The East Galway Landfill

EPA Waste Licence W0178-02

Annual Environmental Report

January 2015 - December 2015

TOBIN

Patrick J. Tobin & Co. Ltd.

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1 Introduction

Greenstar Holdings Ltd. was granted a Waste Licence (Reg.No.W0178-01) to construct and operate a landfill at Killagh More, Ballybaun, Ballintober, Ballinasloe, by the Environmental Protection Agency (Agency, EPA) on the 26th of July 2004. Following a review by the EPA a revised Waste Licence (Reg. No.W0178-02) was issued on the 23rd of March 2010. The facility has accepted waste since December 2005 at a rate of 100,000 tonnes per annum for disposal and up to 27,320 tonnes of engineering materials per annum for recovery purposes. To date approximately 820,000 tonnes of waste has been placed into 7 of the 9 constructed cells. The facility has not accepted any waste since March 2013.

The Environmental Protection Agency has exercised powers to enter the site under S.I. No. 547 of 2008 – European Communities (Environmental Liability) Regulations 2008 and appointed Galway County Council and TOBIN Consulting Engineers as Agents and Authorised Officers on an emergency basis for the ongoing management of liabilities at the site. This decision arose from the decision of the receiver of the Greenstar group of companies to cease operating the facility with effect from May 2013.

The facility is situated in east County Galway, approximately 16km west of the town of Ballinasloe. The landfill is located in an area bounded to the north by the Athenry to Ballinasloe road (R348) with local roads immediately to the east and south; the L7442 and the L7439, respectively. A site location map is provided in Appendix A.

This report addresses Condition 11.11 of Waste Licence 178-02. Condition 11.11 states that:

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

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

This report addresses the items listed in Schedule G: Content of Annual Environmental Report of the waste licence for the facility and the format follows guidelines set in the “Guidance Note for Annual Environmental Report” issued by the Environmental Protection Agency**.** Account is also taken of the AER Draft Guidance Document and AER Information Templates issued by the Agency in January 2013. This AER covers the reporting period from 1st January 2015 to the 31st December 2015.

2 Waste Activities & Records

2.1 Waste Activities Carried out at the Facility

The East Galway Landfill is a fully engineered and contained landfill site. It is licensed to accept 100,000 tonnes per annum of waste, as follows:

Table 2.1 Waste Acceptance Tonnages– 2015

Waste Type	Maximum (Tonnes per Annum)
Household	45,000
Commercial	27,500
Industrial non-hazardous	24,500
Asbestos Waste	3,000
Total	**100,000**

Note: The tonnage of household waste, commercial waste and industrial non-hazardous waste may be altered with the prior agreement of the Agency provided that the total amount of all wastes accepted at the facility does not exceed the combined tonnage of 100,000 tonnes per annum **and the amount of asbestos does not exceed 3,000 tonnes per annum** (as specified in Table 2.1 above).

The facility is also licensed to accept 27,320 tonnes per annum of inert waste for recovery for the purposes of restoration and aftercare.

Waste activities at the facility are restricted to those outlined in Part 1 - Activities Licensed of the Waste Licence. Licensed waste disposal and recovery activities are summarised in Table 2.2 and Table 2.3 below.

Table 2.2 Licensed Waste Activities (Third Schedule of Waste Management Acts, 1996 - 2010)

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

Table 2.3 Licensed Waste Recovery Activities (Fourth Schedule of the Waste Management Acts, 1996 - 2010)

Class 4	**Recycling or reclamation of other inorganic materials:** This activity is limited to the use of material reclaimed from construction and demolition waste for the purposes of fill, daily cover, road construction and other uses.
Class 11	**Use of waste obtained from any activity referred to in a preceding paragraph of the Schedule:** This activity is limited to the use of material reclaimed from construction and demolition waste for the purposes of fill, daily cover, road construction and other uses.
Class 13	**Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced:** This activity is limited to the temporary storage prior to use of material reclaimed from construction and demolition waste for the purposes of fill, daily cover, road construction and other uses.

2.2 WASTE QUANTITIES AND COMPOSITION 2005 - 2015

The quantities and types of wastes accepted for disposal and recovery at the East Galway Landfill between 2005 and 2015 are summarised in Table 2.4 below. There was no waste accepted at the facility either for disposal or for recovery purposes during 2015.

Table 2.4 Quantities of waste accepted, disposed of and recovered from 2005 - 2015

Waste Type Disposed	Description	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)	Total Accepted 2014 (tonnes)	Total Accepted 2015 (tonnes)	Licence Limit (tonnes)	Total Site Intake 2005 2015 (tonnes)
Household		-	44,221.00	46,733.69	66,578.41	61,470.22	43,023.80	50,796.08	42666.15	193.76	-	-	**45,000**	**355,683**
Commercial		-	27,024.00	27,494.63	30,730.16	35,500.04	54,983.70	47,346.73	51809.45	182.1	-	-	**27,500**	**275,071**
Industrial non-hazardous	Misc. Non-Hazardous Industrial solid wastes	-	27,023.00	27,402.73	999.52	2,667.85	3,729.90	4,236.37	11039.10	67	-	-	**24,500**	**77,165**
Asbestos		0	0	0	0	0	0	0	0	0	-	-	**3,000**	
Total Waste Disposed		**161.50**	**98,268.00**	**101,631.05**	**98,308.09**	**99,638.11**	**101,737.40**	**102,379.18**	**105,514.70**	**442.86**	**0**	**0**	**100,000**	**708,081**
Waste Type Recovered	**Description**	**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 2010** (tonnes)	**Total Accepted 2012** (tonnes)	**Total Accepted 2013** (tonnes)	**Total Accepted 2014** (tonnes)	**Total Accepted 2014** (tonnes)	**Licence Limit (tonnes)**	**Accepted 2013 (tonnes)**
Cover / Engineering Material	Shredded timber - reused on site	-	2,690	4,482.60	6,950.90	4,121.50	2,942.14	3,758.88	3582.58	-	-	-	-	**28,529**
Cover / Engineering Material	Recovered C&D Rubble reused on site	-	1,202	989.14	255.01	-	1,080.26	1584.78	69.96	-	-	-	-	**5,181**
Cover / Engineering Material	Soil and fine material reused on site for daily and intermediate cover and liner protection	-	14,538	23,692.17	6,711.11	803.32	2,800.92	2295.74	23,574.64	1778.36	-	-	-	**76,194**
Total Waste Recovered		**-**	**18,430**	**29,163.91**	**13,917.02**	**4,924.82**	**6,823.32**	**7639.40**	**27,227.18**	**1778.36**	**-**	**-**	**27,320**	**109,904**
Total Site Intake		**-**	**116,698**	**130,794.96**	**112,225.11**	**104,562.93**	**108,560.75**	**110,018.58**	**132,741.88**	**2,221.22**	**0**	**0**	**127,320**	**817, 985**

2.3 CALCULATED REMAINING CAPACITY OF THE FACILITY

The remaining capacity of the landfill had been calculated to be 650,815 m^3 at the end of 2013. No waste was accepted at the landfill facility in 2014 or 2015.The remaining capacity of the landfill facility at the end of 2015 remains at 650,815 m^3.

2.4 METHODS OF DEPOSITION OF WASTE

There was no waste accepted at the facility either for disposal or for recovery purposes during 2015.

3 Report on Environmental Emissions

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

- Dust
- Noise
- Landfill Gas
- Surface Water Discharge (measured at SW6 & SW7)
- E-PRTR

3.1 DUST EMISSIONS

Dust deposition Emission Limit Values as stipulated in Licence 178-02 are 350mg/m^2/day.

Dust monitoring was conducted at five locations on a quarterly basis during the 2015 reporting period, as illustrated on Drawing 3588 – 1604 (see Appendix A). City Analysts Limited (Dublin) conducted analysis on the dust deposition samples from the facility. Dust reports were included in all quarterly environmental monitoring reports issued to the Agency during 2015.

Dust monitoring results were below the required ELV (350 mg/m^2/day) during all monitoring events in 2015. Dust deposition ranged between 2.2 mg/m^2/day at D4 in Q3 2015 and 27.10 mg/m^2/day at D3 in Q4 2015.

3.2 NOISE EMISSIONS

Noise emission limit values as stipulated in Licence 178-02 are detailed in Table 3.1 below.

Table 3.1 Noise Emission

Day Db(A) LAeq (15 minutes)	Night dB(A) LAeq (15 minutes)
55	45

Noise monitoring was conducted at five monitoring locations on a quarterly basis during 2015.

Results from all noise monitoring events were issued to the Agency as part of the quarterly environmental monitoring reports for 2015.

During 2015, the measured noise levels were, for the majority of the time, within the ELV of 55 dB (A) (daytime) as set out in Schedule D of Waste Licence W0178-02. Exceedances and tones observed are summarized in the points below;

- Q1 - Exceedance of 58.5 dB(A) at N3 which was attributed to farm machinery. The landfill was not audible at any location during the survey and therefore exceedance was not attributed to the landfill. No tones were recorded.

- Q2 - Exceedance of 59.1 dB(A) at N1, 57.8 dB(A) at N3 and 67.40 dB(A) at N5. Farming activities (silage cutting) was the dominant noise source. The landfill was not audible at any location during the survey and therefore exceedances were not attributed to the landfill. No tones were recorded.

- Q3 - Exceedance of 67.5 dB(A) at N5 which was attributed to passing traffic on the local road. A tone was detected at 63Hz at N2, at 12.5Hz and 160Hz at N3, at 25Hz at N4 and at 16Hz and 40Hz at N5. Farm activity and passing traffic were the dominant noise sources. The landfill was not audible at any location at the time of the survey; therefore no penalty has been applied.

- Q4 - Exceedance of 56.3 dB(A) at N5 which was attributed to passing traffic on the local road. The landfill was not audible at this location at the time of the survey and no penalty was applied. No tones were recorded.

3.3 LANDFILL GAS CONCENTRATIONS

Table 3.2 outlines landfill gas emission limit values as stipulated in Schedule C.2 of Waste Licence 178-02.

Table 3.2 Landfill Gas Concentrations

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

3.3.1 LANDFILL GAS MONITORING WELLS

Tables 3.3 and 3.4 below outline the wells that exceeded the ELV for methane concentration (20% LEL (1% v/v)) and carbon dioxide concentration (1.5% v/v), respectively, during each quarter during 2015. All exceedance were reported to the Agency in a landfill gas incident report after each monthly

monitoring event.

Table 3.3 Wells in Exceedance of Methane Limit (1% v/v)

Quarterly Monitoring Period	Wells in Exceedance of Methane Limit
Q1	LG5, LG9, LG11, LG22
Q2	LG5, LG9, LG11, LG22
Q3	LG5, LG9, LG11, LG19, LG22
Q4	LG4, LG8, LG9, LG11, LG19, LG22, LG23

Table 3.4 Wells in Exceedance of Carbon Dioxide Limit (1.5% v/v)

Quarterly Monitoring Period	Wells in Exceedance of Carbon Limit
Q1	LG5, LG9, LG11, LG15, LG18, LG19, LG22, LG23, LG25
Q2	LG5, LG9, LG11, LG18, LG22, LG23, LG24, LG25, LG28
Q3	LG5, LG9, LG11, LG19, LG21, LG22, LG23, LG24, LG28
Q4	LG1, LG4, LG5, LG6-A, LG9, LG16,LG18, LG19, LG22, LG23, LG24, LG26, LG28

Gas monitoring carried out by White Young & Green (WYG) at the East Galway Landfill in December 2005, prior to waste acceptance at the facility, identified elevated CH4 and CO2 levels at several perimeter boreholes. Their report concluded that the source of elevated methane and/or carbon dioxide in perimeter gas monitoring wells is attributed to the continuous decay of organic peat.

3.3.2 Landfill Gas In Buildings

There were no instances of gas levels in Buildings/Offices breaching Landfill Gas Concentration limits specified in Schedule C.2 during 2015.

3.4 Surface Water Discharge Limits (Measured at SW6 & SW7)

Surface water discharge emission limit values at monitoring locations SW6 and SW7 as stipulated in Schedule C.4 of Waste Licence 178-02 are detailed in Table 3.3 below.

Table 3.5 Surface Water Discharge Limits

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

Suspended solids concentrations at SW6, SW7 complied with the 35mg/L ELVs during all monitoring events throughout 2015.

3.5 E-PRTR

The European Pollutant Release and Transfer Register (E-PRTR) for the East Galway Landfill for 2015 are included in Appendix B.

4 Summary of Environmental Monitoring Results

Environmental Monitoring was conducted at the East Galway Landfill facility in accordance with Schedule D of the Waste Licence throughout the reporting period. All monitoring results from 2015 were presented to the Agency in the quarterly environmental monitoring reports and are summarised below. The locations of all environmental monitoring points are illustrated on Drawing 3588-1604 in Appendix A.

