



ANNUAL ENVIRONMENTAL REPORT

By

Louth County Council

To

Environmental Protection Agency

For

Waste Licence Reference: W0060-03

Reporting Period January – December 2012

WHITERIVER LANDFILL SITE, COUNTY LOUTH



**WHITERIVER LANDFILL SITE
ANNUAL ENVIRONMENTAL REPORT
JANUARY – DECEMBER 2012**

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TABLE OF CONTENTS

1.0	INTRODUCTION	1
1.1	REPORT PERIOD	1
2.0	WASTE ACTIVITIES CARRIED OUT AT THE FACILITY	2
3.0	QUANTITY AND COMPOSITION OF WASTE RECEIVED AND DISPOSED OF DURING THE REPORTING PERIOD AND EACH PREVIOUS YEAR	4
4.0	CALCULATED REMAINING CAPACITY OF THE FACILITY AND YEAR IN WHICH FINALCAPACITY IS EXPECTED TO BE REACHED	6
5.0	METHODS OF DEPOSITION OF WASTE	7
6.0	SUMMARY REPORT ON EMISSIONS.....	8
6.1	EMISSIONS TO AIR.....	8
6.2	EMISSIONS TO GROUNDWATER AND SURFACE WATER.....	8
6.3	EMISSIONS TO WASTE WATER TREATMENT WORKS	9
7.0	SUMMARY OF RESULTS AND INTERPRETATION OF ENVIRONMENTAL MONITORING	10
7.1	MONITORING LOCATIONS.....	10
7.2	LEACHATE QUALITY	13
7.3	GROUNDWATER	14
7.4	QUARTERLY MONITORING PARAMETERS.....	17
7.5	ANNUAL MONITORING PARAMETERS	17
	7.5.1 Up Gradient Annual Results	17
	7.5.2 Down Gradient Annual Results.....	19
7.6	SURFACE WATER.....	20
	7.6.1 Lagoon/Surface Water Retention Pond	23
7.7	GAS MONITORING	23
7.8	MONITORING OF EMISSIONS FROM LANDFILL GAS FLARE.....	24
7.9	NOISE MONITORING.....	24
7.10	DUST MONITORING.....	26
7.11	METEOROLOGICAL MONITORING	26
7.12	SLOPE STABILITY ASSESSMENT	26
7.13	ODOUR MONITORING.....	27
8.0	RESOURCES AND ENERGY CONSUMPTION SUMMARY.....	28
9.0	PROPOSED DEVELOPMENT OF THE FACILITY AND TIMESCALE OF SUCH DEVELOPMENT.....	29
10.0	VOLUME OF LEACHATE PRODUCED AND VOLUME OF LEACHATE TANKERED OFF SITE.....	30

11.0	REPORT ON DEVELOPMENT WORKS UNDERTAKEN DURING THE REPORTING PERIOD, AND A TIMESCALE FOR THOSE PROPOSED DURING THE COMING YEAR ..	31
11.1	RESTORATION OF COMPLETED CELLS/PHASES	31
11.2	REPORT ON DEVELOPMENT WORKS UNDERTAKEN DURING THE REPORTING PERIOD	31
11.3	TIMESCALE FOR DEVELOPMENT WORKS PROPOSED DURING THE COMING YEAR.....	31
12.0	SITE SURVEY SHOWING EXISTING LEVELS OF THE FACILITY AT THE END OF THE REPORTING PERIOD	32
13.0	ESTIMATED ANNUAL AND CUMULATIVE QUANTITIES OF LANDFILL GAS (LFG) EMITTED FROM THE SITE.....	33
14.0	ESTIMATED ANNUAL AND CUMULATIVE QUANTITY OF INDIRECT EMISSIONS TO GROUNDWATER.....	34
15.0	ASSESSMENT OF THE FEASIBILITY OF THE UTILISATION OF LANDFILL GAS AS AN ENERGY RESOURCE.....	35
16.0	MONTHLY WATER BALANCE CALCULATION AND INTERPRETATION	36
17.0	SCHEDULE OF ENVIRONMENTAL OBJECTIVES AND TARGETS FOR THE FORTHCOMING YEAR	37
17.1	SCHEDULE OF ENVIRONMENTAL OBJECTIVES AND TARGETS FOR THE FORTHCOMING YEAR	37
17.2	REPORT ON THE PROGRESS TOWARDS ACHIEVEMENT OF THE ENVIRONMENTAL OBJECTIVES AND TARGETS CONTAINED IN THE PREVIOUS YEARS REPORT	37
18.0	FULL TITLE AND A WRITTEN SUMMARY OF ANY PROCEDURES DEVELOPED BY THE LICENSEE IN THE YEAR, WHICH RELATES TO THE FACILITY OPERATION	38
19.0	REPORTED INCIDENTS AND COMPLAINTS SUMMARIES, CORRESPONDENCE TO/FROM EPA	39
20.0	REVIEW OF NUISANCE CONTROLS	41
20.1	DUST CONTROL	41
20.2	LITTER	41
20.3	BIRDS	41
20.4	ODOURS.....	42
21.0	REPORT ON FINANCIAL PROVISIONS MADE UNDER THIS LICENSE, MANAGEMENT AND STAFFING STRUCTURE OF THE FACILITY AND A PROGRAMME FOR PUBLIC INFORMATION.....	43
22.0	OTHER INFORMATION	45
22.1	REPORT ON TRAINING OF STAFF TRAINING	45
22.2	TANK, PIPELINE AND BUND TESTING AND INSPECTION REPORT	45
22.3	UPDATES TO LANDFILL ENVIRONMENTAL MANAGEMENT PLAN (LEMP).....	45
22.4	REVIEW OF ENVIRONMENTAL LIABILITIES	45
22.5	REPORT ON WASTE RECOVERY.....	45
22.6	STATEMENT OF COMPLIANCE OF FACILITY WITH ANY UPDATES OF THE RELEVANT WASTE MANAGEMENT PLAN.....	46

22.7	STATEMENT ON THE ACHIEVEMENT OF THE WASTE ACCEPTANCE AND TREATMENT
	OBLIGATIONS.....	46

LIST OF FIGURES

Figure 21.1	Management Structure at Whiteriver Landfill Site.....	44
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LIST OF TABLES

Table 2.1	Maximum Annual Tonnage	2
Table 3.1	Waste Quantities Accepted (tonnes).....	4
Table 3.2	Total Waste Quantities Accepted (Tonnes) for Disposal for January to December 2012	5
Table 3.3	Total Waste Quantities Accepted (Tonnes) for Recovery for January to December 2012	5
Table 4.1	Minimum Practicable Cell Capacities of Remaining Cells.....	6
Table 6.1	Net Methane Emission	8
Table 7.1	Grid References of Monitoring Points.....	10
Table 7.2	Location of Groundwater Monitoring Boreholes.....	12
Table 7.3	Treated Leachate Concentrations in 2012.....	13
Table 7.4	Groundwater Parameters Monitoring Frequencies as per W0060-03.....	14
Table 7.5	Summary of 2012 Results from Groundwater Monitoring Boreholes	16
Table 7.6	Surface Water Parameters Monitoring Frequencies.....	20
Table 7.7	Summary of 2012 Results from Surface Water Locations	21
Table 7.8	Results from Dust Monitoring Analysis, Whiteriver Landfill Site.....	26
Table 8.1	Consumption of Resources	28
Table 10.1	Volume of Leachate Transported Off Site in 2012.....	30
Table 19.1	Complaints Summary	39
Table 19.2	Summary of Incidents Reported During the Reporting Period	39
Table 19.3	Summary of Non Compliances and Audit Observations noted during Audits/Landfill Site Inspections undertaken during the Reporting Period by EPA	40
Table 21.1	Landfill Charges	43
Table 22.1	Recovered Wastes	45

LIST OF APPENDICIES

Appendix A	Sludge Analysis
Appendix B	Drawings
Appendix C	PRTR Reporting
Appendix D	Flue Gas Monitoring
Appendix E	Monthly Water Balance Calculation
Appendix F	Leachate Results
Appendix G	Groundwater Monitoring Results
Appendix H	Surface Water Monitoring Results
Appendix I	Gas Monitoring Results
Appendix J	Slope Stability Assessment
Appendix K	Estimated Annual Gas Yield
Appendix L	Objectives and Targets

1.0 INTRODUCTION

Louth County Council holds a Waste Licence from the Environmental Protection Agency to operate Whiteriver landfill Site. This report provides a review of all data collected and the environmental aspects of operations at the site for the year 2012.

The site is located 1 km north of the main R169 Collon Rd at its junction with Whiteriver Cross, Co Louth. The facility is located in a rural setting at grid references O301450E 285625N in the townlands of Whiteriver. The northern and western boundaries adjoin two minor roads which serve scattered dwellings, whilst agricultural grazing lands adjoin the southern and eastern boundaries. The main access to the site is situated on the north western site boundary, immediately off the principle approach road. Louth County Council is the sole landowners of the site on which the landfilling activity is based.

The current waste licence (W0060-03) was issued on the 24th March 2010.

1.1 REPORT PERIOD

The report period for this Annual Environmental Report (AER) is from January to December 2012 and relates to the waste licence (W0060-03).

2.0 WASTE ACTIVITIES CARRIED OUT AT THE FACILITY

In accordance with Condition 5 of the waste licence only those waste types and quantities of waste listed in the Schedule shall be disposed of at the facility unless the prior agreement of the Agency has been obtained. The maximum annual tonnage of individual waste types for disposal is listed in the Schedule of the Waste Licence and total is as follows;

Table 2.1 Maximum Annual Tonnage

Total (Tonnes per annum)	(W0060-03)
Total	96,000

* As from September 2003

The licence waste disposal activities in accordance with the Third Schedule of the waste Management Act, 1996 are restricted to those listed as follows:

- Class 1:** Deposit on, in or under land (including landfill).
- 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 discrete cells which are capped and isolated from one another and the environment.
- Class 6:** Biological treatment not referred to elsewhere in this Schedule which results in Final compounds or mixtures which are disposed of by means of any activity referred to in paragraphs 1 to 10 of this Schedule.
- Class 7:** Physio-chemical treatment not referred to elsewhere in this Schedule (including evaporation, drying and calcination), which results in Final compounds or mixtures which are disposed of by means of any activity referred to in paragraphs 1 to 10 of this Schedule.
- Class 12:** Repacking prior to submission to any activity referred to in a preceding paragraph of this schedule.
- 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 is produced.

The licence waste disposal activities (W0060-03), in accordance with the Fourth Schedule of the Waste Management Act, 1996 are restricted to those listed as follows;

Class 2 Recycling or reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes): This activity is limited to the use of compost or similar material in the restoration of the landfill.

Class 4 Recycling or reclamation of other inorganic materials: This activity is limited to the use of soil, subsoil and construction and demolition waste for daily cover, engineering works and the restoration of cells at the facility.

Class 9 Use of any waste principally as a fuel or other means to generate energy: This activity is limited to the use of landfill gas as a fuel for the generation of electricity/ energy.

Class 10 The treatment of any waste on land with a consequential benefit for an agricultural activity or ecological system: This activity is limited to the use of various suitable wastes as daily or intermediate cover and in the restoration of the landfill, subject to the agreement of the Agency.

Class 13 Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced: This activity is limited to the storage of soil, subsoil and construction and demolitions wastes at the facility prior to recovery / reuse at the facility.

Access to site is controlled by the Site Foreman and Weighbridge Operator. All persons availing of the site must report to the site office at the time of entering and / or leaving the landfill site. Access is restricted to those times when the staff is on duty and the site is secured to prevent unauthorised entry.

3.0 QUANTITY AND COMPOSITION OF WASTE RECEIVED AND DISPOSED OF DURING THE REPORTING PERIOD AND EACH PREVIOUS YEAR

The quantities of waste accepted for disposal at the facility on a yearly basis are shown in Table 3.1.

Table 3.1 Waste Quantities Accepted (tonnes)¹

Waste	1996*	1997*	1998*	1999*	2000*	2001	2002	2003
Total	25,110	20,940	20,000	15,066	31,500	37,146	25,776	36,006
Waste	2004	2005	2006	2007	2008	2010	2011	2012
Total	60,833	80,634	82,547	70,396	84,402	53,744	75,243	89,290

Waste data figures are currently derived from weighbridge readings. Records of quantities, EWC code and type of waste accepted for disposal and recovery at the facility are maintained at the landfill site. These figures for 2012 are shown in Table 3.2 and Table 3.3. A CEN 10.1 Stage Batch Test has been carried out on water treatment sludge received at the facility from Urban Water Schemes (Cavanhill and Staleen). These results are presented in Appendix A.

¹ Figures for 1996 to 2000 are the estimated annual waste inputs (tonnes). Waste data figures were estimated by means of assessment based on the category of vehicle depositing waste at the site.

Table 3.2 Total Waste Quantities Accepted (Tonnes) for Disposal for January to December 2012²

Waste description	Quantity waste recovered at the landfill (tonnes)	EWC code	Quantity waste recovered at the landfill (tonnes)
mixed packaging		15 01 06	19.46
bottom ash and slag other than those mentioned in 19 01 11	Incinerator Bottom ash	19 01 12	39,744
screenings	Sewage screenings	19 08 01	735
sludges from treatment of urban waste water	Water treatment sludges	19 08 05	1,489
other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11	Organic fines from trommelling MSW	19 12 12	80.18
mixed municipal waste		20 03 01	46138.49
street-cleaning residues	Road sweepings	20 03 03	723
bulky waste	Bulky waste from clearing out houses	20 03 07	362
Total			89,290

Table 3.3 Total Waste Quantities Accepted (Tonnes) for Recovery for January to December 2012

Waste description	Quantity waste recovered at the landfill (tonnes)	EWC code	Quantity waste recovered at the landfill (tonnes)
mixture of concrete, bricks, tiles and ceramics other than those mentioned in 17 01 06	C&D	17 01 07	9,481.32
soil and stones other than those mentioned in 17 05 03	soils used as cover	17 05 04	1,354.68
wood other than that mentioned in 19 12 06	Wood chip	19 12 07	299.14
other wastes (including mixtures of materials) from mechanical treatment of wastes other than those mentioned in 19 12 11	C&D Fines for cover material	19 12 12	41,643.66
wood other than that mentioned in 20 01 37	Wood chip	20 01 38	1,120.00
Total			53,898

² As per EPA Waste Survey Part 3 2012

4.0 CALCULATED REMAINING CAPACITY OF THE FACILITY AND YEAR IN WHICH FINAL CAPACITY IS EXPECTED TO BE REACHED

The Capacity of Phase V is approximately 600,000 m³ and is divided into three cells. The development of Phase 5 received planning permission in 2003 and was licensed in Waste Licence W0060-03 in 2003 to fill 96,000 tonnes per annum. The breakdown of the remaining sub-cells capacity within Phase V is provided in Table 4.1 below. Filling is currently being undertaken in Phase V, Cell 1A and 1B. Phase VI at the facility will not be developed and the site will close when Phase V reaches capacity.

Table 4.1 Minimum Practicable Cell Capacities of Remaining Cells

Cell	Total Waste to Final Contour Level	Area m ²	Years
Cell 1A	80,700	10,083	0.84
Cell 1B	118,900	323	1.23

A Topographical survey has been carried out in April 2012 (Drawing Number RW120419) and is including in Appendix B. At present (end of March 2013) there is approximately 36,000 m³ of void space remaining

5.0 METHODS OF DEPOSITION OF WASTE

Waste is only accepted at the landfill facility between 8.30am to 4.00pm Monday to Thursday, 8.30am to 3.00pm Friday and 8.30am to 12.30pm Saturday during November through to February. Between March and October, waste is accepted at the landfill between 8.00am to 4.00pm Monday to Thursday, 8.00am to 3.00pm Friday and 8.30am to 12.30pm Saturday.

Waste was filled in Phase 5, Cell 1A and 1B during 2012.

All acceptable waste loads are directed to the active tip face where the waste is in filled, within a designated area, under the direction of the general operative and machine driver. The waste is inspected and if acceptable for disposal spread and compacted directly by the steel wheeled compactor.

Daily cover consists of construction and demolition fines, wood chip, and soils

6.0 SUMMARY REPORT ON EMISSIONS**6.1 EMISSIONS TO AIR**

In accordance with The PRTR Regulations releases of pollutants and off site transfers of waste by facilities operating in relevant industrial sectors are to be reported by the EPA to the European E-PRTR website where the facility exceeds specified thresholds. This has been completed for Whiteriver landfill site and included in Appendix C.

There are two landfill gas flares in operation at Whiteriver landfill site. Based on model predications and information from the landfill gas flares the estimated net emission of methane from the flare combustion process and both surface and lateral emissions from the landfill body is -17,032 kg/year as shown on Table 6.1. Temporary capping with LLDPE, extension of the landfill gas extraction system and increased extraction of landfill gas has been undertaken due to odour problems on site.

Other emissions include:

- Carbon dioxide (CO₂)
- 1,1,1-trichloroethane
- Hydro-fluorocarbons (HFCs)

Table 6.1 Net Methane Emission

Quantities of Methane Flared and / or Utilised	T (Total) kg/Year
Total estimated methane generation (as per site model)	2,810,068.0
Methane flared	2,827,100.0
Methane utilised in engine/s	0.0
Net Methane Emission	-17,032.0

Flue gas monitoring was also undertaken on the permanent landfill gas flares. All monitoring was carried out in accordance with Environmental Protection Agency Office of Environmental Enforcement (OEE) Air Emission Monitoring Guidance Note 2 (AG2). These results are provided in Appendix D. NO_x as NO₂, CO, TOC, HCL and HF emissions from both flares were within the emission limit values specified in Waste licence W060-03.

6.2 EMISSIONS TO GROUNDWATER AND SURFACE WATER

There are no direct discharges to groundwater or surface water. The volume of leachate transported off site to Drogheda wastewater treatment plant during the period January to December 2012 is 30,436. A water balance calculation has been undertaken and is included in Appendix E using rainfall data from metrological station on the site. This estimates the annual leachate production to be approximately 21,305 m³.

6.3 EMISSIONS TO WASTE WATER TREATMENT WORKS

The volume of leachate transported off site to Drogheda wastewater treatment plant during the period January to December 2012 was 30,436 m³.

7.0 SUMMARY OF RESULTS AND INTERPRETATION OF ENVIRONMENTAL MONITORING**7.1 MONITORING LOCATIONS**

Monitoring is carried out at locations and at frequencies as specified in Schedule D of the waste licence (W0060-03). Monitoring points are labelled and permanent access to all monitoring points is maintained. BH13A was re drilled and BH20 was installed as a groundwater water borehole to detect leakages of the lagoon in June 2006. Private wells BH15 (Taffes), BH16 (Byrnes), and BH18 (Taffes) have been decommissioned and are no longer monitored as part of the licence requirements.

All ditches and drains around the perimeter of the facility are kept clear to allow for surface water monitoring points to be maintained.

Monitoring points are detailed in Drawings No.IBL0069/101D,102A and Drawing IBR0138/100 Landfill Gas piezometer. The monitoring point grid references for those available are detailed in Table 7.1. The locations of groundwater monitoring boreholes are shown in Table 7.2.

Table 7.1 Grid References of Monitoring Points

Monitoring Points of Groundwater Boreholes	Easting	Northing
BH1	301 385	285 310
BH2	301 259	285 380
BH3	301 384	285 501
BH4	301 405	285 648
BH5A	301737	285541
BH6	301 856	285 480
BH7	301 740	285 438
BH8	301 588	285 302
BH9	301 944	285 348
BH10	301 824	285 117
BH11	302 045	285 105
BH12	301 943	285 356
BH13(redrilled)	301 824	285 126
BH14	302 045	285 119
BH15	302 124	284 920
BH16	301 715	285 300
BH17	301 293	285 180
BH18	302 102	284 887
BH19	301490	285650

Monitoring Points of Groundwater Boreholes	Easting	Northing
BH20	301 428	285 623
Surface Water Monitoring		
SW1	301 384	285 424
SW2A	301 965	285 427
SW3	301 935	285 410
Gas Piezometers		
PZ1	301 438	285 596
PZ2	301 454	285 614
PZ3	301 496	285 628
PZ4	301 542	285 624
PZ5	301 600	285 610
PZ6	301 603	285 552
PZ7	301 603	285 512
PZ8	301 601	285 463
PZ9	301 594	285 401
PZ11	301 383	285 333
PZ12	301 382	285 381
PZ13	301 382	285 441
PZ14	301 383	285 498
PZ15	301 385	285 563
PZ16	301 410	285 579
PZ21	301 385	285 289
PZ22	301 377	285 205
PZ23	301 459	285 200
PZ24	301 490	285 201
PZ25	301 586	285 219
PZ26 PZ54	Not available	
Noise		
N1	301 336	285348
N2	135 907	270 000
N3	301345	284 739
N4	302105	284 927
N5	302 723	285 258
N6	301409	285 598
Dust		
DG1	301 395	285 372

Monitoring Points of Groundwater Boreholes	Easting	Northing
DG2	301 596	285 374
DG3	301 960	285 421
DG4	302 058	285 043
DG5	301 648	285584
DG6	301834	285486
Leachate		
L1	301 427	285 625
L2	301 405	285 495

Table 7.2 Location of Groundwater Monitoring Boreholes

Borehole ³	Upstream/Downstream	Private Well	Overburden or Bedrock
BH1	Upstream		Overburden
BH2A	Upstream	Crawleys Private Well	Bedrock
BH3	Upstream		Bedrock
BH4	Upstream		Bedrock
BH5	Downstream		Overburden
BH6	Downstream		Bedrock
BH9	Downstream		Bedrock
BH10	Downstream		Overburden
BH11	Downstream		Overburden
BH12	Downstream		Overburden
BH13A	Downstream		Bedrock
BH14	Downstream		Bedrock
BH17	Downstream	Holcrofts Private Well	Domestic
BH19	Upstream	McGranes Private Well	Agricultural water supply
BH20	Upstream landfill down gradient of leachate lagoon		Overburden

³ Private wells BH15 (Taffes), BH16 (Byrnes), and BH18 (Taffes) have been decommissioned and are no longer monitored as part of the licence requirements.

7.2 LEACHATE QUALITY

Leachate results are shown in Appendix F. Leachate values recorded in the lagoon (treated leachate) are within the emission limit values as set out in the waste licence except for Sulphate which exceeded the limit of 250 mg/l in April and COD in July.

Table 7.3 Treated Leachate Concentrations in 2012

Parameter	Min. Conc	Max. Conc	Limit Value
Ammonia (mg/N)	284.71	541.28	900
BOD (mg/l)	18.5	344	500
COD (mg/l)	595	1950	1,500
Sulphate (mg/l)	107.3	666.6	250
Temperature (°C)	9	12	<25°C
pH (pH units)	8.3	8.5	6 – 9

7.3 GROUNDWATER

As required under the Waste Licence, groundwater monitoring has been undertaken at the borehole locations as set out in the current waste licence. The Schedules of the waste licence requires the monitoring of certain parameters on either a monthly, quarterly or annual basis; the frequencies of the monitoring of groundwater parameters are shown in Table 7.4.

Boreholes BH1, BH3 BH4, BH5A are located within the site boundary, whilst BH6 is located approximately 240m from the eastern boundary of the site. BH2A (Crawleys) is a private well located upstream of the facility. BH9, BH10, BH11, BH12, BH13A and BH14 were installed further downstream of the extension to the existing site. Monitoring is also undertaken at two private wells. These private wells are boreholes BH17 (Holcrofts) and BH19 (McGranes, Agricultural Water Supply).

Table 7.4 Groundwater Parameters Monitoring Frequencies as per W0060-03

Monthly	Quarterly	Annually	
Groundwater Level	Chloride	Metals /Non Metals	List I and II Substances
	Dissolved Oxygen	Cyanide	Residue on evaporation
	pH	Fluoride	
	Total Oxidised Carbon	Total Oxidised Nitrogen	
	Visual Inspection/ Odour	Total Alkalinity	
	Ammoniacal Nitrogen	Orthophosphate	
	Electrical Conductivity	Mercury	
	Temperature	Sulphate	

The results contained in this report are assessed as follows:

- Groundwater:** Assessed against Whiteriver Trigger Levels (WTL) agreed with the EPA (21 December 2004, 60-2/GEN09EM), EPA Interim guideline values (IGV) and the SI. No. 9/2010 European Communities Environmental Objectives (Groundwater) Regulations 2010 (ECEO).
- Total pesticides** means the sum of all individual pesticides detected and quantified in the course of the monitoring procedure. The parametric value 0.50ug/l. (Only those pesticides which are likely to be present in a given supply require to be monitored. "Pesticides" means— — organic insecticides, — organic herbicides,— organic fungicides, —organic nematocides, — organic acaricides, — organic algicides, —

organic rodenticides, — organic slimicides, — related products (*inter alia*, growth regulators) and their relevant metabolites, degradation and reaction products. The parametric value of 0.01µg/l applies to each individual pesticide. In the case of aldrin, dieldrin, heptachlor and heptachlor epoxide the parametric value is 0.030µg/l.

- **Polycyclic aromatic hydrocarbons** parametric value is 0.10ug/l. This applies to the sum of hydrocarbons concentrations of specified compounds. The specified compounds are benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene and indeno(1,2,3-cd)pyrene.
- **Total trihalomethanes** are the sum of concentrations of specified compounds. The parametric value is Trihalomethanes - Total Sum of 100 µg/l. The specified compounds are: chloroform, bromoform, dibrom-ochloromethane and bromodichloromethane

The results are presented graphically and in table format in Appendix G. The majority of parameters are below the recommended limits.

Parameters that are indicative of possible leachate contamination include Ammonia, Conductivity, Iron, Chloride and heavy metals.

Table 7.5 provides a summary of results in 2012 from groundwater monitoring boreholes throughout these monitoring periods.

Table 7.5 Summary of 2012 Results from Groundwater Monitoring Boreholes

	Units	No. of Samples	Minimum	Maximum	Mean	Standard Deviation
Alkalinity	mg/lCaCO3	15	232	408	310	43
Aluminium	µg/l	16	<5	<5		
Ammonia	mg/l N	60	0.03	0.61	0.11	0.11
Antimony	µg/l	45	<0.5	<0.5		
Arsenic	µg/l	45	0.5	0.73	0.63	0.10
Barium	µg/l	45	0.6	242	107	82
Beryllium	µg/l	45	<0.5	<0.5		
Boron	µg/l	45	10.1	210.1	34	52
Cadmium	µg/l	45	<0.1	<0.1		
Calcium	mg/l Ca	45	53.79	139.21	83	21
Chloride	mg/l Cl	60	13	60	21	11
Chromium	µg/l	45	<0.5	<0.5		
Cobalt	µg/l	45	<0.5	0.9		
Coliform Bacteria	No/ml	17	0	34	11	0
Conductivity	µS/cm @ 25	60	538	1160	695	69
Copper	µg/l	45	0.5	17.2	3	5
Cyanide	0	15	<0.05	<0.05		
D.O.	% Saturation	60	10	98	47	20
E. Coli	no/100ml	18				
Fluoride	mg/l	31	<0.150	1		
Iron	µg/l	45	<10	123.7		
Lead	µg/l	45	<0.5	<0.5		
Magnesium	mg/l Mg	45	7.91	46.35	21	10
Manganese	µg/l	45	2.1	252.3	65	99
Mercury	µg/l	43	<0.05	<0.05		
Molybdenum (µg/l)	0	44	<0.5	3.8		
Nickel	µg/l	43	<0.5	2.6		
Ortho-Phosphate	mg/l P	15	<0.02	0.11		
pH	0	60	6.8	8.1	7.48	0.23
Potassium	mg/l	45	0.46	3.18	1.41	1.41
Residue on evap	mg/l	15	303	1642	577	379
Selenium	µg/l	45	<0.5	<0.5		
Sodium	mg/l	45	8.53	43.12	20.38	8.47
Strontium	µg/l	45	143.55	447.74	227	73
Sulphate	0	31	3.3	55.6	16	14
Temp	°C	60	8	15.4	11.00	0.89
Thallium	µg/l	45	<0.1	<0.1		
Tin	µg/l	44	1.89	2.8	2.42	2.42
T.O.C.	mg/l	60	1.5	109	33	38
T.O.N	mg/l N	44	0.14	1.4	0.52	0.52
Uranium	µg/l	42	0.64	5.67	2.20	1.62
Vanadium	µg/l	42	<0.5	0.98	0.81	0.24
Zinc	µg/l	31	1.9	188.3	19	48

7.4 QUARTERLY MONITORING PARAMETERS

All Ammonia concentrations during the reporting period were within the WTL agreed with the EPA of 0.2 mg/l N and the ECEO of 0.175 mg/l N with the exception of BH9 (0.18 mg/l N), BH10 (0.61 mg/l N), BH11 (0.21 mg/l N), BH12 (0.30 mg/l N), and BH14 (0.29 mg/l N) in October. These had all reduced to below the WTL and ECEO in January, 2013.

pH values analysed during the reporting period were all within the WTL of 7.0 to 8.0 with the exception of BH5 (8.1) in January and BH12 (6.8) in October.

Electrical Conductivity values do not exceed the WTL of 800 $\mu\text{S}/\text{cm}$ with the exception of:

- BH10 (825 -850 $\mu\text{S}/\text{cm}$) April, July, October.
- BH11 (835 $\mu\text{S}/\text{cm}$) in October
- BH12 (range 865-1160 $\mu\text{S}/\text{cm}$) April, July, October.

BH12 exceeds the IGV of 1000 $\mu\text{S}/\text{cm}$ but not ECEO of 800-1875 $\mu\text{S}/\text{cm}$.

Chloride levels are in exceedances of the WTL of 20 mg/l in borehole BH1 in the up-gradient boreholes (range 30 mg/l to 33 mg/l) throughout the year. Downstream of the site the Chloride WTL level has been exceeded in BH5, BH10, BH12, BH13A, and BH17 throughout the monitoring period and range from 21 to 60 mg/l Cl. The highest concentration was in BH5 in January. This reduced to 28 mg/l in April. The results are all below the ECEO of 187.5 mg/l.

Chloride WTL level has been exceeded in BH20 throughout the monitoring period and range from 36 to 40 mg/l Cl. This is adjacent to the leachate lagoon.

Dissolved oxygen ranges from 10% O_2 to 98% O_2 .

All boreholes exceeded the WTL for TOC of 10 mg/l in April. TOC levels were all below WTL of 10 mg/l for the remaining monitoring quarters during the year except BH10 and BH12 at times.

7.5 ANNUAL MONITORING PARAMETERS

7.5.1 Up Gradient Annual Results

Annual analysis for List I and II substances, metals and non-metals were undertaken at one location upstream of the site in BH2A in April.

Aluminium, Antimony Arsenic Beryllium, Boron Cadmium, Calcium, Chromium, Cobalt Copper, Fluoride, Iron, Lead, Magnesium, Manganese Mercury, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Sulphate, Thallium, Vanadium and Zinc are below the

WTL, IGV, DWR and ECEO were comparable in all up-gradient boreholes. The remaining parameters are below the lower limits of detection.

Barium exceeds the IGV in BH1. Cyanide concentration of <0.05 mg/l was detected in all up-gradient boreholes. This concentration is the lowest limit of detection for the methodology used for cyanide; therefore this could be lower than the WTL and IGV of 0.01 mg/l. The results are below the DWR of 0.05 mg/l.

Orthophosphate forms are produced by natural processes, but major man-influenced sources include: partially treated and untreated sewage, runoff from agricultural sites and application of some lawn fertilisers. BH3 is above the WTL and IGV of 0.03mg/l.

Strontium concentrations range from 144.19 µg/l to 280.04 µg/l, Tin concentrations range from <1 to 2.8 µg/l and Uranium concentrations range from 0.64 to 2.23 µg/l in the up gradient boreholes.

Annual analysis for Total Oxidised Nitrogen (TON) values upstream range from 0.2 mg/l to 1.06 mg/l. Alkalinity values upstream range from 272 mg/l to 340 mg/l.

The Drinking Water Regulation for Polycyclic Aromatic Hydrocarbon (PAH) is 0.1 ug/l and is the sum of concentrations of specified compounds. The specified compounds are benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene and indeno(1,2,3-cd)pyrene. Analysis for Polycyclic Aromatic Hydrocarbons (total 16 EPA PAHs) was <0.247 µg/l. All parameters measured were less than the limits of detection. This concentration is the limit of detection for the methodology used and as a result could be below the DWR of 0.1µg/l for PAH.

All other compounds measured were all less than the lower detection limit for the methodology used.

Phenol concentration was also analysed at BH2A and is <0.025 mg/l. This concentration is the limit of detection for the methodology used for Phenol however this is higher than the IGV of 0.5µg/l.

Pesticide and herbicide analysis was carried out in BH2A in April. The results were below the lower detection limit for the analytical methodology.

Semi volatiles organic compound parameters were either below the IGV for those comparable or were below the lower detection limit for the analytical methodology used.

7.5.2 Down Gradient Annual Results

Annual analysis for List I and II substances, metals and non-metals were undertaken at two locations downstream of the site in BH9 and BH14 in April.

Aluminium, Antimony Arsenic Beryllium, Boron Cadmium, Calcium, Chromium, Cobalt Copper, Fluoride, Iron, Lead, Magnesium, Mercury, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Sulphate, and are below the WTL, IGV, DWR and ECEO) were comparable in all down -gradient boreholes. The remaining parameters are below the lower limits of detection.

Barium exceeds the IGV in a number of the downstream boreholes. Cyanide concentrations of <0.05 mg/l was recorded in all the downstream boreholes. These concentrations are lower limit of detection for the methodology used for Cyanide; however these are possibly higher than the WTL and IGV (0.01mg/l). These reading are below the DWR of 0.05mg/l.

Orthophosphate values downstream range from <0.02 mg/l to 0.11 mg/l. BH6 (0.04 mg/l) and BH13A (0.11 mg/l) are the only down-gradient borehole above the WTL and IGV of 0.03 mg/l.

All down-gradient boreholes (in overburden and bedrock) are below the IGV and DWR of 50µg/l for Manganese except for BH6 (252.3 µg/l), BH13A (225.4 µg/l), and BH17 (204 µg/l).

