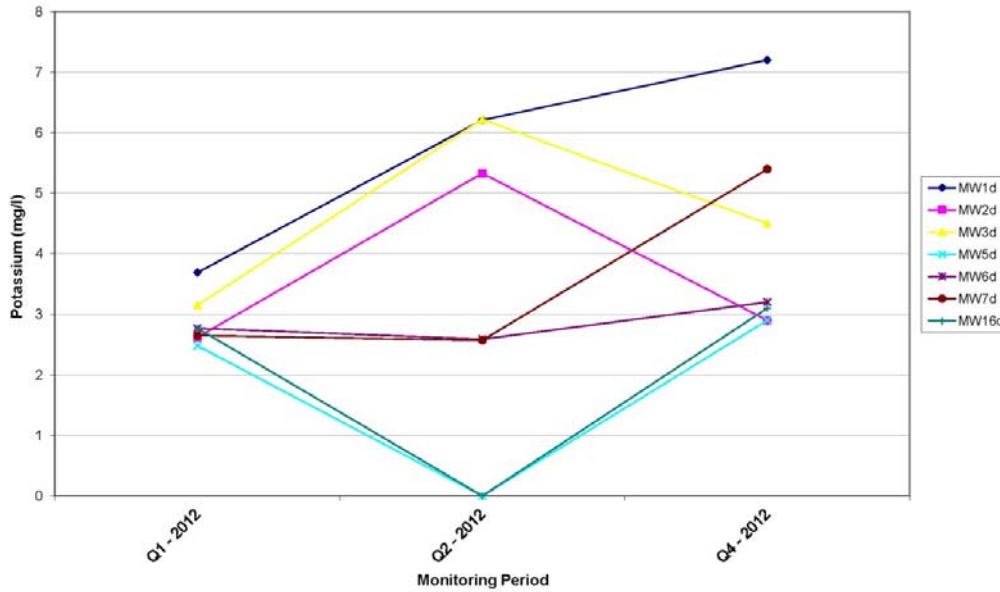


Figure 4.13 Potassium Results for Groundwater

A spike in groundwater potassium levels was observed in quarter 4, presented in Figure 4.13. The potassium level at MW1d (7.2 mg/l) was above the GWTL during this quarter. Potassium results during quarters 1 and 2 and all other samples in quarter 4 were below the GWTL, ranging from 2.48 to 6.22 mg/l.

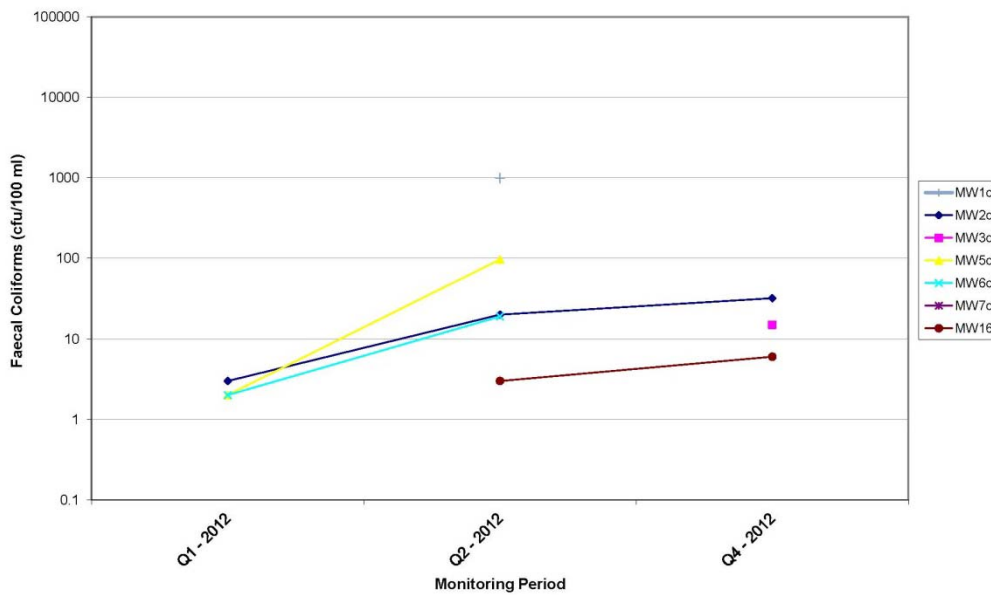


Figure 4.14: Faecal Coliforms Results for Groundwater

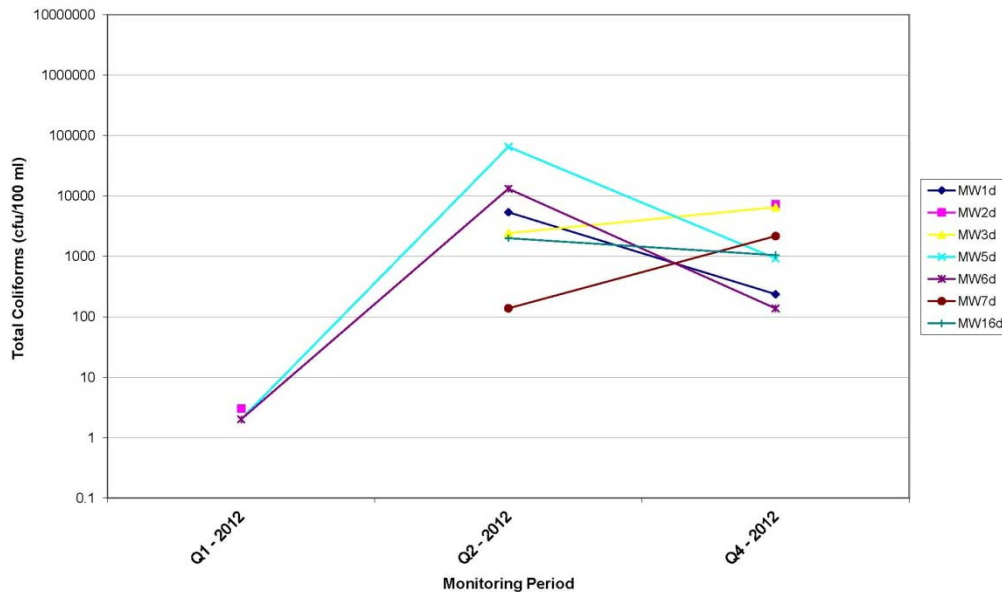


Figure 4.15: Total Coliforms Results for Groundwater

Variable levels of faecal and total coliforms, presented in Figure 4.14 and Figure 4.15 respectively, were recorded in a number of wells during the reporting period. Gaps in the graph are present where no faecal or total coliforms was detected by the laboratory during analysis. Historically total and faecal coliforms have been detected in all groundwater monitoring boreholes around the site. All the monitored groundwater boreholes are dedicated monitoring wells and not used for any other purpose than groundwater monitoring.

4.3.3. Conclusion

In general, groundwater conditions at the site have not altered significantly and are not breaching the GWTLs to a large extent. Those parameters that were breaching the GWTLs will continue to be closely observed during coming monitoring events.

The monitoring program confirms that site activities are not impacting on groundwater quality.

4.4. Dust and PM₁₀ Monitoring

As discussed in Section 3.1, no dust levels were recorded above the limit at the facility during the reporting period. The monitoring results were reported to the Agency as part of quarters 1, 2 and 4 reports.

PM₁₀ levels are monitored on a quarterly basis at six locations around the perimeter of the facility. These locations are presented on Drawing Number LW11-172-03-100-001, Appendix I. The results of this monitoring, including the certificates of analysis, were submitted to the Agency as part of part of quarters 1, 2 and 3. Quarter 4 PM₁₀ monitoring could not be undertaken. The reasons for this were relayed to the EPA by letter on the 9th January 2013.

4.4.1. Conclusion

The PM₁₀ trigger level, as set out in the waste licence condition 6.8.1 of 50 µg/m³ was not exceeded at any of the locations during the reporting period. No dust exceedances were recorded during the reporting period.

4.5. Leachate Monitoring

Leachate monitoring was carried out at ten locations (LC1, LC2, LC3, LC4, LC5, LC6, LC7, LC8, LC9, LC10 and LL) during the reporting period. LC1 to LC10 are sumps within Cells 1 to 10 respectively and LL is located at the leachate lagoon.

Chemical analysis of leachate samples is undertaken in accordance with Schedule D of the waste licence. The main indicator parameter results, pH, electrical conductivity, Ammoniacal Nitrogen and Chemical Oxygen Demand are summarised below.

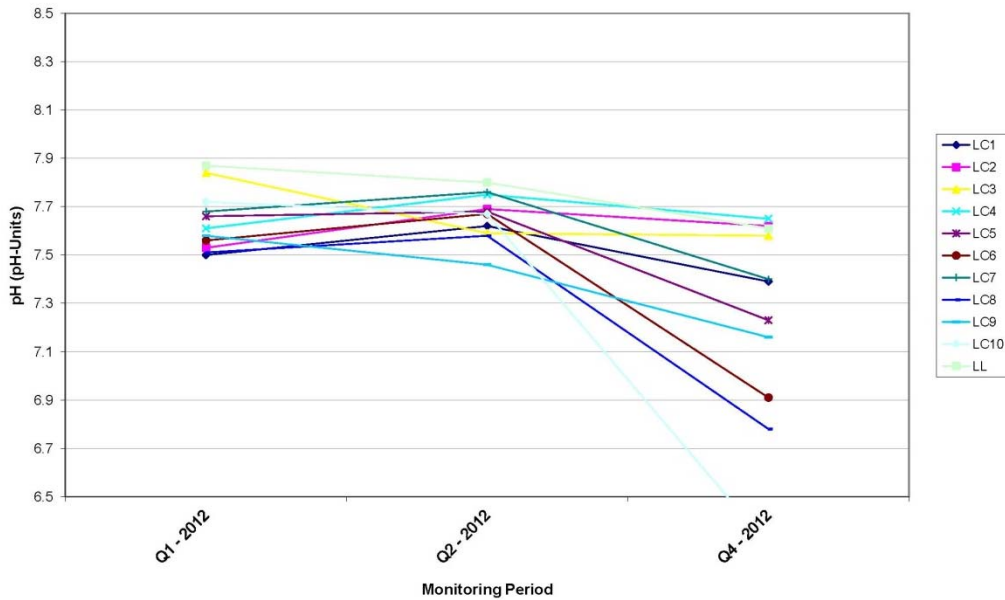


Figure 4.16: pH Results for Leachate

The pH level, presented in Figure 4.16, for leachate samples, though showing variation between quarters, follows a similar trend for all sample locations. The pH level trend indicates that the leachate is generally becoming more acidic from quarter 1 through to quarter 4.