4.1 BIOLOGICAL ASSESSMENT

4.1.1 ELECTROFISHING SURVEY

EirCo and Stillwaters Consultancy were commissioned to undertake an electro-fishing survey on selected sites (A, B, C, D, E and G) in the environs of the East Galway Landfill facility. The objective of the survey was to characterise fish populations in the streams within the vicinity of the landfill site.

The survey was carried out on the 3rd of September 2015. Fishing at site E could not be undertaken due to a bull in the field. No fish were recorded at site A or B but this was likely due to inhibited access due to overgrown vegetation. While there is normal annual fluctuation in population numbers there are no major changes to species composition at these sites to indicate that the landfill area is impacting on them.

The results were submitted to the Agency as part of the Q3 2015 Surface Water and Electrofishing environmental monitoring report, and are summarised below in Table 4.1 below.

Table 4.1 Results of Electro Fishing Survey (2011-2015)

Site	Location	Site Description	Species Recorded 2012 (Note 1 & 2)	Species Recorded 2013 (Note 1 & 2)	Species Recorded 2014 (Note 1 & 2)	Species Recorded 2015 (Note 1 & 2)
A	M708297	Overgrown bog drain Peaty Substrate	Sticklebacks (c) Gammarus (p)	Stickleback (c)	Stickleback (pl)	No Fish recorded
B	M712302	Bog Drain ca. 1.5m deep, very overgrown	No fish recorded due to inhibited access	No fish recorded due to inhibited access	Stickleback (p)	No Fish recorded

C	M707304	Shallow Stream ca. 5-10cm. Clean gravely substrate maintained by local farmer.	Sticklebacks (pl) Trout 0+(p) Gammarus (p)	Stickleback (c) Crayfish (p)	Stickleback (p) Stoneloach (p)	Stickleback (c) Stoneloach (p)
D	M709309	Channel completely overgrown. Upstream Site Surveyed from 2008 on Site more open in 2010	Sticklebacks (pl) Gammarus (p)	Stickleback (p)	No Fish recorded	Stickleback (c)
E	M699313	Mainly silt with some rock. Channel overgrown except for stretch fish	Trout 1+(p) Stoneloach (p) Pike (p) Crayfish (p)	Not Fished	Trout 0+(p) Trout 1 + (p) Stickleback (p) Stoneloach (pl) Crayfish(p)	Not Fished
G	M682308	Shaded channel under bank cover. Good gravel and cobble substrate, Suitable salmonid habitat	Trout 0+(p) Trout 1 + (c) Stoneloach (p) Crayfish (p)	Trout 0+ (a) Trout 1+ (c) Stoneloach (c) Crayfish (p)	Trout 0+ (p) Trout 1+ (c) Stoneloach (c) Stickleback (p)	Trout 0+ (a) Trout 1+ (c) Stoneloach (c) Stickleback (p) Crayfish (p)

Note 1: (p) = Present, (c) = Common, (pl) = Plentiful, (a) = Abundant.
Note 2: **Trout 0+** = trout in their 1st year but not yet 1 year old, **Trout 1+** = trout in their 2nd year but not yet 2 years old.

4.1.2 SMALL STREAM RISK SCORE (SSRS) ASSESSMENT FOR EAST GALWAY LANDFILL 2015

Biological assessment of the surface water quality was carried out by Openfield Ecological Services at four locations along two streams at the East Galway Landfill at Ballybaun, Kilconnell, Co. Galway. Two locations are upstream of the landfill (IN1 and IN2) and two are located downstream of the landfill (IN3 and IN4). The information obtained was used to determine the SSRS, in accordance with the Western River Basin District Project's methodology (WRBD, 2005). As outlined in previous AER's, the SSRS assessment method replaced the EPA Q-Rating system undertaken historically at the site in 2010.

Table 4.2 SSRS Assessment Results

Sampling code	Small Stream Risk	Score Risk Assessment
IN1	4	At Risk
IN2	3.2	At Risk
IN3	3.2	At Risk
IN4	2.4	At Risk

The results of the 2015 assessment provided by the SSRS, which categorises each of the streams monitored as being, "At Risk", are consistent with the previous findings for previous monitoring events (2010 – 2014).

It was noted that at sampling location IN1, vegetation clearance works had improved light levels and flow at this location and this was reflected in an improvement in the overall score, but not enough to change the risk category. Other locations continue to be hindered by vegetation growth, as noted in

2014 findings. The complete SSRS Report from Openfield Ecological Services was submitted as Appendix C of the Q3 report 2015.

4.2 SURFACE WATER MONITORING

Surface water monitoring was conducted at 6 no. monitoring locations (SW1, SW3, SW4, SW5, SW6 and SW7) during 2015 Surface water monitoring locations SW1, SW2, SW3 & SW7 are located up-stream of the landfill, and SW4 & SW5 are located downstream. SW6 is an outlet point from the surface water lagoon.

It should be noted that sampling was not carried out at SW2 during 2015 as it was dry during all four quarterly monitoring events. In addition, sampling could not be carried out at SW3 and SW4 during the Q3 event in 2015 as they were almost dry. Quarterly surface water samples were analysed for parameters stipulated in Schedule D.5 of Waste Licence 178-02 and results were forwarded to the Agency as part of the quarterly environmental monitoring reports Q1 – Q4 2015. The 2015 surface water monitoring results are summarised on Tables 4.3 – 4.7 and Figures 4.1 – 4.5 below.

4.2.1 SURFACE WATER MONITORING RESULTS

All pH results were found to be within normal ranges for natural uncontaminated surface waters.

All conductivity results were also found to be within normal ranges for natural uncontaminated surface waters.

Chloride concentrations ranged from 11.11 mg/l (SW7 in Q3) to 36.51 mg/l (SW3 in Q4) during 2015. These results are within the normal range for uncontaminated freshwater (15-35mg/l, EPA).

Ammoniacal nitrogen (total ammonium plus total ammonia) ranged between 0.01 mg/l (SW1, SW3, SW4 and SW5 in Q2) to 0.18 mg/l (SW6 in Q4), which is consistent with historical records for the site.

Suspended solid concentrations were below the ELV (35mg/l) at sampling locations during all monitoring events in 2015, with a peak concentration of 10 mg/l at SW4 in Q1.

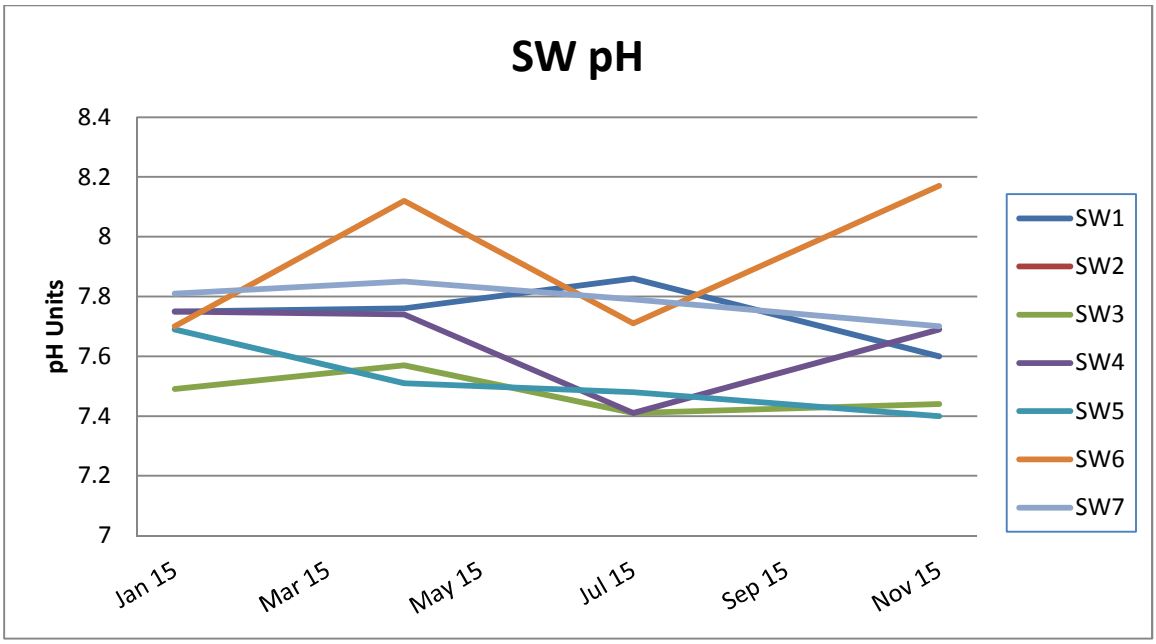


Figure 4.1 SW pH Results 2015

Table 4.3 SW pH Results - 2015

pH Units (mg/l)	January	April	July	November
SW1	7.75	7.76	7.86	7.6
SW2*	*	*	*	*
SW3	7.49	7.57	7.41	7.44
SW4	7.75	7.74	7.41	7.69
SW5	7.69	7.51	7.48	7.4
SW6	7.7	8.12	7.71	8.17
SW7	7.81	7.85	7.79	7.7

*indicates sample could not be collected as monitoring point was too dry at the time of sampling.

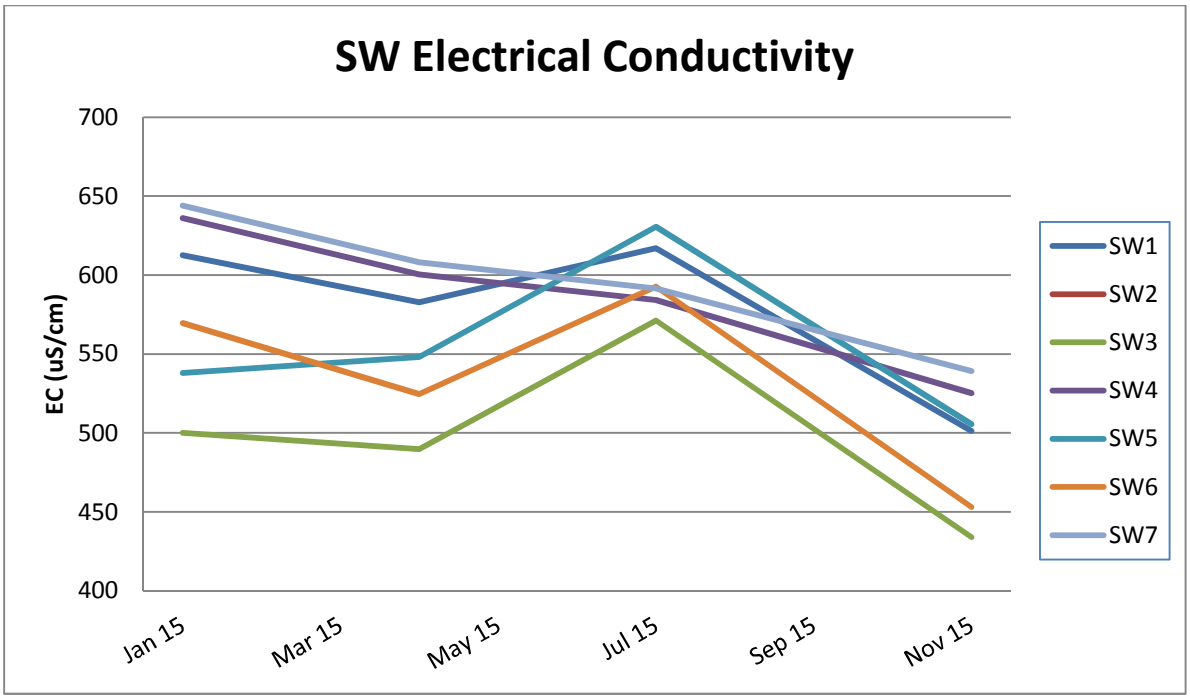


Figure 4.2 SW Conductivity Results 2015

Table 4.4 SW Conductivity Results 2015

Electrical Conductivity (mg/l)	January	April	July	November
SW1	612.6	582.7	617.1	501.4
SW2*	*	*	*	*
SW3	500	489.8	571.2	434.1
SW4	636	600.4	584.2	525.2
SW5	538	548.2	630.6	505.6
SW6	569.7	524.6	592.8	453
SW7	644	608.2	591.5	539.3

*indicates sample could not be collected as monitoring point was too dry at the time of sampling.

