Clare County Council

Tradaree Point Sludge Disposal Facility

Annual Environmental Report 2014

Waste Licence Reg. No. W0037-01

Response Group

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1.0 INTRODUCTION

Response Group was commissioned by Clare County Council to compile an Annual Environmental Report (AER) required under Condition 11 of Waste Licence Reg. No. W0037-01 for a Sludge Disposal Facility situated at Tradaree Point, Shannon (Clonmoney South), Co. Clare for the period January 2014 to December 2014.

1.1 Background

The Environmental Protection Agency (EPA) issued Shannon Free Airport Development Company Limited with a Waste Licence on 1st May 2003. The ownership of the facility was subsequently passed onto Clare County Council under the same Waste Licence.

Under Condition 11.6, Section 11 of the W0037-01, an Annual Environmental Report (AER) must be prepared and submitted to the EPA for approval. The AER for the facility includes the information specified in Schedule F of the Waste Licence, Content of the Environmental Report, and has been prepared in accordance with the EPA (1999) Waste Licensing – Draft Guidance Note on Environmental Management Systems and Reporting to the Agency, the EPA Guidance Note for the Annual Environmental Report and the EPA AER/PRTR Guidance Document.

1.2 Reporting Period

This AER details the activities carried out at the facility in the period from January 2014 to December 2014 in accordance with W0037-01.

1.3 Site Description

The site is situated approximately 4.5km south east of Shannon Town to the south-west of Bunratty (OS National Grid Reference 143,600E, 160,100N). The site is located on a peninsula, which extends into Shannon Estuary. A grassland constructed clay embankment, average height 5.0 mOD, lies to the south of the site between Shannon Estuary and the site.

The site location is shown in **Figure 1**.

1.4 Facility Layout

The landfill (sludge disposal facility) is divided into two sections - the capped historic sludge disposal area and the four newly constructed lined cells. The area where the new cells have been constructed has an average elevation of 1.5mOD. The cells are bounded to the south-east and north-east by an open land drain. The average drain bed level is 0.6mOD. This discharges to Shannon Estuary via an outlet pipe under the clay embankment which is controlled by a sluice valve. A 10m wide buffer zone exists along the southern perimeter of the site between the edge of the catchment drain and the capped sludge cells. No sludge or restoration material is stored within this zone.

The layout of the facility is illustrated in **Figure 2**.

Tradaree Point Wastewater Treatment Plant (WWTP) provides treatment of both domestic and industrial effluent from Shannon Town and Shannon Industrial Estate. The sludge facility accepts waste sludge from the Tradaree Point WWTP. Sludge has been disposed on the site since approximately 1981.

2.0 FACILITY INFRASTRUCTURE AND OPERATION

2.1 Waste Activities Carried Out At the Facility

The facility is licensed to handle a maximum of 2,500 tonnes of waste per annum. This comprises 750 tpa (tonnes per annum) treated dewatered non-hazardous domestic sludge (EWC code 19 08 05) and 1,750 tpa of industrial sludge (EWC code 19 08 12, 19 08 14) in engineered cells within the facility boundary. Waste activities licensed at the facility under the Third and Fourth Schedules of the Waste Management Act 1996, are detailed below.

Table 2.1 Licensed Waste Disposal Activities in Accordance with the Third Schedule of the Waste Management Act

Class 1	Deposit on, in or under land (including Landfill)*. This activity is limited to the disposal of treated dewatered non-hazardous domestic and industrial sludge in the existing activity cells within the facility.
Class 4	Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons
Class 5	Specially engineered landfill, including placement into lined discreet cells which are capped and isolated from one another and the environment.
Class 6	Biological treatment not referred to elsewhere in the Schedule which results in final compounds or mixtures which are disposed of by means of any activity referred to in paragraphs 1 to 5 paragraphs 8 to 10 of this Schedule (including evaporation, drying and calcination).
Class 13	Storage prior to submission to any activity referred to in a preceding paragraph of this schedule, other than temporary storage, pending collection, on the premises where the waste concerned is produced.

2.2 Methods of Deposition of Sludge

Two different waste effluent streams undergo separate treatment at Tradaree Point WWTP. Industrial wastewater is treated in the Industrial Treatment Plant and domestic wastewater is treated in the Domestic Treatment Plant.

The waste disposed of at the sludge disposal facility is treated dewatered sludge from the Tradaree WWTP, Doolough, Castlelake, Drumcliff, Kilmaley-Inagh and Toonagh Group Water Schemes. All sludges accepted except from the Tradaree WWTP are water treatment sludge.

Sludge generated in Tradaree WWTP is sent to a dewatering building to the east of the plant. Both domestic and industrial sludge are dewatered using a centrifuge after which the sludge is conveyed into an open trailer. The dewatered sludge is then transported to the landfill area and unloaded using a dumper. Sludge from off site is transported to site by Clare County Council and Biocore.

The sludge is further dried naturally in the open air. Older dried sludge are excavated from their initial deposition area and heaped into mounds where they are permitted to re-vegetate by natural succession.

The new cells are being filled sequentially in a similar manner. Cell 2 is currently the active cell and sludge is transported for land filling on a daily basis between Monday and Friday by a dumper. Transportation to the landfill is facilitated by the provision of a causeway at the cell entrance which provides a dry area for the unloading of the sludge.

2.3 Quantity and Composition of Sludge Disposed

2.3.1 Sludge Disposed 2014

The facility is licensed to handle up to 2,500 tonnes of waste sludge per annum. The quantities of mixed industrial and domestic sludge disposed at the facility between January and December 2014 are presented in Table 2.2 overleaf.

As specified in Condition 1.1 of the Waste Licence, only those categories and quantities listed in Part 1 (Activities Licensed) [See also Schedule A] can be accepted at the facility. During 2014, approximately 1144 tonnes of sludge were accepted at the facility. This quantity is below the maximum 2,500 tonnes of waste per annum permitted.

Table 2.2: Quantities of Sludge Disposed in 2014

Month	Quantity (Kg)
January	128000
February	98100
March	104800
April	95710
May	126440
June	94000
July	60190
August	98500
September	76700
October	107760
November	95500
December	58460
Total (kg)	1144160
TOTAL (tonnes)	1144.16

2.3.2 Sludge Disposed 2004-2014

Table 2.3 below details the quantities of sludge disposed at the facility between 2005 and 2014.

Year	Quantity (Tonnes) Sludge Disposed/Annum
2005	954
2006	408
2007	756
2008	548
2009	732
2010	489
2011	228
2012	1055
2013	1379
2014	1144

2.4 Calculated Remaining Capacity of the Facility

The volume of sludge disposed in 2011 was 228 tonnes this low volume is due mainly to the dewatering unit being out of operation for much of the year as the belt press has been taken out of operation. The volume of sludge accepted in 2012 increased to 1055 tonnes, and increased again in 2013 to 1379 tonnes the reason for these increases has been the running of the new centrifuge in Tradaree and the acceptance of sludge from outside plants as listed in section 2.1.

The total capacity of the four lined cells is 16,464m3. Landfilling in the lined cells commenced in Cell 1 in 2005 and reached it capacity in 2013, so Cell 2 was opened on 28th June 2013. As Cell 1 had been filled beyond capacity it was necessary to transfer sludge from Cell 1 into Cell 2 when this cell opened. Cell 2 is now nearing its capacity and it is expected that Cell 3 will need to be opened in mid 2015. It is expected that Cell 1 and Cell 2 will both be capped by Dec 2015.
In 2014, approximately 1144 tonnes of sludge was disposed of at the facility.

The density of dewatered sludge varies depending on the dry matter concentration. In 2014, the average cake % dry matter reached in the sludge was 25.5%. At this rate, the bulk density is typically calculated at rate of 1.27t/m3 (assuming that the ratio of volatile and fixed sludge is 65%:35%). Therefore, at this density, the volume of waste sludge disposed of at the facility during 2014 was 1025m3.

Based on the 2014 figure, it is expected that the landfill should reach its full capacity by 2020. However, if yearly tonnages remain low this figure could be extended.

2.5 Restoration of Former Sludge Disposal Areas and Completed Cells/Phases

A restoration and aftercare management plan for the facility was prepared in consultation with the EPA Restoration and Aftercare Manual and was previously submitted to the Agency in January 2004. The Agency confirmed in a letter (Ref. 37-1/GEN03bd) that the plan was to their satisfaction.

All unlined sludge mounds have been capped along with all unlined cells after EPA approval. Waste sludge continues to be disposed of into the second of the newly lined active cells – Cell 2.

The total capped area occupied by waste in the facility is 20,112m2. Between 2005 and June 2013, a total of 5,923 tonnes of waste has been deposited into Cell 1. Since June 2013, a total of 1770 tonnes of waste has been deposited into Cell 2.

2.6 Topographical Survey

A topographical survey was undertaken during September 2003 as part of Licence Condition 8.10.1. The results of the survey were submitted to the Agency in the 6-month report on Drawing No.1, submitted in October 2003. No additional topographical surveys have taken place at the facility since 2003.

2.7 Leachate Management

2.7.1 Leachate Pumping Records

A total of 32,597 m3 of Leachate was pumped during the reporting period. Leachate is collected from the existing sludge disposal area (Cell 2), the inactive cells (Cells 3&4), The uncapped Cell 1 (full) and the capped unlined area via a network of drains which are connected to a Leachate collection sump and from here it is pumped to Tradaree WWTP. There is no flow meter on the Leachate line so flows are calculated based on the hours run of the pumps and the pump capacity. The pump has a capacity to pump 75m3 per hour. Heavy rainfall also leads to increased flow readings due to the rainwater captured in the inactive cells.

The monthly totals of Leachate generated during 2014 are detailed in Table 2.4 below.

Table 2.4: The monthly averages of Leachate generated in 2014

Month	Flow Rate (m^3/Month)
January	5937
February	6243
March	2705
April	1813
May	4527
June	697
July	184
August	1258
September	1200
October	1137
November	3774
December	3122
Total (M^3/Year)	32597

2.8 Estimated Annual and Cumulative Quantities of Landfill Gas Emitted

Landfill gas production is a function of the biodegradable portion of the wastes and other factors including the waste density and moisture content. According to the UK EA, total gas generation depends on the waste type being deposited on site and also the degradable carbon content.

However the rate of decomposition depends on the site-specific factors. The time taken to decompose will directly influence the period over which landfill gas is generated.

Emissions through the in situ clay base and side walls of the landfill facility are expected to be small. The capped sludge disposal area does not have an engineered base lining. Site investigation results indicate that in situ clay has a hydraulic conductivity of less than 1 x 10-9m/s. Gas levels are being measured in monitoring boreholes installed in the ground along the perimeter of the landfill to check if there are any emissions.

The UK Environment Agency's Guidance on the Management of Landfill Gas (November 2002) suggests that biodegradable wastes may be considered to have an approximate gas yield of between 5 - 10 m3/t/yr over the first ten years of a sites life. In this instance, the waste sludge was dried to an average of 25.5% dry matter in 2014. Assuming that the dry matter content would equate to the biodegradable component of the sludge and based on a total input in 2014 of 291 tonnes of biodegradable waste (25.5% of 1144 total tonnes), this would indicate that the following upper and lower quantities of landfill gas might be generated:

- At 5 m3/t/yr an approximate production rate of 1,890m3 per annum
- At 10 m3/t/yr an approximate production rate of 3,780m3 per annum

There are a number of significant controlling factors relating to landfill gas generation/extraction rates from biodegradable wastes including placement density, moisture content, quality of containment systems, climatic conditions and quantity of degradable cellulose available.

It must also be stressed that the above figure is based upon an estimation of the amount of available degradable waste deposited within the landfill body and therefore must only be considered to be an approximation.

The most recent landfill gas assessment at Tradaree was undertaken by Tobin Consulting Engineers in April 2008. The purpose of the assessment was to determine the total quantity of landfill gas produced at the facility in order to determine the viability of constructing a landfill gas flare on-site.

The assessment was undertaken using a landfill gas generation model GasSim 2.0. Data from previous assessments undertaken in 2004 and 2007 were used in the assessment. The results show a peak in landfill gas production in 2003 (12.5 m3/hr), with decreasing figures since that time. A total of 9.88 m3/hr was predicted for 2007. The report concluded that owing to this low volume of gas being produced from the facility, it would not be considered a viable option to install a gas collection system and flaring unit. A gas collection system to operate successfully requires a volume of gas in the order of 75 m3/hr.

A copy of the assessment report was included in the AER for the 2008 reporting period.

2.9 Estimated Annual and Cumulative Quantity of Indirect Emissions to Groundwater

Potential sources of indirect emissions into groundwater are:

Landfill Base

The naturally occurring low permeability clay underlying the site provides a natural liner for the capped area of the landfill. Previous site investigation results indicate that in situ clay has a hydraulic conductivity of less than 1 X 10m-9m/s. The new area of the landfill (Cells 1-4) is lined with a geotextile membrane as stipulated in the current waste licence consisting of a composite liner consisting of a 1m layer of compacted soil with a hydraulic conductivity of less than or equal to 1x10-9m/s. This is overlain by a geocomposite layer which in turn is overlain by a 2mm thick high density polyethylene (HDPE) layer.

Landfill Capping

The old sludge disposal areas were capped in 2004/2005. A five layer composite permanent capping was placed over all the old sludge cells as per the requirements of Condition 4.4 of the current licence. The five layers are comprised of the following;

a) Geocomposite gas collection layer
b) Barrier/Protection layer
c) Geotextile protection layer
d) Surface water drainage layer
e) Subsoil layer
f) Topsoil Layer

The capped layer is approximately 1 metre in thickness. The geosynthetic barrier has a minimum permeability of 1 x 10-9m/s. This layer prevents surface water seeping into the sludge body and also facilitates the collection of gas. The surface water drainage layer collects surface water and extends to the system of open surface water drains at the base of the slopes from where it discharges to the existing catchment drains.

Surface Water Collection and Treatment System

Clean surface water from the uncapped existing sludge cells, is collected via a network of gravel drains which is then discharged to the perimeter drain. Visual inspection of the surface water locations and drains is conducted weekly.

Leachate Collection

Leachate is collected in the Leachate pumping chamber from a series of collection drains at the site. The Leachate is pumped via a 100mm diameter pipe to the effluent treatment plant for treatment.

In summary, as the landfill is contained by the provision of the features outlined above, the risk of indirect emissions to groundwater is greatly minimised.

3.0 MONITORING RESULTS

3.1 Summary Report

This summary report has been compiled in accordance with the emission limit values (ELVs) for the following parameters as specified in Condition 6 and Schedule C of W0037-01:

- Dust
- Noise
- Landfill Gas

3.1.1 Dust Deposition

Dust deposition emission limit values as specified in W0037-01 are detailed in Table 3.1 below.

Table 3.1 Dust Deposition ELV

ELV (mg/m2/day) Note 1
350

Note 1: 30 day composite sample

Annual dust monitoring was conducted by BHP at four locations between 14th October and 12th November 2014. Dust monitoring locations are illustrated in Figure 2. 30-day composite samples were collected in accordance with licence requirements and forwarded to the BHP accredited laboratory for analysis. The monitoring results are summarised in Table 3.2 below. Copies of the dust monitoring results are included in Appendix A.

Table 3.2 Dust Monitoring Results 2014

Location	N1	N3	N5	SS2
	mg/m2/day			
Oct 2014	184.1	148	344.3	77.6

Measured dust levels at all of the monitoring locations were below the ELV of 350 mg/m3/day.

3.1.2 Noise Emissions

Noise emission limit values as specified in W0037-01 are detailed in Table 3.3 below. Day-time and night-time noise monitoring was conducted by Response Group at four boundary locations (N1, N2, N3, N5) on the 8th April 2014. The noise survey report is attached in Appendix B. The monitoring results are summarised in Table 3.4 and 3.5 below.

Table 3.3 Noise ELV's

Day Db(A)L_{Aeq}(30 minutes)	Night Db(A)L_{Aeq}(30 minutes)
55	45

Table 3.4 Day-time Noise Measurements 2014

Location	Date	Sampling Interval	L_{Aeq} 30min Db(A)
N1	08/04/14	30 Minutes	43.2
N2	08/04/14	30 Minutes	41.2
N3	08/04/14	30 Minutes	40.1
N5	08/04/14	30 Minutes	43.4

Table 3.5 Night-time Noise Measurements 2013

Location	Date	Sampling Interval	L_{Aeq} 30min Db(A)
N1	08/04/14	30 Minutes	42.1
N2	08/04/14	30 Minutes	40.1
N3	08/04/14	30 Minutes	39.8
N5	08/04/14	30 Minutes	40.1

The average figures show that there are no noise issues on site. All results obtained from the measurements taken at the four locations by day and night are within the daytime and night-time limits of 55Dba and 45Dba. The noises that were most evident on site were the road traffic and the flow of water. It is clear from carrying out this report that the Waste Water Treatment Plant is having a minimal impact on the local environment in terms of Noise Pollution

3.1.3 Landfill Gas Emissions

The trigger levels for landfill gas emissions from the facility measured in any service duct or manhole on, at, or immediately adjacent to, the facility and/or at any other point located outside the body of the waste stipulated in Condition 6.3.1 of W0037-01 are detailed in Table 3.6 below:

Table 3.6 Landfill Gas Concentrations

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

During 2014, landfill gas concentrations were measured at the following locations: RD1, RD2, RD3, RD4, RD5, RD6, RD7, RD8, L6, L8, L10 and L12.

3.1.3.1 Methane

Monthly methane concentrations measured at gas monitoring location RD1 exceeded the threshold level of 1% v/v in one of the monthly monitoring rounds. Methane levels above the threshold level was 2.4% (Jan).

Methane levels measured at RD2 exceeded the threshold level of 1% v/v in nine of the monthly monitoring rounds. Methane levels above the threshold level ranged from 1.3% (Sept) to 24.6% (July).

Methane levels measured at RD3 exceeded the threshold level of 1% v/v in five of the monthly monitoring rounds. Methane levels above the threshold level ranged from 2% v/v (October) to 2.4% v/v (February).

Methane levels measured at RD4 exceeded the threshold level of 1% v/v in five of the twelve monthly monitoring rounds. Methane levels above the threshold level ranged from 3% (August) to 14.8% (January).

Methane levels measured at RD5 exceeded the threshold level of 1% v/v in six of the 12 monthly monitoring rounds. Methane levels above the threshold level ranged from 1.4% (May) to 28.7% (January).

Methane levels measured at RD6 exceeded the threshold level of 1% v/v in all of the 12 monthly monitoring rounds. Methane levels ranged from 16% (March) to 63.2% (November).

Monthly recorded methane levels in the remaining monitoring boreholes (RD7, RD8, L6, L8, L10 and L12) were below 1% v/v.

3.1.3.2 Carbon Dioxide

Carbon dioxide concentrations exceeded the limit of 1.5% v/v at RD1 in 5 of the 12 monthly monitoring rounds – January (7.8%), April (3.2%), July (2.8%), October (2.6%) and November (3.4%) .

At RD2, carbon dioxide levels exceeded the threshold level of 1.5% v/v in 11 of the 12 monthly monitoring rounds – January (3.3%), February (4.6%), March (2.8%), April (1.7%), June (3.4%), July (4.2%), August (2.8%), Sept (1.2%), Oct (3.6%), Nov (3%) and Dec (2.4%).

In RD3, carbon dioxide concentrations were above the threshold level of 1.5% v/v in 9 of the 12 monthly monitoring rounds – January (3.9%), February (3.2%), June (1.6%), July (2.2%), August (3.5%), September (2.4%), October (3.7%), November (5%)and December (4.2%).

In RD4, carbon dioxide concentrations were above the threshold level of 1.5% v/v in 9 of the 12 monthly monitoring rounds – January (4.8%), May (4.2%), June (5.9%), July (2.7%), August (4.2%), September (3.7%), October (7.2%), November (5.9%) and December (5%).

In RD5, carbon dioxide levels exceeded the threshold level of 1.5% in all of the 12 monthly monitoring rounds – January (10.1%), February (9.5%), March (9.8%), April (7.1%), May (9.7%), June (12.4%), July (11.5%), August (15.9%), September (13.8%), October (15.2%), November (16.9%) and December (15%).

In RD6, carbon dioxide levels exceeded the threshold level of 1.5% v/v in all of the monthly monitoring rounds - January (11.5%), February (9.4%), March (8.5%), April (11.7%), May (10.2%), June (12.9%), July (13.2%), August (9.4%), September (12.2%), October (8.3%), November (12.1%) and December (11.6%).

In L6, carbon dioxide levels exceeded the threshold level of 1.5% v/v in 3 of the 12 monthly monitoring rounds – April(2.7%), June (4%) and July (3.7%).

Monthly recorded carbon dioxide levels in the remaining monitoring boreholes (RD7, RD8, L8, L10 and L12) were below 1.5% v/v.

Landfill gas monitoring results are attached in Appendix C.

3.2 MONITORING RESULTS AND INTERPRETATION

3.2.1 Introduction

Environmental monitoring was conducted at the facility during 2014 in accordance with Schedule D of Waste Licence W0037-01. Details of monitoring and reporting frequencies are presented in Table 3.7 below.

The locations of all environmental monitoring points are illustrated on Figure 2. Monitoring results are presented in Appendices A to F. Copies of the laboratory certificates are included in Appendix G.

Table 3.7 Environmental Monitoring and Reporting Frequency

Environmental Monitoring Requirement	Monitoring Frequency	Reporting Frequency
Groundwater Quality	Biannually/Annually	Biannually
Groundwater Levels	Biannually	Biannually
Surface Water Quality	Biannually	Biannually
Surface Water Visual Inspection	Weekly	Biannually
Leachate Quality	Biannually	Biannually
Leachate Levels	Quarterly	Biannually
Landfill Gas	Monthly	Biannually
Dust Deposition	Annually	Annually
Noise Emissions	Annually	Annually
Meteorological Monitoring	Daily	Annually
Ecological Monitoring	bIannually	Biannually

In 2014,

- Dust analysis and reporting was carried out by BHP, New Road, Thomondgate, Limerick.
- Noise monitoring was carried out by Response Group.
- Groundwater and Leachate level monitoring was carried out by BHP, New Road, Thomondgate, Limerick.
- Groundwater, Leachate, Surface water and Landfill Gas analysis and reporting was carried out by BHP, New Road, Thomondgate, Limerick.
- Meteorological monitoring and surface water visual inspection is undertaken by facility management personnel at the facility.

3.2.2 Dust Monitoring

3.2.2.1 Dust Monitoring Locations

Dust monitoring was conducted at four monitoring locations in 2014 in accordance with Tables D.4.1 and D.3.1 of W0037-01. Dust monitoring locations are outlined in Table 3.8 below.

Table 3.8 Dust Monitoring Locations

Location	Easting	Northing
N1	144.001	159.988
N3	143.727	159.831
N5	143.937	160.076
SS2	143.879	159.874

3.2.2.2 Dust Monitoring Methods

Details of the dust monitoring results attached in Appendix A.