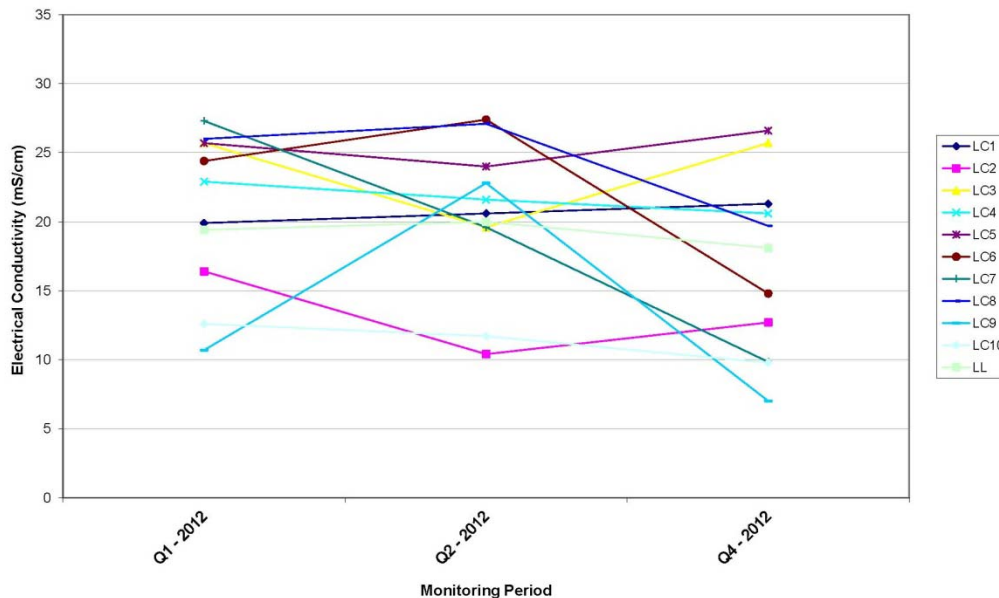


Figure 4.17: Electrical Conductivity Results for Leachate

The electrical conductivity (EC), readings presented in Figure 4.17, show greater variation in results between individual cells and between quarters. High EC levels are observed in all cells.

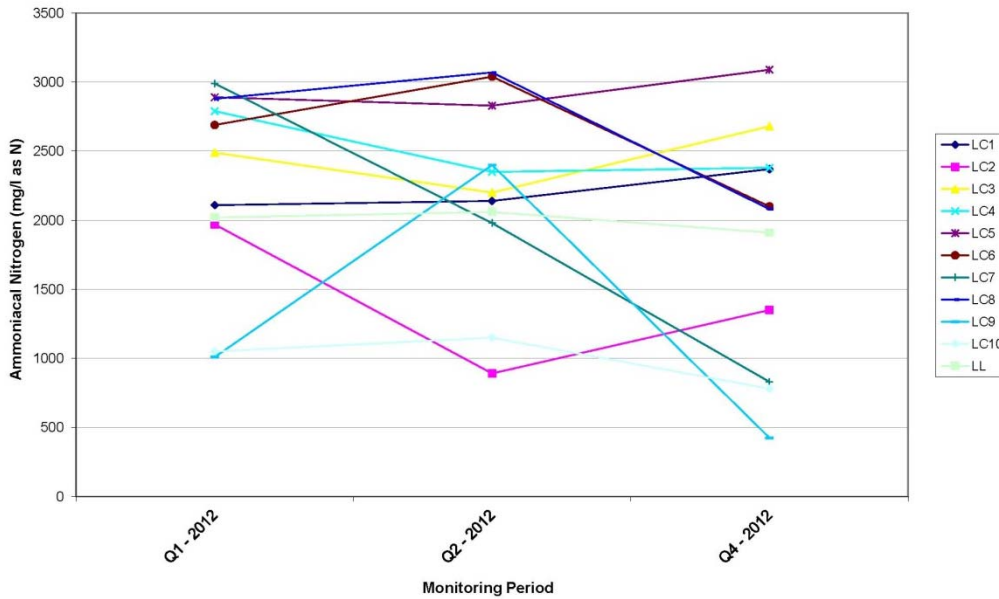


Figure 4.18: Ammoniacal Nitrogen Results for Leachate

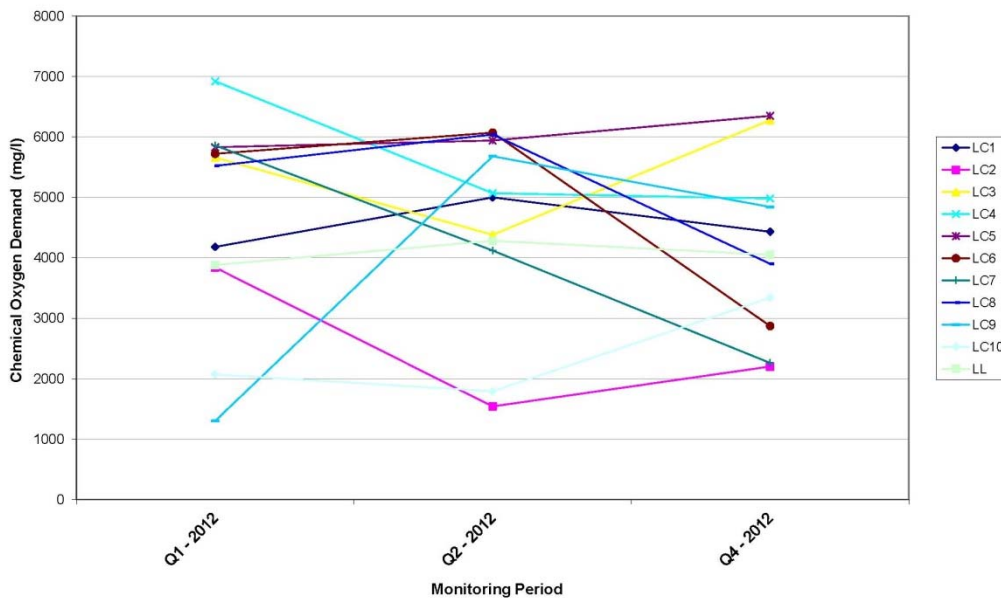


Figure 4.19: Chemical Oxygen Demand Results for Leachate

There are no trends associated with ammoniacal nitrogen, presented in Figure 4.18, and chemical oxygen demand, presented in Figure 4.19 in leachate sampled through the reporting period.

4.5.1. Conclusion

In general, the reported concentrations for the leachate sample are consistent with the typical composition of leachate sampled from large landfills and in line with the levels presented in the Environmental Protection Agency (EPA) Landfill Manual on Landfill Site Design (2000). The 2012 results indicate an increase in leachate strength throughout the reporting period, which is expected given the age of the facility and the extensive capping completed during 2012.

Leachate is removed off site to a Waste Water Treatment Plant (WWTP) as agreed with the Agency.

4.6. Noise Monitoring

Noise monitoring was discussed in Section 3.1 above. Monitoring of noise emissions from the facility is carried out on a quarterly basis at four locations outlined in Drawing Number LW11-172-03-100-001, Appendix I. The results were reported to the Agency as part of the quarterly reports but are summarised below.

Table 4.4: L_{Aeq} Results for Noise Recorded (inclusive of tonal penalties)

Location	Quarter 1	Quarter 2	Quarter 3	Quarter4
N1	54	53	51	48
N2	60	53	57	54
N3	41	52	47	49
N4	52	50	50	49

With the exception of noise recorded in quarter 1 and quarter 2 at N2, all other results were within the 55dB limit for daytime noise at the facility boundary. During monitoring for Quarter 1, the L_{Aeq} was 60 dB at N2 and in Quarter 3, the L_{Aeq} was 57 dB at N2.

As referred to in Section 3.1 above, traffic movements on the close by main road, the N2 and vehicle movements on the local road, adjacent to the noise monitoring locations, both off-site noise sources, contributed to the dominant noise at the monitoring location. This is a trend that is consistent with previous AER reports.

Section 5

Resource and Energy Consumption



5. RESOURCE AND ENERGY CONSUMPTION

The main resources consumed at the facility during the reporting period were electricity, water for potable supply & vehicle wheel cleaning, diesel fuel and hydraulic oils. The details are listed in Table 5.1 below.

Table 5.1: Energy and Resource Consumption at Knockharley, 2012

Resource	Consumption
Electricity	137,375kWh
Water, Mains	1939 units
Diesel (green)	103905 litres
Hydraulic Oils	495litres
Odour Neutralisers	2500 litres (2000L used at Rilta facility re leachate)

An Energy Efficiency Audit was completed in September 2010 in compliance with Condition 2.5.1. The audit was carried out in accordance with the Agency's "Guidance Note on Energy Efficiency Auditing" (2003).

Section 6

Development & Restoration Works



6. DEVELOPMENT & RESTORATION WORKS

6.1. Development Works Undertaken in 2012

The main development works undertaken during 2012 included:

- 9 additional landfill gas extraction wells were drilled and installed
- A new dedicated medium voltage electricity line was installed to provide increased export capacity from landfill gas utilisation
- 2 additional landfill gas engines were installed and commissioned

6.2. Proposed Development Works to be undertaken in 2013

The following development works are planned to be undertaken in 2013:

- Extension of the existing final cap to include Cells 5, 6, 7 and 8
- Placement of impermeable temporary cap in Cell 12

6.3. Restoration of Completed Cells/Phases

The facility will be developed in seven phases. Each phase contains four cells. To date, three phases have been constructed and waste has been placed in eleven cells.

