



Clare County Council

Tradaree Point Sludge Disposal Facility

Annual Environmental Report 2017

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 2016 to December 2017.

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Licence, Content of the Environmental Report, and has been prepared in accordance with the EPA (1999) Waste Licensing – Draft Guidance Note on Environmental Management Systems and Reporting to the Agency, the EPA Guidance Note for the Annual Environmental Report and the EPA AER/PRTR Guidance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 2017 to December 2017 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 WTP & Castlelake WTP. 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 a dumper. 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.

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 3 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 ramp into the cell.

2.3 Quantity and Composition of Sludge Disposed

2.3.1 Sludge Disposed 2017

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 2017 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 2017, approximately 1055 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 2017

| Month | Quantity (Kg) |
|-----------------------|---------------|
| January | 73100 |
| February | 73880 |
| March | 67150 |
| April | 96620 |
| May | 153380 |
| June | 152585 |
| July | 301010 |
| August | 206330 |
| September | 251378 |
| October | 150386 |
| November | 187820 |
| December | 145810 |
| Total (kg) | 1859449 |
| TOTAL (tonnes) | 1859.449 |

2.3.2 Sludge Disposed 2005-2017

Table 2.3 below details the quantities of sludge disposed at the facility between 2005 and 2017.

| 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 |
| 2015 | 1055 |
| 2016 | 1181 |
| 2017 | 1859 |

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 its capacity in 2013. Cell 2 was opened on 28th June 2013 & reached capacity in 2016. Cell 3 was opened on the 15 Feb 2016 and it is expected that Cell 1 and Cell 2 will both be capped by Dec 2018. In 2016, approximately 1181 tonnes of sludge was disposed of at the facility. In 2017, approximately 1860 tonnes of sludge was disposed of in cell 3.

The density of dewatered sludge varies depending on the dry matter concentration. In 2017, the average cake % dry matter reached in the sludge was 21%. At this rate, the bulk density is typically calculated at a 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 2017 was 1464m³.

Based on the 2017 figure, it is expected that the landfill should reach its full capacity by 2020.

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 third of the newly lined active cells – Cell 2.

The total capped area occupied by waste in the facility is 20,112m². Between 2005 and Feb 2016 a total of 6093 tonnes of waste has been deposited into Cell 1 & cell2. Since Feb 2016 to Dec 2017, a total of 2870 tonne of waste has been deposited into Cell 3.

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 71,906 m³ of Leachate was pumped during the reporting period. Leachate is collected from the existing sludge disposal area (Cell 3), the inactive cells (Cell 4), The uncapped Cells 1 & 2 (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 2017 are detailed in Table 2.4 below.

Table 2.4: The monthly averages of Leachate generated in 2017

| Month | Flow Rate (m ³ /Month) |
|-----------------------------------|-----------------------------------|
| January | 7088 |
| February | 4547 |
| March | 7204 |
| April | 4450 |
| May | 280 |
| June | 1568 |
| July | 519 |
| August | 4952 |
| September | 10419 |
| October | 10463 |
| November | 9750 |
| December | 10669 |
| Total (M³/Year) | 71906 |

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 1×10^{-9} m/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 21% dry matter in 2017. Assuming that the dry matter content would equate to the biodegradable component of the sludge and based on a total input in 2016 of 248 tonnes of biodegradable waste (21% of 1181 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 1×10^{-9} m/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 1×10^{-9} m/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 1×10^{-9} m/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/m ² /day) Note 1 |
| 350 |

Note 1: 30 day composite sample

Annual dust monitoring was conducted by BHP at four locations between 4 August and 6 September 2017. 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 2017

| Location | N1 | N3 | N5 | SS2 |
|-----------|------------------------|----|-----|-----|
| | mg/m ² /day | | | |
| Sept 2017 | 433 | 89 | 834 | 116 |

Measured dust levels at Dust Locations N3 & SS2 were below the ELV of 350 mg/m³/day. Dust levels at N1 & N5 were contaminated by organic matter as further analysis was done to determine the dust levels. We suggest moving locations away from organic matter .

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 19th June 2017. 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) _{LAeq} (30 minutes) | Night Db(A) _{LAeq} (30 minutes) |
|--|--|
| 55 | 45 |

Table 3.4 Day-time Noise Measurements 2017

| Location | Date | Sampling Interval | L _{Aeq} 30min Db(A) |
|----------|----------|-------------------|------------------------------|
| N1 | 19/06/17 | 30 Minutes | 43.2 |
| N2 | 19/06/17 | 30 Minutes | 43.9 |
| N3 | 19/06/17 | 30 Minutes | 42.8 |
| N5 | 19/06/17 | 30 Minutes | 44.2 |

Table 3.5 Night-time Noise Measurements 2017

| Location | Date | Sampling Interval | L _{Aeq} 30min Db(A) |
|----------|----------|-------------------|------------------------------|
| N1 | 19/06/17 | 30 Minutes | 39.2 |
| N2 | 19/06/17 | 30 Minutes | 40.7 |
| N3 | 19/06/17 | 30 Minutes | 41.7 |
| N5 | 19/06/17 | 30 Minutes | 39.8 |

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 2017, 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

Methane levels measured at RD1 exceeded the threshold level of 1% v/v in nine of the monthly monitoring rounds. Methane levels above the threshold level ranged from (Aug) 1.9% (Oct) to 8.1% (Dec).

Methane levels measured at RD2 exceeded the threshold level of 1% v/v in eleven of the monthly monitoring rounds. Methane levels above the threshold level ranged from 2% (Oct) to 4.4% (July).

Methane levels measured at RD3 exceeded the threshold level of 1% v/v in ten of the monthly monitoring rounds. Methane levels above the threshold level ranged from 2.4% v/v (May & June) to 5.4% (Dec).

Methane levels measured at RD4 exceeded the threshold level of 1% v/v in seven of the monthly monitoring rounds. Methane levels above the threshold level ranged from 1.8% v/v (July) to 4% (Jan).

Methane levels measured at RD5 exceeded the threshold level of 1% v/v in ten of the 12 monthly monitoring rounds. Methane levels above the threshold level ranged from 5.2% (Nov) to 18.8% (Feb).

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 3.6% (Mar) to 10.6% (Oct).

Monthly recorded methane levels in the remaining monitoring boreholes (RD1, RD7, RD8, L6, L8, L10 and L12) were below 1% v/v.

3.1.3.2 Carbon Dioxide

At RD2, carbon dioxide concentrations exceeded the threshold level of 1.5% v/v in 8 of the 12 monthly monitoring rounds – February (22.9%), March (10.9%), April (14.1%), May (16.4%), June (16.4%), July (15.8%), August (7.3%) and September (4.1%).

In RD3, carbon dioxide concentrations were above the threshold level of 1.5% v/v in 1 of the 12 monthly monitoring rounds – December (1.6%).

In RD6, carbon dioxide levels exceeded the threshold level of 1.5% v/v in all of the monthly monitoring rounds - January (30.2%), February (27.6%), March (27.4%), April (27.5%), May (30%), June (30%), July (30%), August (41.6%), September (45.1%), October (44.8%), November (38.3%) and December (35%).

Monthly recorded carbon dioxide levels in the remaining monitoring boreholes (RD7, RD8, L6, 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 2017 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 Requirement | Monitoring | 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 2017,

- 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 2017 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 2017 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 2017

| Location | N1 | N3 | N5 | SS2 |
|-----------|------------------------|----|-----|-----|
| | mg/m ² /day | | | |
| Sept 2017 | 433 | 89 | 834 | 116 |

The ELV for dust of 350 mg/m²/day .N1 and N5 exceed this due to organic matter.

3.2.3 Groundwater Monitoring

3.2.3.1 Groundwater Monitoring Locations

Groundwater monitoring was conducted at five locations during 2017 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 2017 varied between 0.0m below top of casing (BTOC) (in BH4 Feb 2017) and 1.07m BTOC (in RD3 Aug 2017).

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 February and August 2017.

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 6.55 to 7.88, which is within the IGV range of 6.5-9.5.

Electrical conductivity measurements ranged from 2380 $\mu\text{S}/\text{cm}$ in RD3 (Aug) to 15580 $\mu\text{S}/\text{cm}$ in BH4 (Aug), which are similar to previous monitoring results. The IGV of 1,000 $\mu\text{S}/\text{cm}$ was exceeded in all of the samples analysed.

Ammonia concentrations detected were all above the IGV of 0.2mg/l and ranged between 1mg/l in RD3 (Feb) to 29mg/l in BH3 (Aug).

Total Oxidised Nitrogen concentrations results ranged were <0.13mg/L. These readings are lower than those recorded last year.

Total organic carbon concentrations ranged from 2.7mg/l in RD5 (Aug) to 100mg/l in BH5 (Feb).

Chloride concentrations ranged from 382 mg/l in RD3 (Feb) to 5,004 mg/l in BH4 (Feb). Chloride concentrations in all of the samples analysed exceeded the IGV of 30 mg/l.

Sodium concentration ranged from 564mg/l RD3 (AUG) to 2660mg/l BH4 (AUG), which were all above the IGV of 150 mg/l.

Potassium concentrations in all five samples analysed during the August monitoring round all exceeded the IGV of 5 mg/l. Concentrations ranged from 6.84g/l in RD3 to 138mg/l in BH4.

Iron concentrations detected exceeded the IGV of 0.2mg/l on all occasions. The Iron concentration measured ranged between 0.24 mg/l in BH5 and 18.3mg/l in BH4, samples were taken in August.

Chromium concentrations in all samples were below the IGV of 0.03 mg/l. They ranged from 0.0026mg /l in RD3 to 0.0121mg/l in BH5.

Fluoride concentrations in all samples were below the IGV of 1mg/l. They ranged from 0.21mg/l in BH4 to 0.45mg/l in RD5.

Concentrations of, cadmium, copper, cyanide, lead, mercury, 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 2016 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.

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 (CH₄)
- Carbon Dioxide (CO₂)
- Oxygen (O₂)
- Atmospheric Pressure (mBar)

The LEL (lower explosive limit) for methane, atmospheric pressure (millibars) and temperature (Oc) were also recorded by the gas analyser 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 February and August 2017 as per Schedule D of the licence.

The electrical conductivity was measured at 1585 $\mu\text{S}/\text{cm}$ in February and 968 $\mu\text{S}/\text{cm}$ in August which was above the IGV of 1000 $\mu\text{S}/\text{cm}$.

The chloride concentration was detected at 60mg/l in February and 63mg/l in August, 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 14mg/l in February and 3.2mg/l in August, 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 4.52mg/l which is below the IGV of 5 mg/l.

The iron concentration was 3.8mg/l in August, which is above the IGV of 0.2 mg/l.

Sulphate concentration was 109mg/l which is below the IGV of 200mg/l.

Total Phosphorus was detected above the IGV of 0.01mg/l at 0.2mg/l. This is similar with previous years.

Comparison of results with the results from previous years, indicate that a number of parameters (Ammonia, chloride, conductivity 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 19th June 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 2017

| Location | Date | Sampling Interval | L _{Aeq} 30min dB(A) |
|----------|----------|-------------------|------------------------------|
| N1 | 19/06/17 | 30 Minutes | 43.2 |
| N2 | 19/06/17 | 30 Minutes | 43.9 |
| N3 | 19/06/17 | 30 Minutes | 42.8 |
| N5 | 19/06/17 | 30 Minutes | 44.2 |

Table 3.15 Night-time Noise Measurements 2017

| Location | Date | Sampling Interval | L _{Aeq} 30min dB(A) |
|----------|----------|-------------------|------------------------------|
| N1 | 19/06/17 | 30 Minutes | 39.2 |
| N2 | 19/06/17 | 30 Minutes | 40.7 |
| N3 | 19/06/17 | 30 Minutes | 41.7 |
| N5 | 19/06/17 | 30 Minutes | 39.8 |

Day-time and night time noise levels at all boundary locations did not exceed the daytime emission limit L_{Aeq} 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 2017 with differing biannual and annual parameter requirements as outlined in Table D.6.1 of the waste licence (SS1, SS2, SS4, SS6, SS7).

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 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 February and August for the range of parameters outlined in Table D.6.1 of W0037-01.

Surface water analytical results are attached in Appendix F.

There are 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 were 0.1mg/l (in a samples) and 0.103mg/l SS4 (Aug). There was a decrease the ammonia levels in 2017.

Potassium exceeded the IGV of 5mg/l in 3 samples tested. In August SS1 7.78mg/l SS2 7.76mg/l & in SS4 was 8.55mg/l.

No samples exceeded the BOD IGV of 4mg/l. In November SS4 was 5.7mg/l. Results range from 2mg/l in SS1 (Aug) to 3.1mg/l in SS2 in August.

Conductivity exceeded the IGV of 1000uS/cm in 2 sample tested. In November SS2 was 1239mg/l and SS4 was 11045Us/cm.

There were no other exceedances of the relevant thresholds or EQS's for any of the parameters analysed during both monitoring rounds undertaken in 2017.

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.

3.2.8 Meteorological Monitoring

Details of meteorological monitoring conducted at the facility in 2017 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 | 53.2 | 13.1 | 17.4 | 40.1 | 35.8 |
| FEB | 71.1 | 20.9 | 29.4 | 50.2 | 41.7 |
| MAR | 133.9 | 41.2 | 59.5 | 92.7 | 74.4 |
| APR | 17.5 | 56.4 | 81.1 | -38.9 | -63.6 |
| MAY | 45.2 | 87.2 | 123.4 | -42 | -78.2 |
| JUN | 86.5 | 83.7 | 122.7 | 2.8 | -36.2 |
| JUL | 133.6 | 84.2 | 120.5 | 49.4 | 13.1 |
| AUG | 82.7 | 68.8 | 97.2 | 13.9 | -14.5 |
| SEP | 99.2 | 47.3 | 68.4 | 51.9 | 30.8 |
| OCT | 80.6 | 26.4 | 36.9 | 54.2 | 43.7 |
| NOV | 125.1 | 12.8 | 17.1 | 112.3 | 108 |
| DEC | 139.6 | 10.7 | 13.8 | 128.9 | 125.8 |
| TOTAL | 1068.2 | 552.7 | 787.4 | 515.5 | 280.8 |

*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 1068 mm of rainfall from January 2017 to December 2017.

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 2017, which was 99 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: $L_0 = [(ER.a) + LW + IR] - [aW]$

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 |
| aA: | 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 3277.7 m³ (upper bound) and 2526.62 m³ (lower bound) of Leachate was produced on site in 2017.

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 truck and ride on mower.

Diesel is stored in a 5,000-litre capacity bunded tank located on site. Approximately 1500 litres of diesel were used in 2017.

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 2017.

Pest Patrol 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 2017.
- There is no problem with litter at the facility and no complaints were received in 2017 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 2017.

The only vehicles that use the site roads are a 9-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 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 |
| Lorraine O’Dwyer | Assistant Manager / Lab technician | Landfill management, monthly reporting, environmental monitoring, testing samples | Henry Greensmith |
| 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 2016 AER did not specify any environmental objectives and targets for 2017.

4.3 Schedule of Environmental Objectives and Targets for 2016

The licensee conducted a review of the EMS in 2016 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 2017.

4.4 Facility Procedures

No new procedures were developed or implemented at the site between January 2017 and December 2017.

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 2017.

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 2017 to December 2017, no incidents occurred which would require reporting to the relevant authorities. No complaints or incidents were reported to the facility between January and December 2017.

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 2017 by Gravitation Ltd. Test cert no. 51639

6.0 FACILITY DEVELOPMENT

6.1 Developments during 2017

There were no other development works of note undertaken at the facility between January and December 2017.

6.2 Proposed Development of the Facility and Associated Timescales

Facility development works planned for 2018.

Cell 1 & 2 have reached their capacity and is currently inactive awaiting capping, it is planned that this capping will take place early 2018.

Cell 3 is currently active and should reach capacity early 2018.

FIGURE 1- SITE LOCATION MAP



Tradaree Point Sludge Disposal Facility
 Site Location Map
Figure No. 1

Job No. CE68106 Date: Mar. 2010
 Finalised By - SR Office - 1504
 Drawn By: J. Ferrar - CS2, Illustrator

NOTE: Drawing is for diagrammatic purposes only. No measurements to be taken.

FIGURE 2- SITE PLAN SHOWING ENVIRONMENTAL MONITORING LOCATIONS



APPENDICES

APPENDIX 1— DUST MONITORING RESULTS

BHP/AC/F115

TEST REPORT NO: 141416

Client: Response Engineering

Railway Road
Charleville
Co. Cork

BHP Ref. No: 17/09/0473-0476
Quote Ref: QC001646
Order No: To Follow
Sales Order: 30820
Date Received: 06/09/2017
Date Sampled: 06/09/2017
Date Completed: 12/09/2017
Sample Type: Environmental Dust
Sampling Period: 04/08/2017 - 06/09/2017



Testing
Analysing
Consulting



BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
Fax: +353 61 455261
Email: colettehannan@bhp.ie

FTAO: Ailish Johnston
Site: Tradaree
BHP Ref: Annually_ Environmental Dust

| TestName | ClientRef | Units | Results | DateAnalysed | Method |
|------------------------------------|-----------|------------------------|---------|--------------|------------|
| Dust Deposition <small>Acc</small> | D1 | mg/m ² /day | 433 | 07/09/2017 | BHP AC 017 |
| Inorganic Deposition | D1 | mg/m ² /day | 62 | 07/09/2017 | BHP AC 017 |
| Organic Deposition | D1 | mg/m ² /day | 371 | 07/09/2017 | BHP AC 017 |
| Dust Deposition <small>Acc</small> | D2 | mg/m ² /day | 89 | 07/09/2017 | BHP AC 017 |
| Inorganic Deposition | D2 | mg/m ² /day | 31 | 07/09/2017 | BHP AC 017 |
| Organic Deposition | D2 | mg/m ² /day | 58 | 07/09/2017 | BHP AC 017 |
| Dust Deposition <small>Acc</small> | D3 | mg/m ² /day | 834 | 08/09/2017 | BHP AC 017 |
| Inorganic Deposition | D3 | mg/m ² /day | 163 | 12/09/2017 | BHP AC 017 |
| Organic Deposition | D3 | mg/m ² /day | 671 | 12/09/2017 | BHP AC 017 |
| Dust Deposition <small>Acc</small> | D4 | mg/m ² /day | 116 | 08/09/2017 | BHP AC 017 |
| Inorganic Deposition | D4 | mg/m ² /day | 19 | 12/09/2017 | BHP AC 017 |
| Organic Deposition | D4 | mg/m ² /day | 97 | 12/09/2017 | BHP AC 017 |

Authorised by:



Colette Hannan
Technical Manager

Date Authorised: 12/09/2017

Additional Information: (Opinions, where stated, are not covered by accreditation)

Acc.: INAB Accredited

Notes: Sample at location D1,D3 was outside the EPA limit of 350 mg/m²/day.

Total dust residues were ashed at 600°C for 1 hour to determine Inorganic dust deposition.
Organic deposition was determined by subtracting the inorganic dust deposition from the total dust deposition.

Sample Conditions: Sample jar at location D1 showed major discoloration and turbidity due to organic matter.

APPENDIX 2 – NOISE SURVEY REPORT

Tradaree WWTP

Environmental Noise Monitoring 19nd June 2017

| 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 | 51.8 | Road Traffic | Yes |
| N2 Daytime | Boundary @ Landfill Cell 1 | 10.40 - 11.10 | 30-90 | 43.9 | 52 | Road Traffic, | Yes |
| N3 Daytime | Boundary @ Lagoon | 10.00 - 10.30 | 30-90 | 42.8 | 53.7 | Road Traffic, Flow of Water | Yes |
| N5 Daytime | Boundary @ Landfill Cell 4 | 11.50 - 12.20 | 30-90 | 44.2 | 50.7 | Road Traffic | Yes |
| N1 Night-Time | Boundary @ Landfill Cell 3 | 01.30 - 02.00 | 30-90 | 39.2 | 47.5 | Road Traffic | Yes |
| N2 Night-Time | Boundary @ Landfill Cell 1 | 00.50 - 01.20 | 30-90 | 40.7 | 48.2 | Road Traffic, | Yes |
| N3 Night-Time | Boundary @ Lagoon | 00.10 - 00.40 | 30-90 | 41.7 | 45.8 | Road Traffic, Flow of Water | Yes |
| N5 Night-Time | Boundary @ Landfill Cell 4 | 02.05 - 02.35 | 30-90 | 39.8 | 48.7 | 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 3 – LANDFILL GAS MONITORING RESULTS

| Monthly Status Report | | | | | | | |
|------------------------------|-----------------|--------------|----------------|-----------|-----------------|-------------|-----------------|
| Month | | January-2017 | | | | | |
| Landfill Gas Analysis | | | | | | | |
| Date | Location | CO2 | Methane | O2 | Pressure | Temp | Atmosph |
| | | % | % | % | mBar | oC | Pressure |
| 23-Jan | RD1 | 3.9 | 0.1 | 19.2 | 1019 | 11.5 | |
| | RD2 | 1.8 | 0.1 | 20.2 | 1019 | 11.6 | |
| | RD3 | 5.0 | 0.3 | 18.9 | 1019 | 11 | |
| | RD4 | 4.0 | 0.1 | 12.4 | 1019 | 11.4 | |
| | RD5 | 15.8 | 0.1 | 4.5 | 1019 | 10.9 | |
| | RD6 | 8.5 | 30.2 | 4.2 | 1019 | 8.2 | |
| | RD7 | 0.2 | 0.10 | 20.6 | 1019 | 11.5 | |
| | RD8 | 0.3 | 0.1 | 20.6 | 1019 | 11.6 | |
| | L6 | 0.1 | 0.1 | 20.7 | 1019 | 12.2 | |
| | L8 | 0.1 | 0.1 | 20.6 | 1019 | 11.8 | |
| | L10 | 0.1 | 0.1 | 20.6 | 1019 | 11.1 | |
| | L12 | 0.1 | 0.1 | 20.6 | 1019 | 11.2 | |
| Trigger Level | | 1.5% v/v | 1% v/v | | | | |

| Monthly Status Report | | | | | | | |
|-----------------------|----------|---------------|---------|------|----------|------|----------|
| Month | | February-2017 | | | | | |
| Landfill Gas Analysis | | | | | | | |
| Date | Location | CO2 | Methane | O2 | Pressure | Temp | Atmosph |
| | | % | % | % | mBar | oC | Pressure |
| 28-Feb | RD1 | 7.2 | 0.1 | 15.5 | 993 | 8.5 | |
| | RD2 | 4.0 | 22.9 | 15.7 | 993 | 8.6 | |
| | RD3 | 4.5 | 0.2 | 19.6 | 993 | 8.4 | |
| | RD4 | 3.2 | 0.1 | 20.2 | 993 | 9.2 | |
| | RD5 | 18.8 | 0.1 | 0.9 | 993 | 9.2 | |
| | RD6 | 10.2 | 27.6 | 0.9 | 993 | 9 | |
| | RD7 | 0.2 | 0.10 | 20.9 | 993 | 10.2 | |
| | RD8 | 0.5 | 0.1 | 21.0 | 993 | 9.4 | |
| | L6 | 0.3 | 0.1 | 21.3 | 994 | 11.2 | |
| | L8 | 0.3 | 0.1 | 21.2 | 993 | 10.9 | |
| | L10 | 0.2 | 0.1 | 21.4 | 993 | 10.6 | |
| | L12 | 0.2 | 0.1 | 20.8 | 993 | 9.6 | |
| Trigger Level | | 1.5% v/v | 1% v/v | | | | |

