Comhairle Contae Fhine Gall
Fingal County Council

DUNSINK LANDFILL
ANNUAL ENVIRONMENTAL REPORT 2014

REPORTING PERIOD: JANUARY TO DECEMBER 2014

WASTE LICENCE REGISTER NO. W0127-01

FINGAL COUNTY COUNCIL
COUNTY HALL
MAIN STREET
SWORDS
COUNTY DUBLIN

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1.0 INTRODUCTION

The Environmental Protection Agency (EPA) granted a waste licence (register no. 127-1) to Fingal Council in respect of the above facility on 9th January 2004. From July 2006 the register number was changed to W0127-01. This licence is for the closure and restoration of areas previously landfilled. Under its terms, the Council was required to restore and remediate the facility, to install infrastructure to monitor and manage landfill gas and leachate emissions, to cap previously filled areas using inert materials and these works have been completed. In accordance with the requirements of condition 11.6 of the Waste Licence, an Annual Environmental Report (AER) for the facility must be submitted to the Environmental Protection Agency on an annual basis.

1.1 REPORTING PERIOD

The reporting period for the AER is 1st January to 31st December 2014. This is the eleventh AER for the facility as required by the waste licence.

1.2 FACILITY LOCATION

Fingal County Council has responsibility for the management and operation of the facility. The facility is located at:

Dunsink Landfill,
Dunsink Lane,
Finglas,
County Dublin.

Access to the landfill is now from the Elm Green end of Dunsink Lane only, Irish National Grid 238886 (Northings) 311766 (Eastings). Figure 1 presents a map of the facility and the surrounding locations.

1.3 ENVIRONMENTAL POLICY FOR DUNSINK LANDFILL

Comply with the terms of waste licence W0127-01 and all other relevant legislation and codes of practice.

Strive for continuous improvement in the running of the facility; in order to minimise the effects of the landfill on the environment.

Create better awareness and training for all staff involved in the running of the landfill.

Develop a good relationship with local residents around Dunsink for the betterment of the surrounding area.

FIGURE 1: DUNSINK LANDFILL SITE LOCATION AND SITE ACCESS

2.0 SITE DESCRIPTION

Dunsink Landfill is situated southwest of Finglas, County Dublin (National Grid Reference 239500N, 310500E). It is bounded by Dunsink Lane to the South, Rathoath Road to the East, the M50 motorway to the Northwest and Cappagh Hospital to the North. It is approximately 61ha. in extent. The most elevated point of the site (as measured in 2010) lies at 100m on the western side of the site. The base of the landfill varies topographically but is estimated to average from 65-70m.

The landfill opened in 1976. Approximately 4,400,000 tonnes of waste is estimated to have been deposited at the facility to June 1996. The landfill subsequently phased to closure, culminating in the closure of the civic amenity in 2003. A landfill gas utilisation plant was installed on site in 1996.

The original application for a waste licence was submitted to the Environmental Protection Agency in September 1999. An amendment to the original application was sought in February 2003. A Proposed Decision was issued in August 2003. Waste Licence 127-1 was issued in January 2004.

2.1 LICENCED WASTE ACTIVITIES AT THE FACILITY

On January 9th 2004 Fingal County Council was licensed to carry out the following waste activities at Dunsink Landfill, Finglas, County Dublin subject to twelve conditions.

Licensed Waste Disposal Activities, in accordance with the *Third Schedule* of the Waste Management Act 1996.

Class 4 Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons:

This activity is limited to:

The provision and use of a leachate lagoon to temporarily store leachate generated in the landfill, prior to discharge to the public foul sewer; and

The provision and use of a surface water attenuation pond to control the quality and quantity of the surface water run-off from the site.

Licensed Waste Recovery Activities, in accordance with the *Fourth Schedule* of the Waste Management Act 1996.

Class 2 Recycling or reclamation of organic substances, which are not used as solvents (including composting and other biological transformation processes):
This activity is limited to the composting of green waste, the recycling / reclamation of cardboard, paper and waste oil at the facility.

Class 3 Recycling or reclamation of metals and metal compounds:
This activity is limited to the recycling of ferrous / non-ferrous metals and white goods.

Class 4 Recycling or reclamation of other inorganic materials:
This activity is limited to the recycling or reclamation of subsoil and topsoil (for the restoration of the site) and dry recyclables at the bring centre.

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 for the generation of electricity.

Class 11 The use of waste obtained from any activity referred to in a preceding paragraph of this Schedule:
This activity is limited to the use of suitable subsoil and topsoil and composted material for the restoration programme.

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 recyclable waste prior to recovery off site and the storage of soil on site for the restoration programme.

3.0 EMISSIONS AND INTERPRETATION OF MONITORING RESULTS

3.1 GROUNDWATER

There are eight groundwater stations (BH3, BH4, BH16, BH18, BH28, BH-29, BH31 and BH32) listed in Schedule D.1 of the waste licence. BH28 listed in Table D.1.1 of the licence was not installed however; BH27 was added to the monitoring infrastructure under agreement with the *Environmental Protection Agency.* Borehole monitoring recorded leachate characteristics from BH29 suggesting that it was a potential migration pathway to groundwater for leachate. It was therefore decommissioned on 14th March 2005, upon agreement with *The Agency*. Two additional groundwater stations (BH33 and BH34) were added to the sampling programme upon agreement with *The Agency*, these were installed on Dunsink Observatory land between the 14th and 16th March 2005. BH18 was destroyed during slope stability work in August 2006 and was replaced as BH18_R on 7th September 2006. BH18_R was decommissioned during Q1 of 2011 and replaced with BH35 during the same quarter. BH34 became damaged in 2011 and was replaced in 2012 by a new borehole, BH34N installed adjacent. The grid references for these are shown in Table 1. The sample locations are illustrated in Figure 2.

Table 1: Groundwater Monitoring Locations

Groundwater Borehole Monitoring Location	Eastings	Northings	Classification
BH3	310665	239505	Deep Groundwater
BH4	310650	239490	Shallow Groundwater
BH16	311340	239085	Deep Groundwater
BH18_R	Decommissioned		
BH27	310030	238720	Deep Groundwater
BH28	Not Installed		
BH29	Decommissioned		
BH31	311765	238820	Shallow Groundwater
BH32	311770	238800	Deep Groundwater
BH33	310735	238724	Deep Groundwater
BH34	310719	238725	Shallow Groundwater
BH34N	310717	238724	Shallow Groundwater
BH35	311158	239456	Deep Groundwater

Detailed analysis reports are contained in Appendix I. The results obtained have been compared to the Interim Guideline Values of EPA document "Towards Setting Guideline Values for the Protection of Groundwater Ireland", 2003 and the trigger levels set as per Condition 6.4.1 of the Licence. The Threshold Values of European Communities (Groundwater) Regulations S.I. 9 of 2010 have also been cited for reference since 2011. The following sampling programme was completed in 2014 (Table 2).

Table 2: Groundwater Sampling Programme 2013

Groundwater Borehole Monitoring Location	Q1 Jan-March	Q2 April-June	Q3 July-September	Q4 October - December
BH3	Sampled	Sampled	Sampled	Sampled
BH4	Sampled	Sampled	Sampled	Sampled
BH16	Sampled	Sampled	Sampled	Sampled
BH18_R	Decommissioned			
BH27	Sampled	Sampled	Sampled	Sampled
BH28	Not Installed			
BH29	Decommissioned 14th March 2005			
BH31	Sampled	Sampled	Sampled	Sampled
BH32	Sampled	Sampled	Sampled	Sampled
BH33	Sampled	Sampled	Sampled	Sampled
BH34	Replaced by BH34N	Replaced by BH34N	Replaced by BH34N	Replaced by BH34N
BH34N	Sampled	Sampled	Sampled	Sampled
BH35	Sampled	Sampled	Sampled	Sampled

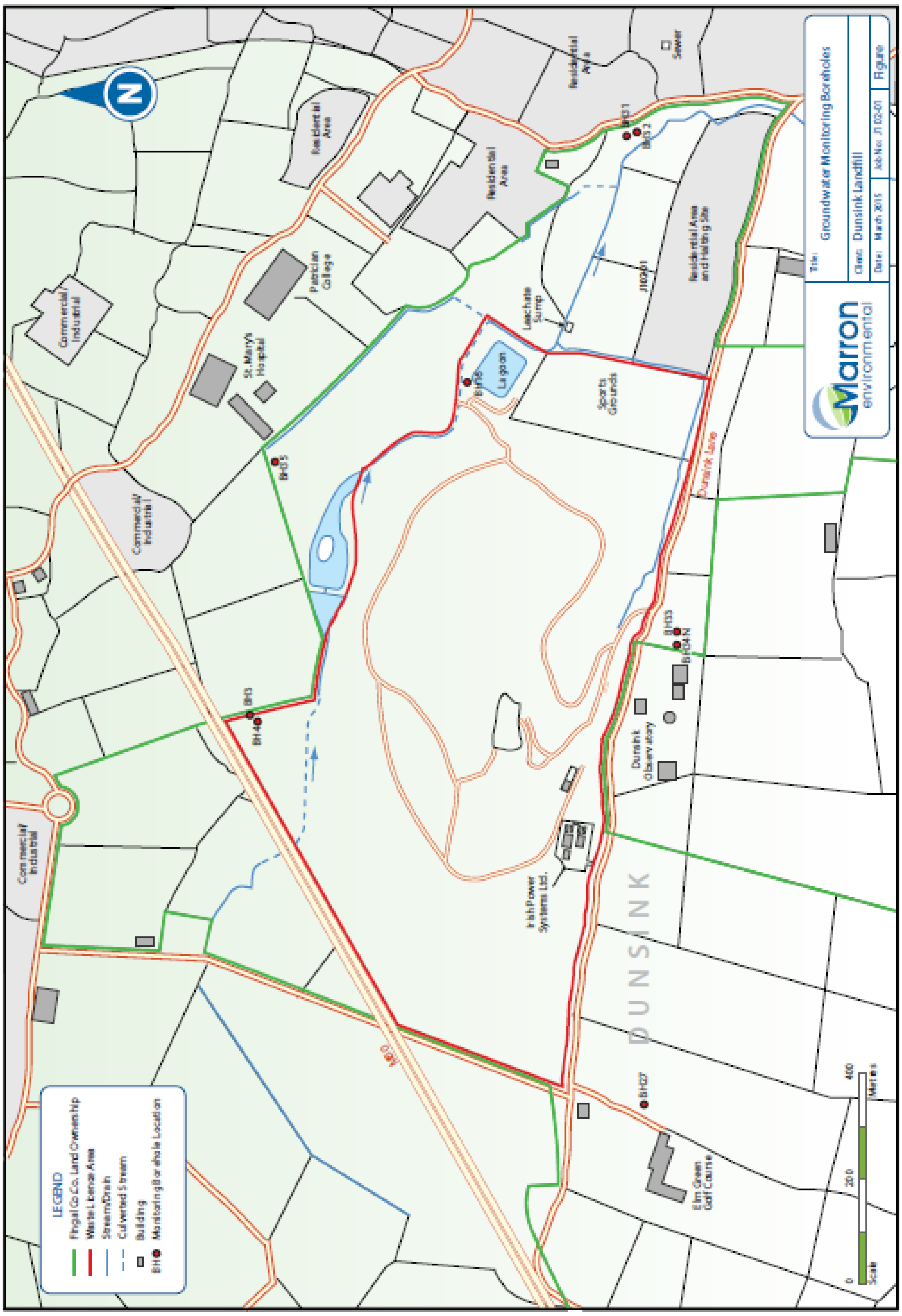

FIGURE 2 Groundwater Monitoring Locations

3.1.1 Groundwater Monitoring Quality - Findings (See Appendix I)

Q1 January to March 2014 – Sampling dated 18th February 2014

Results from groundwater sampling during the 1st Quarter of 2014 indicated good groundwater quality. Results for all parameters at all boreholes were below the threshold values and the control and trigger values where defined.

It is noted that there was a slightly elevated level of conductivity (above normal background levels) recorded at BH3 (1.135 mS/cm) though it did not the threshold, control or trigger values.

Q2 April to June 2014 - Sampling dated 21st May 2014

Results from groundwater sampling during the 2nd Quarter of 2014 indicated good groundwater quality. Results for all parameters at all boreholes were below the threshold values and the control and trigger values where defined apart from a slightly elevated level of ammoniacal nitrogen (0.23 mg/l) at BH31 above the regulated threshold value of 0.175 mg/l.

It is noted that there were slightly elevated levels of conductivity (above normal background levels) recorded at BH3 (1.050 mS/cm), BH4 (1.090 mS/cm), however, none of these exceeded the threshold, control or trigger values.

Q3 July to September 2014 - Sampling dated 12th August 2014

Results from annual groundwater sampling carried out during the 3rd Quarter of 2014 indicated good quality groundwater at BH32 and BH33. Results from the other boreholes were generally below control, trigger and S.I. threshold values with the exception of two or three parameters at each borehole none of which greatly exceeded the stipulated values.

Parameters that exceeded stipulated values included ammoniacal nitrogen at BH16, BH31, BH34N and BH35 (ranging from 0.19 mg/l to 1.72 mg/l); manganese at BH3, BH16, BH27, BH31, BH32, BH34N and BH35 (ranging from 0.074 mg/l to 0.758 mg/l); magnesium at BH3 (23.3 mg/l) and BH33 (22.7 mg/l); chloride at BH3 (91.1 mg/l), BH4 (91.35 mg/l) and BH32 (26.5 mg/l); sodium at BH4 (51 mg/l) and Fluoride at BH35 (1.3 mg/l). There were also some elevated levels of conductivity, sulphate and iron above what would be considered normal background levels for this geological environment similar to trends from previous years.

The elevated levels of manganese and iron at the levels reported are not unusual in groundwaters from this type of geological environment and can be subject to some variation in levels at the same sampling station over time. It should be noted that all iron levels were recorded at the laboratory detection limit (0.02 mg/l) and in some cases this exceeds the control and trigger values.

BH3, BH4, BH31, BH32, BH33 and BH34N were analysed for VOCs, Semi-VOCs and pesticides and all results were recorded at less than the laboratory detection limits.

In overview, the results indicated a general improvement in quality compared to the 2013 results and future monitoring may confirm if there is an upward trend in groundwater quality at the site.

Q4 October to December 2014- Sampling dated 25th November 2014

Results from groundwater sampling during the 4th Quarter of 2014 indicated generally good groundwater quality. There were slightly elevated levels of ammonia at BH31 and BH34N and TOC levels at BH3, BH4, BH32 and BH34N. The TOC levels did not exceed 8 mg/l at any borehole and are not considered to be abnormally high. All other results were below the threshold values and the control and trigger values where defined.

3.1.2 Groundwater Levels

Groundwater levels were recorded from each borehole during each quarter and the results are displayed in Table 3.

Table 3: Groundwater borehole water levels in metres below ground level (mbgl)

Groundwater Borehole Monitoring Location	Q1 2014 18/02/14 (mbgl)	Q2 2014 21/05/14 (mbgl)	Q3 2014 12/08/14 (mbgl)	Q4 2014 25/11/14 (mbgl)
BH3	3.02	3.03	3.6	2.97
BH4 Shallow	2.30	2.62	2.47	2.18
BH16*	0.0	0.0	0.0	0.0
BH27	0.82	2.59	2.15	0.69
BH31 Shallow	3.43	3.65	3.37	3.15
BH32	0.21	0.16	0.21	0.0*
BH33	2.56	2.66	3.37	1.48
BH34N Shallow	0.26	1.07	0.72	0.13
BH35	2.44	3.32	3.50	2.64

* artesian

A hydrogeological Assessment of the facility was forwarded to the Agency in November 2004 (FCC-127-1-2004-065). It determined a regional up gradient / down gradient trending of groundwater from West-North-West to East-South-East beneath the landfill and surrounds. This pattern is generally consistent with the regional drainage pattern.

Bedrock Groundwater Quality

Results during 2014 indicated generally good quality groundwater in bedrock monitoring wells during quarters 1, 3 and 4 with a slight dip in quality during quarter 3.

There were slightly elevated levels of conductivity at BH3 in Q1 and Q2 though no threshold values were exceeded.

During the annual monitoring round in Q3, there were slight elevations in manganese at all deep boreholes, (except BH33), ammoniacal nitrogen at BH16 and BH35, magnesium at BH3 and BH33, chloride at BH3 and BH32 and fluoride at BH35 where either the threshold, control or trigger values were exceeded. It is noted that elevated levels of iron and manganese are not unusual in this geological environment.

During Q4, the results indicated generally good quality groundwater at all deep groundwater monitoring boreholes though there were slightly elevated levels of TOC at BH3 and BH32.

Overburden Groundwater Quality

Shallow groundwater at the site was of generally good quality during Quarter 1 and Quarter 2 though there were slightly elevated levels of conductivity at BH4 and ammoniacal nitrogen at BH31 in Q2.

During Q3 there were slightly elevated levels of ammonia at BH31 and BH34N, manganese at BH31 and BH34N, and sodium and chloride at BH4.

During Q4 there were slightly elevated levels of ammoniacal nitrogen at BH31 and BH34N and TOC at BH4 and BH34N.

Conclusion & Annual Assessment

In overview, groundwater was of generally good quality during quarters 1, 2 and 4 at most of the boreholes and while there were elevations in some parameters in some boreholes above either the control, trigger or threshold values the concentrations were not very high or indicative of significant contamination. There was a slight dip in quality during quarter 3 with slight elevations in a number of parameters at many boreholes.

As per Technical Amendment to the Licence issued in January 2013, a risk screening exercise for the site is being prepared in accordance with the Guidance on the Authorisation of Discharges to Groundwater.

3.2 SURFACE WATER

Schedule D.1 of the waste licence requires the monitoring of surface water at six locations (SW1, SW2, SW4, SW7, SW9 & SW10). Biological sampling is required at three locations (KS1, KS2, KS3) and biological samples were collected at an additional three locations in 2014 (KS3a, KS4 and KS6) (See Table 4 and Figure 3). The Biological Sampling Assessment for 2014 was undertaken on 20th August 2014.

SW11 was incorporated as an additional sampling location under instruction from *The Agency* following Q1 Monitoring Report 2004.

Surface water sampling points were established at the discharge from the wheelwash to the open channel WWSW1 and from the open channel to the Scribblestown Stream WWSW2.

SW1 is located downstream of the facility and sampling at this point monitors the effect of the facility on water quality. SW1 is located some distance downstream of the facility and a breakers yard lies adjacent to the stream and illegal waste tipping occurs between the facility and SW1. A case was put to *The Agency* to move SW1 further upstream to avoid these potential sources of surface water contamination and provide a truer picture of the effect of the facility on surface water quality. During the annual audit of the licence *The Agency* agreed and from 15th August 2005 a new downstream monitoring point, SW17, was used instead of SW1.

SW4 was replaced on 27/2/2006 by SW18 as the upstream sampling point as agreed with *The Agency* (127-1/AK11EM).

In 2010 two additional sampling points were added for the biological monitoring sampling, KS3a and KS6 and in 2011 an additional sampling point, KS4, was included, all of which are presented in Tables 4 & 5 and Figure 3.

In October 2012 it was agreed by the Agency to include SW21 located on the Scribblestown stream upstream of the landfill (on the opposite side of the M50) in the monitoring programme.

Table 4: Surface Water Monitoring Locations

Surface Water Monitoring Location	Eastings	Northings
SW1	311800	238460
SW2	311380	238980
SW4	310480	239365
SW7	311120	239220
SW9	310885	238795
SW10	311350	239100
SW11*	311360	238915
SW12**	310424	239410
SW13**	310829	239356
SW14**	311173	239277
SW15**	311417	239069
SW16**	311410	238926
SW17***	311687	238826
SW18****	310464	239394
SW21*	310334	239455
KS1*****	310781	239373
KS2*****	311145	239242
KS3*****	311739	238812
KS3a*****	311600	238840
KS4*****	311415	239052
KS6*****	311590	238994
WWSW1******	311616	238921
WWSW2******	311644	238835

* Additional sampling location for monitoring programme.

** Enhanced monitoring programme undertaken 30th July 2004.

*** New downstream sampling point agreed during EPA audit August 2005.

**** New upstream sampling point agreed with *The Agency*.

***** Biological Sampling Programme.

****** Sampling points at discharge from wheelwash to open channel and from open channel to Scribblestown Stream. Only sampled when clay was imported onto the Landfill.

See Table 5 for sampling programme completed in 2014.

3.2.1 Surface Water Monitoring Quality - Findings of quarterly monitoring (See Appendix II)

Surface water quality was monitored in the drainage network within the landfill and its immediate environs throughout 2014 (Table 5). The results of the biological sampling programme are discussed later in the report.

The water quality results have been compared to SI 293 of 1988 European Communities (Quality of Salmonid Waters) Regulations 1988 and SI 272 of 2009 (Surface Water Regulations) (Appendix II).