3.2.2.3 Dust Monitoring Results

The results of dust monitoring conducted at the facility during 2014 are presented in Table 3.9 below. Dust concentrations and emission limit values as detailed in Schedule C.3 of W0037-01 were discussed in Section 3.1.1.

Table 3.9 Dust Monitoring Results 2013

Location	N1	N3	N5	SS2
	$mg/m^2/day$			
Oct 2014	184.1	148.0	344.3	77.6

All monitoring results were below the ELV for dust of 350 mg/m2/day.

3.2.3 Groundwater Monitoring

3.2.3.1 Groundwater Monitoring Locations

Groundwater monitoring was conducted at five locations during 2014 in accordance with Schedule D.1.1 and D.6.1 of the current licence. Co-ordinates for all monitoring locations are detailed in Table 3.10 and locations are also illustrated on Figure 2. Monitoring results are attached in Appendix D.

Monitoring location RD2 is located at the southern boundary of the site and RD3 is located at the south-western boundary of the site adjacent to the capped sludge cells. BH3 is located at the north

eastern boundary of the site. BH4 and BH5 are both located in the buffer zone adjacent to the southern boundary of the facility and close to Shannon Estuary.

Table 3.10 Groundwater Monitoring Locations

Location	Easting	Northing
RD2	143.866	159.855
RD3	143.799	159.855
BH3	143.952	160.085
BH4	143.935	159.930
BH5	143.984	159.959

3.2.3.2 Groundwater Levels

Groundwater levels were monitored on a biannual basis in accordance with Schedule D.6.1 of W0037-01 and are included in Appendix D with the groundwater monitoring results.
Groundwater levels recorded during 2014 varied between 0.15m below top of casing (BTOC) (in BH4 May 2014) and 1.2m BTOC (in RD2 May 2014).

3.2.3.3 Groundwater Analytical Results

Groundwater monitoring was conducted on a biannual and annual basis in accordance with Schedule D.6.1 of the licence. Monitoring was undertaken in May and October 2014.

Groundwater analytical results are attached in Appendix D.
There are no emission limits stipulated in Waste Licence W0037-01, therefore the groundwater analytical results have been compared to the Interim Guideline Values (IGVs) specified in the EPA document: 'EPA Interim Report – Towards Setting Guideline Values for the Protection of Groundwater in Ireland' (2003).

The Ph in all of the groundwater samples analysed during both monitoring rounds ranged from 6.7 to 7.45, which is within the IGV range of 6.5-9.5.

Electrical conductivity measurements ranged from 2290 µS/cm in RD3 (May) to 15,370 µS/cm in BH4 (May), which are similar to previous monitoring results. The IGV of 1,000 µS/cm was exceeded in all of the samples analysed.

Ammonia concentrations detected were all above the IGV of 0.2mg/l except for RD3(May) and ranged between 0.15mg/l in RD3 (May) to 28.5mg/l in BH3 (October).

Total Oxidised Nitrogen concentrations results ranged between 0.05mg/l BH5 (May) and 2.3mg/l RD2 (May). These readings are higher than those recorded last year.

Total organic carbon concentrations ranged from 14.9mg/l in RD3 (May) to 175mg/l in BH4 (May), TOC concentrations show an increase compared 2012 results but similar results to 2009 and 2011.

Chloride concentrations ranged from 316 mg/l in RD3 (May) to 5,284 mg/l in BH3 (October). Chloride concentrations in all of the samples analysed exceeded the IGV of 30 mg/l.

Sodium concentration ranged from 697mg/l RD2 (October) to 2730mg/l BH4 (October), which were all above the IGV of 150 mg/l.

Potassium concentrations in all five samples analysed during the October monitoring round all exceeded the IGV of 5 mg/l. Concentrations ranged from 31.3mg/l in RD3 to 131mg/l in BH4.

Iron concentrations detected exceeded the IGV of 0.2mg/l on three occasions. The Iron concentration measured ranged between <0.2mg/l in RD3 & BH3 and 10.2 in BH5, samples were taken in October.

Chromium concentrations in all samples were below the IGV of 0.03 mg/l. They ranged from <0.002mg/l in RD2, RD3, BH3, BH4 to 0.0024mg/l in BH5.

Total phenol concentrations exceeded the IGV 0.0005mg/l in 9 of the 10 samples analysed during both monitoring rounds. Results that exceed the limit ranged from 0.001mg/l in both BH4 (May & October) and BH5 (May) to 0.01mg/l RD2. The May sample for RD3 was all <0.001mg/l.

Fluoride concentrations in all samples were below the IGV of 1mg/l. They ranged from 0.11mg/l in BH5 to 0.45mg/l in RD2.

Concentrations of arsenic, boron, cadmium, calcium, copper, cyanide, lead, magnesium, mercury, nickel, sulphate, tin and zinc were below their respective IGVs and/or laboratory detection limits in all of the samples analysed.

3.2.3.4 Conclusions

Overall the groundwater results are fairly similar to the 2013 biannual and annual monitoring rounds. This represents a maintained improvement in groundwater quality at the facility since previous monitoring rounds.

Certain parameters such as electrical conductivity, ammonia, chloride, iron, potassium and total phosphorus concentrations remain elevated at most or all monitoring locations compared to the IGV's.

Sodium concentrations have increased compared to 2013 results and will be monitored.

3.2.4 Landfill Gas Monitoring

Measurements of landfill gas were carried out at all gas monitoring boreholes (RD1 to RD8) on a monthly basis in accordance with Table D.2.1 of the Waste Licence. Combined gas and Leachate monitoring boreholes (L6, L8, L10, and L12) were also monitored on a monthly basis for gas.

All monitoring locations were sampled for methane, carbon dioxide, oxygen, temperature and pressure.

Results are compared against the EPA Guideline Emission Limits for methane (CH4) and carbon dioxide(CO2) at landfills, which are 1% v/v and 1.5% v/v, respectively (EPA Landfill Manuals: Landfill Monitoring, 2nd Edition, 2003). These are also the ELVs specified in Schedule C.2 of Waste Licence W0037-01.

3.2.4.1 Gas Monitoring Locations

Gas monitoring locations are detailed in Table 3.11 below and illustrated in Figure 2. Gas monitoring results are presented in Appendix C.

Table 3.11 Gas Monitoring Locations

Location	Easting	Northing
RD1	143.761	159.997
RD2	143.876	159.883
RD3	143.801	159.851
RD4	143.760	160.092
RD5	143.906	159.999
RD6	143.928	160.071
RD7	144.000	159.979
RD8	143.939	159.938
L6	143.867	159.959
L8	143.924	159.995
L10	143.944	160.015
L12	143.940	160.064

3.2.4.2 Gas Monitoring Boreholes

Landfill gas measurements were undertaken using an Infrared Gas Analyser. The gas emitted is analysed for its content by % volume of the following constituents:

- Methane (CH_4)
- Carbon Dioxide (CO_2)
- Oxygen (O_2)
- Atmospheric Pressure (mBar)

The LEL (lower explosive limit) for methane, atmospheric pressure (millibars) and temperature (Oc) were also recorded by the gas analyzer and relative pressure was calculated.

3.2.5 Leachate Monitoring

3.2.5.1 Leachate Monitoring Locations

In accordance with Schedule D.1 of the licence, Leachate composition and level monitoring was conducted at locations detailed in Table 3.12.

Table 3.12 Leachate Monitoring Locations

Parameter	Location	Easting	Northing
Leachate Level	L1	143.795	159.990
	L2	143.796	159.926
	L3	143.843	159.890
	L4	143.797	160.016
	L5	143.821	159.997
	L7	143.895	159.928
	L9	143.939	159.958
	L11	143.991	160.000
	L13	143.976	160.052
Leachate Composition	SS3	143.806	159.951

3.2.5.2 Leachate Composition Results

There are no emission limits stipulated in Waste Licence W0037-01, therefore the Leachate analytical results have been compared to the Interim Guideline Values (IGVs) listed in the EPA document: 'EPA Interim Report - Towards Setting Guideline Values for the Protection of Groundwater in Ireland' (2003).

Appendix E contains the annual and biannual Leachate analytical results.

Leachate monitoring at SS3 was undertaken in May and October 2014 as per Schedule D of the licence.

The electrical conductivity was measured at 945 µS/cm in May and 997 µS/cm in October which both were within the IGV of 1000µS/cm.

The chloride concentration was detected at 49.198mg/l in May and 70.5mg/l in October, both of which exceeds the IGV of 30 mg/l; however chloride concentrations have been consistently elevated since 2004.

The ammonia concentration was detected at 0.52mg/l in May and 3.8mg/l in October, which both exceeds the IGV of 0.15 mg/l; Ammonia concentrations have been consistently elevated since 2004 but have reduced since 2013.

Potassium concentration was 5.83mg/l which exceeds the IGV of 5 mg/l. This is similar to last year.

The iron concentration was 3.78mg/l in October, which is above the IGV of 0.02 mg/l. This is similar to previous results.

Sulphate concentration was 154.7mg/l which is below the IGV of 200mg/l. This has reduced since last year.

Total Phosphorus was also detected above the lGV of 0.01mg/l at 0.12mg/l. This is similar with previous years.

Comparison of results with the results from previous years, indicate that a number of parameters (Ammonia, chloride, Iron, potassium and total phosphorus) remain consistently elevated above their respective IGVs.

All the other parameters tested were all below their IGV's.

3.2.6 Noise Monitoring

3.2.6.1 Noise Monitoring Locations

Day-time and night-time annual noise monitoring was conducted at four boundary locations at the facility (N1, N2, N3, N5) on the 15th November as stipulated in Table D.4.1 of the licence. Noise monitoring locations are illustrated on Figure 2 and detailed in Table 3.13 below.

Table 3.13 Noise Monitoring Locations

Location	Easting	Northing
N1	144.001	159.988
N3	143.727	159.831
N5	143.937	160.076
SS2	143.879	159.874

The noise survey report (including details of the methodology) is attached in Appendix B.

3.2.6.2 Noise Monitoring Results

The noise monitoring results are summarised in Table 3.14 and 3.15.

Table 3.14 Day-time Noise Measurements 2013

Location	Date	Sampling Interval	L_{Aeq} 30min dB(A)
N1	28/02/13	30 Minutes	43.2
N2	28/02/13	30 Minutes	41.2
N3	28/02/13	30 Minutes	40.1
N5	28/02/13	30 Minutes	43.4

Table 3.15 Night-time Noise Measurements 2013

Location	Date	Sampling Interval	L_{Aeq} 30min dB(A)
N1	28/02/13	30 Minutes	42.1
N2	28/02/13	30 Minutes	40.1
N3	28/02/13	30 Minutes	39.8
N5	28/02/13	30 Minutes	40.1

Day-time and night time noise levels at all boundary locations did not exceed the daytime emission limit LAeq of 55dB and 45 dB respectively.

It is noted that the predominant noise source on site were non site related traffic noise and the flow of water.

3.2.7 Surface Water Monitoring

3.2.7.1 Surface Water Monitoring Locations

In total, five surface water locations were monitored in 2014 with differing biannual and annual parameter requirements as outlined in Table D.6.1 of the waste licence (SS1, SS2, SS4, SS6).

The surface water monitoring locations are located in the catchment drains along the perimeter of the facility. These drains collect surface water run-off from the site and ultimately discharge to the Shannon Estuary via a sluice gate.

Monitoring location SS1 is located in the catchment drain along the eastern boundary of the facility adjacent to Cell No. 3. Monitoring locations SS2 and SS4 are located in a drain at the southern tip of the landfill. SS6 and SS7 are both estuarine locations. Monitoring location SS6 was dry in May 2014 and location SS7 was dry in both May and October 2014, therefore no sample could be collected on the sampling date.

Monitoring locations are listed in Table 3.16 below and are illustrated on Figure 2.

Table 3.16 Surface Water Monitoring Locations

Location	Easting	Northing
SS1	144.000	160.040
SS2	143.879	159.874
SS4	143.936	160.003
SS6	143.907	159.862
SS7	143.927	159.873

3.2.7.2 Surface Water Monitoring

Surface water monitoring was conducted on a biannual basis at the five locations detailed in Table 3.16. Sampling involved the submergence of the designated sample container into the surface water body.

During submergence, every effort was made to keep the container steady so as to prevent sediment disturbance. Samples were collected and submitted to an accredited laboratory for analysis in May and October for the range of parameters outlined in Table D.6.1 of W0037-01.

Surface water analytical results are attached in Appendix F.

There is no surface water emission limits stipulated in waste licence W0037-01. Therefore, all surface water monitoring results have been compared to the Thresholds, AA-EQS's (Annual Average Environmental Quality Standard) and MAC-EQS's (Maximum Admissible Concentration

Environmental Quality Standard Thresholds) specified in the Surface Water Quality Regulations SI 272 of 2009 applicable to transitional waters (Shannon Estuary at Shannon).

Ammonia levels exceeded the IGV of 0.02mg/l in all the sampled tested. Results ranged between 0.06mg/l SS4 (May) to 0.35mg/l SS4 (October). There was a decrease in the ammonia levels in 2014.

Conductivity exceeded the IGV of 1000µS/cm in SS4 1275µS/cm was recorded in October & in SS6 4995µS/cm was recorded in October . All other results were below the IGV.

Potassium exceeded the IGV of 5mg/l in all of the 4 samples tested. In October SS1 7.86mg/l, SS2 10.1mg/l and SS4 20.3mg/l, SS6 55.7mg/l.

Sulphate exceeded the IGV of 200mg/l in SS6 327.7mg/l in October.

There were no other exceedances of the relevant thresholds or EQS's for any of the parameters analysed during both monitoring rounds undertaken in 2014.

The analytical results indicate that surface water quality is generally good at and beyond the facility boundary.

3.2.7.3 Surface Water Visual Inspections

Visual inspections of surface water drains are carried out on a weekly basis and the visual inspection logs are available for inspection at the facility.

3.2.8 Meteorological Monitoring

Details of meteorological monitoring conducted at the facility in 2014 are attached in Appendix H. Met Eireann publish meteorological data, which is obtained from their weather station at Shannon Airport.

Meteorological data obtained from the Met Eireann weather station at Shannon Airport is summarised in the first three columns of Table 3.17 below.

Table 3.17 Summary Rainfall Data

Month	Rainfall (mm) Shannon Airport	Evapotranspiration (mm) Shannon Airport	Evaporation (mm)	Estimated Effective Rainfall – Capped Area (mm)	Estimated Effective Rainfall – Active Cell (mm)
JAN	175.9	16	21.4	159.9	154.5
FEB	178.2	24.4	34.7	153.8	143.5
MAR	87.3	35.5	52.3	51.8	35
APR	38.3	58.8	84.6	0*	0*
MAY	90.4	67.6	97.3	22.8	0*
JUN	40.5	91.9	126.1	0*	0*
JUL	35.8	85.3	116.7	0*	0*
AUG	90	74.5	103	15.5	0*
SEP	72.3	56.9	75.3	15.4	0*
OCT	105.1	34.3	44.8	70.8	60.3
NOV	129.4	14.4	18.8	115	110.6
DEC	110.2	14.8	19.4	95.5	90.8
TOTAL	1153.4	574.6	794.4	600.5	594.7

***Denotes months where evaporation and/or evapotranspiration exceeded total rainfall**

Rainfall data obtained from the Met Eireann weather station at Shannon Airport estimated that the site received approximately 1153.5 mm of rainfall from January 2014 to December 2014.

Effective rainfall for capped and non-capped/active cells was calculated as follows:
Effective Rainfall (mm) = Net Precipitation (mm) – Loss by Evapotranspiration (mm) (for capped cells)
Effective Rainfall (mm) = Net Precipitation (mm) – Loss by Evaporation (mm) (for active cells)

3.2.9 Annual Water Balance Calculation and Interpretation for Cells

The water balance was calculated using the average monthly figure of sludge disposed in 2014, which was 95 tonnes. A water balance is used to calculate the difference between rainfall on landfilled areas and the various losses prior to Leachate generation.

Water balance calculations are attached in Appendix I.

The method used is based on equation developed by Ehring (Quality and Quantity Sanitary Landfill Leachate, 1983). This method is based on the use of a mathematical equation, which provides a conservative estimate, which caters for the worst-case scenarios.

The equation is as follows: L0 = [(ER.a) + LW + IR] – [aW]
Where:

L_0 :	Free Leachate Produced
ER:	Effective Rainfall (net precipitation after loss by evaporation)
A:	Area of Cell(s)
LW:	Liquid waste
IR:	Infiltration from restored areas
aW:	Absorptive capacity of waste
a_A:	Active area
aR:	Restored area
AL:	Lagoon area
WA:	Waste in active area
WR:	Waste in restored area

Based on the calculations it is estimated that approximately 3,850 m3 (upper bound) and 2,935 m3 (lower bound) of Leachate was produced on site in 2014.

3.2.10 Resource and Energy Consumption Summary

The only consumer of electricity at the facility is the Leachate pump, which pumps the Leachate from the Leachate collection sump to the WWTP. The contribution of this sump to the overall electrical output of the entire WWTP is minor. The Leachate pump is in operation for approximately 4 hrs per day.

Diesel is used to fuel the vehicles used on site namely the sludge dumper trucks and the tractor. Diesel is stored in a 5,000 litre capacity bunded tank located on site. Approximately 2200 litres of diesel were used in 2014.

Mains water is provided via the public mains supply, however water usage at the facility is not metered.

3.2.11 Tank, Pipeline and Bund Integrity Testing and Inspection

The facility contains one bunded diesel tank as outlined in Section 3.2.10. The bund was installed in 2006 and the integrity assessment report was forwarded to the Agency as part of the 2006 AER. The bund is regularly inspected and tested by site personnel to verify integrity.

3.2.12 Review of Nuisance Controls

The assistant landfill supervisor conducts daily inspections of the landfill and the facility and records any incidents in daily duty sheets which are stored at the facility. The inspections are undertaken to identify any environmental nuisances caused by vermin, birds, flies, mud, dust, litter, and odours. No complaints or incidents were received by the facility in 2014.

Rentokil carry out pest control in the treatment plant but no incidences of vermin have been reported on the landfill site. Birds and flies do not pose a problem at the site as there is no domestic refuse being deposited in the landfill; therefore there are no nuisance controls in place for birds or flies.

According to facility management:

- No complaints regarding odours were received in 2014.
- There is no problem with litter at the facility and no complaints were received in 2014 in this regard.
- There are no noise sensitive locations in the immediate vicinity of the facility and no complaints regarding noise from the facility were received in 2014.

The only vehicles that use the site roads are a 5-tonne sludge dumper truck. This is used to deposit the sludge to the landfill from the WWTP. The vehicle travels on a private road between the two sites and do not travel outside the boundary of the two sites.

In general, dust is not a problem encountered at the facility and thus no dust suppression measures are considered necessary. Dust monitoring is currently undertaken as per Table D.3.1 of the licence. All locations were all well within the limit.

4.0 MANAGEMENT OF THE FACILITY

4.1 Management and Staffing Structure

Clare County Council has been responsible for the facility since November 2004. The facility was previously managed by Shannon Development. The facility is under the operational control of the landfill manager – Neil Ronan. The assistant landfill managers are Ailish Johnston, Paul O Keeffe and Michael Lynch. In addition, there is one weighbridge operator, John O Brien. The current management structure is outlined in Table 4.1 below.

Table 4.1 Management and Staffing Structure

Name	Position	Responsibilities	Replacement
Neil Ronan	Landfill Manager	Land Fill Management	Ailish Johnson
Ailish Johnston	Landfill Assistant Manager	Landfill management, monthly reporting, environmental monitoring, nuisance control	Paul O Keeffe
Paul O'Keeffe	Landfill Assistant Manager	Landfill management, monthly reporting, environmental monitoring, nuisance control	Michael Lynch
Michael Lynch	Landfill Assistant Manager	Landfill management, monthly reporting, environmental monitoring, nuisance control	John O Brien
John O Brien	Weighbridge operator	Weighing sludge	Henry Greensmith

4.2 Environmental Management Programme/Environmental Objectives and Targets

The 2013 AER did not specify any environmental objectives and targets for 2014.

4.3 Schedule of Environmental Objectives and Targets for 2014

The licensee conducted a review of the EMS in 2013 and found that no changes to the EMS were required and therefore there are no amendments to the environmental objectives and targets required for the year 2014.

4.4 Facility Procedures

No new procedures were developed or implemented at the site between January 2014 and December 2014.

4.5 Financial Provision

In accordance with Condition 12 of the licence, Charges and Financial Provisions, Clare County Council has the ability to meet any financial commitments or liabilities incurred by the undertaking of the activities relating to the facility. Clare County Council annually in the preparation of the "Book of Estimates" and the passing of these estimates shall make provisions for any capital works and maintenance works required to fulfil the conditions of the waste licence for the facility.

Clare County Council also carries adequate insurance to deal with their liabilities. The type and level of insurance is constantly monitored and updated as required.

4.6 Staff Training

An Environmental Awareness Programme has been developed and implemented at the facility. A copy of the Programme was included in the 2006 AER. The Programme sets out environmental issues relevant to all site staff, contractors and visitors to the facility. Training for all staff involved in the operation of the facility is recorded in the training and awareness programme which includes a sign out section for staff members to record their attendance to courses.

Spill kit and chemical handling training and confined space training was undertaken for staff employed at the facility and copies of training records are kept on site.

No additional environmental training was undertaken in 2014.

4.7 Programme for Public Information

All information and correspondence supplied to the EPA (other than commercially sensitive information) and received from the EPA, is available to the public to view at Tradaree Point WWTP, Shannon (Clonmoney South), Co. Clare. This includes a copy of the waste licence, all reports, monitoring results and interpretations required by the licence and other correspondence between the EPA and the facility. Any member of the public may view the information between the hours of 10.00 and 16.00 and by appointment only, at the below address.

All requests concerning the environmental performance of the facility should be forwarded to:
Mr Neil Ronan,
Facility Manager,
Tradaree Point Sludge Disposal Facility,
Shannon (Clonmoney South),
Co. Clare
Tel: 061 364477

4.8 Facility Notice Board

In compliance with Condition 3.3 of Waste Licence W0037-01, a facility notice is in place at the entrance to the landfill site adjacent to the main gate, and contains all the details outlined in Section 3.3.3 of the licence.

5.0 REPORTED INCIDENTS AND COMPLAINTS SUMMARY

During the reporting period January 2014 to December 2014, no incidents occurred which would require reporting to the relevant authorities. No complaints or incidents were reported to the facility between January and December 2014.

5.1 Incidents

None recorded.

5.2 Non-compliances

No non-compliances were recorded.

5.3 Complaints

None Received.

5.4 Waste Record

Records of the amount and type of sludge (either industrial or domestic) disposed at the facility are kept on file at the facility. Receipts of incoming sludge are recorded at the weighbridge and filed. The weekly records from the weighbridge are then filed and stored in the administration building of the facility. The total quantity of the waste sludge is recorded on a weekly basis and is logged in a waste register that is kept on site at all times. Quantities of waste sludge disposed of to landfill are recorded in the monthly reports for the WWTP and also the AER.

