GREENSTAR LTD. - KNOCKHARLEY LANDFILL, CO. MEATH

ANNUAL ENVIRONMENTAL REPORT:

Report Period: January 2013 – December 2013

WASTE LICENCE REF. NO. W0146-02

Original

MARCH 2014

FEHILY TIMONEY & COMPANY

ENVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION

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Abstract: This report details the Annual Environmental Report for the Knockharley Landfill, Co. Meath for the reporting period from 1 January 2012 to 31 December 2013. 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 19 of March, 2003. A revision of the licence, W0146-02 was issued by the EPA on 23 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 was completed during 2013. Cells 11 and 12 were constructed during 2009 and waste placement commenced in Cell 12 during 2012. Nineteen additional landfill gas extraction wells were drilled and installed during April 2013 in Cell 12.

Greenstar retained Fehily Timoney & Company (FTC) to compile the Annual Environmental Report (AER) for the facility for the reporting period January 2013 to December 2013. This report has been prepared in accordance with Condition 11.7 and Schedule E & F of the waste licence. The contents of chapters 2, 5, 6, 9 and 10 were compiled by Greenstar.

This report addresses Condition 11.7 of the waste licence for the facility which states:

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 31 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 1 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 1 January to 31 December 2013.

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.

In accordance with the amended first schedule of the EPA Act 1992 – 2013, the facility waste licence was amended in December 2013 (Section 76A(11) Amendment to Industrial Emissions Licence) to bring it into conformity with the Industrial Emissions Directive (2010/75/EU).

Licensed activities, in accordance with the amended First Schedule of the EPA Acts 1992 to 2013

Class 11.1 The recovery or disposal of waste in a facility, within the meaning of the Act of 1996, which facility is connected or associated with another activity specified in this Schedule in respect of which a licence or revised licence under Part IV is in force or in respect of which a licence under the said Part is or will be required.

Class 11.5 Landfills, within the meaning of section 5 (amended by Regulation 11(1) of the Waste Management (Certification of Historic Unlicenced Waste Disposal and Recovery Activity) Regulations 2008 (S.I. No. 524 of 2008)) of the Act of 1996, receiving more than 10 tonnes of waste per day or with a total capacity exceeding 25,000 tonnes, other than landfills of inert waste.

2.2. Waste Quantities and Composition 2005 - 2013

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, 2012 and 2013.

From March 2013 to December 2013 the facility was closed to incoming waste material for disposal.

Table 2.2: Waste Quantities Accepted at Knockharley Landfill from 2004 – 2013

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)	Total Accepted 2013 (tonnes)
Waste for disposal											
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	18
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	35
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	795
EWC 19 08 01	Screenings from waste water treatment plants									228.70	4.8
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	17,787.7
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	9,925.98
EWC 20 03 03	Street cleaning waste						69.46	99.84	2,603.22	11,271.13	1,703
EWC 20 03 07	Municipal Bulky Waste					144.44	27,105.50	32,700.70	12,435.36	4,658.48	348.6
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***	***30,618***
Waste for recovery											
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	6,459.32
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	5,852.84
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	4,009.86
EWC 19 09 02	Sludges from water clarification					8.12				6,236.68	8,435.3
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	677.26
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	13,089.66
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***	***38,525***

Table 2.3: Leachate Quantities Consigned from Knockharley Landfill, 2013

European Waste Code Categories	Description	Tonnes	Destination
154EWC 19 07 03	Leachate	15,412.24	EPS LTD
EWC 19 07 03	Leachate	6,963.80	Navan WWTP
EWC 19 07 03	Leachate	3,442.14	Rilta Environmental
Total waste consigned		**25,818.18**	

Table 2.4: Waste Quantities Consigned from Knockharley Landfill, 2013

European Waste Code Categories	Description	Tonnes	Destination
EWC 19 01 02	Metals	34.32	Hammond Lane
Total waste consigned		**34.32**	

2.3. Calculated Remaining Capacity of the Facility

The total capacity of the facility is estimated to be 3,282,500 m^3. It is estimated that approximately 1,394,920 m^3 of void space has been used to January 2014. The remaining capacity is approximately 1,887,580 m^3. The most recent topographical survey, carried out on the 27 January 2014, 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 (m) after compaction, a width of 25 m, a length of 25 m 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 2013 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 57 dB at N2 and again at N2 during Quarter 2 in June when the L_{Aeq} was 56 dB. Vehicle movements on the nearby main road, the N2, and vehicle movements on the local road, adjacent to the noise monitoring locations, 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 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 not identified during the 2013 monitoring period.

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 and 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

10.7.1. 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 50 m 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 1 occasion at 1 no. well during the monitoring period at LG-03 in October of Quarter 4.

This well has historically shown spikes in methane and it along with the elevated natural carbon dioxide levels in perimeters wells were discussed in a letter dated 5 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 this well 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 36 occasions in 15 no. wells during Quarter 1 (LG01, LG02, LG03, LG04, LG05, LG15, LG16, LG20, LG21, LG23, LG24, LG50, LG51, LG52 and LG53)
- on 30 occasions in 12 no. wells during Quarter 2 (LG02, LG03, LG04, LG05, LG15, LG20, LG23, LG50, LG51, LG52, LG53 and LG54)
- on 32 occasions in 16 no. wells during Quarter 3 (LG02, LG03, LG04, LG05, LG12, LG13, LG15, LG16, LG20, LG22, LG23, LG50, LG51, LG52, LG53 and LG54)
- on 34 occasions in 14 no. wells during Quarter 4 (LG01, LG02, LG03, LG04, LG05, LG12, LG15, LG16, LG17, 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 2 m 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

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 by Greenstar personnel at eight locations on a monthly basis during the 2013 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 by Greenstar personnel at eight 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 (the outlet from the surface water wetland) 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

10.7.1. Macroinvertebrate Survey

Biological monitoring of surface water quality was undertaken by means of a macroinvertebrate survey in accordance with Schedule D of the waste licence on 16 September 2013 at four locations, Sites 1–4. These monitoring locations are described in Section 1.1.2, on Table 1.1 and are shown on Figure 1.1. The survey was undertaken by FTC.

10.7.2. Methodology

Biological sampling or macroinvertebrate sampling was carried out by means of Small Stream Risk Score (SSRS) methodology. SSRS is a biological risk assessment system for detecting potential sources of pollution in 1st and 2nd order streams. It was developed by the EPA in association with the Western River Basin District (WRBD) with the primary aim of supporting the programme of measures for the Water Framework Directive (WFD). The main objective of the WFD is the achievement of 'Good' water status in all water bodies by 2015.

SSRS is a simple biotic index based on analysis of the community assemblage and abundance of benthic macroinvertebrates at a monitoring site. The SSRS allows the classification of the stream as 'At Risk', 'Indeterminate – May Be at Risk', or 'Probably Not at Risk'.

SSRS methodology was carried out according to the training manual developed by White Young Green (2009) *SSRS Training Manual – a Pollution Investigation Tool for Use in the Field*. Samples were collected from the four stream and river sites by means of a two minute kick sample, collecting all macroinvertebrates in a 1 mm pond net attached to a metal frame. Macroinvertebrates were identified on the bankside, a field sheet was filled in for each site, and a risk score was calculated (see attached field sheets).

Table 4.1: Biological Monitoring Locations

Sample	Location
Site 1	Less than 1 km downstream receptor site on the Knockharley stream
Site 2	Upstream control site on the Knockharley stream
Site 3	Downstream receptor site (corresponds with the EPA site 08/N/01/ 200) on the River Nanny
Site 4	Upstream control site (Corresponds with EPA site 08/N/01/0110) on the River Nanny

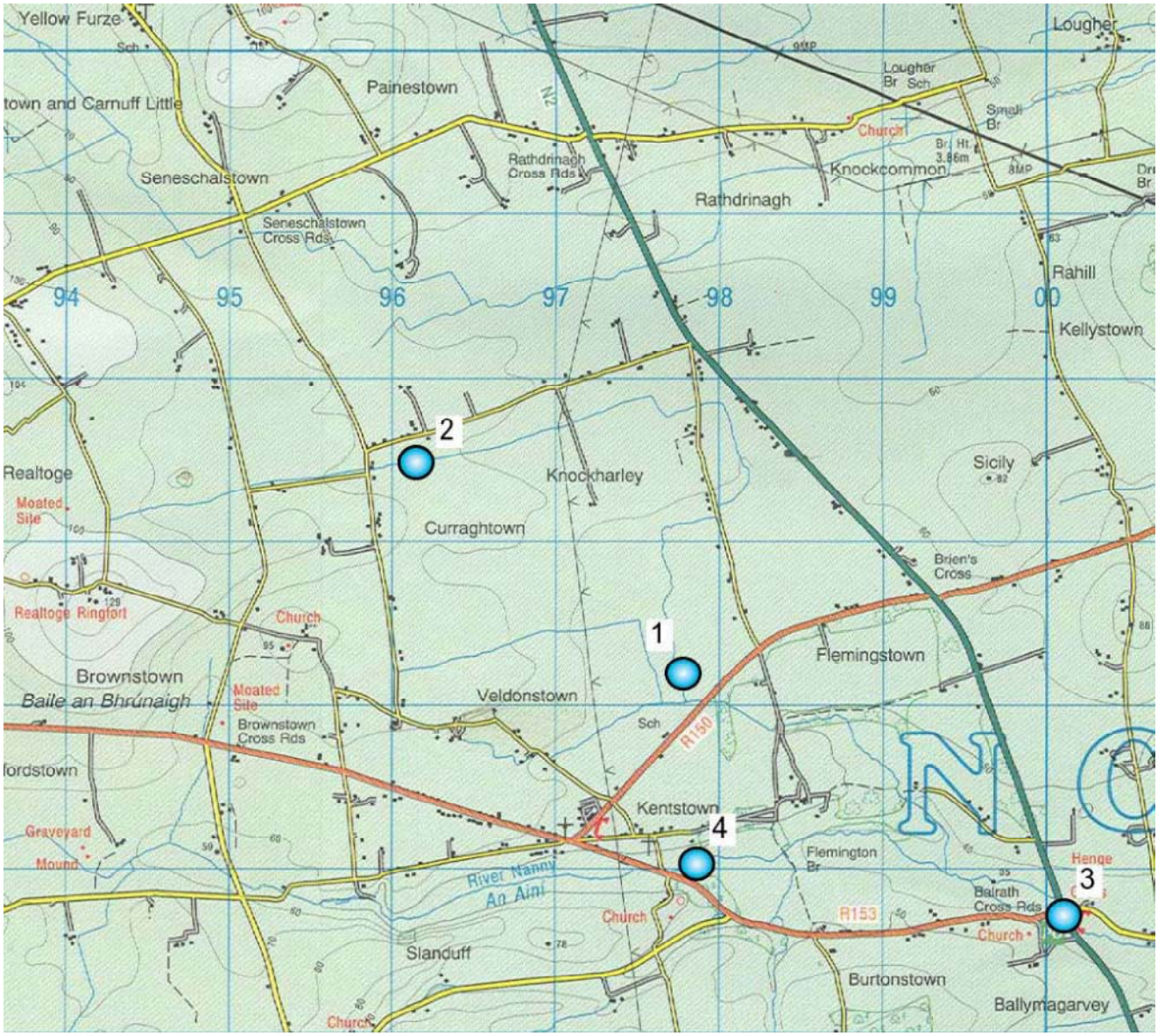


Figure 4.1: Biological Monitoring Locations at Knockharley - 2013

10.7.3. Results

Site 1 - Knockharley Stream

This site is located less than 1 km downstream of Knockharley Landfill on Knockharley Stream. The monitoring location was approximately 3 m wide at the sample location and approximately 0.05 m deep. A very low flow was recorded at the time of monitoring. The substrate was observed to consist of cobble and gravel, with silt present. The location is very overshadowed, with trees and shrubbery, and cattle access was evident. The water was slightly turbid with some sewage fungus and filamentous algae present. This location was given a risk score of 3.2 or 'at risk'. See Figure 4.2 for SSRS field sheet.

Site 2 – Knockharley Stream

This site is located upstream of Knockharley Landfill on Knockharley Stream. The monitoring location was approximately 1 m in width and approximately 0.05 m in depth. A very low flow was recorded at the time of monitoring due to the recent dry summer. The substrate was observed to consist of fine gravel, covered in mud and silt. The banks were covered with vegetation and trees overhanging the stream, and there was leaf litter on the stream bed. The water was slightly turbid with no detectable odour. Sewage fungus was present. This location was given a risk score of 3.2 or 'at risk'. See Figure 4.3 for SSRS field sheet.

Site 3 – River Nanny

This site is located downstream of Knockharley Landfill on the River Nanny. The monitoring location was approximately 4 - 7 m in width and up to 0.3 m in depth. The velocity of the water was moderate and the colour was slight, with slight turbidity. There was cattle access at this site. The substrate was boulders and cobbles and silt. Trees and vegetation were present on the banks, but shading was low. Filamentous algae was abundant and sewage fungus was moderate. This location was given a risk score of 5.6 which is 'at risk' (though at the higher end of the scale, > 6.5 is an intermediate risk). See Figure 4.4 for SSRS field sheet.

Site 4 – River Nanny

This site is located upstream of Knockharley Landfill on the River Nanny. The monitoring location is approximately 2 m in width and approximately 0.15 m in depth. Low and slow flow was observed at the time of sampling. The substrate was mostly silt and mud. There was a slight colour in the water and it was slightly turbid. There was vegetation on the banks, and a moderate covering of leaf litter. Sewage fungus was present. This location was given a risk score of 3.2 or 'at risk'. See Figure 4.5 for SSRS field sheet.

River: Knockharley Stream | **Code:** | **Date:** 16/09/'13 | **Time:** 12:30

Station no. 1

Location: North of Kentstown, Co. Meath

Grid (6 figure): N 977 660

Stream Order: 1st

Stream flow: Riffle / [Riffle/Glide] / Slow flow

Field Chemistry

DO%	
DO mg/l	
Temp (°C)	
Conductivity	
pH	
Bank width (cm)	4m
Wet width (cm)	3m
Avg Depth (cm)	5cm
Staff gauge	

Velocity	Colour
Torrential	None
Fast	[Slight]
[Moderate]	Moderate
Slow	High
Very slow	

Clarity	Discharge
Very clear	Flood
Clear	Normal
[Slightly turbid]	[Low]
Highly turbid	Very Low
	Dry
	Recent Flood

Modifications: Y/N Canalised-widened-bank erosion-arterial drainage

Dominant Types:
Bedrock
Boulder (>128mm)
[Cobble (32-128mm)]
[Gravel (8-32mm)]
Fine Gravel (2-8mm)
Sand (0.25-2mm)
[Silt (<0.25mm)]

Slope: [Low] – Medium – High – Very High

Geology: Calcareous-Siliceous-Mixed

Substratum Condition: Calcareous-Compacted-[Loose] - Normal

Substratum: Stoney bottom-Muddy bottom-[Mud over stones]

Degree of siltation: Clean-Slight-[Moderate]-Heavy

Depth of mud: None: <1cm: 1-5cm: 5-10cm: >10cm

Litter: None – Present – [Moderate] - Abundant

Shading: [High] – Moderate – Low - None

Cattle access Y: upstream – downstream or N
Yes - upstream + downstream

Photo: Y / N
N

Filamentous Algae: None – Present – [Moderate] - Abundant

Sewage Fungus: None – Present – Moderate - [Abundant]

Main land use u/s:

[Pasture]	Urban	
Bog	Tillage	
Forestry	Other	

Sample retained: Y / N

Sampled in Minutes:
[Pond net x] 2min
Stone wash x
Weed sweep x

General Comments:
ADDITIONAL SPECIES: Gammarus sp. - 5 TICK (CARACNIDAE) - 1
HIRUDINEA - 1
SMALL FISH - 6

Macroinvertebrate Composition

The macroinvertebrates are divided into the following 5 specific groups:

- Group 1 = Ephemeroptera (3-tails) – note that tails may be damaged during sampling
- Group 2 = Plecoptera (2-tails) - note that tails may be damaged during sampling
- Group 3 = Trichoptera
- Group 4 = G.OL.D (Gastropoda, Oligochaeta and Diptera)
- Group 5 = *Asellus*
- Calculate the total number of taxa and relative abundance of each macroinvertebrate group below: (Abundance – Ab)

Relative Abundance

1-5	1
6-20	2
21-50	3
51-100	4
101+	5

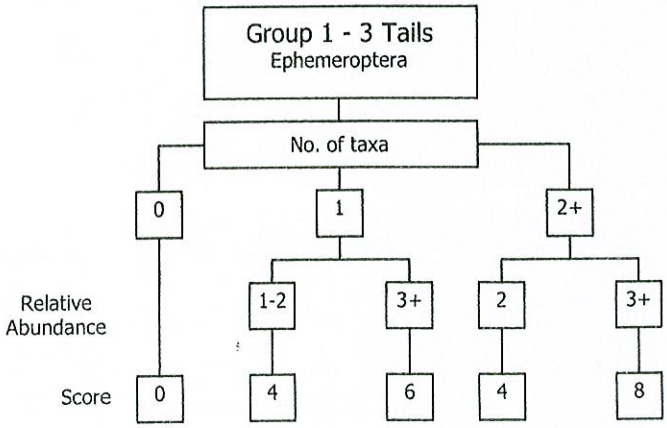
Ephemeroptera:		**Plecoptera:**	
Ecdyonurus Ab		*Leuctra* Ab	
Rhithrogena Ab		*Isoperla* Ab	
Heptagenia Ab		*Protonemura* Ab	
Ephemerella Ab		*Amphinemura* Ab	
Caenis Ab		*Perla* Ab	
Paraleptophlebia Ab		*Dinocras* Ab	
Ephemera danica Ab		Other Plecop Ab	
Other Ephem Ab		Other Plecop Ab	
Total no. of taxa	0	**Total Relative Abundance**	0
Total no. of Taxa	0	**Total Relative Abundance**	0

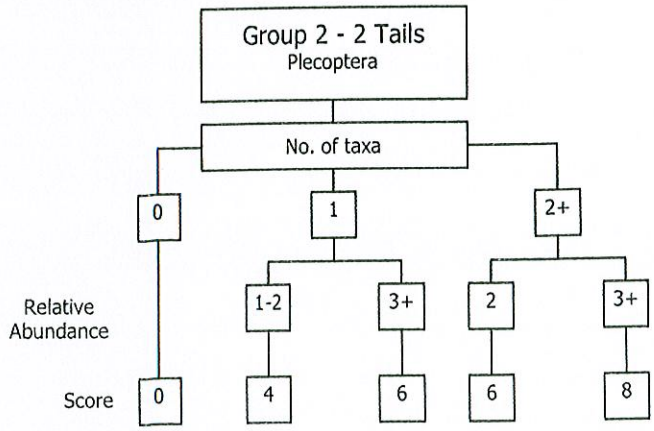
Trichoptera:		**G.OL.D:**			**Asellus:**	
Hydropsychidae Ab		*Lymnaea* (G) Ab		1 Chironomidae (D) Ab 1	Absent	
Polycentropodidae Ab		3 *Potamopyrgus* (G) Ab	1	10 *Chironomus* (D) Ab 2	Few/Low	2
2 *Rhyacophila* Ab	1	*Planorbis* (G) Ab		Simuliidae (D) Ab	Common/ Numerous	
Philopotamidae Ab		*Ancylus* (G) Ab		*Dicranota* (D) Ab		
Limnephilidae Ab		*Physa* (G) Ab		Tipulidae (D) Ab		
Sericostomatidae Ab		*Lumbriculus* (Ol) Ab		Ceratopogonidae (D) Ab		
Glossosomatidae Ab		*Eiseniella* (Ol) Ab		Other GOLD Ab		
Lepidostomatidae Ab		Tubificidae (Ol) Ab				
Other Trichoptera Ab						
Total no. of Taxa	1	**Total Relative Abundance**	1	**Total no. of Taxa** 3	**Total Relative Abundance**	4