| Monthly Status Report | | | | | | | |
|-----------------------|----------|------------|---------|------|----------|------|----------|
| Month | | March-2017 | | | | | |
| Landfill Gas Analysis | | | | | | | |
| Date | Location | CO2 | Methane | O2 | Pressure | Temp | Atmosph |
| | | % | % | % | mBar | oC | Pressure |
| 21-Mar | RD1 | 5.0 | 0.1 | 17.7 | 1004 | 10.9 | |
| | RD2 | 2.1 | 10.9 | 18.0 | 1004 | 9.7 | |
| | RD3 | 3.1 | 0.1 | 19.7 | 1004 | 9.9 | |
| | RD4 | 3.2 | 0.1 | 18.4 | 1004 | 10.4 | |
| | RD5 | 1.1 | 0.1 | 20.7 | 1005 | 10.2 | |
| | RD6 | 3.6 | 27.4 | 7.1 | 1005 | 10 | |
| | RD7 | 0.1 | 0.10 | 20.7 | 1004 | 9.9 | |
| | RD8 | 0.1 | 0.1 | 20.7 | 1004 | 9.5 | |
| | L6 | 0.1 | 0.1 | 20.9 | 1004 | 10.6 | |
| | L8 | 0.1 | 0.1 | 20.8 | 1004 | 10.5 | |
| | L10 | 0.1 | 0.1 | 20.7 | 1004 | 10.3 | |
| | L12 | 0.1 | 0.1 | 20.6 | 1004 | 10 | |
| Trigger Level | | 1.5% v/v | 1% v/v | | | | |

| Monthly Status Report | | | | | | | |
|------------------------------|-----------------|------------|----------------|-----------|-----------------|-------------|-----------------|
| Month | | April-2017 | | | | | |
| Landfill Gas Analysis | | | | | | | |
| Date | Location | CO2 | Methane | O2 | Pressure | Temp | Atmosph |
| | | % | % | % | mBar | oC | Pressure |
| 28-Apr | RD1 | 6.2 | 0.1 | 16.1 | 1020 | 11.6 | |
| | RD2 | 2.8 | 14.1 | 17.2 | 1020 | 12.1 | |
| | RD3 | 1.2 | 0.1 | 20.4 | 1020 | 11.3 | |
| | RD4 | 1.2 | 0.1 | 20.5 | 1020 | 9.8 | |
| | RD5 | 6.9 | 0.1 | 17.8 | 1020 | 10.3 | |
| | RD6 | 8.9 | 27.5 | 4.1 | 1020 | 11.3 | |
| | RD7 | 0.1 | 0.10 | 20.8 | 1020 | 12.3 | |
| | RD8 | 0.1 | 0.1 | 20.8 | 1020 | 11.5 | |
| | L6 | 0.1 | 0.1 | 21.0 | 1020 | 12.4 | |
| | L8 | 0.1 | 0.1 | 20.9 | 1020 | 11.4 | |
| | L10 | 0.1 | 0.1 | 20.7 | 1020 | 10.6 | |
| | L12 | 0.1 | 0.1 | 20.7 | 1020 | 10 | |
| Trigger Level | | 1.5% v/v | 1% v/v | | | | |

| Monthly Status Report | | | | | | | |
|-----------------------|----------|----------|---------|------|----------|------|----------|
| Month | | May-2017 | | | | | |
| Landfill Gas Analysis | | | | | | | |
| Date | Location | CO2 | Methane | O2 | Pressure | Temp | Atmosph |
| | | % | % | % | mBar | oC | Pressure |
| 19-May | RD1 | 3.0 | 0.1 | 19.1 | 1020 | 12.8 | |
| | RD2 | 3.1 | 16.4 | 15.4 | 1020 | 14.2 | |
| | RD3 | 2.4 | 0.1 | 20.4 | 1020 | 11.3 | |
| | RD4 | 1.2 | 0.1 | 19.8 | 1020 | 14.1 | |
| | RD5 | 9.9 | 0.1 | 13.7 | 1020 | 12.8 | |
| | RD6 | 9.2 | 30.0 | 5.2 | 1020 | 16.2 | |
| | RD7 | 0.1 | 0.10 | 20.6 | 1020 | 14.8 | |
| | RD8 | 0.2 | 0.1 | 20.6 | 1020 | 13.5 | |
| | L6 | 0.3 | 0.1 | 20.5 | 1020 | 12.3 | |
| | L8 | 0.6 | 0.1 | 20.4 | 1020 | 12.9 | |
| | L10 | 0.1 | 0.1 | 20.6 | 1020 | 14.2 | |
| | L12 | 0.1 | 0.1 | 20.6 | 1020 | 14.6 | |
| Trigger Level | | 1.5% v/v | 1% v/v | | | | |

| Monthly Status Report | | | | | | | |
|-----------------------|----------|-----------|---------|------|----------|------|----------|
| Month | | June-2017 | | | | | |
| Landfill Gas Analysis | | | | | | | |
| Date | Location | CO2 | Methane | O2 | Pressure | Temp | Atmosph |
| | | % | % | % | mBar | oC | Pressure |
| 19-Jun | RD1 | 3.0 | 0.1 | 19.1 | 1020 | 12.8 | |
| | RD2 | 3.1 | 16.4 | 15.4 | 1020 | 14.2 | |
| | RD3 | 2.4 | 0.1 | 20.4 | 1020 | 11.3 | |
| | RD4 | 1.2 | 0.1 | 19.8 | 1020 | 14.1 | |
| | RD5 | 9.9 | 0.1 | 13.7 | 1020 | 12.8 | |
| | RD6 | 9.2 | 30.0 | 5.2 | 1020 | 16.2 | |
| | RD7 | 0.1 | 0.10 | 20.6 | 1020 | 14.8 | |
| | RD8 | 0.2 | 0.1 | 20.6 | 1020 | 13.5 | |
| | L6 | 0.3 | 0.1 | 20.5 | 1020 | 12.3 | |
| | L8 | 0.6 | 0.1 | 20.4 | 1020 | 12.9 | |
| | L10 | 0.1 | 0.1 | 20.6 | 1020 | 14.2 | |
| | L12 | 0.1 | 0.1 | 20.6 | 1020 | 14.6 | |
| Trigger Level | | 1.5% v/v | 1% v/v | | | | |

| Monthly Status Report | | | | | | | |
|------------------------------|-----------------|------------|----------------|-----------|-----------------|-------------|-----------------|
| Month | | July-2017 | | | | | |
| Landfill Gas Analysis | | | | | | | |
| Date | Location | CO2 | Methane | O2 | Pressure | Temp | Atmosph |
| | | % | % | % | mBar | oC | Pressure |
| 12-Jul | RD1 | 0.7 | 0.1 | 20.2 | 1019 | 16.4 | |
| | RD2 | 4.4 | 15.8 | 13.8 | 1019 | 16.5 | |
| | RD3 | 1.9 | 0.1 | 19.5 | 1019 | 15.9 | |
| | RD4 | 1.8 | 0.1 | 18.9 | 1019 | 15.9 | |
| | RD5 | 11.1 | 0.1 | 9.1 | 1019 | 15.8 | |
| | RD6 | 10.0 | 37.5 | 3.9 | 1019 | 16.9 | |
| | RD7 | 0.1 | 0.10 | 20.5 | 1019 | 16.6 | |
| | RD8 | 0.2 | 0.1 | 20.4 | 1019 | 13.5 | |
| | L6 | 0.1 | 0.1 | 20.6 | 1019 | 15.9 | |
| | L8 | 0.1 | 0.2 | 20.4 | 1019 | 17.6 | |
| | L10 | 0.1 | 0.1 | 20.4 | 1019 | 18 | |
| | L12 | 0.1 | 0.1 | 20.4 | 1019 | 17.7 | |
| Trigger Level | | 1.5% v/v | 1% v/v | | | | |

| Monthly Status Report | | | | | | | |
|-----------------------|----------|-------------|---------|------|----------|------|----------|
| Month | | August-2017 | | | | | |
| Landfill Gas Analysis | | | | | | | |
| Date | Location | CO2 | Methane | O2 | Pressure | Temp | Atmosph |
| | | % | % | % | mBar | oC | Pressure |
| 04-Aug | RD1 | 1.9 | 0.1 | 18.9 | 1015 | 16.8 | |
| | RD2 | 2.8 | 7.3 | 15.8 | 1014 | 15.8 | |
| | RD3 | 2.8 | 0.2 | 18.5 | 1014 | 14.9 | |
| | RD4 | 0.4 | 0.1 | 19.8 | 1015 | 17.5 | |
| | RD5 | 12.6 | 0.1 | 8.0 | 1015 | 19.8 | |
| | RD6 | 10.1 | 41.6 | 3.7 | 1014 | 18.8 | |
| | RD7 | 0.1 | 0.10 | 20.1 | 1014 | 20.5 | |
| | RD8 | 0.1 | 0.1 | 20.1 | 1014 | 18.3 | |
| | L6 | 0.1 | 0.1 | 19.5 | 1014 | 19.8 | |
| | L8 | 0.1 | 0.1 | 20.0 | 1014 | 19.2 | |
| | L10 | 0.1 | 0.1 | 20.1 | 1014 | 21 | |
| | L12 | 0.1 | 0.1 | 20.1 | 1014 | 20.5 | |
| Trigger Level | | 1.5% v/v | 1% v/v | | | | |

| Monthly Status Report | | | | | | | |
|-----------------------|----------|----------------|---------|------|----------|------|----------|
| Month | | September-2017 | | | | | |
| Landfill Gas Analysis | | | | | | | |
| Date | Location | CO2 | Methane | O2 | Pressure | Temp | Atmosph |
| | | % | % | % | mBar | oC | Pressure |
| 06-Sep | RD1 | 1.0 | 0.1 | 19.7 | 1022 | 17.3 | |
| | RD2 | 2.3 | 4.1 | 17.9 | 1022 | 15.8 | |
| | RD3 | 2.5 | 0.1 | 18.8 | 1022 | 16 | |
| | RD4 | 1.5 | 0.1 | 19.5 | 1022 | 16.8 | |
| | RD5 | 13.5 | 0.1 | 7.3 | 1022 | 19.2 | |
| | RD6 | 10.3 | 45.1 | 3.4 | 1022 | 16.1 | |
| | RD7 | 0.1 | 0.10 | 19.7 | 1022 | 17.9 | |
| | RD8 | 0.1 | 0.1 | 19.7 | 1022 | 17.4 | |
| | L6 | 0.1 | 0.1 | 20.0 | 1022 | 19.5 | |
| | L8 | 0.1 | 0.1 | 19.9 | 1022 | 19.4 | |
| | L10 | 0.1 | 0.1 | 19.7 | 1022 | 17.3 | |
| | L12 | 0.1 | 0.1 | 19.8 | 1022 | 17.1 | |
| Trigger Level | | 1.5% v/v | 1% v/v | | | | |

| Monthly Status Report | | | | | | | |
|------------------------------|-----------------|---------------------|----------------|-----------|-----------------|-------------|-----------------|
| Month | | October-2017 | | | | | |
| Landfill Gas Analysis | | | | | | | |
| Date | Location | CO2 | Methane | O2 | Pressure | Temp | Atmosph |
| | | % | % | % | mBar | oC | Pressure |
| 09-Oct | RD1 | 0.2 | 0.1 | 20.7 | 1020 | 15.4 | |
| | RD2 | 0.4 | 0.1 | 20.0 | 1020 | 14.9 | |
| | RD3 | 1.2 | 0.1 | 19.7 | 1020 | 15.2 | |
| | RD4 | 2.0 | 0.1 | 20.0 | 1020 | 15.1 | |
| | RD5 | 15.2 | 0.1 | 4.4 | 1020 | 14.8 | |
| | RD6 | 10.6 | 44.8 | 6.1 | 1020 | 16.1 | |
| | RD7 | 0.2 | 0.10 | 20.5 | 1020 | 15 | |
| | RD8 | 0.2 | 0.1 | 20.5 | 1020 | 15.3 | |
| | L6 | 0.1 | 0.1 | 20.6 | 1020 | 16 | |
| | L8 | 0.2 | 0.1 | 20.6 | 1020 | 15.8 | |
| | L10 | 0.2 | 0.1 | 20.5 | 1020 | 15.5 | |
| | L12 | 0.2 | 0.1 | 20.5 | 1020 | 15.2 | |
| Trigger Level | | 1.5% v/v | 1% v/v | | | | |

| Monthly Status Report | | | | | | | |
|-----------------------|----------|---------------|--------------|---------|------------------|------------|---------------------|
| Month | | November-2017 | | | | | |
| Landfill Gas Analysis | | | | | | | |
| Date | Location | CO2 % | Methane % | O2 % | Pressure mBar | Temp oC | Atmosph Pressure |
| | RD1 | 4.4 | 0.2 | 18.8 | 1020 | 1.8 | |
| | RD2 | 2.0 | 0.1 | 19.8 | 1020 | 1.9 | |
| | RD3 | 4.0 | 0.1 | 19.0 | 1020 | 3.2 | |
| | RD4 | 4.1 | 0.1 | 13.3 | 1020 | 2.2 | |
| | RD5 | 5.2 | 0.1 | 19.2 | 1020 | 2.2 | |
| | RD6 | 9.7 | 38.3 | 0.8 | 1020 | 2.4 | |
| | RD7 | 0.2 | 0.10 | 20.5 | 1020 | 1.4 | |
| | RD8 | 0.5 | 0.1 | 20.6 | 1020 | 1.6 | |
| | L6 | 0.1 | 0.1 | 20.6 | 1020 | 1.6 | |
| | L8 | 0.1 | 0.1 | 20.6 | 1020 | 1.8 | |
| | L10 | 0.2 | 0.1 | 20.5 | 1020 | 2 | |
| | L12 | 0.2 | 0.1 | 20.6 | 1020 | 1.8 | |
| Trigger Level | | 1.5% v/v | 1% v/v | | | | |

| Monthly Status Report | | | | | | | |
|------------------------------|-----------------|---------------|----------------|-----------|-----------------|-------------|-----------------|
| Month | | December-2017 | | | | | |
| Landfill Gas Analysis | | | | | | | |
| Date | Location | CO2 | Methane | O2 | Pressure | Temp | Atmosph |
| | | % | % | % | mBar | oC | Pressure |
| | RD1 | 8.1 | 0.3 | 15.3 | 995 | 5.5 | |
| | RD2 | 2.4 | 0.1 | 19.5 | 995 | 4.2 | |
| | RD3 | 5.4 | 1.6 | 18.6 | 995 | 3.9 | |
| | RD4 | 2.6 | 0.1 | 19.1 | 995 | 3.3 | |
| | RD5 | 10.7 | 0.9 | 16.0 | 995 | 3.2 | |
| | RD6 | 9.3 | 35.0 | 0.6 | 995 | 1 | |
| | RD7 | 0.1 | 0.10 | 20.6 | 995 | 4.3 | |
| | RD8 | 0.5 | 0.1 | 20.3 | 995 | 3.7 | |
| | L6 | 0.2 | 0.1 | 20.5 | 995 | 6 | |
| | L8 | 0.1 | 0.1 | 20.4 | 995 | 5.6 | |
| | L10 | 0.1 | 0.1 | 20.3 | 995 | 5 | |
| | L12 | 0.1 | 0.1 | 20.3 | 995 | 4.5 | |
| Trigger Level | | 1.5% v/v | 1% v/v | | | | |

APPENDIX 4 APPENDIX 4 – GROUNDWATER MONITORING RESULTS

Biannual/Annual Groundwater Monitoring Results 2017

| PARAMETER | UNIT | EPA IGV | BH 3 | | BH 4 | | BH 5 | | RD 2 | | RD 3 | |
|------------------|----------------------|------------|--------|---------|--------|----------|--------|------------|--------|----------|-------|--------------|
| | | | Feb | Aug | Feb | Aug | Feb | Aug | Feb | Aug | Feb | Aug |
| pH | | ≥6.5-≤9.5 | 6.91 | 6.55 | 6.93 | 6.89 | 7.05 | 6.98 | 7.88 | 7.63 | 7.53 | 7.48 |
| Temperature | °C | 25 | 9.7 | 14.3 | 9.8 | 14.8 | 9.7 | 13.5 | 8.6 | 13.6 | 7.53 | 14.7 |
| Conductivity | µS/cm | 1000 | 12980 | 14970 | 13980 | 15580 | 9760 | 10810 | 3750 | 4180 | 2380 | 4490 |
| Nitrite | mg/l | - | <0.016 | 0.016 | <0.016 | 0.016 | <0.016 | 0.016 | <0.016 | 0.016 | 0.016 | 0.016 |
| Nitrate | mg/l | - | 0.113 | 0.113 | 0.113 | 0.113 | 0.113 | 0.113 | 0.113 | 0.113 | 0.113 | <0.113 |
| Total Ammonia | NH ₃ -N | 0.2 | 27 | 29 | 20 | 19 | 20 | 20 | 14 | 17 | 1 | 2.2 |
| Chloride | Cl mg/l | 30 | 4785 | 4852 | 5004 | 4970 | 3443 | 3372 | 939 | 1036 | 383 | 437 |
| Water Level | m | - | 1.01 | 1.03 | 0.0 | 0.42 | 0.75 | 0.36 | 0.59 | 0.90 | 0.16 | 1.07 |
| DO | % O ₂ sat | NAC | | 18.2 | | 12.6 | | 41.8 | | 73.4 | | 72.3 |
| Arsenic | As mg/l | 0.01 | | 0.032 | | 0.011 | | 0.008 1 | | 0.016 | | 0.0019 |
| Boron | B mg/l | 1 | | 1.19 | | 1.59 | | 1.02 | | 0.832 | | 0.3 |
| Cadmium | Cd mg/l | 0.005 | | <0.0006 | | 0.0006 | | 0.0006 | | <0.0006 | | <0.0006 |
| Calcium | Ca mg/l | 200 | | 241 | | 245 | | 298 | | 69.2 | | 37.5 |
| Chromium | Cr mg/l | 0.03 | | 0.005 | | 0.0043 | | 0.012 1 | | 0.0033 | | <0.0026 |
| Copper | Cu mg/l | 0.03 | | 0.009 | | 0.009 | | 0.013 | | 0.009 | | <0.009 |
| Cyanide | Cn mg/l | 0.01 | | 0.009 | | 0.009 | | 0.009 | | <0.009 | | <0.009 |
| Fluoride | F mg/l | 1 | | 0.25 | | 0.21 | | 0.24 | | 0.45 | | 0.43 |
| Iron | Fe mg/l | 0.2 | | 15.3 | | 18.3 | | 11.1 | | 6.6 | | 0.494 |
| Lead | Pb mg/l | 0.01 | | 0.006 | | 0.006 | | 0.016 4 | | 0.0118 | | <0.006 |
| Magnesium | Mg mg/l | 50 | | 303 | | 340 | | 193 | | 62.1 | | 18.3 |
| Mercury | Hg mg/l | 0.001 | | 0.00019 | | <0.00016 | | 0.00012 | | <0.00001 | | <0.0000 1 |
| Nickel | Ni mg/l | 0.02 | | 0.0109 | | 0.0112 | | 0.026 7 | | 0.009 | | 0.0109 |
| Potassium | K mg/l | 5 | | 114 | | 138 | | 91.7 | | 45.1 | | 6.84 |
| Sodium | Na mg/l | 150 | | 2300 | | 2660 | | 1520 | | 703 | | 564 |
| Sulphate | SO ₄ mg/l | 200 | | 10 | | 10 | | 10 | | 10 | | 61 |
| Tin | Sn mg/l | - | | <0.0071 | | 0.007 | | 0.007 | | <0.007 | | 0.007 |
| Total Phosphorus | P mg/l | 0.03 | | 0.075 | | 0.075 | | 0.075 | | 0.29 | | 0.075 |

| | | | | | | | | | | | | |
|-------------------------|---------|--------|-------|-------|-------|-------|-------|------------|-------|-------|-------|--------|
| Total Organic Carbon | C mg/l | NAC | 95 | 22.7 | 95 | 23.1 | 100 | 15.2 | 26 | 10.9 | 15 | 2.7 |
| Total Oxidised Nitrogen | N mg/l | NAC | 0.13 | 0.13 | 0.13 | 0.13 | 0.13 | 0.13 | 0.13 | 0.13 | 0.13 | 0.13 |
| Total Phenols | mg/l | 0.0005 | 0.019 | 0.003 | 0.063 | 0.002 | 0.019 | 0.003 | 0.028 | 0.017 | 0.008 | <0.002 |
| Zinc | Zn mg/l | 0.1 | | 0.018 | | 0.018 | | 0.040 5 | | 0.018 | | 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 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 the 28th February and the 4th of August 2017.

APPENDIX 5 APPENDIX 5— LEACHATE MONITORING RESULTS

Biannual / Annual Leachate Monitoring Results 2017

| Parameter | Unit | EPA IGV | SS3 | |
|-------------------------------|-------|------------|------|----------|
| | | | Feb | Sept |
| Ammonia | mg/l | 0.15 | 14 | 3.2 |
| Arsenic | mg/l | 0.01 | | 0.0019 |
| BOD Total 5 Day with ATU | mg/l | - | 11 | 3 |
| Boron | mg/l | 1 | | <0.23 |
| Cadmium | mg/l | 0.005 | | 0.0006 |
| Calcium | mg/l | 200 | | 143 |
| Chloride | mg/l | 30 | 60 | 63 |
| Chromium | mg/l | 0.03 | | 0.002 |
| COD Total | mg/l | - | 158 | 53 |
| Conductivity | uS/cm | 1000 | 1585 | 968 |
| Copper | mg/l | 0.03 | | <0.009 |
| Cyanide (Total) | mg/l | 0.01 | | <0.009 |
| Fluoride | mgF/l | | | 0.24 |
| Iron | mg/l | 0.2 | | 3.8 |
| Lead | mg/l | 0.01 | | <0.006 |
| Magnesium | mg/l | 50 | | 19.1 |
| Mercury | mg/l | 0.001 | | <0.00001 |
| Nickel | mg/l | 0.02 | | 0.0532 |
| pH Value | Units | 6.5 - 9.5 | 6.94 | 7.03 |
| Potassium | mg/l | 5 | | 4.52 |
| Sodium | mg/l | 150 | | 31.9 |
| Sulphate | mg/l | 200 | | 109 |
| Temperature | °C | 25 | 10.1 | 17.3 |
| Tin | mg/l | | | <0.007 |
| Total Oxidised Nitrogen (TON) | mg/l | NAC | 40 | <0.14 |
| Total Phosphorus | mg/l | 0.01 | | 0.20 |
| 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 February and 4th August 2017.