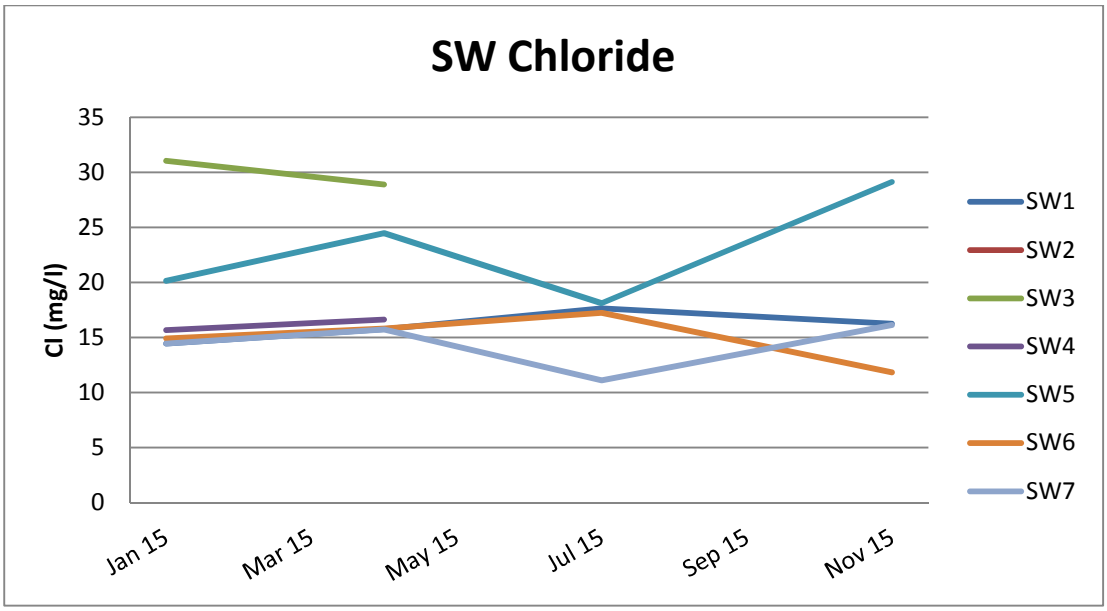


Figure 4.3 SW Chloride Results 2015

Table 4.5 SW Chloride Results 2015

Chloride (mg/l)	January	April	July	November
SW1	14.44	15.76	17.66	16.26
SW2*	*	*	*	*
SW3	31.03	28.9	*	36.51
SW4	15.66	16.64	*	16.24
SW5	20.15	24.47	18.12	29.11
SW6	14.92	15.82	17.25	11.85
SW7	14.46	15.74	11.11	16.13

*indicates sample could not be collected as monitoring point was too dry at the time of sampling.

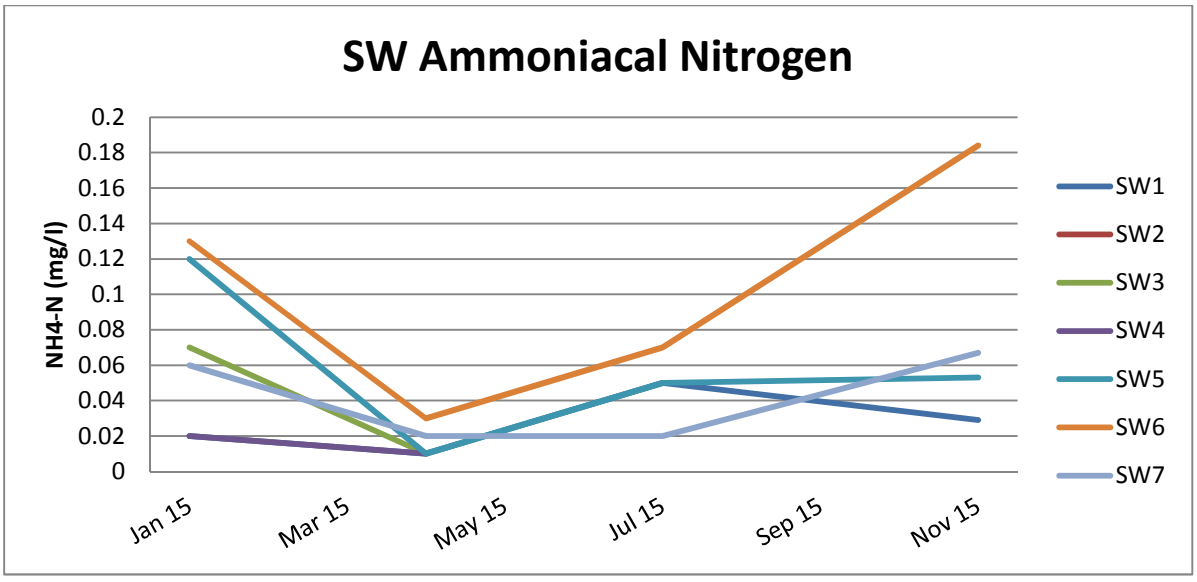


Figure 4.4 SW Ammoniacal Nitrogen Results 2015

Table 4.6 SW Ammoniacal Nitrogen Results 2015

Ammonical Nitrogen (mg/l)	January	April	July	November
SW1	0.02	0.01	0.05	0.029
SW2*	*	*	*	*
SW3	0.07	0.01	*	0.072
SW4	0.02	0.01	*	0.029
SW5	0.12	0.01	0.05	0.053
SW6	0.13	0.03	0.07	0.184
SW7	0.06	0.02	0.02	0.067

*indicates sample could not be collected as monitoring point was too dry at the time of sampling.

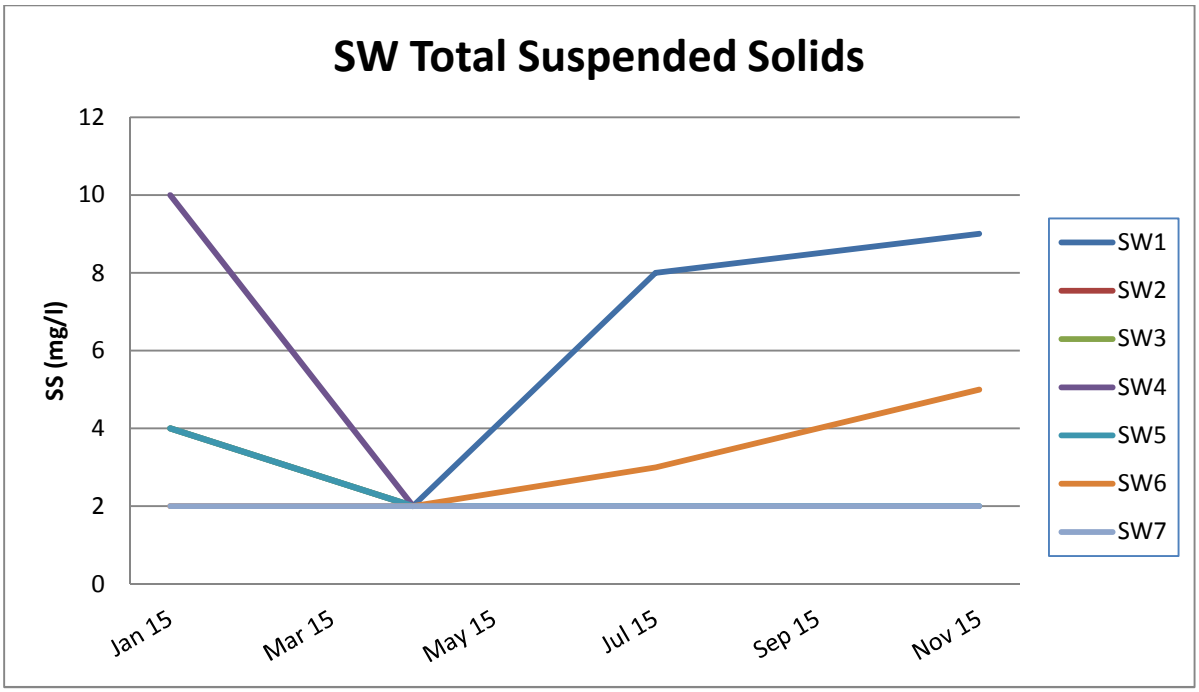


Figure 4.5 SW Total Suspended Solids Results 2015

Table 4.7 SW Suspended Solids Results 2015

Total Suspended Solids (mg/l)	January	April	July	November
SW1	4	<2	8	9
SW2*	*	*	*	*
SW3	4	<2	*	2
SW4	10	<2	*	<2
SW5	4	<2	<2	<2
SW6	2	2	3	5
SW7	2	<2	<2<	2

*indicates sample could not be collected as monitoring point was too dry at the time of sampling.

4.3 GROUNDWATER MONITORING

Groundwater monitoring was conducted at eight locations during 2015, in accordance with Schedule D.1 and D.5 of Waste Licence 178-02.

The trigger levels for groundwater parameters are reviewed annually and were revised in 2008 (as presented in Table 4.8 below). The East Galway Landfill requested Agency agreement of these trigger levels on 8th Dec 2009 in response to a related Agency audit observation. No response was received in relation to this. These trigger levels remain unchanged and were also used between 2008 and the 2015 monitoring period.

In November 2011, the groundwater trigger levels were reviewed and a submission discussing these levels was lodged on behalf of the East Galway Landfill to the Agency following an EPA request for same. Return correspondence was not received in relation to the submission and therefore this report has continued to refer to the trigger values from the 2008-2014 AER as given in Table 4.8 below.

The results of routine licence compliance groundwater monitoring were, for the most part, under the trigger values as revised and submitted in the 2008-2014 AERs. This AER report employs the aforementioned trigger levels for the parameters listed in Condition 6.4.3 of the Waste Licence for wells GW1-A, GW2, GW3, GW4-A, GW5-A, GW6, GW7 and GW8.

Table 4.8 Groundwater Trigger Values for 2014 Analyses, as Revised in 2008

Parameter	*Units*	*GW1-A*	*GW2*	*GW3*	*GW4-A*	*GW5-A*	*GW6*	*GW7*	*GW8*
Potassium	**mg/l**	1.92	2.88	1.44	1.08	21.00	4.20	3.00	0.96
Sodium	**mg/l**	14.40	20.40	16.32	17.22	20.40	50.40	37.20	20.40
pH (lower limit)	**pH Units**	5.73	5.35	5.56	5.77	5.70	5.54	5.87	5.28
pH	**pH Units**	9.02	9.79	9.38	9.14	9.22	10.56	9.53	9.61
Chloride	**mg/l**	20.40	46.80	24.00	39.60	32.40	24.00	18.00	37.20
Ammoniacal Nitrogen	**mg/l**	1.92	6.36	5.40	3.60	8.52	7.44	2.40	3.72
TOC	**mg/l**	60.00	55.20	27.60	60.00	74.40	48.00	21.60	39.60

Groundwater levels were recorded on a monthly basis during 2015 and the results are presented in Figure 4.6 below. The recorded water levels remained relatively constant while allowing for seasonal variation during 2015.

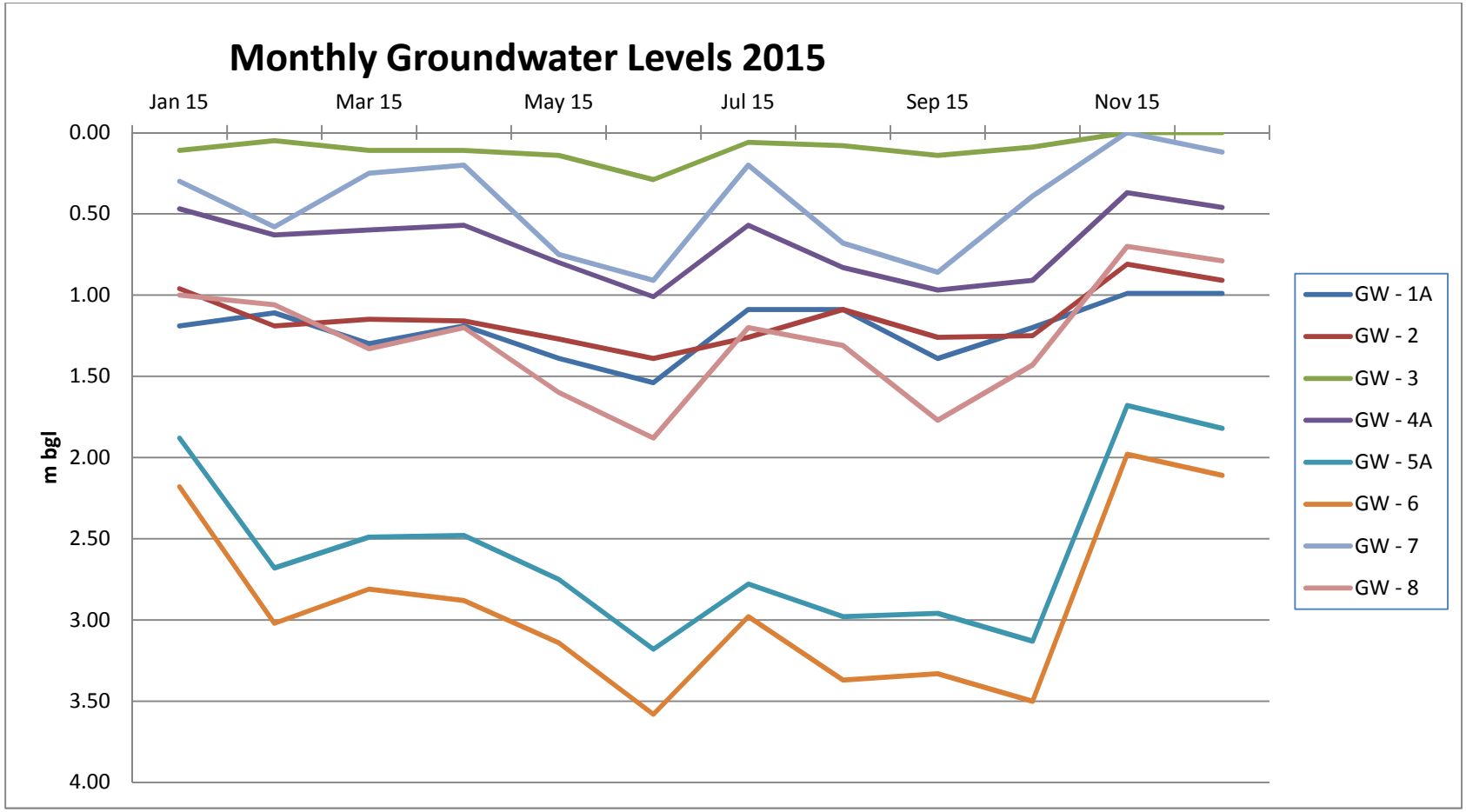


Figure 4.6 Monthly Groundwater Levels – 2015

4.3.1 GROUNDWATER RESULTS SUMMARY

PH concentrations were within their respective trigger values at all monitoring locations during 2015.