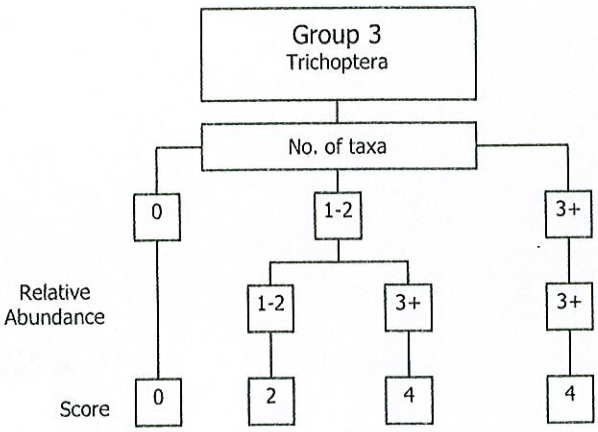
NOTE: *Asellus* must be recorded as absent if none are found

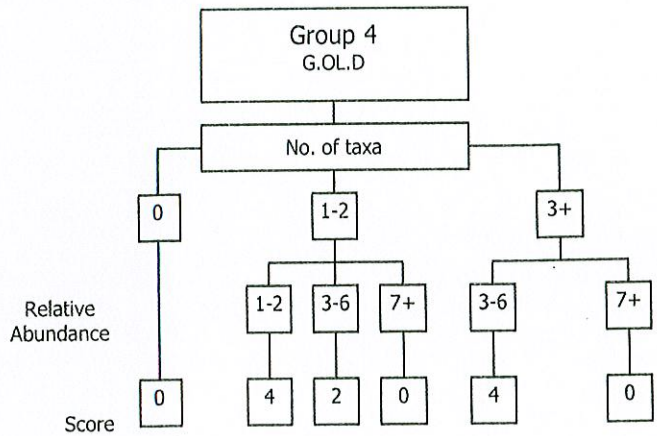
NOTE *Baetis* is an Ephemeropteran and is the most commonly occurring invertebrate genus in streams in Ireland. It is vital that *Baetis* is not counted in SSRS. See Appendix B for more details on how to identify *Baetis*.

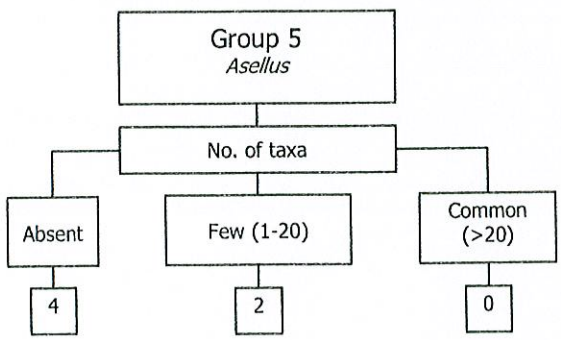
Step 1. Calculate the Index Score by circling the appropriate box representing the total number of taxa and the total abundance calculated from ***each macroinvertebrate group*** calculated from page 1 of the recording sheet and enter in to the boxes in Step 2.











Step 2

a) Index Score Group 1	0
b) Index Score Group 2	0
c) Index Score Group 3	2
d) Index Score Group 4	4
e) Index Score Group 5	2

Step 3. Calculate the Total Index Score, the Average Index Score and the SSR Score using the boxes below

Total Index Score (TIS) sum (a+b+c+d+e)	8	Average Index Score (AIS) TIS/5 (5 for 5 groups)	1.6	**SSR Score** (AIS x 2)	3.2

Step 4. Assess the stream by comparing the final SSR score with the categories below and tick the appropriate box

> 7.25 Probably not at risk		> 6.5 – 7.25 Indeterminate Stream may be at risk		<6.5 Stream at risk	X

Surveyor (signed): Alison McCarthy Name (print): ALISON MCCARTHY Date: 16 / 09 / 2013

River: Knockharley Stream | **Code:** | **Date:** | **Time:** 13:40

Station no. 2

Location: NW OF KENTSTOWN, CO. MEATH

Grid (6 figure): N 96689 16591

Stream Order: 1st

Field Chemistry

DO%	
DO mg/l	
Temp (°C)	
Conductivity	
pH	
Bank width (cm)	3-4m
Wet width (cm)	1M
Avg Depth (cm)	5cm
Staff gauge	

Velocity	Colour
Torrential	None
Fast	[Slight]
Moderate	Moderate
Slow	High
[Very slow]	

Clarity	Discharge
Very clear	Flood
Clear	Normal
[Slightly turbid]	Low
Highly turbid	[Very Low]
	Dry
	Recent Flood

Modifications: Y/N Canalised-widened-bank erosion-arterial drainage

Dominant Types:
Bedrock
Boulder (>128mm)
Cobble (32-128mm)
Gravel (8-32mm)
[Fine Gravel (2-8mm)]
Sand (0.25-2mm)
[Silt (<0.25mm)]

Slope: [Low] – Medium – High – Very High

Geology: Calcareous-Siliceous-Mixed

Substratum Condition: Calcareous-Compacted-[Loose]- Normal

Substratum: Stoney bottom-Muddy bottom-[Mud over stones]

Degree of siltation: Clean-Slight-[Moderate]-Heavy

Depth of mud: None: <1cm: 1-5cm: [5-10cm] >10cm

Litter: None – Present – Moderate -[Abundant]

Stream flow:
Riffle
Riffle/Glide
[Slow flow]

Shading: [High] – Moderate – Low - None

Cattle access Y: upstream – downstream or N
N

Photo: Y / N
N

Filamentous Algae: None – Present –[Moderate]- Abundant

Sewage Fungus: None – [Present] – Moderate - Abundant

Main land use u/s:
Pasture | Urban
Bog | Tillage
Forestry | [Other] RECREATIONAL

Sample retained: Y / N
N

Sampled in Minutes:
[Pond net x] 2min
Stone wash x
Weed sweep x

General Comments: ADDITIONAL SPECIES: SMALL FISH -3, GAMMARUS SP. - 10
Note: Stream was almost dry, very little water present, very little flow.
NEXT TO SOCCER PITCH - SILT MADE SAMPLE DIFFICULT TO SEE

Macroinvertebrate Composition

The macroinvertebrates are divided into the following 5 specific groups:

- Group 1 = Ephemeroptera (3-tails) – note that tails may be damaged during sampling
- Group 2 = Plecoptera (2-tails) - note that tails may be damaged during sampling
- Group 3 = Trichoptera
- Group 4 = G.OL.D (Gastropoda, Oligochaeta and Diptera)
- Group 5 = *Asellus*
- Calculate the total number of taxa and relative abundance of each macroinvertebrate group below: (Abundance – Ab)

Relative Abundance	
1-5	1
6-20	2
21-50	3
51-100	4
101+	5

Ephemeroptera:

Ecdyonurus Ab	
Rhithrogena Ab	
Heptagenia Ab	
Ephemerella Ab	
Caenis Ab	
Paraleptophlebia Ab	
Ephemera danica Ab	
Other Ephem Ab	
Total no. of taxa	0
Total Relative Abundance	0

Plecoptera:

Leuctra Ab	
Isoperla Ab	
Protonemura Ab	
Amphinemura Ab	
Perla Ab	
Dinocras Ab	
Other Plecop Ab	
Other Plecop Ab	
Total no. of Taxa	0
Total Relative Abundance	0

Trichoptera:

Hydropsychidae Ab	
Polycentropodidae Ab	
Rhyacophila Ab	
Philopotamidae Ab	
1 Limnephilidae Ab	1
Sericostomatidae Ab	
Glossosomatidae Ab	
Lepidostomatidae Ab	
Other Trichoptera Ab	
Total no. of Taxa	1
Total Relative Abundance	1

G.OL.D:

Lymnaea (G) Ab	
Potamopyrgus (G) Ab	
Planorbis (G) Ab	
Ancylus (G) Ab	
Physa (G) Ab	
Lumbriculus (Ol) Ab	
Eiseniella (Ol) Ab	
Tubificidae (Ol) Ab	
Chironomidae (D) Ab	
30 *Chironomus* (D) Ab	3
Simuliidae (D) Ab	
13 *Dicranota* (D) Ab	2
Tipulidae (D) Ab	
Ceratopogonidae (D) Ab	
Other GOLD Ab	
Total no. of Taxa	2
Total Relative Abundance	5

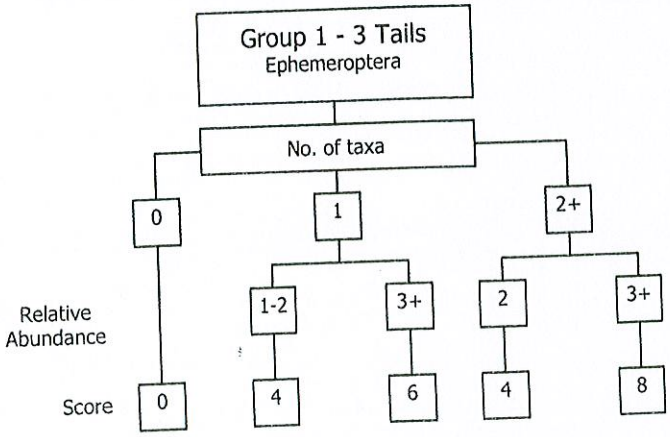
***Asellus*:**

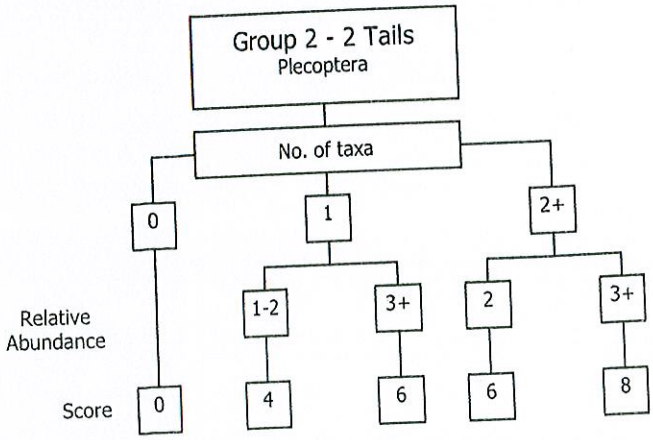
Absent	X
Few/Low	
Common/ Numerous	

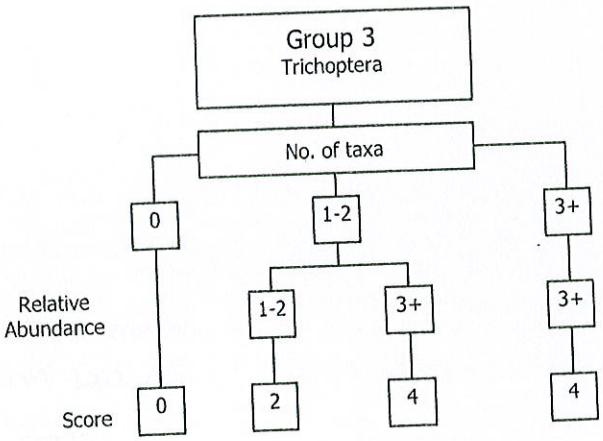
NOTE: *Asellus* must be recorded as absent if none are found

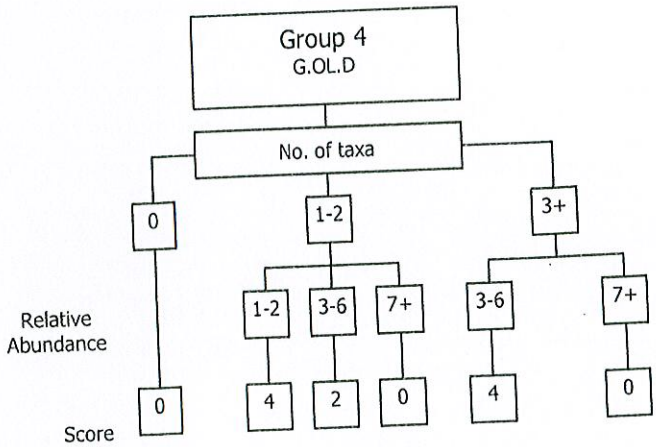
NOTE *Baetis* is an Ephemeropteran and is the most commonly occurring invertebrate genus in streams in Ireland. It is vital that *Baetis* is not counted in SSRS. See Appendix B for more details on how to identify *Baetis*.

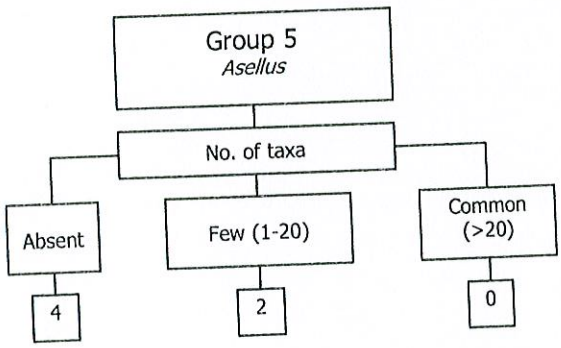
Step 1. Calculate the Index Score by circling the appropriate box representing the total number of taxa and the total abundance calculated from ***each macroinvertebrate group*** calculated from page 1 of the recording sheet and enter in to the boxes in Step 2.











Step 2

a) Index Score Group 1	0
b) Index Score Group 2	0
c) Index Score Group 3	2
d) Index Score Group 4	2
e) Index Score Group 5	4

Step 3. Calculate the Total Index Score, the Average Index Score and the SSR Score using the boxes below

Total Index Score (TIS) sum (a+b+c+d+e) **8**

Average Index Score (AIS) TIS/5 (5 for 5 groups) **1.6**

SSR Score (AIS x 2) **3.2**

Step 4. Assess the stream by comparing the final SSR score with the categories below and tick the appropriate box

> 7.25 Probably not at risk	> 6.5 – 7.25 Indeterminate Stream may be at risk	<6.5 Stream at risk
☐	☐	☒

Surveyor (signed): Alison McCarthy Name (print): ALISON MCCARTHY Date: 16 / 09 / '13

River: NANNY | **Code:** | **Date:** 16/09/13 | **Time:** 14:50

Station no. 3

Location: BALRATH CROSSROADS, CO. MEATH | **Grid (6 figure):** IN99942

Stream Order: 2nd | **Stream flow:** 1064695

Field Chemistry	
DO%	
DO mg/l	
Temp (°C)	
Conductivity	
pH	
Bank width (cm)	4-7M
Wet width (cm)	4-7M
Avg Depth (cm)	30CM
Staff gauge	

Velocity	Colour
Torrential	None
Fast	[Slight]
[Moderate]	Moderate
Slow	High
Very slow	

Clarity	Discharge
Very clear	Flood
Clear	Normal
[Slightly turbid]	[Low]
Highly turbid	Very Low
	Dry
	Recent Flood

Modifications: Y/N Canalised-widened-bank erosion-arterial drainage

Dominant Types:
Bedrock
[Boulder (>128mm)]
[Cobble (32-128mm)]
Gravel (8-32mm)
Fine Gravel (2-8mm)
Sand (0.25-2mm)
[Silt (<0.25mm)]

Slope: [Low] – Medium – High – Very High

Geology: Calcareous-Siliceous-Mixed

Substratum Condition: Calcareous-Compacted-Loose-[Normal]

Substratum:
Stoney bottom-Muddy bottom-[Mud over stones]

Degree of siltation: Clean-Slight-Moderate-[Heavy]

Depth of mud: None: <1cm: 1-5cm: [5-10cm] >10cm

Litter: None –[Present]– Moderate - Abundant

Filamentous Algae:
None – Present – Moderate -[Abundant]

Main land use u/s:
[Pasture] Urban
Bog Tillage
Forestry Other

Sample retained: Y / N N

Stream flow:
Riffle
[Riffle/Glide]
Slow flow

Shading: High – Moderate –[Low]- None

Cattle access Y: upstream – downstream or N
Yes - at sample location

Photo: Y / N

Sewage Fungus:
None – Present –[Moderate]- Abundant

Sampled in Minutes:
[Pond net x] 2 MIN
Stone wash x
Weed sweep x

General Comments: ADDITIONAL SPECIES: BAETIS - 8
GAMMARIDS - 100

Macroinvertebrate Composition

The macroinvertebrates are divided into the following 5 specific groups:

- Group 1 = Ephemeroptera (3-tails) – note that tails may be damaged during sampling
- Group 2 = Plecoptera (2-tails) - note that tails may be damaged during sampling
- Group 3 = Trichoptera
- Group 4 = G.OL.D (Gastropoda, Oligochaeta and Diptera)
- Group 5 = *Asellus*
- Calculate the total number of taxa and relative abundance of each macroinvertebrate group below: (Abundance – Ab)

Relative Abundance	
1-5	1
6-20	2
21-50	3
51-100	4
101+	5

Ephemeroptera:

Ecdyonurus Ab	
Rhithrogena Ab	
Heptagenia Ab	
Ephemerella Ab	1
Caenis Ab	
Paraleptophlebia Ab	
Ephemera danica Ab	
Other Ephem Ab	
Total no. of taxa	1
Total Relative Abundance	1

Plecoptera:

Leuctra Ab	
Isoperla Ab	
Protonemura Ab	
Amphinemura Ab	
Perla Ab	
Dinocras Ab	
Other Plecop Ab	
Other Plecop Ab	
Total no. of Taxa	0
Total Relative Abundance	0

Trichoptera:

Hydropsychidae Ab	
5 Polycentropodidae Ab	1
Rhyacophila Ab	
Philopotamidae Ab	
Limnephilidae Ab	
Sericostomatidae Ab	
Glossosomatidae Ab	
Lepidostomatidae Ab	
Other Trichoptera Ab	
Total no. of Taxa	1
Total Relative Abundance	1

G.OL.D:

Lymnaea (G) Ab	
Potamopyrgus (G) Ab	
Planorbis (G) Ab	
Ancylus (G) Ab	
Physa (G) Ab	
Lumbriculus (Ol) Ab	
Eiseniella (Ol) Ab	
1 5 Tubificidae (Ol) Ab	2
Total no. of Taxa	3

Chironomidae (D) Ab	
3 *Chironomus* (D) Ab	1
Simuliidae (D) Ab	
2 *Dicranota* (D) Ab	1
Tipulidae (D) Ab	
Ceratopogonidae (D) Ab	
Other GOLD Ab	
Total Relative Abundance	4