Final capping of the perimeter of Cells 1 to 4 was completed in 2009 with the remainder of this area completed in 2012. Final capping of Cells 5 to 8 will commence in 2013. Progressive intermediate capping is ongoing in the remaining cells.

6.4. Updates of the Restoration and Aftercare Plan

A restoration and aftercare plan was submitted to the Agency for agreement on 6th April 2005.

6.5. Site Survey

In accordance with Condition 8.9.1 of the waste licence a topographical survey of the facility is carried out annually. The survey for the 2012 reporting period is included in Appendix II.

Section 7

Leachate Volumes



7. LEACHATE

The annual leachate management structure Report (Condition 3.14.5) was carried out on 11th December 2012 and submitted to the Agency on 7th January 2013.

7.1. Volume of Leachate Transported Off Site

The volume of leachate tankered off-site in 2012 was 27,359.66 tonnes. 11,918.86 tonnes was consigned to Navan Wastewater Treatment Plant, 8,298.88 tonnes was consigned to EPS Ltd. Drogheda, 6,851 tonnes was consigned to Rilta Environmental Dublin and 290.22 tonnes was consigned to Dunshaughlin Wastewater Treatment Plant.

Section 8

Landfill Gas



8. LANDFILL GAS

There were four gas utilisation engines and three enclosed flares in operation on-site during the reporting period.

Two high temperature enclosed landfill gas flares (each a *Haase 1,500m³/hr*) were installed at a dedicated gas management area east of the waste cells in 2007 and February 2009 respectively. A high temperature enclosed landfill gas flare (*Haase 2,500m³/hr*) was installed in the dedicated gas management area east of the waste cells in December 2009.

Two landfill gas utilisation engines were installed within the same gas management compound during 2010 with a further two added during 2012.

Table 8.1 presents data on the flaring and utilisation of methane occurring on-site during the reporting period.

Flare and engine stack monitoring was undertaken in June 2012, in accordance with Schedule D of the waste licence. Stack emission testing for the new engines was not undertaken at this time as they were not operational. Both flares 1 and 2 were non-operational at this time as well.

Landfill gas generation at the Site has been determined throughout the filling period and post-closure until 2050. The peak landfill gas generation rate has been modelled by GasSim2 to be 3,130 m³/hr (at the 50%ile) occurring in 2011. After 2011 the gas generation rate is forecast to decline steadily to approximately 200 m³/hr (at the 50%ile) in 2038. The modelled peak of maximum recoverable landfill gas (LFG) is forecasted to be 2,560 m³/hr (50%ile) in 2010. After 2010 the gas recovery rate is forecast to decline being 2,200 m³/hr (50%ile) in 2012.

Based on actual data recorded *in-situ* on-site at the flares and engines and entered into the EPA Gas Combustion spread sheet for annual summation, the flare utilisation figure is 1,486,349 kg/yr CH₄ and the engine utilisation figure is 4,239,148 kg/yr CH₄ for 2012.

Table 8.1: Summary of Landfill Gas Flared at Knockharley, 2012

	Quantity of Methane Collected	
	Total CH ₄ (m ³ /yr) *	Total CH ₄ (kg/yr) *
Flare 1	13,497	9,319
Flare 2	355,910	245,738
Flare 3	1,784,482	1,231,292
Total Flared	2,153,889	1,486,349
Engine 1	1,813,110	1,103,602
Engine 2	1,813,110	1,103,602
Engine 3	1,525,176	928,342
Engine 4	1,813,110	1,103,602
Total Utilised	6,964,605	4,239,148
Total Flared and Utilised	9,118,494	5,725,497

* denotes - at 98% Combustion Efficiency

Section 9

Summary Annual Water Balance



9. METEOROLOGICAL DATA & ANNUAL WATER BALANCE

9.1. Meteorological Data

Meteorological data for the site was obtained from Dublin Airport and is presented in tables 9.1 and 9.2 below.

Table 9.1: Total Rainfall (millimetres)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012	63.0	20.5	25.6	90.2	60.4	147.7	85.3	78.1	83.4	71.0	72.0	52.3	849.5

The total annual rainfall was recorded as 849.5 mm, with the wettest month recorded as June with 147.7 mm of rainfall and the driest month recorded as February with 20.5 mm of rainfall.

Table 9.2: Mean Temperature (degrees Celsius)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2012	6.1	6.6	8.0	6.6	9.8	12.7	14.0	15.3	12.0	8.4	6.4	5.4	9.3

The warmest month was recorded as August with a mean temperature of 15.3 °C, while the coolest month was recorded as December with a mean temperature of 5.4 °C.

9.2. Indirect Emissions to Groundwater

The Knockharley landfill is a fully engineered and contained landfill and there are no indirect emissions to groundwater from the facility.

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

Landfill Base:	The landfill site has a composite base lining system comprising a HDPE geomembrane and a 0.5 m 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. A CQA report was then completed and submitted to the Agency.
Surface Water Collection and 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 is then piped to a reed bed, which further filters the water before it is finally discharged into the nearby stream
Treated Sewage Effluent:	There is a BioCycle wastewater treatment plant located adjacent to the weighbridge which treats the canteen and office wastewater 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.

9.3. Groundwater Trigger Levels

In accordance with Condition 6.6 of the waste licence the groundwater trigger levels (GWTL) were revised and forwarded to the EPA. Approval of the GWTL was given by the EPA for use in the assessment of groundwater samples on the 23 December 2011.

For the present reporting period groundwater quality was assessed against the new GWTLs.

9.4. Water Balance Calculation

An annual water balance calculation was completed for the site. The calculation is based on a waste input of 88,487.63 tonnes of waste.

The calculation indicated a leachate production of 25,404.7 m³ yr⁻¹. Leachate tankered off site was recorded at 27,359.66 tonnes. A greater volume of leachate was tankered off-site during the reporting period than was calculated to have been produced.

9.5. Estimated Liquid In-Waste Volume

Year	Rainfall	Evaporation	Effective Rainfall †	Waste Input	Active area	Intermediate restoration area (cell 5-10)	Final restoration (cells 1,2,3,4)	Active Infiltration *	Intermediate Infiltration **	Capped Infiltration***	Liquid Waste	Absorptive Capacity ††	Active Leachate	Total Leachate Production
	(mm)	(mm)	(mm)	(tonnes)	(m ²)	(m ²)	(m ²)	(m ³)	(m ³)	(m ³)	(m ³)	(m ³)	(m ³)	(m ³)
2012	849.5	84.95	764.55	88487.63	16,000	35,000	43,000	12,232.8	17,393.5	1,972.5	0	6,194.1	6,038.7	25,404.7

Notes:

The calculation was carried out using MS Excel following the method from the EPA Landfill Manual on Landfill Site Design, as shown:

$$L_o = [ER(A) + LW + IRCA + ER(I)] - a(W)$$

where:	L _o	leachate produced (m ³)
	ER	effective rainfall [(ER) is defined as Total Rainfall (R) minus Actual Evapotranspiration (AE) i.e. ER=R-AE]
	A	area of cell (m ²)
	LW	liquid waste (m ³)
	IRCA	infiltration through restored and capped areas (m ³)
	I	surface area of lagoons (m ²)
	a	absorptive capacity of waste (m ³ /t)
	W	weight of waste deposited (t/a)

Cell Area (m ²)	8000
† Evapotranspiration calculated at	10% of actual rainfall
†† Absorptive Capacity (m ³ /tonne)	0.07
* Active Infiltration rate	100%
** Intermediate Infiltration	65%
*** Final Infiltration	6%

Section 10

Environmental Management System



10. ENVIRONMENTAL MANAGEMENT SYSTEM

10.1. Environmental Management System

In accordance with Condition 2.3 of the waste licence an Environmental Management System is maintained at the facility. The EMS proposal completed as part of the Environmental Management Plan was sent to the Agency on the 23rd July 2004 and was approved on the 23rd December 2004.

Updates on the EMS are presented in the following sections of the AER.

10.2. Updates on the Landfill Environmental Management Plan (LEMP)

The Landfill Environmental Management Plan was revised and updated in compliance with Condition 2.3.2.2 in December 2012.

Changes included the increased landfill gas utilisation plant, final capping progress, changes to the bird control regime, updated objectives and targets and updated group Environment, Health and Safety Policy.

10.3. Report on Staff Training

All training was carried out as scheduled in the training plan for 2012. Details are as follows –

- ISO 14001 and Environmental Awareness – All staff
- Fire Procedure and Location of Fire Fighting Equipment – All staff
- Incident Reporting Procedure – All staff
- Various H&S toolbox talks – All staff
- MEWP Scissor and Boomlift training – Chargehand and 1 GO
- Occupational First Aid (Refresher) – Landfill Manager

Any facility staff who performs duties which involve interpretation of monitoring results or site inspections receive the appropriate training by the Landfill Manager or nominated deputy, prior to carrying out such duties.

10.4. Management and Staffing Structure

The day to day management of the facility and supervision of waste activities are the responsibility of the Landfill Manager, nominated Deputy Manager(s) and the site operatives. The positions and names of the persons who provide management and supervision are set out as follows –

Landfill Manager	Heather Lamont
Assistant Landfill Manager	Thomas Finnegan*
Site Foreman	Robert Hughes*
Chargehand/LFG Technician	Sean Smith*
Weighbridge Operator	Michael Noone
Operatives	Donal Blaney and Martin Maguire

*Nominated Deputy in accordance with WO146-02 Condition 2.1.

10.4.1. Responsibilities

Greenstar, as the licensee, is responsible for ensuring that the requisite resources are provided to operate the facility in accordance with the objective of the LEMP and the Waste Licence conditions.

The Landfill Manager or nominated Deputy is responsible for ensuring that the day to day operation of the facility is carried out in accordance with the LEMP, the Waste Licence conditions and the Operating Procedures.

10.5. New Procedures Developed During 2012

New operational procedures developed in for the site are presented below.