Strontium concentrations range from 143.5 µg/l to 447.74 µg/l, Tin concentrations range from <1 to 2.77 µg/l, Uranium concentrations range from 0.70 to 5.67 µg/l and Vanadium concentrations range from <0.5 to 0.98 µg/l in the down gradient boreholes. These are in general higher in concentration than up gradient.

Zinc concentrations exceed the WTL of 100µg/l and the IGV of 0.1mg/l in BH17 (188.3 µg/l). Down gradient, annual analysis for TON values range from <0.08 mg/l to 1.40 mg/l. Alkalinity values down-stream range from 232 mg/l to 408 mg/l.

Analysis for Polycyclic Aromatic Hydrocarbons (total 16 EPA PAHs) was <0.247 µg/l. All parameters measured where less than the limits of detection. This concentration is the limit of detection for the methodology used and as a result could be below the DWR of 0.1µg/l for PAH.

Phenols concentrations were also analysed at BH9 and BH14 and were all <0.025 mg/l. This concentration is the limit of detection for the methodology used for Phenol however this is higher than the IGV of 0.5µg/l.

Pesticides analysis was carried out in BH9 and BH14 for this monitoring period. The results were all below the limit of detection for the analytical methodology used.

Semivolatiles organic compound parameters were either below the IGV for those comparable or were below the lower detection limit for the analytical methodology used.

7.6 SURFACE WATER

Whiteriver landfill site is situated on a plateau and is located in a sub-catchment of one of the main tributaries of the White River. The White River is located approximately 4km south west of the site and it is this river, which is the main receptor for any potential surface water contamination from the site.

As required under the Waste Licence, surface water monitoring has been undertaken at the station locations as set out in Table D.1.1 of the waste licence. Schedule D of the waste licence requires the monitoring of certain parameters on either a monthly, quarterly or annual basis; the frequencies of the monitoring of surface water parameters are shown in Table 7.6 below.

Table 7.6 Surface Water Parameters Monitoring Frequencies

Quarterly	Annually
Ammoniacal Nitrogen	Metals / non metals
Biological Oxygen Demand	Mercury
Chemical Oxygen Demand	Sulphate
Chloride	Total Alkalinity
Dissolved Oxygen	Orthophosphate
Electrical Conductivity	TON
Ph	
Total Suspended Solids	
Temperature	

The results contained in this report are assessed against the EC (Drinking water) Regulations 2007, SI .no 106 of 2007 (DWR) and European Communities Environmental Objectives (Surface Water) Regulations 2009 Environmental quality standard (EQS) and the Surface Water Quality Standards (SWQS) laid out in the European Communities Quality of Surface Water Intended for the Abstraction of Drinking Water Regulations 1989. These results are presented in table format in Appendix H.

Table 7.7 provides a summary of results in 2012 from surface water locations.

Table 7.7 Summary of 2012 Results from Surface Water Locations

	Units	No. of Samples	Minimum	Maximum	Mean	Standard Deviation
Alkalinity	mg/lCaCO3	3	135	280	211.67	72.86
Aluminium	µg/l	3	13.9	15.8	14.97	0.97
Ammonia	mg/l N	12	0.03	5.84	1.17	1.78
Antimony	µg/l	3	<0.5	0.56		
Arsenic	µg/l	3	1.35	2.06	1.63	0.38
Barium	µg/l	3	66.1	105.8	86.03	19.85
Beryllium	µg/l	3	<0.5	<0.5		
B.O.D.	mg/l O2	12	2.1	174.7	24.68	53.11
Boron	µg/l	3	19.7	30.3	23.37	6.01
Cadmium	µg/l		<0.1	<0.1		
Calcium	mg/l Ca	9	69.86	91.46	83.78	12.08
C.O.D.	mg/l O2	12	12	266	65.33	74.15
Chloride	mg/l Cl	12	19	47	29.42	8.16
Chromium	µg/l	3	<0.5	<0.5		
Cobalt	µg/l	3	<0.5	<0.5		
Conductivity	µS/cm @ 25	12	506	745	618.08	78.29
Copper	µg/l	3	2	2.3	2.13	0.15
D.O.	% Saturation	12	43	112	74.08	18.27
Iron	µg/l	3	20	98	58.97	39.00
Lead	µg/l	3	<0.5	<0.5		
Magnesium	mg/l Mg	3	9.01	10.73	9.97	0.88
Manganese	µg/l	3	68.7	134.2	103.90	33.02
Mercury	µg/l	3	<0.05	<0.05		
Molybdenum (µg/l)	0	3	<0.5	2.2	1.55	0.92
Nickel	µg/l	3	1.5	2	1.70	0.26
Ortho-Phosphate	mg/l P	3	<0.02	0.14	0.09	0.07
pH	0	12	7.4	8.3	7.93	0.29
Potassium	mg/l	3	3.23	8.15	5.47	2.49
Selenium	µg/l	3	<0.5	<0.5		
Sodium	mg/l	3	15.26	20.34	18.12	2.60
Strontium	µg/l	3	151.61	171.79	164.63	11.30
Sulphate	mg/l SO4	3	22.9	103.8	60.57	40.74
Temp	°C	12	7	17	12.00	3.20
Thallium	µg/l	3	<0.1	<0.1		
Tin	µg/l	3	<1	<1		
T.O.N	mg/l N	3	0.14	1.77	1.11	0.86
Total Suspended Solids	mg/l	12	5	93	28.30	31.15
Uranium	µg/l	3	0.55	1.24	0.95	0.36
Vanadium	µg/l	3	<0.5	0.51		
Zinc	µg/l	3	2.3	2.5	2.40	0.10

Surface water monitoring is undertaken at one location upstream at SW1 and one location downstream of the site at SW2A. Chemical analyses of surface water are summarised in Appendix H.

SW1 has a pH reading of 7.8 to 8.2 which is within the A1 SWQS of 5.5 to 8.5.

The Ammonia concentration at SW1 ranged from 0.32 mg/l N to 2.69 mg/l N. An excess of 0.1 mg/l N can indicate agricultural contamination. Downstream samples of Ammonia (SW2A) were elevated at times (0.03 mg/l N to 5.84 mg/l N). These are in general lower in concentration throughout the year than the upstream samples except in July.

Dissolved Oxygen (DO) content ranged from 43% to 77 %O₂ in SW1 and 66% to 88% O₂ in SW2A.

COD show lower concentrations down-stream (28 mg/l - 68 mg/l) from the site than those measured in the up-stream samples (46 mg/l - 266 mg/l) indicating possible contamination up-stream of the site. BOD also showed lower concentrations down-stream (2.1 mg/l – 22.6 mg/l) from the site than those measured in the up-stream samples (4.9 mg/l – 174.7 mg/l).

Total Suspended Solids (TSS) exceeds the 1989 Surface Water Quality Standards (SWQS) of 50 mg/l during the monitoring period at SW1 on 3 of the 4 monitoring rounds.

Electrical Conductivity is below the SWQS of 1000µS/cm during the monitoring period.

Annual Results SW1

Arsenic Barium Boron, Cadmium Chromium, Copper, Lead, Mercury Nickel, Sulphate and Zinc are below the SWQS or EQS.

Iron had a concentration of 98 µg/l fitting into the A1 SWQS classification of 200µg/l. Manganese fits into the A2 SWQS classification of 300µg/l with a reading of 108.8 µg/l.

Other parameters were Total Alkalinity (280 mg/l), Calcium (91.46 mg/l), Magnesium (10.17 mg/l), Molybdenum (<0.5 µg/l), Ortho-phosphate (0.14 mg/l), Potassium (8.15 mg/l), Sodium (15.26 mg/l) Strontium (151 µg/l), Uranium (0.55 µg/l), Vanadium (0.51 µg/l) and TON (1.77 mg/l). Other parameters measured were below the lower limits of

Annual Results SW2A

Arsenic Barium Boron, Cadmium Chromium, Copper, Lead, Mercury, Nickel, Sulphate and Zinc are below the SWQS or EQS.

Iron had a concentration of 58.9 µg/l fitting into the A1 SWQS classification of 200µg/l. Manganese fits into the A2 SWQS classification of 300 µg/l with a reading of 134.2 µg/l.

Other parameters were Total Alkalinity (220 mg/l), Calcium (90.03.mg/l), Magnesium (10.73 mg/l), Molybdenum (0.9 µg/l), Ortho-phosphate (0.04 mg/l), Potassium (5.04 mg/l), Sodium (20.34 mg/l) Strontium (170 µg/l), Uranium (1.24 µg/l), Vanadium (<0.5 µg/l) and TON (1.42 mg/l). Other parameters measured were below the lower limits of detection.

7.6.1 Lagoon/Surface Water Retention Pond

The surface water retention pond, SW3 is located on the eastern boundary of the site and discharges to the stream running along the northern boundary of the site.

SW3 has a pH reading of 8.0 to 8.2 which is within the A1 SWQS of 5.5 to 8.5. The DO concentration in SW3 monitoring point is 62 % - 112 % saturation. This falls into the A1 SWQS classification (>60%).

The Ammonia concentration of <0.03 mg/l to 0.55 mg/l for SW3 falls into the SWQS category of A1 (0.2mg/l) and A2 (1.5mg/l).

The BOD concentration in the SW3 ranged from <1.5 mg/l to 3.8 mg/l during this monitoring period, below the SWQS A1 classification of 5mg/l.

Electrical Conductivity in SW3 ranged from 506 µS/cm to 601 µS/cm, which is below the SWQS of 1000µS/cm. The Chloride level of 19 mg/l to 27 mg/l is below the SWQS of 250mg/l for this monitoring period.

Total Suspended Solids concentration of <5 mg/l to 8 mg/l is below the SWQS limit of 50mg/l and the surface water discharge limit of 35mg/l as per Schedule C4 of the waste licence.

The COD level in SW3 was recorded at 12 mg/l to 32 mg/l during this monitoring period, which are below and equal to the SWQS classification of 40 mg/l.

Annual Results

Arsenic Barium Boron, Cadmium Chromium, Copper, Lead, Mercury Nickel, Sulphate and Zinc are below the SWQS or EQS.

Iron had a concentration of 20 µg/l fitting into the A1 SWQS classification of 200µg/l. Manganese fits into the A2 SWQS classification of 300 µg/l with a reading of 68.7 µg/l.

Other parameters were Total Alkalinity (135 mg/l), Calcium (69.86.mg/l), Magnesium (9.01 mg/l), Molybdenum (2.2 µg/l), Ortho-phosphate (<0.02 mg/l), Potassium (3.23 mg/l), Sodium (18.75 mg/l) Strontium (171 µg/l) Uranium (1.07 µg/l), Vanadium (<0.5 µg/l) and TON (0.14 mg/l). Other parameters measured were below the lower limits of detection.

7.7 GAS MONITORING

As required under the Waste Licence, landfill gas monitoring has been undertaken at the borehole locations as set out in current waste licence.

Schedule D of the waste licence requires the licensee to conduct monthly monitoring on the perimeter and in the waste of the landfill site. The trigger level for landfill gas emissions are Methane, greater than or equal to 1.0% v/v and Carbon dioxide, greater than or equal to 1.5% v/v. Landfill gas is monitored using a GA2000 infra-red analyser. These results are presented in Appendix I.

Results are below the trigger limit for Methane of 1% v/v for all perimeter locations (not in waste) during the year. From the results it can be seen that no methane was recorded in piezometers around the perimeter of the site except for:

- 0.2% in piezometer PZ26 in March
- Methane levels of 0.1% were detected in a number of piezometers in May.

Carbon dioxide levels around the perimeter of the site exceed the licence requirements of 1.5%v/v during the year. Exceedances were recorded in PZ2-PZ5, PZ22, PZ28 -PZ36, PZ46 – PZ52. The results can be seen in Appendix I.

There are two enclosed gas flares at Whiteriver Landfill Site with a combined capacity of 2,600m³/hr. Landfill gas is currently been flared through the 2,000 m³/hr flare. Two engines have been installed at the facility to generate power to the national grid. These have been commissioned but are not yet connected to the grid. This is expected to be undertaken in June.

A permanent gas monitoring system has been installed in the site building. No exceedances have been recorded.

7.8 MONITORING OF EMISSIONS FROM LANDFILL GAS FLARE

Flue gas monitoring was also undertaken on the permanent landfill gas flares. All monitoring was carried out in accordance with Environmental Protection Agency Office of Environmental Enforcement (OEE) Air Emission Monitoring Guidance Note 2 (AG2). These results are provided in Appendix D. NO_x as NO₂, CO, TOC, HCL and HF emissions from both flares were within the emission limit values specified in Waste licence W060-03.

7.9 NOISE MONITORING

The measurements were completed on Monday and Thursday 3rd to 6th December in accordance with the following environmental noise standards:

- ISO 1996: 2007 Acoustics – Description and Measurement of Environmental Noise, Parts 1-4
- EPA Guidance Note for Noise (NG4) 2012

- NSL 1: Daytime: LAeq (T 15 min) 64-61dBA;
Evening time: LAeq (T 15 min) 44-43dBA;
Night time: LAeq (T 15 min) 42-40dBA
- NSL 2: Daytime: LAeq (T 15 min) 59-47dBA;
Evening time: LAeq (T 15 min) 56-51dBA;
Night time: LAeq (T 15 min) 50-48dBA
- NSL 3: Daytime: LAeq (T 15 min) 69-61dBA;
Evening time: LAeq (T 15 min) 55-48dBA;
Night time: LAeq (T 15 min) 46-44dBA
- NSL 4: Daytime: LAeq (T 15 min) constant at 72dBA;
Evening time: LAeq (T 15 min) 66-65dBA;
Night time: LAeq (T 15 min) 63-61dBA
- NSL 5: Daytime: LAeq (T 15 min) 53-48dBA;
Evening time: LAeq (T 15 min) 48-46dBA;
Night time: LAeq (T 15 min) 43-41dBA
- NSL 6: Daytime: LAeq (T 15 min) 61-52dBA;
Evening time: LAeq (T 15 min) 49-47dBA;
Night time: LAeq (T 15 min) 40-39dBA
- Flares: Daytime: LAeq (T 15 min) 59-58dBA;
Night time: LAeq (T 15 mins) 56-55dBA

All noise sensitive locations (N1 – N6) are not adversely effected by noise arising from landfill operations. Although noise from the landfill site could be detected at Locations 1, 3, 5, and to a lesser extent Location 2, it was not the dominant source and was not obtrusive. Road traffic noise was the dominant noise source at Location 4. Location 6 shows a significant decrease in noise once traffic entering / leaving the site ceases. Location 6 is not significantly impacted by noise from the flares.

There is no specific waste licence requirement to monitor for noise at the flares. However, measurements show that it is not adversely impacting on noise levels N1-N6.

While daytime LAeq and DEN values are shown to exceed the requirements at Locations 1, 3 and 6 a more accurate representation of noise levels arising from landfill operations as experienced during the survey is provided by the LA90. The current report therefore shows noise levels directly associated with landfill operations and in the absence of traffic noise external to the landfill site to be in compliance with the requirement of the licence.

7.10 DUST MONITORING

Table 7.8 details the results of the four dust monitors installed on the site. The waste licence requires dust deposition limits to be no more than 350 mg/m²/day.

Table 7.8 Results from Dust Monitoring Analysis, Whiteriver Landfill Site

Sampling Point	DG1	DG2	DG3	DG4	DG5	DG6
03/01/12 to 01/02/12	84.5	14.1	145.8	17.0		
01/02/12 to 01/03/12	165.13	238	145.21	16.25		
01/03/12 to 02/04/12	46.1	131.7	37.9	5.6		
02/04/12 to 30/04/12	55.4	66.1	20.9	392.3	149.8	358.4
01-05-12 to 31-05-12	455.2	448.6	300.5	266.7	57.9	82.0
04/06/12 - 03/07/12	1,181.4	1,015.8	1,201.1	924	666.1	1,013.7
01/07/12 - 31/07/12	352.81	255.83	314.54	396.32	273.13	285.18
01/08/12 - 31/08/12	79.68	290.95	255.83	188.2	207.07	207.07
03/09/12 - 28/09/12	230.3	229.5	11.1	21.8	371.1	93.8
01/11/12 - 30/11/12	467.7	409.8	324.3	363.2	308.9	307.4
01/12/12 - 02/01/13	512.2	521.2	424.5	537.0	325.6	292.3

From Table 7.8 it can be seen that dust monitoring results exceeded the licence requirements at all locations at times during the monitoring period. DG1 and DG2 are located adjacent to the haul roads within the site and may receive dust from traffic movement; however excessive dust was not noted in the daily site inspections. No dust complaints were received. Access roads are now swept on a weekly basis since mid November.

7.11 METEOROLOGICAL MONITORING

Meteorological data is monitored in accordance with Schedule of the licence. This information is provided in Appendix E.

7.12 SLOPE STABILITY ASSESSMENT

A slope stability assessment was undertaken in August 2012 and is included in Appendix J.

The analysis for the final waste slopes suggests that the factors of safety for the filling of waste are satisfactory. In addition a site walkover survey and examination of the waste slopes evidenced no apparent slope instability on these recently filled slopes.

7.13 ODOUR MONITORING

Total Volatile Organic compound monitoring has been undertaken at the site on a quarterly basis. Based on these reports a number of the recommendations have been carried out to reduce the landfill gas leakage from the site and therefore reducing odour. These reports were included in quarterly monitoring reports.

8.0 RESOURCES AND ENERGY CONSUMPTION SUMMARY

Consumption of resources for the reporting period is shown in Table 8.1 below.

Table 8.1 Consumption of Resources

Parameters	Annual Total	Unit
Light fuel oil (Diesel)	2,088,200	kWh
Electricity	213,300	kWh

9.0 PROPOSED DEVELOPMENT OF THE FACILITY AND TIMESCALE OF SUCH DEVELOPMENT

Objectives and targets have been set for 2013. These are as follows:

- Reduce pressure on non-renewable fossil fuels used to generate electricity. Generation of electricity to the grid due to commence in June 2013.
- Minimise the release of landfill gases. A new contract is currently being developed for the capping of the entire site as the decision has been made to close after the filling of phase 5.

Capping of filled areas will continue as described in Section 11.

10.0 VOLUME OF LEACHATE PRODUCED AND VOLUME OF LEACHATE TANKERED OFF SITE

The volume of leachate transported off site to Drogheda wastewater treatment plant during the period January to December 2012 is provided in Table 10.1. A water balance calculation has been undertaken and is included in Appendix E using rainfall data from metrological station o site. This estimates the annual leachate production to be approximately 21,305 m³. This is based on using worst case scenario for infiltration on temporarily capped /restored area of 30% and 10% for restored areas.

The results for treated leachate are within the limit values for those parameters as set out in the waste licence as shown in Table 7.3 except for Sulphate and COD.

Table 10.1 Volume of Leachate Transported Off Site in 2012

Month	Weight Volume (m ³)
January	2,700.82
February	2,249.76
March	1,209.44
April	1,913.62
May	1,861.78
June	3,207.82
July	3,622.36
August	2,445.88
September	2,246.34
October	2,411.36
November	3,606.56
December	2,960.52
Total	30,436.26

11.0 REPORT ON DEVELOPMENT WORKS UNDERTAKEN DURING THE REPORTING PERIOD, AND A TIMESCALE FOR THOSE PROPOSED DURING THE COMING YEAR**11.1 RESTORATION OF COMPLETED CELLS/PHASES**

The following Cells/Phases have been restored to date;

- Phase I to IV
- Phase V Cell 3a, b
- Phase V Cell 2 (4000m²)

Approx 4000 m² of LLDPE temporary capping was undertaken on Phase 5 Cell 1a in December 2012 to control odours.

11.2 REPORT ON DEVELOPMENT WORKS UNDERTAKEN DURING THE REPORTING PERIOD

The following development works were completed in 2012;

- Capped 4000 m² with LLDPE to control odours
- Drilled 9 additional gas wells in phase 5 cell 2
- Drilled 500 mm leachate well for phase 5 cell 2 due to SSR collapsing

11.3 TIMESCALE FOR DEVELOPMENT WORKS PROPOSED DURING THE COMING YEAR

The remaining area of Phase 5 will be capped by end of 2014. Louth County Council will continue to expand the landfill gas extraction system as required.

12.0 SITE SURVEY SHOWING EXISTING LEVELS OF THE FACILITY AT THE END OF THE REPORTING PERIOD

A topographical survey was carried out in 2012 and is included in Appendix B.

**13.0 ESTIMATED ANNUAL AND CUMULATIVE QUANTITIES OF LANDFILL GAS (LFG)
EMITTED FROM THE SITE**

The gas yield figures provided in Appendix K are calculated using Gassim Model 2.0. As can be seen from the data landfill gas production is approximately 990 m³/hr in 2012 based on current waste inputs. The average flow rate for the flare in 2012 was 1,446 m³/hr. The average methane was 35%.

14.0 ESTIMATED ANNUAL AND CUMULATIVE QUANTITY OF INDIRECT EMISSIONS TO GROUNDWATER

The site has been developed on a containment basis, hence controlling potential discharge to groundwater. The risk of leakage is mitigated by the following;

- The relative thickness of the low permeability boulder clays constitutes a natural effective barrier to downward groundwater migration.
- Groundwater resources within the granular horizons are confined under subartesian pressure with a net upward groundwater movement.
- Leachate levels are maintained below licence limits on site.
- Leachate is pumped from the cells, to treatment lagoon and tankered off site for treatment.

There are no direct discharges to groundwater or surface water. The volume of leachate transported off site to Drogheda wastewater treatment plant during the period January to December 2012 is 30,436 m³. A water balance calculation has been undertaken and is included in Appendix E using rainfall data from meteorological station on the site. This estimates the annual leachate production to be approximately 21,305 m³ as discussed in Section 10.

15.0 ASSESSMENT OF THE FEASIBILITY OF THE UTILISATION OF LANDFILL GAS AS AN ENERGY RESOURCE

Two 0.65 Mw engines have been installed at the facility to generate power to the national grid. These have been commissioned but are not yet connected to the grid. This is expected to be undertaken in June.

16.0 MONTHLY WATER BALANCE CALCULATION AND INTERPRETATION

The calculation for monthly water balance is as follows;

$$Lo = [ER (A) + LW + IRCA + ER (1)] - [aW]$$

Where;

Lo = leachate produced (m³)

ER = effective rainfall

A = area of cell (m³)

LW = liquid waste

IRCA = infiltration through restored areas and capped areas (m)

a = absorptive capacity of waste (m³/t)

W = weight of waste deposited

I = surface area of lagoons (m²)

A water balance calculation has been undertaken and is included in Appendix E using rainfall data from metrological station on the site. This estimates the annual leachate production to be approximately 21,305 m³. This is based on using worst case scenario for infiltration on temporarily capped /restored area of 30% and 10% for restored areas. The difference in actual and predicted quantities month to month may be partly due to the absorptive capacity of the waste, which determined the speed of percolation of rainwater through the wastes, actual rainfall was used for all areas and using worst case scenario for infiltration.

17.0 SCHEDULE OF ENVIRONMENTAL OBJECTIVES AND TARGETS FOR THE FORTHCOMING YEAR**17.1 SCHEDULE OF ENVIRONMENTAL OBJECTIVES AND TARGETS FOR THE FORTHCOMING YEAR**

Objectives, targets and timescales for the year 2013 for Whiteriver Landfill Site have been completed as part of the ISO14001 Environmental Management System. These are as follows:

- Reduce pressure on non-renewable fossil fuels used to generate electricity.
- Reduce BMW to landfill.
- Minimise the release of landfill gases.
- Meet the requirements of the new Environmental Objectives (Groundwater) Regulations 2010.
- Enhance the Biodiversity of the site post closure.

Some of these are ongoing from previous years. These are included in Appendix L detailing tasks, due date and responsibility.

17.2 REPORT ON THE PROGRESS TOWARDS ACHIEVEMENT OF THE ENVIRONMENTAL OBJECTIVES AND TARGETS CONTAINED IN THE PREVIOUS YEARS REPORT

Objectives, targets and timescales for the year 2012 for Whiteriver Landfill Site were reviewed as part of the ISO14001 Environmental Management System and many on ongoing;

- Reduce pressure on non-renewable fossil fuels used to generate electricity. Project currently underway. Two 0.65 Mw generators have been installed. These have been commissioned but are not yet connected to the grid. This is expected to be undertaken in June.
- Comply with the relevant requirements of the Landfill Directive (1993/31/EC). Objective and Target has been compiled to reduce BMW to landfill. The total reported for 2012 was 32.85 % this was within the target limit of 47%.
- Minimise the release of landfill gases.
- Meet the requirements of the new Environmental Objectives (Groundwater) Regulations 2010.
- Enhance the Biodiversity of the site post closure.

18.0 FULL TITLE AND A WRITTEN SUMMARY OF ANY PROCEDURES DEVELOPED BY THE LICENSEE IN THE YEAR, WHICH RELATES TO THE FACILITY OPERATION

Environmental Management Procedures have been developed as part of the ISO14001 Environmental Management System (EMS) for the purpose of maintaining and assessing the EMS. Operational procedures ensure that the routine operational tasks related to the environmental management of the facility are undertaken in a satisfactory manner as required to maintain effective control of the environmental aspects of the facility. This system is audited annually and is available for inspection on site.

As part of the EMS procedures have been developed. The following procedures were updated in 2012;

- Odour Management Plan
- Waste Placement and Covering Procedure.
- Waste Acceptance and Handling Procedure.
- Landfill Gas Flaring

19.0 REPORTED INCIDENTS AND COMPLAINTS SUMMARIES, CORRESPONDENCE TO/FROM EPA

In total 156 complaints were made in 2012. These related to odour especially during the month of October. These are summarised in Table 19.1.

Table 19.1 Complaints Summary

Category	Number of Complaints	Resolution Status
Odour	4 Complaints in Jan	Complete
Odour	1 Complaint in Feb	Complete
Odour	2 Complaints in March	Complete
Odour	0 Complaints in April	Complete
Odour	1 Complaint in May	Complete
Odour	5 Complaints in June	Complete
Odour	8 Complaints in July	Ongoing
Odour	14 Complaint in August	Ongoing
Odour	7 Complaints in Sept	Complete
Odour	32 Complaints in Oct	Complete
Odour	8 Complaints in Nov	Complete
Odour	0 Complaints in Dec	Complete

These are available for inspection at Whiteriver Landfill Site. Incidents reported for 2012 (15 in total) are summarised in Table 19.2. A summary of non-compliances noted during Audits/Landfill Site Inspections undertaken during the reporting period by EPA are given in Table 19.3.

Table 19.2 Summary of Incidents Reported During the Reporting Period

Date	Nature of Incident
Monthly	Licensees/COA holder Environmental Impact Ranking: 1 The Trigger Level of 1.5% V/V CO ₂ was exceeded in Perimeter Piezometers.
13/02/12	Licensees/COA holders Environmental Impact Ranking: 1 Flare turned off to allow replacement of level probes in condensate KO pot.
13/03/12	Licensees/COA holder Environmental Impact Ranking: 1 Trigger level for surface VOC emission breached.
01/10/12	Licensees/COA holder Environmental Impact Ranking: 1 Trigger level for surface VOC emission breached.

Table 19.3 Summary of Non Compliances and Audit Observations noted during Audits/Landfill Site Inspections undertaken during the Reporting Period by EPA

Date and Reference	Summary of Inspection Report/Audit	Response
29/03/2012 W0060-03 03/12/AR I2EM W0060-02	Audit Observations 1. Dust Monitoring 2. Groundwater Monitoring 3. Landfill Gas Collection System 4. Leachate Monitoring	Our Ref: W0060-02/10/008 Your Ref: W0060-03/12/AR12EM
17/10/2012 W0060-03 /12/SI40 EM Site Inspection	Inspection Observations 1. Landfill Gas Management	Surface emissions reports submitted to EPA as requested as part of the 4th qrt 2012 reporting
29/11/2012 W0060-03 /12/SI41 EM Site Inspection	Inspection Observations 1. Landfill Gas Management 2. New Leachate Extraction Well Phase V Cell 2	Works to be verified during subsequent inspections

20.0 REVIEW OF NUISANCE CONTROLS

The facility is inspected daily and weekly for nuisances caused by vermin, birds, flies, dust and odours and written records are made of all inspections and any actions taken. These records provide for the recording of nuisances and description of works carried out to minimise each nuisance as described below.

20.1 DUST CONTROL

All waste vehicles are required to use the wheel wash prior to exiting the facility. Dust monitoring has shown exceedances during the monitoring period. Access roads are now swept on a weekly basis.

20.2 LITTER

Any waste found around the boundary is removed immediately or by 10.00 a.m. the next working day. Disposal activities are confined to within bunded cells and litter nets have been around entire perimeter of Phase 5 cells 1 and 2. All waste is compacted to reduce the potential sources of litter and wastes are covered daily or as soon as practicable. Litter, which is blown away from the landfilling area, is collected as soon as possible and inspection of the facility and netting is performed on a daily basis.

All vehicles delivering and removing wastes to the facility are checked to ensure that they are appropriately covered.

20.3 BIRDS

In general during the Spring, Summer and Autumn there is no problem on-site from birds scavenging. This is due to the large area of tillage crops in the area and hence the easy availability of food sources. In the Months November – February there are increased numbers of birds trying to feed on the site.

A Pest Control company visits the site between October and March and fly a falcon, fire bangers, fly a kite, etc. to scare birds off.

A Scarecrow bird distress call is also employed on site during operational hours. The operative on the tip face also has a hand held distress caller to scare birds.

20.4 ODOURS

As part of the ISO14001 Environmental Management System an Odour Management Plan has been developed for the facility. This was updated in 2012. Total Volatile Organic compound monitoring has been undertaken at the site on a quarterly basis.

21.0 REPORT ON FINANCIAL PROVISIONS MADE UNDER THIS LICENSE, MANAGEMENT AND STAFFING STRUCTURE OF THE FACILITY AND A PROGRAMME FOR PUBLIC INFORMATION

Louth County Council being a local authority is able to provide the necessary finances to ensure the proper management development and restoration of Whiteriver Landfill Site.

The 2013 gate charges at the facility are provided in Table 21.1.

Table 21.1 Landfill Charges

Category	Base Charge	Landfill Levy	VAT 13.5%	Total Charge
Commercial waste 0 to 10,000 tonnes per annum	€35 to €40 per tonne	€65.00 per tonne	€13.50 to €14.18 per tonne	€113.50 to €119.18 per tonne
Commercial waste 10,001 to 20,000 tonnes per annum	€30 to €35 per tonne	€65.00 per tonne	€12.83 to €13.50 per tonne	€102.83 to €113.50 per tonne
Commercial waste 20,000+ tonnes per annum	€20 to €30 per tonne	€65.00 per tonne	€11.48 to €12.83 per tonne	€96.48 to €107.83 per tonne
Deep burial	€120.00 per tonne	€65.00 per tonne	€24.98 per tonne	€209.98 per tonne

Overall responsibility for the ongoing operations and development of the landfill site is held by a Senior Engineer assigned to the Environmental Section of Louth County Council. A Facility Manager and three Deputy Facility Managers are currently assigned to the site. The Landfill Foreman oversees the day to day running of the landfill site and is assisted by two General Operatives.

As part of the ISO14001 Environmental Management System a communication programme in accordance with the Conditions of the waste licence is provided to ensure that members of the public can obtain information concerning the environmental performance of the facility at all reasonable times.

Management Structure at Whiteriver Landfill site is as follows. This is the present status although it may be changed at a future stage.

Information is available at the facility for public viewing concerning the environmental performance of the facility. Louth County Council hold regular meeting with the local residents committee (approx 6 per year) and issue newsletters as required.

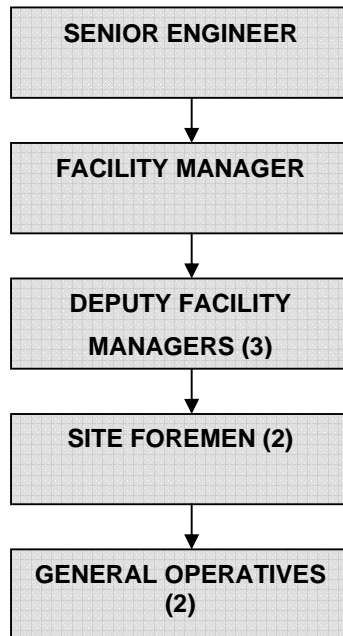


Figure 21.1 Management Structure at Whiteriver Landfill Site

22.0 OTHER INFORMATION**22.1 REPORT ON TRAINING OF STAFF TRAINING**

No staff training was undertaken in 2012.

22.2 TANK, PIPELINE AND BUND TESTING AND INSPECTION REPORT

There are no tanks, pipeline or bund inspection undertaken on site.

22.3 UPDATES TO LANDFILL ENVIRONMENTAL MANAGEMENT PLAN (LEMP)

ISO14001 Environmental Management System was implemented in October 2009. This included a review of the Environmental Management Plan for the site. This was last reviewed in October/November 2010 and is available for inspection on site.

22.4 REVIEW OF ENVIRONMENTAL LIABILITIES

An Environmental Liabilities Risk Assessment (ELRA) has been completed for the site. This was submitted to EPA in June 2011.

22.5 REPORT ON WASTE RECOVERY

A report on the contribution by this facility to the achievement of the waste recovery objectives stated in Condition 2.3.2.1 and as otherwise may be stated in National and European Union waste policies has not been completed to date for the site.

Louth County Council recovers construction and demolition waste arising from council project and other sources in the landfill operations. The material listed below were recovery on site as cover material and used in the construction of temporary roads in 2012.

Table 22.1 Recovered Wastes

Recovery	Cover Material	C & D	C & D Dust	Wood Chip	Total
	17 05 04	17 01 07	19 12 12	19 12 07	
2012	1,354.28	9,481.32	41,681.66	299.14	53,936

22.6 STATEMENT OF COMPLIANCE OF FACILITY WITH ANY UPDATES OF THE RELEVANT WASTE MANAGEMENT PLAN

Under the European Communities (Waste Directive) Regulations 2011, all waste management plans were to be evaluated by 31 December 2012. This evaluation process has been completed and all ten evaluations recommended the development of replacement plans.