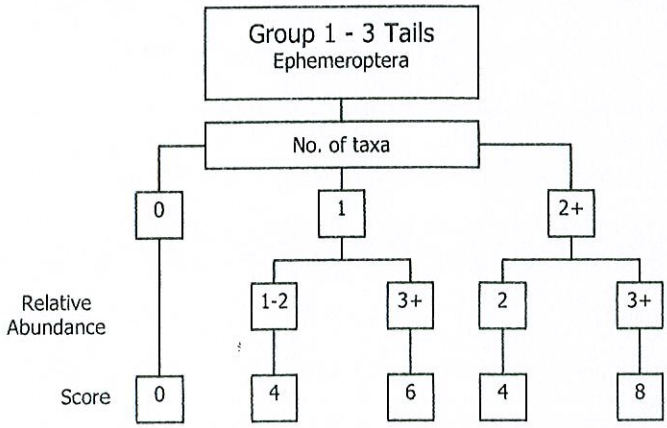
***Asellus*:**

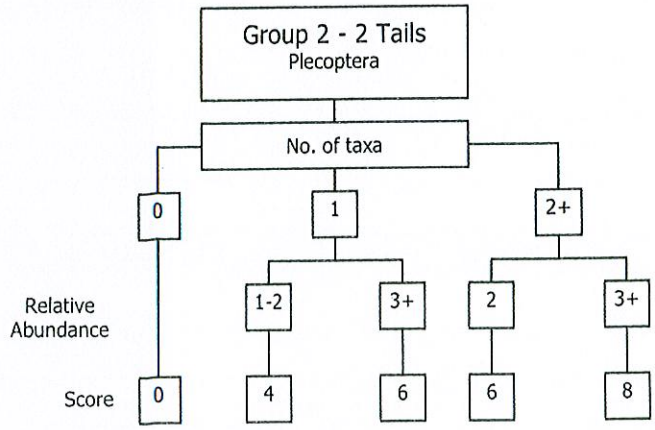
Absent	X
Few/Low	
Common/ Numerous	

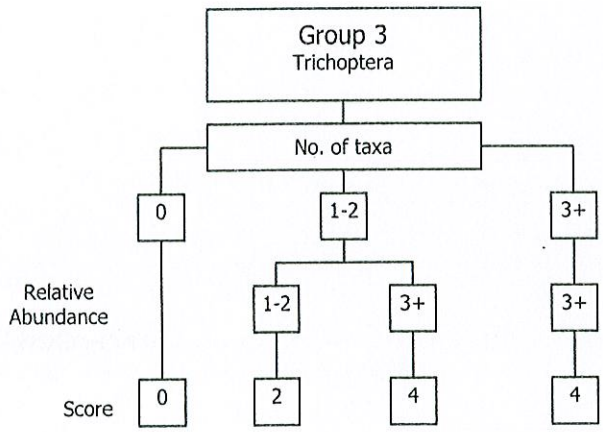
NOTE: *Asellus* must be recorded as absent if none are found

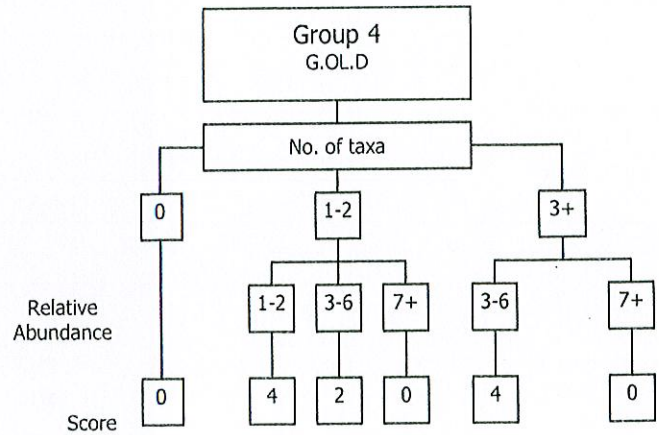
NOTE *Baetis* is an Ephemeropteran and is the most commonly occurring invertebrate genus in streams in Ireland. It is vital that *Baetis* is not counted in SSRS. See Appendix B for more details on how to identify *Baetis*.

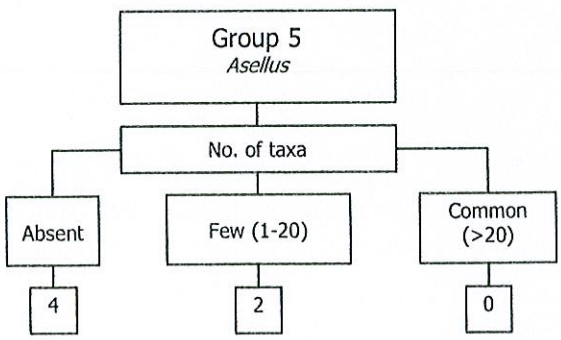
Step 1. Calculate the Index Score by circling the appropriate box representing the total number of taxa and the total abundance calculated from ***each macroinvertebrate group*** calculated from page 1 of the recording sheet and enter in to the boxes in Step 2.











Step 2

a) Index Score Group 1	4
b) Index Score Group 2	0
c) Index Score Group 3	2
d) Index Score Group 4	4
e) Index Score Group 5	4

Step 3. Calculate the Total Index Score, the Average Index Score and the SSR Score using the boxes below

Total Index Score (TIS) sum (a+b+c+d+e)	14	Average Index Score (AIS) TIS/5 (5 for 5 groups)	2.8	**SSR Score** (AIS x 2)	5.6

Step 4. Assess the stream by comparing the final SSR score with the categories below and tick the appropriate box

> 7.25 Probably not at risk		> 6.5 – 7.25 Indeterminate Stream may be at risk		<6.5 Stream at risk	X

Surveyor (signed): Alison McCarthy Name (print): ALISON MCCARTHY Date: 16 / 09 / '13

LW12-172-01 KNOCKHARLEY ENV. MONITORING + REPORTING
ALISON MCCARTHY

River: River Nanny	**Code:**	**Date:** 16/09/13	**Time:** 11:00
Station no. 4	**Location:** South of Kentstown, Co. Meath		**Grid (6 figure):** IN97697 IG64972
	Stream Order: 2nd		**Stream flow:** Riffle / Riffle/Glide / Slow flow ✓

Field Chemistry	
DO%	
DO mg/l	
Temp (°C)	
Conductivity	
pH	
Bank width (cm)	2-3m
Wet width (cm)	2m
Avg Depth (cm)	15cm
Staff gauge	

Velocity	Colour
Torrential	None
Fast	[Slight]
Moderate	Moderate
[Slow]	High
Very slow	

Clarity	Discharge
Very clear	Flood
Clear	Normal
[Slightly turbid]	[Low]
Highly turbid	Very Low
	Dry
	Recent Flood

Modifications: Y/N Canalised-widened-bank erosion-arterial drainage

Dominant Types:
Bedrock
Boulder (>128mm)
Cobble (32-128mm)
Gravel (8-32mm)
Fine Gravel (2-8mm)
Sand (0.25-2mm)
[Silt (<0.25mm)]

Slope: [Low] – Medium – High – Very High

Geology: Calcareous-Siliceous-Mixed

Substratum Condition: Calcareous-Compacted-[Loose] - Normal

Substratum: Stoney bottom-[Muddy bottom]-Mud over stones

Degree of siltation: Clean-Slight-Moderate-[Heavy]

Depth of mud: None: <1cm: 1-5cm: 5-10cm: [>10cm]

Litter: None – Present – [Moderate] - Abundant

Shading: High – [Moderate] – Low - None

Cattle access Y: upstream – downstream or N
Unknown

Photo: Y / N N

Filamentous Algae:
None – Present – [Moderate] – Abundant

Sewage Fungus:
None – [Present] – Moderate - Abundant

Main land use u/s:

[Pasture]	Urban	
Bog	Tillage	
Forestry	Other	

Sample retained: Y / [N]

Sampled in Minutes:
Pond net x 2min
Stone wash x
Weed sweep x

General Comments:
[Baetis present. Hirudinea - 3]
Gammarus +100

Macroinvertebrate Composition

The macroinvertebrates are divided into the following 5 specific groups:

- Group 1 = Ephemeroptera (3-tails) – note that tails may be damaged during sampling
- Group 2 = Plecoptera (2-tails) - note that tails may be damaged during sampling
- Group 3 = Trichoptera
- Group 4 = G.OL.D (Gastropoda, Oligochaeta and Diptera)
- Group 5 = *Asellus*
- Calculate the total number of taxa and relative abundance of each macroinvertebrate group below: (Abundance – Ab)

Relative Abundance	
1-5	1
6-20	2
21-50	3
51-100	4
101+	5

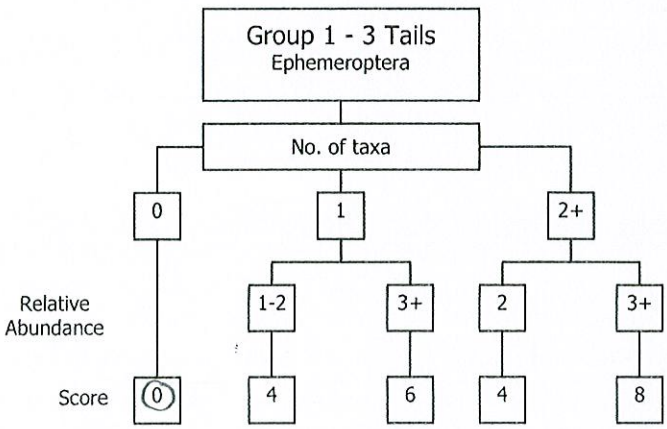
Ephemeroptera:		**Plecoptera:**	
Ecdyonurus Ab		*Leuctra* Ab	
Rhithrogena Ab		*Isoperla* Ab	
Heptagenia Ab		*Protonemura* Ab	
Ephemerella Ab		*Amphinemura* Ab	
Caenis Ab		*Perla* Ab	
Paraleptophlebia Ab		*Dinocras* Ab	
Ephemera danica Ab		Other Plecop Ab	
Other Ephem Ab		Other Plecop Ab	
Total no. of taxa	0	**Total Relative Abundance**	0
Total no. of Taxa	0	**Total Relative Abundance**	0

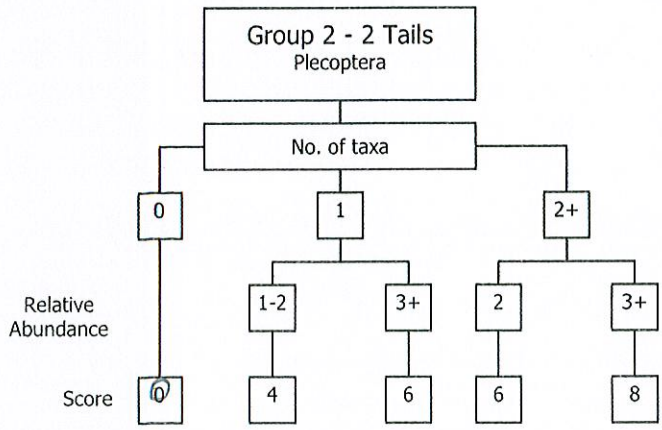
Trichoptera:		**G.OL.D:**			**Asellus:**	
2 Hydropsychidae Ab	1	4 *Lymnaea* (G) Ab	1	Chironomidae (D) Ab		Absent ✓
Polycentropodidae Ab		*Potamopyrgus* (G) Ab		10 *Chironomus* (D) Ab	2	Few/Low
Rhyacophila Ab		*Planorbis* (G) Ab		Simuliidae (D) Ab		Common/ Numerous
10 Philopotamidae Ab	2	*Ancylus* (G) Ab		15 *Dicranota* (D) Ab	2	
1 Limnephilidae Ab	1	*Physa* (G) Ab		Tipulidae (D) Ab		
Sericostomatidae Ab		*Lumbriculus* (Ol) Ab		Ceratopogonidae (D) Ab		
Glossosomatidae Ab		*Eiseniella* (Ol) Ab		Other GOLD Ab		
Lepidostomatidae Ab		25 Tubificidae (Ol) Ab	3			
Other Trichoptera Ab						
Total no. of Taxa 3	**Total Relative Abundance** 4	**Total no. of Taxa** 4		**Total Relative Abundance** 8		

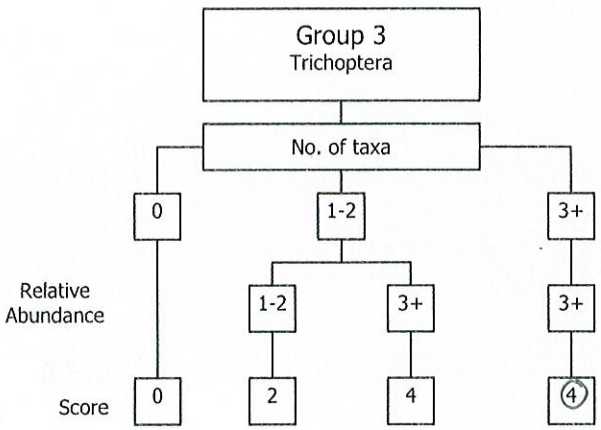
NOTE: *Asellus* must be recorded as absent if none are found

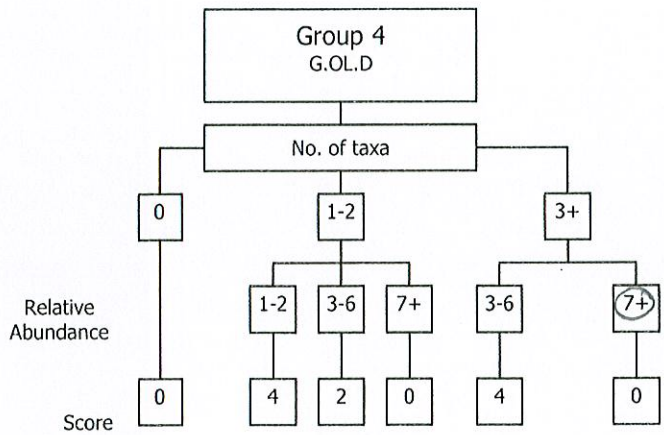
NOTE *Baetis* is an Ephemeropteran and is the most commonly occurring invertebrate genus in streams in Ireland. It is vital that *Baetis* is not counted in SSRS. See Appendix B for more details on how to identify *Baetis*.

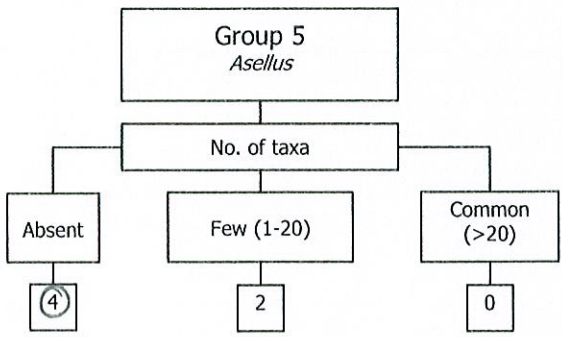
Step 1. Calculate the Index Score by circling the appropriate box representing the total number of taxa and the total abundance calculated from ***each macroinvertebrate group*** calculated from page 1 of the recording sheet and enter in to the boxes in Step 2.











Step 2

a) Index Score Group 1	0
b) Index Score Group 2	0
c) Index Score Group 3	4
d) Index Score Group 4	0
e) Index Score Group 5	4

Step 3. Calculate the Total Index Score, the Average Index Score and the SSR Score using the boxes below

Total Index Score (TIS) sum (a+b+c+d+e)	8	Average Index Score (AIS) TIS/5 (5 for 5 groups)	1.6	**SSR Score** (AIS x 2)	3.2

Step 4. Assess the stream by comparing the final SSR score with the categories below and tick the appropriate box

> 7.25 Probably not at risk		> 6.5 – 7.25 Indeterminate Stream may be at risk		<6.5 Stream at risk	X

Surveyor (signed): Alison McCarthy Name (print): ALISON MCCARTHY Date: 16 / 09 / 2013

10.7.4. Interpretation of Results

Previous surveys at these sites carried out biological monitoring by means of calculating EPA Q-values or using the Q-rating system. Q-rating is generally more useful in larger rivers and not applicable to 1st and 2nd order streams and rivers such as Sites 1–4 surrounding Knockharley landfill. Direct comparison between the Q-values collected in previous years is not possible. However, the current (2013) survey has shown that Sites 1–4 are all 'at risk' of not achieving good status by 2015. In previous surveys the Q-values calculated were mostly Q3 which is classed as 'Poor status' (see Table 1.2). Thus, both methodologies of biological sampling have revealed poor water quality in all sites.

Table 4.2: Q-Values Obtained from 2007–2011.

Sampling Period	Site 1	Site 2	Site 3	Site 4
2007	Q2 – Q3	Q2 – Q3	Q3 – Q4	Q3
2008	Q3	Q2	Q3	Q3 – Q4
2009	Q3	Q3	Q3 – Q4	Q3
2010	Q2	Q3	Q3	Q3
2011	Q3	Q3	Q2	Q2 – 3

10.7.5. EPA Classification

The current EPA classifications for the River Nanny were checked though the Envision map viewer (http://gis.epa.ie/Envision/). The current EPA classification of the River Nanny at Kentstown is Q2 - 3 or Q3, which is 'poor status'. This corresponds with the SSRS score of 'at risk' at Site 4 in the same location. The current EPA classification of the River Nanny at Balrath Crossroads is Q3 - 4 or of 'moderate status'. Indeed, in the current study the SSRS score just upstream of this location at Site 3 was just under the 'intermediate risk' classification. The River Nanny itself has been given a WFD status of 'Moderate'.

Knockharley stream (Sites 1 and 2) is not monitored by the EPA.

10.7.6. Conclusion

As indicated in the EPA monitoring results, the upper reaches of the River Nanny have a history of 'unsatisfactory' biological water quality. Upstream of the landfill site the River Nanny is classed as being of 'poor status' and downstream it is classed as being of 'moderate status'. Knockharley Stream was also given an SSRS score of 'at risk' both upstream and downstream of the landfill site. Thus, it is clear that there are other sources of pollution, other than the landfill that are impacting on the River Nanny. Agricultural practices could be a contributing factor to the water quality of the River Nanny, and cattle access was evident in two of the current sampling sites.

4.2. Surface Water

Surface water monitoring was carried out quarterly by Greenstar personnel at eight monitoring locations in accordance with Schedule D of the licence.

10.7.1. 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 4.3: 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

10.7.2. 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.

10.7.3. 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 baseline monitoring results are presented in Table 4.2.

Table 4.4: 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

Parameter	Units	SW1	SW2	SW3	SW5	SW6	SW7	SW8
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 4.6 – 4.11 below present the summary results of the main surface water monitoring parameters undertaken during the three reporting periods.