Table 5: Surface Water Monitoring Programme 2014

Surface Water Monitoring Location	Q1	Q2	Q3	Q4	Monthly Visual	Annual
SW2	Y	Y	Y	Y	Y	Y
SW4	N	N	N	N	N	N
SW7	Y	Y	Y	Y	Y	Y
SW9	Y	N*	Y	Y	Y	Y
SW10	Y	Y	Y	Y	Y	Y
SW11	Y	Y	Y	Y	Y	Y
SW12	N	N	N	N	N	N
SW13	N	N	N	N	N	N
SW14	N	N	N	N	N	N
SW15	N	N	N	N	N	N
SW16	N	N	N	N	N	N
SW17	Y	Y	Y	Y	Y	Y
SW18	Y	Y	Y	Y	Y	Y
SW19	N	N	Y	Y	Y	Y
SW21	Y	Y	Y	Y	Y	Y
WWSW1	N	N	N	N	Y	N
WWSW2	Y	Y	Y	Y	Y	Y
KS1	N	N	Y	N	N	Y
KS2	N	N	Y	N	N	Y
KS3	N	N	Y	N	N	Y
KS3a	N	N	Y	N	N	Y
KS4	N	N	Y	N	N	Y
KS6	N	N	Y	N	N	Y
*= No sample possible						

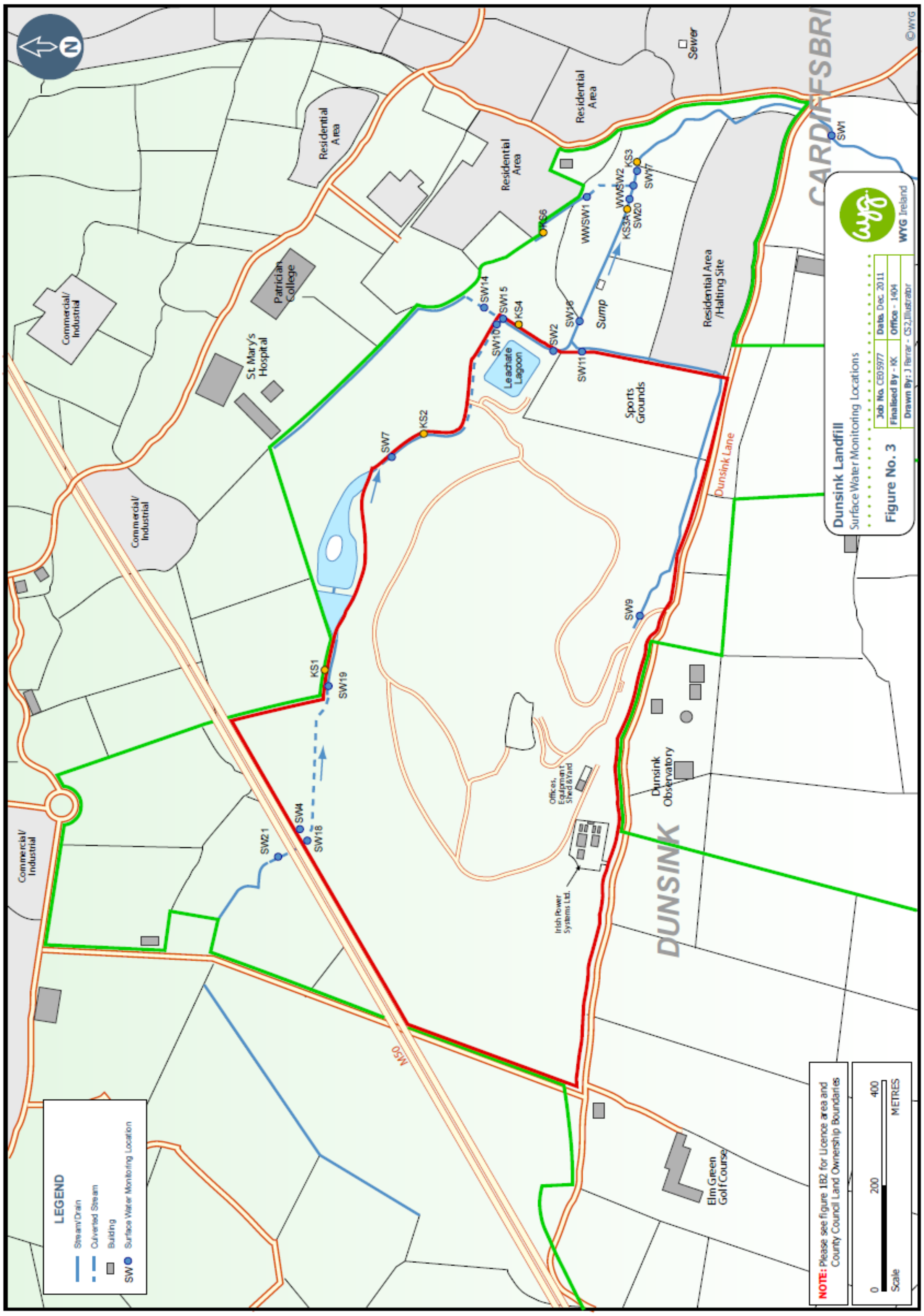

Figure 3 Surface Water Monitoring Locations

The Environmental Protection Agency's document "Parameters of Water Quality – Interpretation and Standards" details concentrations of total ammonia in fresh water which contain an unionised ammonia concentration of 0.02mg/l at their given pH and temperature.

Unionised ammonia is the component of total ammonia which at "the value of 0.02 mg/l has a long term toxic effect level for fish both salmonid and cyprinid. Lethal levels are about ten times greater".

Using this data, concentrations of ammoniacal nitrogen determined during sampling in 2014 indicated that the concentrations of unionized ammonia at the following stations were above the 0.02 mg/l level (note: SW17, SW18 and SW21 were monitored for ammonia on a monthly basis, all other surface water monitoring stations were monitored quarterly).

- 18/02/2014 – SW9 and SW11
- 12/03/2014 – WWSW2 and WWSW3
- 16/07/2014 – SW21
- 12/08/14 – SW21 and SW9
- 11/12/2014 – SW9

All other monitoring stations were below the 0.02 mg/l level for all other monitoring events.

Q1 January to March 2014 – Quarterly Sampling dated 18th February 2014

A review of historical data indicates that there has been a rise in conductivity levels at the site during the Winter months in previous years and reducing again during the following Q2 and Q3 periods. This may relate to gritting of the M50 during the Winter months or there may be other seasonal factors causing this trend. This trend has continued this Winter with elevated levels of conductivity arising in November 2013 and to a lesser extent in December 2013, elevating further in January and February and remaining slightly elevated in March at most (though not all) monitoring stations. Conductivity levels ranged from 830 μS/cm to 1,940 μS/cm (SW19 15/01/14).

Since Fingal County Council carried out remedial works on local drains and sewers in the vicinity of SW21 between February and March 2013 there was a marked improvement in visual quality at SW21 and SW18, the disappearance of the grey deposit on the substrate, clearer water, a significant reduction in the organic odour and a significant reduction in the ammonia levels at all sampling locations. The ammoniacal nitrogen results remained significantly lower at all monitoring stations on the Scribblestown throughout the first quarter 2014 and generally only marginally exceeded the threshold values at SW21 upstream of the site in January and March and at SW17 downstream of the site in February and March 2014. There were elevated levels of ammoniacal nitrogen in the southern tributary (SW9 and SW11) and in the Northern tributary (WWSW2) in February causing the slight elevation at SW17 in February. There were high levels in the northern (Dunsoghly estate) stream in March which resulted in the higher than normal (0.49 mg/l) elevation at SW17 in March.

Due to the slightly elevated levels of ammoniacal nitrogen at SW9, SW11, WWSW2 and to a lesser extent at SW17 recorded in February it was decided to collect samples for analysis of ammoniacal nitrogen at SW21, SW18, SW17, SW9, SW11, WWSW2 during the March monthly inspections and to include a new station WWSW3 upstream of WWSW1 at the boundary of the site where the stream enters the site from Dunsoghly estate. The results from March indicated high levels of ammoniacal nitrogen at WWSW3 (6.63 mg/l), WWSW2 (2.89 mg/l) and SW17 (0.49 mg/l). This portion of the stream also showed sewage algae. The results from SW9 (0.16 mg/l) and SW11 (0.05 mg/l) had reduced considerably from the February situation and the results from SW21 (0.15mg/l) and SW18 (0.05 mg/l) were relatively low. This indicated a contamination issue on the northern stream upstream of the site and was reported to the Fingal County Council water pollution unit and 'building control' to investigate potential sources of contamination upstream of the site. It was considered that the high ammoniacal nitrogen levels in the northern stream were impacting on quality at SW17 and not low quality in the Scribblestown stream itself.

Q2 April to June 2014 – Quarterly Sampling dated 21st May 2014

Following the pollution incident on the northern tributary stream in Q1 and remedial works carried out by Fingal County Council Water Pollution Unit samples were collected from WWSW1, WWSW2 and SW17 again on 16/04/14 and analysed for ammoniacal nitrogen and the field parameters of pH, conductivity and temperature. The results showed that ammoniacal nitrogen levels had reduced considerably at all stations ranging from 0.12 mg/l to 0.03 mg/l indicating that the remedial works were successful in resolving the contamination issue. Samples collected in May confirmed this was the case.

There was a general reduction in conductivity levels during the second quarter following the trend of previous years. Concentrations elevated above the threshold level of 1000 µS/cm were recorded at only SW18 (1,250 µS/cm), SW19 (1,240 µS/cm) and SW10 (1,070 µS/cm) in April and at SW11 (1,050 µS/cm) in May.

In overview, surface water results during the Q2 2014 monitoring period indicated generally good quality water on the Scribblestown stream and tributaries. There were some marginal breaches of the threshold values for ammoniacal nitrogen at SW21 in May and conductivity at SW18, SW19 and SW10 in April and SW11 in May and relatively low levels of dissolved oxygen at all sampling stations. While there remains slightly elevated levels of ammoniacal nitrogen at SW21 these have reduced significantly since the remedial works carried out by Fingal County Council in Q1 2013.

Q3 July to September 2014 – Annual Sampling dated 12th August 2014

The annual trend in conductivity levels was repeated again in the past year with elevations in conductivity beginning in November 2013, peaking in January 2014 and reducing again below the threshold value of 1,000 µS/cm in the Q2 and Q3 periods.

The Q3 ammoniacal nitrogen results were elevated above the threshold value at SW21 on 16/07/14 (0.36 mg/l) and 12/08/14 (0.26 mg/l), at SW18 on 16/07/14 (0.16 mg/l) and at SW17 on 16/07/14 (0.17 mg/l). There were also slight exceedances at SW19 (0.15 mg/l) and SW9 (0.26 mg/l) during the annual monitoring event on 12/08/2014.

Surface water results during the Q3 2014 annual sampling round indicated generally moderate to good quality water at most sampling stations. There were slight exceedances of the S.I. 272 of 2009 threshold value for ammoniacal nitrogen at SW21, SW19 and SW9 (ranging from 0.15 mg/l to 0.26 mg/l), relatively low values of dissolved oxygen at all monitoring stations (ranging from 45.2% to 69.5%) and elevated levels of total suspended solids above the Salmonid Regulations threshold value at SW2 and SW9 (59 mg/l and 79 mg/l respectively). The slightly elevated levels of BOD at four of the monitoring stations did not exceed 3 mg/l and therefore only slightly elevated above the S.I. 272 of 2009 threshold value for good status water.

There were also elevated levels of sulphate at all monitoring stations (ranging from 44.23 mg/l to 210.06 mg/l), conductivity at WWSW2 and SW17 (0.95 mS/cm at both stations) and an elevated level of alkalinity at SW11 (442 mg/l) above what could be considered normal background levels for the region though these were similar to results reported in previous years.

The results from SW17 located at the downstream end of the site indicated generally moderate/good quality water with slightly elevated levels of sulphate and conductivity only and a relatively low level of dissolved oxygen with all other parameters below the stipulated threshold values.

Q4 October to December 2014- Quarterly Sampling dated 25th November 2014

There was a rise in conductivity levels across the site in November and December (ranging up to 1,300 µS/cm) and this appears to be an annual Winter phenomenon as seen by conductivity results from previous years.

Surface water results during the Q4 2014 quarterly sampling round (25/11/14) indicated generally moderate to good quality water at most sampling stations. There were exceedances of the S.I. 272 of 2009 threshold value for ammoniacal nitrogen at SW9, SW11 and SW17 (ranging from 0.16 mg/l to 1.19 mg/l) and conductivity at SW21, SW18, SW19, SW9 and SW11 (ranging from 1,070 to 1,300 μS/cm).

Monthly monitoring indicated ammoniacal nitrogen results were elevated above the threshold value at SW17 on 21/10/14 (0.19 mg/l) and 25/11/14 (0.16 mg/l). There were also exceedances at SW9 on 25/11/14 (1.19 mg/l) and 11/12/14 (1.99 mg/l) and at SW11 on 25/11/14 (1.1 mg/l).

Following a review of the results from the quarterly sampling on 25/11/14, it was decided to carry out additional monitoring at SW2, SW9, SW9A, SW11 and SW17 on 11/12/14 and at SW2, SW7, SW11A, WWSW2 and SW17 on 17/12/14. Total Coliforms and E. Coliforms were included in the analysis to assess if horses corralled near SW9 were having a bacteriological effect on water quality. Ammoniacal nitrogen results were still elevated at SW9 (1.99 mg/l) on 11/12/14 though had reduced at the other stations monitored (SW2, SW9A, SW11 & SW17). There were also elevated levels of conductivity at SW9A and SW17, a low dissolved oxygen level at SW11 and elevated levels of potassium, sulphate and chloride above normal background levels for this region at all stations monitored. The bacteriological results were not particularly elevated along the southern tributary though were notably higher at SW17.

Stations SW21, SW18, SW7, SW2, SW11A, WWSW2 and SW17 were monitored on 17/12/14. There were slightly elevated levels of conductivity at SW21, SW18, SW7 and SW17. The results for total coliforms and E. Coli at SW7, WWSW2 and SW17 were reported as >200 cfu/100ml and were therefore not conclusive, however, all other parameters monitored including ammoniacal nitrogen, BOD and total suspended solids were below the regulated threshold values apart from slightly elevated levels of BOD at SW21, SW7 and WWSW2 (all at 3 mg/l). These results indicated that there was no significant impact on the site monitoring stations apart from the elevated levels of conductivity and as stated previously this appears to be a Winter phenomenon and may be related to gritting of the M50 motorway or perhaps other seasonal factors.

Monthly Sampling for Ammoniacal Nitrogen

Monthly sampling for ammoniacal nitrogen was carried out at SW21, SW18 and SW17 during 2014.

Results indicated elevated levels above the S.I. 272 of 2009 threshold value (0.14 mg/l) at SW21 on 5 of the 12 sampling events, at SW18 on 1 occasion and at SW17 on 5 of the 12 sampling events. The highest value was 0.49 mg/l at SW17 on 12/03/14 caused by an increase in levels on the northern tributary as discussed earlier.

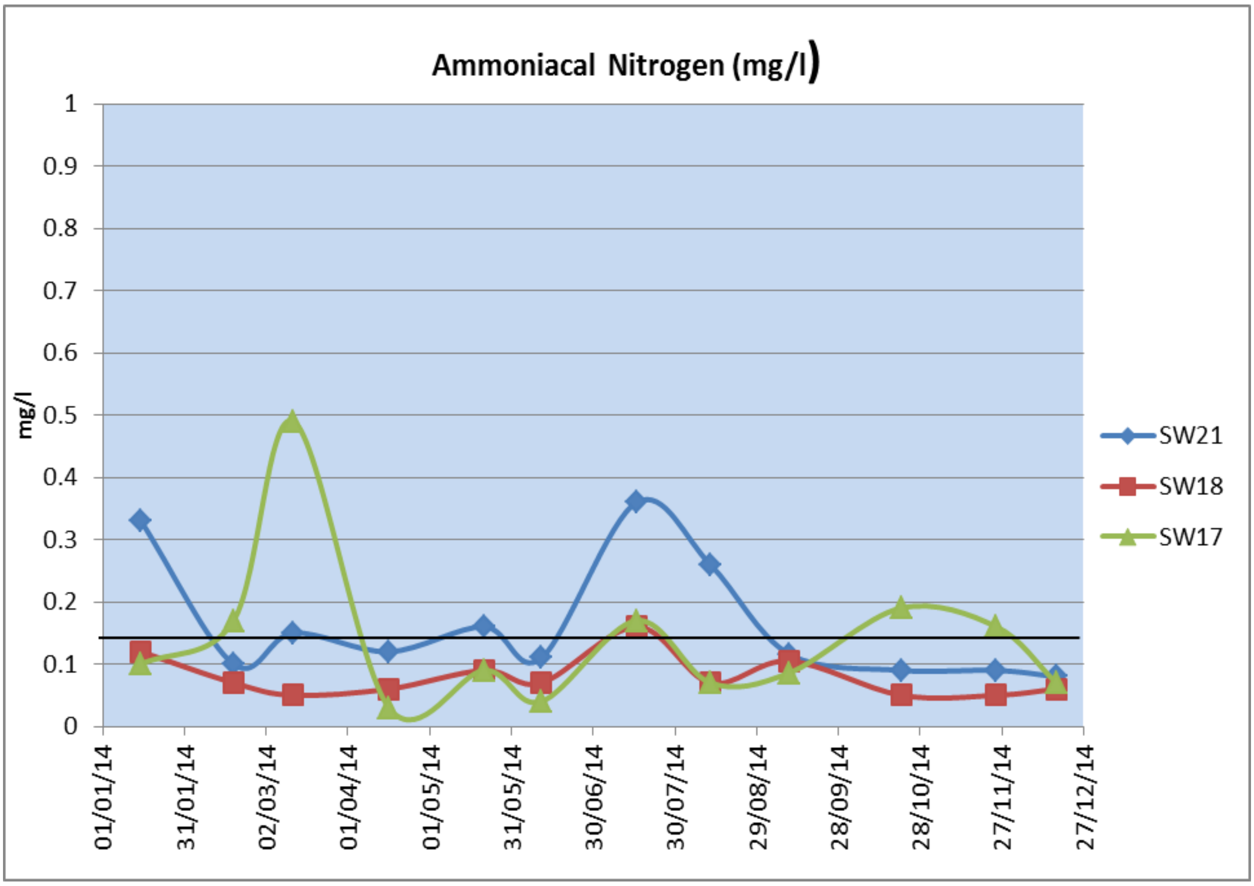

Figure 4: Ammoniacal Nitrogen Levels at SW21, SW18 & SW17 (2014)

Results from Monthly Monitoring

Monthly Electrical Conductivity measurements at SW21, SW18 and SW17 for 2014 are shown on Figure 5 below. The results indicated generally elevated conductivity levels (> 1,000 μS/cm) at the three monitoring stations in January and February, beginning to decrease in March and April, remaining below the threshold value throughout the Summer/Autumn months and increasing again in November and December. There has been a trend over recent years for elevated conductivity levels at these monitoring stations during the Winter months. This may be related to the salting of the M50 during these months or there may be other localised seasonal factors.

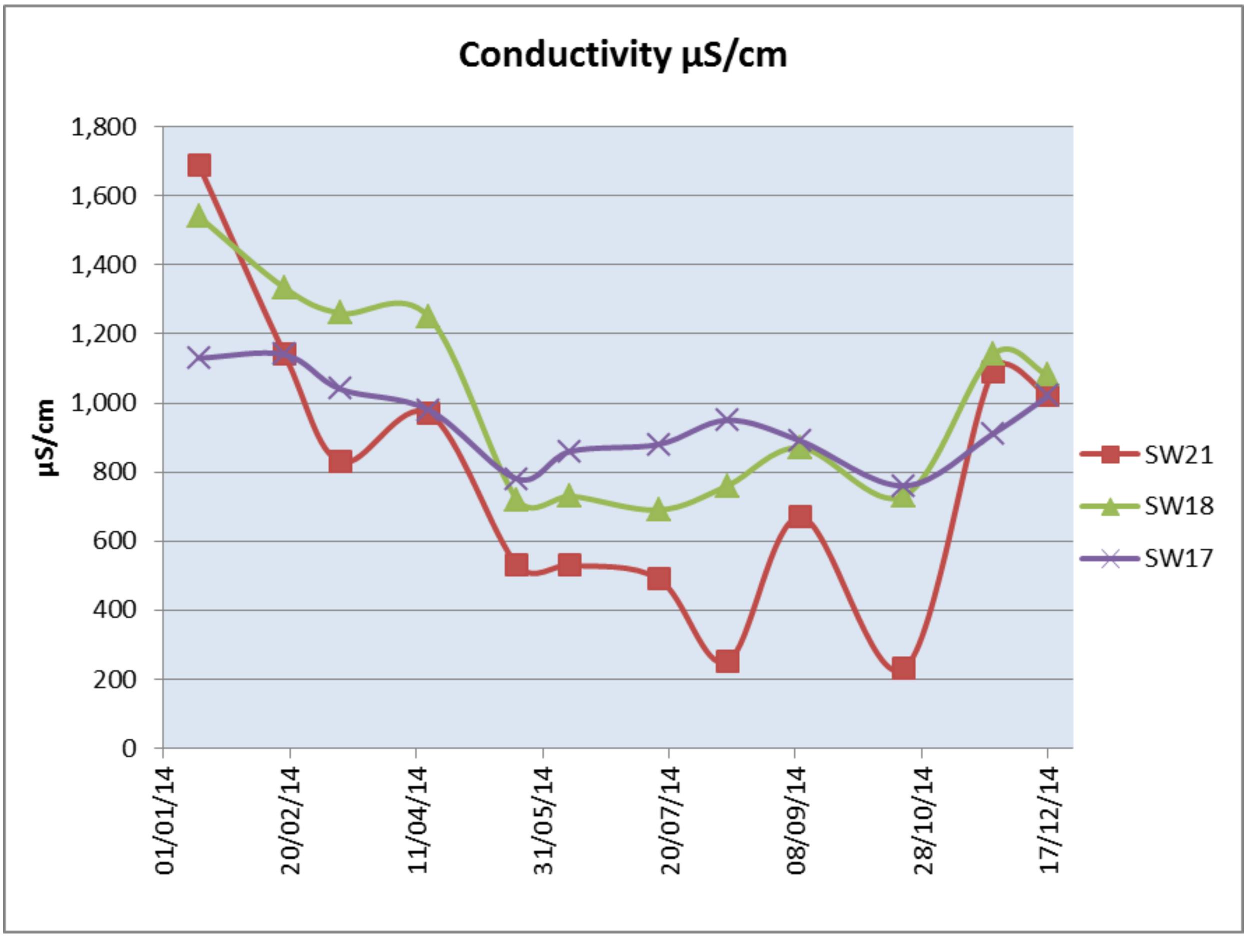

Figure 5: Conductivity measurements at SW21, SW18 & SW17 (2014)

Monthly Visual Inspections

Monthly visual inspections were carried out at all Surface Water Monitoring stations during 2014. The visual inspections included sampling of pH, temperature and conductivity as well as logging a description of the waters, colour, odour, cloudiness, the substrate, weed growth and algae. Conductivity results are discussed above. All temperature readings and pH measurements were within normal ranges for the water type and time of year.