The following information is recorded in the waste register;

- Name of the person transporting the load
- Date of transportation
- Sludge quantity
- Sludge type
- The name of the machine operator
- The cell in which the sludge is to be disposed

The site caretaker signs the logbook to confirm the sludge has been inspected prior to acceptance to the landfill. The records are then transferred to the site office where they are logged on a computer database.

The weighbridge was last calibrated in March 2014 by Gravitation Ltd. Test cert no. 2530

6.0 FACILITY DEVELOPMENT

6.1 Developments during 2014

There were no other development works of note undertaken at the facility between January and December 2014.

6.2 Proposed Development of the Facility and Associated Timescales

Facility development works planned for 2015.
Cell 1 has reached its capacity and is currently inactive awaiting capping, it is planned that this capping will take place by June 2015.
Cell 2 is currently active and is nearing its capacity, on reaching its full capacity it will be capped and landfilling of Cell 3 will commence. It is expected that this will occur in 2014.

FIGURE 1 – SITE LOCATION MAP

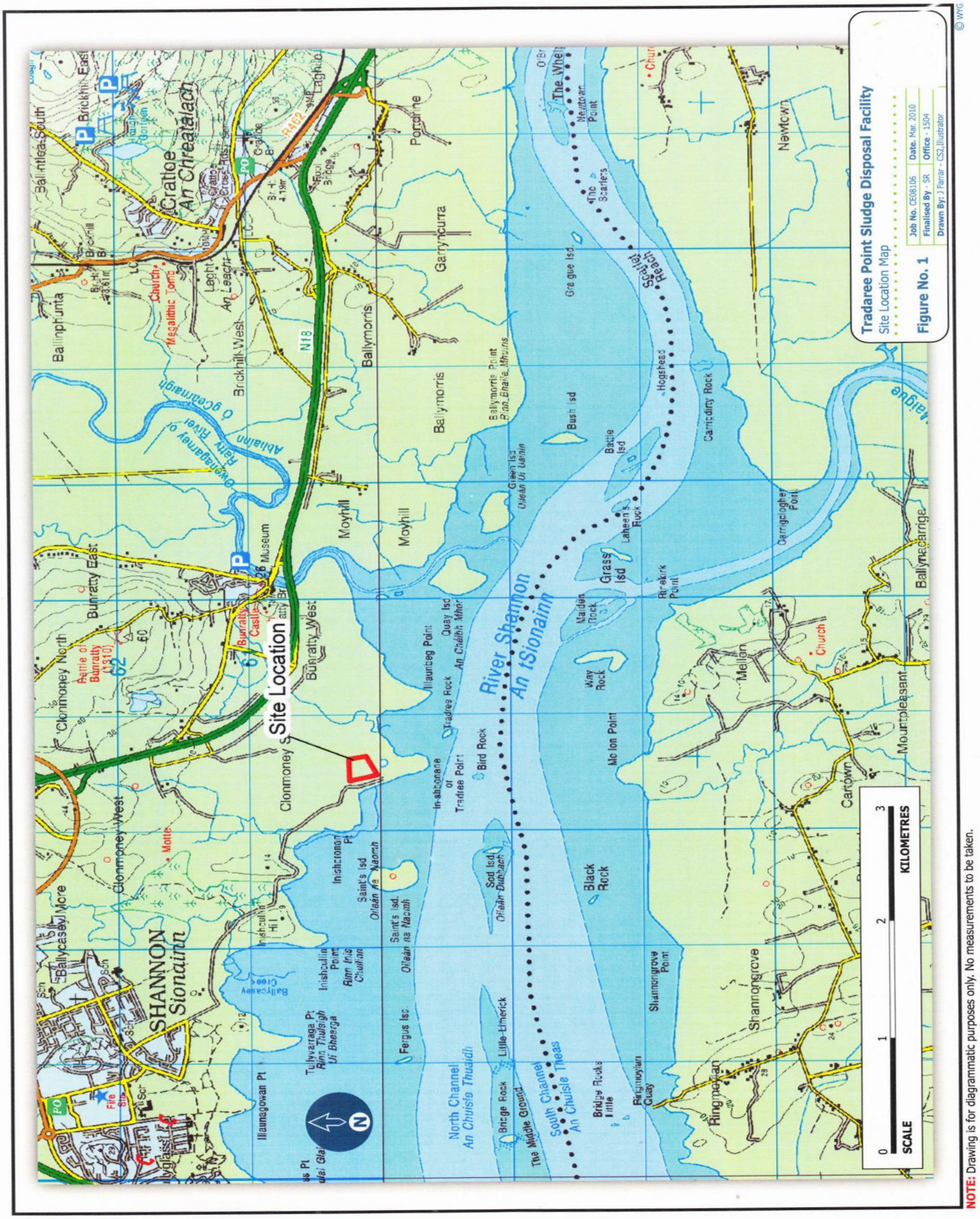
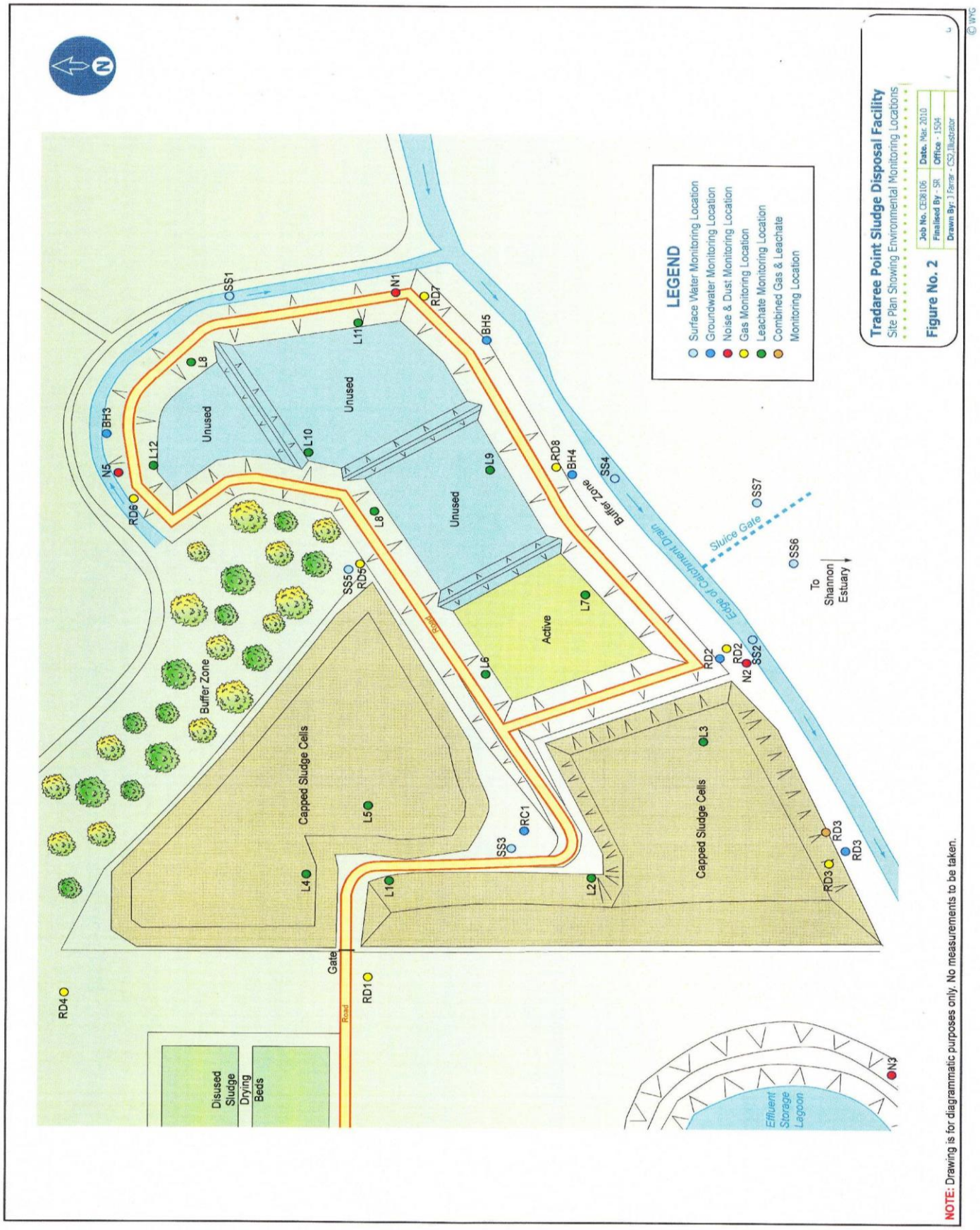

Tradaree Point Sludge Disposal Facility
Site Location Map
Figure No. 1
Job No. CE08106
Date. Mar. 2010
Finalised By - SR
Office - 1504
Drawn By: J Farrar - CS2, Illustrator
Site Location
River Shannon
An tSionainn
SHANNON
Sionainn
Bunratty Castle
Museum
Clonmoney South
Bunratty West
Ballymorris
Moyhill
Cratloe
An Chreatalach
North Channel
An Chuisle Thuaidh
South Channel
An Chuisle Theas
SCALE
KILOMETRES
0
1
2
3
NOTE: Drawing is for diagrammatic purposes only. No measurements to be taken.

FIGURE 2 – SITE PLAN SHOWING ENVIRONMENTAL MONITORING LOCATIONS


Tradaree Point Sludge Disposal Facility
Site Plan Showing Environmental Monitoring Locations
Figure No. 2
Job No. CE08106
Date. Mar. 2010
Finalised By - SR
Office - 1504
Drawn By: J Farrar - CS2 Illustrator
LEGEND
Surface Water Monitoring Location
Groundwater Monitoring Location
Noise & Dust Monitoring Location
Gas Monitoring Location
Leachate Monitoring Location
Combined Gas & Leachate Monitoring Location
NOTE: Drawing is for diagrammatic purposes only. No measurements to be taken.
Capped Sludge Cells
Capped Sludge Cells
Active
Unused
Unused
Unused
Buffer Zone
Buffer Zone
Disused Sludge Drying Beds
Effluent Storage Lagoon
Edge of Catchment Drain
Sluice Gate
To Shannon Estuary
Road
Road
Gate
SS1
SS2
SS3
SS4
SS5
SS6
SS7
N1
N2
N3
N5
BH3
BH4
BH5
RD1
RD2
RD3
RD4
RD5
RD6
RD7
RD8
RC1
L2
L3
L4
L5
L6
L7
L8
L9
L10
L11
L12

APPENDICES

APPENDIX A – DUST MONITORING RESULTS

BHP/CL/02D

TEST REPORT 115246

Analysing
Testing
Consulting
Calibrating

Client: **Response Engineering**
Shannon Town WWTP
Traderee
Shannon
Co.Clare

FTAO: Ailish Johnston

BHP Ref. No.: 14/11/261-264
Order No:
Date Received: 12/11/14
Date Tested: 25/11/14
Test Spec: VDI 2119 Part 2
Item : Dust Deposition

BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpcem2@bhp.ie

TEST	Client Reference	Units	Results	Standard Reference
	Tradree Landfill 14/10/14 TO 12/11/14			
Dust Deposition	D1	mg/m^2/day	184.1	VDI 2119 Part2
Dust Deposition	D2	mg/m^2/day	148.0	VDI 2119 Part2
Dust Deposition	D3	mg/m^2/day	344.3	VDI 2119 Part2
Dust Deposition	D4	mg/m^2/day	77.6	VDI 2119 Part2

Additional Information: All samples are inside the EPA Limit of 350 mg/m2/day

Authorised by:

Paul O'Sullivan
Date of Issue: 03/12/14

APPENDIX B – NOISE SURVEY REPORT

Tradaree WWTP

Environmental Noise Monitoring 8th April 2014

Code	Location	Time	Range dB	Average dB	Maximum dB	Background Noise	Compliant
N1 Daytime	Boundary @ Landfill Cell 3	11.15 - 11.45	30-90	43.2	54.1	Road Traffic	Yes
N2 Daytime	Boundary @ Landfill Cell 1	10.40 - 11.10	30-90	41.2	54.7	Road Traffic,	Yes
N3 Daytime	Boundary @ Lagoon	10.00 - 10.30	30-90	40.1	53.4	Road Traffic, Flow of Water	Yes
N5 Daytime	Boundary @ Landfill Cell 4	11.50 - 12.20	30-90	43.4	54.7	Road Traffic	Yes
N1 Night-Time	Boundary @ Landfill Cell 3	01.30 - 02.00	30-90	42.1	51.2	Road Traffic	Yes
N2 Night-Time	Boundary @ Landfill Cell 1	00.50 - 01.20	30-90	40.1	48.9	Road Traffic,	Yes
N3 Night-Time	Boundary @ Lagoon	00.10 - 00.40	30-90	39.8	47.4	Road Traffic, Flow of Water	Yes
N5 Night-Time	Boundary @ Landfill Cell 4	02.05 - 02.35	30-90	40.1	48.5	Road Traffic	Yes

The weather was dry throughout the Daytime and Night-Time noise measurements.

The Noise meter was an INFOTECH – SLM – 1352A and was calibrated on the morning of the test.

Conclusion:

The average figures show that there are no noise issues on site. All results obtained from the measurements taken at the four locations by day and night are within the daytime and night-time limits of 55dBA and 45dBA. The noises that were most evident on site were the road traffic and the flow of water. It is clear from carrying out this report that the Waste Water Treatment Plant is having a minimal impact on the local environment in terms of Noise Pollution.

APPENDIX C – Landfill Gas Monitoring Results

Month	January-2014					
Landfill Gas Analysis						
Date	**Location**	**CO2**	**Methane**	**O2**	**Temp**	**Atmosph**
		%	**%**	**%**	**oC**	**Pressure**
23-Jan	**RD1**	7.8	2.4	6.7	6.9	1012
	RD2	3.3	0.9	19.4	7.4	1012
	RD3	3.9	0.4	18.9	7	1012
	RD4	4.8	14.8	2.8	7.2	1012
	RD5	10.1	28.7	1.7	8.1	1012
	RD6	11.5	40.9	0.4	6	1012
	RD7	0.1	0.1	21.4	7	1012
	RD8	0.7	0.6	20.8	6.9	1012
	L6	0.6	0.1	21.3	7	1012
	L8	0.1	0.1	21.5	6.3	1012
	L10	0.1	0.1	21.3	6.7	1012
	L12	0.1	0.1	21.2	8.4	1012
Trigger Level		1.5% v/v	1% v/v			

Month	February-2014					
Landfill Gas Analysis						
Date	**Location**	**CO2**	**Methane**	**O2**	**Temp**	**Atmosph**
		%	**%**	**%**	**oC**	**Pressure**
07-Feb	**RD1**	0.1	0.1	21.1	9	984
	RD2	4.6	23.6	15.1	9	985
	RD3	3.2	2.4	19.9	9	985
	RD4	1.2	0.5	17.5	9	984
	RD5	9.5	21.7	4.3	9	984
	RD6	9.4	21.4	2.9	9	984
	RD7	0.2	0.1	21.1	9	984
	RD8	water logged	water logged	water logged	water logged	water logged
	L6	0.2	0.1	21.5	9	985
	L8	0.1	0.1	21.4	9	985
	L10	0.1	0.1	21.3	9	984
	L12	0.1	0.1	21.2	9	984
Trigger Level		1.5% v/v	1% v/v			

Month	March-2014					
Landfill Gas Analysis						
Date	**Location**	**CO2**	**Methane**	**O2**	**Temp**	**Atmosph**
		%	**%**	**%**	**oC**	**Pressure**
06-Mar	**RD1**	0.1	0.1	23.0	11	1012
	RD2	2.8	0.7	22.2	13	1012
	RD3	1.0	0.1	22.7	14	1012
	RD4	0.1	0.1	22.9	11	1014
	RD5	9.8	15.0	0.6	11	1012
	RD6	8.5	13.0	2.6	11	1012
	RD7	0.1	0.1	23.2	12	1012
	RD8	0.1	0.1	23.4	12.0	1012.0
	L6	0.1	0.1	23.4	12	1012
	L8	0.1	0.1	23.4	12	1012
	L10	0.1	0.1	23.2	12	1012
	L12	0.1	0.1	23.2	12	1012
Trigger Level		1.5% v/v	1% v/v			

Month	April-2014					
Landfill Gas Analysis						
Date	**Location**	**CO2**	**Methane**	**O2**	**Temp**	**Atmosph**
		%	**%**	**%**	**oC**	**Pressure**
25-Apr	**RD1**	3.2	0.1	18.2	12	1009
	RD2	1.7	4.0	19.7	12	1009
	RD3	1.5	0.3	20.2	12	1009
	RD4	0.1	0.5	10.5	12	1011
	RD5	7.1	4.7	7.8	12	1010
	RD6	11.7	31.6	0.1	12	1010
	RD7	0.1	0.1	21.1	12	1010
	RD8	0.1	0.1	21.1	12	1010.0
	L6	2.7	0.1	19.1	12	1010
	L8	0.3	0.1	20.9	12	1010
	L10	0.1	0.1	21.2	12	1010
	L12	0.1	0.1	21.1	12	1010
Trigger Level		1.5% v/v	1% v/v			

Month	May-2014					
Landfill Gas Analysis						
Date	**Location**	**CO2**	**Methane**	**O2**	**Temp**	**Atmosph**
		%	**%**	**%**	**oC**	**Pressure**
14-May	**RD1**	0.8	<0.1	19.3	15	1025
	RD2	1.0	4.7	19.2	15	1026
	RD3	0.9	0.1	20.4	15	1026
	RD4	4.2	0.3	10.1	15	1025
	RD5	9.7	1.4	2.7	15	1026
	RD6	10.2	31.7	1.7	15	1027
	RD7	<0.1	<0.1	20.6	15	1026
	RD8	<0.1	<0.1	20.4	15	1026.0
	L6	<0.1	<0.1	20.4	15	1026
	L8	<0.1	<0.1	20.4	15	1026
	L10	<0.1	<0.1	20.9	15	1026
	L12	<0.1	<0.1	20.9	15	1027
Trigger Level		1.5% v/v	1% v/v			

Month	June-2014					
Landfill Gas Analysis						
Date	**Location**	**CO2**	**Methane**	**O2**	**Temp**	**Atmosph**
		%	**%**	**%**	**oC**	**Pressure**
11-Jun	**RD1**	0.4	<0.1	21.0	14	1009
	RD2	3.4	20.0	15.5	14	1009
	RD3	1.6	0.4	19.8	14	1009
	RD4	5.9	0.1	7.7	14	1009
	RD5	12.4	0.5	0.0	14	1009
	RD6	12.9	46.8	0.9	14	1009
	RD7	0.1	<0.1	21.3	14	1009
	RD8	0.1	<0.1	21.3	14	1009.0
	L6	4.0	0.1	16.5	14	1009
	L8	1.5	0.1	19.3	14	1009
	L10	0.1	<0.1	21.0	14	1009
	L12	0.1	<0.1	21.5	14	1009
Trigger Level		1.5% v/v	1% v/v			

Month	July-2014					
Landfill Gas Analysis						
Date	**Location**	**CO2**	**Methane**	**O2**	**Temp**	**Atmosph**
		%	**%**	**%**	**oC**	**Pressure**
04-Jul	**RD1**	2.8	0.1	17.1	16	998
	RD2	4.2	24.6	13.4	16	998
	RD3	2.2	1.2	19.0	16	998
	RD4	2.7	0.1	17.2	16	998
	RD5	11.5	0.4	3.1	16	993
	RD6	13.2	51.2	0.9	16	999
	RD7	0.1	0.1	21.0	16	999
	RD8	0.1	0.1	21.0	16	999.0
	L6	3.7	0.1	17.4	16	998
	L8	0.7	0.1	20.0	16	999
	L10	0.1	0.1	20.8	16	999
	L12	0.1	0.1	21.2	16	999
Trigger Level		1.5% v/v	1% v/v			

Month	August-2014					
Landfill Gas Analysis						
Date	**Location**	**CO2**	**Methane**	**O2**	**Temp**	**Atmosph**
		%	**%**	**%**	**oC**	**Pressure**
19-Aug	**RD1**	0.5	0.1	21.2	15	1004
	RD2	2.8	13.8	16.7	15	1004
	RD3	3.5	2.1	18.6	15	1004
	RD4	4.2	3.0	15.6	15	1004
	RD5	15.9	0.2	2.0	15	1004
	RD6	9.4	45.1	5.7	15	1004
	RD7	0.2	0.2	21.1	15	1004
	RD8	0.3	0.2	21.2	15	1004.0
	L6	0.1	0.1	21.2	15	1004
	L8	0.1	0.1	21.3	15	1004
	L10	0.1	1.2	19.9	15	1004
	L12	0.1	0.1	21.6	15	1004
Trigger Level		1.5% v/v	1% v/v			

Month	September-2014					
Landfill Gas Analysis						
Date	**Location**	**CO2**	**Methane**	**O2**	**Temp**	**Atmosph**
		%	**%**	**%**	**oC**	**Pressure**
14-Sep	**RD1**	0.3	0.1	19.6	17	1018
	RD2	1.2	1.3	19.0	17	1018
	RD3	2.4	0.5	18.6	17	1018
	RD4	3.7	4.5	14.4	17	1018
	RD5	13.8	0.1	4.5	17	1017
	RD6	12.2	62.9	1.7	17	1017
	RD7	0.1	0.1	20.5	17	1017
	RD8	0.1	0.1	20.2	17	1018.0
	L6	0.1	0.1	20.3	17	1018
	L8	0.2	0.1	20.3	17	1017
	L10	0.1	0.1	20.7	17	1017
	L12	0.1	0.1	20.5	17	1017
Trigger Level		1.5% v/v	1% v/v			

Month	October-2014					
Landfill Gas Analysis						
Date	**Location**	**CO2**	**Methane**	**O2**	**Temp**	**Atmosph**
		%	**%**	**%**	**oC**	**Pressure**
14-Oct	**RD1**	2.6	0.1	19.6	14	1005
	RD2	3.6	12.1	16.3	14	1005
	RD3	3.7	2.0	18.6	14	1005
	RD4	7.2	9.6	13.0	14	1005
	RD5	15.2	0.6	2.9	14	1005
	RD6	8.3	40.3	8.1	14	1005
	RD7	0.1	0.1	20.8	14	1005
	RD8	0.5	0.2	20.7	14	1005.0
	L6	1.3	0.1	20.3	14	1005
	L8	0.1	0.1	21.0	14	1005
	L10	0.1	0.1	21.0	14	1005
	L12	1.0	0.1	21.0	14	1005
Trigger Level		1.5% v/v	1% v/v			

Month	November-2014

Landfill Gas Analysis						
Date	Location	CO2	Methane	O2	Temp	Atmosph
		%	%	%	oC	Pressure
14-Nov	RD1	3.4	0.2	18.7	11	985.0
	RD2	3.0	1.8	19.6	10.2	985.0
	RD3	5.0	2.3	18.7	10.4	985.0
	RD4	5.9	9.3	6.5	11	985.0
	RD5	16.1	1.5	3.1	10.5	985.0
	RD6	12.1	63.2	3.2	9.3	985.0
	RD7	0.2	0.2	21.3	9.4	985.0
	RD8	0.2	0.2	21.3	10	985.0
	L6	0.2	0.2	21.3	10.2	985.0
	L8	0.1	0.2	21.3	10	985.0
	L10	0.1	0.1	21.4	10.3	985.0
	L12	0.1	0.1	21.4	10.6	985
Trigger Level		1.5% v/v	1% v/v			