Conductivity measurements were typical of natural uncontaminated groundwater. Conductivity ranged from 403 uS/cm to 841 uS/cm during 2015. All conductivity results were also found to be within normal ranges for natural uncontaminated waters.

Chloride concentrations were below their respective trigger values for 30 no. of the total 32 no. samples collected and analysed during 2015. Two exceedances above their respective trigger values were recorded from monitoring locations GW3 (results of 24.53 mg/l exceeded limit of 24 mg/l) and GW7 (results of 35.99 mg/, exceeded limit of 18 mg/l) during Q2 & Q4 of 2015 respectively.

Ammoniacal Nitrogen concentrations were below their respective trigger values at all monitoring locations during 2015.

Total Organic Carbon concentrations were below respective trigger values at all monitoring locations during 2015, within the exception of Q2 when there was an exceedance of the trigger limit value at GW1 (result of 64.14 mg/l exceeded the limit of 60 mg/l) and at GW8 (result of 46.74 mg/l exceeded limit of 39.60 mg/l) .

Dissolved Oxygen concentrations ranged from 1.71 mg/l to 4.66 mg/l during 2015 and were consistent with previous recordings at the site.

As part of the annual suite of parameters analysed in Q3 2015, Potassium and Sodium concentrations were recorded.
Potassium ranged between 0.60 mg/l at GW8 and 2.30 mg/l at GW5-A. There was one exceedance of potassium trigger limit at GW4-A (result of 1.60 mg/l exceeded the limit of 1.08 at that location).
Sodium ranged between 11.20 mg/l at GW3 and 27.30 mg/l at GW7. There was no exceedance of any sodium trigger limit in 2015.

In general, the results of quarterly parameters are consistent with the data reported for the previous events. All parameters will continue to be monitored closely.

The 2015 groundwater monitoring results are summarised on Tables 4.9 – 4.14 and Figures 4.7 – 4.12 below.

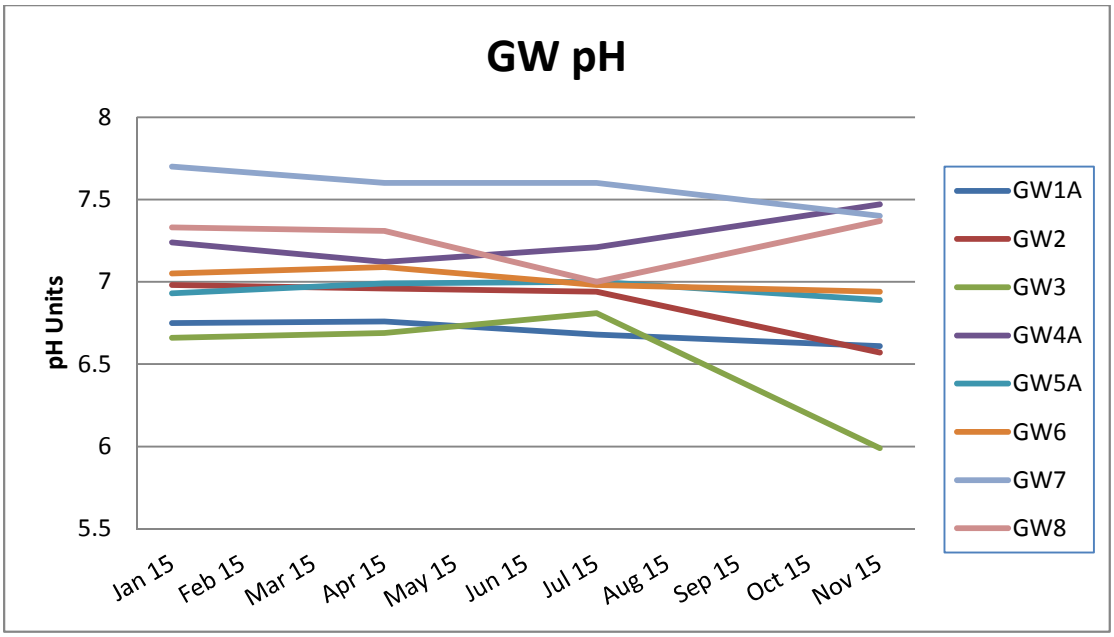


Figure 4.7 Groundwater pH Laboratory Results– 2015

Table 4.9 Groundwater pH Laboratory Results– 2015

pH (pH Units)	*Trigger Values*		January	April	July	November
	pH Lower Limit	*pH Upper Limit*				
GW 1 – A	*5.73*	*9.02*	6.75	6.76	6.68	6.61
GW 2	*5.35*	*9.79*	6.98	6.96	6.94	6.57
GW 3	*5.56*	*9.38*	6.66	6.69	6.81	5.99
GW 4 – A	*5.77*	*9.14*	7.24	7.12	7.21	7.47
GW 5 – A	*5.70*	*9.22*	6.93	6.99	7	6.89
GW 6	*5.54*	*10.56*	7.05	7.09	6.98	6.94
GW 7	*5.87*	*9.53*	7.7	7.6	7.6	7.4
GW 8	*5.28*	*9.61*	7.33	7.31	7	7.37

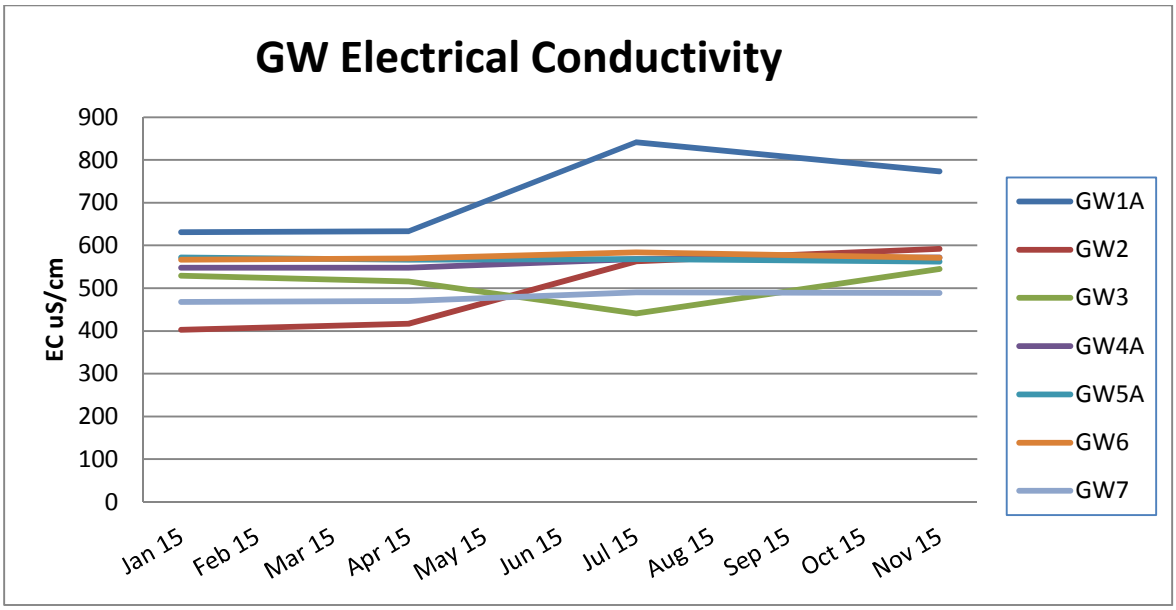


Figure 4.8 Groundwater Electrical Conductivity Results– 2015

Table 4.10 Groundwater Electrical Conductivity Results – 2015

Electrical Conductivity (uS/cm)	*Trigger Values (Note 1)*	January	April	July	November
GW 1 – A	-	631	633	841	773
GW 2	-	403	417	563	592
GW 3	-	529	516	441	545
GW 4 – A	-	548	548	568	572
GW 5 – A	-	572	567	568	562
GW 6	-	567	570	584	571
GW 7	-	468	470	490	489
GW 8	-	647	639	565	659

Note 1: No Set limit for electrical conductivity in groundwater trigger values.

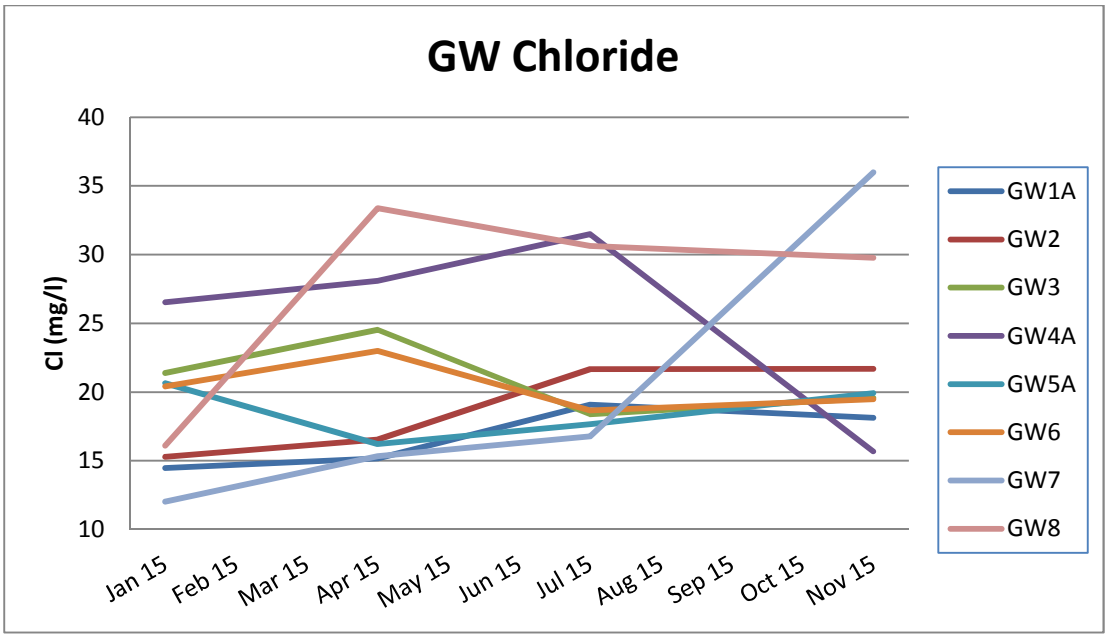


Figure 4.9 Groundwater Chloride Results– 2015

Table 4.11 Groundwater Chloride Results– 2015

Chloride (mg/l)	*Trigger Values*	January	April	July	November
GW 1 – A	*20.4*	14.47	15.18	19.08	18.13
GW 2	*46.8*	15.3	16.54	21.66	21.69
GW 3	*24.0*	21.39	**24.53**	18.39	19.57
GW 4 – A	*39.6*	26.53	28.1	31.49	15.69
GW 5 – A	*32.4*	20.65	16.23	17.66	19.93
GW 6	*24.0*	20.42	23	18.66	19.47
GW 7	*18.0*	12.04	15.34	16.78	**35.99**
GW 8	*37.2*	16.1	33.38	30.64	29.78