Heavy weed growth was recorded in the streams at SW2 and WWSW1 throughout the year.

On each occasion when an incident was recorded, an incident report was issued to the EPA and ERFB.

Monthly Wheelwash Sampling

Monthly sampling ceased in November 2007 as it was agreed with *the Agency* that future sampling of WWSW1 and WWSW2 will occur on a needs be basis.

Conclusion & Annual Assessment

The 2014 annual assessment suggests a slight improvement in water quality at Dunsink Landfill compared to 2013.

There were elevated levels of conductivity at many of the sampling stations on some occasions particularly during the Winter months both early in the year and during November and December. Elevated levels of ammoniacal nitrogen at SW17 in March were caused by an upstream pollution incident in the northern (Dunsoghly estate) stream at that time, and when this was remediated levels reduced again below the threshold value. A further slight increase in levels at SW17 in November and December resulted from contamination of the southern tributary that may have been caused by the corralling of horses in this area for a period in November.

The leachate pumping infrastructure (pumps, sump and leachate valve configuration) commissioned in June 2005 and the leachate interceptor drains established to the West and South of the Lagoon along with the remedial works at SW21 in 2013 have significantly aided in the general improvement in water quality at the facility.

3.3 LEACHATE

Schedule D of the waste licence requires the monitoring of leachate at the station "north-east lagoon", Table 6. A monitoring station which facilitates the obtaining of representative grab and / or continuous samples in accordance with Condition 8.4 is provided at the sump.

Table 6: Leachate Monitoring Locations 2014

Leachate Monitoring Location	Eastings	Northings
Northeast Lagoon	311323	239031
Sump	311417	238895

Table D.5.1 of Schedule D of the waste licence sets down the parameters and frequency for leachate monitoring. Table 9 below outlines the sampling programme for leachate undertaken in 2014.

Table 7: Leachate Monitoring Programme 2014

Leachate Monitoring Location	Q1	Q2	Q3	Q4	Annual
North East Lagoon	Sampled	Sampled	Sampled	Sampled	Sampled (Q3)
Sump	Sampled	Sampled	Sampled	Sampled	Sampled (Q3)

3.3.1 Leachate - Methodology

The monitoring of leachate was undertaken during 2014 using 2 methods – through a grab sample taken at 2 locations (sump and lagoon) at each quarter on one hand, and through continuous monitoring in the sump via a dissolved methane probe.

Refer to Schedule D.5 of waste licence 127-1 for the parameters and frequency of monitoring.

3.3.2 Leachate Monitoring – Results of Quarterly Sampling (See Appendix II)

Q1 January to March 2014 – Sampling dated 18th February 2014

Results from leachate sampling at the lagoon on 18th February 2014 recorded pH of 8.9, conductivity of 1,570 µS/cm and temperature of 7.4°C. A dissolved methane concentration of <0.004 mg/l and ammoniacal nitrogen of 0.15mg/l were recorded.

Results from leachate sampling at the leachate sump on recorded pH of 7.67, conductivity of 2,650 µS/cm and temperature of 11.3 °C. Dissolved methane was recorded at 2.59 mg/l and ammonia of 84.69 mg/l. Table C.6 of the waste licence states that Emission Limits for Dissolved Methane in Leachate Being Discharged to Sewer as 0.14mg/l. The results indicate that emission limit values for dissolved methane were exceeded for leachate in the leachate sump.

Q2 April to June 2014- Sampling dated 21st May 2014

Results from leachate sampling at the lagoon on 21st May 2014 recorded pH of 9.06, conductivity of 1,550 µS/cm and temperature of 17.3°C. A dissolved methane concentration of 0.006 mg/l and ammoniacal nitrogen of 0.13mg/l were recorded.

Results from leachate sampling at the leachate sump recorded pH of 7.50, conductivity of 4,180 µS/cm and temperature of 15.8 °C. Dissolved methane was recorded at 0.969 mg/l and ammonia of 198.02 mg/l. The results indicate that emission limit values for dissolved methane were exceeded for leachate in the leachate sump.

Q3 July to September 2014 – Annual Sampling dated 12th August 2014

Results from leachate sampling at the lagoon on 12th August 2014 recorded pH of 10.17, conductivity of 1,400 µS/cm and temperature of 16.80°C. A dissolved methane concentration of 0.021 mg/l and ammoniacal nitrogen of 0.12 mg/l were recorded. These were significantly lower than concentrations recorded in 2013.

Results from leachate sampling at the leachate sump on recorded pH of 7.48, conductivity of 2,690 µS/cm and temperature of 15.5°C. Dissolved methane was recorded at 4.25 mg/l and ammoniacal nitrogen of 136.22 mg/l. The results indicate that emission limit values for dissolved methane were exceeded for leachate in the leachate sump.

There were elevated or high levels of many of the other parameters analysed as part of the annual round including chloride, potassium, sodium, COD and BOD as would be expected from landfill leachate.

Q4 October to December 2014- Sampling dated 25th November 2014

Results from leachate sampling at the lagoon on 25th November 2014 recorded pH of 9.5, conductivity of 1,680 µS/cm and temperature of 6.8 °C. A dissolved methane concentration of 0.01 mg/l and ammoniacal nitrogen of 17.75mg/l were recorded.

Results from leachate sampling at the leachate sump recorded pH of 7.2, conductivity of 2,360 µS/cm and temperature of 12.6 °C. Dissolved methane was recorded at 6.285 mg/l and ammoniacal nitrogen at 63.38 mg/l. The results indicate that emission limit values (0.14 mg/l) for dissolved methane were exceeded for leachate in the leachate sump.

Leachate – Discussion.

The results from monthly visual inspections and quarterly and annual chemical monitoring of the leachate lagoon and leachate sump indicated concentrations typical of leachate quality at both stations. The lagoon water is of higher quality than the leachate sump for most parameters (apart from BOD, COD and chloride) and this may be due to the diluting effect of rainwater in the lagoon.

Weekly monitoring of Methane, Carbon dioxide and Oxygen is being carried out at the headspace of the sump and the point of discharge to public sewer in Finglas (See Figure 1). The results are being compiled for Dublin City Council. Dublin City Council may require further mitigation measures following a review of the results of these monitoring rounds.

3.3.3 Continuous Monitoring of Dissolved Methane in Leachate

Continuous monitoring of dissolved methane at the sump commenced during Q1 2006. Table C.6 of the waste licence states that Emission Limits for Dissolved Methane in Leachate Being Discharged to Sewer as 0.14mg/l. Continuous monitoring of dissolved Methane has been carried out from 3rd October 2006 to present. Reporting of incidents under this system is being undertaken through the quarterly environmental reports as the data has emerged and is analysed.

3.3.4 Results from Continuous Monitoring of Dissolved Methane in Leachate

This reporting is as per protocols specified in condition 6.3.3.1.

a) No 24 hour mean value shall exceed the ELV;

100% of 24 hour mean values exceeded the ELV of 0.14mg/L

b) 97% of all 30 minute mean values taken continuously over an annual period shall not exceed 1.2 times the emission limit value.

100% of 30 minute mean values exceeded 1.2 times the ELV (0.168mg/L)

c) No 30-minute mean value shall exceed twice the emission limit value.

100% of 30 minute mean values exceeded 2 times the ELV (0.28mg/L).

These results show that the ELV of 0.14mg/L has been continuously breached throughout 2014.

Fingal County Council undertook various exercises in 2012 and 2013 to try and decrease the dissolved methane levels in the leachate pumped to sewer. Progress on this issue was slow in 2014, and work to resolve the issue has been prioritised for 2015.

Compliance investigation CI000399 has been open to monitor progress towards achieving compliance with the ELV.

3.3.5 Discussion of Results from Continuous Sampling of Dissolved Methane

The results indicate that the ELV is exceeded almost continuously at high levels.

Fingal County Council undertook various exercises in 2012 and 2013 to try and decrease the dissolved methane levels in the leachate pumped to sewer.

Progress on this issue was slow in 2014, and work to resolve the issue has been prioritised for 2015. Compliance Investigation CI000399 is used to track progress on the issue.

Weekly monitoring of Methane, Carbon dioxide and Oxygen is being carried out at the headspace of the sump and the point of discharge to public sewer in Finglas. The results are being sent to The Agency through weekly notifications and are also being compiled for Dublin City Council.

3.4 NOISE

No noise survey was undertaken at Dunsink Landfill in 2014. This was addressed in Licence Audit Report for 2008 from the Agency W1027-01/08/AR08EM, observation No.5, on Environmental Monitoring.

3.5 DUST

No dust monitoring surveys were carried out at Dunsink Landfill in 2014. This was addressed in Licence Audit Report for 2008 from the Agency W1027-01/08/AR08EM, observation No.5, on Environmental Monitoring.

3.6 PM_{10} MONITORING

The Agency in correspondence referenced 127-1/GEN01EM stated that "The Agency, in accordance with Condition 8.2, does not require monitoring of PM_{10} as listed in Table D.3.1 of the waste licence unless otherwise instructed by the Agency."

3.7 BIOLOGICAL ASSESSMENT OF THE SCRIBBLESTOWN STREAM

In accordance with the requirements of Dunsink Landfill Waste Licence W0127-01, Condition 8.8.1, AECOM Ltd. were appointed by Marron Environmental on behalf of their client Fingal County Council to carry out a detailed freshwater biological assessment of the Scribblestown Stream at Dunsink landfill, Dunsink, Co. Dublin. The site's waste licence requires a biological assessment of the Scribblestown Stream on an annual basis. Biological sampling is required at three locations (KS1, KS2, KS3) and biological samples were collected at an additional three locations in 2014 (KS3a, KS4 and KS6) (See Table 4 and Figure 3).

3.7.1 Sampling Locations

In order to maintain consistency with previous surveys, six monitoring locations were visited, assessed, and resampled where conditions permitted. Survey locations are presented on Figure 1 and described in Table 8.

Table 8: Sampling Location Descriptions

Location Code	Waste License Sample Point?	Kick Sample/Weed Sweep/Stone Wash	Location Description
KS1	Yes	Weed sweep only due to muddy bottom	KS1 is located approximately 10m downstream of where the stream opens up.
KS2	Yes	Stone wash only due to muddy bottom and absence of weed	Located approximately 20m downstream of the attenuation system. The 2012 location as with the 2011 survey point was 10m upstream from this location as marked on Figure 1. No sample was possible in 2013, a stone wash was conducted in 2014.
KS3	Yes	Kick sample, stone wash and weed sweep completed	Sampling location KS3 is located towards the eastern boundary of the site close to where the Scribblestown exits the landfill site. It was positioned downstream of the confluence of Unnamed stream 2 with Scribblestown Stream
KS3a	No	Weed sweep only due to muddy bottom	A small weir/dam on the stream. Downstream of the confluence of unnamed stream 2 with Scribblestown Stream
KS4	No	Kick sample, stone wash and weed sweep completed	Located on Scribblestown Stream
KS6	No	Weed sweep only due to muddy bottom	Located on Unnamed Stream 2

3.7.2 Results

The field biological assessment was conducted on 20 August 2014. Weather conditions were bright and sunny. The survey conditions on the day of survey were dry but followed a period of rainfall. The macroinvertebrate survey was conducted within the optimum period for Q-value assessment which is generally considered to be between June to September. It was conducted outside the recommended SSRS sampling period of November to February however SSRS allows for a comparison to be made for annual samples conducted at comparable times of the year even if outside of the optimal period. The full taxa list for each kick sample is presented in Appendix B. Table 4 describes the kick sample locations.

Table 9: Kick Sample Descriptions

Sampling Point	Sample Point Description at time of Survey
KS1	The stream was on the day of survey reasonably slow flowing with imperceptible movement. Much of the stream was covered in vegetation but small pools of water were visible. A weedsweep in these areas returned a small aquatic macroinvertebrates assemblage. See photographs presented at Appendix A; Photograph 1.
KS2	At KS2, the stream was observed to be dry. A kick sample and stone wash was performed immediately below the outfall where ponded water was present. See Photographs 2&3 presented at Appendix A.
KS3	At KS3, water levels within the stream was observed to be low, and velocity was also very low. The stream bed was also noted to be comprised largely of fine gravels but predominantly silty. **A weed sweep was retrievable from the stream and an assessment was carried out.** See Photograph 5 presented at Appendix A.
KS3a	At KS3a, water level within the stream was observed to be very low, and velocity was perceptible as the water flowed over the weir. The stream bed was also noted to be comprised largely of fine gravel, **A kick sample and stone wash was retrievable from the stream and an assessment was carried out.** See photograph 4 presented at Appendix A.
KS4	At KS4, water level within the stream was observed to be low, and velocity was also very slow. The stream bed was also noted to be comprised largely of fine gravel. This sampling location is located downsteam from a confluence of two water inputs, one from the lagoon and one from a culvert. At this location, the dominant flow was from the culvert, with very little flow from the direction of the lagoon. Excavation of the channel had taken place and no instream vegetation was present at the sample location but was dense immediately downstream. **A kick sample was retrievable from the stream and an assessment was carried out.** See Photograph 6 presented at Appendix A.
KS6	At KS6, it was not possible to enter the stream at the sample point. However along the same reach of the stream, excavation of silt and vegetation had recently occurred leaving a pool of standing water. Whilst the depth of silt was too great to enter, the channel bottom and vegetated sides of the channel were swept with the net from a bankside location. See Photographs 7&8 presented at Appendix A.

Sample Point KS1

The sample had 7 taxa and a total of 76 individuals representing a similar diversity to the assessment carried out at KS1 in 2012, but a reduction in quantity of aquatic macroinvertebrates. No assessment at this location was carried out in 2013 due to low water levels and overgrown vegetation. Group D dominated the sample (64.47%).

A Q2 classification was assigned indicating seriously polluted water. The Shannon-Weiner (H') diversity index value was 1.44 indicating low species richness and diversity. The SSRS score was 2.4 as only Group 4 and Group 5 taxa were identified indicating that the section of the stream is 'at risk'. Whilst the stream is still considered to be "at risk", the SSRS score calculated during the 2014 assessment is the highest score recorded at KS1 since monitoring commenced in 2011 at this location, by the current surveyors.

Sample Point KS2

The sample had 10 taxa and a total of 150 individuals representing a greater diversity to the assessment carried out at KS2 in 2012, but a reduction in quantity of aquatic macroinvertebrates. No assessment at this location was carried out in 2013 due to low water levels and overgrown vegetation. Group C dominated the sample (72.67%).

A Q3 classification was assigned indicating moderately polluted water. The Shannon-Weiner (H') diversity index value was 1.72 indicating low species richness and diversity. The SSRS score was 1.6 as only Group 3, Group 4 and Group 5 taxa were identified indicating that the section of the stream is 'at risk'. Whilst the stream is still considered to be "at risk", the SSRS score calculated during the 2014 assessment is consistent with historical scores calculated from assessments carried out at KS2 since 2011.

Sample Point KS3

The sample had 6 taxa and a total of 55 individuals representing an increase in diversity and quantity of aquatic macroinvertebrates when compared with assessments carried out in 2012 and 2013. Group C dominated the sample (61.82%).

A Q3 classification was assigned indicating moderately polluted water. The Shannon-Weiner (H') diversity index value was 1.24 indicating low species richness and diversity. The SSRS score was 2.4 as only Group 4 and Group 5 taxa were identified indicating that the section of the stream is 'at risk. Whilst the stream is still considered to be "at risk", the SSRS score calculated during the 2014 assessment is an improvement on the score calculated during the 2013 assessment.

Sample Point KS3a

The sample had 7 taxa and a total of 75 individuals. No Group A or B taxa was present. Group D taxa (58.67%) dominated the sample.

A Q3 classification was assigned indicating moderately polluted water. The Shannon-Weiner (H') diversity index value was 1.55 indicating low species richness and diversity, however an increase in the diversity calculated during the 2013 assessment. The SSRS score was 3.2 which indicates that this stretch of the channel is 'at risk' – a slightly reduced score when compared to that calculated during the 2013 assessment.

Sample Point KS4

The sample had 9 taxa and a total of 49 individuals. The sample comprised of groups B, C, D, and E taxa. Group C taxa dominated the sample (69.39%).

A Q3 classification was assigned indicating moderately polluted water. The Shannon-Weiner (H') diversity index value was 1.81 indicating low species richness and diversity, but an improvement on the score calculated during previous assessments. The SSRS score is 3.2 which indicates that this stretch of the channel is 'at risk'. The SSRS score remains unchanged from the 2011, 2012, and 2013 assessments.

Sample Point KS6

The sample had 6 taxa and a total of 44 individuals. The sample comprised of groups C and D taxa. Group C taxa dominated the sample (61.36%).

A Q3 classification was assigned indicating moderately polluted water. The Shannon-Weiner (H') diversity index value was 1.63 indicating low species richness and diversity. The SSRS score is 1.6 which indicates that this stretch of the channel is 'at risk'.

Historic Q-Value

The Q-value results from the current and previous sampling rounds are presented in Table below.

Table 10: Trend of Q-Value Rating for Sampling Locations From 2005-2014

Site/Year	2005	2006	2007	Dec 2008	Aug 2009	Dec 2009	Sept 2010	Sept 2011	Aug 2012	Sept 2013	Aug 2014
KS1	Q3	Q3	Q2-3	Q2-3	Q2-3	-	Q3	Q3*	Q3	-	Q2
KS2	Q3	-	-	Q3	Q2-3	Q3	Q3	Q3*	Q3	-	Q3*
KS3	Q3	Q3	Q3	Q3	Q2	Q2-3	Q2-3	Q3*	Q3	Q3	Q3
KS3a							Q3	Q3*	Q3	Q3	Q3
KS4	-	-	-	-	-	Q3	-	Q3*	Q3	Q3	Q3
KS5	-	-	-	-	-	Q3	-	-	-	-	-
KS6	-	-	-	-	-	Q2	Q1-2	Q3*	Q2	-	Q3

- indicates not sampled

* very low flow conditions

No kick sample, just weed sweep/stone wash

3.7.3 Discussion

During the 2014 biological assessment of surface waters at Dunsink Landfill Site, water levels were observed to be significantly lower than what would be expected, given the average depths monitored during previous aquatic assessments at the site in 2011 and 2012. The sampling period in 2013 and 2014 has coincided with the end of a relatively dry summer with extended periods of low rainfall, and as a result, water levels in the stream as it passes through the site is seasonally low.

Since the 2013 assessment, some stream channel works have been carried out which consequently removed some of the stream vegetation as well as silt in some sampling locations. The removal of the dense vegetation allowed some form of assessment at all sample locations.

The monitoring locations generally do not permit conventional macroinvertebrate sampling techniques, i.e. aggressive kick sampling, due to very soft silty beds and/or dense vegetation. In the absence of highly oxygenated habitats such as riffles, sensitive to pollution, Group A and B taxa are unlikely to be encountered which will continually limit the maximum potential biological score during future monitoring rounds.

When kick sampling cannot be carried out this presents a limitation to the survey. The limited macroinvertebrate diversity and individual count may be attributed to the generally dry summer when compared to recent years (pre 2013). This should be considered as a limitation to this survey when comparing the results of this assessment to historical assessments – particularly pre-2013.

Has Q-Value Changed?

Despite the varied total individuals and increased species diversity, the Q value at the locations monitored remained the same, with the exception of KS1, when compared with the assessments completed in 2011, 2012, and 2013 (where appropriate). During the 2014 assessment, KS1 was found to be comparable with a Q2 stream due to Group D taxa being "dominant". As detailed in the results Section, the SSRS score for KS1 has increased however. Due to the low order nature of the streams, the SSRS score increase may be more relevant to the assessment, than a decrease in EPA Q-Value, and therefore this apparent decrease in quality at KS1 may not be of grave concern to the overall health of the fluvial environment.

Has the SSR Score Improved?

When comparing the results of the 2014 assessment and the 2013 assessment, the risk category of each of the sampling locations remains 'at risk'. The 'at risk' category is to be expected at streams which, have been modified (including upstream reaches), heavily vegetated, and devoid of a pool riffle habitat. This category is unlikely to change at the site due to the historical development at the site as opposed to current site practices or current chemical loading from the waste mass. Where stream channels are muddy and soft, heavily vegetated, and devoid of riffles, the potential for oxygenation of water is limited. Where dissolved oxygen concentrations are low, the habitat for sensitive taxa which will increase the SSRS score into the 'probably not at risk' category will not exist. Therefore, it is unlikely that an improvement to the SSRS score to this extent will be achieved in the short term. In the long term, unless the in-stream characteristics are modified, there is unlikely to be an improvement.

3.7.4 Recommendations

It is recommended that monitoring continues on an annual basis as per the requirements of the waste license held for the site. Due to the size and morphology of the streams (1st and 2nd order nature of the streams), it is also recommended, as per previous years that the SSRS becomes the primary biological scoring tool for the site. A Q-value type assessment should still be conducted in order to be consistent with previous assessments and to capture species not scored as part of an SSRS.