22.7 STATEMENT ON THE ACHIEVEMENT OF THE WASTE ACCEPTANCE AND TREATMENT OBLIGATIONS

Whiteriver landfill site has completed quarterly Biodegradable Municipal Waste Reporting Landfill Submission Report to the EPA for 2012. The total reported for 2012 was 32.85 %. This is in compliance with Condition 5.15 where the maximum of 47% by weight of municipal solid waste (MSW) accepted for disposal to the body of the landfill shall comprise biodegradable municipal waste (BMW), measured on a calendar year basis.

APPENDIX A

SLUDGE ANALYSIS



SDG: 120619-214
 Job: D_TERRAWATH_KIL
 Client Reference:

Location: Cavan Hill WTP
 Customer: D_TERRAWATH_KIL
 Attention: Damian Walsh

Order Number:
 Report Number: 185292
 Superseded Report:

CEN 10:1 STAGE BATCH TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/2

Client Reference

Mass Sample taken (kg)	0.610
Mass of dry sample (kg)	0.198
Particle Size <4mm	>95%

Site Location

Moisture Content Ratio (%)	391
Dry Matter Content Ratio (%)	15.1

Case

SDG	120619-214
Lab Sample Number(s)	5739963

Sampled Date

Customer Sample Ref. CAVANHILL WTP

Depth (m)

Solid Waste Analysis

Result	Murphy LoD mg/kg dry substance
Total Organic Carbon (%)	1.92 <30,000.0 mg/kg dry substance
Loss on Ignition (%)	-
Sum of BTEX (mg/kg)	<0.026 <6.0
Sum of 7 PCBs (mg/kg)	<0.022 <1.0
Mineral Oil (mg/kg)	232 <500.0
PAH Sum of 17 (mg/kg)	<10 <100.0
pH (pH Units)	-
ANC to pH 6 (mol/kg)	-
ANC to pH 4 (mol/kg)	-

Eluate Analysis

	C2 Conc ⁿ in 10:1 eluate (mg/l)		A2 10:1 conc ⁿ leached (mg/kg)		Murphy Limits of Detection mg/kg dry		
	Result	Limit of Detection	Result	Limit of Detection			
Arsenic	0.000614	<0.00012	0.00614	<0.0012	0.5	-	-
Barium	0.0419	<0.00003	0.419	<0.0003	20	-	-
Cadmium	<0.0001	<0.0001	<0.001	<0.001	0.04	-	-
Chromium	0.00387	<0.00022	0.0387	<0.0022	0.5	-	-
Copper	<0.000875	<0.00085	<0.0085	<0.0085	2	-	-
Mercury Dissolved (CVAF)	<0.00001	<0.00001	<0.0001	<0.0001	0.01	-	-
Molybdenum	0.00129	<0.00024	0.0129	<0.0024	0.5	-	-
Nickel	0.00509	<0.00015	0.0509	<0.0015	0.4	-	-
Lead	<0.00002	<0.00002	<0.0002	<0.0002	0.5	-	-
Antimony	0.00392	<0.00016	0.0392	<0.0016	0.06	-	-
Selenium	0.00167	<0.00039	0.01676	<0.0039	0.1	-	-
Zinc	0.000403	<0.00041	0.00403	<0.0041	4	-	-
Chloride	20.1	<2	201	<20	800	-	-
Fluoride	<0.5	<0.5	<5	<5	10	-	-
Sulphate (soluble)	40	<2	400	<20	1000	-	-
Total Dissolved Solids	301	<10	3010	<100	4000	-	-
Total Monohydric Phenols (W)	<0.016	<0.016	<0.16	<0.16	1	-	-
Dissolved Organic Carbon	11.1	<3	111	<30	500	-	-

Leach Test Information

Date Prepared	19-Nov-2012
pH (pH Units)	7.61
Conductivity (µS/cm)	552.00
Temperature (°C)	20.60
Volume Leachant (Litres)	0.510
Volume of Eluate VE1 (Litres)	

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
 Stated limits are for guidance only and ALcontrol cannot be held responsible for any discrepancies with current legislation
 Mcerts Certification does not apply to leachates

20/11/2012 14:52:42

12:46:28 23/11/2012

A copy of this certificate is available on www.fitzsci.ie

Customer	Dermot Baxter	Lab Report Ref. No.	2710/353/02
	Louth Co. Co.	Date of Receipt	20/01/2012
	County Offices	Sampled On	20/01/2012
	Dundalk	Date Testing Commenced	20/01/2012
	Co. Louth	Received or Collected	Delivered by Customer
Customer PO	4/137116	Condition on Receipt	Acceptable
Customer Ref	Cavan Hill WTP - 20/01/12	Date of Report	13/02/2012
		Sample Type	Other

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
% Dry Matter	302	Drying @ 104 C	14.48	%	
Acid Neutralisation capacity (pH4)	128	Titrimetry	<0.50	mol/Kg	
Acid Neutralisation Capacity (pH7)	128	Titrimetry	<0.50	mol/Kg	
Antimony (Leachate)	128	ICPMS	354.6	ug/Kg	
Arsenic (Leachate)	128	ICPMS	40.03	ug/Kg	
Barium (Leachate)	128	ICPMS	2083	ug/Kg	
Benzene (Solid)	198	GC-FID	<0.5	mg/Kg	
BTEX (Solid)	198	GC-FID	<0.5	mg/Kg	
Cadmium (Leachate)	128	ICPMS	<0.09	ug/Kg	
Chloride (Leachate WAC)	190	IC	253.21	mg/Kg	
Chromium (Leachate)	128	ICPMS	9.349	ug/Kg	
Copper (Leachate)	128	ICPMS	208.5	ug/Kg	
Dissolved Organic Carbon (Leachate)	316	TOC Analyser	1278	mg/Kg	
Ethylbenzene (Solid)	198	GC-FID	<0.5	mg/Kg	
Fluoride (Leachate WAC)	190	IC	4.03	mg/Kg	
Lead (Leachate)	128	ICPMS	<0.38	ug/Kg	
Loss on Ignition	310	Ashing @ 550 C	48.6	%	
m- & p-Xylene (Solid)	198	GC-FID	<1	mg/Kg	
Mercury (Leachate)	128	ICPMS	0.573	ug/Kg	
Mineral oil by Calculation (solid)	327	GC-FID	7.52	mg/Kg	
Molybdenum (Leachate)	128	ICPMS	7.475	ug/Kg	
Nickel (Leachate)	128	ICPMS	64.23	ug/Kg	
o-Xylene (Solid)	198	GC-FID	<0.5	mg/Kg	
PAH Solid (Sum of 17)	200	GCMS	<0.05	mg/Kg	
PCBs(Solid)	323	GCMS	<0.005	mg/Kg	
pH (Solid)	110	Electrometry	7.1	pH Units	
Phenol Index (Leachate)	128	Colorimetry	0.96	mg/Kg	

Signed : 
Aoife Harmon - Technical Supervisor

Date : 13/02/2012

Acc. : Accredited Parameters by ISO 17025:2005

PVL - Parametric Value Limit as per EU Drinking water Regulations (SI 278 2007)

All organic results are analysed as received and all results are corrected for dry weight at 104 C

Results shall not be reproduced, except in full, without the approval of Fitz Scientific

Results contained in this report relate only to the samples tested

**The analytical result for this parameter may not be reflective of the concentration present at the time of sampling. The maximum recommended preservation time for this parameter has been exceeded.

A copy of this certificate is available on www.fitzsci.ie

Customer	Dermot Baxter	Lab Report Ref. No.	2710/353/02
	Louth Co. Co.	Date of Receipt	20/01/2012
	County Offices	Sampled On	20/01/2012
	Dundalk	Date Testing Commenced	20/01/2012
	Co. Louth	Received or Collected	Delivered by Customer
Customer PO	4/137116	Condition on Receipt	Acceptable
Customer Ref	Cavan Hill WTP - 20/01/12	Date of Report	13/02/2012
		Sample Type	Other

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Selenium (Leachate)	128	ICPMS	58.86	ug/Kg	
Sulphate (Leachate WAC)	190	IC	26576.08	mg/Kg	
TOC (Solid)	315	TOC Analyser	14.826	%	
Toluene (Solid)	198	GC-FID	<0.5	mg/Kg	
Total Dissolved Solids (Leachate)	128	Evaporation/ Gravimetry	4150	mg/Kg	
Xylene Total (Solid)	198	GC-FID	<0.5	mg/Kg	
Zinc (Leachate)	128	ICPMS	<4.6	ug/Kg	

Signed : 
Aoife Harmon - Technical Supervisor

Date : 13/02/2012

Acc. : Accredited Parameters by ISO 17025:2005

PVL - Parametric Value Limit as per EU Drinking water Regulations (SI 278 2007)

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A copy of this certificate is available on www.fitzsci.ie

Customer	Dermot Baxter	Lab Report Ref. No.	2710/353/01
	Louth Co. Co.	Date of Receipt	20/01/2012
	County Offices	Sampled On	20/01/2012
	Dundalk	Date Testing Commenced	20/01/2012
	Co. Louth	Received or Collected	Delivered by Customer
Customer PO	4/137116	Condition on Receipt	Acceptable
Customer Ref	Staleen WTP - 20/01/12	Date of Report	13/02/2012
		Sample Type	Other

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
% Dry Matter	302	Drying @ 104 C	16.29	%	
Acid Neutralisation capacity (pH4)	128	Titrimetry	<0.50	mol/Kg	
Acid Neutralisation Capacity (pH7)	128	Titrimetry	<0.50	mol/Kg	
Antimony (Leachate)	128	ICPMS	100.98	ug/Kg	
Arsenic (Leachate)	128	ICPMS	39.68	ug/Kg	
Barium (Leachate)	128	ICPMS	1168	ug/Kg	
Benzene (Solid)	198	GC-FID	<0.5	mg/Kg	
BTEX (Solid)	198	GC-FID	<0.5	mg/Kg	
Cadmium (Leachate)	128	ICPMS	<0.09	ug/Kg	
Chloride (Leachate WAC)	190	IC	135.60	mg/Kg	
Chromium (Leachate)	128	ICPMS	2.33	ug/Kg	
Copper (Leachate)	128	ICPMS	188.3	ug/Kg	
Dissolved Organic Carbon (Leachate)	316	TOC Analyser	1275	mg/Kg	
Ethylbenzene (Solid)	198	GC-FID	<0.5	mg/Kg	
Fluoride (Leachate WAC)	190	IC	4.50	mg/Kg	
Lead (Leachate)	128	ICPMS	<0.38	ug/Kg	
Loss on Ignition	310	Ashing @ 550 C	42.27	%	
m- & p-Xylene (Solid)	198	GC-FID	<1	mg/Kg	
Mercury (Leachate)	128	ICPMS	1.1	ug/Kg	
Mineral oil by Calculation (solid)	327	GC-FID	9.71	mg/Kg	
Molybdenum (Leachate)	128	ICPMS	30.73	ug/Kg	
Nickel (Leachate)	128	ICPMS	145	ug/Kg	
o-Xylene (Solid)	198	GC-FID	<0.5	mg/Kg	
PAH Solid (Sum of 17)	200	GCMS	<0.05	mg/Kg	
PCBs(Solid)	323	GCMS	<0.005	mg/Kg	
pH (Solid)	110	Electrometry	7.1	pH Units	
Phenol Index (Leachate)	128	Colorimetry	1.04	mg/Kg	

Signed : 
Aoife Harmon - Technical Supervisor

Date : 13/02/2012

Acc. : Accredited Parameters by ISO 17025:2005

PVL - Parametric Value Limit as per EU Drinking water Regulations (SI 278 2007)

All organic results are analysed as received and all results are corrected for dry weight at 104 C

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A copy of this certificate is available on www.fitzsci.ie

Customer	Dermot Baxter	Lab Report Ref. No.	2710/353/01
	Louth Co. Co.	Date of Receipt	20/01/2012
	County Offices	Sampled On	20/01/2012
	Dundalk	Date Testing Commenced	20/01/2012
	Co. Louth	Received or Collected	Delivered by Customer
Customer PO	4/137116	Condition on Receipt	Acceptable
Customer Ref	Staleen WTP - 20/01/12	Date of Report	13/02/2012
		Sample Type	Other

CERTIFICATE OF ANALYSIS

Test Parameter	SOP	Analytical Technique	Result	Units	Acc.
Selenium (Leachate)	128	ICPMS	20.61	ug/Kg	
Sulphate (Leachate WAC)	190	IC	600.26	mg/Kg	
TOC (Solid)	315	TOC Analyser	11.697	%	
Toluene (Solid)	198	GC-FID	<0.5	mg/Kg	
Total Dissolved Solids (Leachate)	128	Evaporation/ Gravimetry	3860	mg/Kg	
Xylene Total (Solid)	198	GC-FID	<0.5	mg/Kg	
Zinc (Leachate)	128	ICPMS	<4.6	ug/Kg	

Signed : 
Aoife Harmon - Technical Supervisor

Date : 13/02/2012

Acc. : Accredited Parameters by ISO 17025:2005

PVL - Parametric Value Limit as per EU Drinking water Regulations (SI 278 2007)

All organic results are analysed as received and all results are corrected for dry weight at 104 C

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Results contained in this report relate only to the samples tested

**The analytical result for this parameter may not be reflective of the concentration present at the time of sampling. The maximum recommended preservation time for this parameter has been exceeded.

SDG: 120209-44	Location: Terra Watch Ltd	Order Number: 171967
Job: D_TERRAWATH_KIL-1	Customer: Damian Walsh	Report Number: 171967
Client Reference:	Attention: Damian Walsh	Superseded Report:

CEN 10:1 CUMULATIVE TWO STAGE BATCH TEST

WAC ANALYTICAL RESULTS

REF : BS EN 12457/3

Client Reference

Mass Sample taken (kg)	0.305
Mass of dry sample (kg)	0.175
Particle Size <4mm	>95%

Site Location

Moisture Content Ratio (%)	240
Dry Matter Content Ratio (%)	29.5

Case

SDG	120209-44
Lab Sample Number(s)	5145583
Sampled Date	
Customer Sample Ref.	NO ID
Depth (m)	

Landfill Waste Acceptance Criteria Limits

Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
	5	6
-	-	10
6	-	-
1	-	-
500	-	-
100	-	-
-	<6 or >9	-
-	-	-
-	-	-

Solid Waste Analysis

Total Organic Carbon (%)	2.88
Loss on Ignition (%)	49.8
Sum of BTEX (mg/kg)	<0.024
Sum of 7 PCBs (mg/kg)	<0.021
Mineral Oil (mg/kg)	647
PAH Sum of 17 (mg/kg)	<10
pH (pH Units)	7.54
ANC to pH 6 (mol/kg)	-
ANC to pH 4 (mol/kg)	-

Eluate Analysis

	C ₂ Conc ⁿ in 2:1 eluate	C ₈ Conc ⁿ in 8:1 eluate	A ₂ 2:1 conc ⁿ leached	A ₂₋₁₀ Cumulative conc ⁿ leached	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg		
	mg/l		mg/kg				
Arsenic	0.000693	-	0.00693	-	0.5	2	25
Barium	0.0554	-	0.554	-	20	100	300
Cadmium	<0.0001	-	<0.001	-	0.04	1	5
Chromium	<0.00022	-	<0.0022	-	0.5	10	70
Copper	0.0026	-	0.026	-	2	50	100
Mercury Dissolved (CVAF)	<0.00001	-	<0.0001	-	0.01	0.2	2
Molybdenum	0.000827	-	0.00827	-	0.5	10	30
Nickel	0.00404	-	0.0404	-	0.4	10	40
Lead	0.000562	-	0.00562	-	0.5	10	50
Antimony	0.00221	-	0.0221	-	0.06	0.7	5
Selenium	0.00185	-	0.0185	-	0.1	0.5	7
Zinc	0.000816	-	0.00816	-	4	50	200
Chloride	22.9	-	229	-	800	15000	25000
Fluoride	<0.5	-	<5	-	10	150	500
Sulphate (soluble)	62.7	-	627	-	1000	20000	50000
Total Dissolved Solids	378	-	3780	-	4000	60000	100000
Total Monohydric Phenols (W)	<0.016	-	<0.16	-	1	-	-
Dissolved Organic Carbon	20.2	-	202	-	500	800	1000

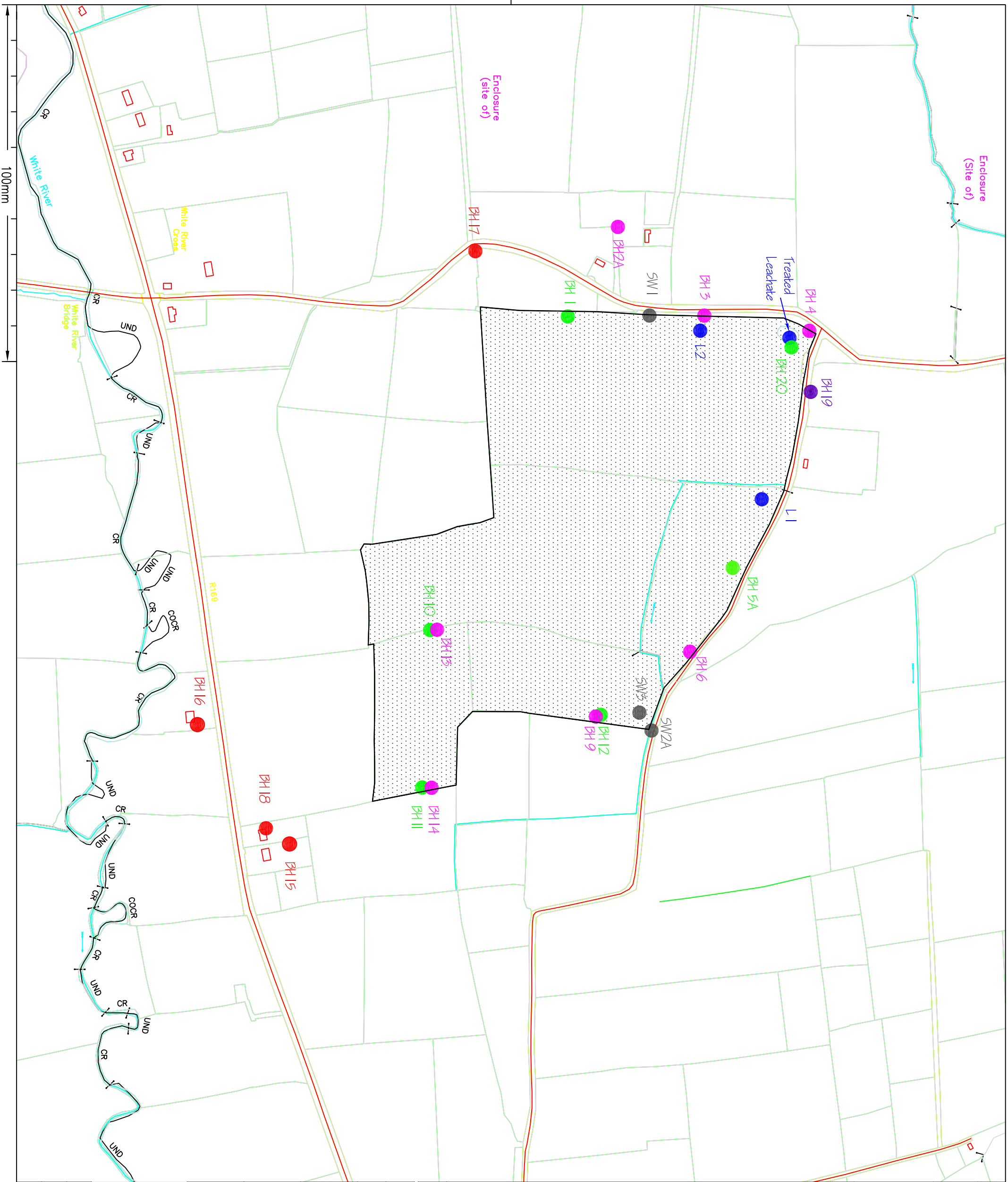
Leach Test Information

	2:1	8:1
Date Prepared	13-Feb-2012	
pH (pH Units)		
Conductivity (µS/cm)		
Temperature (°C)		
Volume Leachant (Litres)	-0.070	
Volume of Eluate VE1 (Litres)		

Solid Results are expressed on a dry weight basis, after correction for moisture content where applicable
 Stated limits are for guidance only and ALcontrol cannot be held responsible for any discrepancies with current legislation
 Mcerts Certification does not apply to leachates

APPENDIX B

DRAWINGS



NOTES

1. VERIFYING DIMENSIONS. THE CONTRACTOR SHALL VERIFY DIMENSIONS AGAINST SUCH OTHER DRAWINGS OR SITE CONDITIONS AS PERTAIN TO THIS PART OF THE WORK.
2. SERVICES. APPROVED OPENINGS FOR SERVICES THROUGH THE STRUCTURE ARE INCORPORATED ON THE DRAWINGS. ANY ADDITIONAL OPENINGS OF A MINOR NATURE REQUIRED BY THE MAIN CONTRACTOR OR HIS SUBCONTRACTORS MUST BE SUBMITTED ON A DRAWING FOR APPROVAL BEFORE WORK COMMENCES.
3. DATUM
4. KEY

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- BH15 Groundwater well (Domestic)
- BH1 Groundwater monitoring boreholes (Overbunden)
- BH4 Groundwater monitoring boreholes (Bedrock)
- SW1 Surfacewater monitoring location points
- L1 Leachate monitoring points
- BH119 Agricultural water supply

D	Private well decommissioned removed.	AMB Jul '12	AMcG Jul '12
REV	DESCRIPTION	BY	CHECK DATE

DRAWN BY	RP	CHECK BY	AMcG	APPROVED	D.D
DATE	NOV '06	DATE	NOV '06	DATE	NOV '06
PLOT SCALE	1:5000	SCHEDULES		SHEET SIZE	A3

CLIENT
LOUTH COUNTY COUNCIL

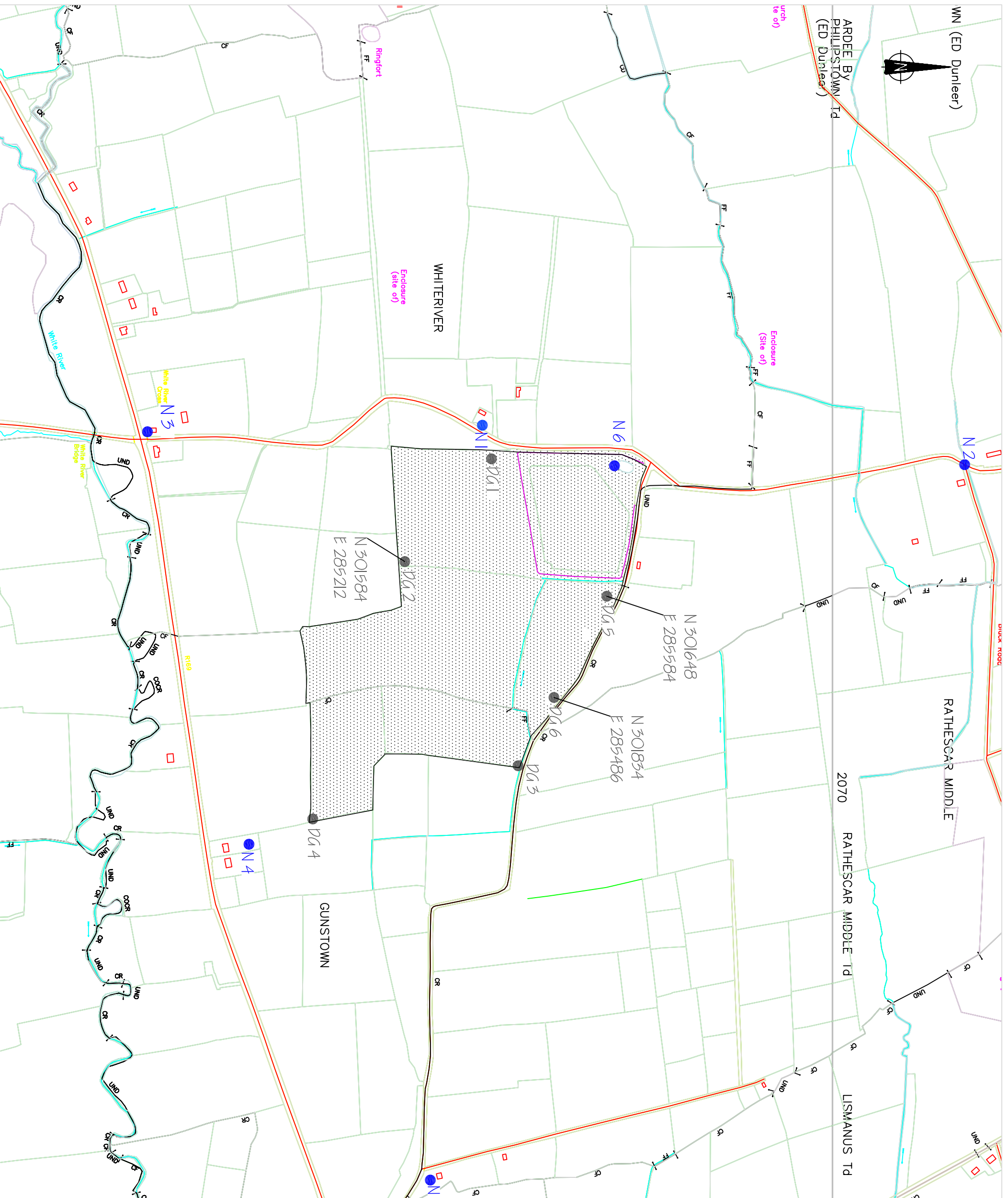
PROJECT
WHITERIVER LANDFILL SITE

TITLE
MONITORING BOREHOLES

RPS Consulting Engineers

TEL: 074 91 61927 WWW.RPSGROUP.COM/IRELAND FAX: 074 91 61928
 THE ENTERPRISE FOUND BUSINESS CENTRE, BALLINACRE, LETTERKENNY, CO. DUBLIN 14

ARCHITECT	DWG. STATUS
DRAWING No. IBL0069/101	PRELIM
REVISION	TENDER
A B C D	CONST.
	RECORD



NOTES

1. Verifying Dimensions:
The contractor shall verify dimensions against such other drawings or site conditions as pertain to this part of the work.
2. Existing Services:
Any information concerning the location of existing services indicated on this drawing is intended for general guidance only. It shall be the responsibility of the contractor to determine and verify the exact horizontal and vertical alignment of all cables, pipes, etc. (both underground and overhead) before work commences.
3. Issue of Drawings:
Hard copies, dwf and pdf will form a controlled issue of the drawing. All other formats (img, dxf etc.) are deemed to be an uncontrolled issue and any work carried out based on these files is at the recipient's own risk. RPS will not accept any responsibility for any errors arising from the use of these files, either by human error by the recipient, listing of un-dimensioned measurements, compatibility issues with the recipient's software, and any errors arising when these files are used to aid the recipient's drawing production, or setting out on site.

5. DATUM:

5. Keys

- Dust gauge location
- Noise monitoring location points

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Rev	amendments	drawn date	checked date
B	Added new DG location	AMB Oct '11	AMcG Oct '11
A	Insertion of the OSI reference	RP Nov '06	AMcG Nov '06

RPS
 Enterprise Fund T +353 74 9161927
 Business Centre F +353 74 9161928
 Ballintrae, Letterkenny W www.rpsgroup.com/ireland
 Co. Donegal E ireland@rpsgroup.com

Louth County Council

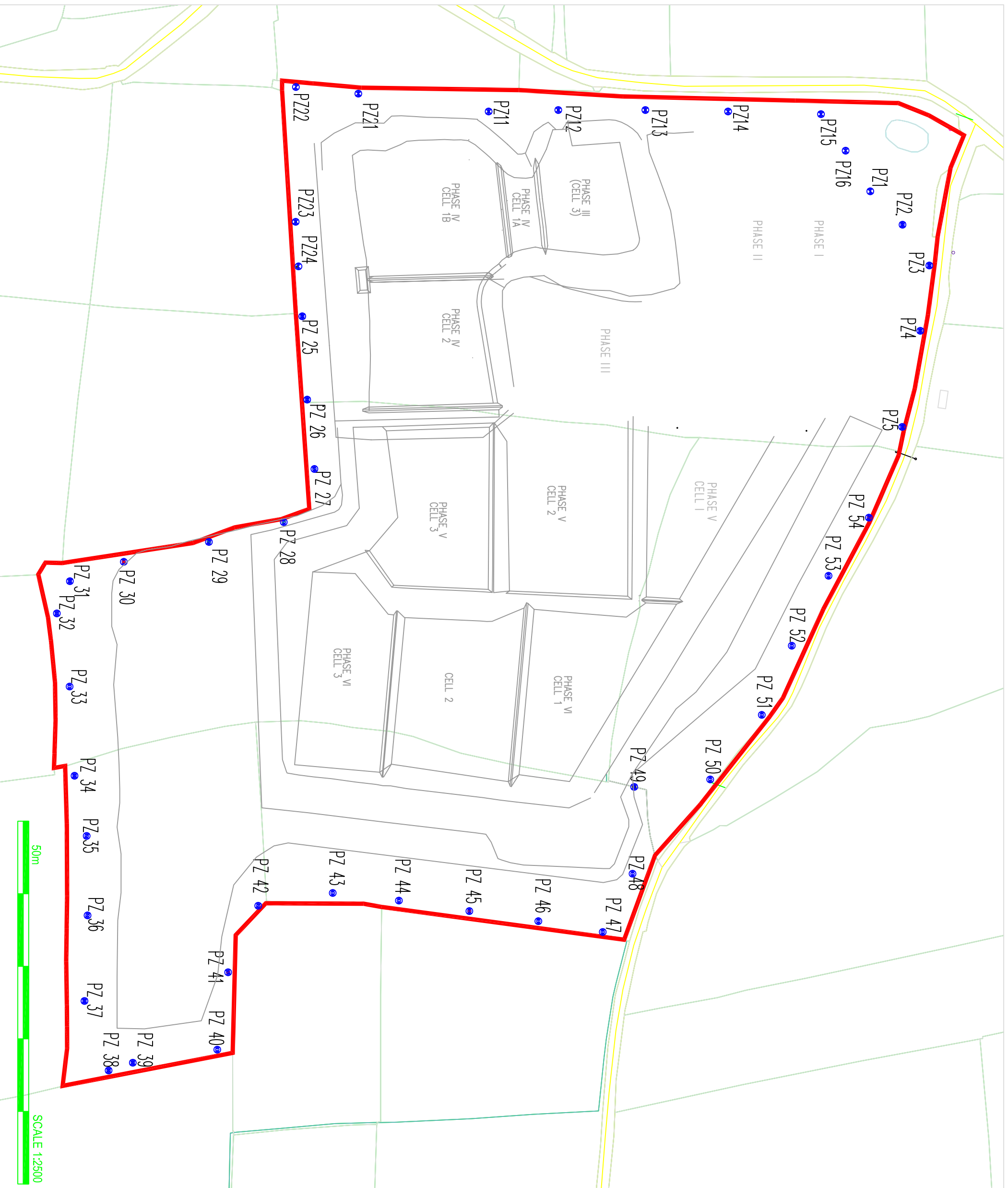
Whiteriver Landfill Site

Noise and Dust Monitoring Locations

Drawing Status	Sheet Size	Drawing Scale
Prelim	A3	1:7500

Drawing Number **IBL0069/102** Rev **B**

Drawn By / Date	Checked By / Date	Approved By / Date
RP Nov '06	AMcG Nov '06	DD Nov '06



NOTES

1. Verifying Dimensions:
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2. Existing Services:
Any information concerning the location of existing services indicated on this drawing is intended for general guidance only. It shall be the responsibility of the contractor to determine and verify the exact horizontal and vertical alignment of all cables, pipes, etc. (both underground and overhead) before work commences.
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4. DATUM:

5. KEYS:
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PZ77 Landfill Gas Piezometer

rev	amendments	drawn date	checked date

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Enterprise Fund T +353 74 9161927
Business Centre F +353 74 9161928
Ballinacree, Letterkenny W www.rpsgroup.com/ireland
Co. Donegal E ireland@rpsgroup.com

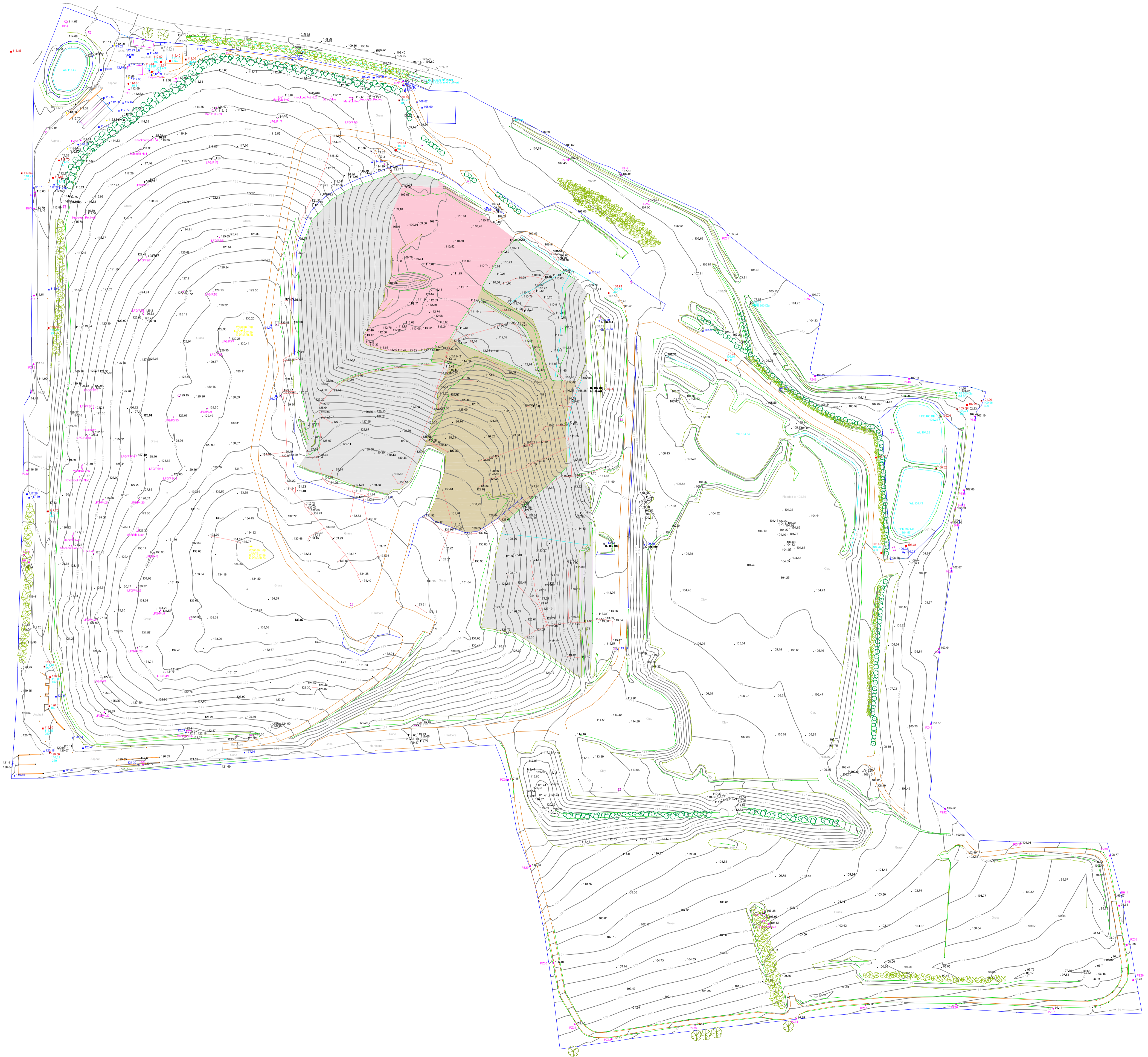
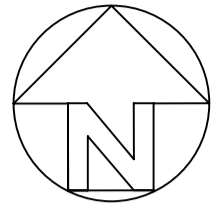
Client: LOUTH COUNTY COUNCIL