KNKP 7 Monitoring and Measurement

This operating procedure has been amended and now incorporates 5 previously separate procedures - KNKP 11 Internal Audit, KNKP 12 Management Review, KNKP 36 Landfill Gas Monitoring, KNKP 37 Surface Water Monitoring Procedure and KNP 39 Environmental Monitoring (all are now obsolete). This revised procedure outlines the procedure for monitoring and measurement of the key environmental aspects associated with Knockharley Landfill.

KNKP 14 Operation Start Up/Shut Down & Compaction of Waste

This operating procedure has been amended and now incorporates KNKP 17 Compaction of Waste On Site (now obsolete). The purpose of this revised procedure is to ensure that all waste received on site (except for cover and inert materials) is tipped, correctly compacted and covered by the end of the working day in accordance with site licence conditions.

KNKP 15 Operation of Facility in Adverse Wind Conditions & Litter Prevention

This operating procedure has been amended and now incorporates KNKP 18 Litter Prevention & Assembly/Disassembly of Nets (now obsolete). The purpose of this revised procedure is to control operations at the facility, in adverse wind conditions, including litter management.

KNKP 33 Odour Management Plan

This procedure has been revised and now incorporates KNKP 31 Odour Control and Monitoring (now obsolete). The revised procedure addresses all aspects of odour control and landfill gas management.

10.6. Summary Schedule of Environmental Objectives and Targets

This section of the report presented the program of environmental objectives and targets for 2012. The progress against the 2011 objectives and targets are also discussed.

Table 10.1: Programme of Environmental Objectives and Targets proposed for 2008-2013

Ref. No.	Objective	Aspect	Target	Deadline	Responsibility
1	Gas Management	1. Generation of LFG 4. Release of LFG	Hold Gas Management meetings every 6 months to review existing infrastructure and discuss maintenance and upgrading as required.	On-going	AM/FM
			In accordance with condition 6.10.5 of the waste licence W0146-02, the site will aim to reduce the number of fugitive VOC emissions from the landfill at each survey. Records are kept showing results of surveys.	On-going	All
			All waste filled to final levels during 2011 to have permanent capping installed within 24 months	2013	FM/AM
			Flow meters to be installed on gas engines to give better optimisation whilst balancing gas wells	Completed	
			Reduce O2 level in bad gas stream to for optimal operational efficiency of flares once temporary capping in place	Completed Completed Completed	AM/FM
			-5%		
			-4.50%		
			-3.50%		
			Maintain engines at O2 level of 2.5% and below for optimal running and output	On-going	AM/FM
Extend existing measures to further insulate pipes and flares to prevent against potential downtime during cold months. Use of light bulbs to keep pumps warm.	Completed	AM/FM			
Increase use of double lifts and horizontal wells along exposed outer flanks of landfill.	On-going	AM/FM			

Ref. No.	Objective	Aspect	Target	Deadline	Responsibility
2	Leachate Management	12. Generation of leachate	Continue to monitor and control leachate through quarterly leachate quality monitoring and weekly leachate level checks.	Weekly, Quarterly, On-going	FM
			Implement recirculation of leachate at the landfill.	When final capping sufficient and Agency approval given	
			Continually assess and upgrade infrastructure as necessary.	Continual	FM
			Construct leachate processing plant on site.	Plans on hold	AM/FM
			Permanent capping to all finished areas of landfill and extra clay capping on intermediate areas.	Start 2011 - 2013	AM/FM
3	Landscaping	2/26. Generation of GHG's	Maintain and continue to improve all on site landscaping and the wetland area.	On-going	FM
		20. Emissions to air 17. Visual Impact	Employ a landscape contractor to assess plantations, replace failed trees/plants and improve the overall general appearance of the landfill site.	On-going (Seasonal) Has been brought in house	FM
			Implement planting of fruit and nut trees as part of landscaping planning application.	Planning application withdrawn	
4	Environmental Control / Nuisance	3/6/8. Generation of dust	Review relationships with neighbours and interested parties on a continual basis and review communications programme annually.	Annually & On-going	AM/FM
		6/14. Birds/vermin/flies	Review the number and composition of complaints to determine any trends.	Monthly	FM
		4. Release of LFG	Extend litter picking to include inner boundary road as illegal dumping appears to have increased here.	On-going from March	AM/FM
		5/9. Litter	Continue to hold regular meetings with local residents	On-going	AM/FM
		13/15/19.Noise	Finish cells 9/10 and go into cells 11/12 where visual aspect can be minimised.	Completed	FM
		17. Visual Impact	Continue with litter patrols and litter picking	On-going, weekly	AM/FM

Ref. No.	Objective	Aspect	Target	Deadline	Responsibility
5	Education and Environmental Awareness	Aspects 1-28	Actively encourage site visits from interested parties i.e. local community groups, schools, clubs, etc.	On-going	AM
			Review relationships with neighbours and interested parties on a continual basis and review communications programme annually.	Annually & On-going	AM/FM
			Continue distribution of newsletter to local people at regular intervals.	On Hold	AM/FM
			Continue to provide sponsorship of interested local parties, clubs, etc.	On Hold September 2012	FM
			Keep Public Information Room updated and current.	On-going	AM
			Update as part of newsletter, progress on planning permission	Planning application withdrawn	
			Review Communications Programme	July 2012	FM
			Investigate possibility of establishing fruit and nut orchard in perimeter land as a natural habitat and as an educational area for local schools and residents	Plans on hold due to the withdrawal of planning application	AM/FM
6	Reduce energy usage on-site	11/16/23. Use of energy 2/19. Generation of GHG's	Implement an updated Energy Awareness Programme incorporating the recommendations from the 2010 energy audit.	Sept 2010 Onwards	AM/FM
			Look into changing all light bulbs to energy saving versions	Investigation closed out	
			Fix water leak and regain costs lost as a direct result by issuing a leak rectifying report to Meath Co Co	Completed	
			Put energy use and energy saving report into Autumn Newsletter	Closed Out	
			Install new energy saving dishwasher	Completed	
7	Minimise fugitive emissions while carrying out capping works	29. Global warming and nuisance	Cap in progressive, small sections to reduce the potential of fugitive emissions. Coordinate with the contractor on this and include nuisance issues in regular construction meetings	Q2 – Q3 2012	AM/FM

Table 10.2: Schedule & progress against Environmental Objectives and Targets for 2012

Ref. No.	Objective	Aspect	Target	Deadline	Responsibility	Progress
1	Gas Management	1. Generation of LFG 4. Release of LFG	Hold Gas Management meetings every 6 months to review existing infrastructure and discuss maintenance and upgrading as required.	On-going	AM/FM	2 meetings were held in 2012
			In accordance with condition 6.10.5 of the waste licence W0146-02, the site will aim to reduce the number of fugitive VOC emissions from the landfill at each survey. Records are kept showing results of surveys.	On-going	All	The number of locations where VOC emissions exceeded the trigger levels increased from 2011 to 2012
			All waste filled to final levels during 2011 to have permanent capping installed within 24 months	2013	FM/AM	Final capping is nearly completed in Cells 1 to 4. Final capping of Cells 5 to 8 is scheduled for 2013
			Flow meters to be installed on gas engines to give better optimisation whilst balancing gas wells	March/April 2011	CetCo	Completed July 2011
			Reduce O2 level in bad gas stream to for optimal operational efficiency of flares once temporary capping in place -5% -4.50% -3.50%	April 2011 Dec 2011 June 2012	AM/FM	The bad gas line was removed before June 2012. All gas combined for utilisation.
			Maintain engines at O2 level of 2.5% and below for optimal running and output	On-going	AM/FM	O2 level maintained between 2 – 3%
			Extend existing measures to further insulate pipes and flares to prevent against potential downtime during cold months. Use of light bulbs to keep pumps warm.	Sept/Oct 2011	AM/FM	Completed

			Increase use of double lifts and horizontal wells along exposed outer flanks of landfill.	On-going	AM/FM	On-going
2	Leachate Management	12. Generation of leachate	Continue to monitor and control leachate through quarterly leachate quality monitoring and weekly leachate level checks.	Weekly, Quarterly On-going	FM	In general, all levels compliant with the licence. 3 leachate related incidents were reported but they were all minor exceedances.
			Implement recirculation of leachate at the landfill.	When final capping sufficient and Agency approval given		Recirculation pipework has been installed in Cells 1 to 4. Recirculation has yet to begin.
			Continually assess and upgrade infrastructure as necessary.	Continually	FM	On-going.
			Permanent capping to all finished areas of landfill and extra clay capping on intermediate areas	Start 2011 - 2013	AM/FM	Final capping works 90% completed in Cells 1 to 4. Capping was interrupted by the Receivership process Clay capping on-going
3	Landscaping	2/26. Generation of GHG's 20. Emissions to air 17. Visual Impact	Maintain and continue to improve all on site landscaping and the wetland area.	On-going	FM	Grass cutting programme completed in conjunction with local farmers
			Employ a landscape contractor to assess plantations, replace failed trees/plants and improve the overall general appearance of the landfill site.	On-going (seasonal)	FM	Landscaping work has been brought in house.

			Implement planting of fruit and nut trees as part of landscaping in planning application	End 2011	AM/FM	Planning application withdrawn in Sept 2011
4	Environmental Control / Nuisance	3/6/8. Generation of dust 6. Birds/vermin/flies 4. Release of LFG 5/9. Litter 13/15/19.Noise 17. Visual Impact	Review relationships with neighbours and interested parties on a continual basis and review communications programme annually.	Annually and on-going	AM/FM	Communications Programme reviewed in July 2012
			Review the number and composition of complaints to determine any trends.	Monthly	FM	Completed for monthly reports
			Extend litter picking to include inner boundary road as illegal dumping appears to have increased here	On-going from March	AM/FM	Completed and on-going
			Continue to hold regular meetings with local residents.	On-going	AM/FM	Completed
			Finish cells 9/10 and go into cells 11/12 where visual impact aspect can be minimised	End 2011	FM	Waste filling has slowed due to planning intake. Entered Cell 12 during 2012.
			Continue with litter patrols and litter picking	Ongoing weekly	AM/FM	Completed and ongoing
5	Education and Environmental Awareness	Aspect 1-28	Actively encourage site visits from interested parties i.e. local community groups, schools, clubs, etc.	On-going	AM	Students from DIT visited. 2 summer interns worked at Knockharley.
			Review relationships with neighbours and interested parties on a continual basis and review communication programme annually	Annually and on-going	AM/FM	On-going. Communications programme reviewed in 2012.
			Continue to provide sponsorship of interested local parties, clubs, etc.	Spring and Autumn 2011	FM	Sponsorships were stopped in Aug 2012 due to the Receivership process.