The survey results suggest that due to the modified nature of the streams and the absence of in-stream features that would promote the presence of pollution intolerant species such as Ephemeroptera and Plecoptera, the SSR score and the Q-values will not increase. Active modification of the stream bed and implementation of a habitat management plan could be considered to improve the in stream features to increase the relevant indices.

3.8 LANDFILL GAS

3.8.1 Landfill Gas Facility Monitoring

Since the 4th Quarter (Q4) of 2006 measurements of landfill gas were carried out at twenty four locations at the perimeter of the landfill (See Figure 6 and Table 11).

During November 2007 (Q4) in agreement with the *Agency*, weekly gas monitoring decreased to six monitoring locations (G35 to G40) and the leachate sump and sewer, with the monthly monitoring round still consisting of all accessible gas monitoring locations (24 locations). From September 2010 monitoring location G23 was also included in the weekly gas monitoring.

Gas monitoring station G41 was lost during site excavation work in September 2012 and a replacement borehole G41R was drilled adjacent to it on 5/12/2012.

At the end of October 2012 the Agency and Fingal County Council agreed to amend the monitoring programme from weekly to monthly with the following exceptions. The sewer at Finglas continues to be monitored weekly and in the event that monitoring at the landfill indicates any exceedances of methane above the trigger level, or unusually high levels of carbon dioxide relative to historical levels at the site, then monitoring should continue weekly until the gas levels subside or remedial action effected.

Table 11: Landfill Gas monitoring Locations and Programme 2014

Landfill Gas Monitoring Locations.	Monitoring Frequency Pre Nov. 2012	Monitoring Frequency Post Nov. 2012	Eastings	Northings
G3**	Monthly	Quarterly	311270	238670
G6**	Monthly	Quarterly	311180	239425
G7**	Monthly	Quarterly	311230	239375
G8**	Monthly	Quarterly	311300	239320
G9**	Monthly	Quarterly	311360	239260
G10**	Monthly	Quarterly	311410	239170
G12	Monthly	Quarterly	310040	238850
G13	Monthly	Quarterly	310560	238795
G18	Monthly	Quarterly	311150	238630

G21	Monthly	Quarterly	311380	238990
G23	Weekly	Monthly	310325	239265
G35	Weekly	Monthly	311265	238740
G36	Weekly	Monthly	311210	238740
G37	Weekly	Monthly	311290	238875
G38	Weekly	Monthly	311245	238880
G39	Weekly	Monthly	311195	238835
G40	Weekly	Monthly	311520	239090
G41R	Monthly	Monthly	311580	239020
G42**	Monthly	Quarterly	311410	238805
G43**	Monthly	Quarterly	311524	239088
G44**	Monthly	Quarterly	311516	239100
IPS inlet	Weekly	Monthly	310515	238849
Leachate Sump	Weekly	Monthly	311417	238895
Finglas Manhole	Weekly	Weekly	311909	238733

** (Changed to monthly monitoring during November 2007)

Gas levels were monitored using a GA2000 landfill gas analyser. The boreholes were monitored for Methane (CH_4), Carbon dioxide (CO_2), Oxygen (O_2), Hydrogen Sulphide, Carbon Monoxide (CO) and atmospheric pressure.

Gas trigger levels at monitoring boreholes outside the waste body have been set at 1% for methane and 1.5% for carbon dioxide in accordance with the waste licence.

The results of the gas monitoring are recorded in monthly landfill gas monitoring round sheets – these are available from the quarterly environmental monitoring reports.

Landfill Gas - Proximity of Buildings and Developments to the Site

There are a number of buildings and developments on site, which are identified in the risk analysis of the site from landfill gas, which have potential to expose receptors to risk from landfill gas (See Figure 6). These include the former Irish Power Systems (IPS) compound (now Fingal County Council) at the southern boundary to the site along Dunsink lane. The Equipment yard and shed (which will also house the site offices) is close to the southern boundary of the site, immediately east of the IPS compound.

There are a number of buildings and developments close to the site which have potential to expose receptors to risk from landfill gas. Cappagh Hospital is located to the north of the landfill boundary. Dunsoghly estate lies to the east of Cappagh Hospital and north east of the landfill boundary. A halting site is established along the south-east boundary of the landfill (Figure 6).

South of Dunsink Lane, which marks the southern boundary of the site, there are a number of developments. From west to east these include; Elm Green Golf Course, Dunsink Observatory and a series of unauthorised halting sites (Figures 2 & 6).

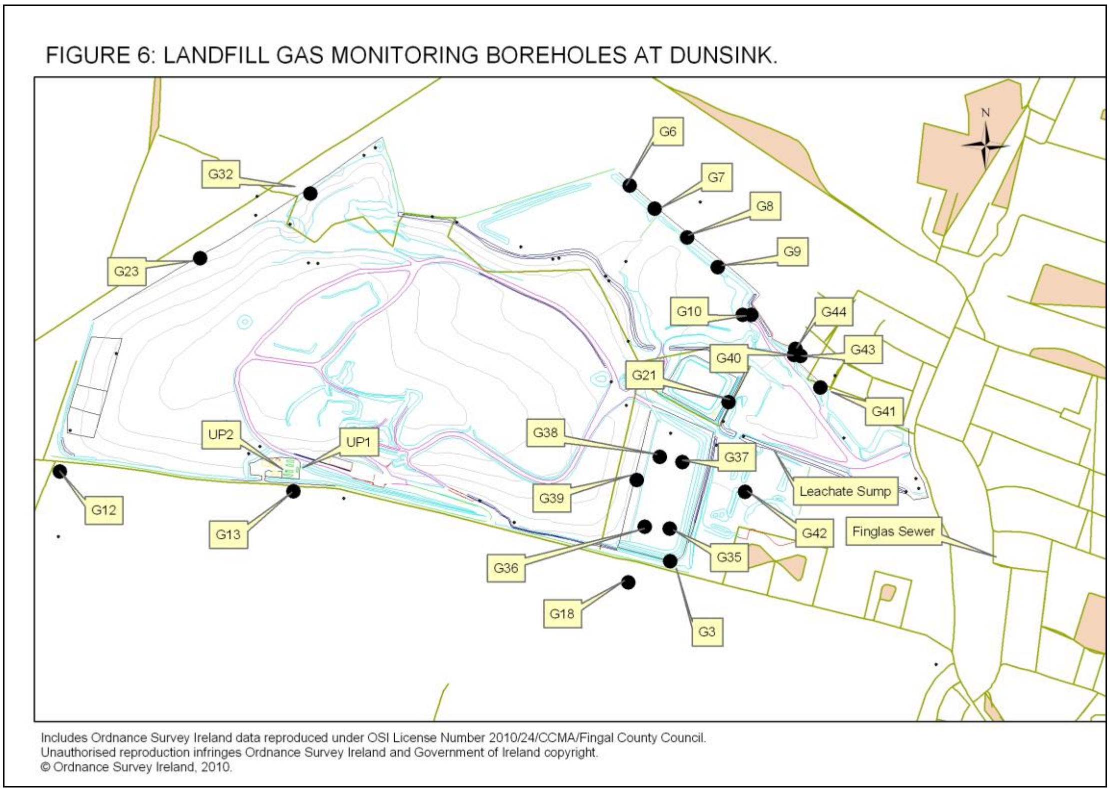

Figure 6: Landfill Gas Borehole Monitoring Locations

Locations of Trigger Level Exceedances

Q1 January to March 2014

The monthly monitoring boreholes (G23, G35, G36, G37, G38, G39, G40, G41R and the leachate sump) were monitored on 3 occasions during Q1 and monitoring was carried out at all boreholes on one occasion (quarterly monitoring round on 18/02/14). During Quarter 1 2014, one elevated level of methane was recorded at the leachate sump (1.4%) on 18/02/14. All other methane measurements were below the threshold value of 1%.

Elevated levels of carbon dioxide were recorded above the threshold value of 1.5% on a regular basis at G35, G36, G37, G38, G39, G40, G41R and the leachate sump ranging from 1.6% to 8.9%. There were also elevated levels of carbon dioxide recorded at G6, G21, G43 and G44 ranging from 1.6% to 6.0% during the quarterly monitoring round (the only sampling event for these boreholes). No elevated levels were recorded at G23 (monthly) or at G3, G7, G8, G9, G10, G12, G13, G18 and G42 (quarterly).

No positive values for hydrogen sulphide were recorded during the 1st Quarter of 2014.

Weekly gas monitoring at the sewer in Finglas recorded methane levels ranging from 0.0% v/v to 0.4% v/v, carbon dioxide levels ranging from 0.9% v/v to 3.3% v/v and all hydrogen sulphide levels at 0 ppm.

Q2 April – June 2014

The monthly monitoring stations (G23, G35 to G39, G40, G41R and the leachate sump) were monitored on 4 occasions during Q2 2014 and the quarterly monitoring stations on 21/05/14.

Elevated levels of methane were recorded at the leachate sump (1.3%) on 16/04/14 and G23 (2.6%) on 21/05/14. Subsequent sample taken at G23 on 28/05/14 had reverted to below the trigger level. No other significant concentrations of methane and no positive values for hydrogen sulphide were recorded during the 2nd Quarter of 2014.

Elevated levels of carbon dioxide were recorded at G35, G37, G38, G39, G40 and the leachate sump on all 4 monitoring events, at G36 on 3 of the 4 events, at G41R on 2 of the 4 events and at G23 on 1 of the 4 events. Elevated levels were also recorded at G6, G9, G10, G21, G42, G43 and G44 during the quarterly monitoring round (the only monitoring event for these boreholes). The elevated levels ranged from 1.7% v/v to 10.1% v/v.

Results from the weekly monitoring at the Finglas sewer manhole during the second quarter indicated low methane levels ranging from 0 to 0.2% v/v and carbon dioxide levels ranging from 0.5 to 2.9% v/v.

Q3 July – September 2014

The monthly monitoring stations (G23, G35 to G39, G40, G41R and the leachate sump) were monitored on 5 occasions during Q3 2014 and the quarterly monitoring stations on 12/08/14. Elevated levels of methane were recorded at the leachate sump on 10/09/14 (1.8%) and at G23 on 17/09/14 (1.0%) and on 24/09/14 (1.1%). Subsequent sample taken at G23 on 01/10/14 had reverted to below the trigger level.

Elevated levels of carbon dioxide were recorded at G35, G36, G37, G38, G40, G41R on all 5 monitoring events at G39 on 4 of the 5 events, at the leachate sump on 3 of the 5 events and at G23 on 2 of the 5 events. Elevated levels were also recorded at G6, G9, G10, G21, G43 and G44 during the quarterly monitoring event (the only time these wells were monitored).

Hydrogen sulphide levels were zero ppm at all monitoring stations throughout the quarter.

Results from the weekly monitoring at the Finglas sewer manhole during the third quarter indicated low methane levels ranging from 0 to 0.1% v/v and carbon dioxide levels ranging from 0.1 to 2.8% v/v.

Q4 October – December 2014

The monthly monitoring stations (G23, G35 to G39, G40, G41R and the leachate sump) were monitored on 4 occasions during Q4 2014 and the quarterly monitoring stations on 25/11/14. During Quarter 4 2014, elevated levels of methane (>1.0% v/v) were recorded at the leachate sump on 01/10/14 (1.5% v/v) and on 25/11/14 (3.7% v/v). No significantly elevated levels of methane were recorded at any of the other monitoring stations.

Elevated levels of carbon dioxide (>1.5% v/v) continued to be recorded at G23 (on 2 of the 4 occasions monitored), boreholes G35, G37, G38, G39, G40, G41R and the leachate sump on all 4 occasions and at G36 on 3 of the 4 occasions monitored and at G6, G9, G10, G21, G43 and G44 on 25/11/14 (the only occasion on which these boreholes were monitored).

No elevated levels of hydrogen sulphide were recorded at any of the site monitoring stations.

Results from the weekly monitoring at the Finglas sewer manhole during the third quarter indicated low methane levels ranging from 0 to 0.2% v/v and carbon dioxide levels ranging from 0.3 to 3.4% v/v.

Landfill Gas Monitoring – Summary

Landfill gas monitoring undertaken at Dunsink landfill in 2014 indicated a slight reduction in the number and level of exceedances in trigger levels compared to previous years. However, there continues to be regular (monthly), though not continuous elevations of carbon dioxide at the sportsfield monitoring boreholes (G35 to G39), at G40, G41R, the leachate sump and frequently at G6, G9, G10, G21, G42, G43 and G44 during the quarterly monitoring rounds.

Elevated levels of methane were recorded regularly at the leachate sump on 5 monitoring events and at G23 on 3 monitoring events.

Exceedances in the monthly and quarterly monitoring of gas at the landfill are reported to the EPA in incident reports as they occur.

3.8.2 Landfill Gas Utilisation Plant Monitoring Equipment and Sampling points

Weekly monitoring at the inlet and continuous monitoring at the outlet commenced during Q1 2006. It was agreed by the Agency that reporting of incidents under this system could be done through the quarterly and annual environmental reports.

Inlet to Landfill Gas Utilisation Plant

A gas sampling system to include chilling and filtration for the protection of the portable infrared analyser was installed. This facilitates weekly monitoring of methane, carbon dioxide and oxygen using a portable landfill gas analyser, which is used for borehole monitoring. It also provides a sampling location for annual monitoring of Total Sulphur, Total Chlorine and Total Fluorine. The results from the weekly sampling at the inlet are reported in the weekly landfill gas monitoring round sheets. These sheets are available from the quarterly environmental monitoring reports.

Outlet from Landfill Gas Utilisation Plant

Carbon monoxide and nitrogen oxides are monitored continuously. Continuous monitors on the outlets of the two gas engines were installed. The analysers are proven to be effective on other landfill gas utilisation plants. An appropriate data management system has been installed and this provides for data logging and data storage.

Additionally, a gas sampling system to allow for annual monitoring of total VOCs as carbon, total non-methane VOCs and Particulates, Hydrochloric acid and Hydrogen fluoride, and, quarterly monitoring of nitrogen oxides has been installed.

Emission limit values for Landfill Gas Plant

The emission point reference numbers are proposed to be:

UP1 Utilisation Plant Input 1

UP2 Utilisation Plant Output Engine 1

UP3 Utilisation Plant Output Engine 2

The analysers are able to measure and report at a sufficient resolution to register the emission limit for Carbon monoxide (CO) (1400mg/m3).

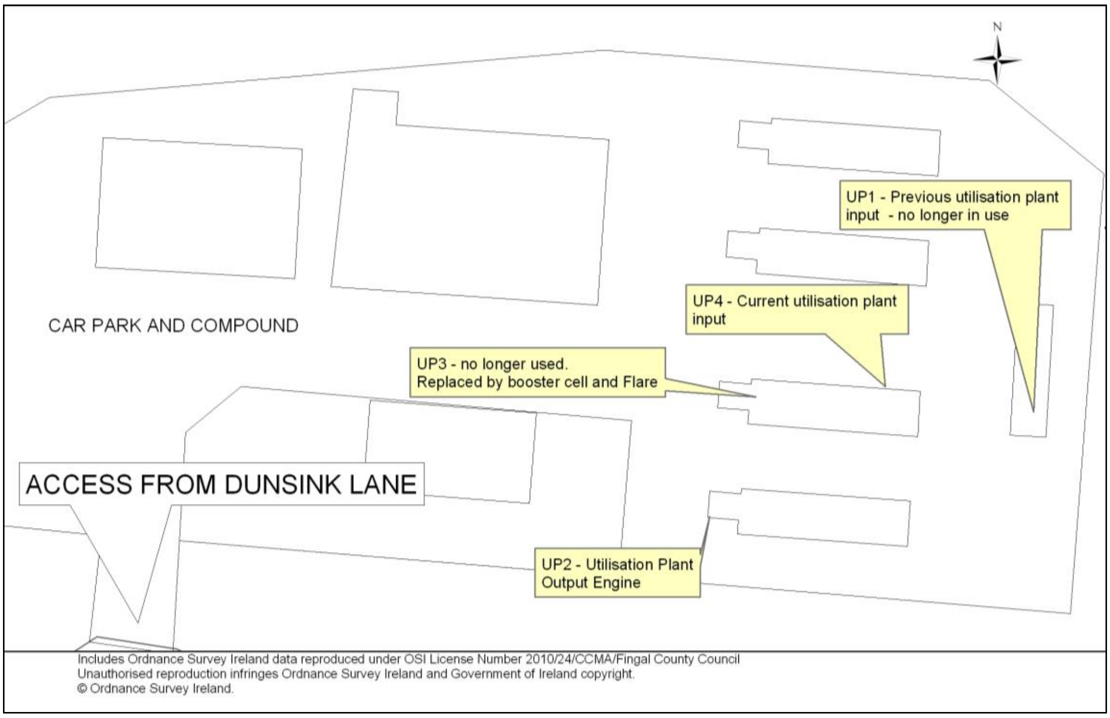

Figure 7: Dunsink Landfill Gas Utilisation Plant

3.8.3 Results from Continuous sampling of parameters at outlets from Landfill Gas Combustion Plant.

Continuous monitoring of outlet parameters at the Landfill Gas Combustion Plant was undertaken throughout 2014. The source of these emissions is the engine identified as UP2, Engine #2 was removed and UP3 is no longer used (see Figure 7 above).

Limit values as per Schedule C.5 of the governing waste licence 127-1 are outlined in the table below;

Table 12: Emission Limit Values for continuous monitoring parameters at outlets for utilisation plant

Parameter	Utilisation Plant Emission Limit Value
Nitrogen oxides (No_x)	500mg/m^3
CO	1400mg/m^3

Note 1: Dry gas referenced to 5% oxygen by volume for utilisation plants.

As per condition 1.6 b) of the waste licence 127-1, and Schedule C.5, specifying the Emission Limits Values (ELV) for Landfill Gas Plant (see Table 9 above) the following incidents occurred during 2014 at the IPS compound in Dunsink.

Condition 6.3.2 has been complied with in full as of 27-09-2006; "The concentration limits …..shall be based on gas volumes under standard conditions of:-

In the case of landfill gas combustion plant:
Temperature 273K, pressure 101.3kPa, dry gas; 5% oxygen".

Throughout 2014 reporting of continuous landfill gas monitoring was as per protocols specified in condition 6.3.3.1.

Results for full year 2014 of continuous emissions monitoring

(a) No 24 hour mean value shall exceed the ELV;

0 No. 24 hour means exceeded 500 mg/m3 for Nitrogen Oxides and 0 No. 24 hour means exceeded 1400 mg/m3 for Carbon monoxide.

(b) 97% of all 30 minute mean values taken continuously over an annual period shall not exceed 1.2 times the emission limit value.

Zero No. 30 minute mean values or 0% of samples taken continuously over this quarter for Carbon monoxide exceeded 1.2 times the 1400mg/m3 ELV at engine number 1. Four No. 30 minute mean values or 0.03% taken continuously over this quarter for Nitrogen Oxides exceeded 1.2 times the 500mg/m3 ELV at engine number 1.

(c) No 30-minute mean value shall exceed twice the emission limit value.

Zero No. or 0 % of 30 minute mean values taken continuously over this quarter for Carbon monoxide exceeded twice the 1400mg/m3 ELV at engine number 1. Zero No. or 0% of 30 minute mean values taken continuously over this quarter for Nitrogen Oxides exceeded twice the 500mg/m3 ELV at engine number 1.

The equipment experienced significant downtime on multiple occasions in 2014 – from 12th February to 20th March, from 30th April to 16th July, from 15th August to 17th September and from 26th November to 4th December. These downtimes were reported as incidents to the Agency upon discovery.

The results above show compliance with the ELV at all times when the monitoring equipment was in working order. There are no indications that the ELV was breached when the equipment was out of order.

3.8.4 Summary of Continuous Sampling of Emissions at Landfill Gas Combustion Plant

The available results from continuous sampling of parameters from outlets at landfill gas combustion plant throughout 2014 presented a general picture of compliance with emission limit values set in the licence. The monitoring equipment experienced significant downtime on multiple occasions throughout 2014.

3.9 METEOROLOGICAL MONITORING

Condition 8.6 and Schedule D.6 require daily monitoring of precipitation volume, temperature (min/max), wind force and direction, evapotranspiration, humidity and atmospheric pressure. This data is obtained from Met. Éireann's Dublin Airport Weather Station and is available in full tabular format at the facility offices.

Table 13 below shows the monthly data – indicating a total rainfall of 927.2mm.

Table 13: Dublin Airport Meteorological Data 2014

year	month	Mean Temperature (C)	Rainfall (mm)	Mean MSL Pressure (hpa)
2014	1	5.7	101.6	994
2014	2	5.6	88.5	989
2014	3	6.8	53.7	1013
2014	4	8.9	34.2	1013
2014	5	11.3	91.5	1013
2014	6	13.6	36.2	1019
2014	7	15.8	35	1015
2014	8	13.9	173	1009
2014	9	13.1	26.5	1015
2014	10	10.9	90.2	1009
2014	11	7.7	140.9	1020
2014	12	5.4	55.9	1007
Total			**927.2**	

Total evaporation for the year was 785.3mm and Potential Evapotranspiration was 547.1mm.

4.0 RESOURCE & ENERGY CONSUMPTION

Resources consumed at Dunsink Landfill include diesel fuel, electricity and hydraulic oil. There were three main consumer entities operating on site:

Fingal County Council

Contractors

Bioverda Power Systems (BPS)

Resource	FCC	Contractors	BPS	Total 2014	Total 2013	Total 2012
Electricity MWh	12	Nil	42	56	132	132*
Diesel Litres – (for Vehicles)	3,000*	8,100*	Nil	11,100*	11,100*	11,100*
Hydraulic Oil (Litres)	Nil	60*	Nil	60*	60*	60*
Lubricating Oil (Litres)	Nil	200*	2,750	2,950*	3700*	3,938*

Table 14: Summary of Resources used on site for the reporting period

*Estimates

5.0 VOLUME OF LEACHATE PRODUCED AND DISCHARGED OFF-SITE

A flow metre measuring volumes of leachate produced from the facility or volumes of leachate discharged off-site was installed with the new pump house in June 2005. However, during 2004 efforts were made to get estimates for leachate production in Dunsink to determine the appropriate capacity of current and proposed leachate infrastructure. It was considered important in view of the daily discharge limit of 1,400m^3 imposed by the Sanitary Authority (Dublin City Council) to determine responses should this limit be breached.