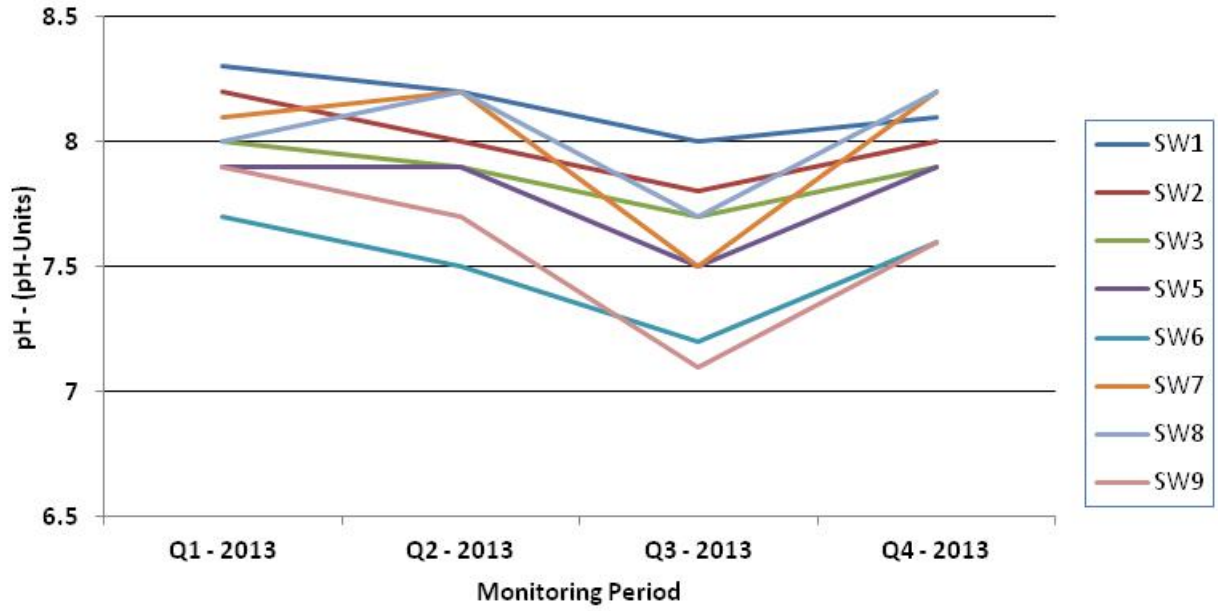


Figure 4.6: pH Results for Surface Water

The pH results, presented in Figure 4.6, are relatively consistent throughout the reporting period. The results are consistent across all monitoring locations.

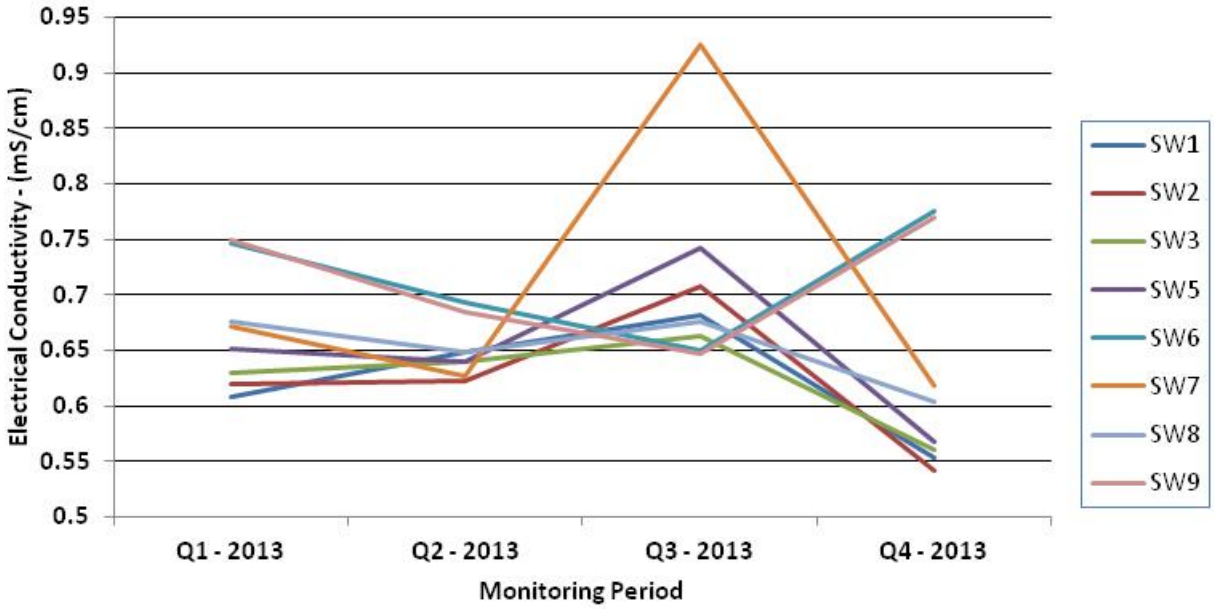


Figure 4.7: Electrical Conductivity Results for Surface Water

The electrical conductivity (EC) results, presented in Figure 4.7, were also relatively consistent throughout the reporting period. All pH and EC readings were within normal ranges for surface water accept for elevated EC readings at SW7 during quarter 3. Greenstar staff has suggested the elevated reading may be from agricultural influences including land spreading in adjoining fields to this location.

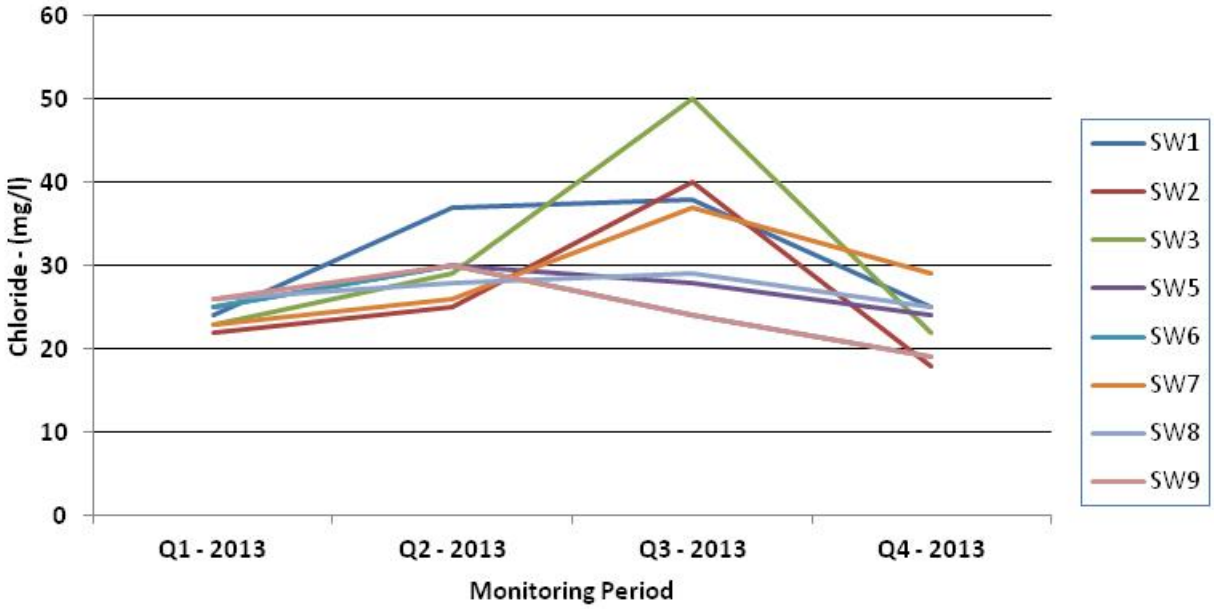


Figure 4.8: Chloride Results for Surface Water

The results for chloride (Cl) at surface water locations as presented in Figure 4.8, are consistent across all locations showing a similar trend during the reporting period.

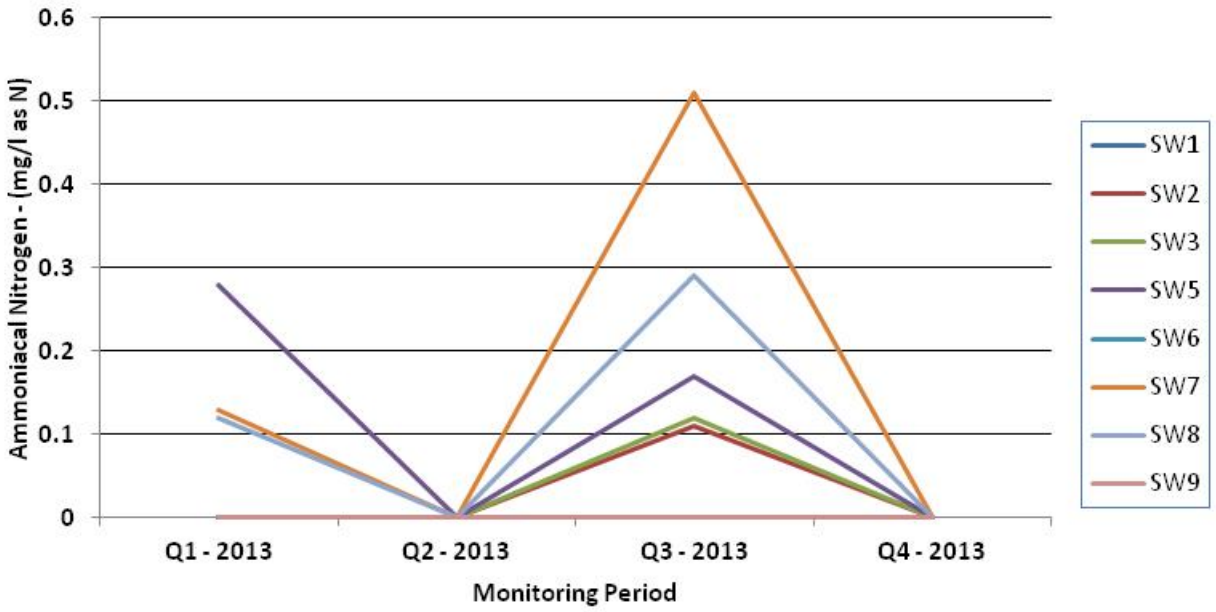


Figure 4.9: Ammoniacal Nitrogen Results for Surface Water

There is some variation in the ammoniacal nitrogen results (as shown in Figure 4.9) during the reporting period. Elevated results were recorded at all locations during Quarter 3 but not exceeding baseline levels. All results from Quarter 4 were below 0.3 mg/l as N. Results at all monitoring locations were so low during all quarters at SW9 that they were under the laboratory limit of detection.

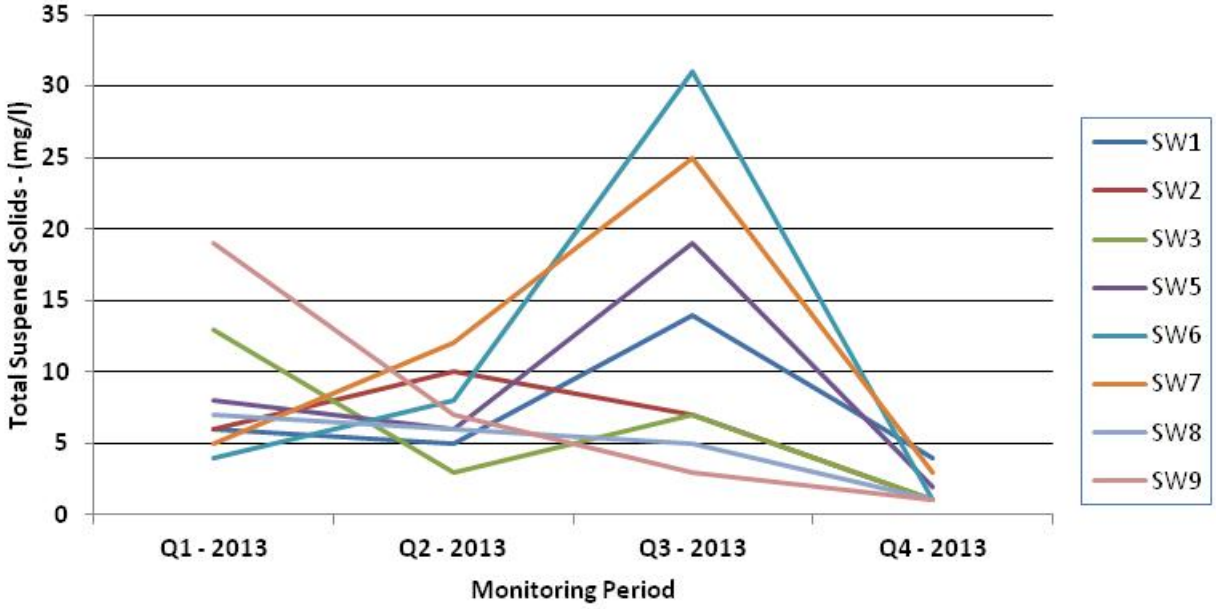


Figure 4.10: Total Suspended Solids Results for Surface Water

Levels of total suspended solids (TSS), Figure 4.10, were all within the normal range for surface waters with the exception of the results for SW7 during quarter 2 and SW5, SW6 and SW7 during quarter 3, which were recorded marginally above the baseline range.

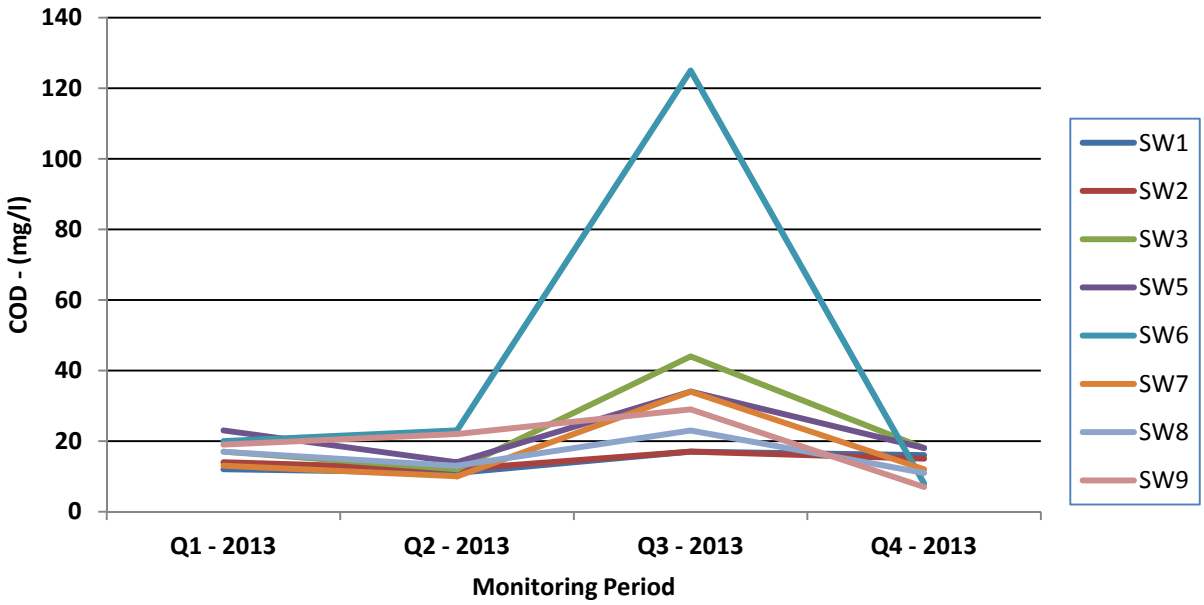


Figure 4.11: Chemical Oxygen Demand Results for Surface Water

COD levels, Figure 4.11, in general are consistent through Quarters 1 to 4 at all monitoring locations. There was a slight increase in levels at all locations during Quarter 3, with results for SW6 and SW7 both above the baseline range.

Annual Surface Water Parameters

Regarding the annual surface water monitoring parameters, the results for total oxidised nitrogen, cadmium, chromium, mercury, orthophosphate, copper, lead and zinc are all recorded under the baseline range of results for all monitoring locations.

The total alkalinity levels are above the baseline at SW1, SW2, SW3, SW5, SW6 and SW7. The results at all other locations are within the baseline range of results.

Iron levels range from 60 mg/l to 590 mg/l and are above baseline levels at SW1, SW2, SW3, SW7 and SW8.

Sulphate levels range from 20 mg/l to 221 mg/l. The results are over the baseline results at SW1, SW5, SW6, SW7 and SW8 whilst the results for all other locations 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 potassium levels were all below the baseline levels at all locations, except at SW2 and SW7 where the results were above the baseline level.

The total phosphorous results range from 0.10 mg/l to 1.48 mg/l and were above the baseline at SW1, SW2, SW3, SW7 and SW8.

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

10.7.4. Conclusion

In general, surface water quality in the 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. SW7 has slightly elevated readings which Greenstar staff has suggested may be from agricultural influences including land spreading in adjoining fields to this location during the year

4.3. Groundwater

Groundwater monitoring was undertaken by FTC personnel at seven 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 17 August 2010. Approval was granted on 23 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 4.5: 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	0[1]
Faecal Coliforms (W)*	CFU/100ml	0[1]

NAC = No abnormal change
[1] = Interim Guideline Values, from EPA, Towards Setting Guideline Values for the Protection of Groundwater in Ireland

10.7.1. Groundwater Monitoring Results – Levels

The groundwater levels were recorded on a monthly basis and the results are presented in Figure 4.12. The levels remained relatively stable throughout the reporting period. During October and December 2013 there was a sharp increase in groundwater levels at MW2d. Levels in these wells have since recovered and are being monitored closely.