Project: Whiteriver Landfill Site

Title: Landfill Gas Piezometer

Architect	
Drawing Status	Sheet Size
Preliminary	A3
	Drawing Scale
	1:2500
Drawing Number	Rev
IBR0138/100	0

Drawn By / Date	Checked By / Date	Approved By / Date
AMB Mar '10	AMcG Mar '10	DD Mar '10



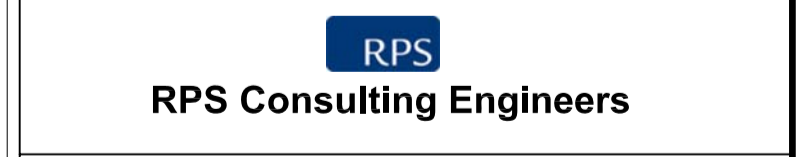
Notes

Elevations in metres to OS Datum
Irish Grid
1 metre contour interval

- Manhole & Cover Level 104.83
 - Manhole & Invert Level Storm 103.25
 - Manhole & Invert Level Foul 103.25F
 - Pipe Diameter (mm) 400
 - Service Manhole 112.86
 - Piezometer PZ16
 - Borehole BH3
 - Gas Pipeline
 - Fence
 - Light Pole
 - Gate
 - Bank Top
 - Bank Bottom
-
- Exposed HDPE
 - Clay Cover
 - Active Landfill
 - Deciduous Woodland
 - Coniferous Woodland
 - Draused Manhole 104.83

No.	Revision	Drg by	Chk by

Drg by PMcC	Chk by LW	App by PMcC
-------------	-----------	-------------



Whiteriver Landfill Site
Colon, Co. Louth



Scale 1:1250 Date April 19th, 2012

Drawing No. RW120419

Revision

APPENDIX C

PRTR REPORTING



AER Returns Workbook

REFERENCE YEAR 2012

1. FACILITY IDENTIFICATION

Parent Company Name	Louth County Council
Facility Name	Whiteriver Landfill Site
PRTR Identification Number	W0060
Licence Number	W0060-03

Waste or IPPC Classes of Activity

No.	class_name
3.0	Specialty engineered landfill, including placement into lined discrete cells which are capped and isolated from one another and the environment.
3.1	Deposit on, in or under land (including landfill).
3.12	Repackaging prior to submission to any activity referred to in a preceding paragraph of this Schedule.
3.13	Storage prior to submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where the waste concerned is produced.
3.4	Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons.
3.6	Biological treatment not referred to elsewhere in this Schedule which results in final compounds or mixtures which are disposed of by means of any activity referred to in paragraphs 1. to 10. of this Schedule.
3.7	The treatment of any waste on land with a consequential benefit for an agricultural activity or ecological system.
4.10	Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced.
4.13	Recycling or reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes).
4.2	Recycling or reclamation of other inorganic materials.
4.4	Use of any waste principally as a fuel or other means to generate energy.
4.9	

Address 1 Whiteriver & Gunstown Townland
 Address 2 Dunlaur
 Address 3 Co Louth
 Address 4
 Louth
 Country Ireland
 Coordinates of Location 4 52774 63 6647
 River Basin District GBNIENG
 NACE Code 3821
 Main Economic Activity Treatment and disposal of non-hazardous waste
 AER Returns Contact Name Damien Holmes
 AER Returns Contact Email Address damian.holmes@louthcoo.ie
 AER Returns Contact Position Facility Manager/Executive Scientist
 AER Returns Contact Telephone Number 041 6656016
 AER Returns Contact Mobile Phone Number 085 0597315
 AER Returns Contact Fax Number 0416651623
 Production Volume 0.0
 Production Volume Units
 Number of Installations 0
 Number of Operating Hours in Year 0
 Number of Employees 0
 User Feedback/Comments 0
 Web Address

2. PRTR CLASS ACTIVITIES

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

3. SOLVENTS REGULATIONS (S.I. No. 543 of 2007)

Is it applicable?

Have you been granted an exemption?

If applicable which activity class applies (as per Schedule 2 of the regulations)?

Is the reduction scheme compliance route being used?

4. WASTE IMPORTED/ACCEPTED ONTO SITE

Do you import/accept waste onto your site for on-site treatment (either recovery or disposal activities)?

[Guidance on waste imported/accepted onto site](#)

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

[Link to previous years emissions data](#)

4.1 RELEASES TO AIR

SECTION A - SECTOR SPECIFIC PRTR POLLUTANTS														
Please enter all quantities in this section in KGs														
No. Annex II	POLLUTANT	Name	M/C/E		METHOD		Emission Point 1			QUANTITY				
			Method Code	Description or Description	Method Code	Description or Description	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year		
03	Carbon dioxide (CO2)		C	OTH	Gasolin			0.0	0.0	0.0	0.0	0.0	0.0	0.0
01	Methane (CH4)		C	OTH	Flare Monitoring			0.0	13600000.0	0.0	13600000.0	0.0	0.0	13600000.0
55	1,1,1-Trichloroethane		C	OTH	GASSIM			0.0	-17032.0	0.0	-17032.0	0.0	0.0	-17032.0
04	Hydro-fluorocarbons (HFCs)		C	OTH	Gasolin			0.0	38.2	0.0	38.2	0.0	0.0	38.2
								0.0	47.6	0.0	47.6	0.0	0.0	47.6
* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button														
SECTION B - REMAINING PRTR POLLUTANTS														
Please enter all quantities in this section in KGs														
No. Annex II	POLLUTANT	Name	M/C/E	Method Code	Description or Description	Method Code	Description or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year			
15	ChloroHydrocarbons (CHCs)		C	OTH	Gasolin			0.0	0.0	0.0	0.0	0.0	0.0	54.8
* Select a row by double-clicking on the Pollutant Name (Column B) then click the delete button														
SECTION C - REMAINING POLLUTANT EMISSIONS (As resulted in your Licence)														
Please enter all quantities in this section in KGs														
Pollutant No.	Name	M/C/E	Method Code	Description or Description	Method Code	Description or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year				
							0.0	0.0	0.0	0.0				

Additional Data Requested from Landfill operators

For the purpose of the National Inventory on Greenhouse Gases, landfill operators are requested to provide summary data on landfill gas (Methane) based or utilised on their methane generation. Operators should only report their net methane (CH4) emission to the environment under 'Total' KG/yr for Section A. Sector specific PRTR pollutants above. Please complete the table below:

Landfill:	Whittaker Landfill Site	T (Total) kg/Year	Method Used		Facility Total Capacity m3 per hour
			M/C/E	Description or Description	
Total estimated methane generation (as per site model)		2810069.0	C	Gasolin Model	N/A
Methane flared		2827100.0	M	Measured at Flare	0.0 (Total Flaring Capacity)
Methane utilised in engines/above		0.0			0.0 (Total Utilising Capacity)
Net methane emission (as reported in Section A above)		-17032.0	C	Gasolin minus measures (As reported in gas survey)	N/A

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

Please enter all quantities on this sheet in Tonnes

Transfer Destination	European Waste Code	Hazardous	Quantity (Tonnes per Year)	Description of Waste	Waste Treatment Operation	Method Used		Location of Treatment	Haz Waste Name and Licence/Permit No of Next Destination Facility Haz Waste Name and Licence/Permit No of Recoverer/Disposer	Haz Waste - Address of Next Destination Facility Non-Haz Waste: Address of Recoverer/Disposer	Name and License / Permit No. and Address of Final Recoverer / Disposer (HAZARDOUS WASTE ONLY)	Actual Address of Final Destination i.e. Final Recovery / Disposal Site (HAZARDOUS WASTE ONLY)
						M/C/E	Method Used					
Within the Country	19 07 03	No	30436.26	landfill leachate other than those mentioned in 19 07 02	D9	M	Weighted	Offsite in Ireland	Marsh Road,Drogheda,Co. Louth, Ireland			

EPS ..

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

[Link to previous years waste data](#)
[Link to previous years waste summary data & percentage change](#)

APPENDIX D

FLUE GAS MONITORING



ODOUR & ENVIRONMENTAL CONSULTANTS

Unit 32 De Granville Court, Dublin Rd, Trim, Co. Meath

Tel: +353 46 9437922
 Fax: +353 46 9483696
 Mobile: +353 86 8550401
 E-mail: info@odourireland.com
www.odourireland.com

TITLE: AIR EMISSION TESTING OF TWO LANDFILL FLARES LOCATED IN WHITERIVER LANDFILL FACILITY, DUNLEER, CO. LOUTH

PREFORMED BY ODOUR MONITORING IRELAND ON BEHALF OF LOUTH COUNTY COUNCIL

PREPARED BY:	Dr. John Casey
ATTENTION:	Mr. Damien Holmes
LICENCE NUMBER:	WL060-03
LICENCE HOLDER:	Louth County Council
FACILITY NAME:	Whiteriver Landfill Facility
DATE OF MONITORING VISIT:	23 rd Nov. 2012
NAME AND ADDRESS OF CLIENT ORGANISATION:	Dunleer, Co. Louth
NAME AND ADDRESS OF MONITORING ORGANISATION:	Odour Monitoring Ireland, Unit 32 DeGranville Court, Dublin Road, Trim, Co. Meath
DATE OF REPORTING:	01 st Feb .2013
NAME AND THE FUNCTION OF THE PERSON APPROVING THE REPORT:	Dr. Brian Sheridan, Managing Partner, Odour Monitoring Ireland
REPORT NUMBER:	2013586(1)
REVIEWERS:	Dr. Brian Sheridan


TABLE OF CONTENTS

Section	Page number
TABLE OF CONTENTS	i
DOCUMENT AMENDMENT RECORD	ii
1. Executive Summary	1
1.1 Monitoring Objectives	1
1.2 Special Monitoring Requirements	1
1.3 The substances to be monitored at each emission point	2
2. Monitoring Results	3
2.1 Operating Information	3
2.2 Monitoring Result Reference Conditions	3
2.3 Sampling Location Summary	3
2.4 Sampling run times	4
2.5 Characteristics of raw inlet gas to enclosed Landfill flares	5
2.6 Theoretically calculated landfill gas exhaust volume and physical characteristics from the Landfill flare.	6
3. Discussion of results	9
4. Conclusion	10
5. References	10
6. Appendix I-Sampling, analysis	11

Document Amendment Record

Client: Louth County Council

Project: Air emission testing of two enclosed Landfill flares located in Whiteriver landfill facility, Dunleer, Co. Louth.

Project Number: 2013586(1)			Document Reference:		
2013586(1)	Document for review	B.A.S.	JWC	B.A.S	01/02/2013
Revision	Purpose/Description	Originated	Checked	Authorised	Date
					

Signing sheet



Brian Sheridan Ph.D Eng

For and on behalf of Odour Monitoring Ireland

1. Executive Summary

The results of the monitoring exercise are contained in Section 2 of this report.

- NO_x as NO₂, CO, TOC and HCL/HF emissions from both flares were within the emission limit values specified in Waste licence W060-03;

1.1 Monitoring Objectives

This report has been prepared by Odour Monitoring Ireland and contains the results of emission testing carried out on 2 No. Enclosed ground flares at Whiteriver Landfill, Co. Louth. The monitoring was carried out at this facility as part of compliance monitoring with the requirements of Waste licence W0060-03. The emission testing was carried out by Odour Monitoring Ireland on behalf of Louth County Council.

1.2 Special Monitoring Requirements

There were no special monitoring requirements for this campaign.

1.3 The substances to be monitored at each emission point

The parameters listed in *Table 1.1* were monitored using the appropriate instrumentation as illustrated in *Table 1.1*. All monitoring was carried out in accordance with Environmental Protection Agency Office of Environmental Enforcement (OEE) Air Emission Monitoring Guidance Note 2 (AG2).

Table 1.1. Monitored parameters and techniques

Sample location	Parameter	Analytical method
Landfill Flare	Volumetric airflow rate & Temperature (°C)	Pitot in accordance with EN13284-1 where possible. MGO coated K type thermocouple and PT100 Volumetric airflow rate theoretical calculated for Landfill flare.
Landfill Flare	Oxides of nitrogen (NO _x as NO ₂), Carbon monoxide (CO), Carbon dioxide (CO ₂), Sulphur dioxide (SO ₂), and Oxygen (O ₂)	Horiba PG250 All analytes, Oxygen EN14789, Oxides of Nitrogen Chemiluminescence, Carbon Monoxide EN15085.
Landfill Flare	Hydrogen chloride (HCL)	Impinger train containing high purity deionised water solution in accordance ISEN 1911:2010
Landfill Flare	Hydrogen fluoride (HF)	Impinger train containing 0.10 molar sodium hydroxide ISEN 15713:2006
Landfill Flare	Total Organic Carbon (TOC)	TOC analyser in accordance with EN12619:2002

This report presents details of this monitoring programme. This environmental monitoring was carried out Dr. John Casey, Managing Partner, Odour Monitoring Ireland on the 23rd Nov. 2012. Methodology, Results, Discussion and Conclusions are presented herein.

2. Monitoring Results

This section will present the results of the monitoring exercise.

2.1 Operating Information

Emission Point Reference	Date	Process Type	Process Duration	Fuel	Feedstock	Abatement	Load
Flare 1	23/11/2012	Landfill flare	Continuous	Landfill Gas	N/A	None	Landfill Gas
Flare 2	23/11/2012	Landfill flare	Continuous	Landfill Gas	N/A	None	Landfill Gas

2.2 Monitoring Result Reference Conditions

Emission Point Reference	Temperature (K)	Pressure	Moisture Correction	Oxygen Correction (%)
Flare 1	K	101.3	Yes	3
Flare 2	K	101.3	Yes	3

2.3. Sampling Location Summary

Comment	Yes/No
Recommended 5 hydraulic diameters straight length before sampling plane	Yes
Recommended 2 hydraulic diameters straight length after sampling plane	Yes
Ports number <1.5m - 2 ports >1.5m - 4 ports	1 port on the flares
Appropriate port size	Yes
Suitable working platform	Yes

Note: Temperature and airflow rate traverse measurements were performed across the stack in one plane only. Only one plane was possible due to access port issues.

2.4. Sampling run times for the monitoring

Parameter	Approx. Sampling period for landfill flare
Inlet CH ₄	30 minutes
Inlet O ₂	30 minutes
Volumetric air flow rate	Theoretically calculated
SO ₂	35 minutes
NO _x	35 minutes
CO	35 minutes
O ₂	35 minutes
CO ₂	35 minutes
Stack gas temp	35 minutes
TOC	35 minutes
HCL	32 minutes
HF	31 minutes

2.5. Characteristics of raw inlet gas to enclosed Landfill flare

Parameter	Compound loading Flare1	Compound loading Flare 2	Units
CH ₄	35	36.7	%
CO ₂	31.5	30.5	%
O ₂	5.87	4.8	%
Volumetric flow rate	500	1002	m ³ /hr
Total chloride	3.54	-	mg/Nm ³
Total fluoride	<1.54	-	mg/Nm ³
Total sulphur	547	-	mg/Nm ³

2.6. Theoretically calculated landfill gas exhaust volume and physical characteristics from the Landfill flare.

Parameter	Flare 1	Flare 2
Total Volumetric methane loading (m ³ /hr)	177	367
Total Volumetric Oxygen loading (m ³ /hr)	29.3	48
Ratio to complete combustion of methane assuming no excess Oxygen	9.57	9.57
Oxygen concentration level in flue gas (%)	11.21	12.67
Flue gas temperature (Kelvin) ²	1,302	1,318
Theoretical calculated Volumetric exhaust airflow rate (m ³ /h)	4,678	11,359
Normalised average exhaust airflow rate (Nm ³ h ⁻¹) ³	980	2,352

Notes: ¹ denotes data from 23/11/2012.
² denoted converted from degrees Celsius to Kelvin (°C + 273.15);
³ denotes normalised to 273.15 Kelvin and 101.3 kPa.

Table 2.7. Emission value results for landfill gas Flare 1.

Flare 1	Conc.	Normalised (mgN/m ³)	Oxygen corrected emission concentration to flare (mgN/m ³) 3% ref.	Kg/hr	Expanded uncertainty as percentage of limit value (%) ¹	Emission limit Values	Operating Status
Total NOx [as NO ₂] (ppm)	17	34.85	64.38	0.03	16.54	<150 mg/Nm ³	As Normal
CO (ppm)	0	0	0.00	0.000	12.41	<50 mg/Nm ³	As Normal
Total Organic Carbon (mg/m ³)	1.88	3.01	5.56	0.00	16.47	<10 mg/Nm ³	As Normal
Average Hydrogen Chloride (mg/m ³)	1.54	1.54	2.85	0.0015	-	<50 mg/Nm ³ (at mass flow > 0.30 kg/hr)	As Normal
Average Hydrogen Fluoride (mg/m ³)	0.52	0.72	1.32	0.0007	-	<5 mg/Nm ³ (at mass flow > 0.050 kg/hr)	As Normal
SO ₂ (ppm)	438	1,248.3	2,305.94	1.22	-	-	As Normal
O ₂ (%)	11.21	-	-	-	-	-	As Normal
Temperature (degrees)	1029	1302K	-	-	-	>1273K	As Normal
CO ₂ (%)	5.55	-	-	-	-	-	As Normal
Volumetric Airflow (m ³ /hr)	-	-	531	-	-	<3,000	As Normal
Efficiency (%)	>99.99	-	-	-	-	-	As Normal

Notes: ¹ denotes that expanded uncertainty is elevated as the equation has not been validated for use with high temperature sources.

Leak check results for Horiba = <2%

Leak check results for Signal = <2%

Leak check results HCL = <2%

Leak check results HF = <2%

Span (<2% range) and drift values within acceptable tolerance (<1%) for Horiba.

Span (<2% range) and drift values within acceptable tolerance (<1%) for Signal.

Table 2.8. Emission value results for landfill gas Flare 2.

Flare 1	Conc.	Normalised (mgN/m ³)	Oxygen corrected emission concentration to flare (mgN/m ³) 3% ref.	Kg/hr	Expanded uncertainty as percentage of limit value (%) ¹	Emission limit Values	Operating Status
Total NOx [as NO ₂] (ppm)	24	49.20	107.01	0.1157	13.54	<150 mg/Nm ³	As Normal
CO (ppm)	5	6.25	13.59	0.015	7.84	<50 mg/Nm ³	As Normal
Total Organic Carbon (mg/m ³)	1.99	3.18	6.93	0.007	16.54	<10 mg/Nm ³	As Normal
Average Hydrogen Chloride (mg/m ³)	0.11	0.10	0.23	0.0003	-	<50 mg/Nm ³ (at mass flow > 0.30 kg/hr)	As Normal
Average Hydrogen Fluoride (mg/m ³)	0.09	0.09	0.19	0.0002	-	<5 mg/Nm ³ (at mass flow > 0.050 kg/hr)	As Normal
SO ₂ (ppm)	444	1,265	2,752	2.97	-	-	As Normal
O ₂ (%)	12.67	-	-	-	-	-	As Normal
Temperature (degrees)	1045	1318.15K	-	-	-	>1273K	As Normal
CO ₂ (%)	4.81	-	-	-	-	-	As Normal
Volumetric Airflow (m ³ /hr)	-	-	1,081	-	-	<3,000	As Normal
Efficiency (%)	>99.99	-	-	-	-	-	As Normal

Notes: ¹ denotes that expanded uncertainty is elevated as the equation has not been validated for use with high temperature sources.
 Leak check results for Horiba = <2%
 Leak check results for Signal = <2%
 Leak check results HCL = <2%
 Leak check results HF = <2%
 Span (<2% range) and drift values within acceptable tolerance (<1%) for Horiba.
 Span (<2% range) and drift values within acceptable tolerance (<1%) for Signal.

3. Discussion of results

Tables 2.1 to 2.8 present the results of the emission monitoring carried out on the landfill flares located in Whiteriver Landfill.

There was very little variation at one traverse in oxygen and flue gas temperature profiles across the stack during the monitoring exercise (i.e. less than 15% as recommended by the Environment Agency, UK (Environment Agency, 2002)).

A high temperature Inconel 625 and ceramic probe (Testo, Germany) was used to prevent variations in CO emissions data. Normal stainless steel probes when subjected to temperatures above 600⁰C can release CO from within the structure of the material and cause the recording of erroneous results (Environment Agency, 2002).

Correction of data to 3% oxygen was performed. Due to possible inaccuracies in airflow rate measurement, it was not possible to determine the oxygen intake of the flare through the louver system using measurement. Since the volume of intake air required for complete combustion was known and the oxygen concentration in the exhaust flue gas was known, the volume of intake excess fuel air could be theoretically calculated through numerous iterations using the Solver program (i.e. Microsoft Excel). This allows for the calculation of the volume of intake excess air through the louver landfill flare intake system (Environment Agency, 2002).

4. Conclusion

The following conclusions can be drawn from this study:

1. A theoretical exhaust flue gas volume was calculated for the landfill flare.
2. NO_x as NO₂, SO₂, CO, O₂, TOC, HCL and HF monitoring and analysis was carried out in accordance with specified requirements;
3. All data was standardised to 273.15 Kelvin, 101.3 kPa;
4. All data is presented as Oxygen corrected to 3% (v/v) using the appropriate equations;
5. NO_x as NO₂, CO, TOC, HCL and HF emissions from both flares were within the emission limit values specified in Waste licence W060-03;

5. References

1. Environment Agency. (2002). Guidance for Monitoring Enclosed Landfill Gas Flares. www.environment-agency.co.uk
2. Environmental Protection Agency. (2009). Air Emissions Monitoring Guidance Note 2 (AG2).
3. I.S. EN 13284-1:2002. Stationary source emissions. Measurement of velocity and volume flow rate of gas streams in ducts.
4. IS EN13526:2002-Stationary source emissions-Determination of the mass concentration of total gaseous organic carbon in flue gases from solvent using processes-Continuous flame ionisation detector method.
5. IS EN12619:1999-Stationary source emissions-Determination of the mass concentration of total gaseous organic carbon at low concentrations in flue gases-Continuous flame ionisation detector method.
6. I.S. EN 13284-1:2002. Stationary source emissions. Determination of low range mass concentration of dust. Manual gravimetric method.

6. Appendix I-Sampling, analysis

6.1.1 Location of Sampling

Whiteriver landfill facility, Dunleer, Co. Louth.

6.1.2 Date & Time of Sampling

23rd Nov. 2012

6.1.3 Personnel Present During Sampling

Dr. John Casey, Odour Monitoring Ireland, Trim, Co. Meath.

6.1.4 Instrumentation check list

Testo 350 MXL/454 in stack analyser;
Federal Method 2 S type pitot and MGO coated thermocouple;
L type pitot tube
Testo 400 handheld and appropriate probes.
Ceramic and Inconel 625 sampling probes.
Portable Signal 3030PM FID calibrated with Propane with non-methane hydrocarbon cutter.
SKC sample pumps and Bios Primary calibrator

APPENDIX E

MONTHLY WATER BALANCE CALCULATION

MONTHLY WATER BALANCE CALCULATION 2012																				
	Active Phase	Active Area A(m ²)	Waste Input t/month	Rainfall mm	Active Area Infiltration AR(A)(m ³)	Liquid Waste LW(m ³) Excess Water From Sludge	Temp Restored area	Temp Restored area(Temp) RCA(m ²)	Restored area(Temp) infiltration IRCA(m ³)	Leachate Lagoon AR(l)	Permanently Restored area	Permanently Restored area	Restored area RCA(m ²)	Total Water	Cumulative Water	Absorptive Capacity aW(m ³)	Cumulative Absorptive Capacity	Cumulative Leachate	Leachate produced Lo(m ³)	Leachate tankered to WWTP
January	5, Cell 1A and Cell	12,006	6234	74.6	896	26	5, Cell 2	15,556	348	119	1,2,3,4,5(3a,b)	103844	775	2164	2164	374.05	374.05	1790	1790	2701
February	5, Cell 1A and Cell	12,006	5748	25.4	305	6	5, Cell 2	15,556	119	41	1,2,3,4,5(3a,b)	103844	264	734	2898	344.89	718.94	2179	389	2250
March	5, Cell 1A and Cell	12,006	7436	13.2	158	418	5, Cell 2	15,556	62	21	1,2,3,4,5(3a,b)	103844	137	797	3695	446.13	1165.07	2530	350	1209
April	5, Cell 1A and Cell	12,006	7545	84.8	1018	115	5, Cell 2	15,556	396	136	1,2,3,4,5(3a,b)	103844	881	2545	6239	452.69	1617.76	4622	2092	1914
May	5, Cell 1A and Cell	12,006	12515	42.8	514	133	5, Cell 2	15,556	200	68	1,2,3,4,5(3a,b)	103844	444	1359	7599	750.88	2368.64	5230	608	1862
June	5, Cell 1A and Cell	12,006	14891	144.6	1736	114	5, Cell 2	15,556	675	231	1,2,3,4,5(3a,b)	103844	1502	4257	11856	893.46	3262.10	8594	3364	3208
July	5, Cell 1A and Cell	12,006	5777	94.4	1133	152	5, Cell 2	15,556	441	151	1,2,3,4,5(3a,b)	103844	980	2857	14714	346.63	3608.73	11105	2511	3622
August	5, Cell 1A and Cell	12,006	3953	103.2	1239	103	5, Cell 2	15,556	482	165	1,2,3,4,5(3a,b)	103844	1072	3060	17774	237.18	3845.91	13928	2823	2446
September	5, Cell 1A and Cell	12,006	5830	61.4	737	106	5, Cell 2	15,556	287	98	1,2,3,4,5(3a,b)	103844	638	1866	19640	349.83	4195.74	15444	1516	2246
October	5, Cell 1A and Cell	12,006	8142	64.6	776	98	5, Cell 2	15,556	301	103	1,2,3,4,5(3a,b)	103844	671	1949	21589	488.54	4684.28	16905	1461	2411
November	5, Cell 1A and Cell	12,006	5692	76.6	920	128	5, Cell 2	15,556	357	123	1,2,3,4,5(3a,b)	103844	795	2323	23912	341.51	5025.79	18886	1981	3607
December	5, Cell 1A and Cell	12,006	4038	84.2	1011	90	5, Cell 2	15,556	393	135	1,2,3,4,5(3a,b)	103844	874	2503	26415	242.30	5268.09	21147	2261	2961
Total			87801	869.8	10443	1489			4059	1392			9032	26415		5268			21147	30436

Assumptions

IRCA=	Temporarily capped/restored area infiltration of rainfall estimated %	30%	%
	Permanent capped/restored area infiltration of rainfall estimated %	10%	%
Absorptive Capacity=	waste density of 0.8 tonnes/m ³ . Estimated absorptive capacity (water per tonne waste before leachate is produced) t/m ³	0.06	t/m ³
Temporary restored assumed 50% Phase I to III permanent restored.	Area of landfill site restored (1,2)	41,000	m ²
	Area of Phase 3	11,500	m ²
	Area of Phase 1,2 and 3 remaining to be temp capped	7,000	m ²
	Area of Phase 4, Cell 1A	2,190	m ²
	Area of Phase 4, Cell 1	15,000	m ²
	Area of Phase 4, Cell 2	8,000	m ²
	Area of Phase 5, Cell 3A	7,974	m ²
	Area of Phase 5, Cell 3B	7,180	m ²
	Area of Phase 5, Cell 2A	13,761	m ²
	Area of Phase 5, Cell 2B	5,795	m ²
	Area of Phase 5, Cell 1A	10,083	m ²
	Area of Phase 5, Cell 1B	323	m ²
	Surface Area Leachate Lagoon	1,600	m ²
Rainfall	Rainfall taken from on site	869.8	mm

MONTHLY CLIMATOLOGICAL SUMMARY for JAN. 2012

NAME: Whiteriver Landfill CITY: STATE:
 ELEV: 374 ft LAT: 37'360'0N LONG: 122'06'00'W

TEMPERATURE (°C), RAIN (mm), WIND SPEED (km/hr)

DAY	MEAN TEMP	HIGH	TIME	LOW	TIME	HEAT DEG DAYS	COOL DEG DAYS	RAIN	AVG WIND SPEED	HIGH	TIME	DOM DIR
1	5.6	8.9	1:00	1.0	00:00	12.7	0.0	2.8	23.5	56.3	13:30	SSW
2	2.5	5.5	00:00	0.8	2:00	15.8	0.0	5.2	24.3	61.2	13:30	SSW
3	5.8	11.7	4:30	2.9	22:00	12.5	0.0	11.8	37.2	83.7	5:30	SW
4	6.4	9.8	00:00	3.3	1:30	11.9	0.0	9.0	36.4	82.1	17:30	SW
5	7.1	9.7	1:00	4.4	00:00	11.3	0.0	2.8	33.6	85.3	3:30	WSW
6	7.3	10.1	20:30	4.1	4:00	11.0	0.0	0.4	23.3	54.7	20:30	SW
7	6.8	8.3	0:30	5.7	8:30	11.5	0.0	0.0	23.7	53.1	2:00	WSW
8	8.6	10.1	13:00	6.7	2:30	9.7	0.0	0.2	21.7	45.1	13:30	SW
9	7.7	9.0	3:00	5.7	00:00	10.6	0.0	0.6	15.9	48.3	1:30	SW
10	8.5	10.4	14:30	5.4	0:30	9.8	0.0	1.2	20.9	54.7	14:00	SSW
11	9.7	17.2	14:00	8.4	9:30	8.4	0.0	0.4	23.0	53.1	18:00	SW
12	7.3	10.3	0:30	3.9	00:00	11.0	0.0	0.2	21.4	64.4	3:30	WSW
13	4.6	7.6	12:30	2.9	00:00	13.7	0.0	0.0	4.7	19.3	0:30	WSW
14	4.3	5.8	14:00	2.4	4:00	14.0	0.0	0.0	8.9	33.8	16:00	ESE
15	4.7	5.2	3:00	3.6	21:30	13.6	0.0	0.0	12.1	37.0	12:30	ESE
16	4.3	5.8	15:00	3.3	20:30	14.0	0.0	0.0	8.7	32.2	22:00	SE
17	7.2	9.6	15:00	3.8	2:30	11.1	0.0	0.0	14.0	45.1	22:30	SSE
18	7.9	10.8	5:00	5.4	18:30	10.4	0.0	0.8	19.3	49.9	7:00	SW
19	5.1	6.8	13:30	3.1	21:30	13.3	0.0	1.8	25.6	104.6	16:30	SW
20	8.0	10.2	23:30	3.9	0:30	10.3	0.0	1.2	30.9	62.8	6:30	SW
21	6.8	10.0	0:30	4.7	20:30	11.5	0.0	3.2	34.4	70.8	6:30	WSW
22	6.6	8.9	5:30	4.5	23:30	11.7	0.0	0.0	29.1	66.0	7:00	SW
23	4.6	6.4	15:00	3.4	21:30	13.7	0.0	0.4	16.3	35.4	11:00	SW
24	8.9	10.4	12:30	3.3	0:30	9.4	0.0	4.6	19.3	48.3	22:30	SSW
25	7.2	10.0	13:00	1.6	00:00	11.1	0.0	7.6	20.6	64.4	12:00	S
26	2.4	4.3	14:30	0.5	1:30	15.9	0.0	1.6	20.9	53.1	18:00	SW
27	3.1	5.6	15:30	1.7	7:30	15.2	0.0	1.0	22.9	48.3	12:00	SW
28	3.3	4.7	23:00	1.7	2:00	15.0	0.0	0.2	9.2	30.6	23:30	S
29	4.7	6.2	14:30	3.1	23:00	13.7	0.0	15.8	10.8	37.0	19:00	SE
30	3.5	3.7	10:30	3.2	0:30	14.8	0.0	1.8	14.0	35.4	11:00	ESE
31	2.8	3.5	0:30	2.1	00:00	15.5	0.0	0.0	11.9	38.6	20:00	E

	5.9	17.2	11	0.5	26	383.8	0.0	74.6	20.6	104.6	19	SW

Max >= 32.0: 0
 Max <= 0.0: 0
 Min <= 0.0: 0
 Min <= -18.0: 0

Max Rain: 15.80 ON 29/01/12

Days of Rain: 23 (> .2 mm) 9 (> 2 mm) 0 (> 20 mm)

Heat Base: 18.3 Cool Base: 18.3 Method: Integration

MONTHLY CLIMATOLOGICAL SUMMARY for FEB. 2012

NAME: Whiteriver Landfill CITY: STATE:
 ELEV: 374 ft LAT: 37'36'0N LONG: 122'06'00'W