5.1 METHODS FOR ESTIMATING LEACHATE PRODUCTION

An annual water balance calculation was performed to estimate leachate production in Dunsink. This figure is compared with figures measured as discharged offsite (See Table 14).

5.1.1 Water Balance Calculations

In calculating the water balance for Dunsink the formula used was taken from Environmental Protection Agency (EPA) guidelines (EPA 2000)[1]. Rainfall data from Dublin airport Meteorological station are used in this calculation. Data from 2014 is used in the average and scenario calculations.

Lo = [ER(A) + LW + IRCA + ER(l)] – [aW]
Whereby;
ER = effective rainfall (m).
A = Area of cell (m^2).
LW = Liquid waste (also includes excess water from sludges) M^3.
IRCA = Infiltration through restored and capped areas (m^3).
l = Surface area of lagoons (m^2).
a =absorptive capacity of waste M^3/t.
W = weight of waste deposited.

ER = Total Rainfall (R) minus Actual Evapotranspiration (AE).
For Dunsink landfill, following the guidance given in the EPA guidelines the ER is taken as R.
Total rainfall (R) for Dunsink in 2014 was 927.2mm or **0.9272m**.

A= The landfill area is 154 acres or 62.3 hectares or **623,000m²**. No area is active, there has been no dumping of municipal waste for over twelve years.

ER(A)=0

LW = Liquid waste is not deposited in Dunsink - $0m^3$.

[1] Environmental Protection Agency (2000). Landfill Manuals; Landfill Site Design. EPA, Ireland. ISBN 1 84095 026 9

IRCA = In areas that have been temporarily capped / restored an infiltration rate of 25-30% of the annual rainfall should be used. In areas which have been restored an infiltration rate of 2-10% should be applied. Given that the landfill is now restored 10% will be used as the infiltration rate through restored and capped areas.
10% of ER = 0.09272. 623,000m^2 X 0.09272m=57,764.56m^3

IRCA= 57,764.56m^3
l = In Dunsink the area of the lagoon is 6,000m^2, ER=0.9272
ER(l) =5,563.2m^3

aW = The total volume of waste has been calculated roughly, as 3.3 million m^3 on the basis of volume of three phases of landfill. It has also been roughly estimated that approximately 5,000,000 tonnes of waste have been deposited in Dunsink based on figures available from 1994 for annual inputs to the site. On this basis the roughly estimated waste density is 1.5t/m^3. This is very high and may be due to compaction by its overburden of subsoil or fill. The absorptive capacity of waste falls to negligible or none per tonne of waste before leachate is generated at densities greater than 1.2t/m^3,

aW=0 m^3/tonne

Lo = [ER(A) + LW + IRCA + ER(l)] – [aW]

Lo = [0 + 0 + 57,764.56+ 5,563.2] – [0]

Lo = 63,327.76m^3 pa

Lo = 173.5m^3 /d

Lo = 7.23m^3 /hr

5.1.2 Scenario Building

This rough estimate should be viewed in the context of varying annual rainfall over a year period. Water balance calculations should be carried out for a number of scenarios such as average monthly leachate volumes to be generated (See Table 15).

Table 15: Estimates of Leachate Production: Average Monthly rainfall recorded at Dublin Airport 2014 (Source: Met Éireann)

2014	Rain (mm)	Rainfall % Total	Estimated Monthly Leachate Production M³
January	101.6	10.96%	6939.28
February	88.5	9.54%	6044.55
March	53.7	5.79%	3667.71
April	34.2	3.69%	2335.86
May	91.5	9.87%	6249.45
June	36.2	3.90%	2472.46
July	35	3.77%	2390.5
August	173	18.66%	11815.9
September	26.5	2.86%	1809.95
October	90.2	9.73%	6160.66
November	140.9	15.20%	9623.47
December	55.9	6.03%	3817.97
Total 2014	927.2	**100.00%**	**63327.76**

The EPA guidelines (EPA, 2000) suggest a peak flow factor of 3 to 5 times the predicted average flow rate should be used when sizing plant / pipe work. Therefore using 2014 rain data and allowing for the now completed restoration of Dunsink, an adequate pump station should be able to handle about (7.23 * 3) to (7.23 * 5) or 21.69 m^3/hr to 36.15 m^3/hr during wet weather flow. During 2014, the volume of leachate discharged to public sewer was 174,665 m^3 which equates to 19.94 m^3/hr.

5.1.3 Results

Water balance calculations from EPA guidelines for Dunsink during peak wet conditions suggest that leachate production / discharge could be in the range of 520-867m^3 /day.

5.1.4 Discussion

The results presented above are estimates only. The results from this exercise (EPA model), indicate that Dublin City Council's discharge limit of 1,400m^3/day would not be breached and the leachate lagoon would not ordinarily be needed to deal with any excess leachate generated. The lagoon has a capacity of 26,700m^3. The pump house design facilitates pumping a maximum of 20 litres/s or 72m^3 / hr or 1,728m^3 / day and the modelled leachate production is well below this.

The new pumping arrangements installed during June 2005 provide data for the volume of leachate generated at the facility (Table 16).

Table 16: Estimates of Leachate Production and Volumes Measured as Discharged from site

2014	Rain mm	%	Estimated Monthly Leachate Production M^3	Volume Discharged as Measured By Flow Metre
January	101.6	10.96%	6939.28	19480
February	88.5	9.54%	6044.55	26332
March	53.7	5.79%	3667.71	15873
April	34.2	3.69%	2335.86	13427
May	91.5	9.87%	6249.45	9778
June	36.2	3.90%	2472.46	7540
July	35	3.77%	2390.5	6317
August	173	18.66%	11815.9	12168
September	26.5	2.86%	1809.95	7745
October	90.2	9.73%	6160.66	9964
November	140.9	15.20%	9623.47	24489
December	55.9	6.03%	3817.97	21552
Total	927.2	**100.00%**	**63327.76**	**174665**

The estimated monthly leachate production is significantly and substantially less than the actual volumes measured as discharged from site. There may be a groundwater influence in leachate generation at the site which accounts for this anomaly. The EPA water balance calculation is based on rainfall contribution to leachate generation.

Since 2006 a significant rise in leachate pumped off-site has occurred and it is considered that this is partially explained by the emplacement of two major leachate interception drains at the north and south of the facility. These leachate interception drains are obviously harnessing significant amounts of leachate and contributing to the leachate load at Dunsink.

5.1.5 Conclusion

Given all the results presented above (the varied estimates for leachate production and the actual volumes discharged offsite), it is suggested that the pump house design, in conjunction with the option to use the lagoon periodically provides sufficient capacity for dealing with the estimated leachate generated in the landfill. The completion of the restoration of the site during 2008 and 2009 has led to a reduced estimate of the amount of leachate generated by the facility through the water balance calculations. However the progress in landfill restoration has ultimately resulted in greater leachate collection and consequent increased volumes of leachate being discharged offsite. Nevertheless, the data provided by the leachate flow metre continues to vindicate the capacity designed into the leachate infrastructure.

5.2 ANNUAL WATER BALANCE CALCULATIONS AND INTERPRETATIONS

5.2.1 Introduction

The actual water balance calculations are outlined in detail in Section 5.1.

5.2.2 Discussion and Interpretation

It must be stated that the results are estimates only and based on many assumptions, which may or may not be correct. Furthermore data from key variables, such as depth of waste, proximity of groundwater table and effect of springs within waste body, are unavailable.

(i) Previous estimates of the wet weather flow and dry weather flows for leachate were prepared by Fingal County Council in 2003 on the basis of direct measurements. These estimates calculated Wet Weather Flow leachate volumes in the range of 1242-1656m^3/day and 414m^3/day during dry weather flow.

(ii) Water balance calculations are presented in Section 5.1.1 from EPA guidelines for Dunsink during peak wet conditions. They suggest that peak leachate production / discharge could be 867m^3/day during wet weather and 173m^3/day during average Flow.

(iii) During 2014, the volume of leachate discharged to public sewer was 174,665m^3 which equates to 19.9m^3/hr. (See Table 15). This suggests that average leachate production/discharge over the year is 479m^3/day.

These figures must be seen in the context of the bedrock geology and aquifer status of the site. The regional view of the vicinity of the Dunsink Landfill is of a low yielding aquifer.

5.2.3 Conclusion

The results from water balance calculations and from the pump house flow-metre are very different in terms of leachate modelled as generated on site and leachate volumes pumped off-site. However both sets of results validate the choice of leachate pump house design, which was based on empirical measurements of leachate flowing through the existing infrastructure. The pump house design facilitates pumping a maximum of 20 litres/s or 72m^3 / hr or 1728m^3 / day. Dublin City Council allows a maximum discharge of 1400 m^3 / day.

The worst case scenario for Dunsink from wet weather flows derived from previous estimates at 1,656m^3/day exceeds this limit. In instances when the pump-house cannot pump away volumes as they are generated from the facility the system is self regulating. During Wet Weather Flow peak flows in excess of the limit are rare and short in duration. When they do occur the automatic valve opens and closes to regulate the level of leachate in the sump and facilitate controlled discharge of leachate to public sewer or the lagoon. The lagoon has additional capacity of 26,700m^3 and if empty would have capacity for 16+ days pumping to lagoon during wet weather flow. This contingency provides for scenarios whereby pumping to the public sewer would not be feasible for any reason.

The results suggest that the pump house design, in conjunction with the option to use the lagoon periodically may provide sufficient capacity for dealing with the estimated leachate generated in the landfill.

5.3 ESTIMATED ANNUAL AND CUMULATIVE QUANTITY OF INDIRECT EMISSIONS TO GROUNDWATER

5.3.1 Emissions to Groundwater - Introduction

At present there are no estimates for annual and cumulative quantities of indirect emissions of leachate to groundwater.

Inferences are made from estimates in Sections 5.1.1 (estimates of leachate going through leachate management infrastructure during Wet Weather Flow) and 5.1.2 (estimates of leachate generated at the facility based on water balance calculations). At the outset, it must be stated that this is an exercise fraught with difficulties in that these estimates are based upon many assumptions, which may or may not be correct. Furthermore, data from key variables such as depth of waste, proximity of groundwater table and effect of springs within the facility, are unavailable.

Nevertheless the volumes of leachate discharged from the facility consistently and substantially exceed those estimated from water balance calculations.

5.3.1.1 Dry Weather Flow

The leachate infrastructure and discharge consents from Dublin City Council are more than adequate to deal with the volumes of leachate generated in Dunsink during dry weather flow. This suggests that there may be no indirect emissions to groundwater during Dry Weather Flow conditions.

5.3.1.2 Wet Weather Flow

The leachate infrastructure system seems to be "flashy" i.e. the amount of leachate going through the system rapidly increases following rainfall events. For all but the highest peaks in wet weather flow the leachate infrastructure and discharge consents from Dublin City Council are more than adequate to deal with the volumes of leachate generated in Dunsink and there is little risk of contamination of groundwater.

In instances when the pump-house cannot pump away volumes as they are generated from the facility the system is self regulating. Peak discharges during Wet Weather Flow are rare and short in duration, the automatic valve opens and closes to regulate the level of leachate in the sump and facilitate controlled discharge of leachate to public sewer or the lagoon.

5.3.2 Bedrock Geology of the Site and Aquifer Status

The western half of the landfill is underlain by Waulsortian Limestones. The GSI classify the County Meath Waulsortian Limestones as Ll, bedrock which is moderately productive only in local zones and this can be assumed to be the case for Dunsink.

The central part of the landfill is underlain by the Tober Colleen formation. The thinly bedded mudstones of the Tober Colleen formation which underlie the Calp Limestone have been classified by the GSI as Pu, bedrock which is generally unproductive due to the low permeability of the bedrock.

The eastern part of the site is underlain by basinal limestones consisting of limestone turbidites with bioclastic and calcareous mudstones (Calp Limestone). The Calp Limestone of County Dublin has been classified in the GSI Groundwater Protection Scheme as a Ll aquifer, bedrock which is generally moderately productive.

There is a minor faulting in the vicinity of the site and there is a minor fault running in a north-west south-east direction through the site.

A number of boreholes have been drilled into the bedrock on the site and a visual inspection of the drill chips from the monitoring boreholes indicated the site to be generally underlain by the soft black basinal (Calp) limestones and mudstones. These were recorded at all boreholes that were drilled to bedrock. The hardness and shade of the rock varied between boreholes and between different depths within the same borehole.
The monitoring well drilling programme confirmed the regional view that the area in the vicinity of Dunsink Landfill should be classified as a low to moderate yielding aquifer.

5.3.3 Conclusion

On the basis that:

(1) The underlying geology and overburden have produced a localised classification of the aquifer as generally low to moderate yielding.
(2) Measured volumes of leachate discharged from the facility are consistently and substantially higher than those calculated through water balance calculations.
(3) The groundwater monitoring programme indicates that groundwater around the facility is generally good;

It is considered that indirect discharges to groundwater are not significant in volumes or effect.

As per Technical Amendment to the Licence issued in January 2013, a risk screening exercise for the site is being prepared in accordance with the Guidance on the Authorisation of Discharges to Groundwater.

6.0 WORKS PROPOSED AND UNDERTAKEN & TIMESCALE FOR THOSE PROPOSED DURING THE COMING YEAR

6.1 WORKS UNDERTAKEN DURING 2014

The phased handover of the landfill and surrounding areas to the Parks (now Operations) Department was completed by December 2009.

The Environment Department continued with all monitoring obligations as set out in the landfill license for 2014.

The maintenance works related to the slope stability report, which were scheduled for 2014 did not take place and will be carried out in 2015.

The progress on resolving Compliance Investigations CI000397 (landfill gas infrastructure remediation) and CI000399 (compliance with dissolved methane ELV) has been slow and found to be unsatisfactory by the EPA as per site visit report SV01033. Work towards resolving these will be prioritised in 2015

In 2014, Fingal County Council Operations Department kept working closely with the Irish Horse Welfare Trust and local horse owners in Dunsink in an effort to address and regulate the situation with regard to the wandering horses in Dunsink. The Council, the Irish Horse Welfare Trust and the owners have now formed a club, which regulates the numbers of animals on the site, all of the horses are now microchipped and passported, and traceable to their owners.

6.2 WORKS PLANNED FOR 2015

In 2015, a new drain will be laid to drain the haulage road located above the attenuation pond, as identified in the slope stability report.

The leachate interception trench located West of the lagoon will be reinstated. It had been dug out in 2012 following flooding in the area and left as an open trench since. The works will seek to re-instate it to its original form.

A programme of works has been submitted to the EPA to address issues raised by Compliance Investigation CI000397 on the remediation of the gas infrastructure. Fingal County Council will work with Bioverda Power Systems to achieve the various steps identified in the programme. For 2015, these will mainly consist of engaging consultants to design the works and engaging civil works contractors to carry out these works. The civil works themselves will be scheduled in 2016. A surface VOC Emissions survey will be carried out in April 2015, and followed by installation of gas extraction from the area adjacent to the M50 if fugitive emissions are confirmed in this area.

Works to resolve Compliance Investigation CI000399 and ensure compliance with the ELV for dissolved methane concentration in the leachate pumped to the sewer will also be undertaken. These have started with meetings with Irish Water and Dublin City Council – the types of works required will be guided by the consultation with Irish Water, Dublin City Council and the EPA.

7.0 SITE SURVEY INDICATING EXISTING LEVELS OF THE FACILITY

Fingal County Council sought approval from the Environmental Protection Agency on the 13/08/2009, (letter Ref FCC-127-1-2009-010) not to undertake a topographic survey in 2009. This was due to the fact that there was no importation of soil into the restored landfill and no subsidence was anticipated. Approval was given by the EPA on the 20/08/2009 by telephone from Mr Eamonn Merriman. A telephone conversation with Mr Merriman on 28/01/2013 confirmed that an updated topographic survey was not required, and it is still considered that an updated survey would not be meaningful. Figure 8 below shows the topographic status of the landfill as established by the most recent topographic survey completed in 2007.

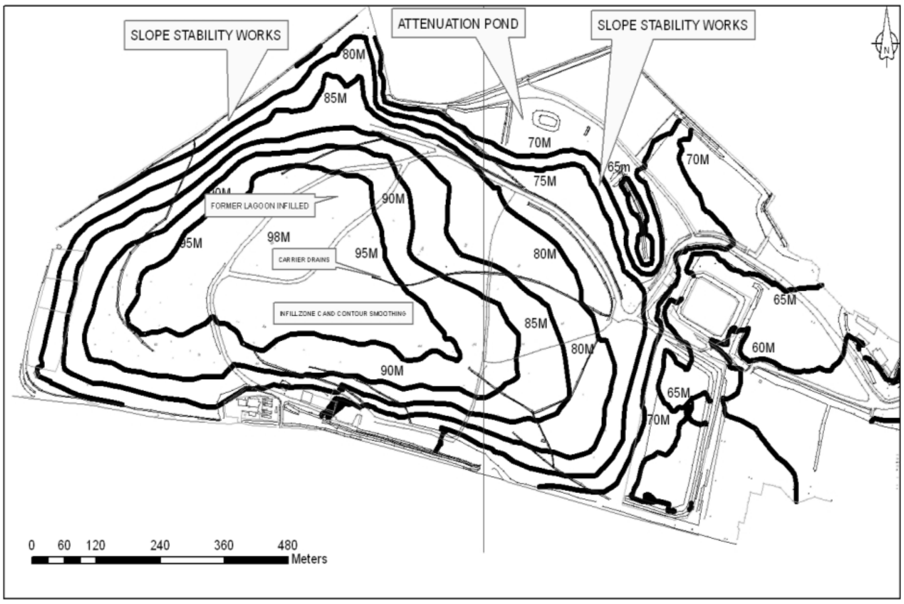

Figure 8: Simplified Topographical Map of Dunsink 2007

8.0 ESTIMATED ANNUAL & CUMULATIVE QUANTITY OF LANDFILL GAS EMITTED

In early 1996 a gas collection network was first configured throughout the whole landfilled portion of Dunsink. In 1999 the collection network was replaced by a larger more extensive arrangement.

It is comprised of a high-density polyethylene (HDPE) ring main around the site with a number of branch lines, which contains manifolds that connect to individual gas extraction wells.

There are approximately eighty-five gas extraction wells connected to manifolds throughout the site. Some of the wellheads are buried so it is not physically possible to confirm their condition or truly assess their performance. An additional thirteen gas wells were installed in Zone A and six additional gas wells were installed in Zone C during 2006.

There are ten branch lines off the main collection ring. These branches are 250mm in diameter and have multi-outlet manifolds configured to collect the gas from the wells in their vicinity. Each branch can be isolated where it connects to the main line. The manifold arrangement allows the line from the individual wells to be sampled and controlled. This has the effect of balancing the "good gas" with the bad to maintain the optimum quality to the utilisation plant.

The mainline ring is a 355mm HDPE pipe that completely encircles the landfill and finishes back at the utilisation plant compound. It has two dewatering chambers, one next to the old main landfill entrance and the other adjacent to the IPS compound, where the collected condensate is returned to the waste body via a disused extraction well. This ring main can be isolated in a number of locations to permit maintenance operations and still maintain operation of the utilisation plant.

The extraction pump which feeds the remaining generator (one was removed from site during 2006) is capable of collecting three thousand cubic metres of gas per hour at a maximum suction pressure of –150mbar. It is currently delivering approximately two hundred and sixty cubic metres per hour at a quality of 47%CH_4. In the unlikely event the engine is out of service for an extended duration, the integral flare can be run to maintain negative pressure on the landfill.

8.1 LANDFILL GAS CONSUMED BY UTILISATION PLANT 2014

Figures for landfill gas emitted from the facility are derived from data submitted by Bioverda Power Systems for the utilisation plant in Dunsink. The migration issues of previous years are largely resolved and the utilisation plant controls the vast majority of the landfill gas emitted. The figures for 2014 are presented in Table 16.

8.2 LANDFILL GAS CONSUMED BY UTILISATION PLANT AND GENERATED BY FACILITY 1996-PRESENT

The amount of landfill gas utilised by the plant has continued to trend downwards as would be expected but utilisation is dropping less sharply in recent years than the period 2003-2005.

In the last five years the gas engine occasionally 'ran out of gas' at viable concentrations indicating that the gas field production is decreasing at an increasing rate. That trend continued in 2014 with the engine regularly 'running out of gas' and having to be restarted after giving the field an opportunity to recover, typically 48-60 hours.

In August 2012, the engine was swapped for a smaller engine, more efficient to run with the amount and quality of landfill gas present in Dunsink. The new engine has been running since early August 2012.