Month	December-2014

Landfill Gas Analysis						
Date	Location	CO2	Methane	O2	Temp	Atmosph
		%	%	%	oC	Pressure
12-Dec	RD1	5.3	0.5	17.6	5.1	996
	RD2	2.4	0.4	21.0	4.7	996
	RD3	4.2	3.6	20.0	5.5	996
	RD4	5.0	7.3	3.3	3.9	996
	RD5	15.0	1.7	3.3	4.2	996
	RD6	11.5	50.9	2.8	5.2	996
	RD7	0.1	0.1	21.7	5.5	996
	RD8	0.1	0.2	21.7	5	996
	L6	0.2	0.2	21.8	4.6	996
	L8	0.1	0.2	21.7	4.8	996
	L10	0.1	0.2	21.7	5.2	996
	L12	0.2	0.2	21.6	4.9	996
Trigger Level		1.5% v/v	1% v/v			

APPENDIX D – GROUNDWATER MONITORING RESULTS

Biannual/Annual Groundwater Monitoring Results 2014

PARAMETER	UNIT	EPA IGV	BH 3		BH 4		BH 5		RD 2		RD 3	
			May	Oct	May	Oct	May	Oct	May	Oct	May	Oct
pH		≥6.5-≤9.5	6.77	6.70	6.78	6.78	6.78	6.87	7.29	7.18	7.45	7.01
Temperature	°C	25	11.6	11.8	12.4	11.2	12.8	12	13	11.4	13.2	
Conductivity	µS/cm	1000	14180	12470	15370	7332	11270	9660	4090	3670	2290	1506
Nitrite	mg/l	-	<0.1	0.24	<0.01	0.14	<0.1	0.16	1.8	0.56	0.02	0.14
Nitrate	mg/l	-	0.09	<0.01	0.08	<0.01	0.05	<0.01	0.47	0.01	0.04	<0.01
Total Ammonia	NH3-N	0.2	28	28.5	19	18	22	22	12.5	12.2	0.15	15.2
Chloride	Cl mg/l	30	4926	5284	5263	5520	3603	3773	1061	894	316	1506
Water Level	m	-	0.86	1.00	0.15	0.25	0.66	0.8	1.2	0.88	0.6	0.85
DO	% O_2 sat	NAC		19		19		25		24		28
Arsenic	As mg/l	0.01		0.053		0.056		0.041		0.023		0.014
Boron	B mg/l	1		1.350		1.67		1.22		0.865		0.467
Cadmium	Cd mg/l	0.005		<0.0006		0.0007		0.0006		<0.0006		<0.0006
Calcium	Ca mg/l	200		248		252		210		56.8		78.5
Chromium	Cr mg/l	0.03		0.002		<0.002		0.0024		<0.002		<0.002
Copper	Cu mg/l	0.03		0.009		0.009		0.009		0.009		<0.009
Cyanide	Cn mg/l	0.01		0.131		0.163		0.104		0.004		0.003
Fluoride	F mg/l	1		0.23		0.31		0.11		0.45		0.32
Iron	Fe mg/l	0.2		<0.23		6.77		10.2		3.55		<0.23
Lead	Pb mg/l	0.01		<0.006		<0.006		<0.006		<0.006		<0.006
Magnesium	Mg mg/l	50		361		364		244		61.4		81.7
Mercury	Hg mg/l	0.001		<0.0001		<0.0001		<0.0001		<0.0001		<0.0001
Nickel	Ni mg/l	0.02		0.003		0.020		0.0054		0.003		0.0092
Potassium	K mg/l	5		122		131		102		47.6		31.3
Sodium	Na mg/l	150		27650		2730		1820		697		978
Sulphate	SO_4 mg/l	200		1.6		0.8		0.3		2		35.1
Tin	Sn mg/l	-		<0.007		0.007		<0.007		<0.007		<0.007
Total Phosphorus	P mg/l	0.03		0.83		0.19		0.24		0.46		0.11
Orthophosphate	P mg/l	0.03		<0.01		<0.01		<0.01		<0.01		<0.01
Total Organic Carbon	C mg/l	NAC	144	19.7	125	19.6	16.3	19.8	83	19.9	19.8	14.9
Total Oxidised Nitrogen	N mg/l	NAC	0.09	0.24	0.05	0.14	0.76	0.16	2.3	0.56	0.06	0.14
Total Phenols	mg/l	0.0005	0.002	0.003	<0.001	0.001	0.004	0.002	0.003	0.01	<0.001	<0.005
Zinc	Zn mg/l	0.1		<0.018		0.018		0.0018		0.018		0.018
Solids Total	mg/l	-		9332		10814		7364		2192		3483

IGV = Interim Guideline Value – from the EPA document "Towards Setting Guideline Values for the Protection of Groundwater in Ireland

Results are Shaded where they Exceed the EPA IGV

NAC = No Abnormal change

n/a = not analysed

n/r = not recorded

Analysis conducted by BHP Laboratories, New Road, Thomondgate, Limerick on 28th April and 29th October 2014.

APPENDIX E – LEACHATE MONITORING RESULTS

Biannual / Annual Leachate Monitoring Results 2014

Parameter	Unit	EPA IGV	SS3	
			May	October
Ammonia	mg/l	0.15	0.52	3.8
Arsenic	mg/l	0.01		0.0019
BOD Total 5 Day with ATU	mg/l	-	2.1	1.94
Boron	mg/l	1		<0.23
Cadmium	mg/l	0.005		0.0006
Calcium	mg/l	200		177
Chloride	mg/l	30	49	70.5
Chromium	mg/l	0.03		<0.002
COD Total	mg/l	-	43	56
Conductivity	uS/cm	1000	945	997
Copper	mg/l	0.03		<0.009
Cyanide (Total)	mg/l	0.01		0.023
Dissolved Oxygen	%	NAC		
Fluoride	mgF/l			0.21
Groundwater Level	m	-		
Iron	mg/l	0.2		3.78
Lead	mg/l	0.01		<0.006
Magnesium	mg/l	50		25.9
Mercury	mg/l	0.001		<0.0001
Mn (Dissolved				
Nickel	mg/l	0.02		0.0378
Nitrate	mg/l		0.01	
Nitrite	mg/l		1.0	
pH Value	Units	6.5 - 9.5	6.97	7.06
Phenol	ug/l			
Potassium	mg/l	5		5.83
Sodium	mg/l	150		42.5
Solids Suspended		-		
Solids Total	mg/l			
Sulphate	mg/l	200		154.7
Surfactant Anionic	ug/l			
Temperature	°C	25	11.6	12.7
Tin	mg/l			<0.007
Total Organic Carbon	mg/l	NAC		
Total Oxidised Nitrogen (TON)	mg/l	NAC	1.02	0.22
Total Phosphorus	mg/l	0.01		0.12
Zinc	mg/l	0.1		0.018

IGV = Interim Guideline Value - from the EPA Document "Towards Setting Guideline Values for the Protection of Groundwater in Ireland"
Results are shaded where they exceeded the EPA IGV
NAC = No abnormal Change
n/a = not analysed
n/r = not recorded
Analysis conducted by BHP Laboratories, New Road, Thomondgate, Limerick on 28th April and 29th October 2014.

APPENDIX F – SURFACE WATER MONITORING RESULTS

Biannual/Annual Surface Water Monitoring Results 2014

Parameter	Unit	EPA IGV	SS1		SS2		SS4		SS6		SS7	
			Jul	Nov	Jul	Nov	Jul	Nov	Jul	Nov	Jul	Nov
Ammonia	mg/l	0.02	0.09	0.17	0.15	0.26	0.06	0.35	n/a	0.15	n/a	n/a
Arsenic	ug/l	20		<0.001		<0.001		0.0049		0.019		n/a
BOD Total 5 Day with ATU	mg/l	≤4	4	2.8	2.8	4.3	3.6	4.4	n/a	3.1	n/a	n/a
Boron	ug/l	1000		<0.23		<0.23		<0.23		0.523		n/a
Cadmium	ug/l	5		<0.0006		<0.0006		<0.0006		<0.0006		n/a
Calcium	mg/l	200		132		139		142		139		n/a
Chloride	mg/l	30										
Chromium	ug/l	30		<0.002		<0.002		0.002		0.002		n/a
COD Total	mg/l	-	21	33	33	37	11	34	n/a	163	n/a	n/a
Conductivity	uS/cm	1000		861		827		1275		4995		n/a
Copper	ug/l	30		0.009		0.009		0.009		0.009		n/a
Cyanide (Total)	mg/l	0.01		0.019		0.03		0.019		0.013		n/a
Dissolved Oxygen	%	NAC	97.2	55	117	58	100	59	n/a	77	n/a	n/a
Fluoride	mgF/l	5.0		0.17		0.19		0.19		0.24		n/a
Groundwater Level	m	-										
Iron	ug/l	200		0.923		0.755		1.85		1.05		n/a
Lead	ug/l	10		<0.006		<0.006		<0.006		<0.006		n/a
Magnesium	mg/l	50		13.3		17.4		40.9		121		n/a
Mercury	ug/l	1		<0.0001		<0.0001		<0.0001		<0.0001		n/a
Mn (Dissolved	Ug/l											
Nickel	ug/l	50		0.003		0.0042		0.0111		0.0032		n/a
Nitrate	mg/l	-		1.64		1.2		1.72		0.77		n/a
Nitrite	mg/l	-		0.03		0.11		0.01		<0.01		n/a
pH Value	Units	6.5 - 9.5	7.80	8.01	8.20	7.92	7.76	7.93	n/a	7.45	n/a	n/a
Phenol	ug/l											
Potassium	mg/l	5		7.86		10.1		20.3		55.7		n/a
Sodium	mg/l	150		30.8		43		261		915		n/a
Solids Suspended		50	4	18.8	3.6	7.4	3.2	12.6	n/a	85.8	n/a	n/a
Solids Total	mg/l											
Sulphate	mg/l	200		72.6		113.9		125.1		327.7		n/a
Surfactant Anionic	ug/l											
Temperature	OC	25	13.7	9.9	16.8	10.1	14.1	9.9	n/a	9.8	n/a	n/a
Tin	ug/l	-		<0.007		<0.007		<0.007		<0.007		n/a
Total Organic Carbon	mg/l	NAC										
Total Oxidised Nitrogen (TON)	mg/l	NAC		1.67		1.31		1.72		0.77		n/a
Total Phosphorus	mg/l	-		0.16		0.14		0.29		0.29		n/a
Zinc	ug/l	100		0.018		0.018		0.018		0.018		n/a

IGV = Interim Guideline Value - from the EPA Document "Towards Setting Guideline Values for the Protection of Groundwater in Ireland"

Results are shaded where they exceeded the EPA IGV

NAC = No abnormal Change

n/a = not analysed Borehole was Dry

n/r = not recorded

Analysis conducted by BHP Laboratories, New Road, Thomondgate, Limerick on 28th April and on 29th October 2014.

APPENDIX G – COPIES OF LABORATORY REPORTS

Groundwater Monitoring Test Reports

BHP/CL/02C

TEST REPORT 112987.1

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Traderee TP
Shannon
Co. Clare

FTAO: Ailish Johnson

BHP Ref. No.: 14/04/733
Order No.:
Date Received: 28/04/14
Date Completed: 08/05/14
Test Specification: Nil
Item : Biannual GW Monitoring

BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpcem2@bhp.ie

TEST	Client Reference	Units	Results	Standard Reference
	Biannual Landfill Monitoring BH3			
Water Level		m	0.86	ISO 5667 - 11
pH		-	6.77	APHA - 4500 - H^+
Temperature		°C	11.6	APHA - 2550 - B
Total Ammonia		mg/L	28	APHA-4500-NH_3-D
Conductivity		µS/cm	14180	APHA - 2510 - B
T.O.C		mg/L	144	APHA - 5310 - C
Phenols		mg/L	0.002	APHA - 5530 - D
Salinity		ppt	11.3	Calculation
Nitrite (as N)		mg/L	<0.01	APHA - 4110 - B
Nitrate (as N)		mg/L	0.09	APHA - 4110 - B
Total oxidised Nitrogen (as N)		mg/L	0.09	APHA - 4110 - B
Chloride		mg/L	4926.36	APHA - 4110 - B

Additional information : All Methods are from Standard Methods for the Examination of Water and Wastewater, 22nd Edition.

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 30/05/14

BHP/CL/02C

TEST REPORT 112987.2

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Traderee TP
Shannon
Co. Clare

BHP Ref. No.: 14/04/734
Order No.:
Date Received: 28/04/14
Date Completed: 08/05/14
Test Specification: Nil
Item : Biannual GW Monitoring

FTAO: Ailish Johnson

BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
E Mail bhpcem2@bhp.ie

TEST	Client Reference	Units	Results	Standard Reference
	Biannual Landfill Monitoring BH4			
Water Level		m	0.15	ISO 5667 - 11
pH		-	6.78	APHA - 4500 - H^+
Temperature		°C	12.4	APHA - 2550 - B
Total Ammonia		mg/L	19	APHA-4500-NH_3-D
Conductivity		µS/cm	15370	APHA - 2510 - B
T.O.C		mg/L	175	APHA - 5310 - C
Phenols		mg/L	0.001	APHA - 5530 - D
Salinity		ppt	12.1	Calculation
Nitrite (as N)		mg/L	<0.01	APHA - 4110 - B
Nitrate (as N)		mg/L	0.08	APHA - 4110 - B
Total oxidised Nitrogen (as N)		mg/L	0.08	APHA - 4110 - B
Chloride		mg/L	5263.87	APHA - 4110 - B

Additional information : All Methods are from Standard Methods for the Examination of Water and Wastewater, 22nd Edition.

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 30/05/14

BHP/CL/02C

TEST REPORT 112987.3

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Traderee TP
Shannon
Co. Clare

FTAO: Ailish Johnson

BHP Ref. No.: 14/04/735
Order No.:
Date Received: 28/04/14
Date Completed: 08/05/14
Test Specification: Nil
Item : Biannual GW Monitoring

BHP
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E Mail bhpcem2@bhp.ie

TEST	Client Reference	Units	Results	Standard Reference
	Biannual Landfill Monitoring BH5			
Water Level		m	0.66	ISO 5667 - 11
pH		-	6.78	APHA - 4500 - H^+
Temperature		°C	12.8	APHA - 2550 - B
Total Ammonia		mg/L	22	APHA-4500-NH_3-D
Conductivity		µS/cm	11270	APHA - 2510 - B
T.O.C		mg/L	125	APHA - 5310 - C
Phenols		mg/L	0.001	APHA - 5530 - D
Salinity		ppt	8.6	Calculation
Nitrite (as N)		mg/L	<0.01	APHA - 4110 - B
Nitrate (as N)		mg/L	0.05	APHA - 4110 - B
Total oxidised Nitrogen (as N)		mg/L	0.05	APHA - 4110 - B
Chloride		mg/L	3603.87	APHA - 4110 - B

Additional information : All Methods are from Standard Methods for the Examination of Water and Wastewater, 22nd Edition.

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 30/05/14

BHP/CL/02C

TEST REPORT 112987.4

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Traderee TP
Shannon
Co. Clare

FTAO: Ailish Johnson

BHP Ref. No.: 14/04/736
Order No.:
Date Received: 28/04/14
Date Completed: 08/05/14
Test Specification: Nil
Item : Biannual GW Monitoring

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Fax + 353 61 455447
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TEST	Client Reference	Units	Results	Standard Reference
	Biannual Landfill Monitoring RD2			
Water Level		m	1.2	ISO 5667 - 11
pH		-	7.29	APHA - 4500 - H^+
Temperature		°C	13	APHA - 2550 - B
Total Ammonia		mg/L	12.5	APHA-4500-NH_3-D
Conductivity		µS/cm	4090	APHA - 2510 - B
T.O.C		mg/L	83	APHA - 5310 - C
Phenols		mg/L	0.003	APHA - 5530 - D
Salinity		ppt	2.9	Calculation
Nitrite (as N)		mg/L	1.8	APHA - 4110 - B
Nitrate (as N)		mg/L	0.47	APHA - 4110 - B
Total oxidised Nitrogen (as N)		mg/L	2.30	APHA - 4110 - B
Chloride		mg/L	1061.65	APHA - 4110 - B

Additional information : All Methods are from Standard Methods for the Examination of Water and Wastewater, 22nd Edition.

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 30/05/14

BHP/CL/02C

TEST REPORT 112987.5

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Traderee TP
Shannon
Co. Clare

FTAO: Ailish Johnson

BHP Ref. No.: 14/04/737
Order No.:
Date Received: 28/04/14
Date Completed: 08/05/14
Test Specification: Nil
Item : Biannual GW Monitoring

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TEST	Client Reference	Units	Results	Standard Reference
	Biannual Landfill Monitoring RD3			
Water Level		m	0.6	ISO 5667 - 11
pH		-	7.45	APHA - 4500 - H^+
Temperature		°C	13.2	APHA - 2550 - B
Total Ammonia		mg/L	0.15	APHA-4500-NH_3-D
Conductivity		µS/cm	2290	APHA - 2510 - B
T.O.C		mg/L	19.8	APHA - 5310 - C
Phenols		mg/L	<0.001	APHA - 5530 - D
Salinity		ppt	<2	Calculation
Nitrite (as N)		mg/L	0.02	APHA - 4110 - B
Nitrate (as N)		mg/L	0.04	APHA - 4110 - B
Total oxidised Nitrogen (as N)		mg/L	0.06	APHA - 4110 - B
Chloride		mg/L	316.62	APHA - 4110 - B

Additional information : All Methods are from Standard Methods for the Examination of Water and Wastewater, 22nd Edition.

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 30/05/14

BHP/CL/02C

TEST REPORT 115095.3

Analysing
Testing
Consulting
Calibrating

Client: **Response Engineering**
Traderee TP
Shannon
Co. Clare

FTAO: Ailish Johnson

BHP Ref. No.: 14/10/661
Order No.:
Date Received: 29/10/14
Date Completed: 24/11/14
Test Specification: Nil
Item : Biannual SW Monitoring

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TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Biannual Landfill Monitoring BH3				
Water Level		m	1.00	29/10/2014	ISO 5667 - 11
pH		-	6.70	29/10/2014	APHA - 4500 - H^+
Temperature		°C	11.8	29/10/2014	APHA - 2550 - B
Total Ammonia		mg/L	28.5	13/11/2014	APHA-4500-NH_3-D
Conductivity		µS/cm	12470	29/10/2014	APHA - 2510 - B
T.O.C		mg/L	19.7	31/10/2014	APHA - 5310 - C
Phenols		mg/L	0.003	17/11/2014	APHA - 5530 - D
Salinity		mg/L	9816	29/10/2014	Calculation
Nitrite (as N)		mg/L	0.24	12/11/2014	APHA - 4110 - B
Nitrate (as N)		mg/L	<0.01	12/11/2014	APHA - 4110 - B
Total oxidised Nitrogen (as N)		mg/L	0.24	12/11/2014	APHA - 4110 - B
Chloride		mg/L	5284.4	24/11/2014	APHA - 4110 - B

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date 25/11/14

BHP/CL/02C

TEST REPORT 115095.4

Analysing
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Client: Response Engineering
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FTAO: Ailish Johnson

BHP Ref. No.: 14/10/662
Order No.:
Date Received: 29/10/14
Date Completed: 24/11/14
Test Specification: Nil
Item : Biannual SW Monitoring

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Biannual Landfill Monitoring BH4				
Water Level		m	0.25	29/10/2014	ISO 5667 - 11
pH		-	6.78	29/10/2014	APHA - 4500 - H^+
Temperature		°C	11.2	29/10/2014	APHA - 2550 - B
Total Ammonia		mg/L	18.0	13/11/2014	APHA-4500-NH_3-D
Conductivity		µS/cm	7332	29/10/2014	APHA - 2510 - B
T.O.C		mg/L	19.6	31/10/2014	APHA - 5310 - C
Phenols		mg/L	0.001	17/11/2014	APHA - 5530 - D
Salinity		mg/L	5631	29/10/2014	Calculation
Nitrite (as N)		mg/L	0.14	12/11/2014	APHA - 4110 - B
Nitrate (as N)		mg/L	<0.01	12/11/2014	APHA - 4110 - B
Total oxidised Nitrogen (as N)		mg/L	0.14	12/11/2014	APHA - 4110 - B
Chloride		mg/L	5520.1	24/11/2014	APHA - 4110 - B

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date 25/11/14

BHP/CL/02C

TEST REPORT 115095.5

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Traderee TP
Shannon
Co. Clare

BHP Ref. No.: 14/10/663
Order No.:
Date Received: 29/10/14
Date Completed: 24/11/14
Test Specification: Nil
Item : Biannual SW Monitoring

FTAO: Ailish Johnson

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TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Biannual Landfill Monitoring BH5				
Water Level		m	0.8	29/10/2014	ISO 5667 - 11
pH		-	6.87	29/10/2014	APHA - 4500 - H^+
Temperature		°C	12.0	29/10/2014	APHA - 2550 - B
Total Ammonia		mg/L	22.0	13/11/2014	APHA-4500-NH_3-D
Conductivity		µS/cm	9660	29/10/2014	APHA - 2510 - B
T.O.C		mg/L	19.8	31/10/2014	APHA - 5310 - C
Phenols		mg/L	0.002	17/11/2014	APHA - 5530 - D
Salinity		mg/L	7412	29/10/2014	Calculation
Nitrite (as N)		mg/L	0.16	12/11/2014	APHA - 4110 - B
Nitrate (as N)		mg/L	<0.01	12/11/2014	APHA - 4110 - B
Total oxidised Nitrogen (as N)		mg/L	0.16	12/11/2014	APHA - 4110 - B
Chloride		mg/L	3773.4	24/11/2014	APHA - 4110 - B

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date 25/11/14

BHP/CL/02C

TEST REPORT 115095.1

Analysing
Testing
Consulting
Calibrating

Client: **Response Engineering**
Traderee TP
Shannon
Co. Clare

FTAO: Ailish Johnson

BHP Ref. No.: 14/10/659
Order No.:
Date Received: 29/10/14
Date Completed: 24/11/14
Test Specification: Nil
Item : Biannual SW Monitoring