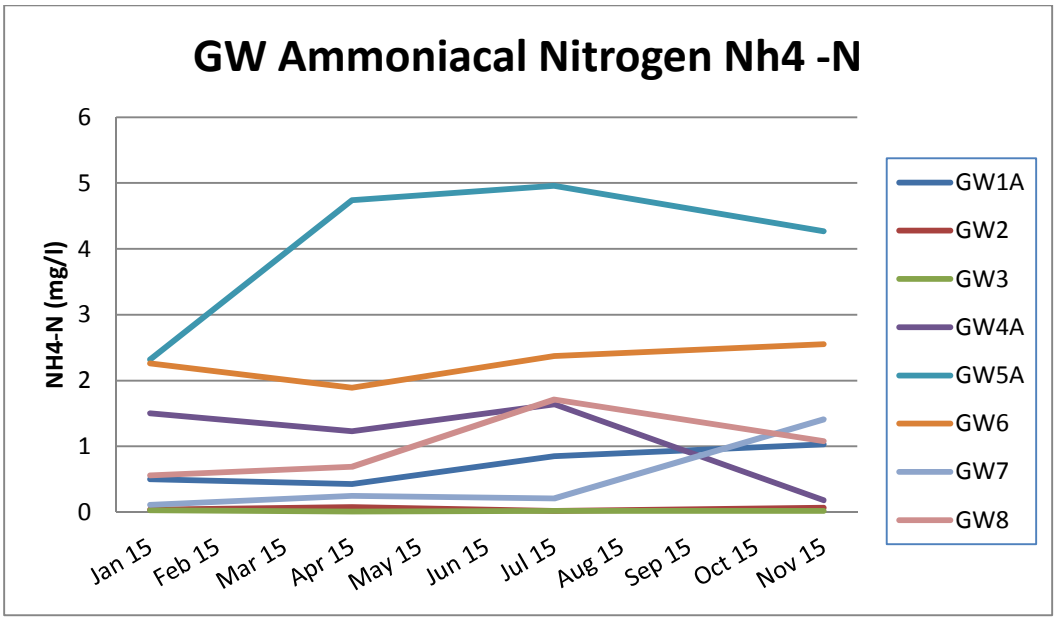


Figure 4.10 Groundwater Ammoniacal Nitrogen Results– 2015

Table 4.12 Groundwater Ammoniacal Nitrogen Results– 2015

Ammonical Nitrogen (mg/l)	*Trigger Values*	January	April	July	November
GW 1 – A	*1.92*	0.5	0.43	0.85	1.03
GW 2	*6.36*	0.04	0.08	0.02	0.07
GW 3	*5.40*	0.03	0.01	0.02	0.02
GW 4 – A	*3.60*	1.5	1.23	1.64	0.18
GW 5 – A	*8.52*	2.32	4.74	4.96	4.27
GW 6	*7.44*	2.26	1.89	2.37	2.55
GW 7	*2.40*	0.11	0.25	0.21	1.41
GW 8	*3.72*	0.56	0.69	1.71	1.08

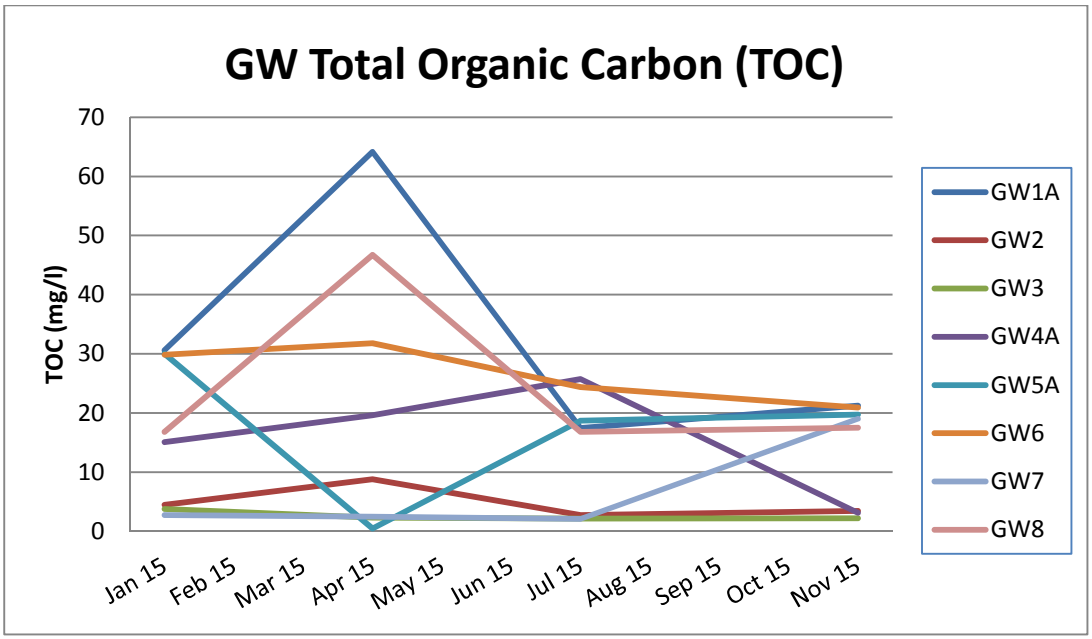


Figure 4.11 Groundwater TOC Results– 2015

Table 4.13 Groundwater TOC Results– 2015

TOC (mg/l)	*Trigger Values*	January	April	July	November
GW 1 – A	*60.00*	30.6	**64.14**	17.45	21.23
GW 2	*55.20*	4.51	8.79	2.73	3.47
GW 3	*27.60*	3.76	2.31	2.15	2.23
GW 4 – A	*60.00*	15.11	19.62	25.75	3.15
GW 5 – A	*74.40*	30.02	0.5	18.7	19.72
GW 6	*48.00*	29.85	31.79	24.39	20.91
GW 7	*21.60*	2.77	2.46	2.1	19.03
GW 8	*39.60*	16.8	**46.74**	16.8	17.54

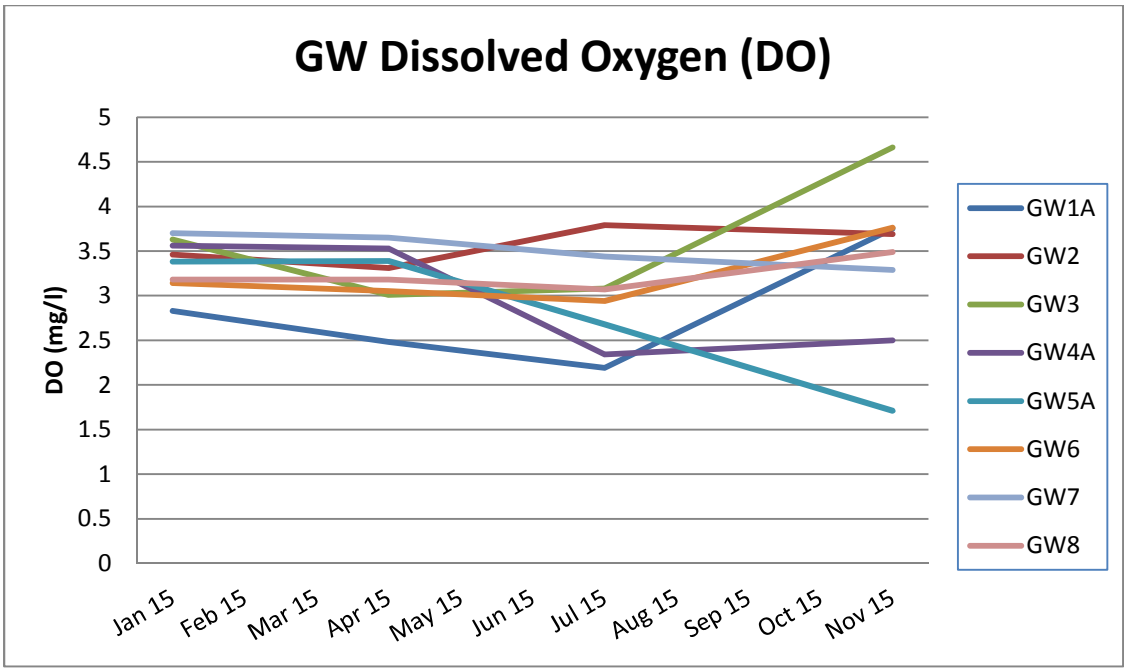


Figure 4.12 Groundwater Dissolved Oxygen Results– 2015

Table 4.14 Groundwater Dissolved Oxygen Results– 2015

DO (mg/l)	*Trigger Values (Note 1)*	January	April	July	November
GW 1 – A	-	2.83	2.48	2.19	3.75
GW 2	-	3.46	3.31	3.79	3.69
GW 3	-	3.63	3.01	3.08	4.66
GW 4 – A	-	3.56	3.53	2.34	2.5
GW 5 – A	-	3.38	3.39	2.68	1.71
GW 6	-	3.14	3.05	2.94	3.76
GW 7	-	3.7	3.65	3.44	3.29
GW 8	-	3.18	3.18	3.07	3.49

Note 1: No Set limit for dissolved oxygen in groundwater trigger values.

4.4 DUST AND PM_{10} MONITORING

4.4.1 DUST MONITORING

As discussed in Section 3.1 above dust monitoring was undertaken at 5 (no.) locations (D1, D2, D3, D4, D5) in accordance with Schedule D.1 and D.3 of Waste Licence 178-02. All dust concentrations recorded were below the required ELV of 350mg/m2/day during all monitoring events in 2015. Dust results from 2015 are summarised in Table 4.15 below.

Table 4.15 Dust Monitoring Results 2015

Date out	Date in	D 1 (mg/m^2/day)	D 2 (mg/m^2/day)	D 3 (mg/m^2/day)	D 4 (mg/m^2/day)	D 5 (mg/m^2/day)
19/01/15	17/02/15	5.8	9.1	8.1	12.2	8.1
15/04/15	14/05/15	16.1	20.3	30.6	4.1	10.8
09/07/15	10/08/15	8.5	13.4	10.8	2.2	19.9
16/11/15	14/12/15	11.05	11.22	27.10	4.26	7.91

4.4.2 PM10 MONITORING

PM10 monitoring was conducted quarterly at the facility in accordance with Schedule D of Waste Licence 178-02. The PM10 monitoring locations are shown on Drawing 3588-1604, Appendix A. All of the PM10 results were below the required limit level of 50ug/m3 during 2014. The PM10 results for 2015 are summarised in Table 4.16 below.

Table 4.16 PM10 (ug/m^3) Monitoring Results for 2015

Monitoring Location	Q1	Q2	Q3	Q4
	Average concentration value (µg/m^3)			
Limit Value	***50***	***50***	***50***	***50***
D1	12	10	9	8
D2	6	7	8	9
D3	11	10	11	10
D4	9	8	7	8
D5	10	11	10	11

4.5 LEACHATE MONITORING

As per Schedule D.5 of Waste Licence 178-02 temperature readings from each of the leachate cells and the leachate holding tank (LHT) are required to be taken on a quarterly basis. Chemical analysis of the leachate in carried out annually and was undertaken in July 2015. Results were submitted to

the Agency as part of the Q3 environmental monitoring report.

4.5.1 LEACHATE RESULTS

Leachate temperature readings and annual chemical analysis results are summarised in Table 4.17 and Table 4.18 below.