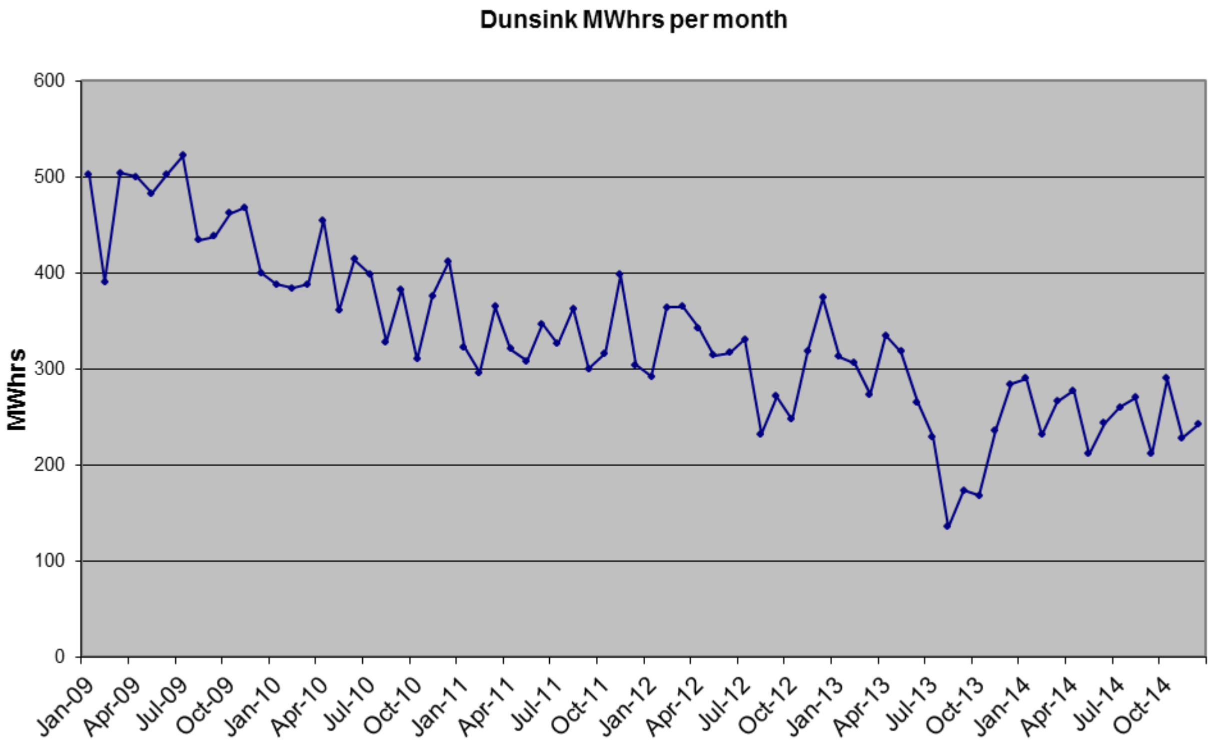

Figure 9 - MWhr exported per month at Dunsink.

Bioverda has reported that supply of gas has dropped sharply. It is considered that landfill gas migration is not an overwhelming issue at Dunsink and it is suggested that these figures reflect a downward pattern over time of landfill gas emitted from the facility. There are however issues of gas migration in the vicinity of G23 (exceedances previously reported in section 3.8.1, and evidence of grass discolouration observed in the summer of 2014 in that area). These will be investigated and remediated in early 2015 as part of the work undertaken through Compliance Investiagtion CI000397.

Bioverda
POWER SYSTEMS LTD

Table 17: landfill gas consumed by utilisation plant 2014

Dunsink	Units	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Total
Diesel	litres	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Electricity Consumed	kWh	878	4,222	1,998	3,632	5,130	3,815	3,749	2,963	4,579	2,423	4,702	3,555	**41,646**
Oil (Lubrication)	litres	450	400	-	400	-	350	-	350	-	400	-	400	**2,750**
Landfill Gas	m3	246,264	242,592	215,016	236,880	223,200	236,880	215,016	151,776	162,000	200,880	192,960	184,512	**2,507,976**
Average Monthly CH4	%CH4	45%	43%	52%	44%	46%	51%	44%	57%	52%	48%	42%	49%	
Electricity Exported	kWh	290,070	231,270	265,720	276,890	210,960	243,440	259,630	270,750	210,980	289,830	228,010	242,210	**3,019,760**

Data compiled by: Donal O'Cinneide & Noel McDermott, Bioverda Power Systems

9.0 REPORT ON PROGRESS TOWARDS ACHIEVEMENT OF ENVIRONMENTAL OBJECTIVES AND TARGETS CONTAINED IN PREVIOUS YEAR'S REPORT.

This is the eleventh AER under this Licence. In 2011 the majority of objectives for the facility nearing completion were fully completed and the Enclosed Flare was commissioned and handed over to Fingal County Council.

The phased handover of the landfill and surrounding areas to the Parks Department which began in 2008 was completed as of December 2009

Capping works, final landscaping and slope stability maintenance were completed in 2009.

Environmental Infrastructure Inspection, Maintenance and Monitoring were on-going in 2014.

The progress on resolving Compliance Investigations CI000397 (landfill gas infrastructure remediation) and CI000399 (compliance with dissolved methane ELV) has been slow and found to be unsatisfactory by the EPA as per site visit report SV01033 (December 2014). Work towards resolving these will be prioritised in 2015.

10.0 SCHEDULE OF ENVIRONMENTAL OBJECTIVES AND TARGETS 2015

The schedule of environmental objectives and targets for 2015 will be as follows:

Resolve the issue of the continuous breach of Emission Limit Value for Dissolved Methane in the leachate released to sewer (Compliance Investigation CI000399);

Work towards resolving the issues highlighted in Compliance Investigation CI000397 with the Gas Management Infrastructure – as per programme submitted to the EPA;

Continue the environmental monitoring to identity any potential sources of pollution coming from the landfill and resolve them as they happen.

11.0 PROCEDURES DEVELOPED RELATING TO THE FACILITY OPERATION

No new Standard operating procedures (SOP`s) were introduced in 2014.

12.0 TANK, PIPELINE AND BUND TESTING AND INSPECTION REPORT

Conditions 3.10.5 and 5.10.2 of the licence require that integrity tests be carried out on the leachate lagoon and oil bunds every three years by an independent and appropriately qualified chartered engineer.

12.1 LAGOON

An integrity test was carried out on the leachate lagoon in late January 2012 and it passed the test. The results of the integrity test were submitted to the Agency in February 2012 (FCC-127-1-2012-03). The test will be carried out again in early 2015.

12.2 OIL BUND IPS COMPOUND- DUNSINK

An integrity test was conducted during October 2007 on the oil bund in the IPS compound. The bund integrity was found to be good, it was watertight and found fit for its intended use. Oil is no longer stored in the compound – it is therefore proposed not to carry out further integrity test on the disused bund.

13.0 REPORTED INCIDENTS AND COMPLAINTS SUMMARIES

13.1 REPORTED ENVIRONMENTAL INCIDENTS

There were 16 reported incidents in 2014 reported under condition 1.6 c) "Any trigger level specified in this licence which is attained or exceeded"; and d) "Any indication that environmental pollution has, or may have, taken place." 11 of these were notified to the Inland Fisheries Ireland (IFI) during 2014.

In October 2012 the Agency agreed that any incidents relating to gas should only be notified to the Agency where methane levels exceeded 1% or where there were unusually high levels of carbon dioxide. Levels of carbon dioxide have regularly exceeded the 1.5% threshold and as per above agreement were not notified to the Agency. It was agreed that only unusually high levels for the site should be notified to the Agency from 1/11/12 onwards – which led to a considerable decrease of incidents notified compared to 2012.

Table 18: Summary of reported incidents during 2014

	Surface Water	Landfill Gas	Other
Month	**2014**	**2014**	**2014**
January	1		
February	3		
March			
April	1		1
May	1	1	
June			
July	1		
August	1		1
September		2	
October	1		
November	1		
December	1		
Total	**11**	**3**	**2**

Incidents from monthly inspections of surface waters and gas monitoring were notified to Fingal County Council, the EPA and the IFI where relevant. Exceedances of groundwater and Dissolved methane were reported in the quarterly reports.

Surface water incidents in the main were caused by elevated levels of ammonia and/or conductivity during Winter months particularly at the upstream monitoring stations (SW21 and SW18) and these reflected off site sources of contamination.

The EPA was notified of all incidents. IFI were notified on all incidents pertaining to surface water and Dublin City Council continues to be informed in relation to Dissolved Methane.

13.2 REPORTED ENVIRONMENTAL COMPLAINTS

Condition 10.4 of Licence 127-1 requires that the licensee shall maintain a written record of all complaints relating to the operation of the facility. No complaints were received by FCC during 2014.

It is considered that with the closure and completed restoration and improvements to landfill infrastructure since the end of 2009, the landfill is now less of an issue for its surroundings. This is a continuation of the trend in recent years. There were no complaints in 2009 while in 2008 there were just two complaints, compared with five for 2004, one for 2005 and two for 2006.

14.0 REVIEW OF NUISANCE CONTROLS

Condition 7 of Waste Licence 127-1 requires that vermin, birds, flies, mud, dust, litter, noise and odours do not give rise to nuisance at the facility or in the immediate area of the facility.

Staff for the Operations Department access the landfill on a regular basis and tackle any nuisance as they arise. The site is also monitored every week by the landfill manager and any outstanding issues observed are reported to be addressed.

15.0 FINANCIAL PROVISION, MANAGEMENT, STAFFING STRUCTURE & PROGRAMME FOR PUBLIC INFORMATION

15.1 FINANCIAL PROVISION

Fingal County Council has made a financial provision of €2.63 million on its accounts (as of 31 December 2014) for the aftercare of Dunsink Landfil.
Aftercare costs continued to be paid for from the revenue account and in 2014 no recourse was made to the capital reserve.

15.2 MANAGEMENT AND STAFFING STRUCTURE

The following comprised the current management structure for Dunsink Landfill in 2014.

Licence Compliance

TITLE	NAME	BASE	DUTIES AND RESPONSIBILITIES	QUALIFICATIONS	EXPERIENCE
Director of Services	Mr Garry O'Brien	Blanchardstown Office, Grove Road, Dublin 15	Responsible for Environment and Water Services Department.	BE Civil 1978, MIEI MBA in Local Government 2011	37 years LA experience in Civil Engineering and Management across a range of Departments.
Senior Executive Officer, Environment Division	Mr. Brendan Fleming	County Hall, Main Street Swords Co Dublin	Responsible for Waste Management and Enforcement.	B.E. Degree (Civil) (1980). Diploma in Highway and Geotechnical Engineering (1990). Diploma in Environmental Engineering (1993). C Eng. MIEI.	20 years Civil Engineering experience in local authorities and 14 years Management experience in local authority.
Senior Executive Engineer	Mr James Walls	County Hall, Main Street Swords Co Dublin	Responsible for Waste Infrastructure and Deputy Facility Manager in the absence of the Facility Manager.	B.Eng. in Civil Engineering. 1984 C Eng. MIEI	13 years Water Service experience. 16 years LA experience
Assistant Scientist	Mr Alain Kerveillant	County Hall, Main Street Swords Co Dublin and Dunsink Landfill	Facility Manager in respect of Waste Licence Compliance, Supervision of Scientific Monitoring, Reporting and Liaison with the Environmental Protection Agency.	Masters in Environment 2002 F.Á.S. Waste Management Training Course.	12 years experience in waste management (recycling infrastructure) in local authorities.

Landfill Management

TITLE	NAME	BASE	DUTIES AND RESPONSIBILITIES	QUALIFICATIONS	EXPERIENCE
Senior Executive Officer	John O'Brien	Blanchardstown Offices	Manager for the Castleknock / Mulhuddart Operational Area	N/A	N/A
Senior Executive Parks Superintendent	Ruairi O'Dulaing	Blanchardstown Offices	Responsibility For Development and transition	N/A	N/A
Inspector	Eamonn Brady	Coolmine Depot	Inspector	N/A	N/A
Assistant Foreman	Paul Rattigan	Coolmine Depot	Management of Landfill maintenance operations	N/A	N/A

15.3 PROGRAMME FOR PUBLIC INFORMATION

Public information can be viewed at the **Council's Headquarters** between 9.30 a.m. and 12.45 p.m. and 2.00 p.m. and 4.00 p.m. Monday to Friday (excluding public holidays), unless otherwise arranged by prior appointment.
Facilities for viewing information from a computer or files are provided at Dunsink Facility office by prior arrangement with the Landfill Manager.

The website (www.fingal.ie) informs that the remediation and restoration phase is now complete.

Site visits to **Dunsink Landfill** can be arranged by applying in writing to the Landfill Manager requesting a date and time for the proposed visit and indicating the number of visitors and the purpose of such a visit and whether any presentation is required. The use of cameras and video equipment during the visit must be agreed in advance with Fingal County Council. Such requests will be accommodated where possible. Operational and security matters will take precedence and visits may be cancelled at short notice.

16.0 STAFF TRAINING REPORT

As activities at the landfill have gradually decreased since the closure and restoration phases during 2008 and 2009, training requirements have also decreased.
Mr James Walls attended a Waste Management course from Environmental Training Solutions.
Mr Alain Kerveillant attended a two day course from the Chartered Institute of Waste Management on landfill gas management, a one-day course on pump operation and maintenance, and a two day course on environmental legislation.

GLOSSARY

Aftercare	Any measures that are necessary to be taken in relation to the facility for the purposes of preventing environmental pollution following the cessation of the activity in question at a facility.
Annually	At approximately twelve monthly intervals.
Aquifer	A formation (e.g. body of rock, gravel or sand stratum) that is capable of storing significant quantities of water and through which groundwater moves.
Baseline monitoring	Monitoring in and around the location of a proposed facility so as to establish background environmental conditions prior to any development of the proposed facility.
Borehole	A shaft installed outside a waste area for the monitoring of and/or extraction of landfill gas/groundwater. Established by placing a casing and well screen into the boring. If installed within the waste area, it is called a well.
Bunding / Berm	A dike or mound usually of clay or other inert material used to define limits of cells or phases or roadways; or to screen the operation of a landfill from adjacent properties; reducing noise, visibility, dust and litter impacts.
Capping	The covering of a landfill, usually with low permeability material (landfill cap).
Condensate	The liquid which forms within the gas pipe work due to the condensation of water vapour from landfill gas.
Detection limit.	The concentration of the determinant for which there is a 95% probability of detection when a single analytical result is obtained, detection being defined as obtaining a result which is significantly greater (p=0.05) than zero. Also referred to as Limit of Detection.
Direct discharge	The introduction into groundwater of List I or II substances without percolation through the ground or subsoil.
Downgradient	The direction towards which groundwater or surface water flows.
Emission	Meaning assigned by the EPA Act of 1992.
Flare unit	A device used for the combustion of landfill gas thereby converting its methane content to carbon dioxide.

Gas wells	Wells installed during filling or retrofitted later within the waste area for the monitoring of and/or removal of landfill gas either actively through an extraction system or passively by venting.
Groundwater	Groundwater is that part of the subsurface water which is in the saturated zone.
Hydrogeology	The study of the interrelationships of the geology of soils and rocks with groundwater.
Indirect discharge	The introduction into groundwater of List I or II substances after percolation through the ground or subsoil.
Inert landfill	A landfill that accepts only inert waste that fulfils the criteria set out in the Agency's draft manual "Waste Acceptance".
Lagoon	A land area used to contain liquid, e.g.leachate collected from landfill.
Landfill	Waste disposal facility used for the deposit of waste on to or in to land.
Landfill gas (LFG)	All gases generated from the landfilled waste.
Leachate	Any liquid percolating through the deposited waste and emitted from or contained within a landfill as defined in Section 5(1) of the Waste Management Act.
Leachate Well	Well installed within the waste area for the monitoring and/or extraction of leachate as opposed to borehole, which is the term, used when located outside the waste deposition area.
List I/II substances	Substances referred to in the EU Directives on Dangerous Substances (76/464/EEC) and Groundwater (80/68/EC).
Lower explosive limit (LEL)	The lowest percentage concentration by volume of a mixture of flammable gas with air which will propagate a flame at $25^{o}C$ and atmospheric pressure.
Macroinvertebrate	Larger invertebrate animals visible to the eye. Usually defined as those that are retained by a net or sieve of mesh size 0.6mm.
Minimum reporting value	This is the lowest concentration of a substance that can be determined with a known degree of confidence. It is a matrix dependent and not necessarily equivalent to the Limit of Detection of the analytical system but is generally a multiple of that value which reflects the robustness and reproducibility of the test method as applied to the specific

	matrix. Also referred to as the limit of quantitation or practical reporting limit.
Noise Sensitive Location	(NSL) Any dwelling-house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.
Quarterly	At approximately three monthly intervals.
Receiving water	A body of water, flowing or otherwise, such as a stream, river, lake, estuary or sea, into which water or wastewater is discharged.
Restoration	Works carried out on a landfill site to allow planned afteruse.
Substrata	River bed or bottom on or in which invertebrates live.
Taxa	Named taxonomic groups. Usually family or species level in biotic indices.
Trigger level	A parameter value specified in the licence, the achievement or exceedance of which requires certain actions to be taken by the licensee.
Upper explosive limit (UEL)	The highest percentage concentration by volume of a mixture of flammable gas with air which will propagate a flame at $25^{o}C$ and atmospheric pressure.
Void space	Space available to deposit waste.
Water balance	A calculation to estimate a volume of liquid generated. In the case of landfills, water balance normally refers to leachate generation volumes.

APPENDIX 1:

Groundwater Monitoring Results

Dunsink Landfill - Groundwater Quality Results Q1 2014

Parameter	Unit	Threshold Value	BH3	BH3 Control Values	BH3 Trigger Values	BH4	BH4 Control Values	BH4 Trigger Values	BH16	BH16 Control Values	BH16 Trigger Values	BH27	BH27 Control Values	BH27 Trigger Values
pH	pH Units	**6.5 - 9.5 [1]**	7.37	8	8.38	7.29	8.2	8.59	7.9	8.24	8.64	7.07	8.18	8.57
Conductivity	mS/cm	**1.875**	1.135	1.231	1.289	0.973	1.352	1.414	0.700	0.8379	0.8778	0.871	1.282	1.343
Temperature	°C	**-**	10.5	-	-	11.3	-	-	12.3	-	-	10.6	-	-
Ammoniacal Nitrogen	mg/l	**0.175**	<0.1	0.42	0.44	<0.1	0.31	0.33	0.05	0.21	0.22	0.03	1.89	1.98
Total Organic Carbon	mg/l	**N-A-C[1]**	<2	6.3	6.6	<2	6.3	6.6	<2	6.3	6.3	<2	5.25	5.5

Parameter	Unit	Threshold Value	BH31	BH31 Control Values	BH31 Trigger Values	BH32	BH32 Control Values	BH32 Trigger Values	BH33	BH33 Control Values	BH33 Trigger Values	BH34N	BH34 Control Values	BH34 Trigger Values	BH35	BH35 Control Values	BH35 Trigger Values
pH	pH Units	**6.5 - 9.5[1]**	7.42	8.39	8.79	7.4	8.18	8.6	7.53	8.58	8.99	7.49	8.61	9.02	7.59	Control & Trigger values not yet determined	
Conductivity	mS/cm	**1.875**	0.681	0.791	0.828	0.639	1.227	1.286	0.591	0.852	0.892	0.749	0.998	1.045	0.695		
Temperature	°C	**-**	10.8	-	-	10.9	-	-	10.7	-	-	11.3	-	-	10.5		
Ammoniacal Nitrogen	mg/l	**0.175**	0.13	1.575	1.65	0.08	0.735	0.77	<0.01	0.21	0.22	0.05	0.21	0.22	0.12		
Total Organic Carbon	mg/l	**N-A-C[1]**	<2	8.4	8.8	<2	5.25	6	<2	5.25	5.5	<2	6.3	6.6	<2		

Threshold value = Groundwater regulations SI 9 of 2010

[1] = Where no threshold value exists results are compared to EPA I.G.V. from Table 3.1 of EPA document "Towards Setting Guideline Values for the protection of Groundwater in Ireland"

Shading & Bold = Value has exceeded threshold value

Shading = Value has exceeded the Control Value

Shading = Value has exceeded Trigger Value

Sampled on 18th February 2014

Analysis conducted by Jones Environmental Laboratory

Dunsink Landfill - Groundwater Quality Results Q2 2014

Parameter	Unit	Threshold Value	BH3	BH3 Control Values	BH3 Trigger Values	BH4	BH4 Control Values	BH4 Trigger Values	BH16	BH16 Control Values	BH16 Trigger Values	BH27	BH27 Control Values	BH27 Trigger Values
pH	pH Units	**6.5 - 9.5 [1]**	7.16	8	8.38	7.07	8.2	8.59	7.14	8.24	8.64	7.02	8.18	8.57
Conductivity	mS/cm	**1.875**	1.050	1.231	1.289	1.09	1.352	1.414	0.642	0.8379	0.8778	0.911	1.282	1.343
Temperature	°C	**-**	11.0	-	-	11.8	-	-	11.7	-	-	11.6	-	-
Ammoniacal Nitrogen	mg/l	**0.175**	0.02	0.42	0.44	0.02	0.31	0.33	0.09	0.21	0.22	0.04	1.89	1.98
Total Organic Carbon	mg/l	**N-A-C[1]**	<2	6.3	6.6	<2	6.3	6.6	<2	6.3	6.3	<2	5.25	5.5

Parameter	Unit	Threshold Value	BH31	BH31 Control Values	BH31 Trigger Values	BH32	BH32 Control Values	BH32 Trigger Values	BH33	BH33 Control Values	BH33 Trigger Values	BH34N	BH34 Control Values	BH34 Trigger Values	BH35	BH35 Control Values	BH35 Trigger Values
pH	pH Units	**6.5 - 9.5[1]**	7.25	8.39	8.79	7.27	8.18	8.6	7.33	8.58	8.99	7.26	8.61	9.02	7.15	Control & Trigger values not yet determined	
Conductivity	mS/cm	**1.875**	0.697	0.791	0.828	0.651	1.227	1.286	0.605	0.852	0.892	0.799	0.998	1.045	0.790		
Temperature	°C	**-**	12.5	-	-	11.7	-	-	12.0	-	-	11	-	-	12.2		
Ammoniacal Nitrogen	mg/l	**0.175**	**0.23**	1.575	1.65	0.09	0.735	0.77	0.02	0.21	0.22	0.1	0.21	0.22	0.02		
Total Organic Carbon	mg/l	**N-A-C[1]**	<2	8.4	8.8	<2	5.25	6	<2	5.25	5.5	5	6.3	6.6	<2		