APPENDIX 6 APPENDIX 6— SURFACE WATER MONITORING RESULTS

Biannual/Annual Surface Water Monitoring Results 2017

| Parameter | Unit | EPA IGV | SS1 | | SS2 | | SS4 | | SS6 | | SS7 | |
|-------------------------------|-------|-----------|------|----------|------|----------|------|----------|-----|------|-----|------|
| | | | Feb | Sept | Feb | Sept | Feb | Sept | Feb | Sept | Feb | Sept |
| Ammonia | mg/l | 0.02 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 0.103 | n/a | n/a | n/a | n/a |
| Arsenic | mg/l | 20 | | <0.001 | | <0.001 | | 0.001 | | n/a | | n/a |
| BOD Total 5 Day with ATU | mg/l | ≤4 | 2.3 | 2 | 2.5 | 3.1 | 2.7 | 2 | n/a | n/a | n/a | n/a |
| Boron | mg/l | 1 | | <0.23 | | <0.23 | | <0.23 | | n/a | | n/a |
| Cadmium | mg/l | 5 | | <0.0006 | | <0.0006 | | <0.0006 | | n/a | | n/a |
| Calcium | mg/l | 200 | | 150 | | 169 | | 159 | | n/a | | n/a |
| Chromium | mg/l | 30 | | <0.002 | | <0.002 | | 0.0021 | | n/a | | n/a |
| COD Total | mg/l | - | <15 | <15 | <15 | 24 | 18 | <15 | n/a | n/a | n/a | n/a |
| Conductivity | uS/cm | 1000 | | 908 | | 1239 | | 1045 | | n/a | | n/a |
| Copper | mg/l | 30 | | 0.009 | | 0.009 | | 0.009 | | n/a | | n/a |
| Cyanide (Total) | mg/l | 0.01 | | <0.009 | | <0.009 | | <0.009 | | n/a | | n/a |
| Dissolved Oxygen | % | NAC | 74.4 | 58 | 67.1 | 157 | 68.3 | 73 | n/a | n/a | n/a | n/a |
| Fluoride | mgF/l | 5.0 | | .13 | | 0.19 | | 0.22 | | n/a | | n/a |
| Iron | ug/l | 200 | | 0.931 | | 0.235 | | 0.272 | | n/a | | n/a |
| Lead | ug/l | 10 | | <0.006 | | <0.006 | | <0.006 | | n/a | | n/a |
| Magnesium | mg/l | 50 | | 11.6 | | 20.5 | | 17.8 | | n/a | | n/a |
| Mercury | ug/l | 1 | | <0.00001 | | <0.00001 | | <0.00001 | | n/a | | n/a |
| Nickel | ug/l | 50 | | 0.0052 | | 0.0931 | | 0.0105 | | n/a | | n/a |
| pH Value | Units | 6.5 - 9.5 | 7.62 | 7.67 | 7.36 | 8.2 | 7.4 | 7.65 | n/a | n/a | n/a | n/a |
| Potassium | mg/l | 5 | | 7.68 | | 7.76 | | 8.55 | | n/a | | n/a |
| Sodium | mg/l | 150 | | 30.6 | | 62.2 | | 33.6 | | n/a | | n/a |
| Solids Suspended | | 50 | <10 | 11 | <5 | 15 | 5.5 | <10 | n/a | n/a | n/a | n/a |
| Sulphate | mg/l | 200 | | 74 | | 184 | | 187 | | n/a | | n/a |
| Temperature | OC | 25 | 7.8 | 7.67 | 6.8 | 18.6 | 6.6 | 16 | n/a | n/a | n/a | n/a |
| Tin | mg/l | - | | <0.007 | | <0.007 | | <0.007 | | n/a | | n/a |
| Total Oxidised Nitrogen (TON) | mg/l | NAC | | 3 | | 1.5 | | 1.8 | | n/a | | n/a |
| Total Phosphorus | mg/l | - | | 0.23 | | <0.075 | | 0.08 | | n/a | | n/a |
| Zinc | mg/l | 100 | | 0.018 | | 0.018 | | 0.018 | | n/a | | 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 February and on the 4th of August 2017.

APPENDIX 7 APPENDIX 7 — COPIES OF LABORATORY REPORTS



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| Leachate Monitoring Reports | 81 |
| Surface Water Monitoring Results | 86 |

Groundwater Monitoring Test Reports

TEST REPORT NO: 140413.3

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0599
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater



BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447

FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|----------------------|---|----------------------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH3 | | | | |
| Dissolved Oxygen | | % O ₂ sat | 18.2 | 18/08/2017 | BHP AC 067 |
| Detergents (as MBAS) | | mg/L | <0.3 | 10/08/2017 | BHP AC 071 |
| Arsenic | | mg/L | 0.032 | 17/08/2017 | WAS060* |
| Boron | | mg/L | 1.19 | 18/08/2017 | WAS049* |
| Cadmium | | mg/L | <0.0006 | 18/08/2017 | WAS049* |
| Calcium | | mg/L | 241 | 18/08/2017 | WAS049* |
| Chromium | | mg/L | 0.005 | 18/08/2017 | WAS049* |
| Copper | | mg/L | <0.009 | 18/08/2017 | WAS049* |
| Cyanide | | mg/L | <0.009 | 11/08/2017 | WAS018* |
| Fluoride | | mg/L | 0.25 | 04/08/2017 | BHP AC 019 |
| Iron | | mg/L | 15.3 | 18/08/2017 | WAS049* |
| Lead | | mg/L | <0.006 | 18/08/2017 | WAS049* |
| Magnesium | | mg/L | 306 | 18/08/2017 | WAS049* |
| Mercury | | mg/L | 0.00019 | 11/08/2017 | WAS013* |
| Nickel | | mg/L | 0.0109 | 18/08/2017 | WAS049* |
| Potassium | | mg/L | 114 | 18/08/2017 | WAS049* |
| Sodium | | mg/L | 2300 | 18/08/2017 | WAS049* |

Additional information :

*Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



John O'Halloran

Issue Date: 28/08/17

TEST REPORT NO: 140413.3

Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0599
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater

Analysing
Testing
Consulting
Calibrating



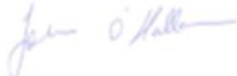
BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447

FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|-----------------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH3 | | | | |
| Tin | | mg/L | 0.0071 | 18/08/2017 | WAS049* |
| Zinc | | mg/L | <0.018 | 18/08/2017 | WAS049* |
| Sulphate (as SO ₄) | | mg/L | <10 | 10/08/2017 | BHP AC 095 |
| Total Phosphorus (as P) | | mg/L | <0.075 | 10/08/2017 | BHP AC 095 |
| Residue on Evaporation | | mg/L | 16800 | 08/08/2017 | BHP AC 040 |
| Volatile Organic Compounds | | | | | |
| Dichlorodifluoromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Chloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Chloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromomethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Trichlorofluoromethane | | mg/L | <0.001 | 18/08/2017 | GEO32* |
| 1,1-Dichloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Dichloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1-Dichloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| cis-1,2-Dichloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 2,2-Dichloropropane | | mg/L | <0.001 | 17/08/2017 | GEO32* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



John O'Halloran
Issue Date : 28/08/17

TEST REPORT NO: 140413.3

Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0599
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater

Analysing
Testing
Consulting
Calibrating



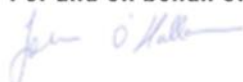
BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447

FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|---------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH3 | | | | |
| Chloroform | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromochloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1,1-Trichloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1-Dichloropropene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dichloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Benzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dichloropropane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Trichloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromodichloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Dibromomethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| cis-1,3-Dichloropropene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Toluene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| trans-1,3-Dichloropropene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1,2-Trichloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Carbon Tetrachloride | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Vinyl Chloride | | mg/L | <0.0005 | 17/08/2017 | GEO32* |
| 1,3-Dichloropropane | | mg/L | <0.001 | 17/08/2017 | GEO32* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



John O'Halloran
Issue Date : 28/08/17

BHP/CL/02C

TEST REPORT NO: 140413.3Analysing
Testing
Consulting
Calibrating
Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0599
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17

Test Specification: Nil
Item: Groundwater

BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|---------------------------|-----------------------------------|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH3 | | | | |
| Tetrachloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Dibromochloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dibromoethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Chlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1,1,2-Tetrachloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Ethyl Benzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| m&p-Xylene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| o-Xylene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Styrene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromoform | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| trans-1,2-Dichloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Isopropylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1,2,2-Tetrachloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2,3-Trichloropropane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| n-Propylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 2-Chlorotoluene | | mg/L | <0.001 | 17/08/2017 | GEO32* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :


TEST REPORT NO: 140413.3
 Analysing
 Testing
 Consulting
 Calibrating

 Client: Response Engineering
 Tradaree TP
 Shannon
 Co. Clare

 BHP Ref. No.: 17/08/0599
 Order No.:
 Date Received: 04/08/17
 Date Completed: 18/08/17
 Test Specification: Nil
 Item: Groundwater

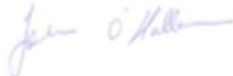
 BHP
 New Road
 Thomondgate
 Limerick
 Ireland
 Tel +353 61 455399
 Fax + 353 61 455447

FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|-----------------------------|-----------------------------------|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH3 | | | | |
| 1,3,5-Trimethylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 4-Chlorotoluene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| tert-Butylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2,4-Trimethylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| sec-Butylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| p-Isopropyltoluene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,3-Dichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,4-Dichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| n-Butylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dibromo-3-chloropropane | | mg/L | <0.002 | 17/08/2017 | GEO32* |
| 1,2,4-Trichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Hexachlorobutadiene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Naphthalene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2,3-Trichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| MTBE | | mg/L | <0.001 | 17/08/2017 | GEO32* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



John O'Halloran

TEST REPORT NO: 140413.3
 Testing
 Consulting
 Calibrating

 Client: Response Engineering
 Tradaree TP
 Shannon
 Co. Clare

 BHP Ref. No.: 17/08/0599
 Order No.:
 Date Received: 04/08/17
 Date Completed: 18/08/17
 Test Specification: Nil
 Item: Groundwater

 BHP
 New Road
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 Tel +353 61 455399
 Fax + 353 61 455447

FTAO: Ailish Johnson

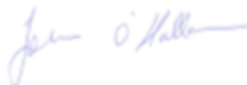
| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|--|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH3 | | | | |
| Semi-Volatile Organic Compounds** | | | | | |
| Phenol | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Bis(2-chloroethyl)ether | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| 2-Chlorophenol | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| 1,3-Dichlorobenzene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| 1,4-Dichlorobenzene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| 2-Methylphenol | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| 3&4-Methylphenol | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Dibenzofuran | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| 1,2-Dichlorobenzene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Bis(2-chloroisopropyl)ether | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| n-Nitrosodi-n-propylamine | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Hexachloroethane | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Nitrobenzene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Isophorone | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| 2,4-Dimethylphenol | | mg/L | <0.004 | 14/08/2017 | GEO40* |

Additional information :

*Subcontracted to an approved accredited supplier

**Reporting limit raised for SVOCs due to nature of sample matrix

For and on behalf of BHP laboratories :



John O'Halloran

Issue Date : 28/08/17

TEST REPORT NO: 140413.3
 Analysing
 Testing
 Consulting
 Calibrating

Client: Response Engineering
 Tradaree TP
 Shannon
 Co. Clare

BHP Ref. No.: 17/08/0599
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater
BHP
 BHP
 New Road
 Thomondgate
 Limerick
 Ireland
 Tel +353 61 455399
 Fax + 353 61 455447
FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|----------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH3 | | | | |
| 2-Nitrophenol | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Bis(2-chloroethoxy)methane | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| 2,4-Dichlorophenol | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| 1,2,4-Trichlorobenzene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Naphthalene | | mg/L | <0.008 | 14/08/2017 | GEO40* |
| Hexachlorobutadiene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| 4-Chloro-3-methylphenol | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| 2-Methylnaphthalene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| 2,4,6-Trichlorophenol | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| 2,4,5-Trichlorophenol | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| 2-Chloronaphthalene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Dimethylphthalate | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| 2,6-Dinitrotoluene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Acenaphthylene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Acenaphthene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| 2,4-Dinitrotoluene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Diethylphthalate | | mg/L | <0.004 | 14/08/2017 | GEO40* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :

John O'Halloran

TEST REPORT NO: 140413.3
 Analysing
 Testing
 Consulting
 Calibrating

Client: Response Engineering
 Tradaree TP
 Shannon
 Co. Clare

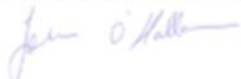
BHP Ref. No.: 17/08/0599
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater

 BHP
 New Road
 Thomondgate
 Limerick
 Ireland
 Tel +353 61 455399
 Fax + 353 61 455447

FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|-----------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH3 | | | | |
| 4-Nitrophenol | | mg/L | <0.02 | 14/08/2017 | GEO40* |
| 4-Chlorophenyl phenyl ether | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Fluorene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Diphenylamine | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| 4-Bromophenyl Phenyl Ether | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Hexachlorobenzene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Pentachlorophenol | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Phenanthrene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Anthracene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| di-n-Butylphthalate | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Fluoranthene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Pyrene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Benzyl Butyl Phthalate | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Benzo(a)anthracene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Chrysene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Bis(2-ethylhexyl)phthalate | | mg/L | <0.02 | 14/08/2017 | GEO40* |
| Di-n-octylphthalate | | mg/L | <0.004 | 14/08/2017 | GEO40* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :

John O'Halloran
 Issue Date: 28/08/17

TEST REPORT NO: 140413.3

Client: Response Engineering
 Tradaree TP
 Shannon
 Co. Clare

BHP Ref. No.: 17/08/0599
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater

FTAO: Ailish Johnson

Analysing
 Testing
 Consulting
 Calibrating

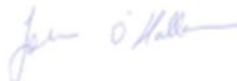


BHP
 New Road
 Thomondgate
 Limerick
 Ireland
 Tel +353 61 455399
 Fax + 353 61 455447

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|-------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH3 | | | | |
| Benzo(b)fluoranthene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Benzo(k)fluoranthene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Benzo(a)pyrene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Indeno(1,2,3-c,d)pyrene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Dibenz(a,h)anthracene | | mg/L | <0.004 | 14/08/2017 | GEO40* |
| Benzo(g,h,i)perylene | | mg/L | <0.004 | 14/08/2017 | GEO40* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



John O'Halloran

Client: Response Engineering
 Railway Road
 Charleville
 Co. Cork

BHP Ref. No: 17/08/0604
Quote Ref: QC001156
Order No: To Follow
Sales Order: 29521
Date Received: 04/08/2017
Date Sampled: 04/08/2017
Date Completed: 11/08/2017
Sample Type: Bore



**Testing
 Analysing
 Consulting**



BHP Laboratories
 New Road
 Thomondgate
 Limerick
 Tel: +353 61 455399
 Fax: +353 61 455261
 EMail: johnohalloran@bhp.ie

FTAO: Ailish Johnston
Site: Tradaree
BHP Ref: Bi-annually_Bore
Client Ref: BH3

| Test | Units | Results | Customer Limits | Date Analysed | Method |
|--|----------|---------|-----------------|---------------|---------------|
| Total Ammonia (as N) Acc. | mg/L | 29 | | 04/08/2017 | BHP AC 095 |
| Chloride (as Cl ⁻) Acc. | mg/L | 4852 | | 04/08/2017 | BHP AC 095 |
| Salinity - Field | ppt | 11.2 | | 04/08/2017 | Calculation |
| Conductivity (25 °C) - Field | µS/cm | 14970 | | 04/08/2017 | BHP AC 067 |
| pH - Field | pH Units | 6.55 | | 04/08/2017 | BHP AC 067 |
| Temperature - Field | °C | 14.3 | | 04/08/2017 | BHP AC 067 |
| Nitrite (as NO ₂ -N) ** | mg/L | <0.016 | | 11/08/2017 | BHP AC 019 |
| Nitrate (as NO ₃ -N) Acc. ** | mg/L | <0.113 | | 11/08/2017 | BHP AC 019 |
| Total Oxidised Nitrogen (as N) ** | mg/L | <0.13 | | 11/08/2017 | BHP AC 065 |
| Total Organic Carbon * | mg/L | 22.7 | | 10/08/2017 | WAS005 |
| Total Phenols | mg/L | 0.003 | | 09/08/2017 | BHP AC 044 |
| Water Level | meters | 1.03 | | 04/08/2017 | On-Site Meter |

| | | | |
|--|---|-------------------------|------------|
| Authorised by: |  John O'Halloran Technical Manager | Date Authorised: | 21/08/2017 |
| Additional information:(Opinions, where stated, are not covered by accreditation) Acc.: INAB Accredited ND: None detected in volume analysed ^ Potable water matrix * Subcontracted to an approved accredited laboratory ** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised. ~: Sample Condition : ACCEPTABLE | | | |

Client: Response Engineering
 Railway Road
 Charleville
 Co. Cork

BHP Ref. No: 17/02/1852
 Quote Ref: QC000790
 Order No: To Follow
 Sales Order: 22648
 Date Received: 28/02/2017
 Date Sampled: 28/02/2017
 Date Completed: 30/03/2017
 Sample Type: Bore




Testing
 Analysing
 Consulting



BHP Laboratories
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 Thomondgate
 Limerick
 Tel: +353 61 455399
 Fax: +353 61 455447
 Email: johnhalloran@bhp.ie

FTAO: Ailish Johnston
 Site: Tradaree
 BHP Ref: Bi-annually_Bore
 Client Ref: BH3

| Test | | Units | Results | Customer Limits | Date Analysed | Method |
|---------------------------------|------|----------|---------|-----------------|---------------|---------------|
| Total Ammonia (as N) | Acc. | mg/L | 27 | | 28/02/2017 | BHP AC 095 |
| Chloride (as Cl ⁻) | Acc. | mg/L | 4785 | | 02/03/2017 | BHP AC 095 |
| Salinity - Field | | ppt | 10.9 | | 28/02/2017 | Calculation |
| Conductivity (25 °C) - Field | | µS/cm | 12980 | | 28/02/2017 | BHP AC 067 |
| pH - Field | | pH Units | 6.91 | | 28/02/2017 | BHP AC 067 |
| Temperature - Field | | °C | 9.7 | | 28/02/2017 | BHP AC 067 |
| Nitrite (as NO ₂ -N) | | mg/L | <0.016 | | 03/03/2017 | BHP AC 019 |
| Nitrate (as NO ₃ -N) | Acc. | mg/L | <0.113 | | 03/03/2017 | BHP AC 019 |
| Total Oxidised Nitrogen (as N) | | mg/L | <0.13 | | 03/03/2017 | BHP AC 065 |
| Total Organic Carbon | ** | mg/L | 95 | | 20/03/2017 | BHP AC 016 |
| Total Phenols | ** | mg/L | 0.019 | | 30/03/2017 | BHP AC 044 |
| Water Level | | meters | 1.01 | | 28/02/2017 | On-Site Meter |

Authorised by:  John O'Halloran Date Authorised: 04/04/2017
 Technical Manager

Additional Information:(Opinions, where stated, are not covered by accreditation)
 Acc.: INAB Accredited
 ND: None detected in volume analysed
 ^ Potable water matrix
 * Subcontracted to an approved accredited laboratory
 ** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.
 ~ Result is expressed as 'Present' since all plates contained less than 10 colonies and total number of colonies was less than 4.

BHP/AC/F115

TEST REPORT NO: 140413 .4

Client: Response Engineering
Railway Road
Charleville
Co. Cork

BHP Ref. No: 17/08/0605
Quote Ref: QC001156
Order No: To Follow
Sales Order: 29521
Date Received: 04/08/2017
Date Sampled: 04/08/2017
Date Completed: 11/08/2017
Sample Type: Bore



Testing
Analysing
Consulting



BHP Laboratories
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Limerick
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Email: johnohalloran@bhp.ie

FTAO: Ailish Johnston
Site: Tradaree
BHP Ref: Bi-annually_Bore
Client Ref: BH4

| Test | | Units | Results | Customer Limits | Date Analysed | Method |
|---------------------------------|---------|----------|---------|-----------------|---------------|---------------|
| Total Ammonia (as N) | Acc. | mg/L | 19 | | 04/08/2017 | BHP AC 095 |
| Chloride (as Cl ⁻) | Acc. | mg/L | 4970 | | 10/08/2017 | BHP AC 095 |
| Salinity - Field | | ppt | 11.6 | | 04/08/2017 | Calculation |
| Conductivity (25 °C) - Field | | µS/cm | 15580 | | 04/08/2017 | BHP AC 067 |
| pH - Field | | pH Units | 6.89 | | 04/08/2017 | BHP AC 067 |
| Temperature - Field | | °C | 14.8 | | 04/08/2017 | BHP AC 067 |
| Nitrite (as NO ₂ -N) | ** | mg/L | <0.016 | | 11/08/2017 | BHP AC 019 |
| Nitrate (as NO ₃ -N) | Acc. ** | mg/L | <0.113 | | 11/08/2017 | BHP AC 019 |
| Total Oxidised Nitrogen (as N) | ** | mg/L | <0.13 | | 11/08/2017 | BHP AC 065 |
| Total Organic Carbon | * | mg/L | 23.1 | | 10/08/2017 | WAS005 |
| Total Phenols | | mg/L | 0.002 | | 09/08/2017 | BHP AC 044 |
| Water Level | | meters | 0.42 | | 04/08/2017 | On-Site Meter |

BHP/AC/F115

TEST REPORT NO: 134718 .4

Client: Response Engineering
Railway Road
Charleville
Co. Cork

BHP Ref. No: 17/02/1853
Quote Ref: QC000790
Order No: To Follow
Sales Order: 22648
Date Received: 28/02/2017
Date Sampled: 28/02/2017
Date Completed: 30/03/2017
Sample Type: Bore



Testing
Analysing
Consulting



BHP Laboratories
New Road
Thomondgate
Limerick
Tel: +353 61 455399
Fax: +353 61 455447
Email: johnhalloran@bhp.ie

FTAO: Ailish Johnston
Site: Traderee
BHP Ref: Bi-annually_Bore
Client Ref: BH4

| Test | Units | Results | Customer Limits | Date Analysed | Method |
|--------------------------------------|----------|---------|-----------------|---------------|---------------|
| Total Ammonia (as N) Acc. | mg/L | 20 | | 28/02/2017 | BHP AC 095 |
| Chloride (as Cl ⁻) Acc. | mg/L | 5004 | | 02/03/2017 | BHP AC 095 |
| Salinity - Field | ppt | 11.7 | | 28/02/2017 | Calculation |
| Conductivity (25 °C) - Field | µS/cm | 13980 | | 28/02/2017 | BHP AC 067 |
| pH - Field | pH Units | 6.93 | | 28/02/2017 | BHP AC 067 |
| Temperature - Field | °C | 9.8 | | 28/02/2017 | BHP AC 067 |
| Nitrite (as NO ₂ -N) | mg/L | <0.016 | | 03/03/2017 | BHP AC 019 |
| Nitrate (as NO ₃ -N) Acc. | mg/L | <0.113 | | 03/03/2017 | BHP AC 019 |
| Total Oxidised Nitrogen (as N) | mg/L | <0.13 | | 03/03/2017 | BHP AC 065 |
| Total Organic Carbon ** | mg/L | 95 | | 20/03/2017 | BHP AC 016 |
| Total Phenols ** | mg/L | 0.063 | | 30/03/2017 | BHP AC 044 |
| Water Level | meters | 0.0 | | 28/02/2017 | On-Site Meter |

TEST REPORT NO: 140413.4

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0600
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater



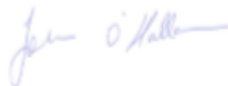
BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447

FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|----------------------|-----------------------------------|----------------------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH4 | | | | |
| Dissolved Oxygen | | % O ₂ sat | 12.6 | 18/08/2017 | BHP AC 067 |
| Detergents (as MBAS) | | mg/L | <0.3 | 10/08/2017 | BHP AC 071 |
| Arsenic | | mg/L | 0.011 | 17/08/2017 | WAS060* |
| Boron | | mg/L | 1.59 | 18/08/2017 | WAS049* |
| Cadmium | | mg/L | <0.0006 | 18/08/2017 | WAS049* |
| Calcium | | mg/L | 245 | 18/08/2017 | WAS049* |
| Chromium | | mg/L | 0.0043 | 18/08/2017 | WAS049* |
| Copper | | mg/L | <0.009 | 18/08/2017 | WAS049* |
| Cyanide | | mg/L | <0.009 | 11/08/2017 | WAS018* |
| Fluoride | | mg/L | 0.21 | 04/08/2017 | BHP AC 019 |
| Iron | | mg/L | 18.3 | 18/08/2017 | WAS049* |
| Lead | | mg/L | <0.006 | 18/08/2017 | WAS049* |
| Magnesium | | mg/L | 340 | 18/08/2017 | WAS049* |
| Mercury | | mg/L | 0.00016 | 11/08/2017 | WAS013* |
| Nickel | | mg/L | 0.0112 | 18/08/2017 | WAS049* |
| Potassium | | mg/L | 138 | 18/08/2017 | WAS049* |
| Sodium | | mg/L | 2660 | 18/08/2017 | WAS049* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



BHP/CL/020

TEST REPORT NO: 140413.4
 Analysing
 Testing
 Consulting
 Calibrating

 Client: Response Engineering
 Tradaree TP
 Shannon
 Co. Clare

 BHP Ref. No.: 17/08/0600
 Order No.:
 Date Received: 04/08/17
 Date Completed: 18/08/17
 Test Specification: Nil
 Item: Groundwater

 BHP
 New Road
 Thomondgate
 Limerick
 Ireland
 Tel +353 61 455300
 Fax + 353 61 455447

FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|-----------------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH4 | | | | |
| Tin | | mg/L | <0.007 | 18/08/2017 | WAS049* |
| Zinc | | mg/L | <0.018 | 18/08/2017 | WAS049* |
| Sulphate (as SO ₄) | | mg/L | <10 | 10/08/2017 | BHP AC 095 |
| Total Phosphorus (as P) | | mg/L | <0.075 | 10/08/2017 | BHP AC 095 |
| Residue on Evaporation | | mg/L | 10380 | 08/08/2017 | BHP AC 040 |
| Volatile Organic Compounds | | | | | |
| Dichlorodifluoromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Chloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Chloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromomethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Trichlorofluoromethane | | mg/L | <0.001 | 18/08/2017 | GEO32* |
| 1,1-Dichloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Dichloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1-Dichloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| cis-1,2-Dichloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 2,2-Dichloropropane | | mg/L | <0.001 | 17/08/2017 | GEO32* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



TEST REPORT NO: 140413.4

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0600
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater



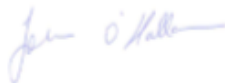
BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447

FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|---------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH4 | | | | |
| Chloroform | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromochloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1,1-Trichloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1-Dichloropropene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dichloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Benzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dichloropropane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Trichloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromodichloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Dibromomethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| cis-1,3-Dichloropropene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Toluene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| trans-1,3-Dichloropropene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1,2-Trichloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Carbon Tetrachloride | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Vinyl Chloride | | mg/L | <0.0005 | 17/08/2017 | GEO32* |
| 1,3-Dichloropropane | | mg/L | <0.001 | 17/08/2017 | GEO32* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



John O'Halloran

BHP/CL/02C

TEST REPORT NO: 140413.4

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0600
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater




BHP
New Road
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Fax + 353 61 455447

FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|---------------------------|-----------------------------------|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH4 | | | | |
| Tetrachloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Dibromochloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dibromoethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Chlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1,1,2-Tetrachloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Ethyl Benzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| m&p-Xylene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| o-Xylene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Styrene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromoform | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| trans-1,2-Dichloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Isopropylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1,2,2-Tetrachloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2,3-Trichloropropane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| n-Propylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 2-Chlorotoluene | | mg/L | <0.001 | 17/08/2017 | GEO32* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



BHP/CL/02C

TEST REPORT NO: 140413.4

Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0600
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater

FTAO: Ailish Johnson

Analysing
Testing
Consulting
Calibrating



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New Road
Thomondgate
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Ireland
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Fax + 353 61 455447

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|-----------------------------|-----------------------------------|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH4 | | | | |
| 1,3,5-Trimethylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 4-Chlorotoluene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| tert-Butylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2,4-Trimethylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| sec-Butylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| p-Isopropyltoluene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,3-Dichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,4-Dichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| n-Butylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dibromo-3-chloropropane | | mg/L | <0.002 | 17/08/2017 | GEO32* |
| 1,2,4-Trichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Hexachlorobutadiene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Naphthalene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2,3-Trichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| MTBE | | mg/L | <0.001 | 17/08/2017 | GEO32* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



BHP/CL/02C

TEST REPORT NO: 140413.4
 Analysing
 Testing
 Consulting
 Calibrating

 Client: Response Engineering
 Tradaree TP
 Shannon
 Co. Clare

 BHP Ref. No.: 17/08/0600
 Order No.:
 Date Received: 04/08/17
 Date Completed: 18/08/17
 Test Specification: Nil
 Item: Groundwater



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 Fax + 353 61 455447

FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|--|-----------------------------------|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH4 | | | | |
| Semi-Volatile Organic Compounds | | | | | |
| Phenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Bis(2-chloroethyl)ether | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2-Chlorophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 1,3-Dichlorobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 1,4-Dichlorobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2-Methylphenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 3&4-Methylphenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Dibenzofuran | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 1,2-Dichlorobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Bis(2-chloroisopropyl)ether | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| n-Nitrosodi-n-propylamine | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Hexachloroethane | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Nitrobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Isophorone | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,4-Dimethylphenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



BHP/CL/02C

TEST REPORT NO: 140413.4
 Analysing
 Testing
 Consulting
 Calibrating

 Client: Response Engineering
 Tradaree TP
 Shannon
 Co. Clare

 BHP Ref. No.: 17/08/0600
 Order No.:
 Date Received: 04/08/17
 Date Completed: 18/08/17
 Test Specification: Nil
 Item: Groundwater



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 Limerick
 Ireland
 Tel +353 61 455399
 Fax + 353 61 455447

FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|----------------------------|-----------------------------------|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH4 | | | | |
| 2-Nitrophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Bis(2-chloroethoxy)methane | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,4-Dichlorophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 1,2,4-Trichlorobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Naphthalene | | mg/L | <0.002 | 14/08/2017 | GEO40* |
| Hexachlorobutadiene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 4-Chloro-3-methylphenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2-Methylnaphthalene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,4,6-Trichlorophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,4,5-Trichlorophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2-Chloronaphthalene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Dimethylphthalate | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,6-Dinitrotoluene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Acenaphthylene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Acenaphthene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,4-Dinitrotoluene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Diethylphthalate | | mg/L | <0.001 | 14/08/2017 | GEO40* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



BHP/CL/02C

TEST REPORT NO: 140413.4Analysing
Testing
Consulting
Calibrating
Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0600
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater

 BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447

FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|-----------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH4 | | | | |
| 4-Nitrophenol | | mg/L | <0.005 | 14/08/2017 | GEO40* |
| 4-Chlorophenyl phenyl ether | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Fluorene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Diphenylamine | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 4-Bromophenyl Phenyl Ether | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Hexachlorobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Pentachlorophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Phenanthrene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Anthracene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| di-n-Butylphthalate | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Fluoranthene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Pyrene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Benzyl Butyl Phthalate | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Benzo(a)anthracene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Chrysene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Bis(2-ethylhexyl)phthalate | | mg/L | <0.005 | 14/08/2017 | GEO40* |
| Di-n-octylphthalate | | mg/L | <0.001 | 14/08/2017 | GEO40* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :

BHP/CL/02C

TEST REPORT NO: 140413.4

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0600
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater



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Ireland
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Fax + 353 61 455447

FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|-------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH4 | | | | |
| Benzo(b)fluoranthene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Benzo(k)fluoranthene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Benzo(a)pyrene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Indeno(1,2,3-c,d)pyrene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Dibenz(a,h)anthracene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Benzo(g,h,i)perylene | | mg/L | <0.001 | 14/08/2017 | GEO40* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



BHP/AC/F115

TEST REPORT NO: 140413 .5

Client: Response Engineering

Railway Road
Charleville
Co. Cork

BHP Ref. No: 17/08/0606
Quote Ref: QC001156
Order No: To Follow
Sales Order: 29521
Date Received: 04/08/2017
Date Sampled: 04/08/2017
Date Completed: 11/08/2017
Sample Type: Bore



Testing
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EMail: johnhalloran@bhp.ie

FTAO: Ailish Johnston

Site: Tradaree

BHP Ref: Bi-annually_Bore

Client Ref: BH5

| Test | Units | Results | Customer Limits | Date Analysed | Method |
|---|----------|---------|-----------------|---------------|---------------|
| Total Ammonia (as N) Acc. | mg/L | 20 | | 04/08/2017 | BHP AC 095 |
| Chloride (as Cl ⁻) Acc. | mg/L | 3372 | | 10/08/2017 | BHP AC 095 |
| Salinity - Field | ppt | 8.0 | | 04/08/2017 | Calculation |
| Conductivity (25 °C) - Field | µS/cm | 10810 | | 04/08/2017 | BHP AC 067 |
| pH - Field | pH Units | 6.98 | | 04/08/2017 | BHP AC 067 |
| Temperature - Field | °C | 13.5 | | 04/08/2017 | BHP AC 067 |
| Nitrite (as NO ₂ -N) ** | mg/L | <0.016 | | 11/08/2017 | BHP AC 019 |
| Nitrate (as NO ₃ -N) Acc. ** | mg/L | <0.113 | | 11/08/2017 | BHP AC 019 |
| Total Oxidised Nitrogen (as N) ** | mg/L | <0.13 | | 11/08/2017 | BHP AC 065 |
| Total Organic Carbon * | mg/L | 15.2 | | 10/08/2017 | WAS005 |
| Total Phenols | mg/L | 0.003 | | 09/08/2017 | BHP AC 044 |
| Water Level | meters | 0.36 | | 04/08/2017 | On-Site Meter |

BHP/AC/F115

TEST REPORT NO: 134718 .5

Client: Response Engineering
 Railway Road
 Charleville
 Co. Cork

BHP Ref. No: 17/02/1854
Quote Ref: QC000790
Order No: To Follow
Sales Order: 22648
Date Received: 28/02/2017
Date Sampled: 28/02/2017
Date Completed: 30/03/2017
Sample Type: Bore



Testing
 Analysing
 Consulting



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 EMail: johnohalloran@bhp.ie

FTAO: Ailish Johnston
Site: Tradaree
BHP Ref: Bi-annually_Bore
Client Ref: BH5

| Test | | Units | Results | Customer Limits | Date Analysed | Method |
|---------------------------------|------|----------|---------|-----------------|---------------|---------------|
| Total Ammonia (as N) | Acc. | mg/L | 20 | | 28/02/2017 | BHP AC 095 |
| Chloride (as Cl ⁻) | Acc. | mg/L | 3443 | | 02/03/2017 | BHP AC 095 |
| Salinity - Field | | ppt | 8.0 | | 28/02/2017 | Calculation |
| Conductivity (25 °C) - Field | | µS/cm | 9760 | | 28/02/2017 | BHP AC 067 |
| pH - Field | | pH Units | 7.05 | | 28/02/2017 | BHP AC 067 |
| Temperature - Field | | °C | 9.7 | | 28/02/2017 | BHP AC 067 |
| Nitrite (as NO ₂ -N) | | mg/L | <0.016 | | 03/03/2017 | BHP AC 019 |
| Nitrate (as NO ₃ -N) | Acc. | mg/L | <0.113 | | 03/03/2017 | BHP AC 019 |
| Total Oxidised Nitrogen (as N) | | mg/L | <0.13 | | 03/03/2017 | BHP AC 065 |
| Total Organic Carbon | ** | mg/L | 100 | | 20/03/2017 | BHP AC 016 |
| Total Phenols | ** | mg/L | 0.019 | | 30/03/2017 | BHP AC 044 |
| Water Level | | meters | 0.75 | | 28/02/2017 | On-Site Meter |

TEST REPORT NO: 140413.5

Analysing
Testing
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Calibrating

Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0601
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater



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FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|----------------------|---|----------------------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH5 | | | | |
| Dissolved Oxygen | | % O ₂ sat | 41.8 | 18/08/2017 | BHP AC 067 |
| Detergents (as MBAS) | | mg/L | <0.3 | 10/08/2017 | BHP AC 071 |
| Arsenic | | mg/L | 0.0081 | 17/08/2017 | WAS060* |
| Boron | | mg/L | 1.02 | 18/08/2017 | WAS049* |
| Cadmium | | mg/L | 0.0006 | 18/08/2017 | WAS049* |
| Calcium | | mg/L | 298 | 18/08/2017 | WAS049* |
| Chromium | | mg/L | 0.0121 | 18/08/2017 | WAS049* |
| Copper | | mg/L | 0.013 | 18/08/2017 | WAS049* |
| Cyanide | | mg/L | <0.009 | 11/08/2017 | WAS018* |
| Fluoride | | mg/L | 0.24 | 04/08/2017 | BHP AC 019 |
| Iron | | mg/L | 11.1 | 18/08/2017 | WAS049* |
| Lead | | mg/L | 0.0164 | 18/08/2017 | WAS049* |
| Magnesium | | mg/L | 193 | 18/08/2017 | WAS049* |
| Mercury | | mg/L | 0.00012 | 11/08/2017 | WAS013* |
| Nickel | | mg/L | 0.0267 | 18/08/2017 | WAS049* |
| Potassium | | mg/L | 91.7 | 18/08/2017 | WAS049* |
| Sodium | | mg/L | 1520 | 18/08/2017 | WAS049* |

TEST REPORT NO: 140413.5

Analysing
Testing
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Calibrating

Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0601
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater



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FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|-----------------------------------|-----------------------------------|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring | | | | |
| | BH5 | | | | |
| Tin | | mg/L | <0.007 | 18/08/2017 | WAS049* |
| Zinc | | mg/L | 0.0405 | 18/08/2017 | WAS049* |
| Sulphate (as SO ₄) | | mg/L | <10 | 10/08/2017 | BHP AC 095 |
| Total Phosphorus (as P) | | mg/L | <0.075 | 10/08/2017 | BHP AC 095 |
| Residue on Evaporation | | mg/L | 12860 | 08/08/2017 | BHP AC 040 |
| Volatile Organic Compounds | | | | | |
| Dichlorodifluoromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Chloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Chloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromomethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Trichlorofluoromethane | | mg/L | <0.001 | 18/08/2017 | GEO32* |
| 1,1-Dichloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Dichloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1-Dichloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| cis-1,2-Dichloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 2,2-Dichloropropane | | mg/L | <0.001 | 17/08/2017 | GEO32* |

BHP/CL/02C

TEST REPORT NO: 140413.5
 Analysing
 Testing
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 Calibrating

Client: Response Engineering
 Tradaree TP
 Shannon
 Co. Clare

BHP Ref. No.: 17/08/0601
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater

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 New Road
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 Ireland
 Tel +353 61 455399
 Fax + 353 61 455447
FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|---------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH5 | | | | |
| Chloroform | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromochloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1,1-Trichloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1-Dichloropropene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dichloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Benzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dichloropropane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Trichloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromodichloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Dibromomethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| cis-1,3-Dichloropropene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Toluene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| trans-1,3-Dichloropropene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1,2-Trichloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Carbon Tetrachloride | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Vinyl Chloride | | mg/L | <0.0005 | 17/08/2017 | GEO32* |
| 1,3-Dichloropropane | | mg/L | <0.001 | 17/08/2017 | GEO32* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :


TEST REPORT NO: 140413.5

Client: Response Engineering
 Tradaree TP
 Shannon
 Co. Clare

BHP Ref. No.: 17/08/0601
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater

FTAO: Ailish Johnson

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 Tel +353 61 455399
 Fax + 353 61 455447

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|---------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH5 | | | | |
| Tetrachloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Dibromochloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dibromoethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Chlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1,1,2-Tetrachloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Ethyl Benzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| m&p-Xylene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| o-Xylene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Styrene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromoform | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| trans-1,2-Dichloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Isopropylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1,2,2-Tetrachloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2,3-Trichloropropane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| n-Propylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 2-Chlorotoluene | | mg/L | <0.001 | 17/08/2017 | GEO32* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



John O'Halloran
Issue Date : 28/08/17

TEST REPORT NO: 140413.5

Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0601
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater

Analysing
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Calibrating



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Thomondgate
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Fax + 353 61 455447

FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|-----------------------------|-----------------------------------|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH5 | | | | |
| 1,3,5-Trimethylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 4-Chlorotoluene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| tert-Butylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2,4-Trimethylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| sec-Butylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| p-Isopropyltoluene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,3-Dichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,4-Dichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| n-Butylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dibromo-3-chloropropane | | mg/L | <0.002 | 17/08/2017 | GEO32* |
| 1,2,4-Trichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Hexachlorobutadiene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Naphthalene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2,3-Trichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| MTBE | | mg/L | <0.001 | 17/08/2017 | GEO32* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



John O'Halloran

TEST REPORT NO: 140413.5

Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0601
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater

FTAO: Ailish Johnson

Analysing
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Thomondgate
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Ireland
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Fax + 353 61 455447

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|--|-----------------------------------|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH5 | | | | |
| Semi-Volatile Organic Compounds | | | | | |
| Phenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Bis(2-chloroethyl)ether | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2-Chlorophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 1,3-Dichlorobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 1,4-Dichlorobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2-Methylphenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 3&4-Methylphenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Dibenzofuran | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 1,2-Dichlorobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Bis(2-chloroisopropyl)ether | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| n-Nitrosodi-n-propylamine | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Hexachloroethane | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Nitrobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Isophorone | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,4-Dimethylphenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



John O'Halloran
Issue Date : 28/08/17

BHP/CL/02C

TEST REPORT NO: 140413.5
 Analysing
 Testing
 Consulting
 Calibrating

 Client: Response Engineering
 Tradaree TP
 Shannon
 Co. Clare

 BHP Ref. No.: 17/08/0601
 Order No.:
 Date Received: 04/08/17
 Date Completed: 18/08/17
 Test Specification: Nil
 Item: Groundwater

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 Tel +353 61 455399
 Fax + 353 61 455447

FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|----------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH5 | | | | |
| 2-Nitrophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Bis(2-chloroethoxy)methane | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,4-Dichlorophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 1,2,4-Trichlorobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Naphthalene | | mg/L | <0.002 | 14/08/2017 | GEO40* |
| Hexachlorobutadiene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 4-Chloro-3-methylphenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2-Methylnaphthalene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,4,6-Trichlorophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,4,5-Trichlorophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2-Chloronaphthalene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Dimethylphthalate | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,6-Dinitrotoluene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Acenaphthylene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Acenaphthene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,4-Dinitrotoluene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Diethylphthalate | | mg/L | <0.001 | 14/08/2017 | GEO40* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



BHP/CL/02C

TEST REPORT NO: 140413.5
 Analysing
 Testing
 Consulting
 Calibrating

 Client: Response Engineering
 Tradaree TP
 Shannon
 Co. Clare

 BHP Ref. No.: 17/08/0601
 Order No.:
 Date Received: 04/08/17
 Date Completed: 18/08/17
 Test Specification: Nil
 Item: Groundwater

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FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|-----------------------------|-----------------------------------|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH5 | | | | |
| 4-Nitrophenol | | mg/L | <0.005 | 14/08/2017 | GEO40* |
| 4-Chlorophenyl phenyl ether | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Fluorene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Diphenylamine | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 4-Bromophenyl Phenyl Ether | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Hexachlorobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Pentachlorophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Phenanthrene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Anthracene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| di-n-Butylphthalate | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Fluoranthene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Pyrene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Benzyl Butyl Phthalate | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Benzo(a)anthracene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Chrysene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Bis(2-ethylhexyl)phthalate | | mg/L | <0.005 | 14/08/2017 | GEO40* |
| Di-n-octylphthalate | | mg/L | <0.001 | 14/08/2017 | GEO40* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



TEST REPORT NO: 140413.5

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0601
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater



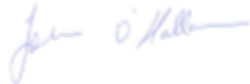
BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447

FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|-------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring BH5 | | | | |
| Benzo(b)fluoranthene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Benzo(k)fluoranthene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Benzo(a)pyrene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Indeno(1,2,3-c,d)pyrene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Dibenz(a,h)anthracene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Benzo(g,h,i)perylene | | mg/L | <0.001 | 14/08/2017 | GEO40* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



John O'Halloran
Issue Date : 28/08/17

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory.

BHP/AC/F115

TEST REPORT NO: 140413 .1**Client: Response Engineering**
 Railway Road
 Charleville
 Co. Cork

BHP Ref. No: 17/08/0602
Quote Ref: QC001156
Order No: To Follow
Sales Order: 29521
Date Received: 04/08/2017
Date Sampled: 04/08/2017
Date Completed: 11/08/2017
Sample Type: Bore

 Testing
 Analysing
 Consulting

 BHP Laboratories
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 Limerick
 Tel: +353 61 455399
 Fax: +353 61 455261
 EMail: johnohalloran@bhp.ie

FTAO: Ailish Johnston
Site: Tradaree
BHP Ref: Bi-annually_Bore
Client Ref: RD2

| Test | | Units | Results | Customer Limits | Date Analysed | Method |
|---------------------------------|---------|----------|---------|-----------------|---------------|---------------|
| Total Ammonia (as N) | Acc. | mg/L | 17 | | 04/08/2017 | BHP AC 095 |
| Chloride (as Cl ⁻) | Acc. | mg/L | 1036 | | 10/08/2017 | BHP AC 095 |
| Salinity - Field | | ppt | 2.9 | | 04/08/2017 | Calculation |
| Conductivity (25 °C) - Field | | µS/cm | 4180 | | 04/08/2017 | BHP AC 067 |
| pH - Field | | pH Units | 7.63 | | 04/08/2017 | BHP AC 067 |
| Temperature - Field | | °C | 13.6 | | 04/08/2017 | BHP AC 067 |
| Nitrite (as NO ₂ -N) | ** | mg/L | <0.016 | | 11/08/2017 | BHP AC 019 |
| Nitrate (as NO ₃ -N) | Acc. ** | mg/L | <0.113 | | 11/08/2017 | BHP AC 019 |
| Total Oxidised Nitrogen (as N) | ** | mg/L | <0.13 | | 11/08/2017 | BHP AC 065 |
| Total Organic Carbon | * | mg/L | 10.9 | | 10/08/2017 | WAS005 |
| Total Phenols | | mg/L | 0.017 | | 09/08/2017 | BHP AC 044 |
| Water Level | | meters | 0.90 | | 04/08/2017 | On-Site Meter |

BHP/AC/F115

TEST REPORT NO: 134718 .1

Client: Response Engineering
 Railway Road
 Charleville
 Co. Cork

BHP Ref. No: 17/02/1850
Quote Ref: QC000790
Order No: To Follow
Sales Order: 22648
Date Received: 28/02/2017
Date Sampled: 28/02/2017
Date Completed: 30/03/2017
Sample Type: Bore



Testing
 Analysing
 Consulting



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 EMail: johnohalloran@bhp.ie

FTAO: Ailish Johnston
Site: Tradaree
BHP Ref: Bi-annually_Bore
Client Ref: RD2

| Test | Units | Results | Customer Limits | Date Analysed | Method |
|--------------------------------------|----------|---------|-----------------|---------------|---------------|
| Total Ammonia (as N) Acc. | mg/L | 14 | | 28/02/2017 | BHP AC 095 |
| Chloride (as Cl ⁻) Acc. | mg/L | 939 | | 02/03/2017 | BHP AC 095 |
| Salinity - Field | ppt | 3.0 | | 28/02/2017 | Calculation |
| Conductivity (25 °C) - Field | µS/cm | 3750 | | 28/02/2017 | BHP AC 067 |
| pH - Field | pH Units | 7.88 | | 28/02/2017 | BHP AC 067 |
| Temperature - Field | °C | 8.6 | | 28/02/2017 | BHP AC 067 |
| Nitrite (as NO ₂ -N) | mg/L | <0.016 | | 03/03/2017 | BHP AC 019 |
| Nitrate (as NO ₃ -N) Acc. | mg/L | <0.113 | | 03/03/2017 | BHP AC 019 |
| Total Oxidised Nitrogen (as N) | mg/L | <0.13 | | 03/03/2017 | BHP AC 065 |
| Total Organic Carbon ** | mg/L | 26 | | 20/03/2017 | BHP AC 016 |
| Total Phenols ** | mg/L | 0.028 | | 30/03/2017 | BHP AC 044 |
| Water Level | meters | 0.59 | | 28/02/2017 | On-Site Meter |

TEST REPORT NO: 140413.1
 Analysing
 Testing
 Consulting
 Calibrating

Client: Response Engineering
 Tradaree TP
 Shannon
 Co. Clare

BHP Ref. No.: 17/08/0597
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater