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TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Biannual Landfill Monitoring RD2				
Water Level		m	0.88	29/10/2014	ISO 5667 - 11
pH		-	7.18	29/10/2014	APHA - 4500 - H^+
Temperature		°C	11.4	29/10/2014	APHA - 2550 - B
Total Ammonia		mg/L	12.2	13/11/2014	APHA-4500-NH_3-D
Conductivity		µS/cm	3670	29/10/2014	APHA - 2510 - B
T.O.C		mg/L	19.9	31/10/2014	APHA - 5310 - C
Phenols		mg/L	0.01	17/11/2014	APHA - 5530 - D
Salinity		mg/L	2675	29/10/2014	Calculation
Nitrite (as N)		mg/L	0.56	12/11/2014	APHA - 4110 - B
Nitrate (as N)		mg/L	<0.01	12/11/2014	APHA - 4110 - B
Total oxidised Nitrogen (as N)		mg/L	0.56	12/11/2014	APHA - 4110 - B
Chloride		mg/L	894.7	24/11/2014	APHA - 4110 - B

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date 25/11/14

BHP/CL/02C

TEST REPORT 115095.2

Analysing
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Calibrating

Client: **Response Engineering**
Traderee TP
Shannon
Co. Clare

FTAO: Ailish Johnson

BHP Ref. No.: 14/10/660
Order No.:
Date Received: 29/10/14
Date Completed: 24/11/14
Test Specification: Nil
Item : Biannual SW Monitoring

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TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Biannual Landfill Monitoring RD3				
Water Level		m	0.85	29/10/2014	ISO 5667 - 11
pH		-	7.01	29/10/2014	APHA - 4500 - H^+
Temperature		°C	11.0	29/10/2014	APHA - 2550 - B
Total Ammonia		mg/L	15.2	13/11/2014	APHA-4500-NH_3-D
Conductivity		µS/cm	5030	29/10/2014	APHA - 2510 - B
T.O.C		mg/L	14.9	31/10/2014	APHA - 5310 - C
Phenols		mg/L	0.005	17/11/2014	APHA - 5530 - D
Salinity		mg/L	3783	29/10/2014	Calculation
Nitrite (as N)		mg/L	0.14	12/11/2014	APHA - 4110 - B
Nitrate (as N)		mg/L	<0.01	12/11/2014	APHA - 4110 - B
Total oxidised Nitrogen (as N)		mg/L	0.14	12/11/2014	APHA - 4110 - B
Chloride		mg/L	1506.4	24/11/2014	APHA - 4110 - B

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date 25/11/14

BHP/CL/02C

TEST REPORT NO: 115096.3

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Client: Response Engineering
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BHP Ref. No.: 14/10/666
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

FTAO: Ailish Johnson

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water BH3				
Dissolved Oxygen		% O_2 sat	19	29/10/2014	APHA - 4500 - O - G
Detergents (as MBAS)		mg/L	N/A**	41957.000	APHA - 5540 - C
Arsenic		mg/L	0.053	07/11/2014	Sub Contract
Boron		mg/L	1.350	10/11/2014	Sub Contract
Cadmium		mg/L	<0.0006	10/11/2014	Sub Contract
Calcium		mg/L	248	10/11/2014	Sub Contract
Chromium		mg/L	<0.002	10/11/2014	Sub Contract
Copper		mg/L	<0.009	10/11/2014	Sub Contract
Cyanide		mg/L	0.131	21/11/2014	APHA - 4500 - CN^- - E
Fluoride		mg/L	0.23	24/11/2014	APHA - 4110 - B
Iron		mg/L	<0.23	10/11/2014	Sub Contract
Lead		mg/L	<0.006	10/11/2014	Sub Contract
Magnesium		mg/L	361	10/11/2014	Sub Contract
Mercury		mg/L	<0.0001	06/11/2014	Sub Contract
Nickel		mg/L	<0.003	10/11/2014	Sub Contract
Potassium		mg/L	122	10/11/2014	Sub Contract
Sodium		mg/L	2650	13/11/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references
**Insufficient sample

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

BHP/CL/02C

TEST REPORT NO: 115096.3

Analysing
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Client: Response Engineering
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BHP Ref. No.: 14/10/666
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

FTAO: Ailish Johnson

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water BH3				
Tin		mg/L	<0.007	10/11/2014	Sub Contract
Zinc		mg/L	<0.018	10/11/2014	Sub Contract
Sulphate (as SO_4)		mg/L	1.6	24/11/2014	APHA - 4110 - B
Total Phosphorus (as P)		mg/L	0.83	04/11/2014	APHA - 4500 - P
Residue on Evaporation		mg/L	9332	12/12/2014	APHA - 2540 - B
Organics					
1,2,3-Trichlorobenzene		ng/L	<10	13/12/2014	Sub Contract
1,2,4-Trichlorobenzene		ng/L	<10	13/12/2014	Sub Contract
1,3,5-Trichlorobenzene		ng/L	<10	13/12/2014	Sub Contract
Aldrin		ng/L	<5	13/12/2014	Sub Contract
alpha-Endosulphan		ng/L	<8	13/12/2014	Sub Contract
alpha-HCH		ng/L	<4	13/12/2014	Sub Contract
beta-Endosulphan		ng/L	<6	13/12/2014	Sub Contract
beta-HCH		ng/L	<4	13/12/2014	Sub Contract
alpha-Chlordane		ng/L	<6	13/12/2014	Sub Contract
Dichlobenil		ng/L	<4	13/12/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

BHP/CL/02C

TEST REPORT NO: 115096.3

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Traderee TP
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Co. Clare

BHP Ref. No.: 14/10/666
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

FTAO: Ailish Johnson

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water BH3				
Dieldrin		ng/L	<5	13/12/2014	Sub Contract
Endrin		ng/L	<6	13/12/2014	Sub Contract
gamma-HCH		ng/L	<4	13/12/2014	Sub Contract
Heptachlor Epoxide		ng/L	<6	13/12/2014	Sub Contract
Hexachlorobenzene		ng/L	<4	13/12/2014	Sub Contract
Hexachlorobutadiene		ng/L	<7	13/12/2014	Sub Contract
Isodrin		ng/L	<6	13/12/2014	Sub Contract
o,p - DDE		ng/L	<4	13/12/2014	Sub Contract
p,p - DDE		ng/L	<4	13/12/2014	Sub Contract
o,p - TDE		ng/L	<4	13/12/2014	Sub Contract
p,p - TDE		ng/L	<4	13/12/2014	Sub Contract
o,p - DDT		ng/L	<5	13/12/2014	Sub Contract
p,p - DDT		ng/L	<6	13/12/2014	Sub Contract
Tecnazene		ng/L	<14	13/12/2014	Sub Contract
gamma-Chlordane		ng/L	<6	13/12/2014	Sub Contract
Triallate		ng/L	<17	13/12/2014	Sub Contract
Trifluralin		ng/L	<30	13/12/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

BHP/CL/02C

TEST REPORT NO: 115096.3

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Traderee TP
Shannon
Co. Clare

BHP Ref. No.: 14/10/666
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

FTAO: Ailish Johnson

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TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water BH3				
Azinphos-ethyl		ng/L	<4	13/12/2014	Sub Contract
Azinphos-methyl		ng/L	<4	13/12/2014	Sub Contract
Carbophenothion		ng/L	<6	13/12/2014	Sub Contract
Chlorfenvinphos		ng/L	<4	13/12/2014	Sub Contract
Chlorpyriphos		ng/L	<4	13/12/2014	Sub Contract
Diazinon		ng/L	<5	13/12/2014	Sub Contract
Dichlorvos		ng/L	<2	13/12/2014	Sub Contract
Dimethoate		ng/L	<20	13/12/2014	Sub Contract
Fenitrothion		ng/L	<5	13/12/2014	Sub Contract
Fenthion		ng/L	<5	13/12/2014	Sub Contract
Malathion		ng/L	<4	13/12/2014	Sub Contract
Mevinphos		ng/L	<20	13/12/2014	Sub Contract
Parathion-ethyl		ng/L	<4	13/12/2014	Sub Contract
Parathion-methyl		ng/L	<4	13/12/2014	Sub Contract
Phorate		ng/L	<6	13/12/2014	Sub Contract
Phosalone		ng/L	<7	13/12/2014	Sub Contract
Pirimiphos-methyl		ng/L	<5	13/12/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

BHP/CL/02C

TEST REPORT NO: 115096.3

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Traderee TP
Shannon
Co. Clare

BHP Ref. No.: 14/10/666
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

FTAO: Ailish Johnson

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Fax + 353 61 455447
E Mail bhpcem2@bhp.ie

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water BH3				
Propetamphos		ng/L	<3	13/12/2014	Sub Contract
Triazophos		ng/L	<4	13/12/2014	Sub Contract
Organo-tin		ng/L	<100	04/12/2014	Sub Contract
Tributyl Tin		ng/L	<100	04/12/2014	Sub Contract
Triphenyl Tin		ng/L	<100	04/12/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

BHP/CL/02C

TEST REPORT NO: 115096.4

Analysing
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Client: Response Engineering
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BHP Ref. No.: 14/10/667
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

FTAO: Ailish Johnson

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water BH4				
Dissolved Oxygen		% O_2 sat	19	29/10/2014	APHA - 4500 - O - G
Detergents (as MBAS)		mg/L	<0.001	14/11/2014	APHA - 5540 - C
Arsenic		mg/L	0.056	07/11/2014	Sub Contract
Boron		mg/L	1.67	10/11/2014	Sub Contract
Cadmium		mg/L	0.0007	10/11/2014	Sub Contract
Calcium		mg/L	252	10/11/2014	Sub Contract
Chromium		mg/L	<0.002	10/11/2014	Sub Contract
Copper		mg/L	<0.009	10/11/2014	Sub Contract
Cyanide		mg/L	0.163	21/11/2014	APHA - 4500 - CN^- - E
Fluoride		mg/L	0.31	24/11/2014	APHA - 4110 - B
Iron		mg/L	6.77	10/11/2014	Sub Contract
Lead		mg/L	<0.006	10/11/2014	Sub Contract
Magnesium		mg/L	364	10/11/2014	Sub Contract
Mercury		mg/L	<0.0001	06/11/2014	Sub Contract
Nickel		mg/L	0.0207	10/11/2014	Sub Contract
Potassium		mg/L	131	10/11/2014	Sub Contract
Sodium		mg/L	2730	13/11/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references
**Insufficient sample

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

BHP/CL/02C

TEST REPORT NO: 115096.4

Analysing
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Client: Response Engineering
Traderee TP
Shannon
Co. Clare

BHP Ref. No.: 14/10/667
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

FTAO: Ailish Johnson

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water BH4				
Tin		mg/L	<0.007	10/11/2014	Sub Contract
Zinc		mg/L	<0.018	10/11/2014	Sub Contract
Sulphate (as SO_4)		mg/L	0.8	24/11/2014	APHA - 4110 - B
Total Phosphorus (as P)		mg/L	0.19	05/11/2014	APHA - 4500 - P
Residue on Evaporation		mg/L	10814	12/12/2014	APHA - 2540 - B
Organics					
1,2,3-Trichlorobenzene		ng/L	<10	13/12/2014	Sub Contract
1,2,4-Trichlorobenzene		ng/L	<10	13/12/2014	Sub Contract
1,3,5-Trichlorobenzene		ng/L	<10	13/12/2014	Sub Contract
Aldrin		ng/L	<4	13/12/2014	Sub Contract
alpha-Endosulphan		ng/L	<4	13/12/2014	Sub Contract
alpha-HCH		ng/L	<3	13/12/2014	Sub Contract
beta-Endosulphan		ng/L	<4	13/12/2014	Sub Contract
beta-HCH		ng/L	<3	13/12/2014	Sub Contract
alpha-Chlordane		ng/L	<3	13/12/2014	Sub Contract
Dichlobenil		ng/L	<2	13/12/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

BHP/CL/02C

TEST REPORT NO: 115096.4

Analysing
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Client: Response Engineering
Traderee TP
Shannon
Co. Clare

BHP Ref. No.: 14/10/667
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

FTAO: Ailish Johnson

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water BH4				
Dieldrin		ng/L	<4	13/12/2014	Sub Contract
Endrin		ng/L	<4	13/12/2014	Sub Contract
gamma-HCH		ng/L	<3	13/12/2014	Sub Contract
Heptachlor Epoxide		ng/L	<4	13/12/2014	Sub Contract
Hexachlorobenzene		ng/L	<2	13/12/2014	Sub Contract
Hexachlorobutadiene		ng/L	<7	13/12/2014	Sub Contract
Isodrin		ng/L	<4	13/12/2014	Sub Contract
o,p - DDE		ng/L	<2	13/12/2014	Sub Contract
p,p - DDE		ng/L	<2	13/12/2014	Sub Contract
o,p - TDE		ng/L	<2	13/12/2014	Sub Contract
p,p - TDE		ng/L	<2	13/12/2014	Sub Contract
o,p - DDT		ng/L	<2	13/12/2014	Sub Contract
p,p - DDT		ng/L	<4	13/12/2014	Sub Contract
Tecnazene		ng/L	<10	13/12/2014	Sub Contract
gamma-Chlordane		ng/L	<4	13/12/2014	Sub Contract
Triallate		ng/L	<10	13/12/2014	Sub Contract
Trifluralin		ng/L	<30	13/12/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

BHP/CL/02C

TEST REPORT NO: 115096.4

Analysing
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Client: Response Engineering
Traderee TP
Shannon
Co. Clare

FTAO: Ailish Johnson

BHP Ref. No.: 14/10/667
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water BH4				
Azinphos-ethyl		ng/L	<4	13/12/2014	Sub Contract
Azinphos-methyl		ng/L	<2	13/12/2014	Sub Contract
Carbophenothion		ng/L	<3	13/12/2014	Sub Contract
Chlorfenvinphos		ng/L	<2	13/12/2014	Sub Contract
Chlorpyriphos		ng/L	<2	13/12/2014	Sub Contract
Diazinon		ng/L	<3	13/12/2014	Sub Contract
Dichlorvos		ng/L	<2	13/12/2014	Sub Contract
Dimethoate		ng/L	<20	13/12/2014	Sub Contract
Fenitrothion		ng/L	<2	13/12/2014	Sub Contract
Fenthion		ng/L	<2	13/12/2014	Sub Contract
Malathion		ng/L	<4	13/12/2014	Sub Contract
Mevinphos		ng/L	<20	13/12/2014	Sub Contract
Parathion-ethyl		ng/L	<3	13/12/2014	Sub Contract
Parathion-methyl		ng/L	<3	13/12/2014	Sub Contract
Phorate		ng/L	<4	13/12/2014	Sub Contract
Phosalone		ng/L	<4	13/12/2014	Sub Contract
Pirimiphos-methyl		ng/L	<5	13/12/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

BHP/CL/02C

TEST REPORT NO: 115096.4

Analysing
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Client: Response Engineering
Traderee TP
Shannon
Co. Clare

BHP Ref. No.: 14/10/667
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

FTAO: Ailish Johnson

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TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water BH4				
Propetamphos		ng/L	<3	13/12/2014	Sub Contract
Triazophos		ng/L	<2	13/12/2014	Sub Contract
Organo-tin		ng/L	<100	04/12/2014	Sub Contract
Tributyl Tin		ng/L	<100	04/12/2014	Sub Contract
Triphenyl Tin		ng/L	<100	04/12/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

Page 5 of 5

BHP/CL/02C

TEST REPORT NO: 115096.5

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BHP Ref. No.: 14/10/668
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

FTAO: Ailish Johnson

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water BH5				
Dissolved Oxygen		% O_2 sat	25	29/10/2014	APHA - 4500 - O - G
Detergents (as MBAS)		mg/L	<0.001	14/11/2014	APHA - 5540 - C
Arsenic		mg/L	0.041	07/11/2014	Sub Contract
Boron		mg/L	1.22	10/11/2014	Sub Contract
Cadmium		mg/L	<0.0006	10/11/2014	Sub Contract
Calcium		mg/L	210	10/11/2014	Sub Contract
Chromium		mg/L	0.0024	10/11/2014	Sub Contract
Copper		mg/L	<0.009	10/11/2014	Sub Contract
Cyanide		mg/L	0.104	21/11/2014	APHA - 4500 - CN^- - E
Fluoride		mg/L	0.11	24/11/2014	APHA - 4110 - B
Iron		mg/L	10.2	10/11/2014	Sub Contract
Lead		mg/L	<0.006	10/11/2014	Sub Contract
Magnesium		mg/L	244	10/11/2014	Sub Contract
Mercury		mg/L	<0.0001	06/11/2014	Sub Contract
Nickel		mg/L	0.0054	10/11/2014	Sub Contract
Potassium		mg/L	102	10/11/2014	Sub Contract
Sodium		mg/L	1820	13/11/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references
**Insufficient sample

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

BHP/CL/02C

TEST REPORT NO: 115096.5

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BHP Ref. No.: 14/10/668
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

FTAO: Ailish Johnson

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water BH5				
Tin		mg/L	<0.007	10/11/2014	Sub Contract
Zinc		mg/L	<0.018	10/11/2014	Sub Contract
Sulphate (as SO_4)		mg/L	0.3	24/11/2014	APHA - 4110 - B
Total Phosphorus (as P)		mg/L	0.24	05/11/2014	APHA - 4500 - P
Residue on Evaporation		mg/L	7364	12/12/2014	APHA - 2540 - B
Organics					
1,2,3-Trichlorobenzene		ng/L	<10	13/12/2014	Sub Contract
1,2,4-Trichlorobenzene		ng/L	<10	13/12/2014	Sub Contract
1,3,5-Trichlorobenzene		ng/L	<10	13/12/2014	Sub Contract
Aldrin		ng/L	<5	13/12/2014	Sub Contract
alpha-Endosulphan		ng/L	<8	13/12/2014	Sub Contract
alpha-HCH		ng/L	<4	13/12/2014	Sub Contract
beta-Endosulphan		ng/L	<6	13/12/2014	Sub Contract
beta-HCH		ng/L	<4	13/12/2014	Sub Contract
alpha-Chlordane		ng/L	<6	13/12/2014	Sub Contract
Dichlobenil		ng/L	<4	13/12/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

BHP/CL/02C

TEST REPORT NO: 115096.5

Analysing
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Client: Response Engineering
Traderee TP
Shannon
Co. Clare

BHP Ref. No.: 14/10/668
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

FTAO: Ailish Johnson

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TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water BH5				
Dieldrin		ng/L	<5	13/12/2014	Sub Contract
Endrin		ng/L	<6	13/12/2014	Sub Contract
gamma-HCH		ng/L	<4	13/12/2014	Sub Contract
Heptachlor Epoxide		ng/L	<6	13/12/2014	Sub Contract
Hexachlorobenzene		ng/L	<4	13/12/2014	Sub Contract
Hexachlorobutadiene		ng/L	<7	13/12/2014	Sub Contract
Isodrin		ng/L	<6	13/12/2014	Sub Contract
o,p - DDE		ng/L	<4	13/12/2014	Sub Contract
p,p - DDE		ng/L	<4	13/12/2014	Sub Contract
o,p - TDE		ng/L	<4	13/12/2014	Sub Contract
p,p - TDE		ng/L	<4	13/12/2014	Sub Contract
o,p - DDT		ng/L	<5	13/12/2014	Sub Contract
p,p - DDT		ng/L	<6	13/12/2014	Sub Contract
Tecnazene		ng/L	<14	13/12/2014	Sub Contract
gamma-Chlordane		ng/L	<6	13/12/2014	Sub Contract
Triallate		ng/L	<17	13/12/2014	Sub Contract
Trifluralin		ng/L	<30	13/12/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

BHP/CL/02C

TEST REPORT NO: 115096.5

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BHP Ref. No.: 14/10/668
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

FTAO: Ailish Johnson

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water BH5				
Dieldrin		ng/L	<5	13/12/2014	Sub Contract
Endrin		ng/L	<6	13/12/2014	Sub Contract
gamma-HCH		ng/L	<4	13/12/2014	Sub Contract
Heptachlor Epoxide		ng/L	<6	13/12/2014	Sub Contract
Hexachlorobenzene		ng/L	<4	13/12/2014	Sub Contract
Hexachlorobutadiene		ng/L	<7	13/12/2014	Sub Contract
Isodrin		ng/L	<6	13/12/2014	Sub Contract
o,p - DDE		ng/L	<4	13/12/2014	Sub Contract
p,p - DDE		ng/L	<4	13/12/2014	Sub Contract
o,p - TDE		ng/L	<4	13/12/2014	Sub Contract
p,p - TDE		ng/L	<4	13/12/2014	Sub Contract
o,p - DDT		ng/L	<5	13/12/2014	Sub Contract
p,p - DDT		ng/L	<6	13/12/2014	Sub Contract
Tecnazene		ng/L	<14	13/12/2014	Sub Contract
gamma-Chlordane		ng/L	<6	13/12/2014	Sub Contract
Triallate		ng/L	<17	13/12/2014	Sub Contract
Trifluralin		ng/L	<30	13/12/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

BHP/CL/02C

TEST REPORT NO: 115096.5

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Client: Response Engineering
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BHP Ref. No.: 14/10/668
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

FTAO: Ailish Johnson

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water BH5				
Azinphos-ethyl		ng/L	<4	13/12/2014	Sub Contract
Azinphos-methyl		ng/L	<4	13/12/2014	Sub Contract
Carbophenothion		ng/L	<6	13/12/2014	Sub Contract
Chlorfenvinphos		ng/L	<4	13/12/2014	Sub Contract
Chlorpyriphos		ng/L	<4	13/12/2014	Sub Contract
Diazinon		ng/L	<5	13/12/2014	Sub Contract
Dichlorvos		ng/L	<2	13/12/2014	Sub Contract
Dimethoate		ng/L	<20	13/12/2014	Sub Contract
Fenitrothion		ng/L	<5	13/12/2014	Sub Contract
Fenthion		ng/L	<5	13/12/2014	Sub Contract
Malathion		ng/L	<4	13/12/2014	Sub Contract
Mevinphos		ng/L	<20	13/12/2014	Sub Contract
Parathion-ethyl		ng/L	<4	13/12/2014	Sub Contract
Parathion-methyl		ng/L	<4	13/12/2014	Sub Contract
Phorate		ng/L	<6	13/12/2014	Sub Contract
Phosalone		ng/L	<7	13/12/2014	Sub Contract
Pirimiphos-methyl		ng/L	<5	13/12/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

BHP/CL/02C

TEST REPORT NO: 115096.5

Analysing
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Client: Response Engineering
Traderee TP
Shannon
Co. Clare

BHP Ref. No.: 14/10/668
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

FTAO: Ailish Johnson

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E Mail bhpcem2@bhp.ie

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water BH5				
Propetamphos		ng/L	<3	13/12/2014	Sub Contract
Triazophos		ng/L	<4	13/12/2014	Sub Contract
Organo-tin		ng/L	<30	04/12/2014	Sub Contract
Tributyl Tin		ng/L	<30	04/12/2014	Sub Contract
Triphenyl Tin		ng/L	<30	04/12/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

Page 5 of 5

BHP/CL/02C

TEST REPORT NO: 115096.1

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Client: Response Engineering
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BHP Ref. No.: 14/10/664
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