			Keep Public Information Room updated and current.	On-going	AM	Completed and on-going
			Update as part of newsletter, progress on planning permission	Autumn 2011	AM/FM	Not completed – planning application withdrawn in Sept 2011
			Review Communications Program	August 2011	FM	Completed
			Investigate possibility of establishing fruit and nut orchard in perimeter land as a natural habitat area and as an educational area for local schools and residents	End 2011	AM/FM	Was planned as part of AD planning application – planning application withdrawn in Sept 2011
6	Reduce energy usage on site	11/16/23. Use of energy 2. Generation of GHG's	Implement an Energy Awareness Programme incorporating the recommendations from the 2010 energy audit.	Sept 2010 Ongoing	AM/FM	Switched energy supplier. Increased export of electricity for additional engines – reduced consumption.
			Look into changing all light bulbs to energy saving versions	June 2011	AM	Completed
			Implement a review of energy consumed per area of the site	May 2011	AM	Reviewed and determined unfeasible
			Fix water leak and regain cost lost as a direct result by issuing a leak rectifying report to Meath Co Co	June 2011	AM/FM	Completed
			Put energy use and energy savings report into Autumn Newsletter	Autumn 2011	AM	Not completed – newsletter on-hold
			Install new energy saving dishwasher	March 2011	FM	Completed

10.7. Review of Nuisance Controls

Greenstar Ltd is committed to operating the Knockharley facility in the best possible manner using the best available techniques to minimise impacts on the environment and local residential neighbours. Knockharley landfill welcomes communications from local residents and any interested parties and all reasonable and practical measures will be implemented to eliminate or minimise any issues or nuisances.

10.7.1. Odour

In addition to the landfill gas abstraction system, good operational practices on-site are the main controls to avoid odour nuisances. The handling, depositing and covering of waste at the facility is carried out in accordance with the Agency's Landfill Manual "Landfill Operational Practices". In addition Greenstar have developed a site specific Odour Management Plan (KNKP 033). The plan specifies the operational requirements for the waste placement, the landfill gas management infrastructure and addresses all aspects of odour control.

Any loads with a particular potential for generation of odours are rejected in accordance with the waste acceptance procedures, which are in operation at the facility as submitted to and agreed by the Agency in October 2010.

The waste delivery trucks are unloaded at the working face and the waste is compacted within 3 to 4 minutes. The level areas of the working face are covered on a continuous basis during the day. The slope of the working face is covered completely with artificial cover sheets at the end of each working day, which can easily be removed again the following day prior to commencement of operations.

An odour neutralizing misting spray is installed along several sections of the litter fencing to mitigate potential waste odours. A mobile misting unit and contact neutralizer are also available on site and are used as necessary.

10.7.2. Vermin Control

The methods used for vermin control are as detailed in Nuisance Inspection Procedure (KNKP 32). A specialist contractor is employed by Greenstar to carry out a vermin control programme. Measures used include 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.

Fly monitoring, which is undertaken throughout the summer months using a Scudder grid and fly counting technique revealed low fly numbers.

10.7.3. Birds

Greenstar employs one of the leading bird control specialists, Falcon Bird Control Services, who operate a seven day dawn to dusk programme. An aviary is provided at the site, which houses the birds of prey used by the contractor. The main aim of the Programme is to create an association of danger, so that birds choose not to fly around the area where bird control is active. This association is achieved using a variety of methods such as visual and audible deterrents in compliance with the licence. To date these measures have proven to be successful.

10.7.4. 6.4 Dust

Dust and mud control measures were implemented at the start of the construction phase of the site and continued into the operational phase. These 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. To date these measures have proven to be successful.

10.7.5. Litter Control

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. As part of operational controls all litter is collected at the end of the working day and litter has not been an issue at the facility.

10.8. Reported Incidents and Complaints Summary

There were nine reported incidents on-site during the reporting period. A summary table of the incidents is presented in Table 10.3.

Table 10.3: Summary of Incidents

Date	Summary of Incident
14-02-2012	Groundwater result for Iron at Mw3d 0.46mg/l is above the trigger level.
28-02-2012	Exceedance of surface emissions VOC trigger level, as per Condition 6.10.5 of W0146-02.
13-03-2012	Noise at N2 was above the Day dB LAeq (30 minutes) of 55.
25-09-2012	Leachate lagoon exceeded the 0.75m minimum freeboard
31-10-2012	Perimeter well LG-03 CH4 result of 11.5% exceeded the trigger level
11-11-2012	Cell 5 leachate level exceeded 1m
12-11-2012	Groundwater result for Potassium at MW1d 7.2m/g is above the trigger level
14-11-2012	Leachate lagoon exceeded the 0.75m minimum freeboard
12-12-2012	Perimeter well LG-03 CH4 result of 3.4% exceeded the trigger level

Greenstar maintains a register of complaints in compliance with Condition 10.4. Details of all complaints received during the reporting period and the action taken by Greenstar are available at the facility.

Summary data showing the composition of the complaints presented in Table 10.4 and Figure 10.1.

Table 10.4: Summary of Complaints

Month	Odour	Other	Total
January	3		3
February	3		3
March	1		1
April	1		1
May	1		1
June	0		0
July	1		1
August	1		1

Month	Odour	Other	Total
September	4		4
October	6		6
November	12		12
December	7		7

As observed from the data in Table 10.3 odour complaints dominate the register during the reporting period.

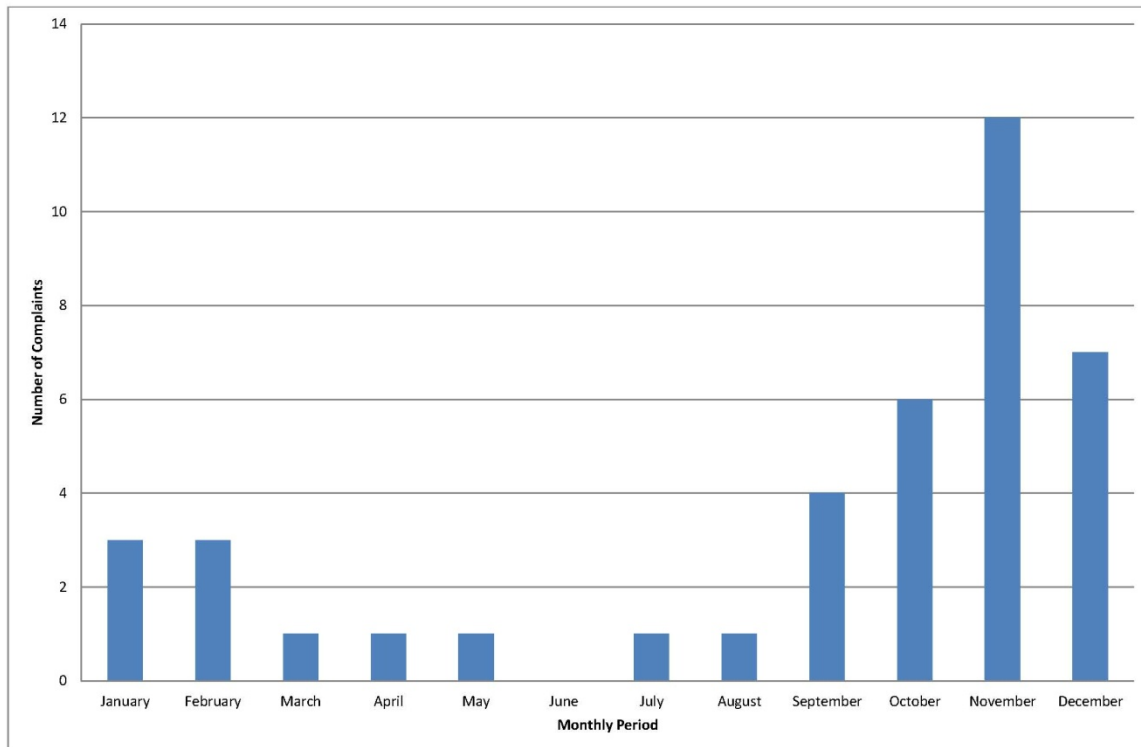


Figure 10.1: Total number of complaints to the site during the reporting period

10.9. Site Testing and Inspection Reports

As per Schedule E and Condition 3.11.6 of the waste licence, the integrity of the bunds and tanks are carried out every three years. This integrity testing was carried out in July 2011 – test certificates are included in Appendix III.

10.10. European Pollutant Release and Transfer Register

Under the European Pollutant Release and Transfer Register Regulation (EC) No. 166/2006 Greenstar are required to submit information annually to the Agency. The information is submitted separately to the Agency via the web-based data reporting system.

10.11. Statement of Measures for prevention of environmental damage and financial provisions/ELRA

The licensee will submit a Section 53A statement to the Agency as requested and required under Section 53A of the Waste Management Act 1996 (as amended). This statement will be submitted to the Agency in May 2013.

Condition 12.3 of the waste licence states, *'In accordance with the provisions of Section 53A of the Waste Management Acts 1996 to 2010, the licensee shall ensure the costs involved in the setting up and operation of the facility, as well as the costs of closure and after-care (including cost of provision of financial security) for a period of at least 30 years (post closure) shall be covered by the price to be charged for the disposal of waste at the facility'.*

In relation to this matter Greenstar can confirm that the gate fee for the disposal of waste at the Knockharley Landfill is appropriate in the current market and includes financial provision for the closure, restoration and aftercare of the site.