TEMPERATURE (°C), RAIN (mm), WIND SPEED (km/hr)

DAY	MEAN TEMP	HIGH	TIME	LOW	TIME	HEAT DEG DAYS	COOL DEG DAYS	RAIN	AVG WIND SPEED	HIGH	TIME	DOM DIR
1	1.5	2.8	15:30	-0.2	20:30	16.8	0.0	0.0	9.5	29.0	0:30	E
2	0.1	2.7	14:30	-1.2	9:00	18.2	0.0	0.0	6.6	20.9	12:00	SSE
3	0.7	4.1	14:30	-2.2	6:30	17.6	0.0	0.0	9.5	29.0	14:30	SSE
4	5.1	7.4	16:00	2.7	0:30	13.2	0.0	3.2	16.6	46.7	16:00	SSE
5	4.6	6.5	14:30	2.9	3:30	13.7	0.0	0.0	14.5	30.6	1:00	SW
6	5.6	8.4	14:30	3.1	23:30	12.7	0.0	0.2	3.7	14.5	1:00	ESE
7	3.9	6.5	15:00	2.1	7:00	14.4	0.0	0.2	9.7	32.2	23:30	SE
8	3.2	4.1	18:30	2.3	10:00	15.2	0.0	1.0	15.6	41.8	4:00	SE
9	6.8	9.1	18:30	3.7	0:30	11.5	0.0	4.4	15.4	37.0	9:00	SW
10	7.1	8.9	0:30	6.1	21:00	11.2	0.0	1.0	7.4	30.6	22:30	E
11	5.9	6.6	14:30	5.4	00:00	12.4	0.0	2.8	11.3	40.2	5:30	S
12	5.3	6.1	12:30	4.5	8:00	13.0	0.0	0.0	9.8	25.7	15:00	WSW
13	5.9	7.6	12:00	4.5	2:30	12.4	0.0	0.2	22.4	49.9	12:30	WNW
14	6.6	7.7	20:30	5.2	9:00	11.7	0.0	0.0	23.5	56.3	23:00	WNW
15	7.3	9.0	12:00	6.2	7:30	11.0	0.0	0.0	24.8	53.1	0:30	WNW
16	7.9	9.3	15:30	6.2	4:30	10.4	0.0	0.0	22.5	51.5	9:30	SW
17	9.1	10.6	14:30	7.4	22:30	9.2	0.0	0.8	24.9	61.2	22:30	SW
18	4.0	7.6	0:30	0.7	23:30	14.3	0.0	3.2	28.0	72.4	5:00	WSW
19	2.6	5.9	14:30	0.2	3:00	15.7	0.0	0.0	15.0	33.8	1:00	WSW
20	5.9	8.2	19:00	1.8	1:00	12.4	0.0	1.0	25.6	62.8	15:30	SSW
21	9.7	11.9	14:30	7.8	1:00	8.6	0.0	0.6	22.7	64.4	21:30	SSW
22	11.0	12.8	13:30	9.9	3:30	7.3	0.0	3.6	27.8	70.8	7:00	SW
23	11.1	12.1	14:30	10.3	3:30	7.2	0.0	0.4	29.1	54.7	11:30	SW
24	8.1	10.9	0:30	5.5	00:00	10.2	0.0	2.0	17.7	48.3	1:30	W
25	6.4	8.0	20:30	4.2	6:30	11.9	0.0	0.0	11.3	38.6	12:00	SW
26	7.7	9.9	15:30	5.2	9:00	10.6	0.0	0.6	14.0	43.5	22:30	S
27	9.7	10.6	17:00	8.7	3:30	8.6	0.0	0.2	25.1	49.9	12:00	SW
28	9.7	10.9	14:30	8.7	23:00	8.6	0.0	0.0	14.3	38.6	1:00	SW
29	8.8	10.6	16:00	7.3	7:00	9.5	0.0	0.0	10.5	38.6	11:00	SSE

	6.3	12.8	22	-2.2	3	349.2	0.0	25.4	16.9	72.4	18	SW

Max >= 32.0: 0
 Max <= 0.0: 0
 Min <= 0.0: 3
 Min <= -18.0: 0

Max Rain: 4.39 ON 09/02/12

Days of Rain: 17 (> .2 mm) 6 (> 2 mm) 0 (> 20 mm)

Heat Base: 18.3 Cool Base: 18.3 Method: Integration

MONTHLY CLIMATOLOGICAL SUMMARY for MAR. 2012

NAME: Whiteriver Landfill CITY: STATE:
 ELEV: 374 ft LAT: 37'360'0N LONG: 122'06'00'W

TEMPERATURE (°C), RAIN (mm), WIND SPEED (km/hr)

DAY	MEAN TEMP	HIGH	TIME	LOW	TIME	HEAT DEG DAYS	COOL DEG DAYS	RAIN	AVG WIND SPEED	HIGH	TIME	DOM DIR
1	8.5	11.7	13:00	5.2	23:00	9.8	0.0	0.0	14.5	51.5	13:30	S
2	7.6	10.3	12:00	5.8	0:30	10.8	0.0	0.0	12.1	38.6	00:00	SE
3	6.9	9.6	14:30	3.9	00:00	11.4	0.0	4.0	18.2	49.9	4:00	SW
4	3.1	6.1	15:00	0.2	7:30	15.2	0.0	0.2	19.8	48.3	15:00	WSW
5	4.6	8.6	15:00	1.4	6:30	13.7	0.0	0.0	15.1	40.2	3:30	WSW
6	6.0	10.6	00:00	1.9	7:00	12.3	0.0	0.8	18.2	59.5	22:30	S
7	5.8	10.6	0:30	2.8	20:30	12.5	0.0	3.8	28.3	64.4	3:30	WSW
8	7.2	11.4	15:30	2.9	2:00	11.2	0.0	0.0	21.7	54.7	15:00	SSW
9	9.9	11.4	16:30	7.6	4:30	8.4	0.0	0.0	23.5	53.1	12:00	SW
10	10.8	12.8	15:30	9.6	7:30	7.5	0.0	0.0	19.8	43.5	15:00	SW
11	8.2	9.8	14:30	5.5	8:00	10.2	0.0	0.0	12.7	30.6	14:30	SW
12	8.3	10.3	15:30	7.2	7:00	10.0	0.0	0.0	3.4	17.7	11:30	SE
13	7.1	8.8	13:00	5.0	00:00	11.2	0.0	0.0	4.8	16.1	13:00	SE
14	6.0	8.2	17:00	3.1	7:00	12.3	0.0	0.0	6.1	25.7	10:30	S
15	8.1	10.4	16:00	5.2	4:30	10.2	0.0	0.0	10.1	41.8	23:00	S
16	8.1	9.9	2:00	4.7	00:00	10.3	0.0	3.4	15.8	48.3	4:00	S
17	4.9	7.3	12:30	1.7	6:30	13.4	0.0	0.2	8.5	27.4	13:00	ENE
18	5.4	9.8	16:00	1.3	6:30	12.9	0.0	0.2	15.0	35.4	11:00	W
19	7.3	10.7	17:00	2.8	3:30	11.0	0.0	0.0	22.9	53.1	12:30	SW
20	9.4	11.3	15:00	6.3	7:30	8.9	0.0	0.0	18.2	53.1	2:00	SSW
21	8.4	9.8	14:30	5.6	00:00	9.9	0.0	0.0	7.9	29.0	11:30	S
22	7.4	9.7	23:00	4.7	2:00	10.9	0.0	0.0	13.0	37.0	12:00	ENE
23	8.6	11.4	11:30	6.6	22:30	9.7	0.0	0.4	9.3	30.6	14:30	ESE
24	10.3	14.2	11:30	6.1	1:00	8.0	0.0	0.2	9.0	35.4	12:00	E
25	12.3	18.6	15:30	9.1	22:00	5.8	0.0	0.0	7.7	27.4	15:30	SE
26	9.7	14.2	17:00	6.3	9:00	8.6	0.0	0.0	4.8	25.7	15:00	E
27	10.7	14.8	16:30	6.9	1:30	7.6	0.0	0.0	3.9	17.7	14:30	E
28	13.1	18.2	16:30	8.6	6:00	5.2	0.0	0.0	7.2	22.5	17:00	WSW
29	11.1	15.8	16:30	8.1	23:00	7.2	0.0	0.0	15.8	38.6	23:30	W
30	8.7	10.5	17:30	7.4	7:30	9.6	0.0	0.0	18.8	37.0	1:00	NW
31	8.3	9.9	15:30	5.6	00:00	10.0	0.0	0.0	13.8	41.8	9:30	NNW
	8.1	18.6	25	0.2	4	315.5	0.0	13.2	13.5	64.4	7	SW

Max >= 32.0: 0
 Max <= 0.0: 0
 Min <= 0.0: 0
 Min <= -18.0: 0

Max Rain: 3.99 ON 03/03/12

Days of Rain: 9 (> .2 mm) 3 (> 2 mm) 0 (> 20 mm)

Heat Base: 18.3 Cool Base: 18.3 Method: Integration

MONTHLY CLIMATOLOGICAL SUMMARY for APR. 2012

NAME: Whiteriver Landfill CITY: STATE:
 ELEV: 374 ft LAT: 37'360'0N LONG: 122'06'00'W

TEMPERATURE (°C), RAIN (mm), WIND SPEED (km/hr)

DAY	MEAN TEMP	HIGH	TIME	LOW	TIME	HEAT DEG DAYS	COOL DEG DAYS	RAIN	AVG WIND SPEED	HIGH	TIME	DOM DIR
1	6.7	9.8	16:30	2.6	7:30	11.6	0.0	0.0	8.5	20.9	12:30	WNW
2	7.3	9.7	17:30	6.0	7:00	11.0	0.0	0.8	12.1	27.4	18:00	W
3	3.7	6.4	0:30	0.6	20:00	14.6	0.0	0.4	26.1	56.3	14:00	NNW
4	3.8	6.3	16:30	1.1	3:00	14.5	0.0	0.2	23.2	54.7	11:30	N
5	4.9	9.2	17:30	-0.4	7:00	13.4	0.0	0.0	8.7	35.4	1:30	NNE
6	7.4	9.9	16:30	3.7	7:30	10.9	0.0	0.0	17.1	40.2	16:00	W
7	9.3	11.1	18:30	7.3	6:30	9.0	0.0	0.0	20.3	40.2	19:30	NW
8	8.4	9.9	14:00	6.8	00:00	9.9	0.0	1.6	20.4	43.5	14:30	WSW
9	6.2	9.4	16:00	2.8	23:30	12.1	0.0	6.6	18.2	51.5	18:30	SSW
10	4.7	8.3	14:00	1.6	7:00	13.6	0.0	1.0	20.4	48.3	14:00	SW
11	5.9	11.2	15:30	2.4	5:00	12.4	0.0	2.6	15.4	40.2	17:30	WSW
12	6.4	9.8	15:30	3.1	5:30	11.9	0.0	0.0	12.1	29.0	6:00	W
13	4.6	7.4	13:00	1.6	7:00	13.7	0.0	0.0	10.8	30.6	16:30	W
14	4.6	7.6	18:30	1.4	7:00	13.7	0.0	0.0	13.5	38.6	11:00	NW
15	4.2	8.7	17:00	0.3	6:30	14.1	0.0	0.0	8.5	30.6	9:30	W
16	6.1	8.6	11:30	3.4	6:00	12.2	0.0	4.4	15.6	48.3	00:00	SSE
17	6.1	8.9	2:00	3.9	7:00	12.2	0.0	8.6	22.0	61.2	14:00	SW
18	6.4	9.7	16:30	4.1	1:30	11.9	0.0	13.8	12.7	33.8	11:00	NNW
19	6.4	10.6	18:30	2.6	5:00	11.9	0.0	0.2	14.0	30.6	12:00	WNW
20	5.7	10.2	18:00	3.2	7:00	12.4	0.0	8.2	13.0	40.2	18:30	WSW
21	7.4	11.7	17:00	3.8	2:00	10.9	0.0	0.2	19.6	45.1	16:00	W
22	6.8	10.0	17:30	4.9	6:00	11.5	0.0	11.4	10.3	33.8	15:30	W
23	7.2	10.0	18:00	4.8	00:00	11.1	0.0	2.6	10.9	38.6	13:00	NNE
24	6.1	9.6	17:00	3.3	5:30	12.2	0.0	0.0	8.0	24.1	13:30	W
25	6.1	6.9	9:30	4.2	0:30	12.3	0.0	13.6	31.5	74.0	18:00	NE
26	6.8	8.8	17:00	5.6	1:30	11.5	0.0	2.4	22.9	48.3	7:30	NNW
27	5.7	8.2	15:00	2.3	00:00	12.6	0.0	0.6	14.5	35.4	18:30	NW
28	5.7	8.3	17:30	2.2	1:00	12.6	0.0	0.0	19.5	48.3	9:30	NNE
29	4.6	7.7	15:00	1.1	6:00	13.7	0.0	5.0	22.4	64.4	14:00	N
30	8.4	12.2	16:30	3.8	0:30	9.9	0.0	0.6	29.0	56.3	12:00	NE

	6.1	12.2	30	-0.4	5	365.1	0.0	84.8	16.7	74.0	25	W

Max >= 32.0: 0
 Max <= 0.0: 0
 Min <= 0.0: 1
 Min <= -18.0: 0

Max Rain: 13.79 ON 18/04/12

Days of Rain: 20 (> .2 mm) 11 (> 2 mm) 0 (> 20 mm)

Heat Base: 18.3 Cool Base: 18.3 Method: Integration

MONTHLY CLIMATOLOGICAL SUMMARY for MAY. 2012

NAME: Whiteriver Landfill CITY: STATE:
 ELEV: 374 ft LAT: 37'360'0N LONG: 122'06'00'W

TEMPERATURE (°C), RAIN (mm), WIND SPEED (km/hr)

DAY	MEAN TEMP	HIGH	TIME	LOW	TIME	HEAT DEG DAYS	COOL DEG DAYS	RAIN	AVG WIND SPEED	HIGH	TIME	DOM DIR
1	8.6	9.7	9:00	7.9	00:00	9.7	0.0	5.0	28.3	61.2	10:30	NNE
2	8.7	10.7	18:30	6.9	7:00	9.6	0.0	0.0	7.9	27.4	0:30	NE
3	8.6	12.1	19:00	6.2	00:00	9.8	0.0	0.0	6.6	22.5	6:30	NE
4	7.2	8.9	9:30	5.8	2:00	11.1	0.0	0.8	13.7	41.8	11:30	WNW
5	4.9	6.8	15:00	2.8	6:00	13.3	0.0	0.0	8.9	30.6	10:00	NE
6	5.5	8.8	16:30	2.7	3:00	12.8	0.0	0.0	4.7	19.3	13:30	E
7	7.3	11.3	13:30	4.1	2:30	11.0	0.0	13.0	12.1	54.7	14:30	E
8	7.4	10.3	17:00	4.9	6:00	10.8	0.0	1.4	9.7	40.2	14:00	NW
9	6.2	9.2	14:30	2.9	6:00	12.1	0.0	0.4	13.4	41.8	23:30	NE
10	7.3	8.3	15:30	5.9	00:00	10.9	0.0	8.4	18.0	45.1	10:30	NNE
11	6.7	9.9	18:00	4.2	6:00	11.6	0.0	1.8	20.4	54.7	14:00	W
12	8.3	12.8	17:30	3.7	2:30	10.0	0.0	0.0	14.5	30.6	10:00	WSW
13	8.4	12.2	15:00	4.8	3:30	9.9	0.0	1.0	28.3	70.8	13:30	SW
14	7.3	10.9	14:30	3.6	00:00	11.0	0.0	1.6	24.6	56.3	12:30	WSW
15	6.1	10.3	16:00	1.7	4:30	12.2	0.0	0.2	21.2	49.9	1:30	WSW
16	6.8	9.7	18:30	2.9	2:30	11.4	0.0	0.4	11.4	27.4	13:30	SW
17	7.3	9.6	13:00	5.4	6:30	11.0	0.0	3.6	4.8	20.9	13:30	ESE
18	7.3	10.0	17:30	5.2	7:00	11.0	0.0	1.0	15.1	41.8	17:30	NNE
19	7.3	9.2	16:00	6.1	8:00	11.0	0.0	0.6	17.9	41.8	11:30	NNE
20	8.4	11.4	15:30	5.4	2:30	9.9	0.0	0.0	4.5	20.9	11:30	E
21	11.1	14.9	16:00	6.9	6:00	7.2	0.0	0.0	5.1	24.1	14:30	E
22	13.1	16.5	14:30	9.1	4:30	5.2	0.0	0.0	5.5	24.1	8:30	ENE
23	14.6	19.2	17:30	10.7	6:00	3.7	0.0	0.0	6.0	24.1	17:30	SSW
24	14.8	18.9	17:00	9.8	5:30	3.5	0.0	0.0	6.1	25.7	1:00	NE
25	16.2	20.2	16:30	13.4	7:00	2.2	0.2	0.0	13.7	40.2	13:30	NE
26	15.6	19.1	18:00	11.2	5:00	2.8	0.1	0.0	20.1	49.9	8:30	NE
27	14.3	17.8	16:30	10.3	5:00	4.0	0.0	0.0	12.9	37.0	14:00	NE
28	15.5	20.9	16:00	10.4	5:30	3.2	0.4	0.0	7.4	29.0	16:00	ENE
29	13.3	16.4	15:00	9.4	5:30	5.0	0.0	0.0	8.7	27.4	5:00	SSW
30	14.4	17.3	18:30	11.9	7:00	3.9	0.0	0.4	6.8	27.4	5:00	SSW
31	13.4	15.3	16:30	11.3	5:30	4.9	0.0	3.2	10.0	27.4	11:30	SW
	9.7	20.9	28	1.7	15	266.2	0.8	42.8	12.5	70.8	13	NE

Max >= 32.0: 0
 Max <= 0.0: 0
 Min <= 0.0: 0
 Min <= -18.0: 0

Max Rain: 13.00 ON 07/05/12

Days of Rain: 16 (> .2 mm) 5 (> 2 mm) 0 (> 20 mm)

Heat Base: 18.3 Cool Base: 18.3 Method: Integration

MONTHLY CLIMATOLOGICAL SUMMARY for JUN. 2012

NAME: Whiteriver Landfill CITY: STATE:
 ELEV: 374 ft LAT: 37'36'0N LONG: 122'06'00'W

TEMPERATURE (°C), RAIN (mm), WIND SPEED (km/hr)

DAY	MEAN TEMP	HIGH	TIME	LOW	TIME	HEAT DEG DAYS	COOL DEG DAYS	RAIN	AVG WIND SPEED	HIGH	TIME	DOM DIR
1	13.4	16.4	14:30	11.7	23:30	4.8	0.0	0.0	5.1	20.9	1:30	SE
2	11.7	13.5	12:30	10.3	22:00	6.6	0.0	8.6	13.4	45.1	22:00	NE
3	8.9	10.3	0:30	8.2	15:00	9.3	0.0	15.6	20.0	49.9	1:00	NNE
4	9.9	13.2	17:30	6.2	5:30	8.4	0.0	0.0	6.1	24.1	12:00	ENE
5	9.5	11.2	15:30	7.1	4:00	8.8	0.0	4.6	5.5	25.7	16:00	ESE
6	12.2	15.8	14:30	10.3	6:30	6.1	0.0	6.4	4.3	27.4	13:00	WSW
7	11.3	12.4	17:00	10.0	4:30	7.0	0.0	25.6	11.9	43.5	11:00	NE
8	10.8	12.3	11:00	8.4	00:00	7.5	0.0	14.0	23.2	57.9	20:00	WSW
9	10.9	15.6	19:30	8.4	0:30	7.4	0.0	0.4	17.9	49.9	0:30	WSW
10	11.7	15.5	17:30	6.8	5:00	6.6	0.0	0.0	5.5	20.9	13:30	W
11	11.8	14.6	14:00	8.6	4:30	6.5	0.0	0.0	5.8	24.1	13:30	ENE
12	11.3	13.4	14:30	10.1	3:30	6.9	0.0	0.0	4.3	22.5	12:00	E
13	10.6	12.6	15:30	9.6	5:00	7.7	0.0	0.2	6.3	25.7	15:00	NE
14	11.4	13.4	13:00	9.5	1:00	6.9	0.0	11.4	12.7	57.9	23:30	E
15	11.4	13.9	20:00	9.9	3:30	6.9	0.0	9.2	15.8	56.3	1:30	E
16	11.4	13.4	11:00	9.4	23:30	6.9	0.0	7.8	14.5	46.7	16:30	W
17	10.2	14.3	16:30	7.1	6:00	8.1	0.0	0.0	9.5	32.2	1:30	WSW
18	11.1	15.3	15:00	7.6	1:00	7.2	0.0	1.0	4.7	33.8	16:00	E
19	11.9	16.4	16:00	7.6	4:30	6.3	0.0	0.0	9.0	29.0	14:30	SW
20	12.4	15.0	16:00	9.6	6:00	5.9	0.0	0.0	6.8	30.6	15:00	E
21	11.2	13.1	19:00	9.1	10:30	7.1	0.0	14.0	10.1	41.8	7:30	NE
22	11.7	14.2	16:00	10.0	00:00	6.6	0.0	1.8	26.9	72.4	13:30	WSW
23	11.7	14.4	17:00	9.7	0:30	6.6	0.0	3.2	18.5	53.1	12:00	SW
24	12.8	16.7	16:30	9.7	2:30	5.5	0.0	0.2	14.2	37.0	17:00	W
25	11.6	14.4	14:00	8.4	5:30	6.7	0.0	0.0	7.1	22.5	17:00	E
26	14.9	20.1	17:30	10.8	0:30	3.6	0.2	0.8	8.4	33.8	17:30	SW
27	17.9	21.6	17:30	15.2	4:00	1.2	0.8	5.4	10.0	40.2	12:00	SSW
28	15.7	20.1	16:00	13.0	7:30	2.8	0.1	10.8	12.9	46.7	19:30	S
29	14.0	18.5	16:00	12.2	23:30	4.3	0.0	3.0	17.5	53.1	13:30	SSW
30	11.7	13.3	16:30	10.3	23:00	6.6	0.0	0.6	17.2	48.3	18:30	SW

	11.9	21.6	27	6.2	4	193.0	1.1	144.6	11.5	72.4	22	E

Max >= 32.0: 0
 Max <= 0.0: 0
 Min <= 0.0: 0
 Min <= -18.0: 0

Max Rain: 25.60 ON 07/06/12

Days of Rain: 21 (> .2 mm) 14 (> 2 mm) 1 (> 20 mm)

Heat Base: 18.3 Cool Base: 18.3 Method: Integration

MONTHLY CLIMATOLOGICAL SUMMARY for JUL. 2012

NAME: Whiteriver Landfill CITY: STATE:
 ELEV: 374 ft LAT: 37'36'0N LONG: 122'06'00'W

TEMPERATURE (°C), RAIN (mm), WIND SPEED (km/hr)

DAY	MEAN TEMP	HIGH	TIME	LOW	TIME	HEAT DEG DAYS	COOL DEG DAYS	RAIN	AVG WIND SPEED	HIGH	TIME	DOM DIR
1	11.9	14.8	16:30	9.9	1:30	6.4	0.0	2.8	16.7	45.1	11:30	WSW
2	15.0	17.9	20:00	12.6	0:30	3.3	0.0	2.4	5.8	20.9	1:00	S
3	14.3	16.4	15:00	13.2	00:00	4.0	0.0	2.6	10.3	30.6	20:30	SE
4	13.6	16.9	15:30	11.6	4:30	4.7	0.0	3.4	6.8	25.7	16:00	E
5	13.7	17.0	16:00	10.4	5:30	4.6	0.0	0.0	4.7	19.3	12:30	W
6	14.6	16.9	18:00	11.6	1:00	3.8	0.0	7.4	11.4	41.8	21:30	NNW
7	14.8	17.5	17:30	12.8	00:00	3.5	0.0	5.8	12.6	33.8	2:30	NE
8	11.8	12.9	0:30	10.2	00:00	6.4	0.0	1.2	12.7	30.6	21:00	WNW
9	11.5	14.8	13:30	9.0	00:00	6.8	0.0	11.2	10.0	33.8	23:00	WNW
10	11.3	14.4	18:30	9.0	0:30	7.0	0.0	7.8	15.0	37.0	18:30	W
11	10.7	14.4	15:00	8.4	5:30	7.7	0.0	6.6	12.7	41.8	14:30	W
12	10.8	13.7	12:30	7.0	4:30	7.5	0.0	0.0	7.4	25.7	15:00	NE
13	12.3	15.2	16:00	9.6	5:00	6.0	0.0	0.0	9.5	33.8	10:30	NE
14	10.9	13.8	17:00	7.7	5:30	7.4	0.0	0.0	13.5	32.2	16:00	W
15	11.7	16.4	18:30	7.2	5:30	6.6	0.0	2.0	12.2	32.2	10:30	SW
16	14.2	17.7	18:30	11.8	0:30	4.1	0.0	5.8	12.9	45.1	17:00	SW
17	15.1	17.3	17:30	13.0	5:00	3.2	0.0	5.8	12.9	45.1	12:00	SW
18	13.9	17.7	14:30	11.6	00:00	4.4	0.0	6.0	19.0	48.3	2:30	WSW
19	12.1	14.7	16:30	9.8	4:30	6.3	0.0	0.2	15.6	38.6	9:30	W
20	12.0	15.2	17:00	8.4	7:00	6.3	0.0	0.0	8.7	27.4	11:00	W
21	14.0	17.7	17:30	9.7	4:00	4.3	0.0	0.0	7.6	33.8	15:30	SSE
22	16.2	20.7	16:00	12.1	4:00	2.5	0.3	0.0	19.0	56.3	18:00	S
23	17.4	21.2	13:00	14.4	00:00	1.4	0.4	4.0	16.3	64.4	13:00	S
24	14.8	17.6	15:00	13.3	4:00	3.5	0.0	7.4	3.5	20.9	20:00	ENE
25	14.4	17.7	17:00	12.1	6:00	3.9	0.0	0.2	5.8	20.9	9:00	NW
26	15.4	20.6	16:30	10.5	4:00	3.2	0.3	0.0	5.8	27.4	14:00	W
27	13.0	16.3	15:00	9.9	00:00	5.3	0.0	0.0	17.1	46.7	15:00	W
28	11.3	14.9	14:30	8.3	4:00	7.0	0.0	3.2	19.0	49.9	16:00	WSW
29	10.8	13.8	15:30	8.7	6:00	7.5	0.0	3.6	15.0	37.0	10:30	WSW
30	11.9	17.3	16:30	8.4	5:30	6.4	0.0	0.2	10.8	35.4	17:00	WSW
31	12.4	14.9	19:30	8.9	6:00	5.9	0.0	4.8	8.4	30.6	14:00	ESE
	13.2	21.2	23	7.0	12	160.6	1.1	94.3	11.6	64.4	23	W

Max >= 32.0: 0
 Max <= 0.0: 0
 Min <= 0.0: 0
 Min <= -18.0: 0

Max Rain: 11.20 ON 09/07/12

Days of Rain: 22 (> .2 mm) 18 (> 2 mm) 0 (> 20 mm)

Heat Base: 18.3 Cool Base: 18.3 Method: Integration

MONTHLY CLIMATOLOGICAL SUMMARY for AUG. 2012

NAME: Whiteriver Landfill CITY: STATE:
 ELEV: 374 ft LAT: 37'360'0N LONG: 122'06'00'W

TEMPERATURE (°C), RAIN (mm), WIND SPEED (km/hr)

DAY	MEAN TEMP	HIGH	TIME	LOW	TIME	HEAT DEG DAYS	COOL DEG DAYS	RAIN	AVG WIND SPEED	HIGH	TIME	DOM DIR
1	15.2	18.1	12:30	11.4	00:00	3.1	0.0	5.2	17.1	51.5	12:30	SE
2	13.9	19.1	16:30	10.1	6:00	4.4	0.0	0.0	10.5	37.0	17:00	S
3	14.4	18.3	17:00	12.2	4:00	3.9	0.0	0.6	12.1	35.4	16:30	ESE
4	13.9	16.2	16:30	11.7	23:30	4.4	0.0	3.8	10.1	32.2	11:00	ENE
5	13.2	16.1	17:30	11.7	1:30	5.1	0.0	0.8	11.4	29.0	15:30	W
6	12.9	17.0	20:30	10.6	6:00	5.4	0.0	0.0	11.1	27.4	14:00	W
7	14.8	17.7	19:00	12.7	7:00	3.5	0.0	0.2	6.9	22.5	2:30	SW
8	14.3	18.3	17:00	9.9	6:00	4.0	0.0	0.0	4.5	19.3	16:30	E
9	14.5	19.4	15:00	10.6	1:30	3.9	0.1	0.2	2.3	19.3	15:30	ESE
10	15.8	19.8	15:00	12.6	6:30	2.6	0.2	0.0	5.1	22.5	15:30	ENE
11	15.4	17.6	18:00	13.4	3:00	2.9	0.0	0.2	8.0	37.0	16:00	E
12	15.2	16.9	18:00	14.5	3:30	3.1	0.0	1.2	7.6	32.2	19:00	ESE
13	16.3	20.9	17:00	14.2	00:00	2.3	0.3	4.0	12.6	45.1	10:00	SE
14	16.4	20.9	16:00	13.3	6:30	2.3	0.4	0.4	8.5	33.8	17:00	SE
15	15.4	16.9	10:00	13.9	21:30	2.9	0.0	10.0	19.3	61.2	21:00	ENE
16	15.6	19.4	15:00	13.0	6:30	2.9	0.1	10.4	18.3	48.3	1:30	SE
17	16.9	20.2	17:30	13.8	0:30	1.7	0.2	7.2	10.5	41.8	0:30	SE
18	17.3	20.7	16:30	15.0	8:30	1.5	0.4	0.2	10.6	33.8	14:00	SSE
19	16.0	19.4	15:00	13.3	6:30	2.4	0.0	2.8	8.2	32.2	16:30	SE
20	16.4	20.9	15:30	13.1	4:30	2.3	0.4	0.8	12.1	41.8	14:30	S
21	14.5	17.9	17:30	12.5	00:00	3.8	0.0	5.8	11.4	40.2	16:30	SW
22	13.8	17.3	15:30	12.1	2:30	4.5	0.0	11.0	15.6	46.7	14:00	SW
23	12.9	15.8	14:30	11.5	22:00	5.3	0.0	13.0	10.1	32.2	17:30	SSW
24	12.9	15.4	14:00	11.2	3:30	5.3	0.0	1.6	7.2	29.0	17:30	E
25	13.6	16.6	16:00	10.7	00:00	4.8	0.0	1.0	16.7	38.6	14:30	NW
26	13.1	17.3	18:00	9.1	5:30	5.2	0.0	0.0	10.6	29.0	00:00	SE
27	14.8	18.2	17:00	11.9	00:00	3.5	0.0	14.2	15.3	38.6	3:00	SE
28	13.3	17.2	17:00	9.8	6:30	5.0	0.0	0.0	14.8	43.5	13:30	SSW
29	12.9	15.7	14:00	11.3	4:30	5.4	0.0	7.8	10.1	37.0	1:30	SSE
30	11.8	15.4	16:00	8.9	7:30	6.5	0.0	0.0	19.2	45.1	10:30	WNW
31	11.9	15.7	18:00	8.5	3:30	6.4	0.0	0.8	12.1	37.0	13:30	SW
	14.5	20.9	13	8.5	31	120.2	2.2	103.1	11.3	61.2	15	SE

Max >= 32.0: 0
 Max <= 0.0: 0
 Min <= 0.0: 0
 Min <= -18.0: 0

Max Rain: 14.20 ON 27/08/12

Days of Rain: 24 (> .2 mm) 12 (> 2 mm) 0 (> 20 mm)

Heat Base: 18.3 Cool Base: 18.3 Method: Integration

MONTHLY CLIMATOLOGICAL SUMMARY for SEP. 2012

NAME: Whiteriver Landfill CITY: STATE:
 ELEV: 374 ft LAT: 37'36'0N LONG: 122'06'00'W

TEMPERATURE (°C), RAIN (mm), WIND SPEED (km/hr)

DAY	MEAN TEMP	HIGH	TIME	LOW	TIME	HEAT DEG DAYS	COOL DEG DAYS	RAIN	AVG WIND SPEED	HIGH	TIME	DOM DIR
1	14.7	18.5	15:00	12.2	6:30	3.7	0.0	0.2	18.0	49.9	16:30	SW
2	15.1	17.6	16:30	13.2	00:00	3.2	0.0	0.2	10.9	37.0	0:30	SW
3	15.6	20.9	16:00	10.2	6:00	3.2	0.5	0.0	12.1	43.5	20:30	SSW
4	14.2	17.0	15:30	10.3	00:00	4.1	0.0	0.0	16.1	38.6	18:00	W
5	12.8	16.8	17:00	9.0	6:00	5.5	0.0	0.0	9.5	25.7	2:00	WSW
6	13.4	18.4	16:30	8.8	7:00	4.9	0.0	0.0	18.0	49.9	12:00	SW
7	15.6	19.4	16:30	13.4	6:00	2.8	0.1	0.0	15.3	46.7	1:00	SW
8	15.6	19.9	17:00	11.2	00:00	2.9	0.2	0.0	6.0	24.1	17:30	SSE
9	14.4	18.7	16:30	10.3	6:30	3.9	0.0	4.2	13.2	43.5	17:30	SSE
10	11.6	14.4	0:30	9.2	00:00	6.7	0.0	6.8	10.8	30.6	10:00	SW
11	9.2	12.5	17:00	6.4	7:00	9.1	0.0	2.2	18.3	59.5	14:00	SW
12	11.1	14.6	13:30	8.1	00:00	7.2	0.0	0.2	18.7	45.1	10:30	SW
13	11.7	16.3	15:00	6.9	4:30	6.7	0.0	0.4	21.1	64.4	18:30	SW
14	12.7	15.2	16:00	10.3	22:30	5.6	0.0	0.6	24.0	54.7	0:30	WSW
15	12.4	15.3	15:00	11.1	4:30	5.8	0.0	0.0	13.0	38.6	15:00	SW
16	11.9	16.3	13:30	8.9	23:00	6.3	0.0	4.2	17.5	57.9	17:30	SSW
17	10.2	13.3	17:00	8.0	2:30	8.2	0.0	2.0	18.7	53.1	13:00	SSW
18	8.7	12.2	15:00	6.1	7:30	9.6	0.0	0.8	21.4	54.7	17:30	WSW
19	9.2	12.7	15:00	5.6	6:30	9.1	0.0	0.2	13.5	35.4	12:30	SW
20	11.3	14.1	14:00	9.1	2:00	7.0	0.0	2.8	14.3	41.8	14:00	SSW
21	8.7	12.2	17:00	5.7	23:30	9.6	0.0	1.4	9.5	29.0	13:00	NW
22	8.3	12.5	15:00	4.7	6:00	10.0	0.0	0.0	6.4	27.4	17:30	SE
23	9.6	12.1	16:30	6.2	5:30	8.7	0.0	0.0	5.1	27.4	11:00	E
24	8.3	9.9	0:30	7.7	9:00	9.9	0.0	16.8	16.1	40.2	1:00	NW
25	9.3	10.9	17:00	7.9	8:00	9.0	0.0	9.6	25.1	54.7	18:00	NW
26	10.9	14.4	16:00	8.5	00:00	7.4	0.0	3.4	22.2	53.1	4:00	NNW
27	9.7	12.3	16:00	7.2	3:30	8.6	0.0	0.2	16.1	43.5	23:00	W
28	10.2	14.3	15:30	7.1	00:00	8.1	0.0	0.2	18.3	57.9	16:30	SW
29	9.8	13.7	16:30	6.1	5:30	8.5	0.0	0.0	17.9	46.7	00:00	SW
30	12.3	15.1	15:00	9.8	23:00	6.0	0.0	5.0	19.3	54.7	2:00	S