 BHP
 New Road
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 Limerick
 Ireland
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 Fax + 353 61 455447
FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|----------------------|---|----------------------|----------|---------------|-------------|
| | Annual Landfill Monitoring RD2 | | | | |
| Dissolved Oxygen | | % O ₂ sat | 73.4 | 04/08/2017 | BHP AC 067 |
| Detergents (as MBAS) | | mg/L | <0.3 | 10/08/2017 | BHP AC 071 |
| Arsenic | | mg/L | 0.016 | 17/08/2017 | WAS060* |
| Boron | | mg/L | 0.832 | 18/08/2017 | WAS049* |
| Cadmium | | mg/L | <0.0006 | 18/08/2017 | WAS049* |
| Calcium | | mg/L | 69.2 | 18/08/2017 | WAS049* |
| Chromium | | mg/L | 0.0033 | 18/08/2017 | WAS049* |
| Copper | | mg/L | <0.009 | 18/08/2017 | WAS049* |
| Cyanide | | mg/L | <0.009 | 11/08/2017 | WAS018* |
| Fluoride | | mg/L | 0.45 | 04/08/2017 | BHP AC 019 |
| Iron | | mg/L | 6.6 | 18/08/2017 | WAS049* |
| Lead | | mg/L | 0.0118 | 18/08/2017 | WAS049* |
| Magnesium | | mg/L | 62.1 | 18/08/2017 | WAS049* |
| Mercury | | mg/L | <0.00001 | 11/08/2017 | WAS013* |
| Nickel | | mg/L | 0.009 | 18/08/2017 | WAS049* |
| Potassium | | mg/L | 45.1 | 18/08/2017 | WAS049* |
| Sodium | | mg/L | 703 | 18/08/2017 | WAS049* |

TEST REPORT NO: 140413.1

Analysing
Testing
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Calibrating

Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0597
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater



BHP
New Road
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Ireland
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Fax + 353 61 455447

FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|-----------------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring RD2 | | | | |
| Tin | | mg/L | <0.007 | 18/08/2017 | WAS049* |
| Zinc | | mg/L | 0.0233 | 18/08/2017 | WAS049* |
| Sulphate (as SO ₄) | | mg/L | <10 | 10/08/2017 | BHP AC 095 |
| Total Phosphorus (as P) | | mg/L | 0.29 | 10/08/2017 | BHP AC 095 |
| Residue on Evaporation | | mg/L | 2440 | 08/08/2017 | BHP AC 040 |
| Volatile Organic Compounds | | | | | |
| Dichlorodifluoromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Chloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Chloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromomethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Trichlorofluoromethane | | mg/L | <0.001 | 18/08/2017 | GEO32* |
| 1,1-Dichloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Dichloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1-Dichloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| cis-1,2-Dichloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 2,2-Dichloropropane | | mg/L | <0.001 | 17/08/2017 | GEO32* |

TEST REPORT NO: 140413.1
 Testing
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Client: Response Engineering
 Tradaree TP
 Shannon
 Co. Clare

BHP Ref. No.: 17/08/0597
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater



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 Fax + 353 61 455447

FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|---------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring RD2 | | | | |
| Chloroform | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromochloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1,1-Trichloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1-Dichloropropene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dichloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Benzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dichloropropane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Trichloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromodichloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Dibromomethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| cis-1,3-Dichloropropene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Toluene | | mg/L | 0.0074 | 17/08/2017 | GEO32* |
| trans-1,3-Dichloropropene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1,2-Trichloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Carbon Tetrachloride | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Vinyl Chloride | | mg/L | <0.0005 | 17/08/2017 | GEO32* |
| 1,3-Dichloropropane | | mg/L | <0.001 | 17/08/2017 | GEO32* |

BHP/CL/02C

TEST REPORT NO: 140413.1

Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0597
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater

FTAO: Ailish Johnson

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Fax + 353 61 455447

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|---------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring RD2 | | | | |
| Tetrachloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Dibromochloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dibromoethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Chlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1,1,2-Tetrachloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Ethyl Benzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| m&p-Xylene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| o-Xylene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Styrene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromoform | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| trans-1,2-Dichloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Isopropylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1,2,2-Tetrachloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2,3-Trichloropropane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| n-Propylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 2-Chlorotoluene | | mg/L | <0.001 | 17/08/2017 | GEO32* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :

TEST REPORT NO: 140413.1

Analysing
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Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0597
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater

BHP
New Road
Thomondgate
Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447

FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|-----------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring RD2 | | | | |
| 1,3,5-Trimethylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 4-Chlorotoluene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| tert-Butylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2,4-Trimethylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| sec-Butylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| p-Isopropyltoluene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,3-Dichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,4-Dichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| n-Butylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dibromo-3-chloropropane | | mg/L | <0.002 | 17/08/2017 | GEO32* |
| 1,2,4-Trichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Hexachlorobutadiene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Naphthalene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2,3-Trichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| MTBE | | mg/L | <0.001 | 17/08/2017 | GEO32* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



TEST REPORT NO: 140413.1

Analysing
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Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0597
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater



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Fax + 353 61 455447

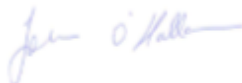
FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|--|-----------------------------------|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring RD2 | | | | |
| Semi-Volatile Organic Compounds | | | | | |
| Phenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Bis(2-chloroethyl)ether | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2-Chlorophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 1,3-Dichlorobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 1,4-Dichlorobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2-Methylphenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 3&4-Methylphenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Dibenzofuran | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 1,2-Dichlorobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Bis(2-chloroisopropyl)ether | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| n-Nitrosodi-n-propylamine | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Hexachloroethane | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Nitrobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Isophorone | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,4-Dimethylphenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |

Additional information :

*Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



John O'Halloran

Issue Date : 28/08/17

TEST REPORT NO: 140413.1

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0597
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater



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New Road
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Tel +353 61 455399
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FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|----------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring RD2 | | | | |
| 2-Nitrophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Bis(2-chloroethoxy)methane | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,4-Dichlorophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 1,2,4-Trichlorobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Naphthalene | | mg/L | <0.002 | 14/08/2017 | GEO40* |
| Hexachlorobutadiene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 4-Chloro-3-methylphenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2-Methylnaphthalene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,4,6-Trichlorophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,4,5-Trichlorophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2-Chloronaphthalene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Dimethylphthalate | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,6-Dinitrotoluene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Acenaphthylene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Acenaphthene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,4-Dinitrotoluene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Diethylphthalate | | mg/L | <0.001 | 14/08/2017 | GEO40* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



John O'Halloran
Issue Date : 28/08/17

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TEST REPORT NO: 140413.1

Analysing
Testing
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Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0597
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater



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FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|-----------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring RD2 | | | | |
| 4-Nitrophenol | | mg/L | <0.005 | 14/08/2017 | GEO40* |
| 4-Chlorophenyl phenyl ether | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Fluorene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Diphenylamine | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 4-Bromophenyl Phenyl Ether | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Hexachlorobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Pentachlorophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Phenanthrene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Anthracene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| di-n-Butylphthalate | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Fluoranthene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Pyrene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Benzyl Butyl Phthalate | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Benzo(a)anthracene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Chrysene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Bis(2-ethylhexyl)phthalate | | mg/L | <0.005 | 14/08/2017 | GEO40* |
| Di-n-octylphthalate | | mg/L | <0.001 | 14/08/2017 | GEO40* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



John O'Halloran
Issue Date : 28/08/17

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TEST REPORT NO: 140413.1

Client: Response Engineering
 Tradaree TP
 Shannon
 Co. Clare

BHP Ref. No.: 17/08/0597
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater

Analysing
 Testing
 Consulting
 Calibrating



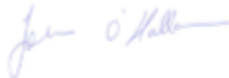
BHP
 New Road
 Thomondgate
 Limerick
 Ireland
 Tel +353 61 455399
 Fax + 353 61 455447

FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|-------------------------|-----------------------------------|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring RD2 | | | | |
| Benzo(b)fluoranthene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Benzo(k)fluoranthene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Benzo(a)pyrene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Indeno(1,2,3-c,d)pyrene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Dibenz(a,h)anthracene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Benzo(g,h,i)perylene | | mg/L | <0.001 | 14/08/2017 | GEO40* |

Additional information : *Subcontracted to an approved accredited supplier

For and on behalf of BHP laboratories :



John O'Halloran
Issue Date : 28/08/17

This Test Report shall not be duplicated except in full and then only with the permission of the test laboratory

BHP/AC/F115

TEST REPORT NO: 134718 .2**Client: Response Engineering**

Railway Road
Charleville
Co. Cork

BHP Ref. No: 17/02/1851
Quote Ref: QC000790
Order No: To Follow
Sales Order: 22648
Date Received: 28/02/2017
Date Sampled: 28/02/2017
Date Completed: 31/03/2017
Sample Type: Bore



Testing
Analysing
Consulting



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Email: johnhalloran@bhp.ie

FTAO: Ailish Johnston
Site: Tradaree
BHP Ref: Bi-annually_Bore
Client Ref: RD3

| Test | | Units | Results | Customer Limits | Date Analysed | Method |
|---------------------------------|------|----------|---------|-----------------|---------------|---------------|
| Total Ammonia (as N) | Acc. | mg/L | 1.0 | | 28/02/2017 | BHP AC 095 |
| Chloride (as Cl ⁻) | Acc. | mg/L | 383 | | 02/03/2017 | BHP AC 095 |
| Salinity - Field | | ppt | <2 | | 28/02/2017 | Calculation |
| Conductivity (25 °C) - Field | | µS/cm | 2380 | | 28/02/2017 | BHP AC 067 |
| pH - Field | | pH Units | 7.53 | | 28/02/2017 | BHP AC 067 |
| Temperature - Field | | °C | 10.5 | | 28/02/2017 | BHP AC 067 |
| Nitrite (as NO ₂ -N) | | mg/L | <0.016 | | 03/03/2017 | BHP AC 019 |
| Nitrate (as NO ₃ -N) | Acc. | mg/L | <0.113 | | 03/03/2017 | BHP AC 019 |
| Total Oxidised Nitrogen (as N) | | mg/L | <0.13 | | 03/03/2017 | BHP AC 065 |
| Total Organic Carbon | ** | mg/L | 15 | | 20/03/2017 | BHP AC 016 |
| Total Phenols | ** | mg/L | 0.008 | | 31/03/2017 | BHP AC 044 |
| Water Level | | meters | 0.16 | | 28/02/2017 | On-Site Meter |

BHP/AC/F115

TEST REPORT NO: 140413 .2**Client: Response Engineering**

Railway Road
Charleville
Co. Cork

BHP Ref. No: 17/08/0603
Quote Ref: QC001156
Order No: To Follow
Sales Order: 29521
Date Received: 04/08/2017
Date Sampled: 04/08/2017
Date Completed: 16/08/2017
Sample Type: Bore



Testing
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Email: johnhalloran@bhp.ie

FTAO: Ailish Johnston
Site: Tradaree
BHP Ref: Bi-annually_Bore
Client Ref: RD3

| Test | Units | Results | Customer Limits | Date Analysed | Method |
|---|----------|---------|-----------------|---------------|---------------|
| Total Ammonia (as N) Acc. | mg/L | 2.2 | | 16/08/2017 | BHP AC 095 |
| Chloride (as Cl ⁻) Acc. | mg/L | 437 | | 10/08/2017 | BHP AC 095 |
| Salinity - Field | ppt | 3.0 | | 04/08/2017 | Calculation |
| Conductivity (25 °C) - Field | µS/cm | 4490 | | 04/08/2017 | BHP AC 067 |
| pH - Field | pH Units | 7.48 | | 04/08/2017 | BHP AC 067 |
| Temperature - Field | °C | 14.7 | | 04/08/2017 | BHP AC 067 |
| Nitrite (as NO ₂ -N) ** | mg/L | <0.016 | | 11/08/2017 | BHP AC 019 |
| Nitrate (as NO ₃ -N) Acc. ** | mg/L | <0.113 | | 11/08/2017 | BHP AC 019 |
| Total Oxidised Nitrogen (as N) ** | mg/L | <0.13 | | 11/08/2017 | BHP AC 065 |
| Total Organic Carbon * | mg/L | 2.7 | | 10/08/2017 | WAS005 |
| Total Phenols | mg/L | <0.002 | | 09/08/2017 | BHP AC 044 |
| Water Level | meters | 1.07 | | 04/08/2017 | On-Site Meter |

TEST REPORT NO: 140413.2
 Testing
 Consulting
 Calibrating

Client: Response Engineering
 Tradaree TP
 Shannon
 Co. Clare

BHP Ref. No.: 17/08/0598
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater

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 New Road
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 Tel +353 61 455399
 Fax + 353 61 455447
FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|----------------------|---|----------------------|----------|---------------|-------------|
| | Annual Landfill Monitoring RD3 | | | | |
| Dissolved Oxygen | | % O ₂ sat | 72.3 | 04/08/2017 | BHP AC 067 |
| Detergents (as MBAS) | | mg/L | <0.3 | 10/08/2017 | BHP AC 071 |
| Arsenic | | mg/L | 0.0019 | 17/08/2017 | WAS060* |
| Boron | | mg/L | 0.3 | 18/08/2017 | WAS049* |
| Cadmium | | mg/L | <0.0006 | 18/08/2017 | WAS049* |
| Calcium | | mg/L | 37.5 | 18/08/2017 | WAS049* |
| Chromium | | mg/L | 0.0026 | 18/08/2017 | WAS049* |
| Copper | | mg/L | <0.009 | 18/08/2017 | WAS049* |
| Cyanide | | mg/L | <0.009 | 11/08/2017 | WAS018* |
| Fluoride | | mg/L | 0.43 | 04/08/2017 | BHP AC 019 |
| Iron | | mg/L | 0.494 | 18/08/2017 | WAS049* |
| Lead | | mg/L | <0.006 | 18/08/2017 | WAS049* |
| Magnesium | | mg/L | 18.3 | 18/08/2017 | WAS049* |
| Mercury | | mg/L | <0.00001 | 11/08/2017 | WAS013* |
| Nickel | | mg/L | 0.0109 | 18/08/2017 | WAS049* |
| Potassium | | mg/L | 6.84 | 18/08/2017 | WAS049* |
| Sodium | | mg/L | 564 | 18/08/2017 | WAS049* |

TEST REPORT NO: 140413.2

Analysing
Testing
Consulting
Calibrating

Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0598
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater



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FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|-----------------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring RD3 | | | | |
| Tin | | mg/L | <0.007 | 18/08/2017 | WAS049* |
| Zinc | | mg/L | <0.018 | 18/08/2017 | WAS049* |
| Sulphate (as SO ₄) | | mg/L | 61 | 10/08/2017 | BHP AC 095 |
| Total Phosphorus (as P) | | mg/L | <0.075 | 10/08/2017 | BHP AC 095 |
| Residue on Evaporation | | mg/L | 1788 | 08/08/2017 | BHP AC 040 |
| Volatile Organic Compounds | | | | | |
| Dichlorodifluoromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Chloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Chloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromomethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Trichlorofluoromethane | | mg/L | <0.001 | 18/08/2017 | GEO32* |
| 1,1-Dichloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Dichloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1-Dichloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| cis-1,2-Dichloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 2,2-Dichloropropane | | mg/L | <0.001 | 17/08/2017 | GEO32* |

TEST REPORT NO: 140413.2
 Consulting
Calibrating

Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0598
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater

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Limerick
Ireland
Tel +353 61 455399
Fax + 353 61 455447
FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|---------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring RD3 | | | | |
| Chloroform | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromochloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1,1-Trichloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1-Dichloropropene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dichloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Benzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dichloropropane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Trichloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromodichloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Dibromomethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| cis-1,3-Dichloropropene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Toluene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| trans-1,3-Dichloropropene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1,2-Trichloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Carbon Tetrachloride | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Vinyl Chloride | | mg/L | <0.0005 | 17/08/2017 | GEO32* |
| 1,3-Dichloropropane | | mg/L | <0.001 | 17/08/2017 | GEO32* |

TEST REPORT NO: 140413.2
 Testing
 Consulting
 Calibrating

Client: Response Engineering
 Tradaree TP
 Shannon
 Co. Clare

BHP Ref. No.: 17/08/0598
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater

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FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|---------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring RD3 | | | | |
| Tetrachloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Dibromochloromethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dibromoethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Chlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1,1,2-Tetrachloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Ethyl Benzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| m&p-Xylene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| o-Xylene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Styrene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromoform | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| trans-1,2-Dichloroethene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Isopropylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,1,2,2-Tetrachloroethane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2,3-Trichloropropane | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| n-Propylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Bromobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 2-Chlorotoluene | | mg/L | <0.001 | 17/08/2017 | GEO32* |

TEST REPORT NO: 140413.2
 Testing
 Consulting
 Calibrating

Client: Response Engineering
 Tradaree TP
 Shannon
 Co. Clare

BHP Ref. No.: 17/08/0598
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater



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 Limerick
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 Tel +353 61 455399
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FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|-----------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring RD3 | | | | |
| 1,3,5-Trimethylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 4-Chlorotoluene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| tert-Butylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2,4-Trimethylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| sec-Butylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| p-Isopropyltoluene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,3-Dichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,4-Dichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| n-Butylbenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2-Dibromo-3-chloropropane | | mg/L | <0.002 | 17/08/2017 | GEO32* |
| 1,2,4-Trichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Hexachlorobutadiene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| Naphthalene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| 1,2,3-Trichlorobenzene | | mg/L | <0.001 | 17/08/2017 | GEO32* |
| MTBE | | mg/L | <0.001 | 17/08/2017 | GEO32* |

Additional information:

*Subcontracted to an approved accredited supplier

TEST REPORT NO: 140413.2

 Testing
 Consulting
 Calibrating

Client: Response Engineering
 Tradaree TP
 Shannon
 Co. Clare

BHP Ref. No.: 17/08/0598
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater

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FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|--|-----------------------------------|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring RD3 | | | | |
| Semi-Volatile Organic Compounds | | | | | |
| Phenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Bis(2-chloroethyl)ether | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2-Chlorophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 1,3-Dichlorobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 1,4-Dichlorobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2-Methylphenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 3&4-Methylphenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Dibenzofuran | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 1,2-Dichlorobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Bis(2-chloroisopropyl)ether | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| n-Nitrosodi-n-propylamine | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Hexachloroethane | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Nitrobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Isophorone | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,4-Dimethylphenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |

Consulting
Calibrating


Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0598
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater

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Tel +353 61 455399
Fax + 353 61 455447

FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|----------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring RD3 | | | | |
| 2-Nitrophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Bis(2-chloroethoxy)methane | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,4-Dichlorophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 1,2,4-Trichlorobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Naphthalene | | mg/L | <0.002 | 14/08/2017 | GEO40* |
| Hexachlorobutadiene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 4-Chloro-3-methylphenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2-Methylnaphthalene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,4,6-Trichlorophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,4,5-Trichlorophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2-Chloronaphthalene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Dimethylphthalate | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,6-Dinitrotoluene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Acenaphthylene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Acenaphthene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 2,4-Dinitrotoluene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Diethylphthalate | | mg/L | <0.001 | 14/08/2017 | GEO40* |

TEST REPORT NO: 140413.2Consulting
Calibrating

Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0598
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater



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FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|-----------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring RD3 | | | | |
| 4-Nitrophenol | | mg/L | <0.005 | 14/08/2017 | GEO40* |
| 4-Chlorophenyl phenyl ether | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Fluorene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Diphenylamine | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| 4-Bromophenyl Phenyl Ether | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Hexachlorobenzene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Pentachlorophenol | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Phenanthrene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Anthracene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| di-n-Butylphthalate | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Fluoranthene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Pyrene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Benzyl Butyl Phthalate | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Benzo(a)anthracene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Chrysene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Bis(2-ethylhexyl)phthalate | | mg/L | <0.005 | 14/08/2017 | GEO40* |
| Di-n-octylphthalate | | mg/L | <0.001 | 14/08/2017 | GEO40* |

TEST REPORT NO: 140413.2

Testing
Consulting
Calibrating



Client: Response Engineering
Tradaree TP
Shannon
Co. Clare

BHP Ref. No.: 17/08/0598
Order No.:
Date Received: 04/08/17
Date Completed: 18/08/17
Test Specification: Nil
Item: Groundwater

BHP
New Road
Thomondgate
Limerick
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Tel +353 61 455399
Fax + 353 61 455447

FTAO: Ailish Johnson

| TEST | Client Reference | Units | Results | Date Analysed | Test Method |
|-------------------------|---|-------|---------|---------------|-------------|
| | Annual Landfill Monitoring RD3 | | | | |
| Benzo(b)fluoranthene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Benzo(k)fluoranthene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Benzo(a)pyrene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Indeno(1,2,3-c,d)pyrene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Dibenz(a,h)anthracene | | mg/L | <0.001 | 14/08/2017 | GEO40* |
| Benzo(g,h,i)perylene | | mg/L | <0.001 | 14/08/2017 | GEO40* |

Leachate Monitoring Test Reports

BHP/AC/F115

TEST REPORT NO: 140413
Client: Response Engineering

 Railway Road
 Charleville
 Co. Cork

BHP Ref. No: 17/08/0596
Quote Ref: QC001156
Order No: To Follow
Sales Order: 29519
Date Received: 04/08/2017
Date Sampled: 04/08/2017
Date Completed: 15/08/2017
Sample Type: Leachate

 Testing
 Analysing
 Consulting



BHP Laboratories

New Road

Thomondgate

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Tel: +353 61 455399

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EMail: johnohalloran@bhp.ie

FTAO: Ailish Johnston
Site: Tradaree
BHP Ref: Bi-annually_Leachate
Client Ref: SS3

| Test | Units | Results | Customer Limits | Date Analysed | Method |
|--------------------------------|----------|---------|-----------------|---------------|------------|
| Total Ammonia (as N) | mg/L | 3.2 | | 04/08/2017 | BHP AC 095 |
| B.O.D. | mg/L | 3.0 | | 10/08/2017 | BHP AC 005 |
| C.O.D. | mg/L | 53 | | 09/08/2017 | BHP AC 006 |
| pH - Field | pH Units | 7.08 | | 04/08/2017 | BHP AC 067 |
| Temperature - Field | °C | 17.3 | | 04/08/2017 | BHP AC 067 |
| Chloride (as Cl ⁻) | mg/L | 63 | | 10/08/2017 | BHP AC 095 |
| Conductivity (25 °C) - Field | µS/cm | 968 | | 04/08/2017 | BHP AC 067 |
| Total Oxidised Nitrogen (as N) | mg/L | <0.14 | | 04/08/2017 | BHP AC 065 |

BHP/AC/F115

TEST REPORT NO: 134718**Client: Response Engineering**

Railway Road
Charleville
Co. Cork

BHP Ref. No: 17/02/1855
Quote Ref: QC000790
Order No: To Follow
Sales Order: 22649
Date Received: 28/02/2017
Date Sampled: 28/02/2017
Date Completed: 10/03/2017
Sample Type: Leachate

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EMail: johnhalloran@bhp.ie

FTAO: Ailish Johnston
Site: Tradaree
BHP Ref: Bi-annually_Leachate
Client Ref: SS3

| Test | Units | Results | Customer Limits | Date Analysed | Method |
|--------------------------------|----------|---------|-----------------|---------------|------------|
| Total Ammonia (as N) | mg/L | 14 | | 28/02/2017 | BHP AC 095 |
| B.O.D. | mg/L | 11 | | 01/03/2017 | BHP AC 005 |
| C.O.D. | mg/L | 158 | | 01/03/2017 | BHP AC 006 |
| pH - Field | pH Units | 6.94 | | 28/02/2017 | BHP AC 067 |
| Temperature - Field | °C | 10.1 | | 28/02/2017 | BHP AC 067 |
| Chloride (as Cl ⁻) | mg/L | 60 | | 02/03/2017 | BHP AC 095 |
| Conductivity (25 °C) - Field | µS/cm | 1585 | | 28/02/2017 | BHP AC 067 |
| Total Oxidised Nitrogen (as N) | ** mg/L | 40 | | 10/03/2017 | BHP AC 065 |

BHP/AC/F115

TEST REPORT NO: 140413

Client: Response Engineering
 Railway Road
 Charleville
 Co. Cork

BHP Ref. No: 17/08/0594
Quote Ref: QC001156
Order No: To Follow
Sales Order: 29517
Date Received: 04/08/2017
Date Sampled: 04/08/2017
Date Completed: 18/08/2017
Sample Type: Leachate