Threshold value = Groundwater regulations SI 9 of 2010

[1] = Where no threshold value exists results are compared to EPA I.G.V. from Table 3.1 of EPA document "Towards Setting Guideline Values for the protection of Groundwater in Ireland"

Shading & Bold = Value has exceeded threshold value

Shading = Value has exceeded the Control Value

Shading = Value has exceeded Trigger Value

Sampled on 21st May 2014

Analysis conducted by Jones Environmental Laboratory

Dunsink Landfill Q3 2014 Annual Groundwater Results

Groundwater Results

PARAMETER	UNIT	Threshold Value	BH3	BH3 Control Values	BH3 Trigger Values	BH4	BH4 Control Values	BH4 Trigger Values	BH16	BH16 Control Values	BH16 Trigger Values	BH27	BH27 Control Value	BH27 Trigger Values	BH31	BH31 Control Values	BH31 Trigger Values	BH32	BH32 Control Values	BH32 Trigger Values	BH33	BH33 Control Values	BH33 Trigger Values	BH34	BH34 Control Values	BH34 Trigger Values	BH34N	BH35
pH Value	**units**	**6.5 - 9.5**	7.09	8	8.38	7.03	8.2	8.59	7.28	8.24	8.64	7.14	8.18	8.57	7.14	8.39	8.79	7.21	8.18	8.6	7.27	8.58	8.99	Not sampled	8.61	9.02	7.26	7.22
Conductivity	**mS/cm**	**1.875**	1.097	1.231	1.289	1.046	1.352	1.414	0.652	0.838	0.878	0.925	1.282	1.343	0.700	0.791	0.828	0.663	1.227	1.286	0.624	0.852	0.892		0.998	1.045	0.647	0.710
Temperature	**°C**	**-**	12.4	-	-	12.2	-	-	15.0	-	-	12.0	-	-	13.0	-	-	13.0	-	-	11.6	-	-				13	11.9
Ammonical Nitrogen as N	**N mg/l**	**0.175**	<0.03	0.42	0.44	0.04	0.315	0.33	0.25	0.21	0.22	0.08	1.89	1.98	0.42	1.575	1.65	0.11	0.735	0.77	<0.03	0.21	0.22		0.21	0.22	1.72	0.19
Chloride (Cl)	**Cl mg/l**	**187.5**	91.1	76.65	80.3	94.0	91.35	95.7	24.6	40.95	42.9	46.6	75.6	79.2	28.4	32.55	34.1	26.5	26.25	27.5	17.2	28.35	29.7		32.55	34.1	8.8	26
Potassium (K)	**K mg/l**	**5 [1]**	3	5.25	5.5	4.1	7.77	8.14	1.9	3.78	3.96	2	3.36	3.52	1.7	4.41	4.62	3	6.72	7.04	1.8	5.25	5.5		3.99	4.2	3.0	1.6
Sodium (Na)	**Na mg/l**	**150**	50.9	51.24	53.68	51	37.8	39.6	16.5	21	22	28	47.25	49.5	18.2	25.2	26.4	17.8	21.31	22.33	16.7	82.95	86.9		64.58	67.7	52.5	26.5
Fluoride (F)	**F mg/l**	**1 [1]**	<0.3	0.315	0.33	<0.3	0.315	0.33	0.4	0.74	0.77	0.5	0.74	0.77	<0.3	0.945	0.99	<0.3	0.315	0.33	0.8	0.945	0.99		0.32	0.3	<0.3	1.3
Total Organic Carbon	**C mg/l**	**N-A-C**	<2	6.3	6.6	2	6.3	6.6	<2	6.3	6.6	2	5.25	5.5	<2	8.4	8.8	<2	5.25	6	<2	5.25	5.5		6.3	6.6	7	<2
Total Oxidised Nitrogen (water)	**N mg/l**	**N-A-C**	<0.2	-	-	0.3	-	-	1.3	-	-	0.8	-	-	<0.2	-	-	<0.2	-	-	<0.2	-	-		-	-	0.4	<0.2
Calcium (Ca)	**Ca mg/l**	**200 [1]**	161.5	-	-	175.8	-	-	90	-	-	125.3	-	-	123.6	-	-	106.3	-	-	90	-	-		-	-	93.3	93.9
Cadmium (Cd)	**Cd mg/l**	**0.003**	<0.0005	-	-	<0.0005	-	-	<0.0005	-	-	<0.0005	-	-	<0.0005	-	-	<0.0005	-	-	<0.0005	-	-		-	-	<0.0005	<0.0005
Chromium (Cr)	**Cr mg/l**	**0.037**	<0.0015	-	-	<0.0015	-	-	<0.0015	-	-	<0.0015	-	-	<0.0015	-	-	<0.0015	-	-	<0.0015	-	-		-	-	<0.0015	<0.0015
Copper (Cu)	**Cu mg/l**	**1.5**	<0.007	-	-	<0.007	-	-	<0.007	-	-	<0.007	-	-	<0.007	-	-	<0.007	-	-	<0.007	-	-		-	-	<0.007	<0.007
Total Cyanide (Cn)*	**Cn mg/l**	**0.037**	<0.01	-	-	<0.01	-	-	0.02	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-	<0.01	-	-		-	-	0.01	<0.01
Iron (Fe)	**Fe mg/l**	**0.2 [1]**	<0.02	0.018	0.019	<0.02	0.019	0.02	<0.02	0.03	0.028	<0.02	0.03	0.032	<0.02	0.0441	0.0462	<0.02	0.01365	0.0143	<0.02	0.0147	0.0154		0.0304	0.0319	<0.02	<0.02
Lead (Pb)	**Pb mg/l**	**0.018**	<0.005	-	-	<0.005	-	-	<0.005	-	-	<0.005	-	-	<0.005	-	-	<0.005	-	-	<0.005	-	-		-	-	<0.005	<0.005
Magnesium (Mg)	**Mg mg/l**	**50 [1]**	23.3	22.73	23.82	9.8	19.08	19.99	26.1	29.23	30.62	38	51.07	53.5	14.1	18.76	19.66	18.5	25.074	26.268	22.7	21.95	23.001		23.247	24.354	8.4	29.4
Manganese (Mn)	**Mn mg/l**	**0.05 [1]**	0.098	0.151	0.158	<0.002	0.0294	0.0308	0.158	0.169	0.177	0.074	0.077	0.08	0.758	0.9135	0.957	0.09	0.0672	0.0704	0.008	0.0483	0.0506		0.391	0.4103	0.375	0.133
Nickel (Ni)	**Ni mg/l**	**0.015**	<0.002	0.0116	0.0121	<0.002	0.042	0.044	<0.002	0.0021	0.0022	<0.002	0.063	0.066	<0.002	0.0105	0.011	<0.002	0.0105	0.011	<0.002	0.021	0.022		0.00525	0.0055	0.006	<0.002
Mercury (Hg)	**Hg mg/l**	**0.00075**	<0.001	-	-	<0.001	-	-	<0.001	-	-	<0.001	-	-	<0.001	-	-	<0.001	-	-	<0.001	-	-		-	-	<0.001	<0.001
Residue on Evaporation	**mg/l**	**-**	748	-	-	680	-	-	404	-	-	587	-	-	442	-	-	412	-	-	373	-	-		-	-	835	465
Sulphate (soluble) (SO4)	**SO4 mg/l**	**187.5**	116.58	-	-	114.61	-	-	46.46	-	-	67.27	-	-	53.27	-	-	49.83	-	-	23.93	-	-		-	-	28.42	59.56
Zinc (Zn)	**Zn mg/l**	**0.1 [1]**	0.005	-	-	0.009	-	-	0.004	-	-	<0.003	-	-	<0.003	-	-	<0.003	-	-	<0.003	-	-		-	-	<0.003	<0.003
Boron (B)	**B mg/l**	**0.75**	0.016	-	-	0.017	-	-	0.053	-	-	0.063	-	-	0.04	-	-	0.04	-	-	0.026	-	-		-	-	0.026	0.099
Alkalinity (as CaCO3)	**CaCO3 mg/l**	**N-A-C**	364	-	-	374	-	-	320	-	-	456	-	-	356	-	-	342	-	-	328	-	-		-	-	384	344
Ortho Phosphate	**P04 mg/l**	**-**	<0.06	-	-	<0.06	-	-	<0.06	-	-	<0.06	-	-	<0.06	-	-	<0.06	-	-	0.14	-	-		-	-	<0.06	<0.06

Threshold value = Groundwater regulations SI 9 of 2010

[1] = Where no threshold value exists results are compared to EPA I.G.V. from Table 3.1 of EPA document "Towards Setting Guideline Values for the protection of Groundwater in Ireland"

Shading = Value has exceeded threshold value

Shading = Value has exceeded the trigger/control value

* Laboratory level of Detection is above threshold value

\# Laboratory level of Detection is in excess of trigger/control value

Sampling was undertaken on the 12th August 2014.

N-A-C= No abnormal change

Analysis conducted by Jones Laboratories, UK

Marron Environmental
J102

Dunsink Landfill Annual Groundwater Quality Results, 12/08/2014
Volatile Organic Compounds

Compound	Unit	LOD	BH3	BH4	BH31	BH32	BH33	BH34N
Dichlorodifluoromethane	µg/l	<2	<2	<2	<2	<2	<2	<2
Chloromethane	µg/l	<3	<3	<3	<3	<3	<3	<3
Vinyl chloride	µg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bromomethane	µg/l	<1	<1	<1	<1	<1	<1	<1
Chloroethane	µg/l	<3	<3	<3	<3	<3	<3	<3
Trichlorofluoromethane	µg/l	<3	<3	<3	<3	<3	<3	<3
1,1-Dichloroethene	µg/l	<3	<3	<3	<3	<3	<3	<3
Dichloromethane	µg/l	<3	<3	<3	<3	<3	<3	<3
Methyl tertiary butyl ether (MTBE)	µg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
trans-1,2-Dichloroethene	µg/l	<3	<3	<3	<3	<3	<3	<3
1,1-Dichloroethane	µg/l	<3	<3	<3	<3	<3	<3	<3
cis-1,2-Dichloroethene	µg/l	<3	<3	<3	<3	<3	<3	<3
2,2-Dichloropropane	µg/l	<1	<1	<1	<1	<1	<1	<1
Bromochloromethane	µg/l	<2	<2	<2	<2	<2	<2	<2
Chloroform	µg/l	<2	<2	<2	<2	<2	<2	<2
1,1,1-Trichloroethane	µg/l	<2	<2	<2	<2	<2	<2	<2
1,1-Dichloropropene	µg/l	<3	<3	<3	<3	<3	<3	<3
Carbontetrachloride	µg/l	<2	<2	<2	<2	<2	<2	<2
1,2-Dichloroethane	µg/l	<2	<2	<2	<2	<2	<2	<2
Benzene	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene	µg/l	<3	<3	<3	<3	<3	<3	<3
1,2-Dichloropropane	µg/l	<2	<2	<2	<2	<2	<2	<2
Dibromomethane	µg/l	<3	<3	<3	<3	<3	<3	<3
Bromodichloromethane	µg/l	<2	<2	<2	<2	<2	<2	<2
cis-1,3-Dichloropropene	µg/l	<2	<2	<2	<2	<2	<2	<2
Toluene	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
trans-1,3-Dichloropropene	µg/l	<2	<2	<2	<2	<2	<2	<2
1,1,2-Trichloroethane	µg/l	<2	<2	<2	<2	<2	<2	<2
1,3-Dichloropropane	µg/l	<2	<2	<2	<2	<2	<2	<2
Tetrachloroethene	µg/l	<3	<3	<3	<3	<3	<3	<3
Dibromochloromethane	µg/l	<2	<2	<2	<2	<2	<2	<2
1,2-Dibromoethane	µg/l	<2	<2	<2	<2	<2	<2	<2
Chlorobenzene	µg/l	<2	<2	<2	<2	<2	<2	<2
1,1,1,2-Tetrachloroethane	µg/l	<2	<2	<2	<2	<2	<2	<2
Ethylbenzene	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
m,p-Xylene	µg/l	<1	<1	<1	<1	<1	<1	<1
o-Xylene	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Styrene	µg/l	<2	<2	<2	<2	<2	<2	<2
Bromoform	µg/l	<2	<2	<2	<2	<2	<2	<2
Isopropylbenzene	µg/l	<3	<3	<3	<3	<3	<3	<3
1,1,2,2-Tetrachloroethane	µg/l	<4	<4	<4	<4	<4	<4	<4
1,2,3-Trichloropropane	µg/l	<3	<3	<3	<3	<3	<3	<3
Bromobenzene	µg/l	<2	<2	<2	<2	<2	<2	<2
Propylbenzene	µg/l	<3	<3	<3	<3	<3	<3	<3
2-Chlorotoluene	µg/l	<3	<3	<3	<3	<3	<3	<3
1,3,5-Trimethylbenzene	µg/l	<3	<3	<3	<3	<3	<3	<3
4-Chlorotoluene	µg/l	<3	<3	<3	<3	<3	<3	<3
tert-Butylbenzene	µg/l	<3	<3	<3	<3	<3	<3	<3
1,2,4-Trimethylbenzene	µg/l	<3	<3	<3	<3	<3	<3	<3
sec-Butylbenzene	µg/l	<3	<3	<3	<3	<3	<3	<3
4-iso-Propyltoluene	µg/l	<3	<3	<3	<3	<3	<3	<3
1,3-Dichlorobenzene	µg/l	<3	<3	<3	<3	<3	<3	<3
1,4-Dichlorobenzene	µg/l	<3	<3	<3	<3	<3	<3	<3
n-Butylbenzene	µg/l	<3	<3	<3	<3	<3	<3	<3
1,2-Dichlorobenzene	µg/l	<3	<3	<3	<3	<3	<3	<3
1,2-Dibromo-3-chloropropane	µg/l	<2	<2	<2	<2	<2	<2	<2
1,2,4-Trichlorobenzene	µg/l	<3	<3	<3	<3	<3	<3	<3
Hexachlorobutadiene	µg/l	<3	<3	<3	<3	<3	<3	<3
1,2,3-Trichlorobenzene	µg/l	<3	<3	<3	<3	<3	<3	<3

Dunsink Landfill Annual Groundwater Quality Results, 12/08/2014

Semi-Volatile Organic Compounds

Compound	Unit	LOD	BH3	BH4	BH31	BH32	BH33	BH34N
Phenols								
2-Chlorophenol (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
2-Methylphenol (aq)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-Nitrophenol (aq)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-Dichlorophenol (aq)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4-Dimethylphenol (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
2,4,5-Trichlorophenol (aq)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,4,6-Trichlorophenol (aq)	µg/l	<10	<1	<1	<1	<1	<1	<1
4-Chloro-3-methylphenol (aq)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
4-Methylphenol (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
4-Nitrophenol (aq)	µg/l	<10	<10	<10	<10	<10	<10	<10
Pentachlorophenol (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
Phenol (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
PAHs								
2-Chloronaphthalene (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
2-Methylnaphthalene (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
Naphthalene (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
Acenaphthylene (aq)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
Fluorene (aq)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene (aq)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene (aq)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene (aq)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene (aq)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)anthracene (aq)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene (aq)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(bk)fluoranthene (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
Benzo(a)pyrene (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
Indeno(1,2,3-cd)pyrene (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
Dibenzo(a,h)anthracene (aq)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g,h,i)perylene (aq)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phthalates								
bis(2-Ethylhexyl) phthalate (aq)	µg/l	<5	<5	<5	<5	<5	<5	<5
Butylbenzyl phthalate (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
Di-n-Dibutyl phthalate (aq)	µg/l	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Di-n-Dioctyl phthalate (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
Diethyl phthalate (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
Dimethyl phthalate (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
Other SVOCs								
1,2,4-Trichlorobenzene (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
1,2-Dichlorobenzene (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
1,3-Dichlorobenzene (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
1,4-Dichlorobenzene (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
2,4-Dinitrotoluene (aq)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2,6-Dinitrotoluene (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
2-Nitroaniline (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
3-Nitroaniline (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
4-Bromophenylphenylether (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
4-Chloroaniline (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
4-Chlorophenylphenylether (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
4-Nitroaniline (aq)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Azobenzene (aq)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
bis(2-Chloroethyl)ether (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
bis(2-Chloroethoxy)methane (aq)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Carbazole (aq)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenzofuran (aq)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Hexachlorobenzene (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
Hexachlorobutadiene (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
n-Nitroso-n-dipropylamine (aq)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Hexachloroethane (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
Nitrobenzene (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1
Isophorone (aq)	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Hexachlorocyclopentadiene (aq)	µg/l	<1	<1	<1	<1	<1	<1	<1

Dunsink Landfill, Annual Groundwater Quality Results 12/08/2014 - Pesticides

Parameter (µg/l)	BH3	BH4	BH31	BH32	BH33	BH34N
Organochlorine Pesticides						
Aldrin	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Alpha-BHC	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Beta-BHC	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dieldrin	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Endosulphan I	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Endosulphan II	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Endosulphan Sulphate	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Endrin	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Gamma-BHC	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Heptachlor	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Heptachlor Epoxide	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
p,p'-DDE	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
p,p'-DDT	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
p,p'-TDE	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total methoxychlor	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Organophosphorous Pesticides	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Azinphos methyl	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Diazinon	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dichlorvos	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Disulfoton	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ethion	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ethyl Parathion	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fenitrothion	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Malathion	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Methyl Parathion	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mervinphos	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Dunsink Landfill - Groundwater Quality Results Q4 2014

Parameter	Unit	Threshold Value	BH3	BH3 Control Values	BH3 Trigger Values	BH4	BH4 Control Values	BH4 Trigger Values	BH16	BH16 Control Values	BH16 Trigger Values	BH27	BH27 Control Values	BH27 Trigger Values
pH	pH Units	**6.5 - 9.5** [1]	6.83	8	8.38	6.85	8.2	8.59	7	8.24	8.64	6.78	8.18	8.57
Conductivity	mS/cm	**1.875**	0.982	1.231	1.289	0.839	1.352	1.414	0.702	0.8379	0.8778	0.926	1.282	1.343
Temperature	°C	**-**	11.3	-	-	11.6	-	-	11.4	-	-	11.5	-	-
Ammoniacal Nitrogen	mg/l	**0.175**	0.02	0.42	0.44	0.02	0.31	0.33	0.05	0.21	0.22	0.05	1.89	1.98
Total Organic Carbon	mg/l	**N-A-C** [1]	7	6.3	6.6	7	6.3	6.6	3	6.3	6.3	3	5.25	5.5

Parameter	Unit	Threshold Value	BH31	BH31 Control Values	BH31 Trigger Values	BH32	BH32 Control Values	BH32 Trigger Values	BH33	BH33 Control Values	BH33 Trigger Values	BH34N	BH34 Control Values	BH34 Trigger Values	BH35	BH35 Control Values	BH35 Trigger Values
pH	pH Units	**6.5 - 9.5** [1]	6.96	8.39	8.79	6.74	8.18	8.6	7.11	8.58	8.99	6.95	8.61	9.02	7.06	Control & Trigger values not yet determined	
Conductivity	mS/cm	**1.875**	0.672	0.791	0.828	0.890	1.227	1.286	0.625	0.852	0.892	0.793	0.998	1.045	0.716		
Temperature	°C	**-**	11.2	-	-	11.4	-	-	11.2	-	-	11.3	-	-	11.3		
Ammoniacal Nitrogen	mg/l	**0.175**	**0.36**	1.575	1.65	0.12	0.735	0.77	0.03	0.21	0.22	**0.4**	0.21	0.22	0.17		
Total Organic Carbon	mg/l	**N-A-C** [1]	4	8.4	8.8	8	5.25	6	5	5.25	5.5	8	6.3	6.6	3		

Threshold value = Groundwater regulations SI 9 of 2010

[1] = Where no threshold value exists results are compared to EPA I.G.V. from Table 3.1 of EPA document "Towards Setting Guideline Values for the protection of Groundwater in Ireland"

Shading & Bold = Value has exceeded threshold value

Shading = Value has exceeded the Control Value

Shading = Value has exceeded Trigger Value

Sampled on 25th November 2014

Analysis conducted by Jones Environmental Laboratory

APPENDIX 2:

Surface Water and Leachate Monitoring Results

Dunsink Landfill - Surface Water Quality Results, Q1 2014

Parameter	Unit	SI 272 of 2009	Salmonid Regs	SW21	SW18	SW7	SW10	SW2	SW9	SW11	WWSW2	SW17
pH	pH Units	6-9 (note 1)	≥6≤9	8.00	7.53	7.94	7.82	8.17	7.87	8.19	7.91	8.06
Conductivity	µS/cm	1,000 (note 2)	-	**1140**	**1333**	**1160**	**1200**	**1090**	**1100**	**1260**	**1010**	**1140**
Temperature	^oC	-	<10^{o}C*	10.0	9.6	7.9	7.3	7.4	10.6	8.2	8.5	8.2
Dissolved Oxygen	%	80-120% saturation	50%>9mg/l	**50.9**	**47.9**	**63.6**	**53.5**	**65.3**	**64.2**	**52.9**	**47.4**	**55.1**
Ammoniacal Nitrogen#	mg/l	0.14	<1	0.1	0.07	0.09	0.09	0.05	**2.09**	**1.19**	**1.02**	**0.17**
BOD	mg/l	<=2.6 (note 3)	5	<1	<1	1	1	<1	**3**	2	**4**	<1
Total Suspended Solids	mg/l	-	25	<10	<10	<10	103	<10	<10	<10	<10	18