10.12. Public Information Programme

Knockharley 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.

The Communications Programme required by Condition 2.4.1 of the waste licence, was established three months before the start of waste activities and has been submitted to the Agency. This document is reviewed and updated at regular intervals.

A dedicated public information room is maintained at the facility and an open door policy is encouraged.

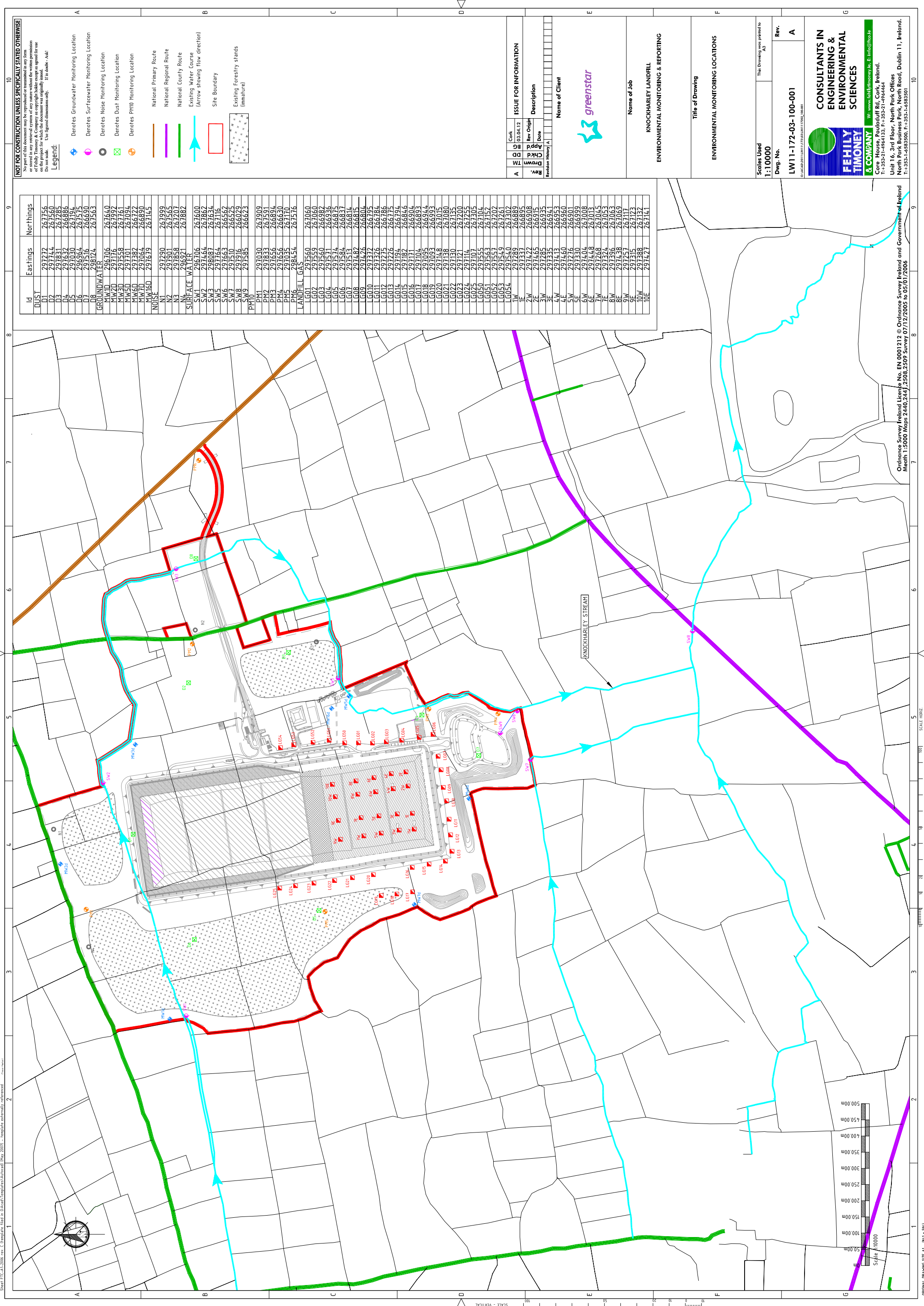
Appendix I

Maps



ENVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION





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- Legend:**
- ◆ Denotes Groundwater Monitoring Location
 - ◆ Denotes Surfacewater Monitoring Location
 - Denotes Noise Monitoring Location
 - ◆ Denotes Dust Monitoring Location
 - Denotes PM10 Monitoring Location
 - National Primary Route
 - National Regional Route
 - National County Route
 - Existing Water Course (Arrow showing flow direction)
 - Site Boundary
 - Existing Forestry stands (mature)