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FTAO: Ailish Johnston
Site: Traderee
BHP Ref: Annually_Leachate
Client Ref: SS3

| Test | Units | Results | Customer Limits | Date Analysed | Method |
|--|-------|----------|-----------------|---------------|------------|
| Detergents (as MBAS) | mg/L | <0.3 | | 10/08/2017 | BHP AC 071 |
| Arsenic (Total as As) | mg/L | 0.0019 | | 17/08/2017 | WAS060 |
| Boron (Total as B) | mg/L | <0.23 | | 18/08/2017 | WAS049 |
| Cadmium (Total as Cd) | mg/L | <0.0006 | | 18/08/2017 | WAS049 |
| Calcium (Total as Ca) | mg/L | 143 | | 18/08/2017 | WAS049 |
| Chromium (Total as Cr) | mg/L | <0.002 | | 18/08/2017 | WAS049 |
| Copper (Total as Cu) | mg/L | <0.009 | | 18/08/2017 | WAS049 |
| Iron (Total as Fe) | mg/L | 3.8 | | 18/08/2017 | WAS049 |
| Lead (Total as Pb) | mg/L | <0.006 | | 18/08/2017 | WAS049 |
| Magnesium (Total as Mg) | mg/L | 19.1 | | 18/08/2017 | WAS049 |
| Mercury (Total as Hg) | mg/L | <0.00001 | | 11/08/2017 | WAS013 |
| Nickel (Total as Ni) | mg/L | 0.0532 | | 18/08/2017 | WAS049 |
| Potassium (Total as K) | mg/L | 4.52 | | 18/08/2017 | WAS049 |
| Sodium (Total as Na) | mg/L | 31.9 | | 18/08/2017 | WAS049 |
| Tin (Total as Sn) | mg/L | <0.007 | | 18/08/2017 | WAS049 |
| Zinc (Total as Zn) | mg/L | <0.018 | | 18/08/2017 | WAS049 |
| Cyanide (Total as CN) | mg/L | <0.009 | | 11/08/2017 | WAS018 |
| Sulphate (as SO ₄ ²⁻) | mg/L | 109 | | 10/08/2017 | BHP AC 095 |

Authorised by:  **John O'Halloran** **Date Authorised:** 24/08/2017
Technical Manager

Additional information (Opinions where stated are not covered by accreditation)
 Acc.: INAB Accredited
 ND: None detected in volume analysed
 ^ Potable water matrix
 * subcontracted to an approved accredited laboratory
 ** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.
 ~: Sample Condition : ACCEPTABLE

BHP/AC/F115

TEST REPORT NO: 140413

Client: Response Engineering
 Railway Road
 Charleville
 Co. Cork

BHP Ref. No: 17/08/0594
Quote Ref: QC001156
Order No: To Follow
Sales Order: 29517
Date Received: 04/08/2017
Date Sampled: 04/08/2017
Date Completed: 18/08/2017
Sample Type: Leachate

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FTAO: Ailish Johnston
Site: Tradaree
BHP Ref: Annually_Leachate
Client Ref: SS3

| Test | Units | Results | Customer Limits | Date Analysed | Method |
|-------------------------------|-------|---------|-----------------|---------------|------------|
| Total Phosphorus (as P) | mg/L | 0.20 | | 10/08/2017 | BHP AC 095 |
| OrthoPhosphate (as P) | mg/L | <0.066 | | 04/08/2017 | BHP AC 019 |
| Fluoride (as F ⁻) | mg/L | 0.24 | | 04/08/2017 | BHP AC 019 |

Surface Water Monitoring Test Reports

BHP/AC/F115

TEST REPORT NO: 134718 .1

Client: Response Engineering
 Railway Road
 Charleville
 Co. Cork

BHP Ref. No: 17/02/1856
Quote Ref: QC000790
Order No: To Follow
Sales Order: 22650
Date Received: 28/02/2017
Date Sampled: 28/02/2017
Date Completed: 06/03/2017
Sample Type: Surface Water



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FTAO: Ailish Johnston
Site: Tradaree
BHP Ref: Bi-annually_Surface Water
Client Ref: SS1

| Test | | Units | Results | Customer Limits | Date Analysed | Method |
|------------------------------|------|----------|---------|-----------------|---------------|------------|
| Total Ammonia (as N) | Acc. | mg/L | <0.1 | | 28/02/2017 | BHP AC 095 |
| B.O.D. | | mg/L | 2.3 | | 01/03/2017 | BHP AC 005 |
| C.O.D. | Acc. | mg/L | <15 | | 01/03/2017 | BHP AC 006 |
| Dissolved Oxygen - Field (%) | | % | 74.4 | | 28/02/2017 | BHP AC 067 |
| pH - Field | | pH Units | 7.62 | | 28/02/2017 | BHP AC 067 |
| Total Suspended Solids | Acc. | mg/L | <10 | | 06/03/2017 | BHP AC 012 |
| Temperature - Field | | °C | 7.8 | | 28/02/2017 | BHP AC 067 |

BHP/AC/F115

TEST REPORT NO: 140413 .1

Client: Response Engineering
 Railway Road
 Charleville
 Co. Cork

BHP Ref. No: 17/08/0617
Quote Ref: QC001156
Order No: To Follow
Sales Order: 29527
Date Received: 04/08/2017
Date Sampled: 04/08/2017
Date Completed: 15/08/2017
Sample Type: Surface Water



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FTAO: Ailish Johnston
Site: Traderee
BHP Ref: Bi-annually_Surface Water
Client Ref: SS1

| Test | Units | Results | Customer Limits | Date Analysed | Method |
|------------------------------|----------|---------|-----------------|---------------|------------|
| Total Ammonia (as N) Acc. | mg/L | <0.1 | | 14/08/2017 | BHP AC 095 |
| B.O.D. | mg/L | 2.0 | | 10/08/2017 | BHP AC 005 |
| C.O.D. Acc. | mg/L | <15 | | 10/08/2017 | BHP AC 006 |
| Dissolved Oxygen - Field (%) | % | 58 | | 04/08/2017 | BHP AC 067 |
| pH - Field | pH Units | 7.67 | | 04/08/2017 | BHP AC 067 |
| Total Suspended Solids Acc. | mg/L | 11 | | 10/08/2017 | BHP AC 012 |
| Temperature - Field | °C | 16.0 | | 04/08/2017 | BHP AC 067 |

BHP/AC/F115

TEST REPORT NO: 140413 .1

Client: Response Engineering

Railway Road
Charleville
Co. Cork

BHP Ref. No: 17/08/0607
Quote Ref: QC001156
Order No: To Follow
Sales Order: 29522
Date Received: 04/08/2017
Date Sampled: 04/08/2017
Date Completed: 18/08/2017
Sample Type: Surface Water




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FTAO: Ailish Johnston
Site: Tradaree
BHP Ref: Annually_Surface Water
Client Ref: SS1

| Test | Units | Results | Customer Limits | Date Analysed | Method |
|--|-------|----------|-----------------|---------------|------------|
| Conductivity (25 °C) - Field | µS/cm | 908 | | 04/08/2017 | BHP AC 067 |
| Arsenic (Total as As) | mg/L | <0.001 | | 17/08/2017 | WAS060 |
| Boron (Total as B) | mg/L | <0.23 | | 18/08/2017 | WAS049 |
| Cadmium (Total as Cd) | mg/L | <0.0006 | | 18/08/2017 | WAS049 |
| Chromium (Total as Cr) | mg/L | <0.002 | | 18/08/2017 | WAS049 |
| Copper (Total as Cu) | mg/L | <0.009 | | 18/08/2017 | WAS049 |
| Iron (Total as Fe) | mg/L | 0.931 | | 18/08/2017 | WAS049 |
| Lead (Total as Pb) | mg/L | <0.006 | | 18/08/2017 | WAS049 |
| Magnesium (Total as Mg) | mg/L | 11.6 | | 18/08/2017 | WAS049 |
| Mercury (Total as Hg) | mg/L | <0.00001 | | 11/08/2017 | WAS013 |
| Nickel (Total as Ni) | mg/L | 0.0052 | | 18/08/2017 | WAS049 |
| Potassium (Total as K) | mg/L | 7.68 | | 18/08/2017 | WAS049 |
| Sodium (Total as Na) | mg/L | 30.6 | | 18/08/2017 | WAS049 |
| Tin (Total as Sn) | mg/L | <0.007 | | 18/08/2017 | WAS049 |
| Zinc (Total as Zn) | mg/L | <0.018 | | 18/08/2017 | WAS049 |
| Cyanide (Total as CN) | mg/L | <0.009 | | 11/08/2017 | WAS018 |
| Sulphate (as SO ₄ ²⁻) | mg/L | 74 | | 10/08/2017 | BHP AC 095 |
| Fluoride (as F ⁻) | mg/L | 0.13 | | 11/08/2017 | BHP AC 019 |
| Total Phosphorus (as P) | mg/L | 0.23 | | 10/08/2017 | BHP AC 095 |

Authorised by:  **John O'Halloran** **Date Authorised:** 25/08/2017
Technical Manager

Additional Information: (Opinions, where stated, are not covered by accreditation)
 Acc.: INAB Accredited
 ND: None detected in volume analysed
 ^ Potable water matrix
 * Subcontracted to an approved accredited laboratory
 ** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

BHP/AC/F115

TEST REPORT NO: 140413 .1

Client: Response Engineering
 Railway Road
 Charleville
 Co. Cork

BHP Ref. No: 17/08/0607
Quote Ref: QC001156
Order No: To Follow
Sales Order: 29522
Date Received: 04/08/2017
Date Sampled: 04/08/2017
Date Completed: 18/08/2017
Sample Type: Surface Water



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FTAO: Ailish Johnston
Site: Tradaree
BHP Ref: Annually_Surface Water
Client Ref: SS1

| Test | Units | Results | Customer Limits | Date Analysed | Method |
|--|-------|---------|-----------------|---------------|------------|
| OrthoPhosphate (as P) Acc. | mg/L | <0.066 | | 11/08/2017 | BHP AC 019 |
| Total Oxidised Nitrogen (as N) ** | mg/L | 3.0 | | 11/08/2017 | BHP AC 065 |
| Calcium (Total as Ca) * | mg/L | 150 | | 18/08/2017 | WAS049 |

BHP/AC/F115

TEST REPORT NO: 134718 .2

Client: Response Engineering
 Railway Road
 Charleville
 Co. Cork

BHP Ref. No: 17/02/1857
Quote Ref: QC000790
Order No: To Follow
Sales Order: 22650
Date Received: 28/02/2017
Date Sampled: 28/02/2017
Date Completed: 06/03/2017
Sample Type: Surface Water



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FTAO: Ailish Johnston
Site: Tradaree
BHP Ref: Bi-annually_Surface Water
Client Ref: SS2

| Test | | Units | Results | Customer Limits | Date Analysed | Method |
|------------------------------|------|----------|---------|-----------------|---------------|------------|
| Total Ammonia (as N) | Acc. | mg/L | <0.1 | | 28/02/2017 | BHP AC 095 |
| B.O.D. | | mg/L | 2.5 | | 01/03/2017 | BHP AC 005 |
| C.O.D. | Acc. | mg/L | <15 | | 01/03/2017 | BHP AC 006 |
| Dissolved Oxygen - Field (%) | | % | 67.1 | | 28/02/2017 | BHP AC 067 |
| pH - Field | | pH Units | 7.36 | | 28/02/2017 | BHP AC 067 |
| Total Suspended Solids | Acc. | mg/L | <5 | | 06/03/2017 | BHP AC 012 |
| Temperature - Field | | °C | 6.8 | | 28/02/2017 | BHP AC 067 |

BHP/AC/F115

TEST REPORT NO: 140413 .2

Client: Response Engineering
 Railway Road
 Charleville
 Co. Cork

BHP Ref. No: 17/08/0618
Quote Ref: QC001156
Order No: To Follow
Sales Order: 29527
Date Received: 04/08/2017
Date Sampled: 04/08/2017
Date Completed: 15/08/2017
Sample Type: Surface Water



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FTAO: Ailish Johnston
Site: Tradaree
BHP Ref: Bi-annually_Surface Water
Client Ref: SS2

| Test | | Units | Results | Customer Limits | Date Analysed | Method |
|------------------------------|------|----------|---------|-----------------|---------------|------------|
| Total Ammonia (as N) | Acc. | mg/L | <0.1 | | 14/08/2017 | BHP AC 095 |
| B.O.D. | | mg/L | 3.1 | | 10/08/2017 | BHP AC 005 |
| C.O.D. | Acc. | mg/L | 24 | | 10/08/2017 | BHP AC 006 |
| Dissolved Oxygen - Field (%) | | % | 157 | | 04/08/2017 | BHP AC 067 |
| pH - Field | | pH Units | 8.20 | | 04/08/2017 | BHP AC 067 |
| Total Suspended Solids | Acc. | mg/L | 15 | | 10/08/2017 | BHP AC 012 |
| Temperature - Field | | °C | 18.6 | | 04/08/2017 | BHP AC 067 |

BHP/AC/F115

TEST REPORT NO: 140413 .2

Client: Response Engineering
 Railway Road
 Charleville
 Co. Cork

BHP Ref. No: 17/08/0608
Quote Ref: QC001156
Order No: To Follow
Sales Order: 29522
Date Received: 04/08/2017
Date Sampled: 04/08/2017
Date Completed: 18/08/2017
Sample Type: Surface Water



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FTAO: Ailish Johnston
Site: Tradaree
BHP Ref: Annually_Surface Water
Client Ref: SS2

| Test | Units | Results | Customer Limits | Date Analysed | Method |
|--|-----------|----------|-----------------|---------------|------------|
| Conductivity (25 °C) - Field | µS/cm | 1239 | | 04/08/2017 | BHP AC 067 |
| Arsenic (Total as As) | mg/L | <0.001 | | 17/08/2017 | WAS060 |
| Boron (Total as B) | mg/L | <0.23 | | 18/08/2017 | WAS049 |
| Cadmium (Total as Cd) | mg/L | <0.0006 | | 18/08/2017 | WAS049 |
| Chromium (Total as Cr) | mg/L | <0.002 | | 18/08/2017 | WAS049 |
| Copper (Total as Cu) | mg/L | <0.009 | | 18/08/2017 | WAS049 |
| Iron (Total as Fe) | mg/L | 0.235 | | 18/08/2017 | WAS049 |
| Lead (Total as Pb) | mg/L | <0.006 | | 18/08/2017 | WAS049 |
| Magnesium (Total as Mg) | mg/L | 20.5 | | 18/08/2017 | WAS049 |
| Mercury (Total as Hg) | mg/L | <0.00001 | | 11/08/2017 | WAS013 |
| Nickel (Total as Ni) | mg/L | 0.0931 | | 18/08/2017 | WAS049 |
| Potassium (Total as K) | mg/L | 7.76 | | 18/08/2017 | WAS049 |
| Sodium (Total as Na) | mg/L | 62.2 | | 18/08/2017 | WAS049 |
| Tin (Total as Sn) | mg/L | <0.007 | | 18/08/2017 | WAS049 |
| Zinc (Total as Zn) | mg/L | <0.018 | | 18/08/2017 | WAS049 |
| Cyanide (Total as CN) | mg/L | <0.009 | | 11/08/2017 | WAS018 |
| Sulphate (as SO ₄ ²⁻) | Acc. mg/L | 184 | | 10/08/2017 | BHP AC 095 |
| Fluoride (as F ⁻) | Acc. mg/L | 0.19 | | 11/08/2017 | BHP AC 019 |
| Total Phosphorus (as P) | mg/L | <0.075 | | 10/08/2017 | BHP AC 095 |

Authorised by:  **John O'Halloran** **Date Authorised:** 25/08/2017
Technical Manager

Additional Information: (Opinions, where stated, are not covered by accreditation)
 Acc.: INAB Accredited
 ND: None detected in volume analysed
 ^ Potable water matrix
 * Subcontracted to an approved accredited laboratory
 ** This sample has been analysed outside recommended stability times. It is therefore possible that the results provided may be compromised.

BHP/AC/F115

TEST REPORT NO: 140413 .2

Client: Response Engineering
 Railway Road
 Charleville
 Co. Cork

BHP Ref. No: 17/08/0608
Quote Ref: QC001156
Order No: To Follow
Sales Order: 29522
Date Received: 04/08/2017
Date Sampled: 04/08/2017
Date Completed: 18/08/2017
Sample Type: Surface Water



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FTAO: Ailish Johnston
Site: Traderee
BHP Ref: Annually_Surface Water
Client Ref: SS2

| Test | Units | Results | Customer Limits | Date Analysed | Method |
|-----------------------------------|-------|---------|-----------------|---------------|------------|
| OrthoPhosphate (as P) Acc. | mg/L | <0.066 | | 11/08/2017 | BHP AC 019 |
| Total Oxidised Nitrogen (as N) ** | mg/L | 1.5 | | 11/08/2017 | BHP AC 065 |
| Calcium (Total as Ca) * | mg/L | 169 | | 18/08/2017 | WAS049 |

BHP/AC/F115

TEST REPORT NO: 134718 .3

Client: Response Engineering
 Railway Road
 Charleville
 Co. Cork

BHP Ref. No: 17/02/1858
Quote Ref: QC000790
Order No: To Follow
Sales Order: 22650
Date Received: 28/02/2017
Date Sampled: 28/02/2017
Date Completed: 06/03/2017
Sample Type: Surface Water



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FTAO: Ailish Johnston
Site: Tradaree
BHP Ref: Bi-annually_Surface Water
Client Ref: SS4

| Test | Units | Results | Customer Limits | Date Analysed | Method |
|------------------------------|----------|---------|-----------------|---------------|------------|
| Total Ammonia (as N) Acc. | mg/L | <0.1 | | 28/02/2017 | BHP AC 095 |
| B.O.D. | mg/L | 2.7 | | 01/03/2017 | BHP AC 005 |
| C.O.D. Acc. | mg/L | 18 | | 01/03/2017 | BHP AC 006 |
| Dissolved Oxygen - Field (%) | % | 68.3 | | 28/02/2017 | BHP AC 067 |
| pH - Field | pH Units | 7.40 | | 28/02/2017 | BHP AC 067 |
| Total Suspended Solids Acc. | mg/L | 5.5 | | 06/03/2017 | BHP AC 012 |
| Temperature - Field | °C | 6.6 | | 28/02/2017 | BHP AC 067 |

BHP/AC/F115

TEST REPORT NO: 140413 .3

Client: Response Engineering
 Railway Road
 Charleville
 Co. Cork

BHP Ref. No: 17/08/0619
Quote Ref: QC001156
Order No: To Follow
Sales Order: 29527
Date Received: 04/08/2017
Date Sampled: 04/08/2017
Date Completed: 15/08/2017
Sample Type: Surface Water



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FTAO: Ailish Johnston
Site: Tradaree
BHP Ref: Bi-annually_Surface Water
Client Ref: SS4

| Test | Units | Results | Customer Limits | Date Analysed | Method |
|------------------------------|----------|---------|-----------------|---------------|------------|
| Total Ammonia (as N) Acc. | mg/L | 0.103 | | 14/08/2017 | BHP AC 095 |
| B.O.D. | mg/L | 2.0 | | 10/08/2017 | BHP AC 005 |
| C.O.D. Acc. | mg/L | <15 | | 10/08/2017 | BHP AC 006 |
| Dissolved Oxygen - Field (%) | % | 73 | | 04/08/2017 | BHP AC 067 |
| pH - Field | pH Units | 7.65 | | 04/08/2017 | BHP AC 067 |
| Total Suspended Solids Acc. | mg/L | <10 | | 10/08/2017 | BHP AC 012 |
| Temperature - Field | °C | 16.0 | | 04/08/2017 | BHP AC 067 |

BHP/AC/F115

TEST REPORT NO: 140413 .3

Client: Response Engineering
Railway Road
Charleville
Co. Cork

BHP Ref. No: 17/08/0609
Quote Ref: QC001156
Order No: To Follow
Sales Order: 29522
Date Received: 04/08/2017
Date Sampled: 04/08/2017
Date Completed: 18/08/2017
Sample Type: Surface Water




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FTAO: Ailish Johnston
Site: Tradaree
BHP Ref: Annually_Surface Water
Client Ref: SS4

| Test | Units | Results | Customer Limits | Date Analysed | Method |
|--|-----------|----------|-----------------|---------------|------------|
| Conductivity (25 °C) - Field | µS/cm | 1045 | | 04/08/2017 | BHP AC 067 |
| Arsenic (Total as As) | mg/L | <0.001 | | 17/08/2017 | WAS060 |
| Boron (Total as B) | mg/L | <0.23 | | 18/08/2017 | WAS049 |
| Cadmium (Total as Cd) | mg/L | <0.0006 | | 18/08/2017 | WAS049 |
| Chromium (Total as Cr) | mg/L | 0.0021 | | 18/08/2017 | WAS049 |
| Copper (Total as Cu) | mg/L | <0.009 | | 18/08/2017 | WAS049 |
| Iron (Total as Fe) | mg/L | 0.272 | | 18/08/2017 | WAS049 |
| Lead (Total as Pb) | mg/L | <0.006 | | 18/08/2017 | WAS049 |
| Magnesium (Total as Mg) | mg/L | 17.8 | | 18/08/2017 | WAS049 |
| Mercury (Total as Hg) | mg/L | <0.00001 | | 11/08/2017 | WAS013 |
| Nickel (Total as Ni) | mg/L | 0.0105 | | 18/08/2017 | WAS049 |
| Potassium (Total as K) | mg/L | 8.55 | | 18/08/2017 | WAS049 |
| Sodium (Total as Na) | mg/L | 33.6 | | 18/08/2017 | WAS049 |
| Tin (Total as Sn) | mg/L | <0.007 | | 18/08/2017 | WAS049 |
| Zinc (Total as Zn) | mg/L | <0.018 | | 18/08/2017 | WAS049 |
| Cyanide (Total as CN) | mg/L | <0.009 | | 11/08/2017 | WAS018 |
| Sulphate (as SO ₄ ²⁻) | Acc. mg/L | 187 | | 10/08/2017 | BHP AC 095 |
| Fluoride (as F ⁻) | Acc. mg/L | 0.22 | | 11/08/2017 | BHP AC 019 |
| Total Phosphorus (as P) | mg/L | 0.08 | | 10/08/2017 | BHP AC 095 |

Authorised by:  **John O'Halloran** **Date Authorised: 25/08/2017**
Technical Manager

Additional information: (Opinions, where stated, are not covered by accreditation)
 Acc: INAB Accredited
 ND: None detected in volume analysed

BHP/AC/F115

TEST REPORT NO: 140413 .3

Client: Response Engineering
 Railway Road
 Charleville
 Co. Cork

BHP Ref. No: 17/08/0609
Quote Ref: QC001156
Order No: To Follow
Sales Order: 29522
Date Received: 04/08/2017
Date Sampled: 04/08/2017
Date Completed: 18/08/2017
Sample Type: Surface Water



Testing
 Analysing
 Consulting



BHP Laboratories
 New Road
 Thomondgate
 Limerick
 Tel: +353 61 455399
 Fax: +353 61 455261
 EMail: johnhalloran@bhp.ie

FTAO: Ailish Johnston
Site: Tradaree
BHP Ref: Annually_Surface Water
Client Ref: SS4

| Test | Units | Results | Customer Limits | Date Analysed | Method |
|--|-------|---------|-----------------|---------------|------------|
| OrthoPhosphate (as P) Acc. | mg/L | <0.066 | | 11/08/2017 | BHP AC 019 |
| Total Oxidised Nitrogen (as N) ** | mg/L | 1.8 | | 11/08/2017 | BHP AC 065 |
| Calcium (Total as Ca) * | mg/L | 159 | | 18/08/2017 | WAS049 |