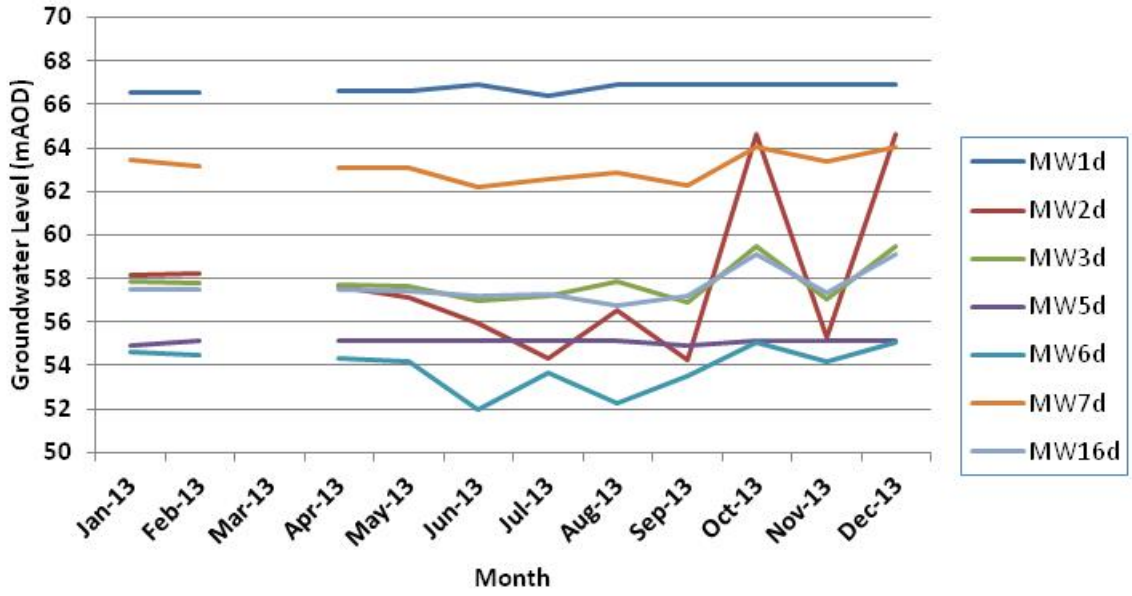


Figure 4.12: Groundwater Levels

10.7.2. Groundwater Monitoring Results – Chemical Assessment

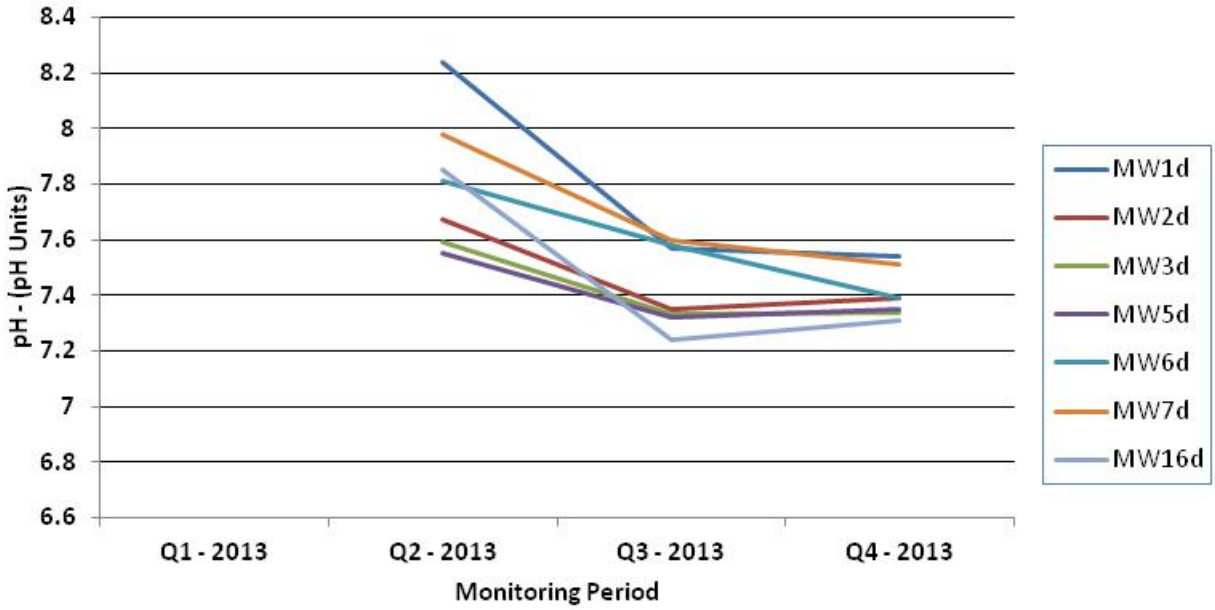


Figure 4.13: pH Results for Groundwater

The pH levels recorded in the groundwater were under the GWTL for all samples. The pH levels, presented in Figure 4.13, in general fell from quarter 2 through to quarter 4. The pH results range from 7.24 to 8.24 pH units. pH for quarter 1 was not available due to faults with the monitoring equipment during sampling.

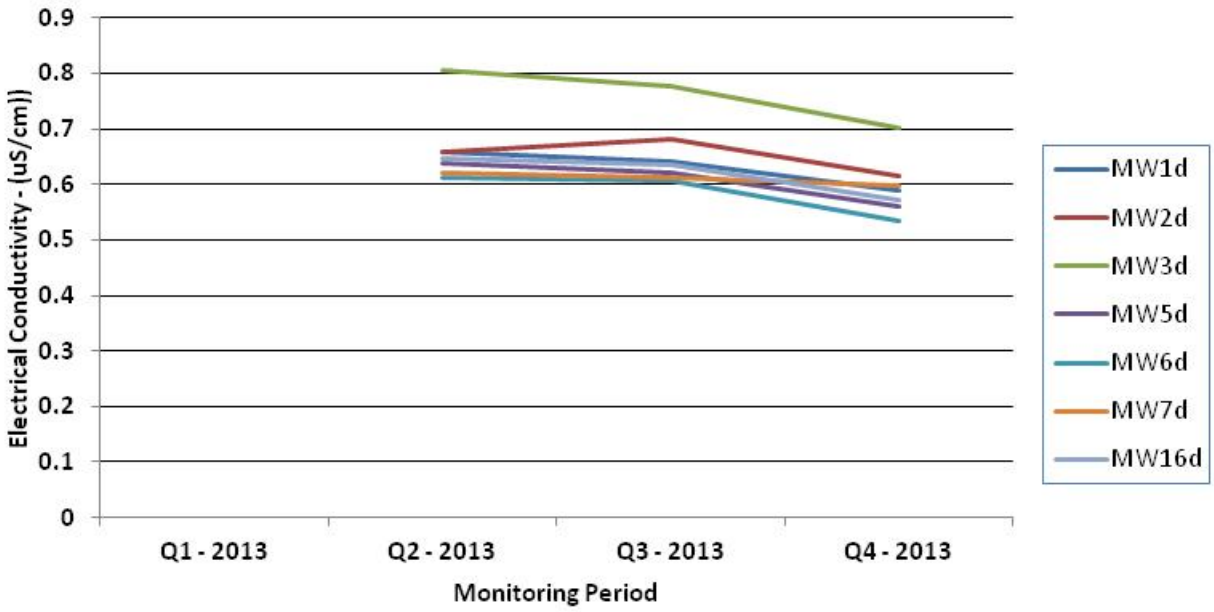


Figure 4.14: Electrical Conductivity Results for Groundwater

Electrical conductivity levels, presented in Figure 4.14, show that all readings remain consistent through quarters 2 to 4, ranging from 0.534 to 0.776 mS/cm, and are below the GWTL for all samples. The electrical conductivity levels are all consistent with unpolluted groundwater. Electrical conductivity for quarter 1 was not available due to faults with the monitoring equipment during sampling.

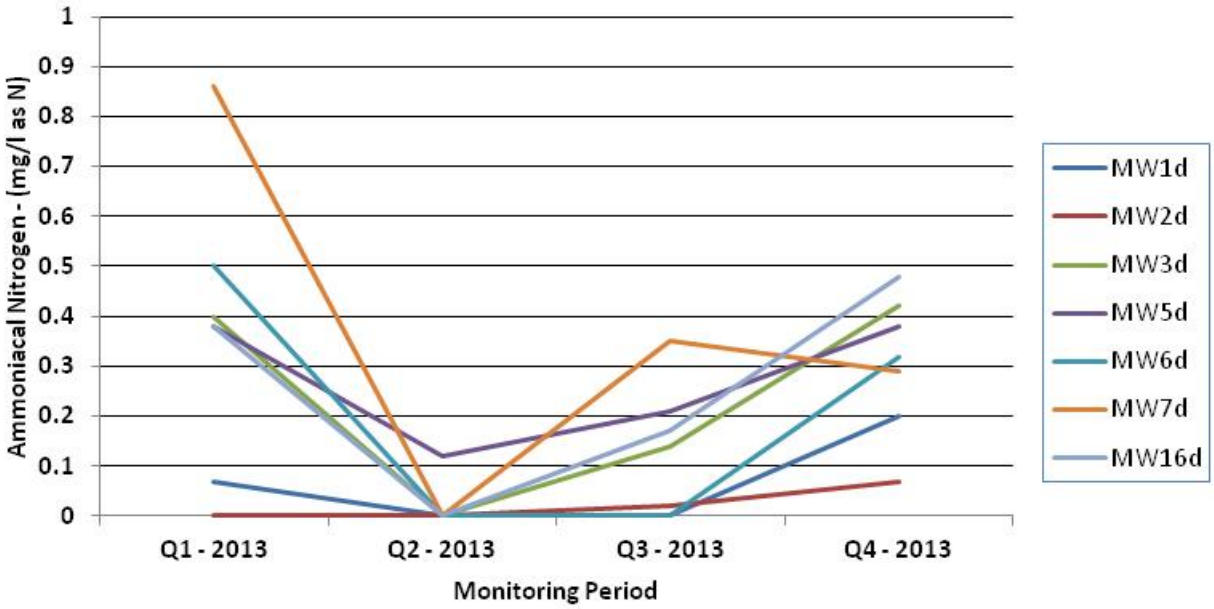


Figure 4.15: Ammoniacal Nitrogen Results for Groundwater

The levels of ammoniacal nitrogen are presented below in Figure 4.15. The ammoniacal nitrogen results are relatively consistent over the reporting period and are all below the GWTL, ranging from <0.2 to 0.544 mg/l as N. The most significant difference in results was recorded in MW7d in quarter 1 where the ammoniacal N levels was 0.86 mg/l. Although below the GWTL, it is more elevated than the levels over the past 2 years. MW7D is up-gradient of the landfill and so the levels of ammoniacal N are likely to be from agricultural practices.

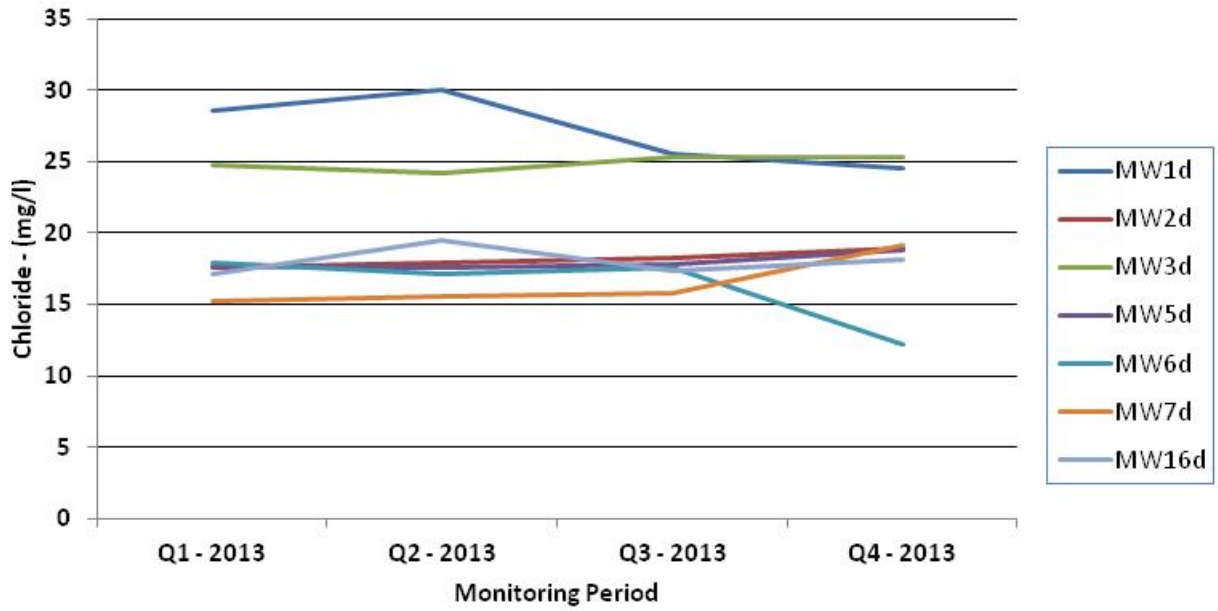


Figure 4.16: Chloride Results for Groundwater

Chloride (Cl) levels, presented in Figure 4.16, show that levels are consistent during the reporting period and all samples fell below the GWTL. The results range from 15.2 to 30.01 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*" apart from MW1d during quarter 2 2013. The level is 0.01 mg/l above the IGV of 30 mg/l. MW1D is up-gradient of the landfill and so the levels of chloride N are unlikely to be from landfilling practices.

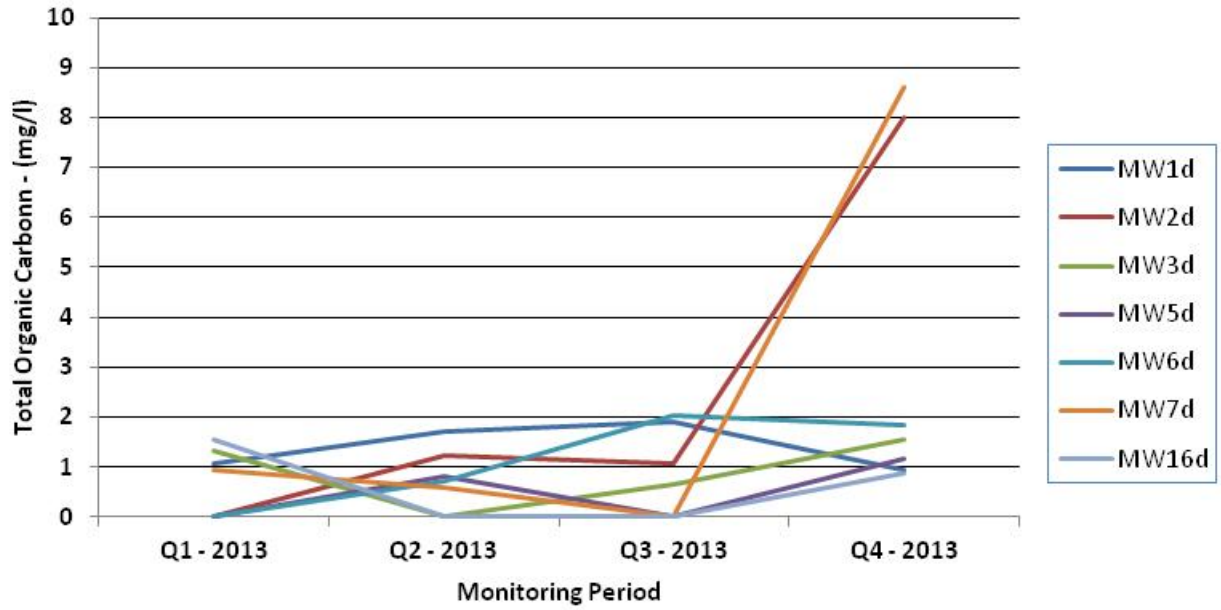


Figure 4.17: TOC Results for Groundwater

The total organic carbon (TOC), presented in Figure 4.12, levels during all quarters were all below the GWTL and ranged from <0.5 to 8.62 mg/l.

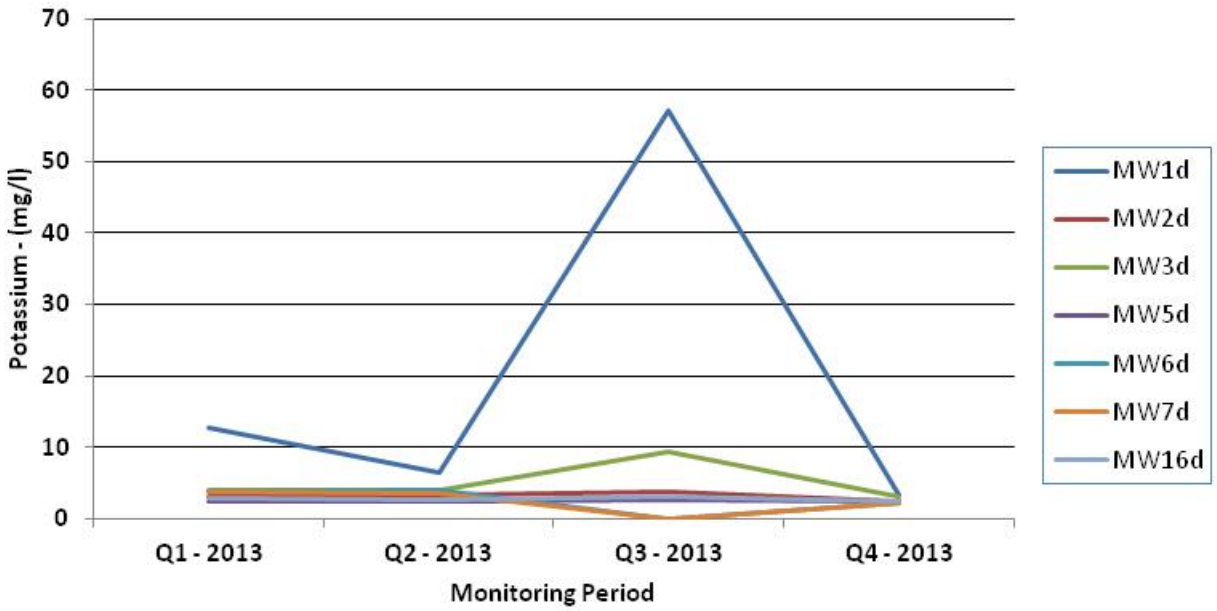


Figure 4.18 Potassium Results for Groundwater

Potassium level spikes above the GWTL was observed in quarters 1, 2 and 3 at MW1d and during quarter 3 at MW3d, presented in Figure 4.18. The potassium levels at MW1d peaked at 57.2 mg/l during quarter 3. All other potassium results during quarters 1 to 4 were below the GWTL, ranging from <0.4 to 6.5 mg/l. As both MW1d and MW3d are up-gradient of the landfill, the elevated levels are unlikely to be as a result of landfill activities.