FTAO: Ailish Johnson

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water RD2				
Dissolved Oxygen		% O_2 sat	24	29/10/2014	APHA - 4500 - O - G
Detergents (as MBAS)		mg/L	0.062	14/11/2014	APHA - 5540 - C
Arsenic		mg/L	0.023	07/11/2014	Sub Contract
Boron		mg/L	0.865	10/11/2014	Sub Contract
Cadmium		mg/L	<0.0006	10/11/2014	Sub Contract
Calcium		mg/L	56.8	10/11/2014	Sub Contract
Chromium		mg/L	<0.002	10/11/2014	Sub Contract
Copper		mg/L	<0.009	10/11/2014	Sub Contract
Cyanide		mg/L	0.004	21/11/2014	APHA - 4500 - CN - E
Fluoride		mg/L	0.45	24/11/2014	APHA - 4110 - B
Iron		mg/L	3.55	10/11/2014	Sub Contract
Lead		mg/L	<0.006	10/11/2014	Sub Contract
Magnesium		mg/L	61.4	10/11/2014	Sub Contract
Mercury		mg/L	<0.0001	06/11/2014	Sub Contract
Nickel		mg/L	<0.003	10/11/2014	Sub Contract
Potassium		mg/L	47.6	10/11/2014	Sub Contract
Sodium		mg/L	697	13/11/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

BHP/CL/02C

TEST REPORT NO: 115096.1

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Client: Response Engineering
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BHP Ref. No.: 14/10/664
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

FTAO: Ailish Johnson

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water RD2				
Tin		mg/L	<0.007	10/11/2014	Sub Contract
Zinc		mg/L	<0.018	10/11/2014	Sub Contract
Sulphate (as SO_4)		mg/L	2.0	24/11/2014	APHA - 4110 - B
Total Phosphorus (as P)		mg/L	0.46	05/11/2014	APHA - 4500 - P
Residue on Evaporation		mg/L	2192	12/12/2014	APHA - 2540 - B
Organics					
1,2,3-Trichlorobenzene		ng/L	<10	13/12/2014	Sub Contract
1,2,4-Trichlorobenzene		ng/L	<10	13/12/2014	Sub Contract
1,3,5-Trichlorobenzene		ng/L	<10	13/12/2014	Sub Contract
Aldrin		ng/L	<4	13/12/2014	Sub Contract
alpha-Endosulphan		ng/L	<4	13/12/2014	Sub Contract
alpha-HCH		ng/L	<3	13/12/2014	Sub Contract
beta-Endosulphan		ng/L	<4	13/12/2014	Sub Contract
beta-HCH		ng/L	<3	13/12/2014	Sub Contract
alpha-Chlordane		ng/L	<3	13/12/2014	Sub Contract
Dichlobenil		ng/L	<2	13/12/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

BHP/CL/02C

TEST REPORT NO: 115096.1

Analysing
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Client: Response Engineering
Traderee TP
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BHP Ref. No.: 14/10/664
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

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TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water RD2				
Dieldrin		ng/L	<4	13/12/2014	Sub Contract
Endrin		ng/L	<4	13/12/2014	Sub Contract
gamma-HCH		ng/L	<3	13/12/2014	Sub Contract
Heptachlor Epoxide		ng/L	<4	13/12/2014	Sub Contract
Hexachlorobenzene		ng/L	<2	13/12/2014	Sub Contract
Hexachlorobutadiene		ng/L	<7	13/12/2014	Sub Contract
Isodrin		ng/L	<4	13/12/2014	Sub Contract
o,p - DDE		ng/L	<2	13/12/2014	Sub Contract
p,p - DDE		ng/L	<2	13/12/2014	Sub Contract
o,p - TDE		ng/L	<2	13/12/2014	Sub Contract
p,p - TDE		ng/L	<2	13/12/2014	Sub Contract
o,p - DDT		ng/L	<2	13/12/2014	Sub Contract
p,p - DDT		ng/L	<4	13/12/2014	Sub Contract
Tecnazene		ng/L	<10	13/12/2014	Sub Contract
gamma-Chlordane		ng/L	<4	13/12/2014	Sub Contract
Triallate		ng/L	<10	13/12/2014	Sub Contract
Trifluralin		ng/L	<30	13/12/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

BHP/CL/02C

TEST REPORT NO: 115096.1

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Client: Response Engineering
Traderee TP
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BHP Ref. No.: 14/10/664
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

FTAO: Ailish Johnson

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water RD2				
Azinphos-ethyl		ng/L	<4	13/12/2014	Sub Contract
Azinphos-methyl		ng/L	<2	13/12/2014	Sub Contract
Carbophenothion		ng/L	<3	13/12/2014	Sub Contract
Chlorfenvinphos		ng/L	<2	13/12/2014	Sub Contract
Chlorpyriphos		ng/L	<2	13/12/2014	Sub Contract
Diazinon		ng/L	<3	13/12/2014	Sub Contract
Dichlorvos		ng/L	<2	13/12/2014	Sub Contract
Dimethoate		ng/L	<20	13/12/2014	Sub Contract
Fenitrothion		ng/L	<2	13/12/2014	Sub Contract
Fenthion		ng/L	<2	13/12/2014	Sub Contract
Malathion		ng/L	<4	13/12/2014	Sub Contract
Mevinphos		ng/L	<20	13/12/2014	Sub Contract
Parathion-ethyl		ng/L	<3	13/12/2014	Sub Contract
Parathion-methyl		ng/L	<3	13/12/2014	Sub Contract
Phorate		ng/L	<4	13/12/2014	Sub Contract
Phosalone		ng/L	<4	13/12/2014	Sub Contract
Pirimiphos-methyl		ng/L	<5	13/12/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

BHP/CL/02C

TEST REPORT NO: 115096.1

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Traderee TP
Shannon
Co. Clare

FTAO: Ailish Johnson

BHP Ref. No.: 14/10/664
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

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Fax + 353 61 455447
E Mail bhpcem2@bhp.ie

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water RD2				
Propetamphos		ng/L	<3	13/12/2014	Sub Contract
Triazophos		ng/L	<2	13/12/2014	Sub Contract
Organo-tin		ng/L	<30	04/12/2014	Sub Contract
Tributyl Tin		ng/L	<30	04/12/2014	Sub Contract
Triphenyl Tin		ng/L	<30	04/12/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

BHP/CL/02C

TEST REPORT NO: 115096.2

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Traderee TP
Shannon
Co. Clare

BHP Ref. No.: 14/10/665
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

FTAO: Ailish Johnson

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TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water RD3				
Dissolved Oxygen		% O_2 sat	28	29/10/2014	APHA - 4500 - O - G
Detergents (as MBAS)		mg/L	0.053	14/11/2014	APHA - 5540 - C
Arsenic		mg/L	0.014	07/11/2014	Sub Contract
Boron		mg/L	0.467	10/11/2014	Sub Contract
Cadmium		mg/L	<0.0006	10/11/2014	Sub Contract
Calcium		mg/L	78.5	10/11/2014	Sub Contract
Chromium		mg/L	<0.002	10/11/2014	Sub Contract
Copper		mg/L	<0.009	10/11/2014	Sub Contract
Cyanide		mg/L	0.003	21/11/2014	APHA - 4500 - CN^- - E
Fluoride		mg/L	0.32	24/11/2014	APHA - 4110 - B
Iron		mg/L	<0.23	10/11/2014	Sub Contract
Lead		mg/L	<0.006	10/11/2014	Sub Contract
Magnesium		mg/L	81.7	10/11/2014	Sub Contract
Mercury		mg/L	<0.0001	06/11/2014	Sub Contract
Nickel		mg/L	0.0092	10/11/2014	Sub Contract
Potassium		mg/L	31.3	10/11/2014	Sub Contract
Sodium		mg/L	978	13/11/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

BHP/CL/02C

TEST REPORT NO: 115096.2

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Shannon
Co. Clare

BHP Ref. No.: 14/10/665
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

FTAO: Ailish Johnson

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water RD3				
Tin		mg/L	<0.007	10/11/2014	Sub Contract
Zinc		mg/L	<0.018	10/11/2014	Sub Contract
Sulphate (as SO_4)		mg/L	35.1	24/11/2014	APHA - 4110 - B
Total Phosphorus (as P)		mg/L	0.11	05/11/2014	APHA - 4500 - P
Residue on Evaporation		mg/L	3483	12/12/2014	APHA - 2540 - B
Organics					
1,2,3-Trichlorobenzene		ng/L	<10	13/12/2014	Sub Contract
1,2,4-Trichlorobenzene		ng/L	<10	13/12/2014	Sub Contract
1,3,5-Trichlorobenzene		ng/L	<10	13/12/2014	Sub Contract
Aldrin		ng/L	<4	13/12/2014	Sub Contract
alpha-Endosulphan		ng/L	<4	13/12/2014	Sub Contract
alpha-HCH		ng/L	<3	13/12/2014	Sub Contract
beta-Endosulphan		ng/L	<4	13/12/2014	Sub Contract
beta-HCH		ng/L	<3	13/12/2014	Sub Contract
alpha-Chlordane		ng/L	<3	13/12/2014	Sub Contract
Dichlobenil		ng/L	<2	13/12/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

BHP/CL/02C

TEST REPORT NO: 115096.2

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BHP Ref. No.: 14/10/665
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

FTAO: Ailish Johnson

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water RD3				
Dieldrin		ng/L	<4	13/12/2014	Sub Contract
Endrin		ng/L	<4	13/12/2014	Sub Contract
gamma-HCH		ng/L	<3	13/12/2014	Sub Contract
Heptachlor Epoxide		ng/L	<4	13/12/2014	Sub Contract
Hexachlorobenzene		ng/L	<2	13/12/2014	Sub Contract
Hexachlorobutadiene		ng/L	<7	13/12/2014	Sub Contract
Isodrin		ng/L	<4	13/12/2014	Sub Contract
o,p - DDE		ng/L	<2	13/12/2014	Sub Contract
p,p - DDE		ng/L	<2	13/12/2014	Sub Contract
o,p - TDE		ng/L	<2	13/12/2014	Sub Contract
p,p - TDE		ng/L	<2	13/12/2014	Sub Contract
o,p - DDT		ng/L	<2	13/12/2014	Sub Contract
p,p - DDT		ng/L	<4	13/12/2014	Sub Contract
Tecnazene		ng/L	<10	13/12/2014	Sub Contract
gamma-Chlordane		ng/L	<4	13/12/2014	Sub Contract
Triallate		ng/L	<10	13/12/2014	Sub Contract
Trifluralin		ng/L	<30	13/12/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

BHP/CL/02C

TEST REPORT NO: 115096.2

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Client: Response Engineering
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BHP Ref. No.: 14/10/665
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

FTAO: Ailish Johnson

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water RD3				
Azinphos-ethyl		ng/L	<4	13/12/2014	Sub Contract
Azinphos-methyl		ng/L	<2	13/12/2014	Sub Contract
Carbophenothion		ng/L	<3	13/12/2014	Sub Contract
Chlorfenvinphos		ng/L	<2	13/12/2014	Sub Contract
Chlorpyriphos		ng/L	<2	13/12/2014	Sub Contract
Diazinon		ng/L	<3	13/12/2014	Sub Contract
Dichlorvos		ng/L	<2	13/12/2014	Sub Contract
Dimethoate		ng/L	<20	13/12/2014	Sub Contract
Fenitrothion		ng/L	<2	13/12/2014	Sub Contract
Fenthion		ng/L	<2	13/12/2014	Sub Contract
Malathion		ng/L	<4	13/12/2014	Sub Contract
Mevinphos		ng/L	<20	13/12/2014	Sub Contract
Parathion-ethyl		ng/L	<3	13/12/2014	Sub Contract
Parathion-methyl		ng/L	<3	13/12/2014	Sub Contract
Phorate		ng/L	<4	13/12/2014	Sub Contract
Phosalone		ng/L	<4	13/12/2014	Sub Contract
Pirimiphos-methyl		ng/L	<5	13/12/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

BHP/CL/02C

TEST REPORT NO: 115096.2

Analysing
Testing
Consulting
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Client: Response Engineering
Traderee TP
Shannon
Co. Clare

BHP Ref. No.: 14/10/665
Order No.:
Date Received: 29/10/14
Date Completed: 13/12/14
Test Specification: Nil
Item :See below

FTAO: Ailish Johnson

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TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring Annual Ground Water RD3				
Propetamphos		ng/L	<3	13/12/2014	Sub Contract
Triazophos		ng/L	<2	13/12/2014	Sub Contract
Organo-tin		ng/L	<20	04/12/2014	Sub Contract
Tributyl Tin		ng/L	<20	04/12/2014	Sub Contract
Triphenyl Tin		ng/L	<20	04/12/2014	Sub Contract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 15/01/15

Leachate Monitoring Test Reports

BHP/CL/02C

TEST REPORT 112989

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Traderee TP
Shannon
Co. Clare

FTAO: Ailish Johnson

BHP Ref. No.: 14/04/741
Order No.:
Date Received: 28/04/14
Date Completed: 07/05/14
Test Specification: Nil
Item : Biannual Leachate

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TEST	Client Reference	Units	Results	Standard Reference
	Biannual Landfill Monitoring SS3-Leachate 2014			
pH		-	6.97	APHA - 4500 - H^+
Temperature		°C	11.6	APHA - 2550 - B
Total Ammonia		mg/l	0.52	APHA-4500-NH_3-D
Conductivity		μScm^{-1}	945	APHA - 2510 - B
B.O.D		mg/l	2.1	APHA - 5210 - B
C.O.D		mg/l	43	APHA - 5220 - D
Nitrite (as NO_2)		mg/l	1.0	APHA - 4110 - B
Nitrate (as NO_3)		mg/l	0.01	APHA - 4110 - B
Total oxidised Nitrogen (as N)		mg/l	1.02	APHA - 4110 - B
Chloride		mg/l	49.198	APHA - 4110 - B

Additional information : All Methods are from Standard Methods for the Examination of Water and Wastewater, 22nd Edition.

For and on behalf of BHP laboratories :

Paul O'Sullivan
Issue Date 08/05/14

Page 1 of 1

BHP/CL/02C

TEST REPORT 115091

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Traderee TP
Shannon
Co. Clare

BHP Ref. No.: 14/10/649
Order No.:
Date Received: 29/10/14
Date Completed: 07/11/14
Test Specification: Nil
Item : Biannual Leachate

FTAO: Ailish Johnson

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TEST	Client Reference	Units	Results	Date Analysed	Standard Reference
	Biannual Landfill Monitoring SS3-Leachate 2014				
pH		-	7.06	29/10/2014	APHA - 4500 - H^+
Temperature		°C	12.7	29/10/2014	APHA - 2550 - B
Total Ammonia		mg/L	3.8	12/11/2014	APHA-4500-NH_3-D
Conductivity		µS/cm	997	29/10/2014	APHA - 2510 - B
B.O.D		mg/L	1.94	29/10/2014	APHA - 5210 - B
C.O.D		mg/L	56	07/11/2014	APHA - 5220 - D
Total oxidised Nitrogen (as N)		mg/L	0.22	06/11/2014	APHA - 4110 - B
Chloride		mg/L	70.5	06/11/2014	APHA - 4110 - B

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 20/11/14

Page 1 of 1

BHP/CL/02C

TEST REPORT NO: 115092

Analysing
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Client: Response Engineering
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FTAO: Ailish Johnson

BHP Ref. No.: 14/10/650
Order No.:
Date Received: 29/10/14
Date Completed: 24/11/14
Test Specification: Nil
Item :See below

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring SS3				
Arsenic		mg/L	0.0019	07/11/2014	Subcontract
Boron		mg/L	<0.23	10/11/2014	Subcontract
Cadmium		mg/L	0.0006	10/11/2014	Subcontract
Calcium		mg/L	177	10/11/2014	Subcontract
Chromium		mg/L	<0.002	10/11/2014	Subcontract
Copper		mg/L	<0.009	10/11/2014	Subcontract
Cyanide		mg/L	0.023	21/11/2014	APHA - 4500 - CN- E
Fluoride		mg/L	0.21	24/11/2014	APHA - 4110 - B
Iron		mg/L	3.78	10/11/2014	Subcontract
Lead		mg/L	<0.006	10/11/2014	Subcontract
Magnesium		mg/L	25.9	10/11/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date 25/11/14

BHP/CL/02C

TEST REPORT NO: 115092

Analysing
Testing
Consulting
Calibrating

Client: **Response Engineering**
Traderee TP
Shannon
Co. Clare

FTAO: Ailish Johnson

BHP Ref. No.: 14/10/650
Order No.:
Date Received: 29/10/14
Date Completed: 24/11/14
Test Specification: Nil
Item :See below

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TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring SS3				
Mercury		mg/L	<0.0001	06/11/2014	Subcontract
Nickel		mg/L	0.0378	10/11/2014	Subcontract
Potassium		mg/L	5.83	10/11/2014	Subcontract
Sodium		mg/L	42.5	13/11/2014	Subcontract
Tin		mg/L	<0.007	10/11/2014	Subcontract
Zinc		mg/L	<0.018	10/11/2014	Subcontract
Sulphate (as SO_4)		mg/L	154.7	24/11/2014	APHA - 4110 - B
Total Phosphorus (as P)		mg/L	0.12	04/11/2014	APHA - 4500 - P
Detergents (as MBAS)		mg/L	0.136	14/11/2014	APHA - 5540 - C

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date 25/11/14

Surface Water Monitoring Test Reports

BHP/CL/02C

TEST REPORT 112988.1

Analysing
Testing
Consulting
Calibrating

Client: **Response Engineering**
Traderee TP
Shannon
Co. Clare

FTAO: Ailish Johnson

BHP Ref. No.: 14/04/738
Order No.:
Date Received: 28/04/14
Date Completed: 01/05/14
Test Specification: Nil
Item : Biannual SW Monitoring

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TEST	Client Reference	Units	Results	Standard Reference
	Biannual Landfill Monitoring SS1			
pH		-	7.80	APHA - 4500 - H^+
Temperature		^0C	13.7	APHA - 2550 - B
Total Ammonia		mg/l	0.09	APHA-4500-NH_3-D
B.O.D		mg/l	4	APHA - 5210 - B
C.O.D		mg/l	21	APHA - 5220 - D
Total Suspended Solids		mg/l	4	APHA - 2540 - B
Dissolved Oxygen		% O_2 sat	97.2	APHA - 4500-O-G

Additional information : All Methods are from Standard Methods for the Examination of Water and Wastewater, 20th Edition.

For and on behalf of BHP laboratories :

Colette Hannan
Issue Date 14/05/14

BHP/CL/02C

TEST REPORT 112988.2

Analysing
Testing
Consulting
Calibrating

Client: **Response Engineering**
Traderee TP
Shannon
Co. Clare

FTAO: Ailish Johnson

BHP Ref. No.: 14/04/739
Order No.:
Date Received: 28/04/14
Date Completed: 01/05/14
Test Specification: Nil
Item : Biannual SW Monitoring

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TEST	Client Reference	Units	Results	Standard Reference
	Biannual Landfill Monitoring SS2			
pH		-	8.20	APHA - 4500 - H^+
Temperature		^0C	16.80	APHA - 2550 - B
Total Ammonia		mg/l	0.15	APHA-4500-NH_3-D
B.O.D		mg/l	2.80	APHA - 5210 - B
C.O.D		mg/l	33.00	APHA - 5220 - D
Total Suspended Solids		mg/l	3.60	APHA - 2540 - B
Dissolved Oxygen		% O_2 sat	117.00	APHA - 4500-O-G

Additional information : All Methods are from Standard Methods for the Examination of Water and Wastewater, 20th Edition.

For and on behalf of BHP laboratories :

Colette Hannan
Issue Date 14/05/14

BHP/CL/02C

TEST REPORT 112988.3

Analysing
Testing
Consulting
Calibrating

Client: **Response Engineering**
Traderee TP
Shannon
Co. Clare

FTAO: Ailish Johnson

BHP Ref. No.: 14/04/740
Order No.:
Date Received: 28/04/14
Date Completed: 01/05/14
Test Specification: Nil
Item : Biannual SW Monitoring

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TEST	Client Reference	Units	Results	Standard Reference
	Biannual Landfill Monitoring SS4			
pH		-	7.76	APHA - 4500 - H^+
Temperature		^0C	14.1	APHA - 2550 - B
Total Ammonia		mg/l	0.06	APHA-4500-NH_3-D
B.O.D		mg/l	3.6	APHA - 5210 - B
C.O.D		mg/l	11	APHA - 5220 - D
Total Suspended Solids		mg/l	3.2	APHA - 2540 - B
Dissolved Oxygen		% O_2 sat	100.0	APHA - 4500-O-G

Additional information : All Methods are from Standard Methods for the Examination of Water and Wastewater, 20th Edition.