Table 4.17 Leachate Temperatures– 2015

Monitoring Location	Q1 Temperature (°C)	Q2 Temperature (°C)	Q3 Temperature (°C)	Q4 Temperature (°C)
Cell 1	8.8	9.9	15.5	12.7
Cell 2	20.4	19.5	23.8	20.6
Cell 3	14.5	19.4	21.5	19.7
Cell 4	15.6	17.2	17.2	16.8
Cell 5	8.3	14.4	15.9	15.4
Cell 6	19.5	19.9	23.9	27.7
Cell 7	23.1	23.2	24.6	24.5
Leachate Holding Tank	5.7	10.1	18.3	10.4

Table 4.18 Annual Chemical Analysis of Leachate– 2015

Parameter	Unit	Cell 1	Cell 2	Cell 3	Cell 4	Cell 5	Cell 6	Cell 7	LHT
Alkalinity		4722	5179	3716	6893	6882	3093	4551	4573
Ammonia as N	mg/l	1337.33	892.55	851.90	1223.08	1190.49	599.51	865.81	794.62
BOD	mg/l	148	87	325	114	323	124	122	118
Boron	µg/l	5990	8020	4900	7730	7080	6370	6290	5660
Cadmium	mg/l	7.4	4.6	4.9	5.0	6.6	3.8	4.9	5.0
Calcium	mg/l	76.1	118.0	96.8	62.4	72.4	97.1	117.0	106.0
Total Chromium	mg/l	0.3	<0.2	<0.2	0.4	0.4	0.2	0.3	0.2
Chloride	mg/l	1443	1446	948	1629	1682	910	1494	1136
COD	mg/l	2640	2230	1580	3130	3870	1370	1760	2080
Electrical Conductivity	us/cm	<132	<132	<132	<132	<132	<132	<132	<132
Copper	mg/l	0.680	3.280	0.100	0.640	0.530	0.490	0.510	50
Total cyanide	mg/l	0.049	0.029	0.041	0.024	<0.020	<0.020	0.029	<0.020
Dissolved Oxygen	Mg/l O2	<1.0	5.7	5.4	1.1	1.2	5.0	5.6	1.5
Iron	mg/l	4.74	10.90	3.14	4.35	1.69	1.69	6.17	5.05
Lead	mg/l	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

Magnesium	mg/l	37.4	43.2	27.6	35.1	35.8	25.7	33.3	32.6
Nickel	mg/l	0.2	0.2	0.2	0.2	0.3	0.2	0.5	0.2
Mercury	ug/l	0.50	0.66	0.26	0.30	0.38	0.20	0.28	0.27
Ortho-phosphate as P	mg/l	12.259	7.532	10.884	19.242	13.972	7.308	8.201	8.663
pH	pH Units	7.32	7.61	7.40	7.54	7.58	7.34	7.67	7.73
Potassium	mg/l	474.0	591.0	373.0	608.0	650	126.0	681.0	492.0
Sodium	mg/l	1130	1330	753	1300	1330	295	1340	959
Sulphate	mg/l	1782.4	1029.0	618.9	1039.7	1162.9	187.5	467.6	331.9
TON as N	mg/l	<5	6.33	<5	<5	<5	<5	6.46	<5
TSS	Mg/l	22	*	*	*	*	*	*	*
Zinc	mg/l	0.78	0.45	0.27	0.61	0.79	0.47	1.21	<0.2

*TSS was recorded for Cell 1 only

4.6 NOISE MONITORING

During 2015, noise monitoring was carried out on a quarterly basis at 5 no. monitoring locations, as indicated on Drawing No. 3588 – 1604 (see Appendix A). All noise monitoring results were submitted to the Agency as part of the quarterly environmental monitoring reports for 2015. Results for noise monitoring conducted at the facility on a quarterly basis during 2015 are summarised in Table 4.19 below.

All noise monitoring locations had LAeq values less than the required ELV of 55dB LAeq during 2015, with the exception of N1 during Q2, N3 during Q1 and Q2 and N5 during Q2, Q3 and Q4. These exceedance were attributable to farming activities and passing traffic on the R348 and not attributable to facility operations.

Table 4.19 Noise Monitoring Results– 2015

Location	Q1 2015 (19/01/15)				Q2 2015 (11/06/15)				Q3 2015 (30/09/15)				Q4 2015 16/12/15			
	Time	LAeq dB(A)	LA10 dB(A)	LA90 dB(A)	Time	LAeq dB(A)	LA10 dB(A)	LA90 dB(A)	Time	LAeq dB(A)	LA10 dB(A)	LA90 dB(A)	Time	LAeq dB(A)	LA10 dB(A)	LA90 dB(A)
N1*	11:45	31.5	31.93	31.10	11:45	**59.1**	58.15	47.49	11:03	39.5	37.7	27.1	12:18	32.5	32.96	31.21
N2	12:30	36.5	31.99	31.11	12:30	51.4	51.66	47.17	11:43	35.7	36.9	28.1	12:58	31.8	31.96	31.17
N3*	14:05	**58.5**	32.73	31.12	13:50	**57.8**	60.20	48.07	12:58	53	44.5	31.3	14:50	38	41.22	31.27
N4	11:00	32	31.94	31.10	11:00	49.6	49.55	47.10	10:25	39.8	41.8	32.8	11:38	32.2	32.36	31.11
N5*	13:30	52.1	50.93	31.16	13:15	**67.40**	61.04	47.42	12:23	**67.5**	64	39.6	13:44	**56.3**	55.56	31.16

*Noise Sensitive Receptor

5 Resource and Energy Consumption Summary

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

Electricity consumed from the national grid for 2015 was 27,386 kWhr. This is due largely to the operation of a gas utilisation plant (engine) on site which generated a substantial percentage of the sites electrical demand in 2015. It represents a decrease of 20% on the amount consumed from the national grid in 2014 due to higher on site electrical generation in 2015.

Total water consumption increased from 83,000litres in 2014 to 156,000 litres in 2015 (88% Increase). This is largely as a result of a one off need to fill a tank with 50,000 litres of water (accounting for 60% of the increase) as well as increased staff numbers on site. Water for dust suppression is obtained from the surface water lagoon and drains back into the surface water lagoon. It is therefore being reused and is not consumed. Water used in the wheel wash was significantly reduced as waste was not being accepted.

Total diesel consumption increased by 23% from 2014 due to increased water pumping in Q4 following prolonged and heavy rainfall.

No Terram, imported aggregates or soil materials from site stockpiles were used during the reporting period as waste was not being accepted.

Table 5.1: Energy and Resource Use 2015

Resource	2015 Consumption	2014 Consumption
Electricity(kWhr)	27,386	34,136
Water, Potable Supply (Litres)	156,000	83,000
Water, Dust suppression (Litres)	0.0	0.0
Water, Wheelwash (Litres)	10,000	10,000
Total Water (Litres)	166,000	93,000
Diesel (Including Contractor Plant) (Litres)	926	674
Hydraulic & Engine Oils (Litres)	0	0
Petrol (Litres)	40	85
Grease (kg)	0	0
Terram for road base (m2)	0	0
Imported Aggregates (Tonnes)	0	0
Soil materials from site stockpiles (Tonnes)	0	0

6 Development and Restoration Works

6.1 Development Works Undertaken in 2015

The following development works were carried out during 2015:

- Enabling works in preparation for acceptance of waste including:
  - Cell preparation and associated CQA works pertaining to Cells 8 & 9
  - Extension of gas extraction ring main pipework
  - Re-erection of litter netting

6.2 Development Works to be Undertaken in 2016

Potential development works for 2016 are currently being considered.

6.3 Restoration of Completed Cells/Phases

The Landfill facility has accepted waste from December 2005 until March 2013 at a rate of 100,000 tonnes per annum for disposal and up to 27,320 tonnes of engineering materials per annum for recovery purposes. To date approximately 820,000 tonnes of waste has been placed into 7 of the 9 constructed cells. Cell 1 and a portion of Cell 2 has been permanently capped with LLDPE liner and a drainage/protective geotextile. The majority of Cells 2 to 7 have been capped with a temporary impermeable membrane while Cells 8 & 9 have been constructed but have not accepted waste. The table below summarises the capping status of the landfill at the end of the reporting period:

Table 6.1 Capping Status of the Landfill

Landfill Capping Status	Area m^2
Permanent capping with LLDPE and drainage/protective geotextile	**22,000**
Temporary Impermeable membrane	**55,000**
Total Landfill Plan Area (Cells 1 to 7)	**77,000**

7 Volume of Leachate Transported/Discharged Off Site

Volumes of leachate tankered off site on a monthly basis are summarised in Table 7.1 below.

Table 7.1 Volume of Leachate Transported Off Site

2015 (Month)	Leachate Consigned Off Site (m^3)
January	1,630.84
February	1,967.11
March	2,111.50
April	2,068.74
May	2,162.20
June	1,308.50
July	1,076.20
August	1,403.84
September	1,566.64
October	1,379.10
November	2,017.64
December	2,607.76
Total	**21,300.07**

8 Landfill Gas

Tables 8.1 to 8.3 below present the annual cumulative quantity of landfill gas captured, flared and utilised at the facility during 2015.

Table 8.1 Landfill Gas collected in 2015 – 2000 Haase Flare

Flare No. 1 Connaught 1							
Model: Haase		**Type:** HTN 2000 Enclosed			**Commisioned:** Apr-08		
2015 Monthly	Average Flow Rate (m^3/hr)	Average CH_4 %v/v	Average CO_2 %v/v	Average O_2 %v/v	Combustion Efficiency (%)	Total CH_4 m^3	Total CH_4 kgs
January	551	37.20	15.50	1.90	99.9	6,348	4,288
February	548	40.90	21.50	2.10	99.9	17,073	11,462
March	687	38.70	24.20	1.60	99.9	6,928	4,580
April	708	37.40	29.30	1.60	99.9	6,613	4,350
May	651	37.10	28.40	1.30	99.9	13,737	9,157
June	645	37.90	25.90	1.10	99.9	733	491
July	619	38.40	28.90	0.80	99.9	26,136	17,618
August	598	37.70	26.20	1.00	99.9	37,387	25,253
September	586	38.70	24.50	1.40	99.9	14,481	9,751
October	588	28.80	24.10	1.20	99.9	10,853	7,323
November	550	38.20	24.00	1.30	99.9	2,732	1,849
December	551	36.60	23.20	1.30	99.9	12,289	8,318
Total						**155,309**	**104,441**

Table 8.2 Landfill Gas collected in 2015 – HTN 2000 Enclosed

Flare No. 2 Connaught 2							
Model: Haase	**Type:** HTN 2000 Enclosed				**Commisioned:** Jan-09		
2014 Monthly	Average Flow	Average CH_4	Average CO_2	Average O_2	Combustion	Total CH_4	Total CH_4
	Rate (m^3/hr)	%v/v	%v/v	%v/v	Efficiency (%)	m^3	kgs
January	325	21.30	17.40	10.60	99.9	51,452	33,597
February	316	22.50	15.20	10.00	99.9	8,523	5,566
March							
April							
May							
June							
July							
August							
September							
October							
November							
December							
Total						**59,975**	**39,162**

Table 8.3 Landfill Gas collected in 2015 – HT 500 Low Calorific Enclosed Flare

Flare No. 3 Low Calorific Value Flare							
Model: AFS	**Type:** HT 500 Low Calorific Enclosed Flare				**Commisioned:** Feb-15		
2014 Monthly	Average Flow	Average CH_4	Average CO_2	Average O_2	Combustion	Total CH_4	Total CH_4
	Rate (m^3/hr)	%v/v	%v/v	%v/v	Efficiency (%)	m^3	kgs
January							
February	344	19.90	15.40	10.40	99.9	37,750	25,293
March	332	17.01	13.75	11.53	99.9	41,973	28,323
April	294	18.05	14.94	10.28	99.9	38,177	25,683
May	280	24.73	15.27	10.16	99.9	51,457	34,652
June	284	19.70	15.94	10.02	99.9	40,242	27,127
July	285	19.14	15.34	9.87	99.9	40,541	27,439
August	284	20.07	15.32	10.01	99.9	42,360	28,670
September	278	19.07	14.76	10.77	99.9	38,132	25,783
October	275	19.14	15.26	10.27	99.9	39,112	26,339
November	228	20.88	16.40	9.43	99.9	34,248	23,133
December	173	21.90	17.60	8.50	99.9	28,160	19,059
Total						**432,153**	**291,500**

Table 8.4 Landfill Gas collected in 2015 – Engine No. 1

Flare No. 3 Connaught 3							
Model: Deutz	**Type: :** TGB 620 V16				**Commisioned:** Oct-10		
2014 Monthly	Average Flow	Average CH_4	Average CO_2	Average O_2	Combustion	Total CH_4	Total CH_4
	Rate (m^3/hr)	%v/v	%v/v	%v/v	Efficiency (%)	m^3	kgs
January	551	37.20	15.50	1.90	99.9	145,999	98,616
February	548	40.90	21.50	2.10	99.9	133,393	89,556
March	687	38.70	24.20	1.60	99.9	190,681	126,068
April	708	37.40	29.30	1.60	99.9	183,846	120,923
May	651	37.10	28.40	1.30	99.9	165,775	110,506
June	645	37.90	25.90	1.10	99.9	175,099	117,318
July	619	38.40	28.90	0.80	99.9	150,533	101,473
August	598	37.70	26.20	1.00	99.9	130,177	87,929
September	586	38.70	24.50	1.40	99.9	148,639	100,096
October	588	28.80	24.10	1.20	99.9	115,013	77,608
November	550	38.20	24.00	1.30	99.9	148,389	100,433
December	551	36.60	23.20	1.30	99.9	137,600	93,131
Total						**1,825,145**	**1,223,657**

9 Indirect Emissions to Groundwater

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

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

Landfill Base:	The landfill site has a composite base lining system comprising a HDPE geomembrane and a 0.5 m thick layer of compacted Bentonite Enhanced Soil. A leak detection survey of the HDPE geomembrane after placement of the drainage stone layer was completed and defects to the HDPE liner were repaired in accordance with industry standards. A CQA report was then completed and submitted to the agency.
Surface Water Collection and Treatment System:	Surface water from the paved access roads and landfill cell swale drain is collected and discharged into the surface water lagoon along with groundwater collected at the interceptor sump located below the landfill cells. Water from the lagoon is then piped to a reed bed, which further filters the water before it is finally discharged into the nearby stream.
Treated Sewage Effluent:	There is a BioCycle wastewater treatment plant located adjacent to the weighbridge which treats the canteen and office wastewater prior to being pumped to the leachate holding tank via the foul water sump. Leachate (containing foul water) is tankered off-site to a waste water treatment plant via a vacuum tanker.
Leachate Lagoon and Holding Tank:	Leachate from the engineered landfill is collected within a Leachate Lagoon and Holding Tank before being tankered offsite to a registered waste recovery facility.