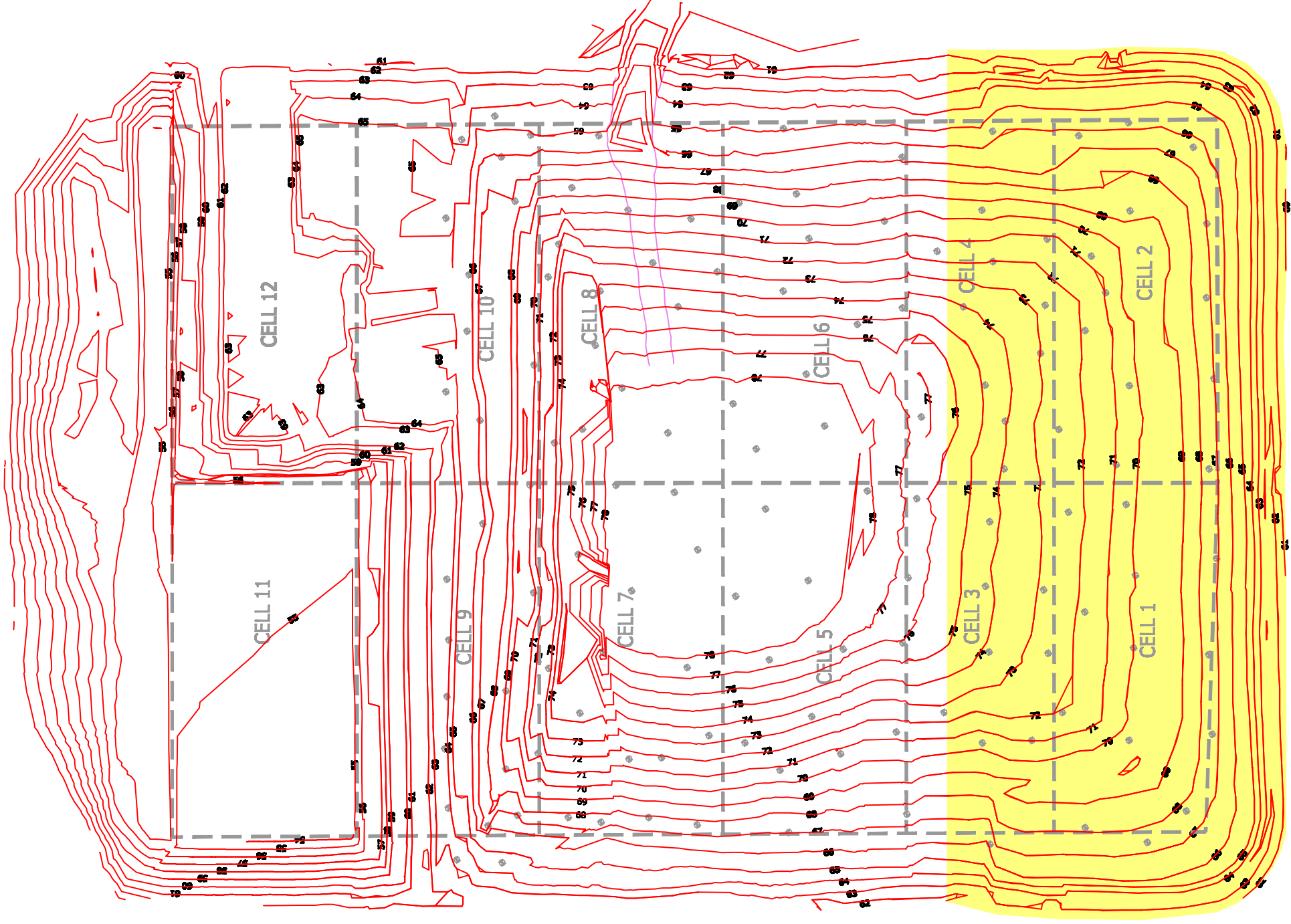
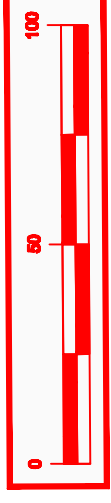
Id	Eastings	Northings
DUST		
D1	297272	267756
D2	297744	267560
D3	297831	267285
D4	297632	266886
D5	297030	267194
D6	296964	267575
D7	297516	266690
D8	298124	267563
GROUNDWATER		
MW1D	296706	267640
MW2D	297176	267992
MW3D	297558	267761
MW4D	297701	267094
MW5D	297382	266667
MW6D	297069	266960
MW7D	297679	267145
NOISE		
N1	297290	267999
N2	297801	267565
N3	297858	267207
N4	296921	267882
SURFACE WATER		
SW1	296706	267600
SW2	297464	267862
SW3	298087	267634
SW5	297764	267116
SW6	297663	266562
SW7	297510	266525
SW8	297916	266029
SW9	297585	266623
PM10		
PM1	297030	267909
PM2	297833	267491
PM3	297656	266864
PM4	297035	267170
PM5	297035	267170
PM6	298454	267576
LANDFILL GAS		
LG01	297560	267060
LG02	297559	267060
LG03	297560	266982
LG04	297571	266936
LG05	297574	266875
LG06	297584	266837
LG07	297513	266814
LG08	297482	266815
LG09	297426	266804
LG10	297372	266795
LG11	297326	266786
LG12	297275	266786
LG13	297226	266775
LG14	297194	266794
LG15	297182	266846
LG16	297101	266889
LG17	297101	266889
LG18	297095	266947
LG19	297095	266993
LG20	297168	267015
LG21	297138	267080
LG22	297130	267135
LG23	297121	267200
LG24	297114	267255
LG25	297107	267305
LG26	297095	267355
LG27	297087	267404
LG28	297079	267453
LG29	297071	267502
LG30	297063	267551
LG31	297055	267600
LG32	297047	267649
LG33	297039	267698
LG34	297031	267747
LG35	297023	267796
LG36	297015	267845
LG37	297007	267894
LG38	297000	267943
LG39	296992	267992
LG40	296984	268041
LG41	296976	268090
LG42	296968	268139
LG43	296960	268188
LG44	296952	268237
LG45	296944	268286
LG46	296936	268335
LG47	296928	268384
LG48	296920	268433
LG49	296912	268482
LG50	296904	268531
LG51	296896	268580
LG52	296888	268629
LG53	296880	268678
LG54	296872	268727
LG55	296864	268776
LG56	296856	268825
LG57	296848	268874
LG58	296840	268923
LG59	296832	268972
LG60	296824	269021
LG61	296816	269070
LG62	296808	269119
LG63	296800	269168
LG64	296792	269217
LG65	296784	269266
LG66	296776	269315
LG67	296768	269364
LG68	296760	269413
LG69	296752	269462
LG70	296744	269511
LG71	296736	269560
LG72	296728	269609
LG73	296720	269658
LG74	296712	269707
LG75	296704	269756
LG76	296696	269805
LG77	296688	269854
LG78	296680	269903
LG79	296672	269952
LG80	296664	270001
LG81	296656	270050
LG82	296648	270099
LG83	296640	270148
LG84	296632	270197
LG85	296624	270246
LG86	296616	270295
LG87	296608	270344
LG88	296600	270393
LG89	296592	270442
LG90	296584	270491
LG91	296576	270540
LG92	296568	270589
LG93	296560	270638
LG94	296552	270687
LG95	296544	270736
LG96	296536	270785
LG97	296528	270834
LG98	296520	270883
LG99	296512	270932
LG100	296504	270981
LG101	296496	271030
LG102	296488	271079
LG103	296480	271128
LG104	296472	271177
LG105	296464	271226
LG106	296456	271275
LG107	296448	271324
LG108	296440	271373
LG109	296432	271422
LG110	296424	271471
LG111	296416	271520
LG112	296408	271569
LG113	296400	271618
LG114	296392	271667
LG115	296384	271716
LG116	296376	271765
LG117	296368	271814
LG118	296360	271863
LG119	296352	271912
LG120	296344	271961
LG121	296336	272010
LG122	296328	272059
LG123	296320	272108
LG124	296312	272157
LG125	296304	272206
LG126	296296	272255
LG127	296288	272304
LG128	296280	272353
LG129	296272	272402
LG130	296264	272451
LG131	296256	272500
LG132	296248	272549
LG133	296240	272598
LG134	296232	272647
LG135	296224	272696
LG136	296216	272745
LG137	296208	272794
LG138	296200	272843
LG139	296192	272892
LG140	296184	272941
LG141	296176	272990
LG142	296168	273039
LG143	296160	273088
LG144	296152	273137
LG145	296144	273186
LG146	296136	273235
LG147	296128	273284
LG148	296120	273333
LG149	296112	273382
LG150	296104	273431
LG151	296096	273480
LG152	296088	273529
LG153	296080	273578
LG154	296072	273627
LG155	296064	273676
LG156	296056	273725
LG157	296048	273774
LG158	296040	273823
LG159	296032	273872
LG160	296024	273921
LG161	296016	273970
LG162	296008	274019
LG163	296000	274068
LG164	295992	274117
LG165	295984	274166
LG166	295976	274215
LG167	295968	274264
LG168	295960	274313
LG169	295952	274362
LG170	295944	274411
LG171	295936	274460
LG172	295928	274509
LG173	295920	274558
LG174	295912	274607
LG175	295904	274656
LG176	295896	274705
LG177	295888	274754
LG178	295880	274803
LG179	295872	274852
LG180	295864	274901
LG181	295856	274950
LG182	295848	275000
LG183	295840	275049
LG184	295832	275098
LG185	295824	275147
LG186	295816	275196
LG187	295808	275245
LG188	295800	275294
LG189	295792	275343
LG190	295784	275392
LG191	295776	275441
LG192	295768	275490
LG193	295760	275539
LG194	295752	275588
LG195	295744	275637
LG196	295736	275686
LG197	295728	275735
LG198	295720	275784
LG199	295712	275833
LG200	295704	275882
LG201	295696	275931
LG202	295688	275980
LG203	295680	276029
LG204	295672	276078
LG205	295664	276127
LG206	295656	276176
LG207	295648	276225
LG208	295640	276274
LG209	295632	276323
LG210	295624	276372
LG211	295616	276421
LG212	295608	276470
LG213	295600	276519
LG214	295592	276568
LG215	295584	276617
LG216	295576	276666
LG217	295568	276715
LG218	295560	276764
LG219	295552	276813
LG220	295544	276862
LG221	295536	276911
LG222	295528	276960
LG223	295520	277009
LG224	295512	277058
LG225	295504	277107
LG226	295496	277156
LG227	295488	277205
LG228	295480	277254
LG229	295472	277303
LG230	295464	277352
LG231	295456	277401
LG232	295448	277450
LG233	295440	277499
LG234	295432	277548
LG235	295424	277597
LG236	295416	277646
LG237	295408	277695
LG238	295400	277744
LG239	295392	277793
LG240	295384	277842
LG241	295376	277891
LG242	295368	277940
LG243	295360	277989
LG244	295352	278038
LG245	295344	278087
LG246	295336	278136
LG247	295328	278185
LG248	295320	278234
LG249	295312	278283
LG250	295304	278332
LG251	295296	278381
LG252	295288	278430
LG253	295280	278479
LG254	295272	278528
LG255	295264	278577
LG256	295256	278626
LG257	295248	278675
LG258	295240	278724
LG259	295232	278773
LG260	295224	278822
LG261	295216	278871
LG262	295208	278920
LG263	295200	278969
LG264	295192	279018
LG265	295184	279067
LG266	295176	279116
LG267	295168	279165
LG268	295160	279214
LG269	295152	279263
LG270	295144	279312
LG271	295136	279361
LG272	295128	279410
LG273	295120	279459
LG274	295112	279508
LG275	295104	279557
LG276	295096	279606
LG277	295088	279655
LG278	295080	279704
LG279	295072	279753
LG280	295064	279802
LG281	295056	279851
LG282	295048	279900
LG283	295040	279949
LG284	295032	280000
LG285	295024	280050
LG286	295016	280100
LG287	295008	280150
LG288	295000	280200
LG289	294992	280250
LG290	294984	280300
LG291	294976	280350
LG292	294968	280400
LG293		

Appendix II

Topographical Survey



ENVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION



LEGEND	
	TOPO CONTOUR (SURVEYED 04/01/13)
	EXISTING GAS WELL
	EXISTING CAPPED AREA

LANDFILL VOID CONSUMED DURING THE PERIOD OF 19th OCTOBER 2012 AND 4th JANUARY 2013 = 34,000 m³

TOTAL LANDFILL VOID SPACE CONSUMED UP TO 4th JANUARY 2013 = 1,350,900 m³

TOTAL AIR SPACE AVAILABLE FROM 4th JAN 2013 = 258,000m³
(BASED ON FILLING OUT TO EDGE OF CELLS 11 & 12)
(NOTE: 59,000m³ VOID SPACE AVAILABLE IN CELL 12)

Client		
Project	KNOCKHARLEY RESIDUAL LANDFILL SITE	
Location	KNOCKHARLEY, Co. MEATH	
Title	TOPOGRAPHICAL CONTOUR HEIGHTS OF WASTE BASED ON WASTE SURVEY 4th JANUARY 2013	
Project No.	Checked by	Drawing No.
File No.	Reviewed by	W-S26/01
Created by	I McC	
TO CLIENT		14/01/13
		A
Description	Date	Version
Scale	1:1,500 A3	Date
		January 2013

[Guidance to completing the PRTR workbook](#)

AER Returns Workbook

Version 1.1.16

REFERENCE YEAR	2012
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1. FACILITY IDENTIFICATION

Parent Company Name	Greenstar Holdings Limited
Facility Name	Knockharley Landfill
PRTR Identification Number	W0146
Licence Number	W0146-02

Waste or IPPC Classes of Activity

No.	class_name
3.5	Specially engineered landfill, including placement into lined discrete cells which are capped and isolated from one another and the environment.
3.1	Deposit on, in or under land (including landfill).
3.13	Storage prior to submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where the waste concerned is produced.
3.4	Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons.
3.6	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.
4.11	Use of waste obtained from any activity referred to in a preceding paragraph of this Schedule.
4.13	Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced.
4.4	Recycling or reclamation of other inorganic materials.
4.9	Use of any waste principally as a fuel or other means to generate energy.
Address 1	Knockharley
Address 2	Navan
Address 3	(Includes Townlands of Tuiteath & Flemingstown)
Address 4	Co. Meath
	Meath
Country	Ireland
Coordinates of Location	-6.57373 52.3511
River Basin District	IEEA
NACE Code	3821
Main Economic Activity	Treatment and disposal of non-hazardous waste
AER Returns Contact Name	Thomas Finnegan
AER Returns Contact Email Address	tom.finnegan@greenstar.ie
AER Returns Contact Position	Assistant Landfill Manager, Knockharley Landfill
AER Returns Contact Telephone Number	0419821650
AER Returns Contact Mobile Phone Number	
AER Returns Contact Fax Number	0419821750
Production Volume	0.0
Production Volume Units	
Number of Installations	0
Number of Operating Hours in Year	0
Number of Employees	7
User Feedback/Comments	
Web Address	

2. PRTR CLASS ACTIVITIES

Activity Number	Activity Name
5(d)	Landfills
5(c)	Installations for the disposal of non-hazardous waste
5(d)	Landfills
50.1	General

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

Is it applicable?	No
Have you been granted an exemption ?	
If applicable which activity class applies (as per Schedule 2 of the regulations) ?	
Is the reduction scheme compliance route being used ?	