For and on behalf of BHP laboratories :

Colette Hannan
Issue Date 14/05/14

BHP/CL/02C

TEST REPORT 112988.5

Analysing
Testing
Consulting
Calibrating

Client: **Response Engineering**
Traderee TP
Shannon
Co. Clare

FTAO: Ailish Johnson

BHP Ref. No.: N/A*
Order No.:
Date Received: N/A*
Date Completed: N/A*
Test Specification: Nil
Item : Biannual SW Monitoring

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TEST	Client Reference	Units	Results	Standard Reference
	Biannual Landfill Monitoring SS6			
pH		-	dry	APHA - 4500 - H^+
Temperature		^0C	dry	APHA - 2550 - B
Total Ammonia		mg/l	dry	APHA-4500-NH_3-D
B.O.D		mg/l	dry	APHA - 5210 - B
C.O.D		mg/l	dry	APHA - 5220 - D
Total Suspended Solids		mg/l	dry	APHA - 2540 - B
Dissolved Oxygen		% O_2 sat	dry	APHA - 4500-O-G

Additional information : All Methods are from Standard Methods for the Examination of Water and Wastewater, 20th Edition.
*Sample location dry, unable to sample

For and on behalf of BHP laboratories :

Colette Hannan
Issue Date 14/05/14

BHP/CL/02C

TEST REPORT 112988.6

Analysing
Testing
Consulting
Calibrating

Client: **Response Engineering**
Traderee TP
Shannon
Co. Clare

FTAO: Ailish Johnson

BHP Ref. No.: N/A*
Order No.:
Date Received: N/A*
Date Completed: N/A*
Test Specification: Nil
Item : Biannual SW Monitoring

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TEST	Client Reference	Units	Results	Standard Reference
	Biannual Landfill Monitoring			
	SS7			
pH		-	dry	APHA - 4500 - H^+
Temperature		^0C	dry	APHA - 2550 - B
Total Ammonia		mg/l	dry	APHA-4500-NH_3-D
B.O.D		mg/l	dry	APHA - 5210 - B
C.O.D		mg/l	dry	APHA - 5220 - D
Total Suspended Solids		mg/l	dry	APHA - 2540 - B
Dissolved Oxygen		% O_2 sat	dry	APHA - 4500-O-G

Additional information : All Methods are from Standard Methods for the Examination of Water and Wastewater, 20th Edition.
*Sample location dry, unable to sample

For and on behalf of BHP laboratories :

Colette Hannan
Issue Date 14/05/14

BHP/CL/02C

TEST REPORT 115093.1

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Traderee TP
Shannon
Co. Clare

FTAO: Ailish Johnson

BHP Ref. No.: 14/10/651
Order No.:
Date Received: 29/10/14
Date Completed: 13/11/14
Test Specification: Nil
Item : Biannual SW Monitoring

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TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Biannual Landfill Monitoring SS1				
pH		-	8.01	29/10/2014	APHA - 4500 - H^+
Temperature		^0C	9.9	29/10/2014	APHA - 2550 - B
Total Ammonia (as NH_3-N		mg/L	0.17	13/11/2014	APHA-4500-NH_3-D
B.O.D		mg/L	2.8	29/10/2014	APHA - 5210 - B
C.O.D		mg/L	33	07/11/2014	APHA - 5220 - D
Total Suspended Solids		mg/L	18.8	10/11/2014	APHA - 2540 - B
Dissolved Oxygen		% O_2 sat	55.0	29/10/2014	APHA - 4500-O-G

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 20/11/14

BHP/CL/02C

TEST REPORT 115093.2

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Traderee TP
Shannon
Co. Clare

FTAO: Ailish Johnson

BHP Ref. No.: 14/10/652
Order No.:
Date Received: 29/10/14
Date Completed: 13/11/14
Test Specification: Nil
Item : Biannual SW Monitoring

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TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Biannual Landfill Monitoring SS2				
pH		-	7.92	29/10/2014	APHA - 4500 - H^+
Temperature		^0C	10.1	29/10/2014	APHA - 2550 - B
Total Ammonia (as NH_3-N		mg/L	0.26	13/11/2014	APHA-4500-NH_3-D
B.O.D		mg/L	4.3	29/10/2014	APHA - 5210 - B
C.O.D		mg/L	37	07/11/2014	APHA - 5220 - D
Total Suspended Solids		mg/L	7.4	10/11/2014	APHA - 2540 - B
Dissolved Oxygen		% O_2 sat	58.0	29/10/2014	APHA - 4500-O-G

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 20/11/14

BHP/CL/02C

TEST REPORT 115093.3

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Traderee TP
Shannon
Co. Clare

FTAO: Ailish Johnson

BHP Ref. No.: 14/10/653
Order No.:
Date Received: 29/10/14
Date Completed: 13/11/14
Test Specification: Nil
Item : Biannual SW Monitoring

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TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Biannual Landfill Monitoring SS4				
pH		-	7.93	29/10/2014	APHA - 4500 - H^+
Temperature		^0C	9.9	29/10/2014	APHA - 2550 - B
Total Ammonia (as NH_3-N		mg/L	0.35	13/11/2014	APHA-4500-NH_3-D
B.O.D		mg/L	4.4	29/10/2014	APHA - 5210 - B
C.O.D		mg/L	34	07/11/2014	APHA - 5220 - D
Total Suspended Solids		mg/L	12.6	10/11/2014	APHA - 2540 - B
Dissolved Oxygen		% O_2 sat	59.0	29/10/2014	APHA - 4500-O-G

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 20/11/14

BHP/CL/02C

TEST REPORT 115093.3

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Traderee TP
Shannon
Co. Clare

FTAO: Ailish Johnson

BHP Ref. No.: 14/10/653
Order No.:
Date Received: 29/10/14
Date Completed: 13/11/14
Test Specification: Nil
Item : Biannual SW Monitoring

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TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Biannual Landfill Monitoring SS4				
pH		-	7.93	29/10/2014	APHA - 4500 - H^+
Temperature		^0C	9.9	29/10/2014	APHA - 2550 - B
Total Ammonia (as NH_3-N		mg/L	0.35	13/11/2014	APHA-4500-NH_3-D
B.O.D		mg/L	4.4	29/10/2014	APHA - 5210 - B
C.O.D		mg/L	34	07/11/2014	APHA - 5220 - D
Total Suspended Solids		mg/L	12.6	10/11/2014	APHA - 2540 - B
Dissolved Oxygen		% O_2 sat	59.0	29/10/2014	APHA - 4500-O-G

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O'Halloran
Issue Date 20/11/14

BHP/CL/02C

TEST REPORT NO: 115094.1

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Client: Response Engineering
Traderee TP
Shannon
Co. Clare

FTAO: Ailish Johnson

BHP Ref. No.: 14/10/655
Order No.:
Date Received: 29/10/14
Date Completed: 21/11/14
Test Specification: Nil
Item :See below

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring SS1				
Conductivity		µS/cm	861	29/10/2014	APHA - 2510 - B
Arsenic		mg/L	<0.001	07/11/2014	Subcontract
Boron		mg/L	<0.23	10/11/2014	Subcontract
Cadmium		mg/L	<0.0006	10/11/2014	Subcontract
Calcium		mg/L	132	10/11/2014	Subcontract
Chromium		mg/L	<0.002	10/11/2014	Subcontract
Copper		mg/L	<0.009	10/11/2014	Subcontract
Cyanide		mg/L	0.019	21/11/2014	APHA - 4500 - CN- E
Fluoride		mg/L	0.17	12/11/2014	APHA - 4110 - B
Iron		mg/L	0.923	10/11/2014	Subcontract
Lead		mg/L	<0.006	10/11/2014	Subcontract
Magnesium		mg/L	13.3	10/11/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date 25/11/14

BHP/CL/02C

TEST REPORT NO: 115094.1

Analysing
Testing
Consulting
Calibrating

Client: **Response Engineering**
Traderee TP
Shannon
Co. Clare

FTAO: Ailish Johnson

BHP Ref. No.: 14/10/655
Order No.:
Date Received: 29/10/14
Date Completed: 21/11/14
Test Specification: Nil
Item :See below

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TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring SS1				
Mercury		mg/L	<0.0001	06/11/2014	Subcontract
Nickel		mg/L	<0.003	10/11/2014	Subcontract
Potassium		mg/L	7.86	10/11/2014	Subcontract
Sodium		mg/L	30.8	13/11/2014	Subcontract
Tin		mg/L	<0.007	10/11/2014	Subcontract
Zinc		mg/L	<0.018	10/11/2014	Subcontract
Sulphate (as SO_4)		mg/L	72.6	12/11/2014	APHA - 4110 - B
Total Phosphorus (as P)		mg/L	0.16	04/11/2014	APHA - 4500 - P
Nitrate (as N)		mg/L	1.64	12/11/2014	APHA - 4110 - B
Nitrite (as N)		mg/L	0.03	12/11/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	1.67	12/11/2014	APHA - 4110 - B

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date 25/11/14

BHP/CL/02C

TEST REPORT NO: 115094.2

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FTAO: Ailish Johnson

BHP Ref. No.: 14/10/656
Order No.:
Date Received: 29/10/14
Date Completed: 21/11/14
Test Specification: Nil
Item :See below

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring SS2				
Conductivity		µS/cm	827	29/10/2014	APHA - 2510 - B
Arsenic		mg/L	<0.001	07/11/2014	Subcontract
Boron		mg/L	<0.23	10/11/2014	Subcontract
Cadmium		mg/L	0.0006	10/11/2014	Subcontract
Calcium		mg/L	139	10/11/2014	Subcontract
Chromium		mg/L	<0.002	10/11/2014	Subcontract
Copper		mg/L	<0.009	10/11/2014	Subcontract
Cyanide		mg/L	0.03	21/11/2014	APHA - 4500 - CN- E
Fluoride		mg/L	0.19	12/11/2014	APHA - 4110 - B
Iron		mg/L	0.755	10/11/2014	Subcontract
Lead		mg/L	<0.006	10/11/2014	Subcontract
Magnesium		mg/L	17.4	10/11/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date 25/11/14

BHP/CL/02C

TEST REPORT NO: 115094.2

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FTAO: Ailish Johnson

BHP Ref. No.: 14/10/656
Order No.:
Date Received: 29/10/14
Date Completed: 21/11/14
Test Specification: Nil
Item :See below

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring SS2				
Mercury		mg/L	<0.0001	06/11/2014	Subcontract
Nickel		mg/L	0.0042	10/11/2014	Subcontract
Potassium		mg/L	10.1	10/11/2014	Subcontract
Sodium		mg/L	43	13/11/2014	Subcontract
Tin		mg/L	<0.007	10/11/2014	Subcontract
Zinc		mg/L	<0.018	10/11/2014	Subcontract
Sulphate (as SO_4)		mg/L	113.9	13/11/2014	APHA - 4110 - B
Total Phosphorus (as P)		mg/L	0.14	04/11/2014	APHA - 4500 - P
Nitrate (as N)		mg/L	1.2	12/11/2014	APHA - 4110 - B
Nitrite (as N)		mg/L	0.11	12/11/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	1.31	12/11/2014	APHA - 4110 - B

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date 25/11/14

BHP/CL/02C

TEST REPORT NO: 115094.3

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Client: Response Engineering
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BHP Ref. No.: 14/10/657
Order No.:
Date Received: 29/10/14
Date Completed: 21/11/14
Test Specification: Nil
Item :See below

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring SS4				
Conductivity		µS/cm	1275	29/10/2014	APHA - 2510 - B
Arsenic		mg/L	0.0049	07/11/2014	Subcontract
Boron		mg/L	<0.23	10/11/2014	Subcontract
Cadmium		mg/L	<0.0006	10/11/2014	Subcontract
Calcium		mg/L	142	10/11/2014	Subcontract
Chromium		mg/L	0.002	10/11/2014	Subcontract
Copper		mg/L	<0.009	10/11/2014	Subcontract
Cyanide		mg/L	0.019	21/11/2014	APHA - 4500 - CN- E
Fluoride		mg/L	0.19	12/11/2014	APHA - 4110 - B
Iron		mg/L	1.85	10/11/2014	Subcontract
Lead		mg/L	<0.006	10/11/2014	Subcontract
Magnesium		mg/L	40.9	10/11/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date 25/11/14

BHP/CL/02C

TEST REPORT NO: 115094.3

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FTAO: Ailish Johnson

BHP Ref. No.: 14/10/657
Order No.:
Date Received: 29/10/14
Date Completed: 21/11/14
Test Specification: Nil
Item :See below

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring SS4				
Mercury		mg/L	<0.0001	06/11/2014	Subcontract
Nickel		mg/L	0.0111	10/11/2014	Subcontract
Potassium		mg/L	20.3	10/11/2014	Subcontract
Sodium		mg/L	261	13/11/2014	Subcontract
Tin		mg/L	<0.007	10/11/2014	Subcontract
Zinc		mg/L	<0.018	10/11/2014	Subcontract
Sulphate (as SO_4)		mg/L	125.1	13/11/2014	APHA - 4110 - B
Total Phosphorus (as P)		mg/L	0.29	04/11/2014	APHA - 4500 - P
Nitrate (as N)		mg/L	1.72	12/11/2014	APHA - 4110 - B
Nitrite (as N)		mg/L	<0.01	12/11/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	1.72	12/11/2014	APHA - 4110 - B

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date 25/11/14

BHP/CL/02C

TEST REPORT NO: 115094.4

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FTAO: Ailish Johnson

BHP Ref. No.: 14/10/658
Order No.:
Date Received: 29/10/14
Date Completed: 21/11/14
Test Specification: Nil
Item :See below

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring SS6				
Conductivity		µS/cm	4995	29/10/2014	APHA - 2510 - B
Arsenic		mg/L	0.019	07/11/2014	Subcontract
Boron		mg/L	0.523	10/11/2014	Subcontract
Cadmium		mg/L	<0.0006	10/11/2014	Subcontract
Calcium		mg/L	139	10/11/2014	Subcontract
Chromium		mg/L	<0.002	10/11/2014	Subcontract
Copper		mg/L	<0.009	10/11/2014	Subcontract
Cyanide		mg/L	0.013	21/11/2014	APHA - 4500 - CN- E
Fluoride		mg/L	0.24	12/11/2014	APHA - 4110 - B
Iron		mg/L	1.05	10/11/2014	Subcontract
Lead		mg/L	<0.006	10/11/2014	Subcontract
Magnesium		mg/L	121	10/11/2014	Subcontract

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date 25/11/14

BHP/CL/02C

TEST REPORT NO: 115094.4

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Client: Response Engineering
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FTAO: Ailish Johnson

BHP Ref. No.: 14/10/658
Order No.:
Date Received: 29/10/14
Date Completed: 21/11/14
Test Specification: Nil
Item :See below

TEST	Client Reference	Units	Results	Date Analysed	Standard Reference*
	Annual Landfill Monitoring SS6				
Mercury		mg/L	<0.0001	06/11/2014	Subcontract
Nickel		mg/L	0.0032	10/11/2014	Subcontract
Potassium		mg/L	55.7	10/11/2014	Subcontract
Sodium		mg/L	915	13/11/2014	Subcontract
Tin		mg/L	<0.007	10/11/2014	Subcontract
Zinc		mg/L	<0.018	10/11/2014	Subcontract
Sulphate (as SO_4)		mg/L	327.7	13/11/2014	APHA - 4110 - B
Total Phosphorus (as P)		mg/L	0.29	04/11/2014	APHA - 4500 - P
Nitrate (as N)		mg/L	0.77	12/11/2014	APHA - 4110 - B
Nitrite (as N)		mg/L	<0.01	12/11/2014	APHA - 4110 - B
Total Oxidised Nitrogen (as N)		mg/L	0.77	12/11/2014	APHA - 4110 - B

Additional information : *Documented in-house methods based on stated standard references

For and on behalf of BHP laboratories :

John O' Halloran
Issue Date 25/11/14

Appendix H – Meteorological Data

Shannon Airport Weather Records 2014

Year	Month	Day	Mean Realative Humidity (%)	Mean MSL Pressure (hpa)	Mean Wind Speed (kt)	Predominant Wind Direction (degrees)	Potential Evapotranspiration (mm)	Evaporation (mm)
2014	1	1	92	979.1	9.8	210	0.4	0.6
2014	1	2	84.3	982.5	12.8	180	0.7	0.8
2014	1	3	79.8	978.5	19.5	195	0.8	1
2014	1	4	90.1	988.3	8.4	170	0.4	0.5
2014	1	5	86.6	984.2	13.5	150	0.6	0.8
2014	1	6	81.4	975.3	17.9	190	0.9	1.1
2014	1	7	83.5	990.4	13.2	195	0.7	0.9
2014	1	8	96.2	1006.4	5.5	165	0.2	0.3
2014	1	9	92.8	1008.2	6.2	205	0.2	0.2
2014	1	10	91.6	1008.3	6.5	175	0.2	0.2
2014	1	11	89.9	1017.1	7.5	110	0.2	0.3
2014	1	12	90	1003	15.2	140	0.6	0.9
2014	1	13	89.8	998.6	7	140	0.2	0.3
2014	1	14	96.7	998.9	9.6	110	0.3	0.4
2014	1	15	88.8	986.7	10	135	0.3	0.5
2014	1	16	93.2	978.8	5.8	115	0.4	0.5
2014	1	17	94.3	985.3	5.4	220	0.2	0.3
2014	1	18	95.4	986.7	3.1	225	0.3	0.4
2014	1	19	91.1	992.6	6.6	135	0.3	0.5
2014	1	20	87.2	1006.5	6.2	165	0.4	0.5
2014	1	21	89	997.7	10.7	155	0.5	0.7
2014	1	22	87.9	1005.7	8.8	245	0.6	0.8
2014	1	23	87.6	1014.2	9.8	260	0.6	0.8
2014	1	24	97.2	1007.8	12.7	240	0.3	0.5
2014	1	25	80.3	1012.1	16	225	1.1	1.4
2014	1	26	74.4	994.1	22	255	0.9	1.3
2014	1	27	79.6	984.9	23.2	260	1	1.4
2014	1	28	79.4	983.8	13.1	315	0.8	1
2014	1	29	81.6	998	8	300	0.7	0.8
2014	1	30	92.4	1001.6	6.4	120	0.3	0.4
2014	1	31	82.5	984.2	14.5	155	0.9	1.3
January							16	21.4

Shannon Airport Weather Records 2014

Year	Month	Day	Mean Realative Humidity (%)	Mean MSL Pressure (hpa)	Mean Wind Speed (kt)	Predominant Wind Direction (degrees)	Potential Evapotranspiration (mm)	Evaporation (mm)
2014	2	1	78.5	976.7	25.2	155	1.3	2.1
2014	2	2	76.6	994.7	15.5	260	1.2	1.5
2014	2	3	82.6	987.2	13.6	240	0.8	1.1
2014	2	4	83.1	979	12.5	220	0.6	0.8
2014	2	5	87.5	964.7	16.6	245	0.9	1.2
2014	2	6	82.8	986.8	6.1	280	0.6	0.8
2014	2	7	81.4	982.8	11	155	0.6	0.8
2014	2	8	81.5	958.6	20.4	125	1.2	1.7
2014	2	9	75.8	978.6	15.3	145	0.9	1.3
2014	2	10	79	991.5	10.2	155	0.9	1.2
2014	2	11	77.8	990	12.7	215	0.7	1
2014	2	12	80.5	976.7	21.5	185	1.1	1.7
2014	2	13	78.2	987.5	14.4	125	1	1.4
2014	2	14	88.4	972.1	10.8	130	0.6	0.9
2014	2	15	74.7	989.7	13.5	280	1	1.4
2014	2	16	86.3	1000	9.4	125	0.6	0.9
2014	2	17	95.4	995.8	4.2	265	0.5	0.6
2014	2	18	90.1	1006.4	4.6	220	0.7	0.9
2014	2	19	90.4	1003.7	8.9	145	0.6	0.9
2014	2	20	81.1	994.1	13.2	230	0.9	1.3
2014	2	21	81.3	996.8	16.3	225	1.1	1.6
2014	2	22	84.5	999	14.2	165	0.9	1.3
2014	2	23	81.5	992.4	13.5	165	0.8	1.1
2014	2	24	85.5	990.9	11.2	150	0.8	1.1
2014	2	25	78.9	988.3	16.5	230	1.1	1.7
2014	2	26	77.3	1004.8	14.2	230	1.1	1.6
2014	2	27	79.5	1001.8	11.4	235	0.9	1.3
2014	2	28	80.4	1005.1	10	270	1	1.5
February							24.4	34.7

Shannon Airport Weather Records 2014

Year	Month	Day	Mean Realative Humidity (%)	Mean MSL Pressure (hpa)	Mean Wind Speed (kt)	Predominant Wind Direction (degrees)	Potential Evapotranspiration (mm)	Evaporation (mm)
2014	3	1	86.4	999.5	7.2	135	0.9	1.2
2014	3	2	85.4	984.6	9.1	200	0.9	1.2
2014	3	3	83.5	987.4	9.5	270	1	1.5
2014	3	4	85	1003.6	4.8	215	0.8	1.2
2014	3	5	87.3	1014.9	8.7	155	0.9	1.2
2014	3	6	95.2	1013.4	7.8	155	0.8	1.1
2014	3	7	74.3	1019.3	8.9	255	1.2	1.7
2014	3	8	82.5	1011.4	21.3	160	1.6	2.5
2014	3	9	96.3	1017.9	4.2	335	0.5	0.7
2014	3	10	88	1031.4	2.5	95	0.8	1.1
2014	3	11	81	1034	3	110	1.2	1.8
2014	3	12	89	1033	2.5	115	0.9	1.3
2014	3	13	94.9	1032	2.2	75	0.6	0.8
2014	3	14	92.3	1031.1	7.3	250	0.7	1.1
2014	3	15	85.1	1033.5	11.8	250	1.4	2.2
2014	3	16	91.3	1029.6	9.6	260	1	1.4
2014	3	17	87.5	1022	7.4	235	1	1.4
2014	3	18	83.8	1017.4	15.8	250	1.5	2.3
2014	3	19	80.6	1016.2	13	190	1.7	2.5
2014	3	20	81.3	999.7	17.5	240	1.2	1.9
2014	3	21	83.9	998.3	12.5	190	1.1	1.7
2014	3	22	81.3	998.3	13.5	260	1.4	2.2
2014	3	23	70.9	1012.2	7.9	275	1.6	2.4
2014	3	24	83.7	998.6	18.1	115	1.2	1.8
2014	3	25	78.6	1012.3	9.2	300	1.5	2.2
2014	3	26	78.3	1023.6	7.8	325	1.5	2.1
2014	3	27	82	1013.8	6.3	25	1.2	1.7
2014	3	28	81.6	1015.9	8.2	20	1.4	2
2014	3	29	89	1009	6.9	90	0.9	1.4
2014	3	30	87	1008	6.7	90	1.4	2.2
2014	3	31	82.6	1007.6	8.8	100	1.7	2.5
March							35.5	52.3

Shannon Airport Weather Records 2014

Year	Month	Day	Mean Realative Humidity (%)	Mean MSL Pressure (hpa)	Mean Wind Speed (kt)	Predominant Wind Direction (degrees)	Potential Evapotranspiration (mm)	Evaporation (mm)
2014	4	1	82.4	1007.2	8.1	85	1.6	2.2
2014	4	2	86.5	997	9.5	105	1.2	1.6
2014	4	3	82.2	998.7	9.3	140	1.8	2.5
2014	4	4	81.4	1003.9	9.5	110	2	2.8
2014	4	5	90.2	1002.3	8.3	145	1.3	1.8
2014	4	6	78.6	1001.3	14.6	220	1.6	2.7
2014	4	7	83.1	1005.8	8.8	235	1.8	2.6
2014	4	8	78.9	1019.8	11.7	250	1.7	2.7
2014	4	9	78.7	1024.6	8.6	210	1.5	2
2014	4	10	79.5	1023.3	7.8	200	1.3	1.9
2014	4	11	79.6	1024.3	6.5	230	1.3	1.9
2014	4	12	76.2	1019.7	11.8	270	1.5	2.4
2014	4	13	78.4	1025.7	10	250	1.8	2.6
2014	4	14	69.5	1027.7	3.7	265	2.5	3.5
2014	4	15	66.1	1025.6	10.5	140	3	4.4
2014	4	16	72.6	1022.2	9.9	135	2.9	4
2014	4	17	82.9	1023.3	9.5	265	1.2	1.9
2014	4	18	79.2	1022.2	2.9	275	2.2	3
2014	4	19	73	1017.4	5.8	120	2.4	3.3
2014	4	20	70.7	1012.8	7.5	20	1.7	2.2
2014	4	21	75.1	1005.3	11.5	85	2.5	3.6
2014	4	22	83.1	1005.5	6.7	105	1.3	1.8
2014	4	23	78.3	1008.6	9.3	170	2.2	3.3
2014	4	24	75	1015.8	7.8	120	2.6	3.8
2014	4	25	76.8	1006.7	13.7	85	2.1	3.2
2014	4	26	88.8	992.2	10.3	25	1.2	1.9
2014	4	27	82.8	1008.3	6.3	330	2.5	3.5
2014	4	28	82.1	1012.8	3.7	230	2.3	3.1
2014	4	29	76.8	1011.6	7	145	3.4	4.9
2014	4	30	84.4	1007.6	9.1	115	2.4	3.5
April							58.8	84.6