In accordance with Technical Amendment B, Condition 8.15 of the Waste Licence, a risk screening and Tier 3 assessment was carried out at the facility by TOBIN Consulting Engineers in March 2015. The assessment was completed to assess compliance with the Groundwater regulations SI 122 of 2010. This report was submitted to the EPA via the EDEN web portal in March 2015 and is summarised herein.

In general, downgradient water quality was found to be similar to, or slightly improved, in comparison with upgradient wells. The average results indicate good consistency across the site and the monitoring results have been generally consistent over the previous 10 years.

A review of the data plots suggest that the COPCs show a relatively stable to downward trend for almost all parameters and all monitoring points except GW1A located upgradient of the Landfill.

No significant upward trends in downgradient wells were observed since the commencement of landfill operations. Concentrations of chloride and ammonia have significantly decreased since the commencement of activities at the landfill. Concentrations downgradient are generally lower

than the background concentrations and the upgradient at the facility, with the reduction of agricultural activities at the site and removal of peat from the footprint of the landfill cited as one possible reason for this observation.

Based on the extensive groundwater data, most parameters appear to be decreasing or stable since 2004 with the exception of the upgradient well GW1A. Statistical analysis of the main quarterly parameters using the Mann-Kendall statistical trend analysis (p=0.05) indicated a stable or a statistically significant decreasing trend. In conclusion, based on the site data, the groundwater body is not at risk. No contaminated groundwater plume exists as a result of the engineered landfill.

10 Annual Water Balance

10.1 Estimated Liquid In-Waste Liquid Volume

The estimated liquid in-waste liquid volume for 2015 was assessed using rainfall figures obtained from the on-site meteorological station, potential in-waste liquid volume and the assumed absorption capacity of the waste mass (see Table 10.1 below).

Table 10.1 Estimated Liquid In-Waste Liquid Volume

2015	Total uncapped area (Note 1)	Rainfall (Note 2)	Potential in waste liquid volume	Absorption capacity of Waste (assumed to be 2%)	Balance	Leachate Tankered off site (Note 3)
	(m^2)	(m)	(m^3)	(m^3)	(m^3)	(m^3)
Jan	0	0.1756	0.00	0.00	0.00	1,630.84
Feb	0	0.0768	0.00	0.00	0.00	1,967.11
Mar	0	0.1272	0.00	0.00	0.00	2,111.50
Apr	0	0.0580	0.00	0.00	0.00	2,068.74
May	0	0.1380	0.00	0.00	0.00	2,162.20
Jun	0	0.0395	0.00	0.00	0.00	1,308.50
Jul	0	0.1236	0.00	0.00	0.00	1,076.20
Aug	0	0.1178	0.00	0.00	0.00	1,403.84
Sept	0	0.0706	0.00	0.00	0.00	1,566.64
Oct	300	0.0630	18.90	0.38	18.52	1,379.10
Nov	300	0.2806	84.18	1.68	82.50	2,017.64
Dec	300	0.3960	118.80	2.38	116.42	2,607.76
		1.6667	**221.88**	**4.44**	**217.44**	**21300.07**

Note 1: For the purposes of water balance calculation 'Uncapped Area' = area of landfill which is not under an intermediate cap of impermeable synthetic material preventing ingress of rainfall.

Note 2: Rainfall values obtained from on-site meteorological station**.**

Note 3: The total volume of leachate tankered off site also includes:

- *Office and weighbridge foulwater;*
- *Run-off from within bunded areas and wheelwash;*
- *Condensate/leachate removed from the landfill gas collection system;*
- *Moisture content held in waste received and cover materials used.*

11 Facility Management

11.1 New Procedures Developed During 2015

While all procedures were reviewed during the reporting period, there were no new operating procedures developed.

11.2 Site Testing and Inspection Reports

As per Schedule E of the waste licence, the integrity of the bunds and tanks are carried out every three years. This was carried out in February 2015 and the results were presented in Appendix C of the 2014 AER.

11.3 Topographical Survey

As per condition 8.7 of the waste licence, a survey showing the topography of the facility at the end of the reporting period is included in Appendix C.

11.4 Reported Incidents and Complaints Summary

11.4.1 Reported Incidents

As was the case in 2014, the majority of incidents reported to the Agency during 2015 were in relation to methane and carbon dioxide detected in the gas migration monitoring boreholes. Concentrations of these gases exceeded the limits set out in Waste Licence 178-02.

Previous monitoring at the East Galway Landfill was carried out by White Young & Green (WYG) on the 6th and 13th of December 2005, prior to the facility accepting waste. These two rounds of landfill gas monitoring identified elevated CH4 gas levels at LG14, LG16 and LG18 and elevated CO2 levels at monitoring locations LG6, LG6-A, LG9, LG10, LG14, LG16 and LG18.

The report on LFG monitoring carried out by WYG in December 2005 concluded the slightly high levels of CH^4 and CO^2 could be attributed to the large quantities of peat deposited in the area where the monitoring wells are located. A literature search carried out for that report demonstrated that the levels of carbon dioxide and methane measured in the landfill gas monitoring wells could be attributed to the natural background levels from the continuous decay of organic peat. A summary of the reported incidents is presented in Table 11.1 below.

There was also four incidences relating to noise but none of these were attributed to landfill activity.

Table 11.1 Summary of Incidents at the East Galway Landfill – 2015

Incident Reference No.	Date	Description	Action
I15/01	INCI006456	19/01/2015	Exceedence of Daytime Noise Limit at N3 Noise Monitoring Point (Off site location)
I15/02	INCI006563	27/01/2015	Elevated CH4 & CO2 level in landfill gas monitoring boreholes
I15/03	INCI006743	12/02/2015	Exceedence of VOC surface emission trigger level
I15/04	INCI006880	25/02/2015	Elevated CH4 & CO2 level in landfill gas monitoring boreholes
I15/05	INCI007292	25/03/2015	Elevated CH4 & CO2 level in landfill gas monitoring boreholes
I15/06	INCI007548	15/04/2015	Elevated Chloride and TOC in groundwater monitoring boreholes
I15/07	INCI007556	29/04/2015	Elevated CH4 & CO2 level in landfill gas monitoring boreholes
I15/08	INCI007891	11/06/2015	Exceedence of Daytime Noise Limit at N1, N3 and N5 Noise Monitoring Point (Off site location)
I15/09	INCI008288	05/08/2015	Exceedence of VOC surface emission trigger level
I15/10	INCI008354	09/07/2015	Elevated Potassium in Groundwater monitoring boreholes
I15/11	INCI008635	30/09/2015	Exceedence of Daytime Noise Limit at N5 Noise Monitoring Point (Off site location)
I15/12	INCI009223	30/09/2015	Elevated Chloride in Groundwater monitoring borehole
I15/13	INCI009262	16/12/2015	Exceedence of Daytime Noise Limit at N5 Noise Monitoring Point (Off site location)

11.4.2 COMPLAINTS SUMMARY

Two complaints were received relating to the East Galway Landfill Facility in 2015.

These are summarised in Table 11.2 below.

Table 11.2 Summary of Complaints to the East Galway Landfill – 2015

Incident Reference No.	Date	Nature of Complaint	Method of Communication
1	16/03/2015	Odour	Phone via EPA
2	27/11/2015	Odour, Waste Haulage, Water Quality	Phone via EPA

11.5 NUISANCE CONTROL

In order to control potential sources of nuisance at the landfill best available techniques are used to minimise impacts on the environment and local neighbours and all reasonable and practical measures will be implemented to eliminate or minimise any issues or nuisances.

11.5.1 BIRD CONTROL

As the facility has not accepted waste since Quarter 1 2013 there has been no requirement to employ Bird Control measures at the facility. At times when the facility is actively accepting waste an integrated approach to bird control is implemented involving the use of kites, heli-kites, distress calls and various birds of prey including falcons. This method is preferred as it is non-destructive to the birds and by varying the timing and use of bird control measures it is a very effective method of control.

11.5.2 VERMIN CONTROL

Pestguard were employed throughout the duration of the reporting period in order to control potential nuisance caused by rodents. Continuous baiting was carried out by Pestguard and adjusted as necessary to prevent any infestation of vermin at the facility.

11.5.3 DUST AND MUD CONTROL

Dust and mud control measures have been implemented at the facility since the start of the construction phase and continue to be implemented as required. These measures include the use of a wheel wash, road sweeper and the use of a water bowser to dampen access roads and stockpiles during periods of dry weather.

11.5.4 LITTER CONTROL

The facility did not accept any waste in 2015 and therefore litter control was not required.

When the facility is actively accepting waste litter is controlled by fencing 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 the operational controls, all litter is collected at the end of the working day when the facility is actively accepting waste. All waste deposited must be covered by the end of the working day. Adequate daily cover reduces the risk of odour, windblown litter, vermin, flies and birds.

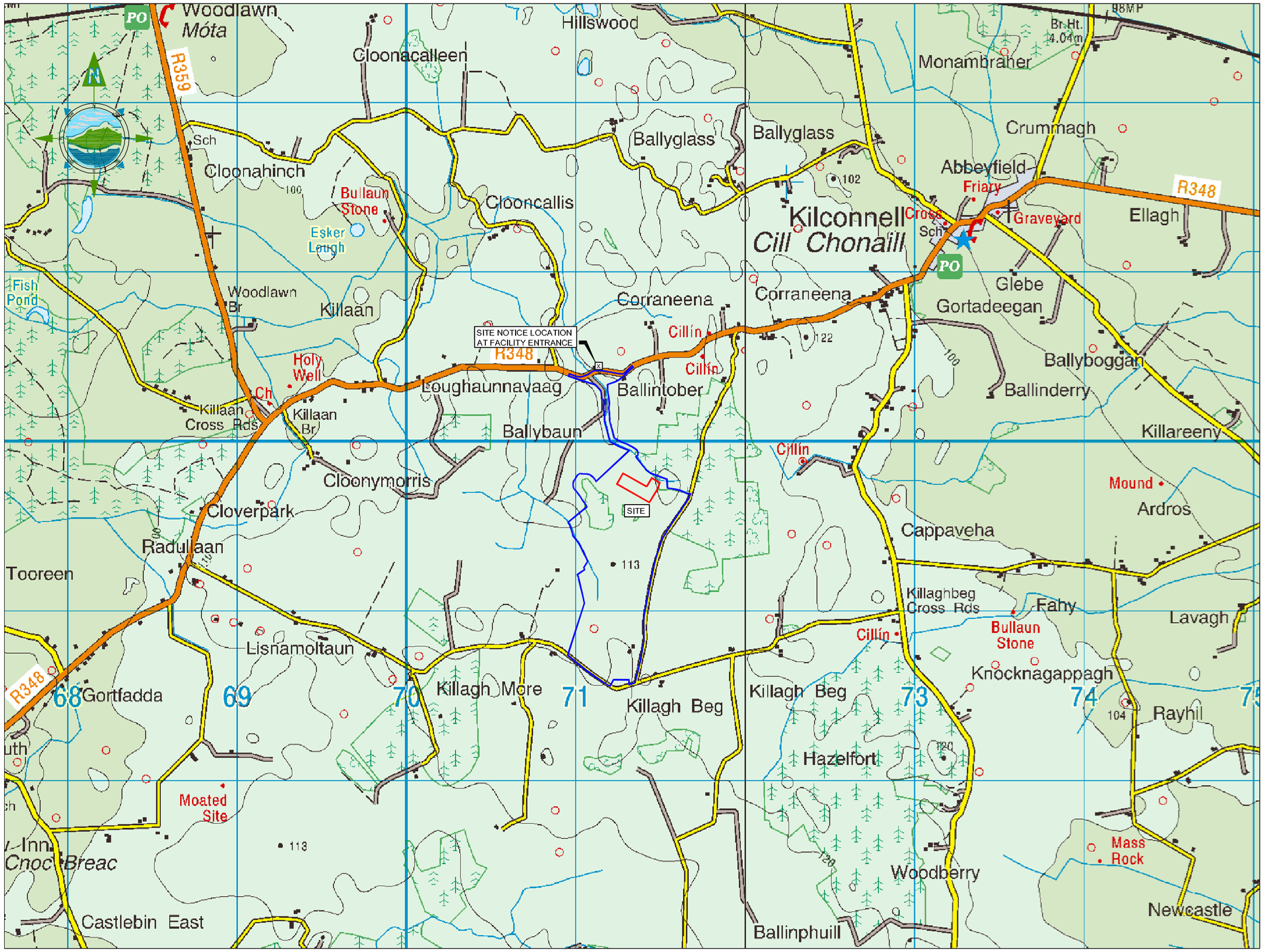
Good operational practices on site are the main controls to avoid nuisances.