APPENDIX 8 APPENDIX 8— METEOROLOGICAL DATA

| Shannon Airport Weather Records 2017 | | | | | | |
|--------------------------------------|--------------------|-------------------------|----------------------|--------------------------------------|------------------|-----------------------------------|
| Date | Precipitation (mm) | Mean CBL Pressure (hpa) | Mean Wind Speed (kt) | Predominant Wind Direction (degrees) | Evaporation (mm) | Potential Evapotranspiration (mm) |
| 01/01/2017 | 0.4 | 1024.4 | 10.5 | 10 | 0.1 | 0.1 |
| 02/01/2017 | 0 | 1031.5 | 4.3 | 0 | 0.1 | 0.1 |
| 03/01/2017 | 0 | 1030.7 | 2.8 | 150 | 0.3 | 0.4 |
| 04/01/2017 | 0 | 1028.4 | 2.5 | 140 | 0.2 | 0.4 |
| 05/01/2017 | 0.7 | 1027.1 | 10 | 150 | 0.3 | 0.3 |
| 06/01/2017 | 11.4 | 1027.3 | 5.3 | 140 | 0.3 | 0.4 |
| 07/01/2017 | 0.7 | 1030.2 | 2.5 | 230 | 0.2 | 0.2 |
| 08/01/2017 | 1.1 | 1025.4 | 4.8 | 180 | 0.3 | 0.4 |
| 09/01/2017 | 4.8 | 1016.3 | 13.9 | 260 | 0.4 | 0.5 |
| 10/01/2017 | 1.4 | 1012.7 | 15 | 280 | 0.7 | 0.9 |
| 11/01/2017 | 0.3 | 1014.7 | 16.2 | 290 | 0.7 | 0.8 |
| 12/01/2017 | 7.9 | 1008.4 | 10 | 310 | 0.5 | 0.7 |
| 13/01/2017 | 0.7 | 1017.2 | 7.6 | 310 | 0.3 | 0.4 |
| 14/01/2017 | 0.9 | 1024.5 | 7.7 | 290 | 0.5 | 0.6 |
| 15/01/2017 | 0.4 | 1026.9 | 8.5 | 270 | 0.4 | 0.5 |
| 16/01/2017 | 0.8 | 1028.8 | 4.6 | 240 | 0.2 | 0.3 |
| 17/01/2017 | 0.2 | 1030.8 | 3.3 | 170 | 0.3 | 0.4 |
| 18/01/2017 | 0 | 1033 | 6.5 | 170 | 0.7 | 0.8 |
| 19/01/2017 | 0 | 1033.2 | 6.2 | 150 | 0.3 | 0.4 |
| 20/01/2017 | 0 | 1028.8 | 6.2 | 100 | 0.4 | 0.5 |
| 21/01/2017 | 0 | 1022.6 | 5.6 | 100 | 0.2 | 0.3 |
| 22/01/2017 | 0 | 1020.8 | 3.4 | 110 | 0.1 | 0.2 |
| 23/01/2017 | 2.4 | 1020.1 | 8.4 | 170 | 0.4 | 0.6 |
| 24/01/2017 | 1.1 | 1016.2 | 10.9 | 160 | 0.7 | 0.9 |
| 25/01/2017 | 0.1 | 1010.9 | 20.8 | 150 | 1.1 | 1.5 |
| 26/01/2017 | 3.4 | 1001.5 | 22.8 | 140 | 1.3 | 1.9 |
| 27/01/2017 | 5.3 | 998.7 | 8 | 130 | 0.3 | 0.5 |
| 28/01/2017 | 0.5 | 1004.9 | 6.3 | 310 | 0.4 | 0.6 |
| 29/01/2017 | 5.9 | 1003.9 | 7.5 | 110 | 0.4 | 0.5 |
| 30/01/2017 | 2.5 | 999.2 | 10.9 | 140 | 0.5 | 0.7 |
| 31/01/2017 | 0.3 | 1001.2 | 3.3 | 260 | 0.3 | 0.5 |
| January | | | | | 12.9 | 17.3 |

| Shannon Airport Weather Records 2017 | | | | | | |
|--------------------------------------|--------------------|-------------------------|----------------------|--------------------------------------|------------------|-----------------------------------|
| Date | Precipitation (mm) | Mean CBL Pressure (hpa) | Mean Wind Speed (kt) | Predominant Wind Direction (degrees) | Evaporation (mm) | Potential Evapotranspiration (mm) |
| 01/02/2017 | 0.2 | 990.8 | 14.5 | 130 | 0.6 | 0.8 |
| 02/02/2017 | 3.2 | 972 | 17.4 | 140 | 0.6 | 0.9 |
| 03/02/2017 | 1.9 | 982.6 | 7.8 | 220 | 0.5 | 0.7 |
| 04/02/2017 | 0.1 | 989.9 | 5 | 300 | 0.4 | 0.6 |
| 05/02/2017 | 0.8 | 1001.6 | 6.8 | 260 | 0.5 | 0.7 |
| 06/02/2017 | 7.1 | 1003.2 | 15.2 | 150 | 0.9 | 1.2 |
| 07/02/2017 | 2.8 | 1013.4 | 4.4 | 280 | 0.4 | 0.5 |
| 08/02/2017 | 0 | 1022.2 | 9.6 | 150 | 0.6 | 0.8 |
| 09/02/2017 | 0.5 | 1019.1 | 15.7 | 130 | 0.9 | 1.2 |
| 10/02/2017 | 0 | 1024.8 | 8.2 | 60 | 1.2 | 1.5 |
| 11/02/2017 | 0 | 1028.8 | 11.3 | 20 | 0.8 | 1.2 |
| 12/02/2017 | 0 | 1020.9 | 15 | 40 | 1.1 | 1.5 |
| 13/02/2017 | 0 | 1012.4 | 15.3 | 90 | 1.6 | 2 |
| 14/02/2017 | 0.6 | 1012.5 | 13.7 | 100 | 1.2 | 1.6 |
| 15/02/2017 | 1.4 | 1019 | 10.2 | 140 | 0.8 | 1 |
| 16/02/2017 | 2.5 | 1023.2 | 6 | 210 | 0.7 | 1 |
| 17/02/2017 | 0 | 1018.5 | 10.4 | 120 | 0.5 | 0.8 |
| 18/02/2017 | 0.2 | 1017.3 | 5.1 | 250 | 0.7 | 1 |
| 19/02/2017 | 1.3 | 1019.8 | 7.5 | 270 | 0.5 | 0.7 |
| 20/02/2017 | 5.8 | 1019.2 | 12.2 | 260 | 0.4 | 0.6 |
| 21/02/2017 | 5.7 | 1012.2 | 17.2 | 250 | 0.5 | 0.8 |
| 22/02/2017 | 11.6 | 1000.4 | 10.9 | 250 | 0.5 | 0.8 |
| 23/02/2017 | 4.8 | 1001.3 | 20.4 | 250 | 1.1 | 1.8 |
| 24/02/2017 | 1.5 | 1010.6 | 7.2 | 200 | 0.7 | 0.9 |
| 25/02/2017 | 2.2 | 1002.4 | 11.2 | 190 | 0.8 | 1.1 |
| 26/02/2017 | 11 | 994 | 14.1 | 240 | 0.7 | 1.1 |
| 27/02/2017 | 4.5 | 984.3 | 8.5 | 250 | 0.7 | 1 |
| 28/02/2017 | 1.4 | 990.3 | 12 | 300 | 1 | 1.5 |
| | | | | | | |

| Shannon Airport Weather Records 2017 | | | | | | |
|--------------------------------------|--------------------|-------------------------|----------------------|--------------------------------------|------------------|-----------------------------------|
| Date | Precipitation (mm) | Mean CBL Pressure (hpa) | Mean Wind Speed (kt) | Predominant Wind Direction (degrees) | Evaporation (mm) | Potential Evapotranspiration (mm) |
| 01/03/2017 | 5.6 | 995.5 | 11.5 | 260 | 1 | 1.5 |
| 02/03/2017 | 7.4 | 1001.7 | 10.4 | 270 | 1 | 1.3 |
| 03/03/2017 | 32.4 | 988.8 | 8.6 | 30 | 0.4 | 0.6 |
| 04/03/2017 | 0.8 | 983.1 | 13 | 300 | 1.1 | 1.7 |
| 05/03/2017 | 8.5 | 988 | 13.4 | 250 | 1.1 | 1.6 |
| 06/03/2017 | 5.8 | 1004.8 | 9.2 | 280 | 0.9 | 1.3 |
| 07/03/2017 | 8.1 | 1008.8 | 10.5 | 230 | 0.6 | 0.9 |
| 08/03/2017 | 0.2 | 1009.2 | 6.5 | 240 | 1.1 | 1.6 |
| 09/03/2017 | 0.3 | 1015.7 | 7.9 | 140 | 1 | 1.4 |
| 10/03/2017 | 0 | 1014.6 | 10.6 | 160 | 1 | 1.4 |
| 11/03/2017 | 2.9 | 1009.8 | 4.5 | 250 | 1.5 | 2.1 |
| 12/03/2017 | 0.7 | 1015.2 | 10.1 | 290 | 1.5 | 2.2 |
| 13/03/2017 | 0.7 | 1026 | 8.5 | 240 | 1.2 | 1.7 |
| 14/03/2017 | 0.7 | 1029.7 | 10.1 | 270 | 1.3 | 2 |
| 15/03/2017 | 0.1 | 1027.1 | 5.7 | 170 | 1 | 1.4 |
| 16/03/2017 | 0.6 | 1020.5 | 10.2 | 290 | 1.2 | 1.8 |
| 17/03/2017 | 19.8 | 1014.9 | 20.3 | 240 | 0.8 | 1.3 |
| 18/03/2017 | 6.6 | 1008.5 | 17.6 | 250 | 0.7 | 1.3 |
| 19/03/2017 | 2.5 | 1003.2 | 15.5 | 250 | 1 | 1.5 |
| 20/03/2017 | 4.7 | 1000.2 | 14.2 | 260 | 1.3 | 2.2 |
| 21/03/2017 | 6 | 1000.8 | 9.8 | 260 | 1.3 | 1.9 |
| 22/03/2017 | 3 | 1006.2 | 13.3 | 360 | 1.9 | 3 |
| 23/03/2017 | 0 | 1020 | 10 | 20 | 1.6 | 2.3 |
| 24/03/2017 | 0 | 1029 | 5.8 | 120 | 1.9 | 2.7 |
| 25/03/2017 | 0 | 1028.1 | 4.2 | 30 | 2 | 2.8 |
| 26/03/2017 | 0 | 1021.2 | 7.2 | 110 | 2.4 | 3.2 |
| 27/03/2017 | 0 | 1015.6 | 9 | 110 | 2.5 | 3.5 |
| 28/03/2017 | 1.2 | 1010.6 | 11 | 170 | 1.7 | 2.3 |
| 29/03/2017 | 0.5 | 1007.3 | 12.7 | 150 | 1.5 | 2.1 |
| 30/03/2017 | 11 | 1002.3 | 11.5 | 170 | 1.7 | 2.5 |
| 31/03/2017 | 3.8 | 998.3 | 8.1 | 190 | 1.8 | 2.5 |

| Shannon Airport Weather Records 2017 | | | | | | |
|--------------------------------------|--------------------|-------------------------|----------------------|--------------------------------------|------------------|-----------------------------------|
| Date | Precipitation (mm) | Mean CBL Pressure (hpa) | Mean Wind Speed (kt) | Predominant Wind Direction (degrees) | Evaporation (mm) | Potential Evapotranspiration (mm) |
| 01/04/2017 | 0.2 | 1009.4 | 10.2 | 300 | 1.8 | 2.9 |
| 02/04/2017 | 0 | 1018.4 | 9.5 | 170 | 2.1 | 3 |
| 03/04/2017 | 3.6 | 1016.4 | 15.6 | 160 | 1.3 | 2 |
| 04/04/2017 | 0 | 1027.8 | 8.1 | 300 | 1.8 | 2.4 |
| 05/04/2017 | 0 | 1033.8 | 5.1 | 320 | 1.5 | 2 |
| 06/04/2017 | 0 | 1030.5 | 3.2 | 210 | 1.4 | 1.9 |
| 07/04/2017 | 0 | 1024.4 | 5.8 | 180 | 2.2 | 3.1 |
| 08/04/2017 | 0 | 1017.4 | 9.1 | 140 | 2.7 | 3.9 |
| 09/04/2017 | 0 | 1019.9 | 7.6 | 280 | 1.6 | 2.2 |
| 10/04/2017 | 0 | 1028.1 | 7 | 290 | 2 | 2.9 |
| 11/04/2017 | 0 | 1026.4 | 9.2 | 250 | 1.4 | 1.9 |
| 12/04/2017 | 0 | 1021.1 | 10.5 | 280 | 1.7 | 2.7 |
| 13/04/2017 | 0 | 1017.8 | 6.7 | 240 | 1.6 | 2.3 |
| 14/04/2017 | 2.3 | 1015.5 | 9.4 | 270 | 1.1 | 1.7 |
| 15/04/2017 | 0.1 | 1020 | 8.3 | 280 | 1.9 | 2.8 |
| 16/04/2017 | 1.2 | 1022.4 | 11.5 | 280 | 1.7 | 2.5 |
| 17/04/2017 | 0 | 1025.2 | 5.1 | 290 | 1.5 | 2.1 |
| 18/04/2017 | 0 | 1030.2 | 2.7 | 320 | 1.3 | 1.8 |
| 19/04/2017 | 0 | 1033.9 | 3.5 | 330 | 1.5 | 2 |
| 20/04/2017 | 0 | 1034.6 | 4.3 | 250 | 2.5 | 3.5 |
| 21/04/2017 | 0 | 1032.4 | 4.2 | 310 | 2.2 | 3 |
| 22/04/2017 | 0 | 1029.6 | 3.3 | 10 | 1.7 | 2.3 |
| 23/04/2017 | 0 | 1024.5 | 3.2 | 260 | 2 | 2.6 |
| 24/04/2017 | 0 | 1019 | 8.4 | 10 | 2.5 | 3.9 |
| 25/04/2017 | 3.3 | 1021.6 | 9.3 | 20 | 2.4 | 3.7 |
| 26/04/2017 | 0 | 1022.8 | 6.6 | 300 | 2.1 | 3.1 |
| 27/04/2017 | 0.3 | 1021.6 | 5.9 | 310 | 1.8 | 2.6 |
| 28/04/2017 | 0 | 1014.7 | 5.2 | 240 | 2.3 | 3.1 |
| 29/04/2017 | 3.5 | 1000.9 | 15.4 | 160 | 2 | 3.1 |
| 30/04/2017 | 3 | 992.5 | 14 | 120 | 2.7 | 4.2 |

| Shannon Airport Weather Records 2017 | | | | | | |
|--------------------------------------|--------------------|-------------------------|----------------------|--------------------------------------|------------------|-----------------------------------|
| date | Precipitation (mm) | Mean CBL Pressure (hpa) | Mean Wind Speed (kt) | Predominant Wind Direction (degrees) | Evaporation (mm) | Potential Evapotranspiration (mm) |
| 01/05/2017 | 0 | 1004.7 | 4.4 | 250 | 2.9 | 4.1 |
| 02/05/2017 | 0 | 1017.2 | 4.9 | 120 | 3.3 | 4.6 |
| 03/05/2017 | 0 | 1023.3 | 8.2 | 60 | 3.6 | 5.2 |
| 04/05/2017 | 0 | 1022.1 | 9 | 60 | 2.4 | 3.3 |
| 05/05/2017 | 0 | 1016.5 | 14.1 | 100 | 3.7 | 5.4 |
| 06/05/2017 | 0 | 1014.6 | 9.7 | 70 | 1.8 | 2.4 |
| 07/05/2017 | 0 | 1021.3 | 3.7 | 320 | 2.9 | 3.9 |
| 08/05/2017 | 0 | 1025.5 | 4.8 | 50 | 3.6 | 4.9 |
| 09/05/2017 | 0 | 1018.9 | 3.3 | 110 | 3.3 | 4.5 |
| 10/05/2017 | 0 | 1004.8 | 4.5 | 320 | 3.7 | 5 |
| 11/05/2017 | 0 | 993.8 | 3.6 | 120 | 3.3 | 4.4 |
| 12/05/2017 | 0.8 | 992.9 | 6.4 | 280 | 1.8 | 2.4 |
| 13/05/2017 | 9.1 | 999.6 | 8.3 | 170 | 2 | 2.8 |
| 14/05/2017 | 1.3 | 1007.8 | 11.2 | 200 | 2.8 | 4.3 |
| 15/05/2017 | 3.4 | 1005.5 | 13.5 | 150 | 1.7 | 2.4 |
| 16/05/2017 | 0.5 | 1011.7 | 12.8 | 260 | 3.1 | 5.1 |
| 17/05/2017 | 0.3 | 1013.7 | 10.2 | 250 | 3.1 | 4.7 |
| 18/05/2017 | 1.3 | 1010 | 7.4 | 280 | 3 | 4.4 |
| 19/05/2017 | 4.4 | 1010.3 | 6.4 | 230 | 1.9 | 2.8 |
| 20/05/2017 | 0.8 | 1012.2 | 8.9 | 240 | 3.1 | 4.6 |
| 21/05/2017 | 0 | 1011.3 | 15 | 170 | 3 | 4.5 |
| 22/05/2017 | 1.9 | 1010 | 9.5 | 240 | 3.1 | 4.4 |
| 23/05/2017 | 0.2 | 1018.2 | 5.7 | 240 | 2.1 | 2.9 |
| 24/05/2017 | 0 | 1022.2 | 4.4 | 140 | 3.3 | 4.4 |
| 25/05/2017 | 0 | 1017 | 8.1 | 140 | 3.4 | 4.7 |
| 26/05/2017 | 4.9 | 1010.5 | 6.5 | 140 | 2.6 | 3.4 |
| 27/05/2017 | 15.8 | 1012 | 9.4 | 270 | 1.5 | 2.2 |
| 28/05/2017 | 0.5 | 1014.9 | 3.5 | 30 | 3 | 4 |
| 29/05/2017 | 0 | 1010.7 | 3.3 | 230 | 2 | 2.7 |
| 30/05/2017 | 0 | 1013.3 | 6.6 | 310 | 3 | 4.2 |
| 31/05/2017 | 0 | 1015.2 | 9.6 | 150 | 3.3 | 4.8 |

| Shannon Airport Weather Records 2017 | | | | | | |
|--------------------------------------|--------------------|-------------------------|----------------------|--------------------------------------|------------------|-----------------------------------|
| Date | Precipitation (mm) | Mean CBL Pressure (hpa) | Mean Wind Speed (kt) | Predominant Wind Direction (degrees) | Evaporation (mm) | Potential Evapotranspiration (mm) |
| 01/06/2017 | 5.5 | 1012.5 | 9.6 | 160 | 1.5 | 2.1 |
| 02/06/2017 | 0.1 | 1012.8 | 7.9 | 250 | 3.8 | 5.6 |
| 03/06/2017 | 2.3 | 1010.2 | 11.5 | 250 | 3.3 | 5 |
| 04/06/2017 | 7.5 | 1005.7 | 10.8 | 150 | 2.5 | 3.9 |
| 05/06/2017 | 0.8 | 997.2 | 9.5 | 300 | 1.4 | 2 |
| 06/06/2017 | 2.7 | 1003.1 | 13.2 | 270 | 3 | 5 |
| 07/06/2017 | 6.3 | 1005.6 | 8.1 | 130 | 1.6 | 2.5 |
| 08/06/2017 | 15.8 | 999 | 8 | 240 | 2.1 | 3.1 |
| 09/06/2017 | 12.5 | 1002.6 | 9.8 | 130 | 2.6 | 3.9 |
| 10/06/2017 | 2.4 | 1000.9 | 13.7 | 190 | 3.3 | 5.3 |
| 11/06/2017 | 4.4 | 1006.2 | 17.6 | 240 | 2.1 | 3.7 |
| 12/06/2017 | 1.2 | 1013.2 | 11 | 260 | 1.8 | 2.6 |
| 13/06/2017 | 0 | 1014.3 | 9 | 190 | 2.6 | 3.6 |
| 14/06/2017 | 0.5 | 1009.5 | 13 | 170 | 2.9 | 4.2 |
| 15/06/2017 | 0.3 | 1012.1 | 14.6 | 240 | 2.6 | 4 |
| 16/06/2017 | 0.2 | 1021.1 | 7.2 | 240 | 2.4 | 3.2 |
| 17/06/2017 | 0 | 1023.7 | 5.6 | 280 | 4.6 | 6.4 |
| 18/06/2017 | 0 | 1021.1 | 4 | 310 | 4.5 | 5.9 |
| 19/06/2017 | 0 | 1017.9 | 5.3 | 350 | 4.4 | 5.8 |
| 20/06/2017 | 0.1 | 1015.3 | 6.2 | 90 | 4 | 5.3 |
| 21/06/2017 | 1.3 | 1010.9 | 7.4 | 120 | 2.4 | 3.3 |
| 22/06/2017 | 0.1 | 1011.5 | 10.7 | 240 | 3 | 4.5 |
| 23/06/2017 | 0.9 | 1010.8 | 13.8 | 230 | 2.1 | 3.1 |
| 24/06/2017 | 1.5 | 1010.8 | 11.1 | 270 | 2.8 | 4.4 |
| 25/06/2017 | 1.2 | 1011.3 | 9 | 250 | 2.5 | 3.8 |
| 26/06/2017 | 15.4 | 1008.8 | 7.3 | 110 | 1.5 | 2.2 |
| 27/06/2017 | 0.2 | 1001.4 | 7.4 | 260 | 3.6 | 5.2 |
| 28/06/2017 | 2.3 | 999.3 | 4.8 | 310 | 2.3 | 3.1 |
| 29/06/2017 | 1 | 1004.5 | 12.3 | 330 | 2.6 | 3.9 |
| 30/06/2017 | 0 | 1013.2 | 14.2 | 330 | 4 | 6.1 |
| | | | | | | |

| Shannon Airport Weather Records 2017 | | | | | | |
|--------------------------------------|--------------------|-------------------------|----------------------|--------------------------------------|------------------|-----------------------------------|
| Date | Precipitation (mm) | Mean CBL Pressure (hpa) | Mean Wind Speed (kt) | Predominant Wind Direction (degrees) | Evaporation (mm) | Potential Evapotranspiration (mm) |
| 01/07/2017 | 0.3 | 1018.2 | 9.8 | 270 | 1.7 | 2.5 |
| 02/07/2017 | 0.6 | 1019.5 | 7.3 | 240 | 2.4 | 3.5 |
| 03/07/2017 | 3.3 | 1016.9 | 4.8 | 260 | 1.9 | 2.6 |
| 04/07/2017 | 0.4 | 1016.4 | 8.2 | 240 | 1.9 | 2.9 |
| 05/07/2017 | 0 | 1016.5 | 3.3 | 260 | 2.8 | 3.7 |
| 06/07/2017 | 2.5 | 1014.1 | 5.8 | 260 | 2.8 | 3.8 |
| 07/07/2017 | 0.3 | 1015.9 | 7 | 280 | 2 | 2.7 |
| 08/07/2017 | 0 | 1016.2 | 4.7 | 280 | 4.4 | 5.8 |
| 09/07/2017 | 1.2 | 1011.8 | 9.8 | 230 | 2 | 3 |
| 10/07/2017 | 0.6 | 1007.8 | 5.4 | 250 | 2.2 | 2.9 |
| 11/07/2017 | 0.5 | 1006.8 | 5.7 | 30 | 2.3 | 3.1 |
| 12/07/2017 | 0 | 1014.5 | 4.3 | 280 | 3.8 | 5.2 |
| 13/07/2017 | 0.2 | 1018.8 | 8.9 | 270 | 2.7 | 3.8 |
| 14/07/2017 | 0.6 | 1019.1 | 9.2 | 250 | 3.3 | 4.9 |
| 15/07/2017 | 5.3 | 1016.9 | 10.7 | 240 | 2 | 2.9 |
| 16/07/2017 | 0.1 | 1021.8 | 6.4 | 280 | 3.5 | 5.1 |
| 17/07/2017 | 0 | 1021.4 | 3.2 | 130 | 4.3 | 5.7 |
| 18/07/2017 | 1 | 1010.5 | 7.9 | 130 | 3.4 | 4.6 |
| 19/07/2017 | 9.2 | 1002.1 | 10.2 | 270 | 1.6 | 2.3 |
| 20/07/2017 | 12.9 | 1000.4 | 9.5 | 240 | 2.9 | 4.2 |
| 21/07/2017 | 42.6 | 992.8 | 11.4 | 250 | 1.4 | 2.3 |
| 22/07/2017 | 0 | 1002.1 | 7.5 | 40 | 3.3 | 4.7 |
| 23/07/2017 | 0 | 1013.3 | 6.9 | 280 | 3.3 | 4.6 |
| 24/07/2017 | 0 | 1018.5 | 7.1 | 260 | 3.9 | 5.5 |
| 25/07/2017 | 6.8 | 1011 | 5.1 | 170 | 1.8 | 2.4 |
| 26/07/2017 | 7.4 | 1000.7 | 15.9 | 250 | 2.5 | 4.4 |
| 27/07/2017 | 6.5 | 1000 | 15.5 | 240 | 2.4 | 3.9 |
| 28/07/2017 | 0.8 | 1000.3 | 15.5 | 240 | 3.3 | 5 |
| 29/07/2017 | 7.1 | 1001.6 | 12.1 | 240 | 2.9 | 4.3 |
| 30/07/2017 | 12.2 | 999.8 | 12 | 240 | 2.1 | 3.2 |
| 31/07/2017 | 11.2 | 1004.3 | 12 | 240 | 3.2 | 4.9 |