4. WASTE IMPORTED/ACCEPTED ONTO SITE

[Guidance on waste imported/accepted onto site](#)

Do you import/accept waste onto your site for on-site treatment (either recovery or disposal activities) ?	
--	--

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

4.1 RELEASES TO AIR

[Link to previous years emissions data](#)

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

RELEASES TO AIR		Please enter all quantities in this section in KGs										QUANTITY		
No. Annex II	POLLUTANT Name	M/C/E	METHOD Method Used		Engine 1	Engine 2	Engine 3	Engine 4	Flare 1	Flare 2	Flare 4	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
			Method Code	Designation or Description	Emission Point 1	Emission Point 2	Emission Point 3	Emission Point 4	Emission Point 5	Emission Point 6	Emission Point 7			
02	Carbon monoxide (CO)	C		Flue gas analyser, Testo 350/454 MXL	6473.81	8163.42	0.0	0.0	28.64	0.0	0.0	14665.87	0.0	0.0
11	Sulphur oxides (SOx/SO2)	C		Impinger train containing 0.10 molar sodium hydroxide and deionised water solution in accordance EN1911, EPA 26A and EN15713:2006	4671.14	6601.11	0.0	0.0	5440.57	0.0	0.0	16712.82	0.0	0.0
08	Nitrogen oxides (NOx/NO2)	C		Flue gas analyser, Testo 350/454 MXL	3500.77	2814.64	0.0	0.0	688.72	0.0	0.0	7004.13	0.0	0.0
01	Methane (CH4)	C		See calculation below	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1180624.0	0.0	1180624.0

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

SECTION B : REMAINING PRTR POLLUTANTS

RELEASES TO AIR		Please enter all quantities in this section in KGs										QUANTITY		
No. Annex II	POLLUTANT Name	M/C/E	METHOD Method Used		Engine 1	Engine 2	Engine 3	Engine 4	Flare 1	Flare 2	Flare 3	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
			Method Code	Designation or Description	Emission Point 1	Emission Point 2	Emission Point 3	Emission Point 4	Emission Point 5	Emission Point 6	Emission Point 7			
80	Chlorine and inorganic compounds (as HCl)	C			16.43	7.09	0.0	0.0	14.5	0.0	0.0	38.02	0.0	0.0
84	Fluorine and inorganic compounds (as HF)	C			10.59	19.92	0.0	0.0	26.6	0.0	0.0	57.11	0.0	0.0

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

SECTION C : REMAINING POLLUTANT EMISSIONS (As required in your Licence)

RELEASES TO AIR		Please enter all quantities in this section in KGs										QUANTITY				
Pollutant No.	POLLUTANT Name	M/C/E	METHOD Method Used		Engine 1	Engine 2	Engine 3	Engine 4	Flare 1	Flare 2	Flare 3	Emission Point 8	Emission Point 9	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
			Method Code	Designation or Description	Emission Point 1	Emission Point 2	Emission Point 3	Emission Point 4	Emission Point 5	Emission Point 6	Emission Point 7					
244	Total Particulates	C		TCR tekora isokinetic particulate sampler with OMA (Quartz) high temperature filters in accordance with EN13284-1:2002	263.68	43.11	0.0	0.0	0.0	0.0	0.0	0.0	0.0	306.79	0.0	0.0
351	Total Organic Carbon (as C)	C		Measured at engines using a pre-calibrated Signal 3030 analyser	0.0	0.0	0.0	0.0	47.11	0.0	0.0	0.0	0.0	47.11	0.0	0.0

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

Additional Data Requested from Landfill operators

For the purposes of the National Inventory on Greenhouse Gases, landfill operators are requested to provide summary data on landfill gas (Methane) flared or utilised on their facilities to accompany the figures for total methane generated. Operators should only report their Net methane (CH4) emission to the environment under T(total) KG/y for Section A: Sector specific PRTR pollutants above. Please complete the table below:

Landfill:	Knockharley Landfill				
Please enter summary data on the quantities of methane flared and / or utilised	T (Total) kg/Year	M/C/E	Method Used		Facility Total Capacity m3 per hour
	Total estimated methane generation (as per site model)	6906121.0	C	Oth Gas Sim Model	N/A
	Methane flared	1486349.0	M	Oth Measured at Flares	0.0 (Total Flaring Capacity)
	Methane utilised in engine/s	4239148.0	M	Oth Measured at Engines	0.0 (Total Utilising Capacity)
	Net methane emission (as reported in Section A above)	1180624.0	C		N/A

4.2 RELEASES TO WATERS

[Link to previous years emissions data](#)

| PRTR# : W0146 | Facility Name : Knockharley Landfill | Filename : W0146_2012.xlsm | Return Year : 2012 |

25/06/2013 08:05

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

Data on ambient monitoring of storm/surface water or groundwater, conducted as part of your licence requirements, should NOT be submitted under AER / PRTR Reporting as this only concerns Releases from your facility

POLLUTANT		RELEASERS TO WATERS			Please enter all quantities in this section in KGs			
No. Annex II	Name	M/C/E	Method Used		QUANTITY			
			Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
79	Chlorides (as Cl)	C	OTH	annual lab result and discharge volume per annum used to calculate emission	2175.7	2175.7	0.0	0.0
13	Total phosphorus	C	OTH	annual lab result and discharge volume per annum used to calculate emission	8.96	8.96	0.0	0.0
20	Copper and compounds (as Cu)	C	OTH	annual lab result and discharge volume per annum used to calculate emission	217.57	217.57	0.0	0.0

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

SECTION B : REMAINING PRTR POLLUTANTS

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

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

SECTION C : REMAINING POLLUTANT EMISSIONS (as required in your Licence)

POLLUTANT		RELEASERS TO WATERS			Please enter all quantities in this section in KGs			
Pollutant No.	Name	M/C/E	Method Used		QUANTITY			
			Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
303	BOD	C	OTH	annual lab result and discharge volume per annum used to calculate emission	639.91	639.91	0.0	0.0
305	Calcium	C	OTH	annual lab result and discharge volume per annum used to calculate emission	18173.0	18173.0	0.0	0.0
306	COD	C	OTH	annual lab result and discharge volume per annum used to calculate emission	2559.6	2559.6	0.0	0.0
320	Magnesium	C	OTH	annual lab result and discharge volume per annum used to calculate emission	2047.7	2047.7	0.0	0.0
338	Potassium	C	OTH	annual lab result and discharge volume per annum used to calculate emission	640.0	640.0	0.0	0.0
341	Sodium	C	OTH	annual lab result and discharge volume per annum used to calculate emission	1664.0	1664.0	0.0	0.0
343	Sulphate	C	OTH	annual lab result and discharge volume per annum used to calculate emission	28028.0	28028.0	0.0	0.0
379	Total Oxidised Nitrogen (TON)	C	OTH	annual lab result and discharge volume per annum used to calculate emission	19.2	19.2	0.0	0.0
240	Suspended Solids	C	OTH	annual lab result and discharge volume per annum used to calculate emission	511.93	511.93	0.0	0.0

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

4.3 RELEASES TO WASTEWATER OR SEWER

[Link to previous years emissions data](#)

| PRTR# : W0146 | Facility Name : Knockharley Landfill | Filename : W0146_2012.xlsm | Return Year

25/06/2013 08:05

SECTION A : PRTR POLLUTANTS

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

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

SECTION B : REMAINING POLLUTANT EMISSIONS (as required in your Licence)

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

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

4.4 RELEASES TO LAND

[Link to previous years emissions data](#)

| PRTR# : W0146 | Facility Name : Knockharley Landfill | Filename : W0146_2012.xlsm | Return Year : 2012 |

25/06/2013 08:05

SECTION A : PRTR POLLUTANTS

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

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

SECTION B : REMAINING POLLUTANT EMISSIONS (as required in your Licence)

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

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

5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE

| PRTR# : W0146 | Facility Name : Knockharley Landfill | Filename : W0146_2012.xlsm | Return Year : 2012 |

25/06/2013 08:05

Please enter all quantities on this sheet in Tonnes

3

Transfer Destination	European Waste Code	Hazardous	Quantity (Tonnes per Year)	Description of Waste	Waste Treatment Operation	Method Used		Location of Treatment	Haz Waste : Name and Licence/Permit No of Next Destination Facility	Non	Haz Waste : Address of Next Destination Facility	Name and License / Permit No. and Address of Final Recoverer / Disposer (HAZARDOUS WASTE ONLY)	Actual Address of Final Destination i.e. Final Recovery / Disposal Site (HAZARDOUS WASTE ONLY)
						Haz Waste : Name and Licence/Permit No of Recover/Disposer			Non Haz Waste: Address of Recover/Disposer				
						M/C/E	Method Used						
Within the Country	19 07 03	No	11918.86	landfill leachate other than those mentioned in 19 07 02	D9	M	Weighed	Offsite in Ireland	Navan Waste Water Treatment Plant, Navan, County Meath, Ireland		Navan Waste Water Treatment Plant, Navan, County Meath, Ireland		
Within the Country	19 07 03	No	6851.0	landfill leachate other than those mentioned in 19 07 02	D9	M	Weighed	Offsite in Ireland	Rilta, .		Greenogue Business Park, Rathcoole, Dublin, Ireland		
Within the Country	19 07 03	No	8298.88	landfill leachate other than those mentioned in 19 07 02	D9	M	Weighed	Offsite in Ireland	EPS Ltd. WWTP, .		Drogheda, Co. Louth, Ireland		
Within the Country	19 07 03	No	290.22	landfill leachate other than those mentioned in 19 07 02	D9	M	Weighed	Offsite in Ireland	Dunshaughlin WWTP, .		Dunshaughlin, Co. Meath, Ireland		

* Select a row by double-clicking the Description of Waste then click the delete button

[Link to previous years waste data](#)

[Link to previous years waste summary data & percentage change](#)