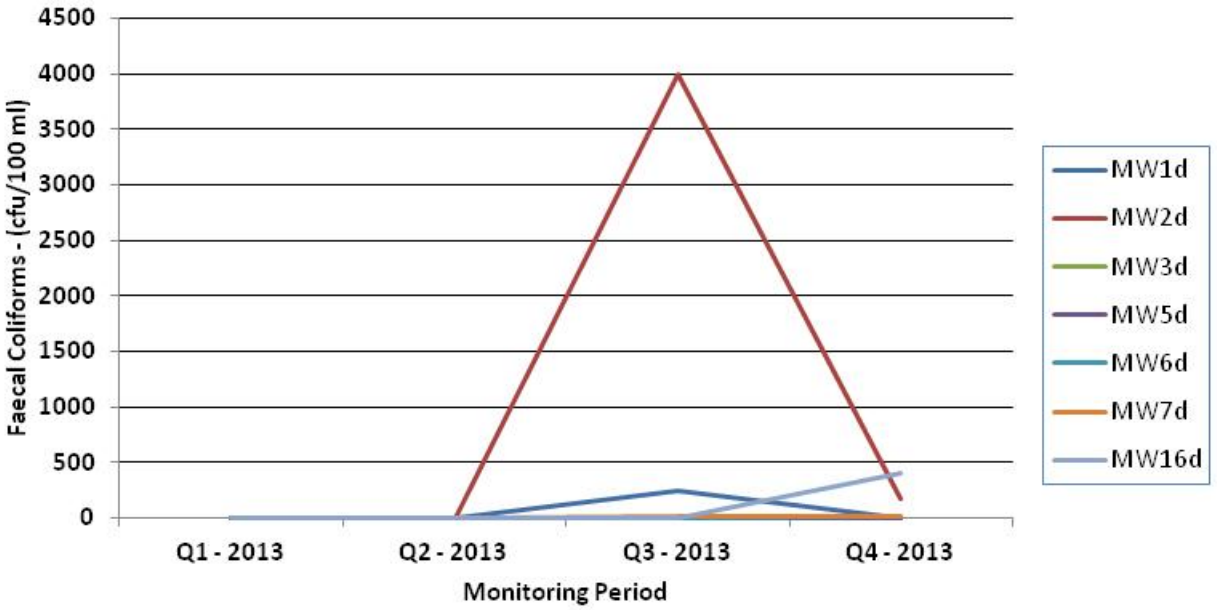


Figure 4.19: Faecal Coliforms Results for Groundwater

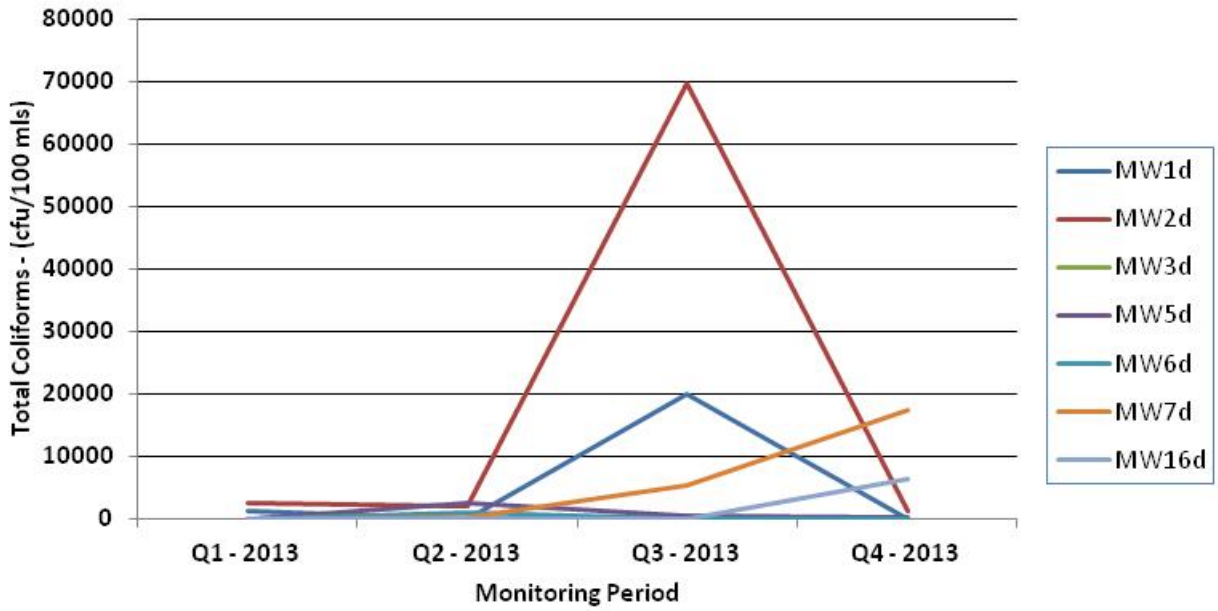


Figure 4.20: Total Coliforms Results for Groundwater

Variable levels of faecal and total coliforms, presented in Figure 4.19 and Figure 4.20 respectfully, were recorded in a number of wells during the reporting period. 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.

10.7.3. 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 PM_{10} Monitoring

Greenstar made a submission to the EPA (LR002767) requesting a reduction in the frequency of dust and particulate (PM_{10}) monitoring. The EPA agreed on the 14 August 2013 to reduce the frequency for dust monitoring from monthly to quarterly and for PM_{10} monitoring from quarterly to annually.

Due to a failure of the ambient air sampler, there are no PM_{10} results for Quarters 1 and 2, 2013. This incident was the subject of a letter to the EPA from Fehily Timoney and Company, dated 9 January 2013.

As a result of submission LR002767, PM_{10} levels were monitored during quarter 4 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 the quarter 4 monitoring report.

10.7.1. Conclusion

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, 3 and 4 reports.

The PM_{10} trigger level, as set out in the waste licence condition 6.8.1 of 50 µg/m^3 was not exceeded at any of the locations during the reporting period.

4.5. Leachate Monitoring

Leachate monitoring was carried out by Greenstar Personnel at 10 locations (LC1, LC2, LC3, LC4, LC5, LC6, LC7, LC8, LC9, LC10, LC12 and LL) during the reporting period. LC1 to LC12 are sumps within Cells 1 to 12 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.

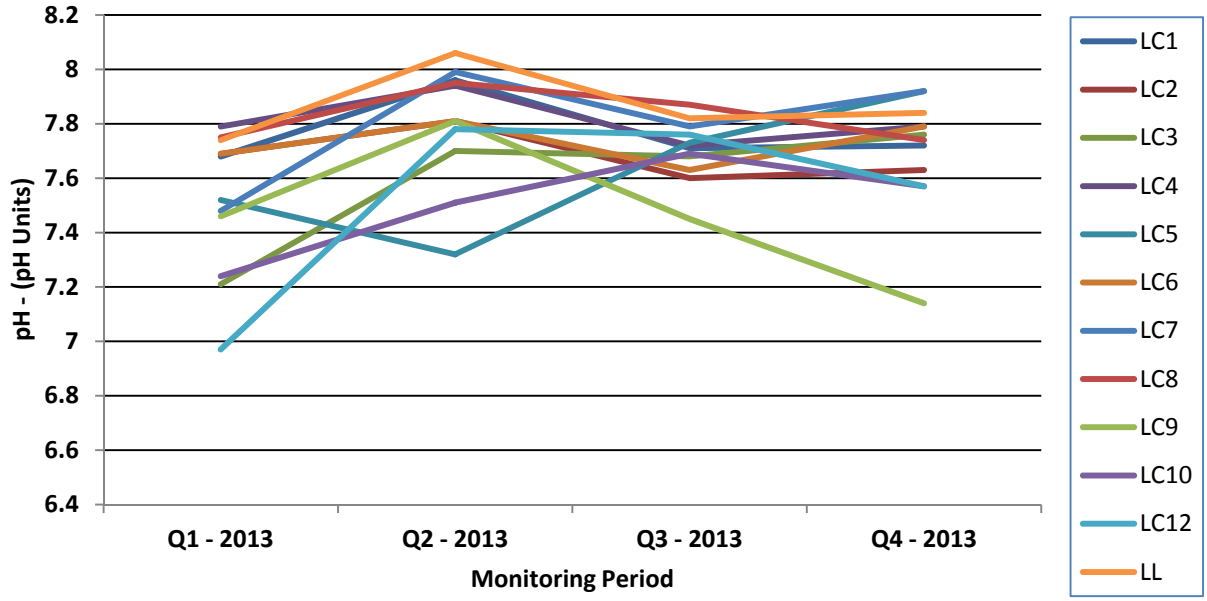


Figure 4.21: pH Results for Leachate

The pH level, presented in Figure 4.21, 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.

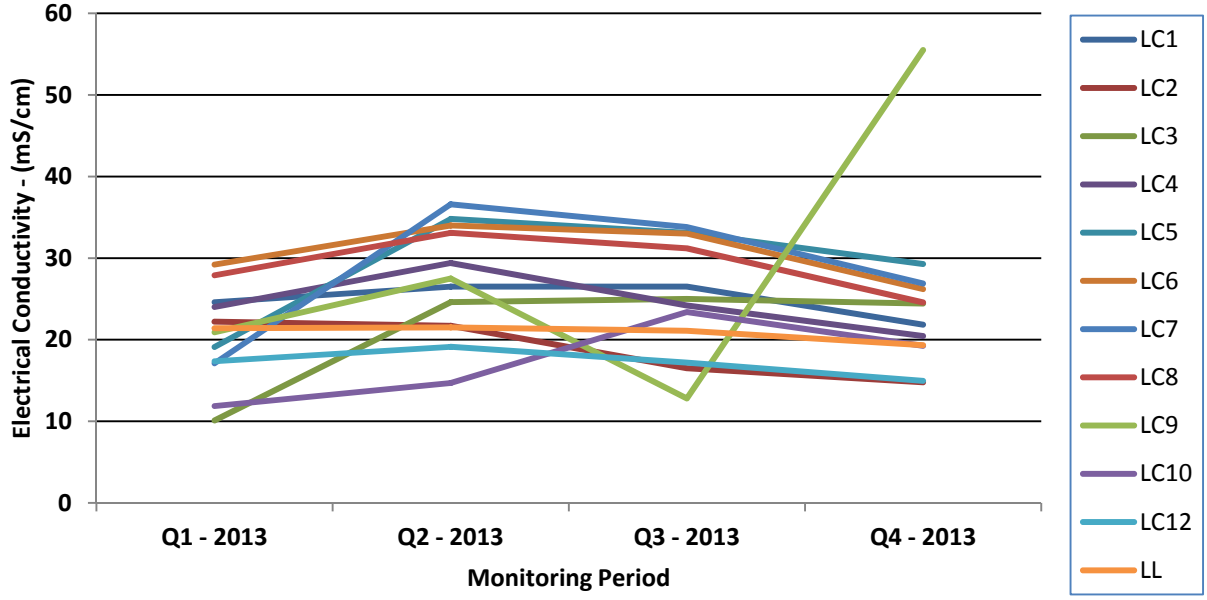


Figure 4.22: Electrical Conductivity Results for Leachate

The electrical conductivity (EC), readings presented in Figure 4.22, show greater variation in results between individual cells and between quarters. High EC levels are observed in all cells with a large elevation in cell 9 during quarter 4 2013.

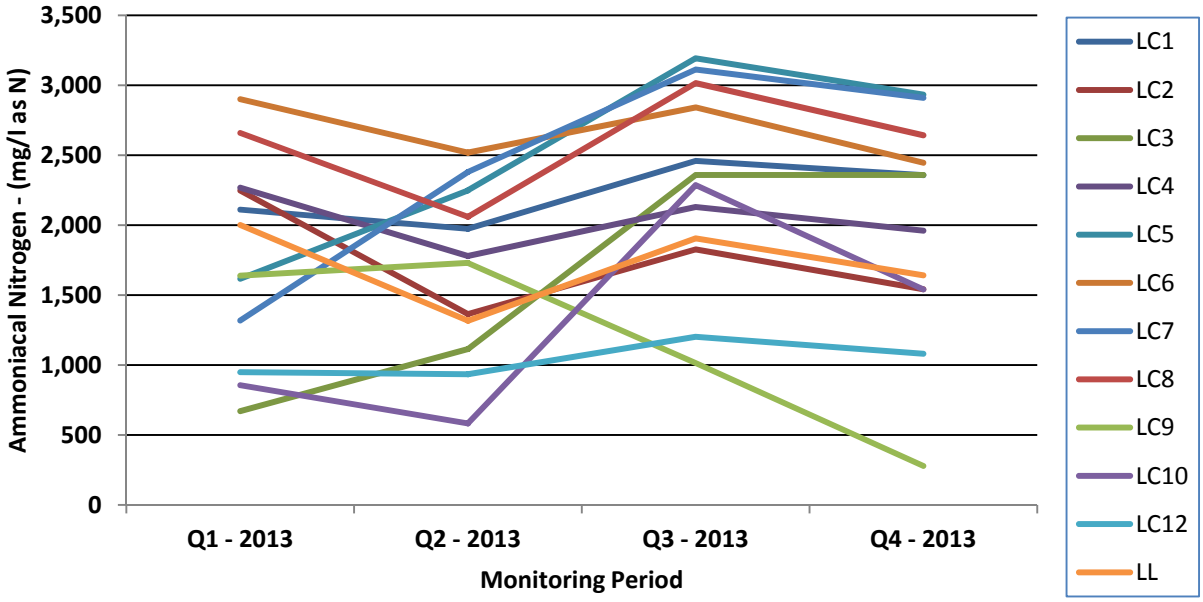


Figure 4.23: Ammoniacal Nitrogen Results for Leachate

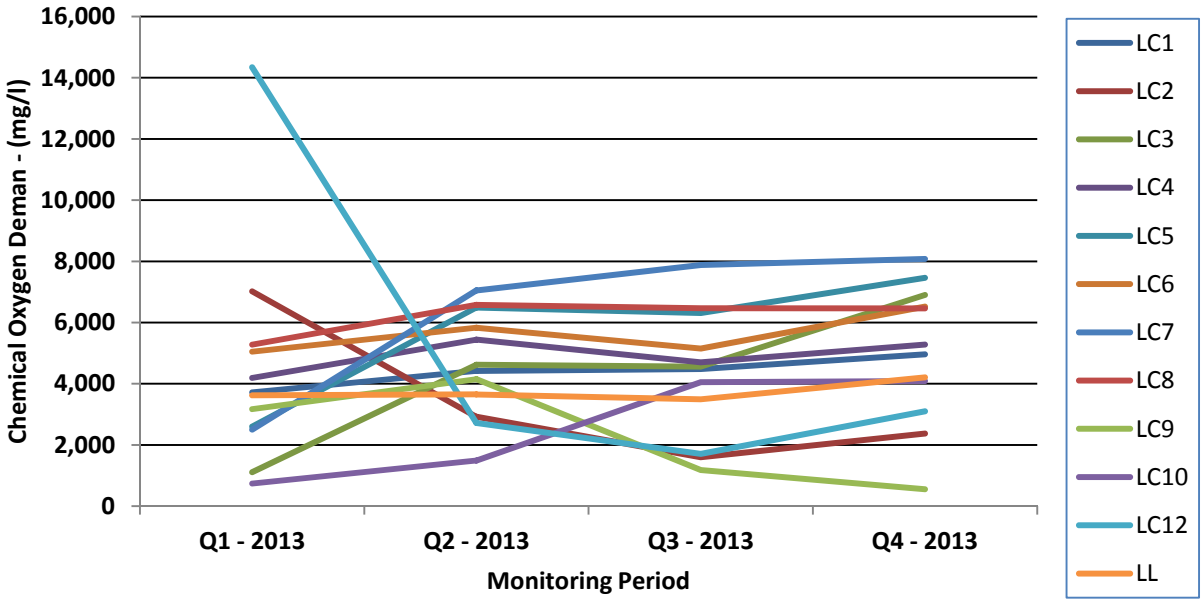


Figure 4.24: Chemical Oxygen Demand Results for Leachate

There are no trends associated with ammoniacal nitrogen, presented in Figure 4.23, and chemical oxygen demand, presented in Figure 4.24 in leachate sampled through the reporting period apart from elevated COD levels at LC12 during quarter 1.

10.7.1. Conclusion

In general, the reported concentrations for leachate samples are consistent with the typical composition of leachate sampled from large landfills and in line with the levels presented in the EPA *Landfill Manual on Landfill Site Des*ign (2000). The 2013 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 2012/2013.

Leachate is removed off site to Wastewater 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 4.6: L_{Aeq} Results for Noise Recorded (inclusive of tonal penalties)

Location	Quarter 1	Quarter 2	Quarter 3	Quarter4
N1	53	53	52	54
N2	57	56	54	53
N3	49	46	41	48
N4	54	52	40	50

With the exception of noise recorded in quarter 1 and quarter 2 at N2, all other results were within the 55 dB limit for daytime noise at the facility boundary. During monitoring for Quarter 1, the L_{Aeq} was 57 dB at N2 and in Quarter 3, the L_{Aeq} was 56 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, 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, 2013

Resource	Consumption
Electricity	138,662 kWh
Water, Mains	5,475 units
Diesel (green)	88,445 litres
Hydraulic Oils	450 litres
Odour Neutralisers	1000 litres (used at Rilta facility re leachate)
Waste Oil (Bioverda Compound)	29,800 litres

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 2013

The main development works undertaken during 2013 included:

- 19 additional landfill gas extraction wells were drilled and installed in cell 12
- Final capping applied to an area of 55,000m2 in Cells 1 to 6 and parts ofCells 7 and 8.
- Placement of 5,500 m^2 of impermeable temporary capping along the northern flanks of Cell 12.

6.2. Proposed Development Works to be undertaken in 2014

The following development works are planned to be undertaken in 2014:

- Continue soil placement on the final cap placed during 2013.
- Placement of impermeable temporary cap in Cell 12 and along flanks of Cell 9.

6.3. Updates of the Restoration and Aftercare Plan

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

6.4. 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 2013 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 15 January 2014 and is included as part of the AER in Appendix III.

7.1. Volume of Leachate Transported Off Site

The volume of leachate tankered off-site in 2012 was 25,818.18 tonnes. 6,963.80 tonnes was consigned to Navan Wastewater Treatment Plant, 15,412.24 tonnes was consigned to EPS Ltd. Drogheda and 3,442.14 tonnes was consigned to Rilta Environmental Dublin.

Section 8

Landfill Gas

8. LANDFILL GAS

There were four gas utilisation engines and three enclosed flares present on-site during the reporting period. One of the four engines is awaiting overhaul and was not operational during 2013.

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 August 2013, in accordance with Schedule D of the waste licence. Stack emission testing for engine one was not undertaken at this time as it was 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 m^3/hr (at the 50%ile) occurring in 2011. After 2011 the gas generation rate is forecast to decline steadily to approximately 200 m^3/hr (at the 50%ile) in 2038. The modelled peak of maximum recoverable landfill gas (LFG) is forecasted to be 2,560 m^3/hr (50%ile) in 2010. After 2010 the gas recovery rate is forecast to decline being 2,400 m^3/hr (50%ile) in 2013.

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 33,577 kg/yr CH_4 and the engine utilisation figure is 5,728,637 kg/yr CH_4 for 2013.

Table 8.1: Summary of Landfill Gas Flared at Knockharley, 2013

	Quantity of Methane Collected	
	Total CH_4 (m^3/yr) *	Total CH_4 (kg/yr) *
Flare 3	55,164	33,577
Total Flared	**55,164**	**33,577**
Engine 1	884,138	538,156
Engine 2	3,235,762	1,969,541
Engine 3	2,324,280	1,414,740
Engine 4	2,967,410	1,806,200
Total Utilised	**9,411,590**	**5,728,637**
Total Flared and Utilised	**9,466,754**	**5,762,214**

* denotes - at 98% Combustion Efficiency

Section 9

Summary Annual Water Balance

9. METEROLOGICAL 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
2013	94.4	47.3	85.5	40.1	45.8	60.8	68.8	48.5	35.1	127.8	26.6	83.2	763.9

The total annual rainfall was recorded as 763.9 mm, with the wettest month recorded as October with 127.8 mm of rainfall and the driest month recorded as November with 26.6 mm of rainfall.

Table 9.2: Mean Temperature (degrees Celsius)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2013	4.9	4.2	3.1	6.8	10	12.7	16.7	15.6	13	11.7	6.3	6.9	9.325

The annual average temperature was 9.3°C with the warmest month recorded as July with a mean temperature of 16.7 °C, while the coolest month was recorded as March with a mean temperature of 3.1 °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 wastewater 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 and these have been used in quarterly and AER reports since 2012.

9.4. Water Balance Calculation

An annual water balance calculation was completed for the site. The calculation is based on a waste input of 30,618 tonnes of waste.