SI 272 of 2009 = European Communities Environmental Objectives (Surface Water) Regulations 2009
Bold = Value has exceeded Surface Water Regulations
Salmonid Regs= European Communities (Quality of Salmonid Waters) Regulation , SI 293 of 1988.
Shading = Value has exceeded Salmonid Regulations
*=Second Schedule of Salmonid Regulations states " temperature must not exceed 10 degrees celsius during the period from 1 November to 30 April where species which need cold water for reproduction are present
Note 1 : Hard water - >100mg/l CACO3
Note 2 : In the absence of a standard for conductivity under SI 272 of 2009 or the Salmonid Regulations SI 293 of 1988, a threshold value from SI 294 of 1989 (Quality of SW Intended for Abstraction of Drinking Water) has been used (1,000 µS/cm)
Note 3 : 95 %ile for waters achieving good status

Sampled on 18th February 2014

Analysis conducted by Jones Environmental Laboratory

Dunsink Landfill - Surface Water Quality Results, Q2 2014

Parameter	Unit	SI 272 of 2009	Salmonid Regs	SW21	SW18	SW7	SW10	SW2	SW9	SW11	WWSW2	SW17
pH	pH Units	6-9 (note 1)	≥6≤9	7.88	6.72	8.26	7.69	7.85	Dry	7.78	7.66	7.94
Conductivity	µS/cm	1,000 (note 2)	-	530	720	550	750	670		**1,050**	840	780
Temperature	°C	-	<10°C*	13.1	12.7	15.6	15.1	14.3		17.3	12.9	13.6
Dissolved Oxygen	%	80-120% saturation	50%>9mg/l	**42.0**	**44.9**	**52.1**	**44.4**	**47**		**43.4**	**45.5**	**50.1**
Ammoniacal Nitrogen#	mg/l	0.14	<1	**0.16**	0.09	0.06	0.05	0.03		0.05	0.04	0.09
BOD	mg/l	<=2.6 (note 3)	5	2	2	**11**	**9**	**5**		2	<1	**4**
Total Suspended Solids	mg/l	-	25	<10	<10	<10	<10	<10		<10	<10	<10

SI 272 of 2009 = European Communities Environmental Objectives (Surface Water) Regulations 2009
Bold = Value has exceeded Surface Water Regulations
Salmonid Regs= European Communities (Quality of Salmonid Waters) Regulation , SI 293 of 1988.
Shading = Value has exceeded Salmonid Regulations
*=Second Schedule of Salmonid Regulations states " temperature must not exceed 10 degrees celsius during the period from 1 November to 30 April where species which need cold water for reproduction are present
Note 1 : Hard water - >100mg/l CACO3
Note 2 : In the absence of a standard for conductivity under SI 272 of 2009 or the Salmonid Regulations SI 293 of 1988, a threshold value from SI 294 of 1989 (Quality of SW Intended for Abstraction of Drinking Water) has been used (1,000 µS/cm)
Note 3 : 95 %ile for waters achieving good status

Sampled on 21st May 2014

Analysis conducted by Jones Environmental Laboratory

Dunsink Landfill Annual Surface Water Quality Results, 12th August 2014

Surface Water Results

PARAMETER	UNIT	SI 272 of 2009	Salmonid	SW21	SW18	SW19	SW7	SW10	SW2	SW17	SW9	SW11	WWSW2
pH Value	units	6-9 (note 1)	6-9	8.5	7.3	7.41	7.99	7.65	8.13	8.16	8.64	8.34	8.1
Conductivity	mS/cm	1	-	0.25	0.76	0.72	0.400	0.480	0.52	0.95	0.74	0.570	0.95
Temperature	°C			16.4	16.7	16.0	16.5	17.1	15.6	15.9	16.6	15.0	15.9
Ammonical Nitrogen as N	N mg/l	0.14	1	**0.26**	0.07	**0.15**	0.04	0.05	0.05	0.07	**0.26**	0.08	0.09
Dissolved Oxygen (O2)*	O2 %l	80-120% saturation	50% >9mg/l	**59.6**	**47.4**	**45.2**	**69.5**	**56.4**	**47.3**	**54.1**	**52.2**	**50.5**	**57.0**
Chloride (Cl)	Cl mg/l	-	-	10.5	37.5	34.7	18.3	20.2	21.6	34.5	10.1	38.9	35.6
Potassium (K)	K mg/l	-	-	2.1	4.7	4.6	2.6	2.8	2.9	2.9	5.6	4.7	2.9
Sodium (Na)	Na mg/l	-	-	8.5	34.2	31.3	17.5	18.8	19.2	26.5	7.2	25.6	27.2
COD	02 mg/l	-	-	21	22	11	14	8	18	9	34	18	<7
BOD	02 mg/l	<=1.5 mean (note 2)	5	**3**	**2**	<1	**2**	<1	1	<1	**3**	1	<1
Total Oxidised Nitrogen (water)	N mg/l	-	-	0.5	1.4	1.2	<0.2	<0.2	0.3	2.5	0.9	<0.2	1.4
Total Suspended Solids	mg/l	-	25	19	<10	<10	<10	<10	59	11	73	12	<10
Calcium (Ca)	Ca mg/l	-	-	38.9	142.5	134.7	59.1	76.7	86.6	171.1	147.8	224.7	177.9
Cadmium (Cd)	Cd mg/l	0.15	-	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium (Cr)	Cr mg/l	0.0047	-	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0015
Copper (Cu)	Cu mg/l	0.03 (Note 3)	-	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007
Iron (Fe)	Fe mg/l	-	-	0.04	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Lead (Pb)	Pb mg/l	0.0072	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Magnesium (Mg)	Mg mg/l	-	-	2.1	10.6	9.9	4.6	5.6	6.3	9.8	8	14.2	10.2
Manganese (Mn)	Mn mg/l	-	-	0.004	0.028	0.059	<0.002	0.018	<0.002	0.009	<0.002	0.052	0.008
Nickel (Ni)	Ni mg/l	0.02	-	<0.002	<0.002	<0.002	0.003	0.003	0.003	0.003	0.006	0.003	0.002
Mercury (Hg)	Hg mg/l	0.00005	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Sulphate (soluble) (SO4)	SO4 mg/l	-	-	44.23	168.31	156.33	77.12	86.64	97.57	192.52	210.06	174.29	205.85
Zinc (Zn)	Zn mg/l	0.1	-	0.032	0.02	0.026	0.016	0.014	0.01	0.004	<0.003	0.004	0.004
Alkalinity (as CaCO3)	CaCO3 mg/l	N-A-C	-	80	242	248	116	154	164	282	84	**442**	292
Boron (B)	B mg/l	-	-	<0.012	0.038	0.038	0.017	0.023	0.03	0.045	0.023	0.067	0.046
ortho - phosphate	PO4 mg/l	-	-	<0.06	0.21	<0.06	<0.06	0.17	<0.06	0.07	<0.06	<0.06	0.08

Legend:
SI 272 of 2009 = European Communities Environmental Objectives (Surface Water) Regulations 2009
Bold = Value has exceeded Surface water Regulations
Salmonid Regs= European Communities (Quality of Salmonid Waters) Regulation, 1988
Shading = Value has exceeded Salmonid Water Quality Standard
Sampling was undertaken on 12th August 2014
Note 1 : Hard water - >100mg/l CACO3
Note 2 : For waters achieving good status
Note 3 : The standard of 0.005mg/l applies where hardness <100mg/l CACO3; 0.03mg/l applies where hardness >100mg/l CACO3
N-A-C= No abnormal change
* DO values are laboratory results

Analysis conducted by Jones Laboratories, UK

Marron Environmental
J102-01

Dunsink Landfill - Surface Water Quality Results, Q4 2014

Parameter	Unit	SI 272 of 2009	Salmonid Regs	SW21	SW18	SW19	SW7	SW10	SW2	SW9	SW11	WWSW2	SW17
pH	pH Units	6-9 (note 1)	≥6≤9	7.95	7.67	7.73	7.71	7.67	7.90	7.77	8.05	7.76	7.88
Conductivity	μS/cm	1,000 (note 2)	-	**1090**	**1140**	**1070**	720	800	820	**1100**	**1,300**	930	910
Temperature	^{o}C	-	<10^{o}C*	11.8	12.2	12.2	7.6	8.2	9.2	11.3	10.8	11.6	9.6
Dissolved Oxygen	%	80-120% saturation	50%>9mg/l	92.5	91.2	91.2	107.1	104.3	107.5	86.1	106.7	111.2	112.1
Ammoniacal Nitrogen#	mg/l	0.14	<1	0.09	0.05	0.08	0.12	0.08	0.08	**1.19**	**1.10**	0.08	**0.16**
BOD	mg/l	<=2.6 (note 3)	5	2	2	1	2	1	1	1	<1	<1	1
Total Suspended Solids	mg/l	-	25	10	22	14	13	<10	196	255	17	11	<10

SI 272 of 2009 = European Communities Environmental Objectives (Surface Water) Regulations 2009
Bold = Value has exceeded Surface Water Regulations
Salmonid Regs= European Communities (Quality of Salmonid Waters) Regulation , SI 293 of 1988.
Shading = Value has exceeded Salmonid Regulations
*=Second Schedule of Salmonid Regulations states " temperature must not exceed 10 degrees celsius during the period from 1 November to 30 April where species which need cold water for reproduction are present
Note 1 : Hard water - >100mg/l CACO3
Note 2 : In the absence of a standard for conductivity under SI 272 of 2009 or the Salmonid Regulations SI 293 of 1988, a threshold value from SI 294 of 1989 (Quality of SW Intended for Abstraction of Drinking Water) has been used (1,000 μS/cm)
Note 3 : 95 %ile for waters achieving good status

Sampled on 25th November 2014

Analysis conducted by Jones Environmental Laboratory

Table 1: Surface Water Quality Results -January 2014 to December 2014

Parameter	Unit	SI 272 of 2009	Salmonid Regs	SW21	SW21	SW21	SW21	SW21	SW21	SW21	SW21	SW21	SW21	SW21	SW21
				15/01/2014	18/02/2014	12/03/2014	16/04/2014	21/05/2014	11/06/2014	16/07/2014	12/08/2014	10/09/2014	21/10/2014	25/11/2014	17/12/2014
pH	pH Units	6-9 (note 1)	≥6≤9	7.5	8	7.67	7.79	7.88	8.21	8.32	8.5	8.28	7.86	7.95	7.86
Conductivity	µS/cm	1 ,000 (note 2)	-	1,690	1,140	830	970	530	530	490	250	670	230	1,090	1,020
Temperature	°C	-	<10°C*	10.4	10	11.2	10.8	13.1	13.7	17.4	16.4	13.8	12.9	11.8	109
Ammoniacal Nitrogen	mg/l	0.14 (note 3)	<1	0.33	0.1	0.15	0.12	0.16	0.11	0.36	0.26	0.116	0.09	0.09	0.08

Parameter	Unit	SI 272 of 2009	Salmonid Regs	SW18	SW18	SW18	SW18	SW18	SW18	SW18	SW18	SW18	SW18	SW18	SW18
				15/01/2014	18/02/2014	12/03/2014	16/04/2014	21/05/2014	11/06/2014	16/07/2014	12/08/2014	10/09/2014	21/10/2014	25/11/2014	17/12/2014
pH	pH Units	6-9 (note 1)	≥6≤9	7	7.53	6.97	7.02	6.72	7.8	6.94	7.3	7.66	8.22	7.67	7.13
Conductivity	µS/cm	1,000 (note 2)	-	1,540	1,333	1,260	1,250	720	730	690	760	870	730	1,140	1,080
Temperature	°C	-	<10°C*	9.9	9.6	8.5	12.3	12.7	12.6	15.3	16.7	13.6	12.3	12.2	11.1
Ammoniacal Nitrogen	mg/l	0.14 (note 3)	<1	0.12	0.07	0.05	0.06	0.09	0.07	0.16	0.07	0.105	0.05	0.05	0.06

Parameter	Unit	SI 272 of 2009	Salmonid Regs	SW17	SW17	SW17	SW17	SW17	SW17	SW17	SW17	SW17	SW17	SW17	SW17
				15/01/2014	18/02/2014	12/03/2014	16.04/2014	21/05/2014	11/06/2014	16/07/2014	12/08/214	10/09/2014	21/10/2014	25/11/2014	17/12/2014
pH	pH Units	6-9 (note 1)	≥6≤9	7.72	8.06	7.98	8.15	7.94	8.02	7.98	8.16	8.14	8.02	7.88	7.43
Conductivity	µS/cm	1 ,000 (note 2)	-	1,130	1140	1,040	980	780	860	880	950	890	760	910	1,020
Temperature	°C	-	<10°C*	8.2	8.2	9.2	11.5	13.6	13.6	15.9	15.9	12.7	11.1	9.6	9.6
Ammoniacal Nitrogen	mg/l	0.14 (note 3)	<1	0.1	0.17	0.49	0.03	0.09	0.04	0.17	0.07	0.086	0.19	0.16	0.07

Salmonid Regs= European Communities (Quality of Salmonid Waters) Regulation , SI 293 of 1988.

Bold = Value has exceeded Salmonid Regulations

SI 272 of 2009 = European Communities Environmental Objectives (Surface Water) Regulations 2009

Shading = Value has exceeded S.I 272 of 2009

Italics = Field reading

*=Second Schedule of Salmonid Regulations states " temperature must not exceed 10 degrees celsius during the period from 1 November to 30 April where species which need cold water for reproduction are present

Note 1 : Hard water - >100mg/l CACO3

Note 2: Trigger Level for Surface Waters

Note 3 : For waters achieving good status

Analysis conducted by Jones Environmental Forensics Laboratories, UK

Dunsink Landfill - Leachate Quality Results, Q1 2014

Parameter	Units	Leachate Sump	Lagoon
		18/02/2014	18/02/2014
pH	pH units	7.67	8.9
Conductivity	µS/cm	2,650	1,570
Temperature	^{o}C	11.3	7.4
Ammoniacal Nitrogen#	mg/l	84.69	0.15
Dissolved Methane	mg/l	2.590	0.004

Sampled on 13th November 2013

Analysis conducted by Jones Environmental Laboratory

Dunsink Landfill - Leachate Quality Results, Q2 2014

Parameter	Units	Lagoon	Leachate Sump
		21/05/2014	21/05/2014
pH	pH units	9.1	7.5
Conductivity	µS/cm	1,550	4,180
Temperature	°C	17.3	15.8
Ammoniacal Nitrogen#	mg/l	0.13	198.02
Dissolved Methane	mg/l	0.006	0.969

Sampled on 21st May 2014

Analysis conducted by Jones Environmental Laboratory

Dunsink Landfill Annual Leachate Results, 12st August 2014

Leachate Monitoring			
PARAMETER	**UNIT**	**Lagoon**	**Leachate Sump**
pH Value	units	10.17	7.48
Conductivity	mS/cm	1.4	2.69
Temperature	°C	16.8	15.5
Ammonical Nitrogen as N	N mg/l	0.12	136.22
Dissolved Methane	CH4 mg/l	0.021	4.25
Chloride (Cl)	Cl mg/l	304.6	277.2
Potassium (K)	K mg/l	87	86.2
Sodium (Na)	Na mg/l	199.8	197.2
COD	02 mg/l	184	99
BOD	02 mg/l	22	9
Total Oxidised Nitrogen (water)	N mg/l	<0.2	0.2
Calcium (Ca)	Ca mg/l	16.6	229.2
Cadmium (Cd)	Cd mg/l	<0.0005	<0.0005
Chromium (Cr)	Cr mg/l	<0.0015	0.0016
Copper (Cu)	Cu mg/l	<0.007	<0.007
Fluoride (F)	F mg/l	<0.3	<0.3
Iron (Fe)	Fe mg/l	0.082	0.075
Lead (Pb)	Pb mg/l	<0.005	<0.005
Magnesium (Mg)	Mg mg/l	21.6	39.8
Manganese (Mn)	Mn mg/l	0.01	1.691
Nickel (Ni)	Ni mg/l	0.018	0.02
Mercury (Hg)	Hg mg/l	<0.001	<0.001
Sulphate (soluble) (SO4)	SO4 mg/l	16.34	102.73
Zinc (Zn)	Zn mg/l	<0.003	0.004
Boron (B)	B mg/l	0.749	0.769
ortho-phosphate	PO4 mg/l	0.64	<0.06

Analysis conducted by Jones Laboratories, UK

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J102-01

Dunsink Landfill - Leachate Quality Results, Q4 2014

Parameter	Units	Leachate Sump	Lagoon
		25/11/2014	25/11/2014
pH	pH units	7.2	9.5
Conductivity	µS/cm	2,360	1,680
Temperature	^{o}C	12.6	6.8
Ammoniacal Nitrogen	mg/l	63.38	17.75
Dissolved Methane	mg/l	6.285	0.01

Sampled on 25th November 2014

Analysis conducted by Jones Environmental Laboratory

APPENDIX 3:

Pollution Release and Transfer Register

Guidance to completing the PRTR workbook

AER Returns Workbook

Version 1.1.18

REFERENCE YEAR	2014

1. FACILITY IDENTIFICATION

Parent Company Name	Fingal County Council
Facility Name	Dunsink Landfill aka Dunsink Civic Amenity
PRTR Identification Number	W0127
Licence Number	W0127-01

Classes of Activity

No.	class_name
-	Refer to PRTR class activities below

Address 1	Dunsink Lane
Address 2	Finglas
Address 3	
Address 4	
	Dublin
Country	Ireland
Coordinates of Location	-6.33899 53.3903
River Basin District	IEEA
NACE Code	3832
Main Economic Activity	Recovery of sorted materials
AER Returns Contact Name	Alain Kerveillant
AER Returns Contact Email Address	alain.kerveillant@fingal.ie
AER Returns Contact Position	Assistant Scientist
AER Returns Contact Telephone Number	01-8708461
AER Returns Contact Mobile Phone Number	0879915832
AER Returns Contact Fax Number	
Production Volume	0.0
Production Volume Units	
Number of Installations	0
Number of Operating Hours in Year	0
Number of Employees	0
User Feedback/Comments	
Web Address	

2. PRTR CLASS ACTIVITIES

Activity Number	Activity Name
50.1	General
50.1	General

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

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

4. WASTE IMPORTED/ACCEPTED ONTO SITE

Guidance on waste imported/accepted onto site

Do you import/accept waste onto your site for on-site treatment (either recovery or disposal activities) ?	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# : W0127 | Facility Name : Dunsink Landfill aka Dunsink Civic Amenity | Filename : PRTR 2014.xls | Return Year : 2014 | 30/03/2015 13:18

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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	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0

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

SECTION B : REMAINING PRTR POLLUTANTS

RELEASES TO AIR					Please enter all quantities in this section in KGs				
POLLUTANT		METHOD			QUANTITY				
			Method Used		Flare	Engine			
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
					0.0	0.0	0.0	0.0	0.0
01	Methane (CH4)	C	OTH	Estimated generation per GAS SIM model ; flare and engine emissions from utilisation data	51.0	11023.2	1017673.2	0.0	1006599.0
03	**Carbon dioxide (CO2)**	C	OTH	Estimated generation per GAS SIM model ; flare and engine emissions from stack monitoring data	4415.0	675236.0	6575477.0	0.0	5895826.0

* 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: Dunsink Landfill aka Dunsink Civic Amenity

Please enter summary data on the quantities of methane flared and / or utilised	**T (Total) kg/Year**	**M/C/E**	**Method Used** Method Code	Designation or Description	**Facility Total Capacity m3 per hour**	
Total estimated methane generation (as per site model)	1560315.0	C	other	GAS SIM data obtained from RPS	N/A	
Methane flared	2505.0	E	other	Data provided by Bioverda -	2500.0	(Total Flaring Capacity)
Methane utilised in engine/s	540137.0	E	other	Data provided by Bioverda -	360.0	(Total Utilising Capacity)
Net methane emission (as reported in Section A above)	1017673.0	C	c	Total generated - flared - util	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 concerns Releases from your facility

RELEASES TO WATERS					Please enter all quantities in this section in KGs			
POLLUTANT					QUANTITY			
			Method Used					
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 B : REMAINING PRTR POLLUTANTS

RELEASES TO WATERS					Please enter all quantities in this section in KGs			
POLLUTANT					QUANTITY			
			Method Used					
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					
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

SECTION A : PRTR POLLUTANTS

OFFSITE TRANSFER OF POLLUTANTS DESTINED FOR WASTE-WATER TREATMENT OR SEWER					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD			QUANTITY			
			Method Used					
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 B : REMAINING POLLUTANT EMISSIONS (as required in your Licence)

OFFSITE TRANSFER OF POLLUTANTS DESTINED FOR WASTE-WATER TREATMENT OR SEWER					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD			QUANTITY			
			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

SECTION A : PRTR POLLUTANTS

RELEASES TO LAND					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	T (Total) KG/Year	A (Accidental) KG/Year
					0.0	0.0	0.0

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

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

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

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

5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE | PRTR# : W0127 | Facility Name : Dunsink Landfill aka Dunsink Civic Amenity | Filename : PRTR 2014.xls | Return Year : 2014 | 30/03/2015 13:19

Please enter all quantities on this sheet in Tonnes 3

Transfer Destination	European Waste Code	Hazardous	Quantity (Tonnes per Year)	Description of Waste	Waste Treatment Operation	Method Used		Location of Treatment	Haz Waste : Name and Licence/Permit No of Next Destination Facility Non Haz Waste: 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	174665.0	landfill leachate other than those mentioned in 19 07 02	D9	M	Volume Calculation	Offsite in Ireland	Dublin City Council Waste Water Treatment Facility,D0034-01	.,Ringsend,Dublin 4,.,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