Shannon Airport Weather Records 2014

Year	Month	Day	Mean Realative Humidity (%)	Mean MSL Pressure (hpa)	Mean Wind Speed (kt)	Predominant Wind Direction (degrees)	Potential Evapotranspiration (mm)	Evaporation (mm)
2014	5	1	83.7	1012	7.4	245	1.9	2.6
2014	5	2	86.8	1024.2	6.4	110	1.1	1.4
2014	5	3	90.2	1024.2	8.8	145	1.3	1.8
2014	5	4	84.2	1016.9	11	160	1.3	1.6
2014	5	5	81.3	1002.3	14.1	140	1.4	2.2
2014	5	6	80.2	1000.5	12.7	170	1.9	2.9
2014	5	7	82.4	1006.3	15.9	240	1.8	2.9
2014	5	8	90.1	1005.6	12.2	240	1.2	2
2014	5	9	78.8	1008.1	14.2	240	2.3	3.7
2014	5	10	89	998	19.7	245	1.2	2.2
2014	5	11	72.9	1006.4	16	250	3.1	5.3
2014	5	12	81.6	1011.9	10.5	245	2.3	3.6
2014	5	13	75.2	1024.3	9	265	3	4.5
2014	5	14	90.2	1032.9	6	235	1.5	2.1
2014	5	15	82.8	1035.8	3.1	275	3.1	4.2
2014	5	16	72.8	1031.7	6.4	240	3.1	4.2
2014	5	17	63	1020.9	9.4	185	3.3	4.6
2014	5	18	76.2	1007	8.2	245	2.1	3.1
2014	5	19	87	1002.7	4.2	330	1.5	2.1
2014	5	20	89.5	1002.9	4.8	130	2.3	3.1
2014	5	21	80.8	1007.8	6.6	135	2.2	3.2
2014	5	22	84	1006	9.8	335	1.9	2.9
2014	5	23	78	1010.2	11.7	340	2	2.8
2014	5	24	84.4	1012.6	10.6	340	1.6	2.3
2014	5	25	82.7	1015.9	6.6	330	1.4	2
2014	5	26	79.4	1017.5	3.5	305	2.1	2.7
2014	5	27	74	1017.2	5.4	115	3	4.1
2014	5	28	75.8	1017.9	3.9	275	3.7	5
2014	5	29	73.8	1020	5.2	25	2.8	3.8
2014	5	30	76.4	1025.1	3.5	355	2.9	3.8
2014	5	31	81	1026.1	5.5	245	3.3	4.6
May							67.6	97.3

Shannon Airport Weather Records 2014

Year	Month	Day	Mean Realative Humidity (%)	Mean MSL Pressure (hpa)	Mean Wind Speed (kt)	Predominant Wind Direction (degrees)	Potential Evapotranspiration (mm)	Evaporation (mm)
2014	6	1	84.5	1019.5	8.6	135	2.5	3.4
2014	6	2	84.8	1017.5	8.2	255	1.7	2.5
2014	6	3	77.7	1012	8.2	220	2.6	3.7
2014	6	4	71.4	1009.9	8.3	275	3.9	6.1
2014	6	5	63.2	1010.3	4	110	3.3	4.6
2014	6	6	82.4	1005.3	12.5	85	1.9	2.8
2014	6	7	76.7	1005.9	11.5	125	2.7	3.8
2014	6	8	79	1009.7	11.8	140	2.7	4
2014	6	9	82.9	1011.1	9.7	120	2.5	3.5
2014	6	10	79.7	1011.5	6.6	105	2.9	4.1
2014	6	11	75.9	1023.8	4.5	225	2.5	3.3
2014	6	12	67.3	1027	7.5	140	3.8	5.1
2014	6	13	80	1027.3	5.5	250	2.1	2.8
2014	6	14	79.5	1029.7	4.1	345	2.5	3.4
2014	6	15	74.7	1031.2	6	325	3.6	5
2014	6	16	66	1030.8	7	20	4.4	6.1
2014	6	17	64.7	1030.5	4	10	4.6	6
2014	6	18	72.1	1029.4	5.3	310	4.7	6.3
2014	6	19	70.5	1027.8	7.5	335	3.1	4.2
2014	6	20	59.9	1025.3	6.5	15	3.3	4.3
2014	6	21	69.6	1023.9	7.7	335	3.7	5.2
2014	6	22	72	1024.3	5.2	5	3.3	4.5
2014	6	23	70	1025.6	4.2	325	3.1	4
2014	6	24	68.9	1022.7	3.2	340	4	5.2
2014	6	25	79.5	1016.2	5.4	95	2.2	2.9
2014	6	26	88.1	1010.7	8.1	90	1.8	2.7
2014	6	27	86	1009.9	4	35	2.5	3.3
2014	6	28	73	1012.7	5.1	355	3	4.1
2014	6	29	68.1	1015.9	4.8	140	3	3.9
2014	6	30	54.7	1015.8	7.6	90	4	5.3
June							91.9	126.1

Shannon Airport Weather Records 2014

Year	Month	Day	Mean Realative Humidity (%)	Mean MSL Pressure (hpa)	Mean Wind Speed (kt)	Predominant Wind Direction (degrees)	Potential Evapotranspiration (mm)	Evaporation (mm)
2014	7	1	62.0	1020.1	4.9	125	4.3	5.8
2014	7	2	75.2	1019.8	10.0	220	2.8	3.7
2014	7	3	83.3	1014.7	7.9	225	2.6	3.6
2014	7	4	82.8	1001.2	9.7	195	2.4	3.3
2014	7	5	73.8	1002.4	8.2	235	3.5	5.1
2014	7	6	73.9	1006.6	9.2	250	3.4	5
2014	7	7	75.2	1013.6	4.2	240	3.2	4.2
2014	7	8	72.5	1020.9	9.5	285	3.6	5.4
2014	7	9	82.5	1026.8	7.2	255	2.3	3.4
2014	7	10	86.3	1023.2	6.8	250	1.8	2.4
2014	7	11	90.8	1020.1	4.7	230	1.7	2.2
2014	7	12	92.1	1012.8	8.0	215	1.7	2.3
2014	7	13	72.1	1012.9	7.2	255	3.3	4.5
2014	7	14	83.5	1010.6	11.2	245	2.1	3.1
2014	7	15	73.5	1017.1	7.9	150	2.6	3.4
2014	7	16	76.8	1017.0	10.3	230	3.4	4.9
2014	7	17	71.8	1018.3	6.0	105	3.4	4.5
2014	7	18	80.5	1008.7	4.3	115	2.3	3
2014	7	19	85.8	1008.5	5.4	300	2.6	3.5
2014	7	20	74.6	1014.3	5.2	270	3.4	4.6
2014	7	21	83.2	1019.1	5.9	140	2	2.6
2014	7	22	79.9	1022.2	7.1	130	2.6	3.3
2014	7	23	80.7	1020.7	4.2	100	2.5	3.2
2014	7	24	85.8	1019.4	4.4	320	2.2	2.8
2014	7	25	84.4	1018.7	3.6	200	3.2	4.1
2014	7	26	79.0	1019.9	8.0	270	2.8	3.8
2014	7	27	73.3	1021.3	9.5	270	3.3	4.6
2014	7	28	71.4	1021.7	8.2	285	2.8	3.7
2014	7	29	76.9	1021.0	9.1	285	2.5	3.4
2014	7	30	80.5	1017.8	10.8	240	2.7	3.9
2014	7	31	78.2	1012.1	9.0	235	2.5	3.4
July							**85.5**	**116.7**

Shannon Airport Weather Records 2014

Year	Month	Day	Mean Realative Humidity (%)	Mean MSL Pressure (hpa)	Mean Wind Speed (kt)	Predominant Wind Direction (degrees)	Potential Evapotranspiration (mm)	Evaporation (mm)
2014	8	1	87.5	1005.0	5.6	210	1.8	2.4
2014	8	2	81.5	1004.0	9.2	285	1.8	2.5
2014	8	3	72.3	1007.6	10.2	260	3.2	4.5
2014	8	4	72.5	1013.0	6.8	125	2.7	3.6
2014	8	5	84.4	1011.5	4.0	120	2.2	2.9
2014	8	6	73.7	1011.6	8.1	260	3.3	4.6
2014	8	7	69.8	1014.3	5.3	235	2.8	3.6
2014	8	8	74.3	1007.8	7.8	215	2.8	3.8
2014	8	9	80.4	1003.9	8.4	220	2.9	4
2014	8	10	82.2	1000.9	8.7	265	2.2	3.1
2014	8	11	77.7	1005.2	13.0	235	2.9	4.4
2014	8	12	77.5	1004.5	11.7	255	2.6	4
2014	8	13	78.1	1009.3	10.3	275	2.6	3.6
2014	8	14	78.9	1013.3	6.7	310	2.8	3.9
2014	8	15	70.5	1022.2	7.2	315	2.4	3.2
2014	8	16	74.0	1021.1	11.6	240	2.1	2.9
2014	8	17	69.8	1014.4	12.2	285	3.1	4.6
2014	8	18	65.0	1016.9	8.2	310	3	4.1
2014	8	19	67.3	1018.1	5.9	305	2.6	3.6
2014	8	20	67.6	1020.9	5.2	260	2.2	3
2014	8	21	75.9	1014.0	10.0	220	2.4	3.4
2014	8	22	68.8	1016.0	6.7	320	2.5	3.4
2014	8	23	68.8	1019.2	4.0	295	2.8	3.8
2014	8	24	83.7	1012.3	8.3	100	1.3	1.8
2014	8	25	85.2	998.1	8.3	100	1.8	2.2
2014	8	26	79.7	1005.9	9.0	20	2.1	2.8
2014	8	27	81.6	1004.6	12.3	90	1.6	2.2
2014	8	28	77.3	1002.4	14.1	195	2.5	3.6
2014	8	29	84.0	1007.4	17.5	240	1.9	2.7
2014	8	30	76.2	1017.5	9.7	260	2	2.6
2014	8	31	86.9	1018.3	6.7	220	1.6	2.2
August							74.5	103

Shannon Airport Weather Records 2014

Year	Month	Day	Mean Realative Humidity (%)	Mean MSL Pressure (hpa)	Mean Wind Speed (kt)	Predominant Wind Direction (degrees)	Potential Evapotranspiration (mm)	Evaporation (mm)
2014	9	1	69.7	1022.6	4.2	255	1.7	2.2
2014	9	2	62.9	1023.7	2.5	325	1.6	2.1
2014	9	3	67.3	1020.8	5.4	100	2.8	3.7
2014	9	4	74.3	1018.3	5.5	120	2.8	3.5
2014	9	5	87.8	1017.9	3.5	130	1.6	2.1
2014	9	6	66.9	1018.3	7.3	15	2.2	3.1
2014	9	7	69.8	1019.9	4.8	20	2.4	3.3
2014	9	8	72.6	1022.3	4.0	15	2.2	3
2014	9	9	71.2	1022.5	2.6	65	2.1	2.9
2014	9	10	68.2	1019.8	6.1	110	2.8	3.7
2014	9	11	68.5	1020.8	8.1	100	2.6	3.4
2014	9	12	73.0	1022.8	8.5	90	2.2	2.9
2014	9	13	67.0	1025.5	7.0	105	2.8	3.6
2014	9	14	75.4	1022.4	6.4	80	1.7	2.2
2014	9	15	83.6	1018.5	4.5	30	1.3	1.7
2014	9	16	80.5	1014.1	4.5	30	1.9	2.5
2014	9	17	78.4	1010.8	6.6	20	1.9	2.4
2014	9	18	76.2	1009.5	7.0	20	2.5	3.2
2014	9	19	92.5	1012.6	5.8	10	0.9	1.1
2014	9	20	75.6	1021.4	6.8	10	1.6	2.2
2014	9	21	80.7	1026.8	2.8	60	1.5	2
2014	9	22	81.0	1025.8	3.5	170	1.7	2.4
2014	9	23	82.7	1019.6	6.5	235	1.4	1.8
2014	9	24	77.1	1018.6	6.8	275	1.7	2.4
2014	9	25	87.7	1018.7	9.6	240	1.6	2.1
2014	9	26	68.3	1023.5	6.0	245	1.8	2.5
2014	9	27	72.5	1023.5	5.9	160	1.6	2.1
2014	9	28	86.6	1020.3	3.4	155	1.4	1.9
2014	9	29	87.0	1018.4	4.4	120	1.2	1.6
2014	9	30	84.2	1016.6	8.6	140	1.4	1.7
September							56.9	75.3

Shannon Airport Weather Records 2014

Year	Month	Day	Mean Realative Humidity (%)	Mean MSL Pressure (hpa)	Mean Wind Speed (kt)	Predominant Wind Direction (degrees)	Potential Evapotranspiration (mm)	Evaporation (mm)
2014	10	1	73.1	1025.4	5.7	270	1.3	1.8
2014	10	2	68.1	1024.6	8.8	165	1.8	2.4
2014	10	3	86.1	1013.4	8.5	210	1	1.3
2014	10	4	73.3	1015.3	7.7	250	1.6	2.2
2014	10	5	79.1	1007.4	14.8	150	1.1	1.5
2014	10	6	76.8	993.9	7.8	230	1.1	1.5
2014	10	7	76.5	993.5	7.6	115	1.3	1.8
2014	10	8	80.2	984.5	8.2	115	1.3	1.6
2014	10	9	79.2	993.3	6.7	265	1.5	1.9
2014	10	10	83.5	1004.0	4.5	175	1.1	1.6
2014	10	11	81.8	1009.8	2.8	110	1	1.5
2014	10	12	89.5	1011.8	2.5	15	0.8	1.1
2014	10	13	89.6	1011.6	4.2	350	0.9	1.2
2014	10	14	90.2	1008.5	5.4	90	0.7	1
2014	10	15	87.7	995.2	9.4	90	0.9	1.1
2014	10	16	86.1	993.0	8.3	115	1.1	1.4
2014	10	17	88.6	994.3	12.4	130	0.9	1.1
2014	10	18	71.2	995.6	14.4	165	1.9	2.4
2014	10	19	85.9	1007.0	14.2	225	1.2	1.6
2014	10	20	86.1	1009.5	13.3	205	0.9	1.2
2014	10	21	62.7	1015.7	17.2	285	1.4	1.9
2014	10	22	63.8	1023.4	9.5	225	1.4	1.6
2014	10	23	88.4	1013.2	10.2	215	0.9	1.2
2014	10	24	86.3	1012.2	9.8	195	1	1.2
2014	10	25	77.9	1012.5	13.8	210	1.3	1.6
2014	10	26	83.5	1011.6	13.6	205	1.3	1.5
2014	10	27	83.2	1008.3	10.7	165	1.1	1.3
2014	10	28	89.0	1008.4	8.5	350	0.5	0.7
2014	10	29	89.0	1013.5	6.7	80	0.5	0.7
2014	10	30	88.4	1008.0	11.4	125	0.9	1.1
2014	10	31	91.8	1004.4	9.6	175	0.6	0.8
October							34.3	44.8

Shannon Airport Weather Records 2014

Year	Month	Day	Mean Realative Humidity (%)	Mean MSL Pressure (hpa)	Mean Wind Speed (kt)	Predominant Wind Direction (degrees)	Potential Evapotranspiration (mm)	Evaporation (mm)
2014	11	1	87.7	1002.4	11.5	150	0.6	0.8
2014	11	2	79.3	997.6	11.1	195	0.9	1.1
2014	11	3	84.0	986.6	8.6	265	0.8	1
2014	11	4	82.2	999.3	9.7	295	0.9	1.1
2014	11	5	81.5	1009.0	5.6	190	0.4	0.6
2014	11	6	91.7	990.1	12.6	155	0.6	0.8
2014	11	7	84.9	989.7	9.6	235	0.7	0.9
2014	11	8	88.0	993.3	6.6	240	0.7	0.9
2014	11	9	86.6	1000.4	8.5	240	0.6	0.7
2014	11	10	90.8	991.7	9.9	115	0.5	0.6
2014	11	11	91.5	986.8	5.4	100	0.4	0.6
2014	11	12	90.5	987.0	7.2	190	0.6	0.7
2014	11	13	89.6	987.9	10.5	105	0.9	1.1
2014	11	14	90.8	987.8	8.5	125	0.6	0.8
2014	11	15	91.7	993.9	7.8	90	0.4	0.6
2014	11	16	98.3	1003.4	4.7	335	0.1	0.2
2014	11	17	92.6	1008.7	6.7	315	0.4	0.6
2014	11	18	91.4	1008.0	7.9	90	0.4	0.5
2014	11	19	80.9	1011.8	10.1	95	0.5	0.7
2014	11	20	99.2	1021.7	3.1	15	0.2	0.3
2014	11	21	93.9	1007.3	9.6	95	0.6	0.7
2014	11	22	89.6	1010.4	4.7	260	0.2	0.2
2014	11	23	88.8	1021.3	3.2	130	0.1	0.2
2014	11	24	91.6	1024.2	5.0	115	0.3	0.4
2014	11	25	92.5	1021.0	4.8	115	0.3	0.5
2014	11	26	91.1	1012.8	6.4	105	0.1	0.2
2014	11	27	86.2	997.1	11.5	100	0.5	0.6
2014	11	28	84.6	999.9	8.7	55	0.5	0.6
2014	11	29	93.7	1010.0	3.2	200	0.3	0.4
2014	11	30	99.2	1017.9	2.5	110	0.3	0.4
November							14.4	18.8

Shannon Airport Weather Records 2014

Year	Month	Day	Mean Realative Humidity (%)	Mean MSL Pressure (hpa)	Mean Wind Speed (kt)	Predominant Wind Direction (degrees)	Potential Evapotranspiration (mm)	Evaporation (mm)
2014	12	1	95.4	1017.2	5.5	125	0.2	0.3
2014	12	2	90.1	1029.0	3.5	310	0	0.1
2014	12	3	97.5	1028.7	2.8	110	0.3	0.3
2014	12	4	91.3	1018.7	5.5	110	0.3	0.5
2014	12	5	84.1	1026.8	6.3	280	0.4	0.4
2014	12	6	93.2	1026.8	10.2	230	0.4	0.5
2014	12	7	76.3	1019.7	15.7	250	0.7	0.9
2014	12	8	79.8	1025.2	7.1	265	0.6	0.7
2014	12	9	85.7	1016.6	15.8	230	0.8	1
2014	12	10	70.3	1014.6	21.8	250	1.5	2.1
2014	12	11	84.8	1006.0	19.9	250	0.7	1
2014	12	12	92.0	999.9	7.2	240	0	0.1
2014	12	13	89.2	1012.3	7.3	210	0.3	0.4
2014	12	14	88.9	1006.9	11.6	250	0.5	0.7
2014	12	15	95.4	1012.6	5.4	220	0.1	0.2
2014	12	16	97.7	1013.4	9.0	230	0.2	0.3
2014	12	17	97.7	1007.0	16.4	240	0.3	0.4
2014	12	18	96.0	1005.6	18.7	235	0.5	0.7
2014	12	19	78.3	1018.0	11.8	250	0.8	0.9
2014	12	20	86.7	1028.8	9.8	245	0.5	0.6
2014	12	21	89.3	1021.2	13.1	210	0.7	0.8
2014	12	22	90.8	1013.5	21.5	230	0.8	1.1
2014	12	23	89.9	1010.3	13.5	210	0.6	0.7
2014	12	24	77.2	1020.5	9.4	250	0.6	0.7
2014	12	25	87.0	1032.3	4.8	255	0.3	0.4
2014	12	26	93.6	1021.1	11.5	135	0.4	0.6
2014	12	27	87.2	1018.6	8.1	290	0.3	0.4
2014	12	28	93.7	1034.1	3.8	330	0.1	0.2
2014	12	29	89.4	1039.1	7.6	120	0.3	0.4
2014	12	30	83.5	1032.3	10.3	125	0.6	0.8
2014	12	31	81.0	1021.3	13.4	160	1	1.2
December							14.8	19.4

Appendix I – Water Balance Calculations

Water Balance Calculations 2014

Upper Bound 10% infiltration of actual rainfall on the area covered with capping and Cell 1

Period (Jan 2014 - Dec 2014)	Active cell (m2)	Effective Rainfall (m) - Active Cell	Volume of waste (t)	Effective Rainfall x Active Area	Absorptive Capacity (m3)	Volume of free leachate	Final Capped Area (m2)	Effective Rainfall (m) - Capped Area	Volume of Leachate Capped (m3)	Total Leachate produced
January	4621	0.1545	95	713.9445	3.468	710.48	15742	0.1599	251.71	962.19
February	4621	0.1435	95	663.1135	3.468	659.65	15742	0.1539	242.27	901.91
March	4621	0.035	95	161.735	3.468	158.27	15742	0.0518	82	239.81
April	4621	0	95	0	3.468	-3.47	15742	0.0255	40	36.67
May	4621	0	95	0	3.468	-3.47	15742	0.0228	35.89	32.42
June	4621	0	95	0	3.468	-3.47	15742	0.0000	0.00	-3.47
July	4621	0	95	0	3.468	-3.47	15742	0.0000	0	-3.47
August	4621	0	95	0	3.468	-3.47	15742	0.0155	24	20.93
September	4621	0	95	0	3.468	-3.47	15742	0.0154	24.24	20.77
October	4621	0.0603	95	278.6463	3.468	275.18	15742	0.0708	111.45	386.63
November	4621	0.1106	95	511.0826	3.468	507.61	15742	0.1150	181.03	688.65
December	4621	0.0908	95	419.5868	3.468	416.12	15742	0.0955	150.34	566.45
TOTAL						**2706.49**			**1143.03**	**3849.52**

Lower Bound 2% infiltration of actual rainfall on the area covered with capping and Cell 1

Period (Jan 2014 - Dec 2014)	Active cell (m2)	Effective Rainfall (m) - Active Cell	Volume of waste (t)	Effective Rainfall x Active Area	Absorptive Capacity (m3)	Volume of free leachate	Final Capped Area (m2)	Effective Rainfall (m) - Capped Area	Volume of Leachate Capped (m3)	Total Leachate produced
January	4621	0.1545	95	713.945	3.468	710.48	15742	0.1599	50.343	760.82
February	4621	0.1435	95	663.114	3.468	659.65	15742	0.1539	48.454	708.10
March	4621	0.035	95	162	3.468	158.27	15742	0.0518	16.309	174.58
April	4621	0	95	0	3.468	-3.47	15742	0.0255	8.028	4.56
May	4621	0	95	0	3.468	-3.47	15742	0.0228	7.178	3.71
June	4621	0	95	0	3.468	-3.47	15742	0.0000	0.000	-3.47
July	4621	0	95	0	3.468	-3.47	15742	0.0000	0.000	-3.47
August	4621	0	95	0	3.468	-3.47	15742	0.0155	4.880	1.41
September	4621	0	95	0.000	3.468	-3.47	15742	0.0154	4.849	1.38
October	4621	0.0603	95	278.646	3.468	275.18	15742	0.0708	22.291	297.47
November	4621	0.1106	95	511.083	3.468	507.61	15742	0.1150	36.207	543.82
December	4621	0.0908	95	419.587	3.468	416.12	15742	0.0955	30.067	446.19
TOTAL						**2706.49**			**228.61**	**2935.10**