The calculation indicated a leachate production of 23,552.4 $m^3 yr^{-1}$. Leachate tankered off site was recorded at 25,818.18 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 1-8)	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)*
2013	763.9	76.39	687.51	30,618	24,000	15,500	55,000	16,500.2	6,926.7	2,268.8	*0*	2,143.3	14,357.0	23,552.4

Notes:

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

Lo = [ER(A) + LW + IRCA + ER(I)] - a(W);

where:

Lo =	leachate produced(m3)
ER =	effective rainfall, [(ER) is defined as Total Rainfall (R) minus Actual Evapotranspiration (AE) i.e. ER=R-AE]
A =	area of cell (m2)
LW =	liquid waste (m3)
IRCA =	infiltration through restored and capped areas (m3)
I =	surface area of lagoons (m2)
a =	absorptive capacity of waste (m3/t)
W =	weight of waste deposited (t/a)

Cell Area (m2)	8000
† Evapotranspiration calculated at	10% of actual rainfall
†† Absorptive Capacity (m3/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 completed as part of the Environmental Management Plan was sent to the Agency on the 23 July 2004 and was approved on the 23 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 January 2014.

Changes include the updated company and staffing structure to reflect receivership changes and staff changes. Also updated was the company EHS policy document.

10.3. Report on Staff Training

All training was carried out as scheduled in the training plan for 2013. Details are as follows –

- Incident Reporting Procedure – All staff
- Various H&S toolbox talks – All staff
- Grinder: Chargehand and 1 General Operative
- Occupational First Aid, plus one (Refresher) – Weighbridge Operator & 1 General operative
- All relevant refresher courses such as dozer training, 360 degree excavator was carried out as required.

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 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.

10.7.1. 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 2013

No new operational procedures were developed in 2013 for the site.

10.6. Summary Schedule of Environmental Objectives and Targets

This section of the report presents the program of environmental objectives and targets for 2013. The progress against the 2012 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		AM/FM
			-5%	Completed	
			-4.50%	Completed	
			-3.50%	Completed	
			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 warms.	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	FM
			Continually assess and upgrade infrastructure as necessary.	Continual	FM
			Construct leachate processing plant on site.	Plans on hold	
			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 20. Emissions to air 17. Visual Impact	Maintain and continue to improve all on site landscaping and the wetland area.	On-going	FM
			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 6/14. 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 & On-going	AM/FM
			Review the number and composition of complaints to determine any trends.	Monthly	FM
			Extend litter picking to include inner boundary road as illegal dumping appears to have increased here.	On-going from March	AM/FM
			Continue to hold regular meetings with local residents	On-going	AM/FM
			Finish cells 9/10 and go into cells 11/12 where visual aspect can be minimised.	Completed	
			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 2013

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 2013
			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 by 3 zones from 2012 to 2013
			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 warms.	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.
			Implement recirculation of leachate at the landfill.	When final capping sufficient and Agency approval given		Recirculation pipework has been installed in Cells 1 to 8. 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 completed in Cells 1 to 8.
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	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 Jan 2014

		17. Visual Impact	Review the number and composition of complaints to determine any trends.	Monthly	FM	Completed for monthly reports
			Extend litter pocking 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.
			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 2014.
			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 operate a dawn to dusk programme for bird control, utilising in-house staff. 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. 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 eight 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
30/11/2012	Exceedance of Potassium GWTL at MW1d on 12/11/12
11/02/2013	Cell 3 leachate level reached 1.04m over the weekend (Sunday 10th February)
11/04/2013	Exceedance of surface emissions VOC trigger level, as per Condition 6.10.5 of W0146-02. Sixteen zones of surface emissions were identified
10/10/2013	Potassium above GWTL at MW1D and MW3D
22/10/2013	Methane trigger level reached at LG3 (2.6%)
28/12/2013	Relates to leachate Lagoon Freeboard.
18/01/2014	Relates to cell 5 above meter mark
30/11/2012	Exceedance of Potassium GWTL at MW1d on 12/11/12

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	8		8
February	6		6
March	1		1
April	2		2
May	2		2
June	0		0
July	3		3
August	1		1
September	0		0

Month	Odour	Other	Total
October	3		3
November	7		7
December	1		1

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

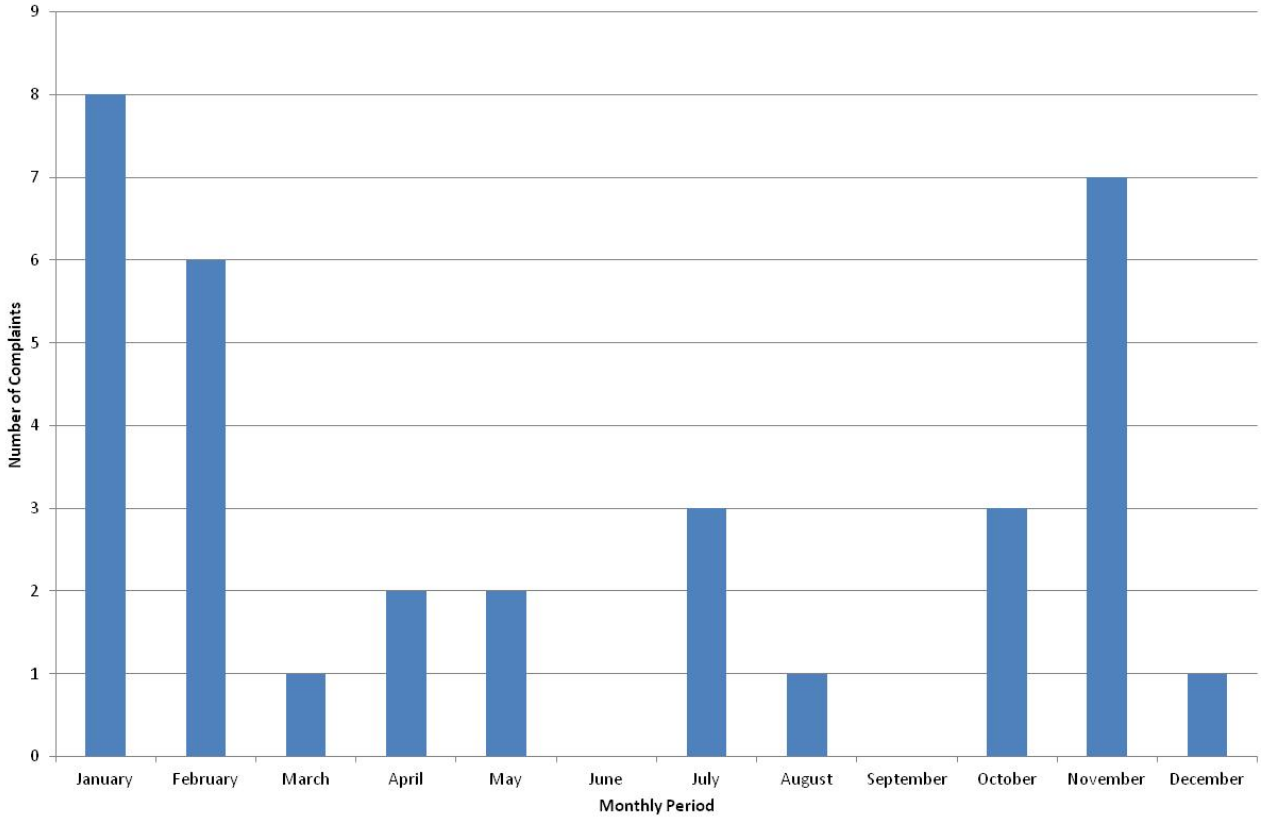


Figure 10.1: Total number of complaints to the site during the reporting period

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.

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 and included in Appendix IV.

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

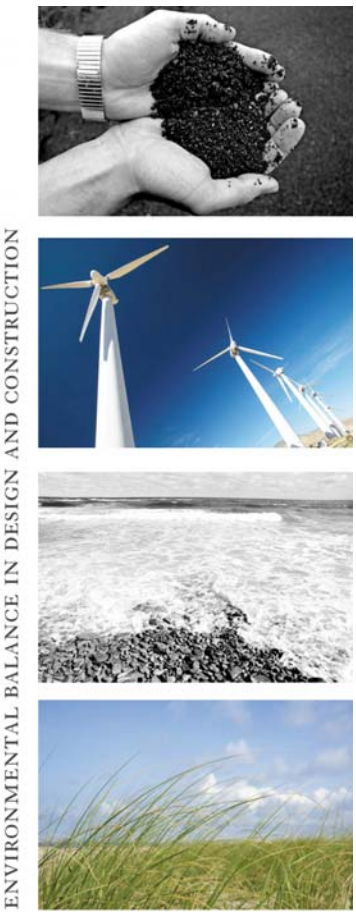
Knockharley Landfill pursues an active programme of disseminating information on its operations to interested parties. This is undertaken through a variety of means including site tours, the company website, presentations and open days.

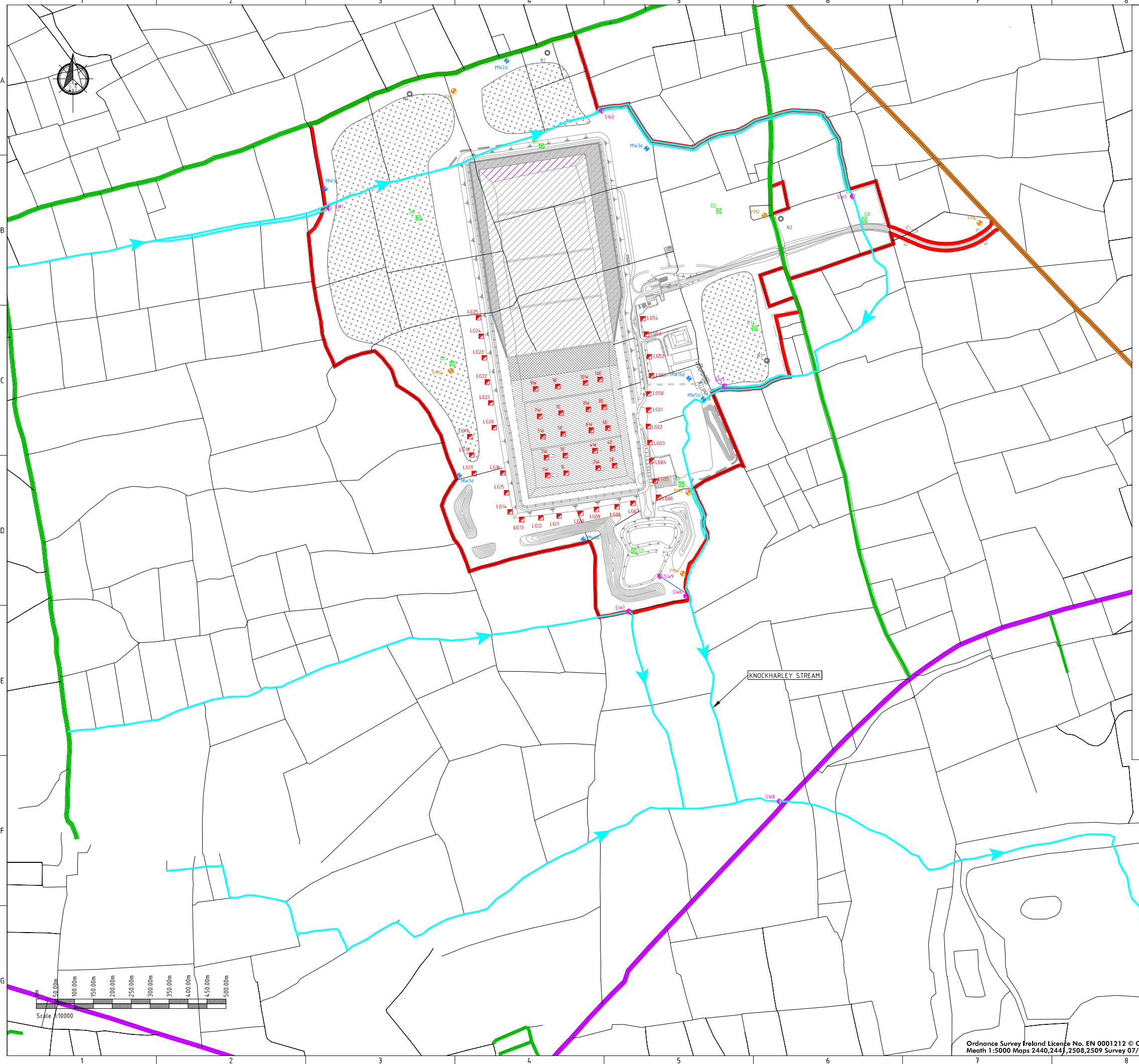
The Communications Programme required by Condition 2.4.1 of the waste licence, was established three months before the start of waste activities and has been submitted to the Agency. This document is reviewed and updated at regular intervals.

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

Appendix I

Maps





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	267161
MW5D	297701	267094
MW6D	297382	266722
MW7D	297064	266890
MW16D	297679	267145
NOISE		
N1	297290	267999
N2	297901	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	267591
PM3	297656	266894
PM4	297656	266630
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
LG010	297372	266795
LG011	297326	266784
LG012	297275	266786
LG013	297226	266775
LG014	297194	266794
LG015	297182	266846
LG016	297171	266904
LG017	297104	266893
LG018	297095	266944
LG019	297093	266993
LG020	297168	267015
LG021	297138	267080
LG022	297130	267135
LG023	297121	267200
LG024	297114	267255
LG025	297107	267305
LG050	297555	267104
LG051	297563	267152
LG052	297557	267202
LG053	297549	267261
LG054	297540	267302
1W	297289	266889
1E	297337	266895
2W	297422	266908
2E	297465	266915
3W	297285	266935
3E	297335	266941
4W	297413	266953
4E	297460	266960
5W	297276	266901
5E	297330	266999
6W	297404	267008
6E	297448	267013
7W	297268	267045
7E	297324	267053
8W	297396	267063
8E	297438	267069
9W	297257	267117
9E	297315	267123
10W	297388	267132
10E	297427	267141

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 (immature)

Rev.	Drawn	Chk'd	App'd	Date	Description
A	TM	DD	BG	Cork 03.04.12	ISSUE FOR INFORMATION

Revision History: A

Name of Client

greenstar

Name of Job

KNOCKHARLEY LANDFILL
ENVIRONMENTAL MONITORING & REPORTING

Title of Drawing

ENVIRONMENTAL MONITORING LOCATIONS

Scales Used 1:10000

This Drawing was printed to A3

Dwg. No. LW11-172-03-100-001

Rev. A

O:\ACAD\2011\LW11\172\03\LW11172003_100-001

FEHILY TIMONEY & COMPANY

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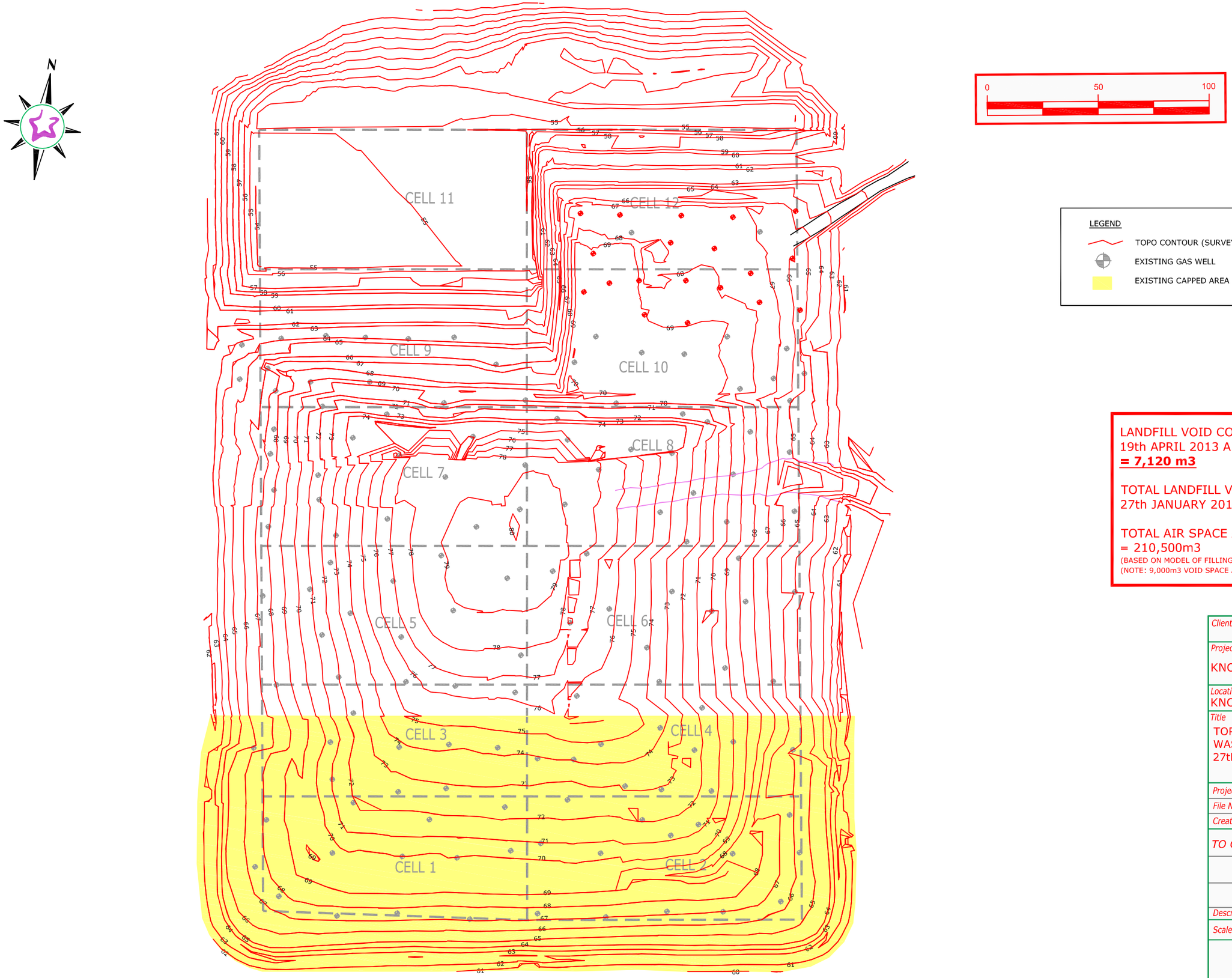
ORIGINAL DRAWING SIZE A1 - (841 x 594)

SCALE HORIZ.