	11.6	20.9	3	4.7	22	201.2	0.8	61.4	15.6	64.4	13	SW

Max >= 32.0: 0

Max <= 0.0: 0

Min <= 0.0: 0

Min <= -18.0: 0

Max Rain: 16.79 ON 24/09/12

Days of Rain: 20 (> .2 mm) 10 (> 2 mm) 0 (> 20 mm)

Heat Base: 18.3 Cool Base: 18.3 Method: Integration

MONTHLY CLIMATOLOGICAL SUMMARY for OCT. 2012

NAME: Whiteriver Landfill CITY: STATE:
 ELEV: 374 ft LAT: 37'360'0N LONG: 122'06'00'W

TEMPERATURE (°C), RAIN (mm), WIND SPEED (km/hr)

DAY	MEAN TEMP	HIGH	TIME	LOW	TIME	HEAT DEG DAYS	COOL DEG DAYS	RAIN	AVG WIND SPEED	HIGH	TIME	DOM DIR
1	9.9	12.9	14:30	8.3	23:30	8.3	0.0	1.4	17.4	51.5	14:30	SSW
2	9.3	13.3	14:00	6.5	00:00	9.0	0.0	3.2	17.5	48.3	10:30	S
3	7.6	10.6	16:30	6.1	2:00	10.7	0.0	2.8	16.7	45.1	11:00	SW
4	7.6	12.6	16:00	5.0	2:00	10.7	0.0	3.4	11.4	37.0	17:00	SW
5	8.2	11.6	15:00	5.6	6:00	10.1	0.0	0.2	15.6	40.2	10:30	SW
6	8.7	12.3	14:30	5.7	8:30	9.6	0.0	0.0	10.5	27.4	6:00	WNW
7	8.1	11.3	14:30	5.0	8:00	10.2	0.0	0.0	4.3	20.9	14:30	W
8	8.9	11.3	16:30	6.1	00:00	9.4	0.0	0.2	9.7	37.0	13:00	NNE
9	7.7	10.8	15:00	4.9	5:30	10.6	0.0	0.0	6.6	25.7	11:30	NE
10	10.2	12.4	19:30	8.0	1:00	8.1	0.0	0.6	5.1	29.0	17:00	ESE
11	10.3	12.3	0:30	6.8	00:00	8.0	0.0	11.0	19.2	49.9	15:30	SE
12	6.7	10.6	16:00	4.2	6:30	11.6	0.0	0.0	14.8	35.4	7:00	SW
13	6.4	10.9	16:00	2.8	7:30	11.9	0.0	0.0	11.9	29.0	16:30	WSW
14	7.4	10.2	15:00	5.4	8:30	10.9	0.0	2.0	9.8	30.6	9:30	SW
15	6.7	9.2	13:30	4.5	7:00	11.6	0.0	5.6	7.4	20.9	3:30	W
16	7.1	10.7	17:00	4.4	9:00	11.2	0.0	3.6	11.7	38.6	4:00	SW
17	9.3	10.7	18:00	7.1	0:30	9.0	0.0	15.6	12.6	41.8	5:30	ESE
18	10.2	12.6	13:00	8.7	3:00	8.1	0.0	0.2	5.1	27.4	1:00	ESE
19	9.6	11.3	15:00	8.7	00:00	8.7	0.0	1.2	6.3	20.9	9:00	NW
20	9.8	13.1	15:30	8.0	7:30	8.5	0.0	0.2	6.1	24.1	23:00	SSE
21	9.7	12.4	14:30	7.6	6:00	8.6	0.0	0.0	5.0	22.5	15:00	ESE
22	10.1	11.1	15:00	8.1	0:30	8.2	0.0	0.4	7.9	24.1	11:30	ENE
23	10.7	12.1	15:30	10.1	7:30	7.6	0.0	0.4	12.2	29.0	2:00	NNE
24	10.5	11.0	19:00	9.8	00:00	7.8	0.0	0.6	15.3	37.0	13:00	NNE
25	9.2	9.9	0:30	7.8	00:00	9.1	0.0	0.0	21.2	49.9	20:00	NNE
26	4.2	7.8	0:30	1.1	23:30	14.2	0.0	1.4	16.1	46.7	0:30	NNW
27	3.6	7.6	15:30	0.1	7:30	14.7	0.0	0.0	15.6	49.9	23:30	W
28	7.2	8.1	15:00	5.9	00:00	11.1	0.0	3.4	23.8	49.9	8:00	SW
29	5.7	9.5	15:00	3.6	8:00	12.6	0.0	0.4	12.6	27.4	13:30	W
30	5.8	8.3	14:00	2.8	2:00	12.5	0.0	0.2	21.2	51.5	22:30	SW
31	4.8	6.9	7:00	1.5	23:00	13.5	0.0	6.6	12.6	46.7	1:30	SW
	8.1	13.3	2	0.1	27	316.1	0.0	64.6	12.4	51.5	1	SW

Max >= 32.0: 0
 Max <= 0.0: 0
 Min <= 0.0: 0
 Min <= -18.0: 0

Max Rain: 15.60 ON 17/10/12

Days of Rain: 23 (> .2 mm) 10 (> 2 mm) 0 (> 20 mm)

Heat Base: 18.3 Cool Base: 18.3 Method: Integration

MONTHLY CLIMATOLOGICAL SUMMARY for NOV. 2012

NAME: Whiteriver Landfill CITY: STATE:
 ELEV: 374 ft LAT: 37'360'0N LONG: 122'06'00'W

TEMPERATURE (°C), RAIN (mm), WIND SPEED (km/hr)

DAY	MEAN TEMP	HIGH	TIME	LOW	TIME	HEAT DEG DAYS	COOL DEG DAYS	RAIN	AVG WIND SPEED	HIGH	TIME	DOM DIR
1	3.2	5.8	14:00	0.7	7:30	15.1	0.0	0.4	21.2	49.9	15:00	SW
2	3.7	6.6	11:30	1.6	00:00	14.6	0.0	5.4	23.5	62.8	11:30	SW
3	2.8	6.6	14:30	0.2	7:00	15.5	0.0	0.0	16.7	51.5	14:30	SSW
4	5.4	6.8	15:00	3.3	0:30	12.9	0.0	10.2	12.1	40.2	11:30	SE
5	4.6	8.6	15:00	1.7	5:30	13.7	0.0	0.0	14.6	33.8	15:30	W
6	7.4	10.3	14:00	3.9	1:00	10.9	0.0	0.0	21.4	45.1	15:00	WSW
7	8.5	9.9	14:30	7.3	0:30	9.8	0.0	0.0	25.1	54.7	15:00	SW
8	7.8	9.6	15:00	6.4	8:00	10.5	0.0	0.0	17.5	43.5	23:30	SW
9	7.0	8.8	15:00	3.9	00:00	11.3	0.0	5.0	18.2	46.7	5:30	SSW
10	4.2	7.4	14:00	2.3	7:00	14.1	0.0	0.4	16.6	35.4	0:30	SSW
11	5.5	8.1	13:00	3.0	0:30	12.8	0.0	0.6	12.9	30.6	3:30	WSW
12	10.1	12.4	15:30	4.9	1:30	8.2	0.0	2.8	19.2	57.9	14:30	SSW
13	11.4	12.8	12:30	9.6	20:30	6.8	0.0	3.4	17.2	53.1	5:00	S
14	10.3	11.7	15:00	9.0	6:30	8.0	0.0	4.4	8.7	37.0	13:00	S
15	9.0	10.6	14:30	5.1	00:00	9.3	0.0	0.0	8.0	27.4	15:30	S
16	5.5	7.4	13:30	3.6	6:00	12.8	0.0	1.0	9.2	25.7	14:00	SSW
17	4.2	6.7	14:00	1.9	22:30	14.1	0.0	0.2	18.3	38.6	14:30	SW
18	3.7	9.5	00:00	0.2	8:30	14.6	0.0	10.6	16.9	56.3	00:00	SE
19	10.6	12.9	12:30	8.9	21:30	7.8	0.0	6.2	24.8	67.6	2:30	SSE
20	8.9	11.4	14:00	5.4	00:00	9.4	0.0	0.6	20.0	75.6	18:00	S
21	6.8	9.2	00:00	4.3	8:30	11.5	0.0	0.0	12.4	38.6	19:00	S
22	6.8	10.2	2:30	4.7	23:30	11.5	0.0	15.8	20.6	51.5	21:30	S
23	4.1	6.3	13:30	2.2	21:30	14.3	0.0	0.0	18.7	53.1	15:00	SSW
24	2.6	4.8	19:00	0.4	10:00	15.7	0.0	8.2	7.4	29.0	1:00	N
25	1.9	4.1	00:00	-0.7	9:00	16.4	0.0	1.4	11.1	38.6	23:00	NNW
26	5.1	6.8	14:00	3.9	00:00	13.2	0.0	0.0	24.8	46.7	10:00	NW
27	3.7	5.8	14:00	2.2	22:30	14.6	0.0	0.0	19.5	45.1	12:00	WNW
28	2.7	5.3	15:00	1.3	6:00	15.6	0.0	0.0	14.0	27.4	15:00	WNW
29	2.4	4.3	11:30	1.2	7:00	15.9	0.0	0.0	7.7	24.1	5:00	SW
30	2.4	4.9	12:30	0.7	21:00	15.9	0.0	0.0	7.6	30.6	23:00	S

	5.7	12.9	19	-0.7	25	376.7	0.0	76.6	16.2	75.6	20	SSW

Max >= 32.0: 0

Max <= 0.0: 0

Min <= 0.0: 1

Min <= -18.0: 0

Max Rain: 15.80 ON 22/11/12

Days of Rain: 17 (> .2 mm) 10 (> 2 mm) 0 (> 20 mm)

Heat Base: 18.3 Cool Base: 18.3 Method: Integration

MONTHLY CLIMATOLOGICAL SUMMARY for DEC. 2012

NAME: Whiteriver Landfill CITY: STATE:
 ELEV: 374 ft LAT: 37'360'0N LONG: 122'06'00'W

TEMPERATURE (°C), RAIN (mm), WIND SPEED (km/hr)

DAY	MEAN TEMP	HIGH	TIME	LOW	TIME	HEAT DEG DAYS	COOL DEG DAYS	RAIN	AVG WIND SPEED	HIGH	TIME	DOM DIR
1	2.8	4.9	14:30	1.2	0:30	15.5	0.0	0.0	15.3	37.0	4:00	WSW
2	3.4	8.9	23:00	0.8	8:00	14.8	0.0	4.0	8.9	40.2	23:30	SW
3	4.3	8.7	0:30	1.8	21:30	14.0	0.0	0.2	23.8	48.3	23:30	SW
4	2.9	4.3	14:30	1.3	9:00	15.4	0.0	0.0	20.9	46.7	10:30	SW
5	1.3	3.2	14:00	-0.2	00:00	17.0	0.0	0.2	13.4	32.2	1:00	W
6	2.4	5.7	17:00	-0.4	2:30	15.9	0.0	11.2	24.0	64.4	13:30	S
7	3.9	6.6	14:00	1.9	2:30	14.4	0.0	0.0	28.8	61.2	4:00	W
8	4.7	6.9	17:00	1.8	3:30	13.6	0.0	0.2	20.6	45.1	17:00	SW
9	5.3	6.7	14:00	2.4	00:00	13.0	0.0	0.2	22.7	51.5	5:30	W
10	2.3	4.4	14:00	0.9	8:30	16.0	0.0	0.0	7.1	25.7	0:30	W
11	2.8	4.6	13:30	1.8	20:00	15.5	0.0	0.0	6.1	19.3	13:00	SE
12	3.1	4.6	14:30	0.9	6:00	15.2	0.0	1.2	7.6	22.5	5:00	SE
13	2.8	4.0	12:30	1.5	6:30	15.5	0.0	0.0	10.0	32.2	23:00	ESE
14	5.4	6.3	16:00	3.1	0:30	12.9	0.0	16.0	20.1	46.7	8:00	ESE
15	5.2	7.0	14:00	3.8	00:00	13.1	0.0	0.0	17.2	49.9	2:30	SSW
16	5.3	8.1	13:00	3.3	5:00	13.0	0.0	0.2	13.4	35.4	21:30	S
17	5.7	6.9	14:00	4.9	7:00	12.7	0.0	2.8	18.3	51.5	4:00	SW
18	5.1	6.5	23:00	3.7	16:00	13.2	0.0	0.2	7.6	38.6	00:00	ESE
19	7.0	8.0	16:00	5.9	5:30	11.3	0.0	11.8	16.1	53.1	4:00	ESE
20	5.7	7.7	0:30	4.1	19:30	12.6	0.0	2.2	11.3	30.6	8:30	NE
21	5.4	6.7	00:00	4.2	18:30	12.9	0.0	0.4	7.9	29.0	00:00	SW
22	10.3	12.3	14:30	6.7	0:30	8.0	0.0	11.0	16.7	46.7	2:30	S
23	7.3	11.9	0:30	5.2	00:00	11.0	0.0	0.2	30.6	96.6	2:30	SW
24	6.2	7.6	12:30	4.0	21:30	12.2	0.0	0.8	10.1	33.8	6:30	S
25	4.8	6.2	14:30	3.2	22:00	13.5	0.0	1.0	16.4	41.8	23:00	SW
26	5.2	7.1	14:30	3.6	9:30	13.1	0.0	9.2	25.9	64.4	23:00	SW
27	4.3	5.4	14:00	3.0	8:00	14.0	0.0	1.2	16.3	41.8	1:00	SW
28	9.8	12.1	22:30	4.2	1:30	8.5	0.0	1.6	24.3	72.4	22:30	S
29	5.8	10.2	0:30	1.8	00:00	12.5	0.0	0.4	22.4	54.7	10:30	SSW
30	5.4	9.8	22:30	1.0	0:30	12.9	0.0	6.2	28.8	67.6	00:00	SSW
31	6.6	10.1	3:30	2.0	00:00	11.7	0.0	1.8	25.3	80.5	3:30	SW
	4.9	12.3	22	-0.4	6	414.9	0.0	84.2	17.3	96.6	23	SW

Max >= 32.0: 0
 Max <= 0.0: 0
 Min <= 0.0: 2
 Min <= -18.0: 0

Max Rain: 16.00 ON 14/12/12

Days of Rain: 24 (> .2 mm) 9 (> 2 mm) 0 (> 20 mm)

Heat Base: 18.3 Cool Base: 18.3 Method: Integration

APPENDIX F

LEACHATE RESULTS



Whiteriver Landfill Site

LEACHATE QUALITY RESULTS

RESULTS

Monitoring Point:

Raw Leachate 1

	Units	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date
		01-Jul-08	07-Oct-08	13-Jan-09	21-Apr-09	14-Jul-09	06-Oct-09	21-Jan-10	14-Apr-10	06-Jul-10	11-Oct-10	18-Jan-11	05-Apr-11	19-Jul-11	11-Oct-11	10-Jan-12	25-Apr-12	18-Jul-12	10-Oct-12
Alkalinity	mg/l CaCO3																	572.1	777.3
Aluminium	µg/l																	89.32	199.63
Ammonia	mg/l N	838.62	557.3	680.81	606.44	652.35	0.21	262.5	365.02	499.8	343.7	493.68	763.12	589.95	1006.31	1033.79	1260.63	515.31	19.63
Antimony	µg/l																	<25	30.44
Arsenic	µg/l																	304.3	915.9
Barium	µg/l																	107.1	248.6
Beryllium	µg/l																	<25	<5
B.O.D.	mg/l O2	<100	188.8	<40	6588.8	45.6	116	1608	>2307	1040	320	210.0	>280	6060	4800	587	260.5	372.5	263.0
Boron	µg/l				47.2				3632.1				6062.4			6080.2	5622.5	3647.3	6549.3
Cadmium	µg/l				<1				<0.1				0.2		<0.5	<1	<5	<1	
Calcium	mg/l Ca				144.15				555.85				268.2		199.05	147.49	75.82	124.49	
C.O.D.	mg/l O2	1415	940	1090	986	998	1126	3488	4014	3066	2076		2970	7510	8390	3330	2460	2120	2515
Chloride	mg/l Cl	1317	902	893	887	893	853	423	1253	1946	2928	2004	3147	2669	2502	2646	2414	1497	2535
Chromium	µg/l				64.7				88				193.7		207.8	206.2	73.0	350.5	
Cobalt	µg/l																	<25	44.6
Coliform Bacteria	no/100ml																		
Conductivity	µS/cm @ 25	12360	9020	9670	9710	9640	9400	9900	9410	11800	nm	8805	15	17070	19830	17120	17330	10530	19280
Copper	mg/l				46.3				15.3				63.5		16	12.5	<25	41.6	
Cyanide	mg/l				<0.05				<0.05				<0.05				<0.05		
D.O.	% Saturation																		
E. Coli	no/100ml																		
Fluoride	mg/l				0.6				3.63				<0.150				10.71		
Iron	µg/l	10775.2	8311	25277.7	5584.5	16442.4		1377.9	6945.7	14013.2	8479.8	7538.3	2023.3	425.3	3171.2	4509.7	321	4701.0	1496.0
Lead	µg/l				<10				4.4				9.1		13.3	<5	<25	11.9	
Magnesium	mg/l Mg				119.21				184.61				281.89		310.49	253.32	113.46	196.49	
Manganese	µg/l				856.7				7422.5				1270.3		1198.5	835.2	213.8	717.2	
Mercury	µg/l				0.2				<0.1				<0.05		nm	0.1	nm	nm	
Molybdenum (µg/l)																		<25	15.9
Nickel	µg/l				90.3				116.2				281.5		234.5	298.8	83.2	325.7	
Ortho-Phosphate	mg/l P				2.34				0.28				1.44			1.44			
pH		7.4	7.4	7.3	7.5	7.3	7.2	7.2	7.2	7.3	7.6	7.7	7.6	7.1	7.4	7.4	7.6	8.4	7.5
Potassium	mg/l	570.96	429.71	445.98	385.92	448.46		301.27	341.2	499.96	583.56	287.46	641.97	712.97	942.31	840.92	707.05	467.96	802.22
Residue on evaporation																			
Sampling Depth	m																		
Selenium	µg/l																	<25	<5
Silver	µg/l																	nm	nm
Sodium	mg/l	974.56	770.54	713.85	696.94	652.47		672.87	872.54	1273.09	1641.2	839.50	1954.66	1726.63	1967.78	1742.22	1519.92	1166.26	1875.35
Strontium	µg/l																	740.120	1228.830
Sulphate	mg/l SO4				15.1				57.9				776.1				69.4		
Suspended Solids	mg/l			65															
Temp	°C	nt	10.5	5	11	16	12	8	9	15	12	9.0	12	15	15	9	8	19.0	10.0
Thallium	µg/l																	<5	<1
Time		nm	13	9.5	9.3		12.15	10.15	9.3	9.05	09:35	9.30	10:15	09:40	09:15	10:15	10:00	09:15	10:10
Tin	µg/l																	<50	<10
T.O.C.	mg/l																		
T.O.N	mg/l N	4.21	2.46	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Total Suspended Solids	mg/l	72	440			80	250	150		1280	140	370		900	840	420		560	230
Uranium	µg/l																	<5	<1
Vanadium	µg/l																	68.97	268.74
Zinc	µg/l				1377.7				114.7				187.5		102.9	270.5	172.8	124.4	



Whiteriver Landfill Site

LEACHATE QUALITY RESULTS

PARAMETERS	RESULTS	Raw Leachate 2																				
		Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date		
Monitoring Point:	Units	01-Jul-08	07-Oct-08	13-Jan-09	21-Apr-09	14-Jul-09	06-Oct-09	21-Jan-10	14-Apr-10	06-Jul-10	11-Oct-10	18-Jan-11	05-Apr-11	19-Jul-11	11-Oct-11	10-Jan-12	25-Apr-12	18-Jul-12	10-Oct-12	Date		
Alkalinity	mg/lCaCO3																					
Aluminium	µg/l																		443.7	108.6		
Ammonia	mg/l N	1032.46	606.97	624.23	820.72	350.71	<0.03	229.4	565.48	567.8	742.5	556.89	468.14	766.9	423.56	275.49	352.92	358.64	275.78			
Antimony	µg/l																		<25	<5		
Arsenic	µg/l																		78.56	11.58		
Barium	µg/l															180.4	612.7	109.9	286.0			
Beryllium	µg/l																		<25	<5		
B.O.D.	mg/l O2	<1000	1614	60.5	4970.8	29.3	<100	40.3	57.6	47.5	63.3	65.0	50.4	374	154.2	21.5	41.7	42.0	38.8			
Boron	µg/l				101				3788.6				2471.1			1311.9	2195.1	3560.5	1584.7			
Cadmium	µg/l				<1				0.1				<1			<0.5	<1	<5	<1			
Calcium	mg/l Ca				126.06				144.18				143.3			130.18	122.32	72.90	159.11			
C.O.D.	mg/l O2	2820	2790	1299	1950	641	2255	526	1305	1186	1191		929	2395	756	381	586	707	494			
Chloride	mg/l Cl	2160	1356	1091	1625	665	1586	571	1132	1204	1096	1005	863	1471	812	340	581	645	448			
Chromium	µg/l				218.6				96.7				93.7			34.1	67.4	76.4	40.7			
Cobalt	µg/l																		<25	7.1		
Coliform Bacteria	no/100ml																					
Conductivity	µS/cm @ 25	16360	10980	9620	13180	6240	12690	4810	9130	9470	nm	7950	<9	12120	7140	3850	5770	6570	5680			
Copper	mg/l				24.3				86.4				10.5			10.7	8.4	<25	<5			
Cyanide	mg/l				0.06				<0.05				<0.05					<0.05				
D.O.	% Saturation																					
E. Coli	no/100ml																					
Fluoride	mg/l				0.42				6.02				<0.150					3.68				
Iron	µg/l	4772.4	3186	8963.1	3611.5	2129.1		2890.9	3070.7	3322.7	4581.6	1363.1	1111.5	7441.8	1897.9	1616.6	631.6	4707.4	834.7			
Lead	µg/l				9.3				35.5				<5			2.5	<5	<25	<5			
Magnesium	mg/l Mg				88.11				69.88				59.55			42.72	63.56	116.49	50.60			
Manganese	µg/l				632.4				723.1				683.5			756.3	579	215.3	750.9			
Mercury	µg/l				0.9				<0.1				<0.05			nm	<0.05	nm	nm			
Molybdenum (µg/l)																			<25	<5		
Nickel					202				170.3				73			27.2	56.6	87.3	27.8			
Ortho-Phosphate	mg/l P				5.5				1.27				2.92				1.93					
pH		8	7.2	7.4	7.8	7.3	7.7	7.1	7.7	7.3	7.5	7.4	7.4	7.4	7.5	7.2	7.5	7.7	7.2			
Potassium	mg/l	612.8	396.9	337.25	447.81	204.85		114.09	360.63	289.92	306.19	233.49	222.34	443.03	222.49	113.85	178.93	465.47	136.28			
Residue on evaporation																						
Sampling Depth	m																					
Selenium																			<25	<5		
Silver																			nm	nm		
Sodium	mg/l	1712.2	1112.03	798.17	1198.22	523.8		282.71	948.03	782.83	780.36	604.65	648.45	1173.17	693.92	285.11	508.94	1174.89	381.14			
Strontium																			715.630	976.600		
Sulphate	mg/l SO4				204.8				684.1				200.4					41.8				
Suspended Solids	mg/l			60																		
Temp	°C	9.31	10.5	5	11	17	12	8	9	15	12	10.0	12	14	15	10	8	20.3	11.0			
Thallium																			<5	<1		
Time		16	13	10	9.3		10.15	9.55	9.4	9	0.40625	9.40	10:25	09:45	09:00	10:20	09:55	12:45	10:20			
Tin																			<50	<10		
T.O.C.	mg/l																					
T.O.N	mg/l N	3.25	0.15	0.16	5.93	2.85	0.23	1.38	5.42	0.24	0.17	<0.08	0.08	<0.08	0.22	0.23	0.1	<0.08	0.16			
Total Suspended Solids	mg/l	113	309			15	130	90		57	350	110		180	37	28		<5	10			
Uranium																			<5	<1		
Vanadium																			68.85	33.65		
Zinc	µg/l				1254.8				361.7				32.3			259.6	195.9	184.5	89.5			



Whiteriver Landfill Site

LEACHATE QUALITY RESULTS

PARAMETERS	Leachate at active cell																	
	Monitoring Point:	P5, Cell 2	P5, Cell 2	P5, Cell 2	P5, Cell 2	P5, Cell 2	P5, Cell 2	P5, Cell 2	P5, Cell 2	P5, Cell 1	P5, Cell 1	P5, Cell 1	P5, Cell 1	P5, Cell 1	P5, Cell 2	P5, Cell 3	P5, Cell 3	
		Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date
	Units	21-Apr-09	14-Jul-09	06-Oct-09	21-Jan-10	14-Apr-10	06-Jul-10	11-Oct-10	18-Jan-11	05-Apr-11	19-Jul-11	10-Oct-11	11-Oct-11	10-Jan-12	25-Apr-12	18-Jul-12	10-Oct-12	
Alkalinity	mg/lCaCO3																	
Aluminium	µg/l															1087.5	676.2	
Ammonia	mg/l N	684.35	1.2	378.78	439.7	247.96	567.4	622.4	667.15	666.49	524.61	164.17	934.02	319.99	184.43	1147.23	19.17	
Antimony	µg/l															56.58	87.31	
Arsenic	µg/l															190.83	468.48	
Barium	µg/l													150.8	759.1	209.5	290.4	
Beryllium	µg/l															<25	<5	
B.O.D.	mg/l O2	6152.1	21.8	3070	2140	4716	149.6	140.8	798.0	>84000	8850	214.5	424.5	94.2	612	2156.0	493.0	
Boron	µg/l	<40.0				3561				4464				2123.2	2371.4	4287.1	6550.6	
Cadmium	µg/l	<0.1				<0.1				0.6				<0.5	<1	<5	<1	
Calcium	mg/l Ca	135.5				964.76				2569.1				145	405.13	89.53	143.92	
C.O.D.	mg/l O2	979	78	3320	4300	7180	2118	1748		75250	17340	825	3070	1021	1493	3980	3280	
Chloride	mg/l Cl	911	28	1669	1036	1678	2054	1940	2560	1474	1249	595	2256	941	1629	2410	3108	
Chromium	µg/l	63.6				56.9				140.7				97.7	44.9	163.4	224.9	
Cobalt	µg/l															<25	24.8	
Coliform Bacteria	no/100ml																	
Conductivity	µS/cm @ 25	9740	541	10230	8600	12050	14100	nm	10640	18	11550	4790	17330	7040	9040	19260	2000	
Copper	µg/l	39.6				4.7				165.2				474.8	47.8	57.8	41.9	
Cyanide	mg/l	0.06				<0.05				<0.05						<0.05		
D.O.	% Saturation																	
E. Coli	no/100ml																	
Fluoride	mg/l	0.47				5.36				<0.150					3.54			
Iron	µg/l	4580.5	503.1		15698.7	22808.1	5017.3	1152.8	1400.5	195556.9	926.3	655	682.5	3992.7	167.9	3280.0	1365.5	
Lead	µg/l	<1				2.8				59				6.9	<5	32.1	17.3	
Magnesium	mg/l Mg	113.15				281.67				555.78				76.13	78.46	213.36	140.18	
Manganese	µg/l	835.4				7946.8				49243.1				957.6	5435.5	382.1	664.3	
Mercury	µg/l	0.2				<0.1				<0.05				nm	0.1	nm	nm	
Molybdenum (µg/l)																<25	22.6	
Nickel	µg/l	88.5				90.1				465.9				91.7	39	155.2	197.5	
Ortho-Phosphate	mg/l P	1.69				<0.02				4.8					0.57			
pH		7.4	7.5	7	7.1	6.9	7.9	8.3	7.6	4	7.3	7.8	7.2	7.6	7	8.0	7.6	
Potassium	mg/l	385.12	7.02		241.66	391.6	570.43	535.45	313.43	1022.01	511.61	218.18	552.54	328.94	264.78	879.91	801.18	
Residue on evaporation																		
Sampling Depth	mg/l																	
Selenium	µg/l															<25	<5	
Silver	µg/l															nm	nm	
Sodium	mg/l	719.63	16.98		634.68	1291.19	1507.06	1416.55	958.77	1527.9	952.86	425.55	1481.66	636.35	1087.92	1690.89	2294.51	
Strontium	µg/l																	
Sulphate	mg/l SO4	18.8				7.3				787.8					771.7			
Suspended Solids	mg/l																	
Temp	°C	18	17	12	19	19	20	29	12.0	13	17	19	26	14	17	29.0	35.0	
Thallium	µg/l															<5	<1	
Time		12.3		12.2	13.35	13.1	11.45	13:15	13.40	12:30	11:35	12:50	13:10	11:55	11:50	11:50	11:55	
Tin	µg/l															<50	10.30	
T.O.C.	mg/l																	
T.O.N	mg/l N	0.08	<0.08	<0.08	<0.08	<0.08	0.14	0.16	<0.08	<0.08	<0.08	<0.08	<0.08	1.49	<0.08	<0.08	<0.08	
Total Suspended Solids	mg/l		15	717	450		477	360	280		414	130	190	150		560	590	
Uranium	µg/l															<5	<1	
Vanadium	µg/l															112.12	148.64	
Zinc	µg/l	256.8				114.1				663.6				54.5	292.7	447.7	76.1	




Whiteriver Landfill Site

LEACHATE QUALITY RESULTS

PARAMETERS	RESULTS	Treated leachate																		
		Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	
Monitoring Point:																				
	Units	01-Jul-08	07-Oct-08	13-Jan-09	21-Apr-09	14-Jul-09	06-Oct-09	21-Jan-10	14-Apr-10	06-Jul-10	11-Oct-10	18-Jan-11	05-Apr-11	19-Jul-11	11-Oct-11	10-Jan-12	25-Apr-12	18-Jul-12	10-Oct-12	
Alkalinity	mg/lCaCO3																	497.4	408.6	
Aluminium	µg/l																	486.60	541.28	
Ammonia	mg/l N	367.96	437.56	533.09	433.63	248.87	0.66	267.3	260.14	428.7	658		367.79	488.77	340.29	284.71	362.46	110.3	198.9	
Antimony	µg/l																	25.27	33.16	
Arsenic	µg/l																	89.50	236.42	
Barium	µg/l															102.3	495.5	110.3	198.9	
Beryllium	µg/l																	<25	<5	
B.O.D.	mg/l O2	<50	288	32.7	3063.8	32.4	71	207.2	73.3	91.5	274.2		15020	459	88.8	18.5	282.5	344.0	177.3	
Boron	µg/l				<30.0				2918.4				3146.9			2154.9	3010.1	3464.5	4904.5	
Cadmium	µg/l				0.2				<0.1				0.4			<0.5	<1	<5	<1	
Calcium	mg/l Ca				95.17				70.29				319.69			90.99	151.96	72.90	119.87	
C.O.D.	mg/l O2	924	1280	1016	833	449	1056	896	683	1143	977		5850	2330	842	595	1226	1950	1461	
Chloride	mg/l Cl	897	1082	1042	878	489	954	1180	671	1419	1100		875	1367	826	617	1380	1531	2210	
Chromium	µg/l				86.6				40.8				65.9			55.9	74.2	73.7	116.1	
Cobalt	µg/l																	<25	16.3	
Coliform Bacteria	no/100ml																			
Conductivity	µS/cm @ 25	6750	8000	8620	6950	4360	7570	5240	5230	8740	nm		<9	9660	7000	5030	8970	10910	1347	
Copper	µg/l				16.6				8.8				10.4			10.5	58.5	<25	13.0	
Cyanide	mg/l				<0.05				<0.05				<0.05					<0.05		
D.O.	% Saturation																			
E. Coli	no/100ml																			
Fluoride	mg/l				0.21				0.34				<0.150				0.96			
Iron	µg/l	2656.4		7486.8	2938.6	1707		2680.5	3847.9	5139.3	5817.2		19269.6	653.3	2867.7	3621	1275.2	4575.7	2884.8	
Lead	µg/l				4.9				2.2				9			<2.5	6.6	<25	<5	
Magnesium	mg/l Mg				77.37				85.01				159.65			58.38	79.43	108.75	114.74	
Manganese	µg/l				388.7				193.1				607.9			308.9	1132.9	226.3	536.0	
Mercury	µg/l				0.2				<0.1				<0.05			nm	0.1	nm	nm	
Molybdenum (µg/l)																		<25	17.5	
Nickel	µg/l				95.9				59.7				137.1			53.8	73.6	80.1	125.2	
Ortho-Phosphate	mg/l P				1.75				0.53				0.21				0.08			
pH		8.7	8.3	8.6	8.7	8.2	8.6	7.7	8.5	8.5	8.4		7.9	8.5	8.5	8.4	8.4	8.3	8.5	
Potassium	mg/l	278		351.56	259.95	150.15		148.5	207.35	355.59	338.49		356.37	424.93	291.86	196.57	324.61	451.53	560.52	
Residue on evaporation																				
Sampling Depth	mg/l																			
Selenium	µg/l																	<25	<5	
Silver	µg/l																	nm	nm	
Sodium	mg/l	676.4		739.35	671.23	348.5		375.85	529.4	806.6	776.14		709.68	1033.72	678.99	444.33	1075.89	1122.54	1614.46	
Strontium	µg/l																	712.880	1102.250	
Sulphate	mg/l SO4	241		226.4	123.3	405.5	125.1	360.1	436.4	303.9	436.5		330.2		356.6	107.3	666.6		278.4	
Suspended Solids	mg/l			141.7	70															
Temp	°C	nm	13	7	17	19	13	11	12	15	13		14	16	16	9	12	19.0	13.0	
Thallium	µg/l																		<5	<1
Time		nt	13.3	11.45	12.15		12.3	13.4	13.15	11.05	13:30		10:00	11:50	12:30	12:05	12:15	11:25	12:25	
Tin	µg/l																		<50	<10
T.O.C.	mg/l																			
T.O.N	mg/l N	14.24	0.1	0.73	1.79	0.53	28.45	<0.08	0.48	50.62	129.32		<0.08	<0.08	1.53	0.32	<0.08	<0.08	22.31	
Total Suspended Solids	mg/l	275	410			40	330	390		1080	250				475	167	130	700	230	
Uranium	µg/l																		<5	<1
Vanadium	µg/l																		71.91	102.95
Zinc	µg/l				89.3				41.4				107.1			24.5	230.1	165.8	47.1	