| Shannon Airport Weather Records 2017 | | | | | | |
|--------------------------------------|--------------------|-------------------------|----------------------|--------------------------------------|------------------|-----------------------------------|
| Date | Precipitation (mm) | Mean CBL Pressure (hpa) | Mean Wind Speed (kt) | Predominant Wind Direction (degrees) | Evaporation (mm) | Potential Evapotranspiration (mm) |
| 01/08/2017 | 0.9 | 1006.5 | 6.8 | 210 | 2.4 | 3.2 |
| 02/08/2017 | 4.1 | 998.8 | 11 | 240 | 2.7 | 3.9 |
| 03/08/2017 | 2.1 | 999.2 | 11.6 | 230 | 2.4 | 3.6 |
| 04/08/2017 | 1.6 | 1009.9 | 6.8 | 280 | 3.4 | 4.9 |
| 05/08/2017 | 1.8 | 1016.2 | 8.2 | 280 | 3.2 | 4.6 |
| 06/08/2017 | 6.7 | 1016 | 11.9 | 250 | 1.2 | 1.9 |
| 07/08/2017 | 2.3 | 1014.2 | 8.1 | 300 | 2.7 | 3.9 |
| 08/08/2017 | 3.5 | 1016.3 | 6.2 | 300 | 2.6 | 3.7 |
| 09/08/2017 | 0 | 1023.5 | 8.2 | 360 | 3.1 | 4.4 |
| 10/08/2017 | 0 | 1023 | 7.4 | 240 | 2.3 | 3.3 |
| 11/08/2017 | 2.1 | 1015.6 | 11.3 | 240 | 1.6 | 2.5 |
| 12/08/2017 | 0.3 | 1016.9 | 8.9 | 260 | 3.1 | 4.5 |
| 13/08/2017 | 2.3 | 1014.8 | 6.3 | 170 | 1.9 | 2.7 |
| 14/08/2017 | 0.9 | 1008.7 | 8.2 | 230 | 2 | 2.6 |
| 15/08/2017 | 0.6 | 1011.6 | 7.7 | 240 | 3 | 4.3 |
| 16/08/2017 | 0.8 | 1008.2 | 12.5 | 160 | 2.3 | 3.4 |
| 17/08/2017 | 4.6 | 1003.9 | 10.8 | 230 | 2.7 | 3.9 |
| 18/08/2017 | 9.4 | 1009.5 | 14.9 | 270 | 1.6 | 2.7 |
| 19/08/2017 | 0.3 | 1016.3 | 10.8 | 260 | 2.4 | 3.3 |
| 20/08/2017 | 22 | 1016.4 | 7.2 | 110 | 1.1 | 1.5 |
| 21/08/2017 | 8.3 | 1014.8 | 7.2 | 170 | 2.2 | 2.8 |
| 22/08/2017 | 0 | 1010.6 | 8.3 | 130 | 1.2 | 1.6 |
| 23/08/2017 | 0 | 1009.4 | 9.3 | 240 | 2.6 | 3.7 |
| 24/08/2017 | 1.2 | 1011.8 | 10.1 | 240 | 1.6 | 2.2 |
| 25/08/2017 | 0.1 | 1013 | 4.9 | 250 | 2.4 | 3.2 |
| 26/08/2017 | 1.8 | 1014.7 | 2.2 | 130 | 1.9 | 2.5 |
| 27/08/2017 | 0 | 1015.1 | 5.2 | 240 | 2 | 2.6 |
| 28/08/2017 | 0.8 | 1013.7 | 7.2 | 250 | 1.2 | 1.7 |
| 29/08/2017 | 0 | 1014.2 | 6.5 | 240 | 1.7 | 2.2 |
| 30/08/2017 | 2.1 | 1012.5 | 6.3 | 250 | 2.3 | 3.3 |
| 31/08/2017 | 2.1 | 1017 | 3.4 | 260 | 2.1 | 2.8 |

| Shannon Airport Weather Records 2017 | | | | | | |
|--------------------------------------|--------------------|-------------------------|----------------------|--------------------------------------|------------------|-----------------------------------|
| Year | Precipitation (mm) | Mean CBL Pressure (hpa) | Mean Wind Speed (kt) | Predominant Wind Direction (degrees) | Evaporation (mm) | Potential Evapotranspiration (mm) |
| 01/09/2017 | 0.1 | 1022.8 | 3.6 | 250 | 3 | 4.2 |
| 02/09/2017 | 10.7 | 1012.2 | 11.6 | 140 | 1.1 | 1.7 |
| 03/09/2017 | 0.6 | 1001.6 | 4.6 | 120 | 2.2 | 3 |
| 04/09/2017 | 0.3 | 1005.7 | 6.8 | 250 | 1.3 | 1.7 |
| 05/09/2017 | 1.5 | 1010.7 | 11.1 | 250 | 2.2 | 3.2 |
| 06/09/2017 | 0.4 | 1017.1 | 10.1 | 270 | 2 | 2.8 |
| 07/09/2017 | 5.8 | 1008.7 | 11.6 | 240 | 1.3 | 1.8 |
| 08/09/2017 | 5.2 | 999.7 | 11.1 | 280 | 2.1 | 3.1 |
| 09/09/2017 | 0.4 | 1001.8 | 13.5 | 300 | 2.2 | 3.3 |
| 10/09/2017 | 8.7 | 994.9 | 19.1 | 260 | 1.6 | 2.7 |
| 11/09/2017 | 2.4 | 995.5 | 16.1 | 260 | 2.1 | 3.4 |
| 12/09/2017 | 5 | 994.8 | 10.6 | 230 | 1.1 | 1.7 |
| 13/09/2017 | 5.3 | 1000.8 | 9.5 | 250 | 1.7 | 2.5 |
| 14/09/2017 | 0.1 | 1012.1 | 10 | 300 | 2.2 | 3.2 |
| 15/09/2017 | 0.6 | 1018.4 | 6.8 | 320 | 1.7 | 2.3 |
| 16/09/2017 | 3.6 | 1015.7 | 5.9 | 330 | 1 | 1.3 |
| 17/09/2017 | 0 | 1016 | 4.1 | 30 | 1.8 | 2.5 |
| 18/09/2017 | 0 | 1019.5 | 3.8 | 260 | 1.7 | 2.3 |
| 19/09/2017 | 0 | 1014.8 | 9.4 | 160 | 1.2 | 1.7 |
| 20/09/2017 | 11.8 | 1009.4 | 7.2 | 130 | 0.6 | 0.9 |
| 21/09/2017 | 0.7 | 1010.5 | 6.6 | 230 | 1.4 | 2.1 |
| 22/09/2017 | 2.1 | 1007.8 | 10.9 | 150 | 1.8 | 2.8 |
| 23/09/2017 | 0.6 | 1007.5 | 15 | 160 | 1.2 | 1.7 |
| 24/09/2017 | 4 | 1013.2 | 3.8 | 260 | 1.3 | 1.8 |
| 25/09/2017 | 0.2 | 1018 | 6.6 | 150 | 1.5 | 2 |
| 26/09/2017 | 0.8 | 1013.2 | 15.1 | 150 | 1.9 | 2.8 |
| 27/09/2017 | 24.8 | 1007.8 | 10.1 | 130 | 0.5 | 0.8 |
| 28/09/2017 | 1.3 | 1007.3 | 12 | 160 | 0.8 | 1.1 |
| 29/09/2017 | 2.1 | 1006.8 | 11.2 | 230 | 1.6 | 2.3 |
| 30/09/2017 | 0.1 | 1007.4 | 4.9 | 190 | 1.2 | 1.7 |

| Shannon Airport Weather Records 2017 | | | | | | |
|--------------------------------------|--------------------|-------------------------|----------------------|--------------------------------------|------------------|-----------------------------------|
| Year | Precipitation (mm) | Mean CBL Pressure (hpa) | Mean Wind Speed (kt) | Predominant Wind Direction (degrees) | Evaporation (mm) | Potential Evapotranspiration (mm) |
| 01/10/2017 | 1.3 | 1002.9 | 16.4 | 250 | 1.1 | 1.6 |
| 02/10/2017 | 0.6 | 1014 | 13.6 | 260 | 1.5 | 2.1 |
| 03/10/2017 | 0 | 1023.2 | 7.7 | 280 | 1.3 | 1.7 |
| 04/10/2017 | 4.6 | 1017.5 | 16.4 | 240 | 1 | 1.4 |
| 05/10/2017 | 0.5 | 1020 | 7.1 | 270 | 0.8 | 1.3 |
| 06/10/2017 | 3.4 | 1023.1 | 6.8 | 230 | 0.7 | 1 |
| 07/10/2017 | 0.4 | 1017.8 | 8.6 | 270 | 0.8 | 1.2 |
| 08/10/2017 | 0.2 | 1018.9 | 3 | 290 | 1 | 1.4 |
| 09/10/2017 | 5.1 | 1014.4 | 7.9 | 240 | 0.5 | 0.8 |
| 10/10/2017 | 3.1 | 1005.8 | 10.3 | 230 | 0.9 | 1.3 |
| 11/10/2017 | 4.4 | 1004.5 | 13 | 250 | 1.1 | 1.6 |
| 12/10/2017 | 0.4 | 1009.8 | 11.2 | 160 | 1 | 1.4 |
| 13/10/2017 | 6.3 | 1010.2 | 8.5 | 230 | 0.7 | 0.9 |
| 14/10/2017 | 1 | 1011.6 | 10 | 160 | 0.9 | 1.2 |
| 15/10/2017 | 0.3 | 1007.4 | 9.5 | 160 | 0.8 | 1.1 |
| 16/10/2017 | 3.9 | 990.6 | 23.9 | 130 | 1.6 | 2.2 |
| 17/10/2017 | 1.1 | 1011.7 | 7.8 | 250 | 1.2 | 1.6 |
| 18/10/2017 | 0.3 | 1004.5 | 8 | 110 | 0.5 | 0.8 |
| 19/10/2017 | 19.4 | 994.5 | 11.3 | 310 | 0.7 | 0.9 |
| 20/10/2017 | 3.5 | 990.8 | 12.4 | 130 | 0.8 | 1.1 |
| 21/10/2017 | 9.4 | 991.8 | 23.4 | 230 | 1.4 | 2.1 |
| 22/10/2017 | 1.8 | 1011.3 | 12 | 280 | 1.1 | 1.4 |
| 23/10/2017 | 1.6 | 1009 | 7.6 | 210 | 0.8 | 1 |
| 24/10/2017 | 7 | 1007.8 | 8.4 | 240 | 0.5 | 0.7 |
| 25/10/2017 | 0.1 | 1015.1 | 6.9 | 230 | 0.8 | 1.1 |
| 26/10/2017 | 0.1 | 1023.8 | 4.9 | 120 | 0.5 | 0.7 |
| 27/10/2017 | 0.2 | 1031.7 | 3.1 | 120 | 0.4 | 0.7 |
| 28/10/2017 | 0.2 | 1029.1 | 6.5 | 270 | 0.5 | 0.6 |
| 29/10/2017 | 0.3 | 1026.9 | 6 | 300 | 0.4 | 0.6 |
| 30/10/2017 | 0.1 | 1025.9 | 5.5 | 120 | 0.5 | 0.7 |
| 31/10/2017 | 0 | 1019.6 | 5.5 | 140 | 0.7 | 0.8 |

| Shannon Airport Weather Records 2017 | | | | | | |
|--------------------------------------|--------------------|-------------------------|----------------------|--------------------------------------|------------------|-----------------------------------|
| Year | Precipitation (mm) | Mean CBL Pressure (hpa) | Mean Wind Speed (kt) | Predominant Wind Direction (degrees) | Evaporation (mm) | Potential Evapotranspiration (mm) |
| 01/11/2017 | 0 | 1015 | 4.2 | 150 | 0.7 | 0.9 |
| 02/11/2017 | 0 | 1014.8 | 2.7 | 20 | 0.4 | 0.6 |
| 03/11/2017 | 0.1 | 1009.3 | 6 | 240 | 0.7 | 0.9 |
| 04/11/2017 | 4.9 | 1007.8 | 9.4 | 290 | 0.5 | 0.7 |
| 05/11/2017 | 2.2 | 1016.8 | 8 | 310 | 0.7 | 0.9 |
| 06/11/2017 | 5.8 | 1013.1 | 12 | 250 | 0.7 | 1 |
| 07/11/2017 | 2 | 1014.6 | 6.6 | 300 | 0.4 | 0.6 |
| 08/11/2017 | 1 | 1021.8 | 8 | 250 | 0.4 | 0.5 |
| 09/11/2017 | 2.6 | 1023.2 | 12 | 260 | 0.7 | 0.8 |
| 10/11/2017 | 12.8 | 1018.2 | 12 | 250 | 0.6 | 0.8 |
| 11/11/2017 | 20.6 | 1012 | 9.8 | 250 | 0.3 | 0.4 |
| 12/11/2017 | 0 | 1021 | 7.1 | 330 | 0.3 | 0.5 |
| 13/11/2017 | 2.5 | 1024.1 | 5.5 | 230 | 0.4 | 0.5 |
| 14/11/2017 | 1 | 1020.2 | 6.3 | 230 | 0.3 | 0.5 |
| 15/11/2017 | 0.1 | 1018.8 | 5 | 210 | 0.4 | 0.5 |
| 16/11/2017 | 1.2 | 1021.8 | 5.6 | 280 | 0.4 | 0.5 |
| 17/11/2017 | 0.9 | 1025.9 | 5.7 | 190 | 0.5 | 0.6 |
| 18/11/2017 | 9.1 | 1021.9 | 4.3 | 250 | 0.4 | 0.5 |
| 19/11/2017 | 0.8 | 1016.8 | 8 | 200 | 0.5 | 0.6 |
| 20/11/2017 | 6.6 | 1009.5 | 10.1 | 240 | 0.3 | 0.5 |
| 21/11/2017 | 4.3 | 1001 | 7.5 | 240 | 0.4 | 0.6 |
| 22/11/2017 | 27.8 | 987.8 | 7.8 | 360 | 0.4 | 0.6 |
| 23/11/2017 | 1 | 994 | 9.6 | 230 | 0.4 | 0.5 |
| 24/11/2017 | 1.9 | 1010.3 | 4.5 | 290 | 0.2 | 0.3 |
| 25/11/2017 | 1.8 | 1020.3 | 7.8 | 290 | 0.4 | 0.5 |
| 26/11/2017 | 10.6 | 1020.8 | 10.5 | 240 | 0.3 | 0.5 |
| 27/11/2017 | 3.3 | 1014.5 | 11.2 | 270 | 0.5 | 0.6 |
| 28/11/2017 | 0 | 1016.1 | 7.5 | 340 | 0.3 | 0.3 |
| 29/11/2017 | 0 | 1019.8 | 6 | 350 | 0.1 | 0.2 |
| 30/11/2017 | 0.2 | 1022.3 | 6 | 340 | 0.2 | 0.3 |

| Shannon Airport Weather Records 2017 | | | | | | |
|--------------------------------------|--------------------|-------------------------|----------------------|--------------------------------------|------------------|-----------------------------------|
| Date | Precipitation (mm) | Mean CBL Pressure (hpa) | Mean Wind Speed (kt) | Predominant Wind Direction (degrees) | Evaporation (mm) | Potential Evapotranspiration (mm) |
| 01/12/2017 | 0 | 1028 | 3.1 | 320 | 0 | 0.1 |
| 02/12/2017 | 0.2 | 1029.7 | 4.7 | 290 | 0.2 | 0.3 |
| 03/12/2017 | 0.2 | 1031.3 | 3 | 310 | 0 | 0 |
| 04/12/2017 | 0.4 | 1034.1 | 3.5 | 250 | 0 | 0 |
| 05/12/2017 | 0.1 | 1028.9 | 7.6 | 140 | 0.5 | 0.6 |
| 06/12/2017 | 8 | 1011.4 | 11.2 | 170 | 0.6 | 0.7 |
| 07/12/2017 | 4.3 | 1008.8 | 14 | 320 | 0.4 | 0.5 |
| 08/12/2017 | 0.6 | 1021.4 | 8.2 | 310 | 0.4 | 0.5 |
| 09/12/2017 | 3.4 | 1006.4 | 7.2 | 100 | 0.2 | 0.3 |
| 10/12/2017 | 27.2 | 983.1 | 9.8 | 270 | 0.3 | 0.4 |
| 11/12/2017 | 0 | 995.2 | 6.3 | 330 | 0.1 | 0.2 |
| 12/12/2017 | 1.9 | 1001.2 | 7.8 | 250 | 0.3 | 0.5 |
| 13/12/2017 | 16.5 | 995.7 | 17.4 | 240 | 0.5 | 0.7 |
| 14/12/2017 | 7.7 | 992.2 | 13 | 270 | 0.7 | 0.9 |
| 15/12/2017 | 0 | 1008.2 | 7 | 330 | 0.2 | 0.2 |
| 16/12/2017 | 1.8 | 1020.1 | 5 | 250 | 0.2 | 0.3 |
| 17/12/2017 | 2.5 | 1020.1 | 6.7 | 220 | 0.1 | 0.2 |
| 18/12/2017 | 0.2 | 1026.2 | 6.2 | 100 | 0.1 | 0.2 |
| 19/12/2017 | 0 | 1028.6 | 6.6 | 110 | 0.2 | 0.3 |
| 20/12/2017 | 4 | 1030.2 | 4.6 | 220 | 0.2 | 0.3 |
| 21/12/2017 | 8.2 | 1030.4 | 6.5 | 210 | 0.4 | 0.5 |
| 22/12/2017 | 0.4 | 1032.5 | 6.4 | 240 | 0.2 | 0.2 |
| 23/12/2017 | 0.2 | 1029.4 | 6.8 | 240 | 0.2 | 0.3 |
| 24/12/2017 | 5.3 | 1013.6 | 14 | 220 | 0.7 | 0.9 |
| 25/12/2017 | 14.8 | 999.8 | 8 | 240 | 0.4 | 0.5 |
| 26/12/2017 | 1.5 | 990.7 | 8 | 20 | 0.4 | 0.5 |
| 27/12/2017 | 0 | 998.7 | 7.2 | 310 | 0.3 | 0.3 |
| 28/12/2017 | 2.8 | 998.2 | 6.5 | 130 | 0.2 | 0.3 |
| 29/12/2017 | 15.2 | 987.4 | 14.3 | 260 | 1.1 | 1.3 |
| 30/12/2017 | 7.2 | 986.6 | 18.2 | 230 | 0.6 | 0.8 |
| 31/12/2017 | 5 | 986 | 15.7 | 230 | 1 | 1.3 |

APPENDIX 9 APPENDIX 9— WATER BALANCE CALCULATIONS

| Water Balance Calculations 2017 | | | | | | | | | | |
|--|------------------|--------------------------------------|---------------------|----------------------------------|--------------------------|-------------------------|------------------------|--------------------------------------|--------------------------------|-------------------------|
| <u>Upper Bound 10% infiltration of actual rainfall on the area covered with capping and Cell 1,2 & 3</u> | | | | | | | | | | |
| Period (Jan 2016 - Dec 2016) | 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 | 5135 | 0.0358 | 155 | 183.833 | 3.468 | 180.37 | 15742 | 0.0401 | 63.13 | 243.49 |
| February | 5135 | 0.0417 | 155 | 214.1295 | 3.468 | 210.66 | 15742 | 0.0502 | 79.02 | 289.69 |
| March | 5135 | 0.0744 | 155 | 382.044 | 3.468 | 378.58 | 15742 | 0.0927 | 145.93 | 524.50 |
| April | 5135 | 0 | 155 | 0 | 3.468 | 0.00 | 15742 | 0.0000 | 0.00 | 0.00 |
| May | 5135 | 0 | 155 | 0 | 3.468 | 0.00 | 15742 | 0 | 0.00 | 0.00 |
| June | 5135 | 0 | 155 | 0 | 3.468 | 0.00 | 15742 | 0.0028 | 4.41 | 4.41 |
| July | 5135 | 0 | 155 | 0 | 3.468 | 0.00 | 15742 | 0.0494 | 77.77 | 77.77 |
| August | 5135 | 0 | 155 | 0 | 3.468 | 0.00 | 15742 | 0.0139 | 21.88 | 21.88 |
| September | 5135 | 0.0308 | 155 | 158.158 | 3.468 | 154.69 | 15742 | 0.0519 | 81.70 | 236.39 |
| October | 5135 | 0.0437 | 155 | 224.3995 | 3.468 | 220.93 | 15742 | 0.0542 | 85.32 | 306.25 |
| November | 5135 | 0.108 | 155 | 554.58 | 3.468 | 551.11 | 15742 | 0.1123 | 176.78 | 727.89 |
| December | 5135 | 0.1258 | 155 | 645.983 | 3.468 | 642.52 | 15742 | 0.1289 | 202.91 | 845.43 |
| TOTAL | | | | | | 2338.85 | | | 938.85 | 3277.70 |
| <u>Lower Bound 2% infiltration of actual rainfall on the area covered with capping and Cell 1,2 & 3</u> | | | | | | | | | | |
| Period (Jan 2016 - Dec 2016) | 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 | 5135 | 0.0358 | 155 | 183.833 | 3.468 | 180.37 | 15742 | 0.0401 | 12.63 | 192.99 |
| February | 5135 | 0.0417 | 155 | 214.130 | 3.468 | 210.66 | 15742 | 0.0502 | 15.80 | 226.47 |
| March | 5135 | 0 | 155 | 382 | 3.468 | 378.58 | 15742 | 0 | 29.19 | 407.76 |
| April | 5135 | 0 | 155 | 0 | 3.468 | 0.00 | 15742 | 0.0000 | 0.00 | 0.00 |
| May | 5135 | 0 | 155 | 0 | 3.468 | 0.00 | 15742 | 0 | 0.00 | 0.00 |
| June | 5135 | 0.0000 | 155 | 0 | 3.468 | 0.00 | 15742 | 0.0028 | 0.88 | 0.88 |
| July | 5135 | 0.0000 | 155 | 0 | 3.468 | 0.00 | 15742 | 0.0494 | 15.55 | 15.55 |
| August | 5135 | 0.0000 | 155 | 0 | 3.468 | 0.00 | 15742 | 0.0139 | 4.38 | 4.38 |
| September | 5135 | 0 | 155 | 158.158 | 3.468 | 154.69 | 15742 | 0.0519 | 16.34 | 171.03 |
| October | 5135 | 0.0437 | 155 | 224.400 | 3.468 | 220.93 | 15742 | 0.0542 | 17.06 | 238.00 |
| November | 5135 | 0.1080 | 155 | 554.580 | 3.468 | 551.11 | 15742 | 0.1123 | 35.36 | 586.47 |
| December | 5135 | 0.1258 | 155 | 645.983 | 3.468 | 642.52 | 15742 | 0.1289 | 40.58 | 683.10 |
| TOTAL | | | | | | 2338.85 | | | 187.77 | 2526.62 |