SCALE - VERTICAL

Appendix II

Topographical Survey



0 50 100

LEGEND

- TOPO CONTOUR (SURVEYED 27/01/14)
- EXISTING GAS WELL
- EXISTING CAPPED AREA

LANDFILL VOID CONSUMED DURING THE PERIOD OF 19th APRIL 2013 AND 27th JANUARY 2014
= 7,120 m3

TOTAL LANDFILL VOID SPACE CONSUMED UP TO 27th JANUARY 2014 = 1,394,920 m3

TOTAL AIR SPACE AVAILABLE FROM 27th JAN 2014 = 210,500m3
(BASED ON MODEL OF FILLING OUT TO EDGE OF CELLS 11 & 12)
(NOTE: 9,000m3 VOID SPACE AVAILABLE IN CELL 12)

Client greenstar

Project
KNOCKHARLEY RESIDUAL LANDFILL SITE

Location
KNOCKHARLEY, Co. MEATH

Title
TOPOGRAPHICAL CONTOUR HEIGHTS OF WASTE BASED ON WASTE SURVEY
27th JANUARY 2014

Project No.	Checked by	Drawing No.
File No.	Reviewed by	**W-S28/01**
Created by I McC		

Description	Date	Version
TO CLIENT	05/02/14	A

Scale 1:1,500 A3 Date February 2014

Appendix III

Leachate Integrity and Slope Stability Assessment

KNOCKHARLEY LANDFILL

LEACHATE INFRASTRUCTURE INSPECTION AND CERTIFICATION AND SLOPE STABILITY REPORT

AS PER CONDITION 3.14.5 WASTE LICENCE W0146 – 02

GREENSTAR NORTH EAST LTD.

JANUARY 2014

greenstar

FEHILY TIMONEY & COMPANY

KNOCKHARLEY LANDFILL

LEACHATE INFRASTRUCTURE INSPECTION AND CERTIFICATION AND SLOPE STABILITY REPORT

AS PER CONDITION 3.14.5 WASTE LICENCE W0146 – 02

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/MT			15-01-14
1	Re-Issue to Client	NM/MT			16-01-14

Client: Greenstar North East Ltd.

Keywords: leachate, inspection, containment structures, slope

Abstract: This document outlines the findings of an inspection of the leachate infrastructure and an assessment of the slopes' stability in respect of 2013 monitoring requirements, that was carried out on the 14th January 2014 at Knockharley Landfill.

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1. BACKGROUND

Condition 3.14.5 of the Waste Licence W0146–02 requires that:

"All leachate management structures on-site shall be inspected and certified fit for purpose on an annual basis by an independent and appropriately qualified chartered engineer. Any remedial works recommended in this report must be implemented immediately."

In addition, Condition 8.13 of the licence requires that:

"Within one year of the date of commencement of waste activities and annually thereafter, the licensee shall carry out a stability assessment of the side slopes of the facility".

With regard to Condition 3.14.5, the following structures were inspected on the 15th of January 2014:

- leachate lagoon
- truck wash
- condensate pipe-work
- visible pipe-work between headwalls and valve chambers
- valve chambers

As the pumped rising leachate recirculation main is not in use, an inspection of the pump chambers was not required. Observations and recommendations with respect to leachate containment infrastructure are given in Sections 2, 3 and 4 of this report.

With regard to the stability assessment of the slopes, the main external embankments of the landfill were inspected as were:

- the final-caped area
- the intermediate-capped area
- the internal slopes of cells 11 & 12
- the northern slope of cells 9 & 10

Observations and recommendations with respect to slope stability are presented in Section 5 of this report.

2. LEACHATE LAGOON INSPECTION

The inspection of the leachate lagoon involved a visual inspection of the extraction pipe and headwall, the concrete apron and drainage channels and the control box slab. A visual inspection around the perimeter fencing was also conducted. The purpose of the inspection was to look for any deterioration of the concrete structures such as spalling or cracking, tears in the lagoon cover or damage to manholes, drainage channels or fencing.

2.1. Extraction Pipe and Headwall

No damage or concrete deterioration was observed at the extraction pipe and headwall. There was evidence of ivy growth around the headwall.

Figure 2.1: Extraction Pipe Headwall

Figure 2.2: Extraction Pipe headwall; ivy growth

Figure 2.3: Extraction Pipe at lagoon cover

2.2. Concrete Apron and Control Box Slab

No damage or concrete deterioration was observed at the concrete apron and control box slab or its drainage channels and manholes.

Figure 2.4: Drainage Channel

Figure 2.5: Tanker parking slab & Control box compound

Figure 2.6: Control box slab

2.3. Lagoon Cover

No damage or tears were observed to the Lagoon Cover. Vegetation growth on the cover may be seen as a threat to its integrity.

Figure 2.7: Leachate Lagoon Cover (looking Southwest)

Figure 2.8: Leachate Lagoon Cover (looking West); Vegetation Growth

Figure 2.9: Leachate Lagoon Cover (looking South)

2.4. Perimeter Fencing

No damage was observed at the perimeter fencing or access gates to the leachate lagoon.

Figure 2.10: Access Gate to Leachate Lagoon

Figure 2.11: Access gate to control slab

Figure 2.12: Perimeter Fencing with Warning Sign

3. VALVE CHAMBERS INSPECTION

The inspection of the valve chambers involved a visual inspection of the chamber cover, headwall and pipes and ducts. Each chamber was opened and inspected internally.

The purpose of the inspection was to look for any deterioration of the concrete structures such as spalling or cracking, damage to valves, chamber covers or ducts. The six chamber inspected were located at Cells 1/3, Cells 2/4, Cells 5/7, Cells 6/8, Cells 9/11 and Cells 10/12.

3.1. Chamber at Cells 1 and 3

No damage or concrete deterioration was observed at the chamber at Cells 1 and 3. Vegetation growth is evident but does not compromise integrity. Regular removal is recommended.

Photograph 1: Headwall at cells 1 & 3

Photograph 2: Pipework in Chamber 1 & 3

Photograph 3: Pipework in Chamber 1 & 3

3.2. Chamber at Cells 2 and 4

Some concrete damage (at construction stage) was observed around the duct pipes at the chamber at Cells 2 and 4. This does not compromise the integrity of the leachate system. A monthly photographic record of the concrete damage was taken in 2011, which indicated that no deterioration occurred during the period. Vegetation Growth in the vicinity of the headwall does not compromise the integrity of the leachate containment system but its removal is recommended. There are no visible leaks from any of the pipework.

Photograph 4: Headwall at cells 2 & 4

Photograph 5: Concrete damage (construction stage finish)

Photograph 6: Concrete damage (construction stage finish)

Photograph 7: Pipework for Cells 2 & 4

3.3. Chamber at Cells 5 and 7

No damage or concrete deterioration was observed at the chamber at Cells 5 and 7. There are no visible leaks from any of the pipework.

Photograph 8: Headwall at Cells 5 & 7

Photograph 9: Pipework at Cells 5 & 7

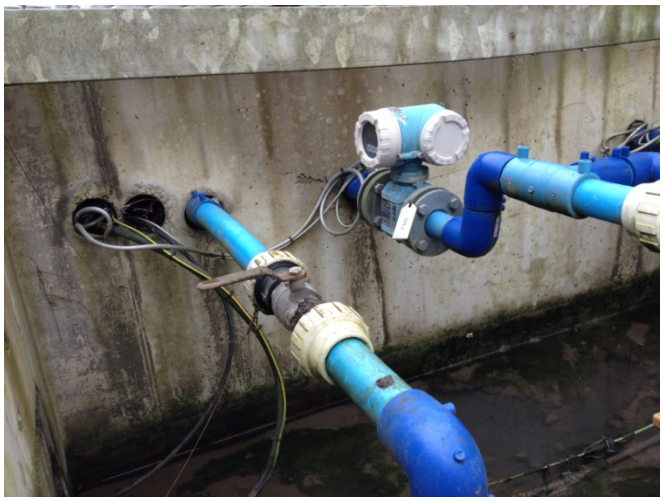
Photograph 10: Pipework at Cells 5 & 7

3.4. Chamber at Cells 6 and 8

No concrete deterioration was observed at the chamber at Cells 6 and 8. There are no visible leaks from any of the pipework. Undermining of the headwall foundations to the rear is evident. This is as a result of capping works and will be rectified with the placement of cover soil on top of the bare liner during Spring 2014.

Photograph 11: Headwall at Cells 6 & 8

Photograph 12: Pipework for Cells 6 & 8



Photograph 13: Pipework for Cell 8

Photograph 14: Undermining to rear of headwall

3.5. Chamber at Cells 9 and 11

No damage or concrete deterioration was observed at the chamber at Cells 9 and 11. There are no visible leaks from any of the pipework. It is noted that as cells 11 and 12 contain no waste, discharge from the pump in Cell 11 is directed to the swale (discharge pipe is green in colour in the photograph).

Photograph 15: Headwall at Cells 9 & 11

Photograph 16: Pipework at Cell 9 & 11

3.6. Chamber at Cells 10 and 12

No concrete deterioration was observed at the chamber at Cells 10 and 12. It is noted that as cells 11 and 12 contain no waste, discharge from the pump in Cell 12 is directed to the swale.

Photograph 17: Headwall at 10 & 12

Photograph 18: Pipework at Cell 10

3.7. Wheel wash

The contents of the wheel wash are managed as leachate. Trucks drive through a water bath before exiting the site. There was no evidence of cracking or other deterioration of the concrete that would give rise to concerns regarding containment of the wheel wash water.

Photograph 19: View of wheelwash, looking North

3.8. Condensate

Small-diameter condensate pipes convey condensate from the landfill gas system to the leachate system. All visible pipes were inspected and no leaks were found.

Photograph 20: Insulated condensate pipework

Photograph 21: Insulated condensate pipework

4. RECOMMENDATIONS REGARDING LEACHATE CONTAINMENT

It is recommended that:-

- Vegetation and other detritus be cleared from the vicinity of head walls and chambers.
- All chamber covers be closed and secured.
- All valves within the chambers and on the headwalls be operated at least every quarter to ensure operability.
- Capping works completed to rear of headwall of cells 6 and 8 as soon as possible.

5. SLOPE STABILITY

An inspection of the slopes listed in Section 1 was undertaken on January 14th 2014. Apart from a general inspection of the observed slopes, evidence of failure such as tension cracks were looked for. In general terms, there was no apparent cause for concern.

5.1. External embankments

The external embankments comprise boulder clay that was placed in layers and rolled as per the original specification. The external slope is 1:3 (or flatter) which is as per the original design and well below a slope that would give rise to concern.

5.2. Final Capped Area

The entirety of Cells 1, 2, 3, 4, 5, 6, 7 and 8 are capped with a combination of geo-textile, LLDPE barrier, drainage geocomposite, subsoil and topsoil. The cap is at a slope of 1:5, well within normal good practice and within its design parameters. There is no evidence of slippage or other deterioration.

Photograph 22: Final Capped Area

Photograph 23: Final Capped Area Awaiting Soils

5.3. Intermediate-capped area

Parts of Cells 9, 10 and 12 are capped with intermediate cover material. The intermediate capping comprises clays and other soil-like material. It is at a slope of between 1:5 and 1:50 (with some flat areas) and gives no cause for concern.

5.4. Internal Slopes of Cells 11 & 12

These slopes were designed and constructed at a gradient of 1:3. Examination of the record drawings confirms that the design slope was not exceeded and thus gives no cause for concern.

5.5. Northern Slopes of Cells 9 & 10

This is an 'operational' slope, constructed as waste is places and (theoretically) an area that would give rise to concern. In this instance, Greenstar has constructed this slope as a terraced embankment in a manner than can only be described as exemplar. The terracing performs a number of positive functions including safe access to personnel undertaking litter patrols. There is no exposed waste as a layer of black polythene is used to seal the slope and thus contain leachate and gas.

Photograph 24: Northern slope of Cell 9

5.6. Northern and Western Slopes of Cell 12

This is an 'operational' slope, constructed as waste is places and (theoretically) an area that would give rise to concern. In this instance, Greenstar has constructed this slope as a terraced embankment in a manner than can only be described as exemplar. The terracing performs a number of positive functions including safe access to personnel undertaking litter patrols. There is no exposed waste as a layer of green geo-hesh is used to seal the slope and thus contain leachate and gas.

Photograph 25: Northern slope of Cell 12

5.7. Retaining Structures

Thirteen reinforced concrete retaining structures retain the landfill and its cap where gas and leachate pipework exit the waste mass. All are in good condition with no evidence of distress.

Photograph 26: Retaining Structures at Cell 1 & 2

6. RECOMMENDATIONS REGARDING SLOPE STABILITY

Current practice should continue with due regard to the site's design parameters. As heretofore, contract quality assurance procedures should be applied to future construction phases.

7. SIGN OFF

This report was checked and approved by Mr. Declan O'Sullivan, Chartered Engineer.

Signed: 

Date: 14-01-14

Appendix IV

PRTR

ENVIRONMENTAL BALANCE IN DESIGN AND CONSTRUCTION

Guidance to completing the PRTR workbook

AER Returns Workbook

Version 1.1.18

REFERENCE YEAR	2013

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 Tuiterath & 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@landfills.ie
AER Returns Contact Position	Assistant Landfill Manager, Knockharley Landfill
AER Returns Contact Telephone Number	041-982 1650
AER Returns Contact Mobile Phone Number	086-8076237
AER Returns Contact Fax Number	041-982 1750
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) 5(d) 50.1	Installations for the disposal of non-hazardous waste Landfills General

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

Is it applicable?	
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) ?	

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									
POLLUTANT		METHOD										QUANTITY		
			Method Used		Engine 1	Engine 2	Engine 3	Engine 4	Flare 1	Flare 2	Flare 3			
No. Annex II	Name	M/C/E	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	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
02	Carbon monoxide (CO)	C	OTH	Flue gas analyser, Testo 350/454 MXL	0.0	15762.0	14259.6	23416.56	0.0	0.0	4.16	53442.32	0.0	0.0
11	Sulphur oxides (SOx/SO2)	C	ALT	Impinger train containing 0.10 molar sodium hydroxide and deionised water solution in accordance EN1911, EPA 26A and EN15713:2006	0.0	11842.8	10342.8	16383.6	0.0	0.0	301.6	38870.8	0.0	0.0
08	Nitrogen oxides (NOx/NO2)	C	OTH	Flue gas analyser, Testo 350/454 MXL	0.0	7582.8	6915.6	12147.84	0.0	0.0	72.8	26719.04	0.0	0.0
01	Methane (CH4)	C	OTH	See calculation below	0.0	0.0	0.0	0.0	0.0	0.0	0.0	769943.0	0.0	769943.0

* 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									
POLLUTANT		METHOD										QUANTITY		
			Method Used		Engine 1	Engine 2	Engine 3	Engine 4	Flare 1	Flare 2	Flare 3			
No. Annex II	Name	M/C/E	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	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
80	Chlorine and inorganic compounds (as HCl)	C	EN 1911-1 to 3:2003		0.0	0.0	9.79	19.98	0.0	0.0	0.83	30.6	0.0	0.0
84	Fluorine and inorganic compounds (as HF)	C	ISO/DIS 15713:2004		0.0	9.37	21.42	24.78	0.0	0.0	0.1	55.67	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									
POLLUTANT		METHOD										QUANTITY		
			Method Used		Engine 1	Engine 2	Engine 3	Engine 4	Flare 1	Flare 2	Flare 3			
Pollutant No.	Name	M/C/E	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	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
244	Total Particulates	C	OTH	TCR tekora isokenetic particulate sampler with QMA (Quartz) high temperature filters in accordance with EN13284-1:2002	0.0	255.6	122.4	159.84	0.0	0.0	0.0	537.84	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) KGlyr 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			Method Used			
	T (Total) kg/Year	**M/C/E**	**Method Code**	**Designation or Description**	**Facility Total Capacity m3 per hour**	
Total estimated methane generation (as pe site model)	6532157.0	C	GasSim Model	OTH	N/A	
Methane flared	33577.0	M	Measured at Flares	OTH	0.0	(Total Flaring Capacity)
Methane utilised in engine/s	5728637.0	M	Measured at Engines	OTH	0.0	(Total Utilising Capacity)
Net methane emission (as reported in Sectio A above)	769943.0	C	Calculated	OTH	N/A	

4.2 RELEASES TO WATERS

Link to previous years emissions data

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

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

RELEASES TO WATERS					Please enter all quantities in this section in KGs				
POLLUTANT							QUANTITY		
			Method Used		SW9				
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	Emission Point 2	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	2971.37	0.0	2971.37	0.0	0.0
13	Total phosphorus	C	OTH	annual lab result and discharge volume per annum used to calculate emission	6.19	0.0	0.0	0.0	0.0
20	Copper and compounds (as Cu)	C	OTH	annual lab result and discharge volume per annum used to calculate emission	160.95	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 PRTR POLLUTANTS

RELEASES TO WATERS					Please enter all quantities in this section in KGs			
POLLUTANT					QUANTITY			
			Method Used		SW9			
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0

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

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

RELEASES TO WATERS					Please enter all quantities in this section in KGs				
POLLUTANT							QUANTITY		
			Method Used		SW9				
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	Emission Point 2	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	619.04	0.0	619.04	0.0	0.0
305	Calcium	C	OTH	annual lab result and discharge volume per annum used to calculate emission	13247.35	0.0	0.0	0.0	0.0
306	COD	C	OTH	annual lab result and discharge volume per annum used to calculate emission	2590.4	0.0	0.0	0.0	0.0
320	Magnesium	C	OTH	annual lab result and discharge volume per annum used to calculate emission	2104.72	0.0	0.0	0.0	0.0
338	Potassium	C	OTH	annual lab result and discharge volume per annum used to calculate emission	123.81	0.0	0.0	0.0	0.0
341	Sodium	C	OTH	annual lab result and discharge volume per annum used to calculate emission	2352.33	0.0	0.0	0.0	0.0
343	Sulphate	C	OTH	annual lab result and discharge volume per annum used to calculate emission	27361.5	0.0	0.0	0.0	0.0

379	Total Oxidised Nitrogen (TON)	C	OTH	annual lab result and discharge volume per annum used to calculate emission	21.05	0.0	0.0	0.0	0.0
240	Suspended Solids	C	OTH	annual lab result and discharge volume per annum used to calculate emission	371.42	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

5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE

| PRTR# : W0146 | Facility Name : Knockharley Landfill | Filename : w0146_2013.xls | Return Year : 2013 | 14/03/2014 11:55

Please enter all quantities on this sheet in Tonnes 0

Transfer Destination	European Waste Code	Hazardous	Quantity (Tonnes per Year)	Description of Waste	Waste Treatment Operation	Method Used		Location of Treatment	Haz Waste : Name and Licence/Permit No of Next Destination Facility Non Haz Waste: Name and Licence/Permit No of Recover/Disposer	Haz Waste : Address of Next Destination Facility Non Haz Waste: Address of Recover/Disposer	Name and License / Permit No. and Address of Final Recoverer / Disposer (HAZARDOUS WASTE ONLY)	Actual Address of Final Destination i.e. Final Recovery / Disposal Site (HAZARDOUS WASTE ONLY)
						M/C/E	Method Used					
Within the Country	19 07 03	No	6963.8	landfill leachate other than those mentioned in 19 07 02	D9	M	Weighed	Offsite in Ireland	Navan Waste Water Treatment Plant,.	Navan Waste Water Treatment Plant,.,Navan,County Meath,Ireland		
Within the Country	19 07 03	No	3442.14	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	15412.24	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 01 02	No	34.32	ferrous materials removed from bottom ash	R4	M	Weighed	Offsite in Ireland	The Hammond Lane Metal Company Ltd,WFP-DC-0013-01	Pigeon House Road,Ringsend,Dub 4,.,Ireland		

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