APPENDIX G

GROUNDWATER MONITORING RESULTS

							
		Whiteriver Trigger Limits (WTL)	S.I. No. 9/2010 — European Communities Environmental Objectives (Groundwater)	EPA Interim guideline values (IGV)	EC (Drinking water) Regulations 2007 (SI .no 106 of 2007)	EC (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations 1989 S.I. No.294/1989 Surface Water Quality Standards	EUROPEAN COMMUNITIES ENVIRONMENTAL OBJECTIVES (SURFACE WATERS)
PARAMETERS	UNITS						
Alkalinity	mg/l CaCO3			NAC			
Aluminium	µg/l		150	0.2 mg/l	200		
Ammonia	mg/l N	0.2 mg/l N	65-175 µg/l	0.15 mg/l	0.3 mg/l (0.23 mg/l N)	(A1- 0.2) (A2- 1.5) (A3- 4)	High status ≤ 0.040 (mean) or < 0.090 (95%ile)
Antimony	µg/l				5		
Arsenic	µg/l		7.5				25
Barium	mg/l			0.1		(A1- 0.1) (A2- 1)	
Beryllium	µg/l						
B.O.D.	mg/l					(A1- 5) (A2- 5), (A3- 7)	High status < 1.3 (mean) or < 2.2
Boron	µg/l	1000	750	1000	1000	2000	
Cadmium	µg/l	5	3.75	5	5	5	
Calcium	mg/l Ca	200		200			
C.O.D.	mg/l					40	
Chloride	mg/l Cl	20	24-187.5	30	250	250	
Chromium	µg/l	30	37.5	30	50	50	
Colbalt	µg/l						
Coliform Bacteria	No/100 ml				0		
Conductivity	µS/cm @20	800	800-1875	1000	2500	1000	
Copper	µg/l	30	1500	0.03 mg/l	2000	(A1- 0.05) (A2- 0.1) (A3- 1)	5 or 30
Cyanide	µg/l	0.01	37.5	0.01 mg/l	0.05	50	
D.O	% Sat			NAC		>60% (A1), >50% (A2), >30% (A3)	lower limit 95%ile >80% saturation,
E Coli	No/100 ml			0	0	(A1- 1000) (A2- 5000) (A3- 40000)	
Fluoride	mg/l	1		1	0.8	(A1- 1) (A2- 1.7)	
Iron	µg/l			200	200	(A1- 200) (A2- 2000)	
Lead	µg/l	10	18.75	10	25	50	
Magnesium	mg/l Mg	50		50			
Manganese	µg/l			50	50	(A1- 50) (A2- 300) (A3- 1000)	
Mercury	µg/l	1	0.75	1	1	1	0.05
Molybdenum	µg/l		35				
Nickel	µg/l	20	15	20	20		20
o-Phosphate	mg/l P	0.03		0.03			
pH		>7 or <8		6.5 - 9.5	6.5 - 9.5	(A1- 5.5-8.5) (A2- 5.5-9.0)	Soft Water 4.5< pH < 9.0 Water hardness 100 mg/1 CaCO3 Hard Water 6.0< pH < 9.0 Water hardness > 100 mg/1 CaCO3
Phenol	mg/l			0.0005		(A1- 0.5) (A2- 5) (A3- 100)	
Potassium	mg/l	5		5			
Selenium	µg/l				10		
Silver	µg/l						
Sodium	mg/l	150	150	150	200	200	
Strontium	mg/l SO4	50	187.5		250		
Sulphate	mg/l SO4	50	187.5		250		
Total Dissolved Solids	mg/l			1000			
Temperature	degrees C			25		25	
Thallium							
Tin							
T.O.C.	mg/l	10		NAC	No abnormal change		
T.O.N	mg/l N			NAC			
Nitrate	mg/l		37.5	25	50	Nitrates 50	
Nitrite	mg/l		375	0.1	0.5		
Nitrites	mg/l				0.1		
Total S Solids	mg/l					50	
Uranium	µg/l						
Vanadium	µg/l						
Zinc	µg/l	100		100		(A1- 3000) (A2- 5000)	

PARAMETERS		Whiteriver Landfill Site GROUNDWATER QUALITY																		
		RESULTS																		
Monitoring Point:		BH1																		
		UPSTREAM OVERBURDEN																		
	Units	Trigger Level	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date
Alkalinity	mg/CaCO3	NAC	07-Oct-08	13-Jan-09	21-Apr-09	14-Jul-09	06-Oct-09	21-Jan-10	14-Apr-10	06-Jul-10	11-Oct-10	18-Jan-11	05-Apr-11	19-Jul-11	11-Oct-11	10-Jan-12	25-Apr-12	18-Jul-12	10-Oct-12	
Aluminium	µg/l				216				272				240				290			
Ammonia	mg/l N	0.2	0.05	<0.03	0.03	<0.03	0.09	0.03	0.23	<0.03	0.03	0.03	<0.03	<0.03	0.04	<0.03	0.03	<0.03	0.05	
Antimony	µg/l																<0.5			
Arsenic	µg/l																<0.5			
Barium	µg/l																153.6			
Beryllium	µg/l																<0.5			
B.O.D.	mg/l O2				<50															
Boron	µg/l	1000							11.9				13.9				12.3			
Cadmium	µg/l	5			<0.1				<0.1				<0.1				<0.1			
Calcium	mg/l Ca	200			101.49				99.77				97.49				100.79			
C.O.D.	mg/l O2											6.8								
Chloride	mg/l Cl	20	39	28	31	33	27	31	38	41	32	30	36	39	34	30	33	33	30	
Chromium	µg/l	30			6.2				<1				<0.5				<0.5			
Cobalt	µg/l																<0.5			
Coliform Bacteria	No/ml		1986	411	1															
Conductivity	µS/cm @ 25	800	651	650	647	646	636	637	660	661	578	643	690	632	716	660	657	730	735	
Copper	µg/l	30			2.3				1.4				1.1				<0.5			
Cyanide	µg/l	0.01			<0.05				<0.05				<0.05				<0.05			
D.O.	% Saturation		42	10	51	50	44	24	45	nm	46	56	42	30	35	44	36	43	44	
E. Coli	no/100ml		39	19	0															
Fluoride	mg/l	1			<0.150				0.15				<0.150				<0.150			
Iron	µg/l				572.7				314.9				97				<10			
Lead	µg/l	10			2				<1				<0.5				<0.5			
Magnesium	mg/l Mg	50			10.11				9.95				10.38				9.76			
Manganese	µg/l				64.3				38.9				60.5				2.1			
Mercury	µg/l	1			<0.1				<0.1				<0.05				<0.05			
Molybdenum (µg/l)																	<0.5			
Nickel	µg/l	20			2.7				1.3				<0.5				<0.5			
Ortho-Phosphate	mg/l P	0.03			0.05				0.03				<0.02				<0.02			
pH		>7 or <8	7.3	7.3	7.2	7.2	7.4	7.3	7.2	7.2	7.3	7.5	7.4	7.2	7.4	7.4	7.3	7.2	7.2	
Potassium	mg/l	5			<1				<1				0.48				0.46			
Residue on evap	mg/l				545				420				392				366			
Sampling Depth	m		6.8	6.8	6.9	6.8	6.8	6.7	6.7	6.9	7		6.7	7.1	7.2	7	6.9	6.8	6.9	
Selenium	µg/l																<0.5			
Silver	µg/l																<0.5			
Sodium	mg/l	150			23.43				20.82				20.31				16.54			
Strontium	µg/l																144.190			
Sulphate	µg/l	50			22.6				21.1				19.2				18.2			
Suspended Solids	mg/l																			
Temp	°C		11	10.3	11	11	11	9	10.5	10	13	10.4	10	12.7	12	10	9.0	11.0	11.0	
Thallium	µg/l																<0.1			
Time			13.1	12.4	12.15		12.1	12.35	12.35	11.1	12:35	11:55	11:45	11:05	11:00	11:30	11:35	11:30	11:22	
Tin	µg/l																2.80			
T.O.C.	mg/l	10	16.2	4.5	2.2	3.4	4	2.9	1.9	1.6	3.5	3.3	2.5	2.4	4	1.7	70.3	<1.5	3.8	
T.O.N	mg/l N				1.82				1.1				1.23				1.06			
Total Suspended Solids	mg/l																			
Uranium	µg/l																0.64			
Vanadium	µg/l																<0.5			
Zinc	µg/l	100			8.7				17.3				19.4				6.1			
Water Level m OD	119.94		113.14	113.14	113.04	113.14	113.14	113.24	113.24	113.04	112.94	119.94	113.24	112.84	112.74	112.94	113.04	113.14	113.04	



Whiteriver Landfill Site

GROUNDWATER QUALITY

RESULTS


PARAMETERS


Monitoring Point:

BH2A

UPSTREAM BEDROCK CRAWLEYS PRIVATE WELL- POTABLE SOURCE

	Units	Trigger Level	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date
Alkalinity	mg/CaCO3	NAC	07-Oct-08	13-Jan-09	21-Apr-09	14-Jul-09	06-Oct-09	21-Jan-10	14-Apr-10	06-Jul-10	11-Oct-10	18-Jan-11	05-Apr-11	19-Jul-11	11-Oct-11	10-Jan-12	25-Apr-12	18-Jul-12	10-Oct-12
Aluminium	µg/l				282				324				288				340		
Ammonia	mg/l N	0.2	0.03	<0.03	<0.03	<0.03	0.05	<0.03	0.04	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.14
Antimony	µg/l																<0.5		
Arsenic	µg/l																<0.5		
Barium	µg/l								<1								0.6		
Beryllium	µg/l																<0.5		
B.O.D.	mg/l O2				<50														
Boron	µg/l	1000							12.5				15.3				14.1		
Cadmium	µg/l	5			<0.1				<0.1				<0.1				<0.1		
Calcium	mg/l Ca	200			63.64				63.33				69.74				65.21		
C.O.D.	mg/l O2											nm							
Chloride	mg/l Cl	20	16	16	16	16	16	16	16	17	17	16	16	15	16	15	16	16	16
Chromium	µg/l	30			6.2				<1				<0.5				<0.5		
Cobalt	µg/l																<0.5		
Coliform Bacteria	no/100ml		50	4	9	130	34	0	7	18					20	0			
Conductivity	µS/cm @ 25	800	614	607	603	609	611	616	615	610	549	627	608	610	657	632	614	674	644
Copper	µg/l	30			1.2				1.6				1.5				0.7		
Cyanide	mg/l	0.01			<0.05				<0.05				<0.05				<0.05		
D.O.	% Saturation		34	30	25	23	33	31	54	25	20	43	26	37	33	30	28	33	19
E. Coli	no/100ml		0	0	0	0	0	0	0	0				1	0				
Fluoride	mg/l	1			<0.150				<0.150				<0.150				<0.150		1
Iron	µg/l				101.8				<10				<10				<10		
Lead	µg/l	10			<1				<1				<0.5				<0.5		
Magnesium	mg/l Mg	50			30.62				31.3				34.16				31.42		
Manganese	µg/l				4.6				2.5				2.9				2.5		
Mercury	µg/l	1			<0.1				<0.1				<0.05				<0.05		
Molybdenum (µg/l)																	<0.5		
Nickel	µg/l	20			<1				<1				<0.5				<0.5		
Ortho-Phosphate	mg/l P	0.03			<0.02				<0.02				<0.02				<0.02		
pH		>7 or <8	7.4	7.5	7.4	7.2	7.5	7.5	7.5	7.4	7.5	7.7	7.5	7.5	7.6	7.6	7.6	7.5	7.5
Potassium	mg/l	5			1				1.06				1.13				1.16		
Residue on evaporation	mg/l				354				332				322				337		
Sampling Depth	m		nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm	nm
Selenium	µg/l																<0.5		
Silver	µg/l																nm		
Sodium	mg/l	150			20.75				19.78				21.1				20.11		
Strontium	µg/l																226.680		
Sulphate	µg/l	50			4.4				4.9				4.8				5.1		
Suspended Solids	mg/l																		
Temp	°C		11.3	10.2	10.8	14.1	11.7	7.5	7.8	15	11.4	8.7	14	13.5	16.2	10.1	11.7	15.0	14.5
Thallium	µg/l																<0.1		
Time			12.1	12	12.1		12.15	11.4	11.55	10.25	12:20	12:35	10:45	10:10	10:20	10:30	10:25	10:45	11:00
Tin	µg/l																<1		
T.O.C.	mg/l	10	34.4	<1.5	3.3	<3.0	<3.0	2.1	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	4.2	<1.5	77.0	<1.5	<1.5
T.O.N	mg/l N				0.32				0.26				0.46				0.37		
Total Suspended Solids	mg/l																		
Uranium	µg/l																1.81		
Vanadium	µg/l																<0.5		
Zinc	µg/l	100			2				2.6				4.9				1.9		

	Whiteriver Landfill Site																		
	GROUNDWATER QUALITY																		
PARAMETERS	RESULTS																		
Monitoring Point:	BH3																		
	UPSTREAM BEDROCK																		
	Trigger Level	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date
	Units																		
Alkalinity	mg/l CaCO3	NAC	13-Jan-09	21-Apr-09	14-Jul-09	06-Oct-09	21-Jan-10	14-Apr-10	06-Jul-10	11-Oct-10	18-Jan-11	05-Apr-11	19-Jul-11	11-Oct-11	10-Jan-12	25-Apr-12	18-Jul-12	10-Oct-12	
Aluminium	µg/l			328				308				308				320			
Ammonia	mg/l N	0.2	<0.03	<0.03	<0.03	0.07	0.03	0.06	<0.03	0.03	0.03	<0.03	<0.03	<0.03	<0.03	0.09	<0.03	0.17	
Antimony	µg/l															<0.5			
Arsenic	µg/l															0.69			
Barium	µg/l															67.0			
Beryllium	µg/l															<0.5			
B.O.D.	mg/l O2			<50															
Boron	µg/l	1000						17.6				18				18.8			
Cadmium	µg/l	5		0.2				<0.1				<0.1				<0.1			
Calcium	mg/l Ca	200		102.59				78.89				72.76				73.59			
C.O.D.	mg/l O2										0.0								
Chloride	mg/l Cl	20	23	37	40	33	23	17	15	15	15	15	14	15	15	15	15	15	15
Chromium	µg/l	30		4.8				<1				<0.5				<0.5			
Cobalt	µg/l															<0.5			
Coliform Bacteria	no/100ml		>2420	8164															
Conductivity	µS/cm @ 25	800	709	767	801	797	696	649	623	559	634	616	621	709	638	626	686	716	
Copper	µg/l	30		4.5				<1				<0.5				2.7			
Cyanide		0.01		<0.05				<0.05				<0.05				<0.05			
D.O.	% Saturation		47	96	82	36	24	43	nm	40	42	28	26	27	31	27	29	27	
E. Coli	no/100ml		30	<10															
Fluoride	mg/l	1		<0.150				<0.150				<0.150				<0.150			
Iron	µg/l			186.8				<10				31.7				<10			
Lead	µg/l	10		<1				<1				<0.5				<0.5			
Magnesium	mg/l Mg	50		27.77				26.64				25.92				25.74			
Manganese	µg/l			791.9				17.3				9.7				10.9			
Mercury	µg/l	1		<0.1				<0.1				<0.05				<0.05			
Molybdenum (µg/l)																<0.5			
Nickel	µg/l	20		2.8				<1				<0.5				1.1			
Ortho-Phosphate	mg/l P	0.03		0.04				0.04				0.04				0.05			
pH		>7 or <8	7.4	7.3	7.1	7.3	7.4	7.4	7.5	7.6	7.7	7.5	7.5	7.6	7.6	7.6	7.5	7.5	
Potassium	mg/l	5		1.25				1.4				1.38				1.60			
Residue on evaporation	mg/l			495				357				348				370			
Sampling Depth	m		7.7	8.8	9.3	2.8	0.5	0	nm	0		nm	nm	nm	nm	nm	nm	nm	
Selenium	µg/l															<0.5			
Silver	µg/l															nm			
Sodium	mg/l	150		22.77				21.71				20.6				21.03			
Strontium	µg/l															280.040			
Sulphate		50		51.3				17.6				4.9				4.6			
Suspended Solids	mg/l																		
Temp	°C		10.5	11	12	12	8.2	10.3	10	13	10.3	11	13.7	12	10	10.0	11.0	11.0	
Thallium	µg/l															<0.1			
Time			12.2	12.3		12.3	12.55	12.5	11.15	12:45	12.05	11:50	11:10	11:05	11:35	11:40	11:35	11:30	
Tin	µg/l															<1			
T.O.C.	mg/l	10	2.9	7.9	6.3	4.6	2.7	<1.5	<1.5	<1.5	2.5	<1.5	<1.5	8.5	<1.5	80.5	<1.5	<1.5	
T.O.N	mg/l N			0.24				0.21				0.28				0.20			
Total Suspended Solids	mg/l																		
Uranium	µg/l															2.23			
Vanadium	µg/l															<0.5			
Zinc	µg/l	100		11.9				10.7				13				14.2			

	Whiteriver Landfill Site																			
	GROUNDWATER QUALITY																			
PARAMETERS	RESULTS																			
Monitoring Point:	BH4																			
	UPSTREAM BEDROCK																			
		Trigger Level	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date
	Units		07-Oct-08	13-Jan-09	21-Apr-09	14-Jul-09	06-Oct-09	21-Jan-10	14-Apr-10	06-Jul-10	11-Oct-10	18-Jan-11	05-Apr-11	19-Jul-11	11-Oct-11	10-Jan-12	25-Apr-12	18-Jul-12	10-Oct-12	
Alkalinity	mg/lCaCO3	NAC			284				282				278					272		
Aluminium	µg/l																	<5		
Ammonia	mg/l N	0.2	0.04	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	0.07	
Antimony	µg/l																	<0.5		
Arsenic	µg/l																	<0.5		
Barium	µg/l																	7.1		
Beryllium	µg/l																	<0.5		
B.O.D.	mg/l O2				<50															
Boron	µg/l	1000							11				12.4					11.5		
Cadmium	µg/l	5			<0.1				<0.1				<0.1					<0.1		
Calcium	mg/l Ca	200			74.07				77.68				76.57					75.90		
C.O.D.	mg/l O2											nm								
Chloride	mg/l Cl	20	13	13	13	14	13	14	13	14	14	21	14	13	16	14	14	15	14	
Chromium	µg/l	30			3.1				<1				<0.5					<0.5		
Cobalt	µg/l																	<0.5		
Coliform Bacteria	no/100ml		1	0	0															
Conductivity	µS/cm @ 25	800	563	559	556	561	560	566	588	599	540	905	563	559	645	562	576	627	675	
Copper	µg/l	30			2.9				11.3				<0.5					<0.5		
Cyanide		0.01			<0.05				<0.05				<0.05					<0.05		
D.O.	% Saturation		20	25	29	25	27	21	24	nm	14	29	16	23	40	15	nm	21	10	
E. Coli	no/100ml		0	0	0															
Fluoride	mg/l	1			<0.150				<0.150				<0.150					<0.150		
Iron	µg/l				77.8				1284.2				337.8					123.7		
Lead	µg/l	10			<1				8.7				<0.5					<0.5		
Magnesium	mg/l Mg	50			19.45				20.56				20.99					20.01		
Manganese	µg/l				1.5				21.2				17.3					39.3		
Mercury	µg/l	1			<0.1				<0.1				<0.05					<0.05		
Molybdenum (µg/l)																		<0.5		
Nickel	µg/l	20			<1				1.1				<0.5					<0.5		
Ortho-Phosphate	mg/l P	0.03			<0.02				<0.02				<0.02					<0.02		
pH		>7 or <8	7.4	7.4	7.4	7.3	7.5	7.5	7.3	7.3	7.3	7.4	7.4	7.5	7.3	7.4	7.6	7.4	7.3	
Potassium	mg/l	5			<1				<1				0.91					0.98		
Residue on evaporation	mg/l				314				340				303					303		
Sampling Depth	m		10.3	nm	nm	nm	0	0	nm	nm	0		nm	nm	nm	nm	nm	nm	nm	nm
Selenium	µg/l																	<0.5		
Silver	µg/l																	nm		
Sodium	mg/l	150			16.74				16.19				16.25					15.65		
Strontium	µg/l																	201.780		
Sulphate		50			4				21.7				3.7					4.8		
Suspended Solids	mg/l																			
Temp	°C		11.4	9.8	12	12	12	8.6	8.5	11	12	6.1	11	15	14	8	nm	14.0	11.0	
Thallium	µg/l																	<0.1		
Time			13.4	12.55	12.4		13.2	13.2	14	11.55	13:00	12.20	12:10	10:55	11:55	12:00	nt	11:45	11:50	
Tin	µg/l																	<1		
T.O.C.	mg/l	10	28.1	<1.5	5.5	<3.0	<3.0	<1.5	<1.5	<1.5	<1.5	2.9	<1.5	1.6	5.5	3.9	69.7	<1.5	1.7	
T.O.N	mg/l N				0.55				<0.08				0.59					0.50		
Total Suspended Solids	mg/l																			
Uranium	µg/l																	1.29		
Vanadium	µg/l																	<0.5		
Zinc	µg/l	100			44.4				323.3				10.3					34.1		





Whiteriver Landfill Site


GROUNDWATER QUALITY

RESULTS


PARAMETERS	RESULTS																			
Monitoring Point:	BH5A																			
	DOWNSTREAM OVERBURDEN																			
	Units	Trigger Level	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date
Alkalinity	mg/l CaCO3	NAC	07-Oct-08	13-Jan-09	21-Apr-09	14-Jul-09	06-Oct-09	21-Jan-10	14-Apr-10	06-Jul-10	11-Oct-10	18-Jan-11	05-Apr-11	19-Jul-11	11-Oct-11	10-Jan-12	25-Apr-12	18-Jul-12	10-Oct-12	
Aluminium	µg/l				270				240				192				232			
Ammonia	mg/l N	0.2	0.03	<0.03	0.05	<0.03	0.08	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.06	
Antimony	µg/l																		<0.5	
Arsenic	µg/l																		0.50	
Barium	µg/l																		81.4	
Beryllium	µg/l																		<0.5	
B.O.D.	mg/l O2				<50															
Boron	µg/l	1000							17				21.5						15.9	
Cadmium	µg/l	5			0.1				<0.1				<0.1						<0.1	
Calcium	mg/l Ca	200			114.58				103.29				87.15						74.90	
C.O.D.	mg/l O2											7.8								
Chloride	mg/l Cl	20	59	74	57	40	25	46	54	49	30	48	57	44	42	60	28	26	25	
Chromium	µg/l	30			11.9				4.6				0.6						<0.5	
Cobalt	µg/l																		<0.5	
Coliform Bacteria	no/100ml		45	18	41															
Conductivity	µS/cm @ 25	800	756	763	706	664	638	605	671	640	534	584	645	631	666	660	564	627	609	
Copper	µg/l	30			15.2				6.2				1.3						2.5	
Cyanide		0.01			<0.05				<0.05				<0.05						<0.05	
D.O.	% Saturation		47	21	52	69	36	92	81	nm	56	97	53	37	54	90	75	98	65	
E. Coli	no/100ml		4	1	<10															
Fluoride	mg/l	1			0.19				0.23				0.19						0.190	
Iron	µg/l				6848.9				3272.3				312.1						<10	
Lead	µg/l	10			14.4				5.2				<0.5						<0.5	
Magnesium	mg/l Mg	50			17.1				15.01				12.9						10.81	
Manganese	µg/l				592.7				263.2				12.3						<1	
Mercury	µg/l	1			<0.1				<0.1				<0.05						<0.05	
Molybdenum (µg/l)																			0.6	
Nickel	µg/l	20			22.6				9.6				<0.5						0.7	
Ortho-Phosphate	mg/l P	0.03			<0.02				<0.02				<0.02						<0.02	
pH		>7 or <8	7.4	7.6	7.6	7.5	7.5	8.1	7.7	7.5	7.7	8.1	7.7	7.6	7.8	8.1	8.0	7.9	7.7	
Potassium	mg/l	5			1.3				1.38				1.31						1.41	
Residue on evaporation	mg/l				2103				2099				456						956	
Sampling Depth	m		7.1	7.5	7.7	7.8	7.2	7.8	7.9	8.1	8		7.9	8.2	8.1	7.4	3.5	7.7	7.6	
Selenium	µg/l																		<0.5	
Silver	µg/l																		nm	
Sodium	mg/l	150			30.55				29.11				29.31						26.89	
Strontium	µg/l																		143.550	
Sulphate		50			56.3				42				42						32.3	
Suspended Solids	mg/l																			
Temp	°C		11	10.4	11.4	12	11	8.7	11	11	11	10.0	11	12.4	13	10	11.0	11.0	11.0	
Thallium	µg/l																		<0.1	
Time			12.55	13.45	14.05		13.1	12	13.2	10.15	12:10	12.55	12:10	11:15	11:15	11:45	12:00	11:10	12:00	
Tin	µg/l																		2.02	
T.O.C.	mg/l	10	18.4	4.1	2.9	4.3	4.4	5.7	3.4	3.9	4.9	5.3	3.5	3.2	11.5	5.4	67.0	4.4	4.7	
T.O.N	mg/l N				0.16				<0.08				0.08						0.17	
Total Suspended Solids	mg/l																			
Uranium	µg/l																		0.99	
Vanadium	µg/l																		0.64	
Zinc	µg/l	100			32.5				17.3				4.2						3.9	
Water Level m OD	107.88		100.78	100.38	100.18	100.08	100.68	100.08	99.98	99.78	99.88	107.88	99.98	99.68	99.78	100.48	104.38	100.18		


	Whiteriver Landfill Site																			
	GROUNDWATER QUALITY																			
PARAMETERS	RESULTS																			
Monitoring Point:	BH6																			
	DOWNSTREAM BEDROCK																			
		Trigger Level	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date
	Units		07-Oct-08	13-Jan-09	21-Apr-09	14-Jul-09	06-Oct-09	21-Jan-10	14-Apr-10	06-Jul-10	11-Oct-10	18-Jan-11	05-Apr-11	19-Jul-11	11-Oct-11	10-Jan-12	25-Apr-12	18-Jul-12	10-Oct-12	
Alkalinity	mg/CaCO3	NAC			250				141				208				260			
Aluminium	µg/l																<5			
Ammonia	mg/l N	0.2	0.05	<0.03	<0.03	<0.03	0.28	<0.03	<0.03	<0.03	<0.03	<0.03	0.06	0.03	<0.03	0.03	0.03	<0.03	0.05	
Antimony	µg/l																<0.5			
Arsenic	µg/l																0.73			
Barium	µg/l																209.3			
Beryllium	µg/l																<0.5			
B.O.D.	mg/l O2				54.2															
Boron	µg/l	1000							32.5				61.3				60.3			
Cadmium	µg/l	5			<0.1				<0.1				<0.1				<0.1			
Calcium	mg/l Ca	200			75.21				40.67				66.84				74.69			
C.O.D.	mg/l O2											13.4								
Chloride	mg/l Cl	20	15	32	16	9	10	13	7	8	9	7	13	16	16	14	14	15	14	
Chromium	µg/l	30			5.3				1.9				2.1				<0.5			
Cobalt	µg/l																<0.5			
Coliform Bacteria	no/100ml		>12100	>2420	98															
Conductivity	µS/cm @ 25	800	534	422	536	263	638	240	301	273	262	281	464	528	584	544	538	575	610	
Copper	µg/l	30			3.6				6.1				3.1				<0.5			
Cyanide	µg/l	0.01			<0.05				<0.05				<0.05				<0.05			
D.O.	% Saturation		30	72	28	78	48	75	24	32	37	45	35	59	43	58	42	60	42	
E_Coli	no/100ml		114	58	<10															
Fluoride	mg/l	1			<0.150				<0.150				<0.150				<0.150			
Iron	µg/l				871.5				1694				1983				<10			
Lead	µg/l	10			3.9				6.9				1.8				<0.5			
Magnesium	mg/l Mg	50			16.65				8.86				15.58				16.46			
Manganese	µg/l				121.8				425.7				59.7				252.3			
Mercury	µg/l	1			<0.1				<0.1				<0.05				<0.05			
Molybdenum (µg/l)																	0.8			
Nickel	µg/l	20			2.9				3.6				16.7				0.6			
Ortho-Phosphate	mg/l P	0.03			0.02				0.03				0.03				0.04			
pH		>7 or <8	7.5	7.5	7.5	7.6	7.5	7.5	7.5	7.4	7.6	7.6	7.6	7.7	7.5	7.8	7.8	7.7	7.5	
Potassium	mg/l	5			1.98				2.67				6.2				2.18			
Residue on evaporation	mg/l				1077				580				378				370			
Sampling Depth	m		13.9	13.3	13.1		13.8	13.9	13.3				13.8		13.9		0.0	nm	nm	
Selenium	µg/l																<0.5			
Silver	µg/l																nm			
Sodium	mg/l	150			16.29				7.98				21.44				14.82			
Strontium	µg/l																199.450			
Sulphate	mg/l	50			10.5				6				8.9				10.4			
Suspended Solids	mg/l																			
Temp	°C		11.2	10.3	11.9	11.8	12.3	10	10.3	11	10.9	9.3	11	15	14.6	10.9	11.0	13.0	14.5	
Thallium	µg/l																<0.1			
Time			12.45	12.4	13.4		12.5	12.35	13.2	11.3	13.15	13.45	12:20	12:00	12:25	11:20	11:20	11:30	12:00	
Tin	µg/l																<1			
T.O.C.	mg/l	10	24.2	5.6	4	5.3	8.2	43.3	19.8	47.1	36.2	5.9	3.4	12.3	4	3.3	68.0	2.2	2.4	
T.O.N	mg/l N				0.28				0.33				0.31				0.14			
Total Suspended Solids	mg/l																			
Uranium	µg/l																0.95			
Vanadium	µg/l																<0.5			
Zinc	µg/l	100			8.4				14.6				12.2				10.4			
Water Level m OD	105.01		91.11	91.71	91.91	105.01	91.21	91.11	91.71	105.01	91.11	105.01	91.21	105.01	91.11	105.01	105.01			