11.6 MANAGEMENT AND STAFFING STRUCTURE

The Environmental Protection Agency has exercised powers to enter the site under S.I. No. 547 of 2008 – European Communities (Environmental Liability) Regulations 2008 and have appointed Galway County Council and TOBIN as Agents and Authorised officers on an emergency basis for the ongoing management of liabilities at the site. This decision arose from the decision of the receiver of the Greenstar group of companies to cease operating the facility with effect from May 2013.

APPENDIX A

Site Location Map
Environmental Monitoring Locations



GENERAL LEGEND

LANDS UNDER CONTROL OF DEVELOPER

ACTIVITY BOUNDARY

SITE NOTICE LOCATION

[X]

NOTES

1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING
2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
3. ENGINEER TO BE INFORMED BY THE CONTRACTOR OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES
4. ALL LEVELS SHOWN RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD
5. DISCOVERY MAPPING SHEET NO: M-1622

210m 0 210m 420m 630m

Issue	Date	Description	By	Chkd.
D01	13-07-07	ISSUED FOR REVIEW	MN	MC

Client: greenstar

Project: EAST GALWAY LANDFILL PLANNING APPLICATION 2007

Title: REGIONAL SITE LOCATION MAP

Scale @ A1: 1:10,560

Prepared by:	Checked:	Date:
M. Nolan	M. Conroy	July 2007

Project Director: D. Grehan

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Consulting, Civil and Structural Engineers,
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tel: +353-(0)1-8030406
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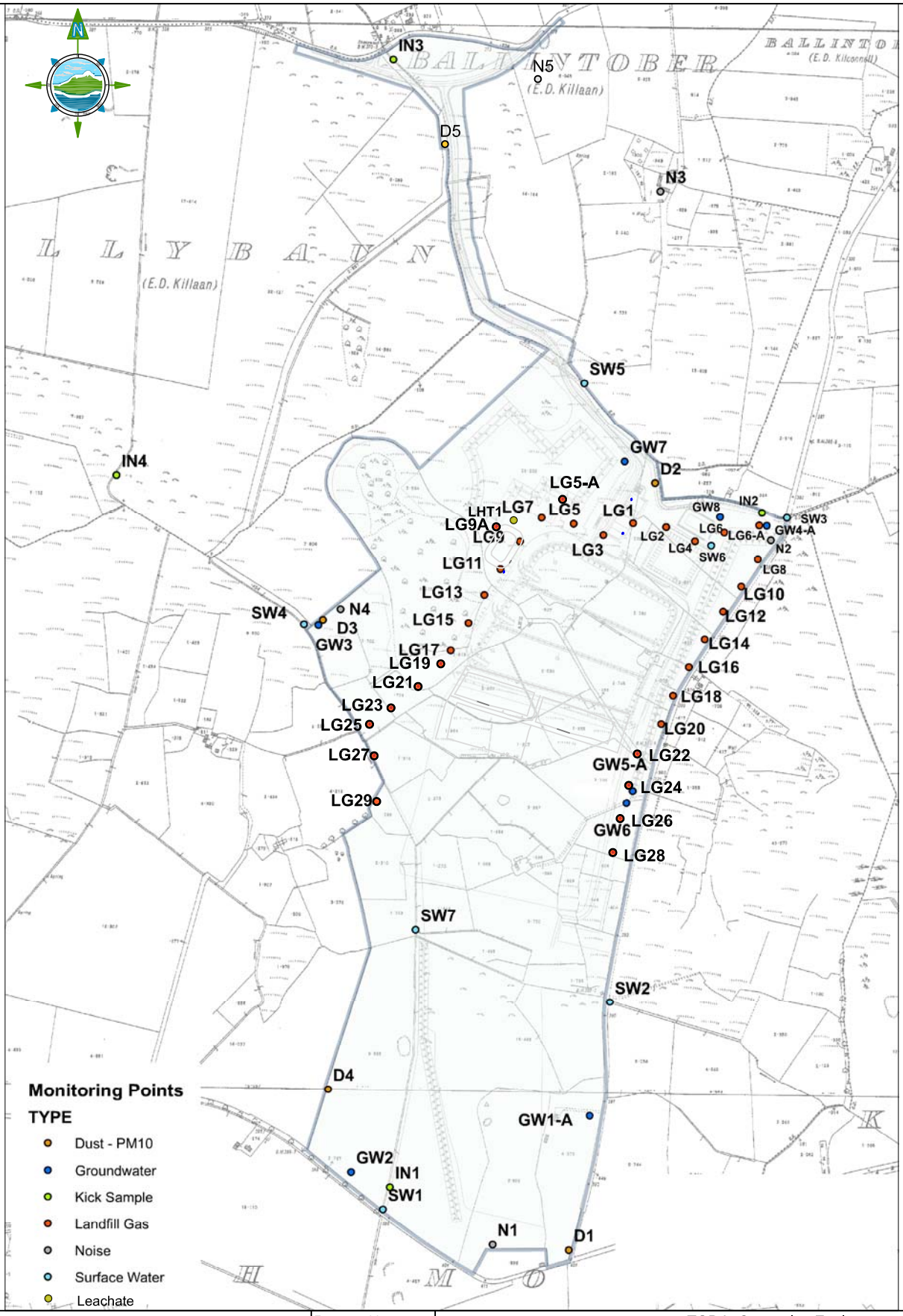
Drawing No.: 2228-2200 Issue: D01



Client
GREENSTAR LTD

Project
CONNAUGHT REGIONAL RESIDUAL LANDFILL

Title
LANDFILL ENVIRONMENTAL MONITORING LOCATIONS

Prepared by: R.K.
Checked: D.O'S.
Date: 24.09.09
Project Director: M.F.G.
Drawing Status: LG29 ADDED
Scale @ A4: N.T.S.

TOBIN
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www.tobin.ie

Drawing No. 3588-1604

Revision: A

APPENDIX B

E-PRTR

18/03/2016 15:52

Guidance to completing the PRTR workbook

PRTR Returns Workbook

Version 1.1.19

REFERENCE YEAR	2015

1. FACILITY IDENTIFICATION

Parent Company Name	Greenstar Holdings
Facility Name	East Galway Residual Landfill Site
PRTR Identification Number	W0178
Licence Number	W0178-02

Classes of Activity

No.	**class_name**
-	Refer to PRTR class activities below

Address 1	Killagh More
Address 2	Ballybaun (E.D. Killaan)
Address 3	Ballintober (E.D. Killaan)
Address 4	Ballinasloe
	Galway
Country	Ireland
Coordinates of Location	-8.43099 53.31318
River Basin District	IEWE
NACE Code	3821
Main Economic Activity	Treatment and disposal of non-hazardous waste
AER Returns Contact Name	Colin Ryder (W0178)
AER Returns Contact Email Address	cryder@galwaycoco.ie
AER Returns Contact Position	Landfill Manager
AER Returns Contact Telephone Number	090-9686014

AER Returns Contact Mobile Phone Number	
AER Returns Contact Fax Number	090-9686026
Production Volume	0.0
Production Volume Units	
Number of Installations	0
Number of Operating Hours in Year	0
Number of Employees	2
User Feedback/Comments	The accuracy of the Net Methane Emission as shown on 'Releases to Air' tab of 1,467,656kg/yr is questionable. GASSIM appears to over estimate the volumes produced which gives a 60%/40% split of gas collected/fugitive gas emission. A high collection efficiency is expected
Web Address	

2. PRTR CLASS ACTIVITIES

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

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

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

4. WASTE IMPORTED/ACCEPTED ONTO SITE Guidance on waste imported/accepted onto site

Do you import/accept waste onto your site for on-site treatment (either recovery or disposal activities) ?	No

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

4.1 RELEASES TO AIR Link to previous years emissions data | PRTR# : W0178 | Facility Name : East Galway Residual Landfill Site | Filename : W0178_2015.xls | Return Year : 2015 | 18/03/2016 15:52

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

RELEASES TO AIR					Please enter all quantities in this section in KGs					
POLLUTANT		METHOD						QUANTITY		
			Method Used							
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	Emission Point 2	Emission Point 3	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
01	**Methane (CH4)**	M	ALT	TOC analyser in accordance with EN12619:2002	1.31	0.72	196.53	1467854.56	0.0	1467656.0
03	Carbon dioxide (CO2)	M	OTH	Horbia PG250,	79666.14	24682.1	1124940.95	1229289.19	0.0	0.0
02	Carbon monoxide (CO)	M	ALT	CO EN15058:2006	2.03	0.84	4006.19	4009.06	0.0	0.0
08	Nitrogen oxides (NOx/NO2)	M	ALT	Oxides of Nitrogen (EN14792:2006),	25.78	7.53	2117.41	2150.72	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 AIR					Please enter all quantities in this section in KGs					
POLLUTANT		METHOD						QUANTITY		
			Method Used							
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	Emission Point 2	Emission Point 3	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
80	Chlorine and inorganic compounds (as HCl)	M	ALT	Impinger train containing deionised water solution in accordance with EN1911:2010	0.06	0.02	0.83	0.91	0.0	0.0
84	Fluorine and inorganic compounds (as HF)	M	ALT	Impinger train containing 0.1 Molar sodium hydroxide in accordance with EN15713:2006	0.59	0.16	1.32	2.07	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					
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0

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

Additional Data Requested from Landfill operators

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

Landfill: East Galway Residual Landfill Site

Please enter summary data on the quantities of methane flared and / or utilised	**T (Total) kg/Year**	**M/C/E**	**Method Used**		**Facility Total Capacity m3 per hour**	
			Method Code	**Designation or Description**		
Total estimated methane generation (as per site model)	3126416.0	C	Gas Sim	CRA Report 2014	N/A	
Methane flared	435103.0	M	Landfill Gas Survey 2015	Landfill Gas Survey 2015	10500.0	(Total Flaring Capacity)
Methane utilised in engine/s	1223657.0	M	Landfill Gas Survey 2015	Landfill Gas Survey 2015	650.0	(Total Utilising Capacity)
Net methane emission (as reported in Section A above)	1467854.56	C	N/A	N/A	N/A	

5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE

| PRTR# : W0178 | Facility Name : East Galway Residual Landfill Site | Filename : W0178_2015.xls | Return Year : 2015 | 18/03/2016 15:52

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	19426.33	landfill leachate other than those mentioned in 19 07 02	D9	M	Weighed	Offsite in Ireland	Enva,W0041-01	Smithstown Industrial Estate,.,Shannon,County Clare,Ireland		
Within the Country	19 07 03	No	1873.74	landfill leachate other than those mentioned in 19 07 02	D9	M	Weighed	Offsite in Ireland	Enva,W0196-01	JFK Road,JFK Industrial Estate,Naas Road,Dublin 12,Ireland		

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

Link to previous years waste data
Link to previous years waste summary data & percentage change
Link to Waste Guidance

APPENDIX C

Topographical Site Survey –2015

N

NOTES:

1. FIGURED DIMENSIONS ONLY TO BE TAKEN FROM THIS DRAWING.
2. ALL DRAWINGS TO BE CHECKED BY THE CONTRACTOR ON SITE
3. ENGINEER/EMPLOYERS REPRESENTATIVE, AS APPROPRIATE, TO BE INFORMED BY THE CONTRACTOR OF ANY DISCREPANCIES BEFORE ANY WORK COMMENCES
4. THE CONTRACTOR SHALL UNDERTAKE A THOROUGH CHECK FOR THE ACTUAL LOCATION OF ALL SERVICES/UTILITIES, ABOVE AND BELOW GROUND, BEFORE ANY WORK COMMENCES
5. ALL LEVELS SHOWN RELATE TO ORDNANCE SURVEY DATUM AT MALIN HEAD

Rev	Date	Description	By	Chkd.
C	16.03.16	SURVEY UPDATED	R.K.	C.R.
B	19.01.15	SURVEY UPDATED	R.K.	C.R.
A	19.02.14	FIRST ISSUE	R.K.	C.R.

Client:
EPA

Project:
EAST GALWAY LANDFILL

Title:
TOPOGRAPHICAL SITE SURVEY

Scale @ A1: 1 : 750

Prepared by:	Checked:	Date:
R.K.	C.McG.	Feb '16

Project Director: CIARAN McGOVERN

Drawing Status: REPORT

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Drawing No.: 7256-1111

Revision: C