		Whiteriver Landfill Site																		
		GROUNDWATER QUALITY																		
PARAMETERS		RESULTS																		
Monitoring Point:		BH9																		
		DOWNSTREAM BEDROCK																		
	Units	Trigger Level	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date
Alkalinity	mg/ICaCO3	NAC			440					440				408					336	
Aluminium	µg/l																		<5	
Ammonia	mg/l N	0.2	0.03	<0.03	<0.03	<0.03	0.05	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.05	0.03	0.18
Antimony	µg/l																		<0.5	
Arsenic	µg/l																		0.56	
Barium	µg/l																		163.0	
Beryllium	µg/l																		<0.5	
B.O.D.	mg/l O2				<50															
Boron	µg/l	1000								17.3				37.3					19.2	
Cadmium	µg/l	5			<0.1					<0.1				<0.1					<0.1	
Calcium	mg/l Ca	200			139.46					151.69				148.74					102.87	
C.O.D.	mg/l O2												23.3							
Chloride	mg/l Cl	20	14	15	14	15	15	16	16	17	19	19	19	15	16	16	16	17	17	16
Chromium	µg/l	30			5.4					<1				1.8					<0.5	
Cobalt	µg/l																		<0.5	
Coliform Bacteria	no/100ml		548	105	31															
Conductivity	µS/cm @ 25	800	726	737	825	872	919	961	905	936	898	1002	891	625	706	632	677	740	771	
Copper	µg/l	30			1.5				1.2				1						1.5	
Cyanide		0.01			<0.05				<0.05				<0.05						<0.05	
D.O.	% Saturation		66	36	85	59	47	54	68	nm	62	65	35	67	54	67	61	78	65	
E. Coli	no/100ml		5	0	20															
Fluoride	mg/l	1			<0.150				<0.150				<0.150						<0.150	
Iron	µg/l				1215.8				6454.7				1116.4						<10	
Lead	µg/l	10			<1				<1				1.1						<0.5	
Magnesium	mg/l Mg	50			18.92				21.98				27.48						18.00	
Manganese	µg/l				217				941.6				199.3						3.1	
Mercury	µg/l	1			<0.1				<0.1				<0.05						<0.05	
Molybdenum (µg/l)																			<0.5	
Nickel	µg/l	20			1.6				<1				2						<0.5	
Ortho-Phosphate	mg/l P	0.03			<0.02				<0.02				<0.02						<0.02	
pH		>7 or <8	7.1	7.2	7.2	7	7.1	7.1	7.1	7	7.1	7.2	7.1	7.4	7.5	7.6	7.5	7.4	7.4	
Potassium	mg/l	5			<1				<1				3.39						1.20	
Residue on evaporation	mg/l				605				604				754						486	
Sampling Depth	m		23	23	23.2	23.1	23	22.9	23	23	22.9	23.1	23.3	23.3	23.4	22.9	23.0	22.8		
Selenium	µg/l																		<0.5	
Silver	µg/l																		nm	
Sodium	mg/l	150			14.63				14.25				23.78						15.24	
Strontium	µg/l																		213.380	
Sulphate		50			32.4				46.9				35.5						13.7	
Suspended Solids	mg/l																			
Temp	°C		11	8.8	11	12	11	8.4	11.1	10	11	9.5	10	13.7	13	10	9.0	11.0	11.0	
Thallium	µg/l																		<0.1	
Time			11.25	10.25	10.55		10.5	11.25	9.45	10.3	11:30	11.15	11:10	10:30	10:45	11:00	10:50	10:45	11:00	
Tin	µg/l																		<1	
T.O.C.	mg/l	10	27.2	2.8	6.5	4.9	5.4	9	5.6	4.3	4.6	5.7	8.4	3.5	6.5	1.7	83.3	<1.5	<1.5	
T.O.N	mg/l N				0.08				<0.08				0.08						0.21	
Total Suspended Solids	mg/l																			
Uranium	µg/l																		1.61	
Vanadium	µg/l																		<0.5	
Zinc	µg/l	100			3.7				7.2				3.5						4.2	
Water Level m OD	103.47		80.47	80.47	80.27	80.37	80.47	80.57	80.47	80.47	80.57	103.47	80.37	80.17	80.17	80.07	80.57	80.47		

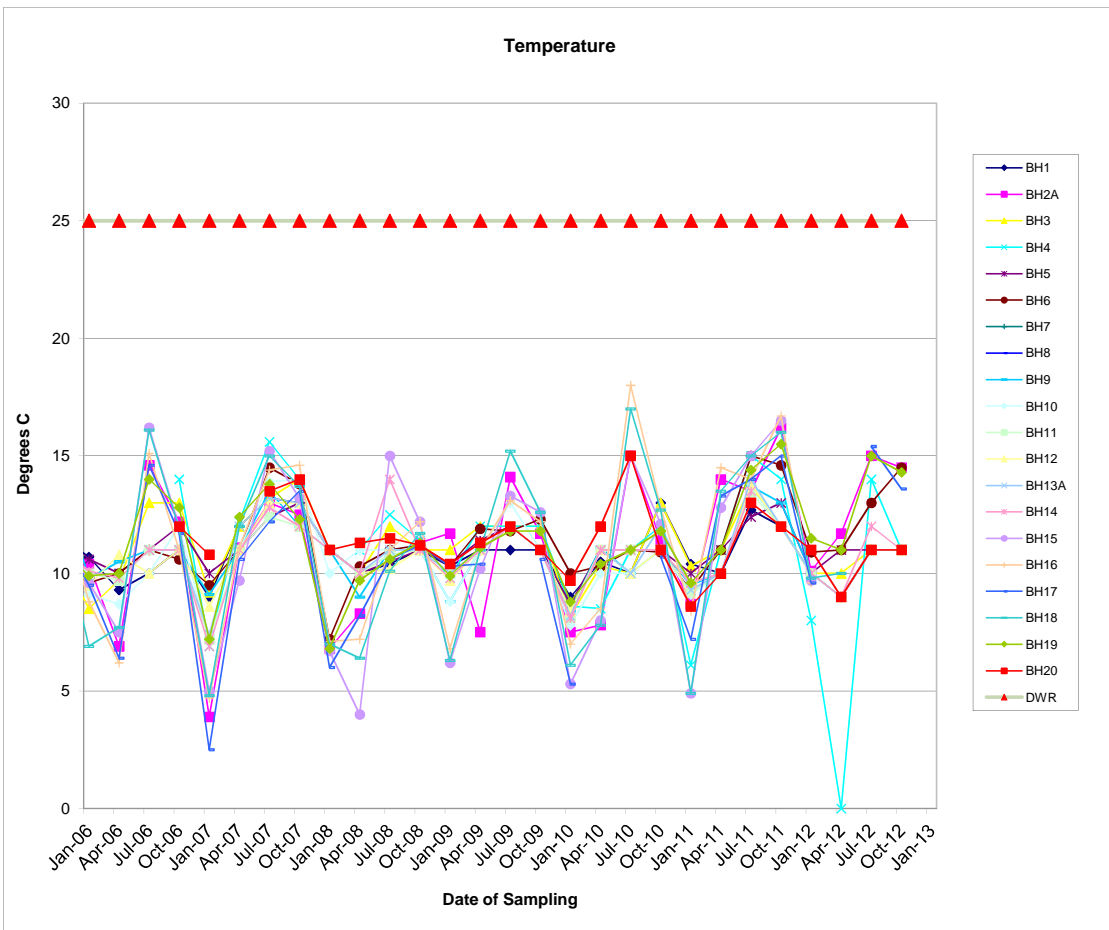
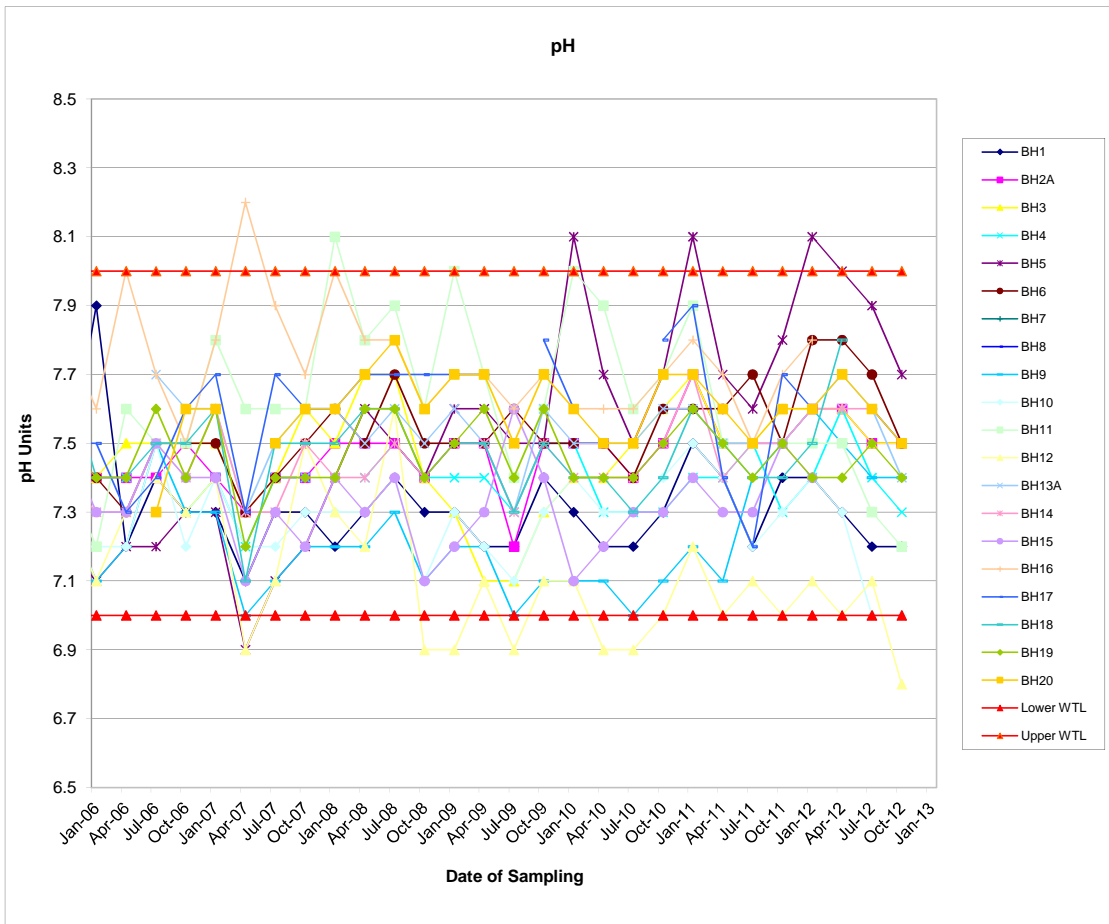
	Whiteriver Landfill Site																			
	GROUNDWATER QUALITY																			
PARAMETERS	RESULTS																			
Monitoring Point:	BH10																			
	DOWNSTREAM OVERBURDEN																			
	Units	Trigger Level	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date
Alkalinity	mg/CaCO3	NAC	07-Oct-08	13-Jan-09	21-Apr-09	14-Jul-09	06-Oct-09	21-Jan-10	14-Apr-10	06-Jul-10	11-Oct-10	18-Jan-11	05-Apr-11	19-Jul-11	11-Oct-11	10-Jan-12	25-Apr-12	18-Jul-12	10-Oct-12	
Aluminium	µg/l				294				284				308				270			
Ammonia	mg/l N	0.2	0.05	<0.03	0.06	0.06	0.06	0.04	<0.03	<0.03	<0.03	<0.03	0.03	0.16	<0.03	0.04	0.05	0.03	0.61	
Antimony	µg/l																<0.5			
Arsenic	µg/l																<0.5			
Barium	µg/l																209.3			
Beryllium	µg/l																<0.5			
B.O.D.	mg/l O2				<50															
Boron	µg/l	1000							<10				11.2				<10			
Cadmium	µg/l	5			<0.1				0.1				<0.1				<0.1			
Calcium	mg/l Ca	200			132.91				114.18				112.14				102.54			
C.O.D.	mg/l O2											3.0								
Chloride	mg/l Cl	20	21	23	24	18	21	16	17	22	27	27	35	25	24	25	18	21	23	
Chromium	µg/l	30			6.9				5.4				1.9				<0.5			
Cobalt	µg/l																<0.5			
Coliform Bacteria	no/100ml		2420	579	52															
Conductivity	µS/cm @ 25	800	686	767	772	768	716	614	637	667	604	640	682	683	776	686	606	850	825	
Copper	µg/l	30			5.3				9				1.4				1.6			
Cyanide	µg/l	0.01			<0.05				<0.05				<0.05				<0.05			
D.O.	% Saturation		51	22	67	44	54	61	45	nm	53	74	66	51	70	63	67	67	47	
E_Coli	no/100ml		26	3	<10															
Fluoride	mg/l	1			<0.150				<0.150				<0.150				<0.150			
Iron	µg/l				1576.6				4062.2				1001.3				<10			
Lead	µg/l	10			4.8				10.1				1.3				<0.5			
Magnesium	mg/l Mg	50			13.19				12.43				13.17				7.91			
Manganese	µg/l				735.7				686.1				673.5				12.1			
Mercury	µg/l	1			<0.1				<0.1				<0.05				<0.05			
Molybdenum (µg/l)																	<0.5			
Nickel	µg/l	20			6.7				10.9				0.8				<0.5			
Ortho-Phosphate	mg/l P	0.03			<0.02				<0.02				<0.02				<0.02			
pH		>7 or <8	7.1	7.3	7.2	7.1	7.3	7.4	7.3	7.3	7.4	7.5	7.4	7.2	7.3	7.4	7.3	7.0	7.0	
Potassium	mg/l	5			1.25				1.26				1.22				1.08			
Residue on evaporation	mg/l				765				941				15250				741			
Sampling Depth	m		2	1.8	2.3	1.8	3.6	1.7	2.9	3.3	4		4.1	4.5	4	3.8	3.7	3.6	4.6	
Selenium	µg/l																<0.5			
Silver	µg/l																<0.5			
Sodium	mg/l	150			15.97				11.59				12.91				8.53			
Strontium	µg/l																159.170			
Sulphate	mg/l	50			92				60.6				36.7				31.5			
Suspended Solids	mg/l																			
Temp	°C		11	8.8	11	13	11	7.8	10	10	11	9.1	10	13.6	12	10	9.0	11.0	11.0	
Thallium	µg/l																<0.1			
Time			12:35	11:3	11:55		11:55	10:3	12:15	10:5	0:45:1389	10:30	10:40	10:05	10:35	10:40	10:15	10:20	10:35	
Tin	µg/l																2.63			
T.O.C.	mg/l	10	16.4	3.7	4.7	7.3	3.6	6.6	3.7	1.8	5.1	9.3	14.6	3.2	6.6	12.2	70.0	2.7	21.3	
T.O.N	mg/l N				0.46				0.13				0.18				1.40			
Total Suspended Solids	mg/l																			
Uranium	µg/l																0.70			
Vanadium	µg/l																<0.5			
Zinc	µg/l	100			11.6				19.3				3.5				1.9			
Water Level m OD	105.6		103.6	103.8	103.3	103.8	102	103.9	102.7	102.3	101.6	105.6	101.5	101.1	101.6	101.8	101.9	102		

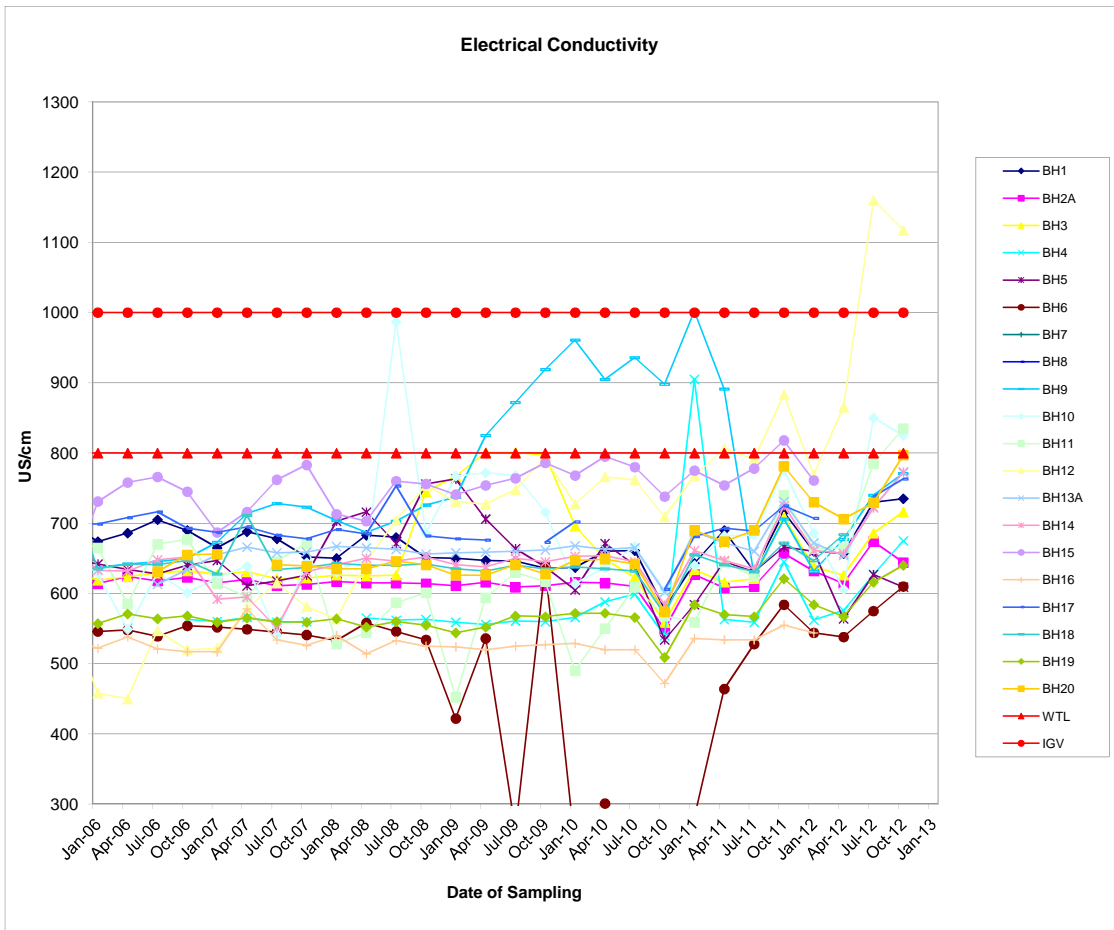
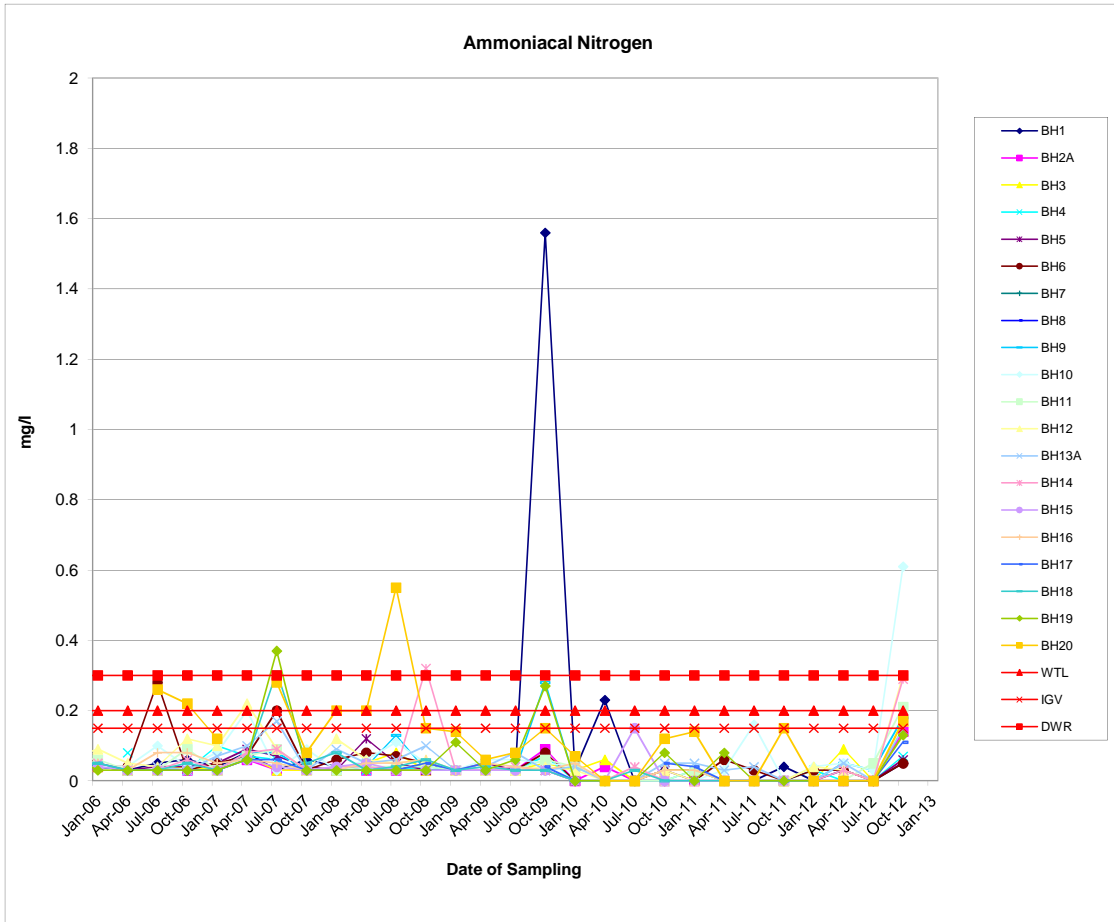
Whiteriver Landfill Site																				
GROUNDWATER QUALITY																				
RESULTS																				
BH11																				
DOWNSTREAM OVERBURDEN																				
	Trigger Level	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date
PARAMETERS	Units	07-Oct-08	13-Jan-09	21-Apr-09	14-Jul-09	06-Oct-09	21-Jan-10	14-Apr-10	06-Jul-10	11-Oct-10	18-Jan-11	05-Apr-11	19-Jul-11	11-Oct-11	10-Jan-12	25-Apr-12	18-Jul-12	10-Oct-12		
Alkalinity	mg/CaCO3	NAC		280				236				296				328				
Aluminium	µg/l															<5				
Ammonia	mg/l N	0.2	0.04	<0.03	<0.03	<0.03	0.04	0.04	<0.03	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	0.05	0.21		
Antimony	µg/l															<0.5				
Arsenic	µg/l															<0.5				
Barium	µg/l															141.7				
Beryllium	µg/l															<0.5				
B.O.D.	mg/l O2			<50																
Boron	µg/l	1000						10.1				28.8				25.2				
Cadmium	µg/l	5		<0.1				<0.1				0.2			<0.1					
Calcium	mg/l Ca	200		67.21				37.04				75.87			78.74					
C.O.D.	mg/l O2										9.4									
Chloride	mg/l Cl	20	9	10	9	9	10	7	10	10	9	4	14	13	16	15	15	16	15	
Chromium	µg/l	30			2.1				<1			0.5				<0.5				
Cobalt	µg/l															<0.5				
Coliform Bacteria	no/100ml		1414	51	7															
Conductivity	µS/cm @ 25	800	601	452	594	630	617	490	550	609	568	559	644	624	740	664	665	785	835	
Copper	µg/l	30			1.9				1.8			1.2				<0.5				
Cyanide	µg/l	0.01			<0.05				<0.05			<0.05				<0.05				
D.O.	% Saturation		97	54	81	69	83	89	75	nm	80	97	33	27	29	47	35	28	54	
E. Coli	no/100ml		8	0	0															
Fluoride	mg/l	1			<0.150				0.17			<0.150				<0.150				
Iron	µg/l				119.4				147.8			801.8				<10				
Lead	µg/l	10			<1				<1			1.1				<0.5				
Magnesium	mg/l Mg	50			14.13				11.16			22.98				20.87				
Manganese	µg/l				108.7				212.9			154.1				19.7				
Mercury	µg/l	1			<0.1				<0.1			<0.05				<0.05				
Molybdenum (µg/l)																0.8				
Nickel	µg/l	20			1.1				1.3			<0.5				<0.5				
Ortho-Phosphate	mg/l P	0.03			<0.02				<0.02			<0.02				<0.02				
pH		>7 or <8	7.6	8	7.7	7.4	7.6	8	7.9	7.6	7.7	7.9	7.5	7.5	7.5	7.5	7.5	7.3	7.2	
Potassium	mg/l	5			1.25				1.4			1.39				1.35				
Residue on evaporation	mg/l				376				380			464				426				
Sampling Depth	m		9.2	9.3	9.4	9.2	9.1	9.1	9.3	9.3	9.3	9.2	9.2	9.4	9.7	9.1	9.3	9.4		
Selenium	µg/l															<0.5				
Silver	µg/l															<0.5				
Sodium	mg/l	150			46.71				72.3			32.36				24.50				
Strontium	µg/l															204.500				
Sulphate	µg/l	50			25.4				42.1			15.7				11.2				
Suspended Solids	mg/l																			
Temp	°C		11	10	11	12	11	8.1	11	11	11	9.2	10	13.4	12	10	9.0	11.0	11.0	
Thallium	µg/l															<0.1				
Time			11.55	11.1	11.25		11.1	11.1	11.45	10.4	11:00	11:00	10:55	10:15	10:25	10:55	10:30	10:35	10:40	
Tin	µg/l															<1				
T.O.C.	mg/l	10	25.2	2.3	2.9	4.5	3.2	6.3	3	1.7	2.4	6.3	1.8	2.9	7.6	1.9	83.6	1.5	2.8	
T.O.N	mg/l N				0.29				0.21			0.75				0.64				
Total Suspended Solids	mg/l																			
Uranium	µg/l															2.52				
Vanadium	µg/l															<0.5				
Zinc	µg/l	100			4.5				14.2			23.7				2.5				
Water Level m OD	95.66		86.46	86.36	86.26	86.46	86.56	86.56	86.36	86.36	86.36	95.66	86.46	86.46	86.26	85.96	86.56	86.36	86.26	

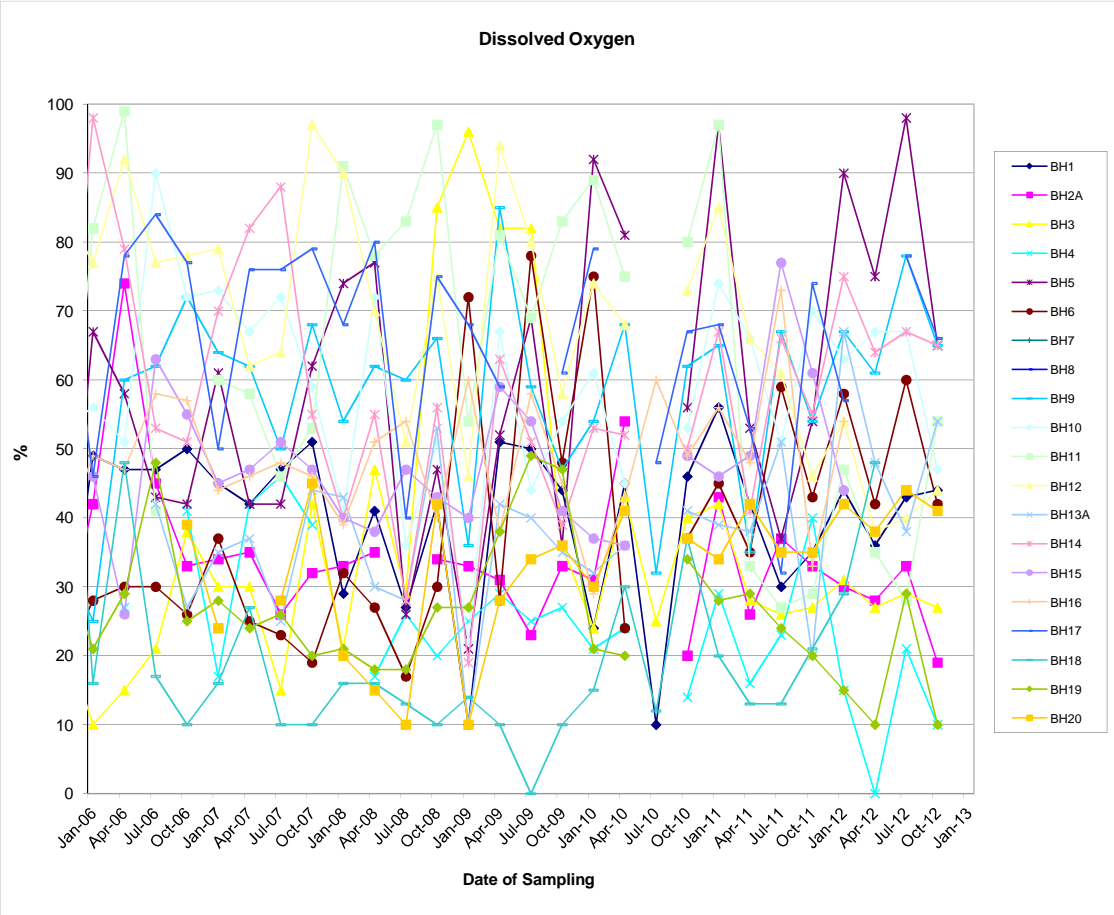
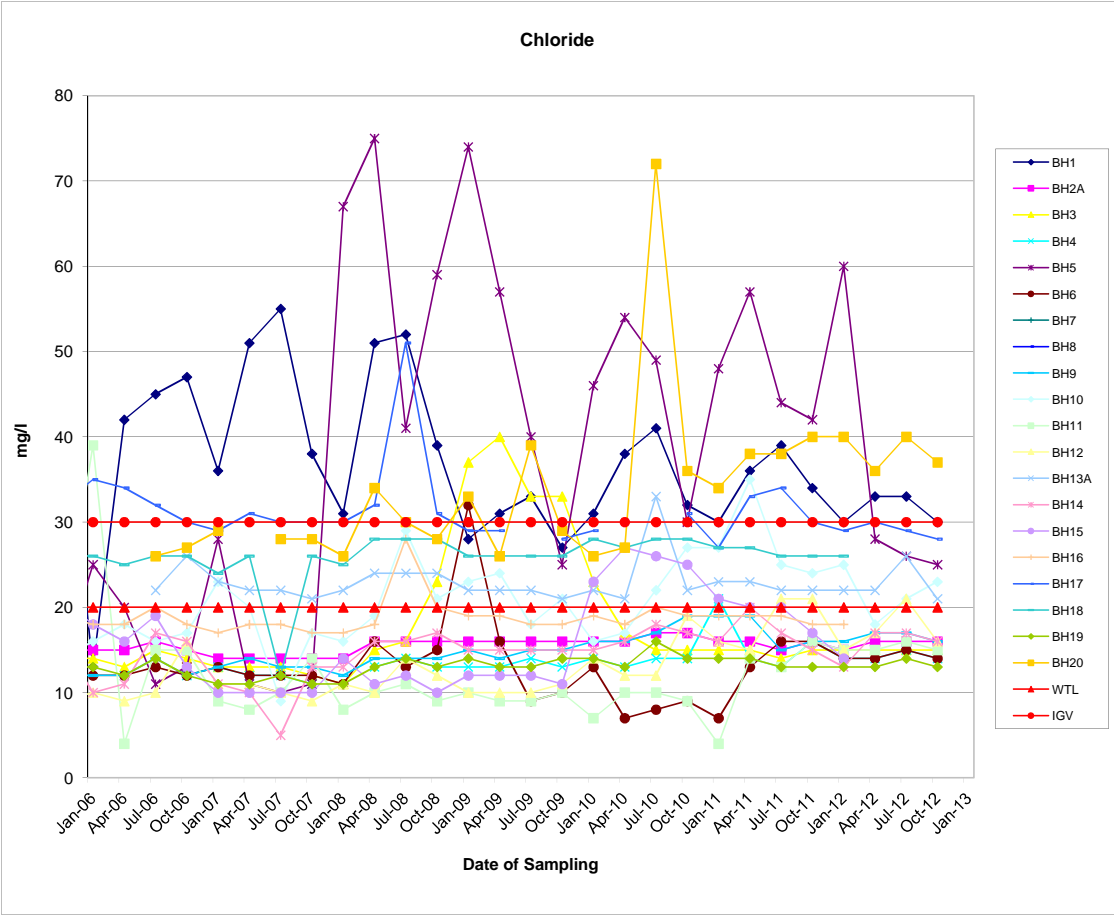
	Whiteriver Landfill Site																		
	GROUNDWATER QUALITY RESULTS																		
PARAMETERS	BH12																		
Monitoring Point:	DOWNSTREAM OVERBURDEN																		
	Trigger Level	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date
	Units	07-Oct-08	13-Jan-09	21-Apr-09	14-Jul-09	06-Oct-09	21-Jan-10	14-Apr-10	06-Jul-10	11-Oct-10	18-Jan-11	05-Apr-11	19-Jul-11	11-Oct-11	10-Jan-12	25-Apr-12	18-Jul-12	10-Oct-12	
Alkalinity	mg/ICaCO3	NAC		348				396				324				408			
Aluminium	µg/l															<5			
Ammonia	mg/l N	0.2	0.06	<0.03	0.03	<0.03	<0.03	0.03	<0.03	<0.03	0.03	<0.03	<0.03	<0.03	0.04	0.03	<0.03	0.30	
Antimony	µg/l															<0.5			
Arsenic	µg/l															0.52			
Barium	µg/l															242.0			
Beryllium	µg/l															<0.5			
B.O.D.	mg/l O2			<50															
Boron	µg/l	1000						<10				10.9				10.1			
Cadmium	µg/l	5		0.3				0.2				0.4				<0.1			
Calcium	mg/l Ca	200		135.76				143.83				141.79				139.21			
C.O.D.	mg/l O2										5.7								
Chloride	mg/l Cl	20	12	10	10	10	11	14	12	12	19	16	15	21	21	15	17	21	16
Chromium	µg/l	30			5.5				1.1				1.9				<0.5		
Cobalt	µg/l																<0.5		
Coliform Bacteria	no/100ml		>12100	>2420	135									nm					
Conductivity	µS/cm @ 25	800	754	731	727	748	793	727	766	762	709	768	806	792	883	769	865	1160	1117
Copper	µg/l	30			5.5				2.6				1.9				2.2		
Cyanide		0.01			<0.05				<0.05				<0.05				<0.05		
D.O.	% Saturation		75	46	94	80	58	74	68	nm	73	85	66	61	46	54	38	40	44
E. Coli	no/100ml		131	0	<10									nm					
Fluoride	mg/l	1			<0.150				<0.150				<0.150				<0.150		
Iron	µg/l				912.8				565.4				878.5				<10		
Lead	µg/l	10			1.6				<1				<0.5				<0.5		
Magnesium	mg/l Mg	50			11.74				12.99				14.32				16.44		
Manganese	µg/l				773.5				606.6				3463.8				3.1		
Mercury	µg/l	1			<0.1				<0.1				<0.05				<0.05		
Molybdenum (µg/l)																	<0.5		
Nickel	µg/l	20			6.2				2.9				3.6				1.0		
Ortho-Phosphate	mg/l P	0.03			<0.02				<0.02				<0.02				<0.02		
pH		>7 or <8	6.9	6.9	7.1	6.9	7.1	7.1	6.9	6.9	7	7.2	7	7.1	7	7.1	7.0	7.1	6.8
Potassium	mg/l	5			<1				<1				0.74				1.06		
Residue on evaporation	mg/l				655				519				1005				1081		
Sampling Depth	m		5.5	5.6	5.7	5.4	5.5	5.5	5.6	5.7	5.7		5.7	5.8	5.6	5.7	5.1	5.3	6.3
Selenium	µg/l																<0.5		
Silver	µg/l																nm		
Sodium	mg/l	150			6.92				7.01				9.04				10.39		
Strontium	µg/l																247.230		
Sulphate		50			31.3				34				44.8				55.6		
Suspended Solids	mg/l																		
Temp	°C		11	9.7	11	12	11	8.4	11	10	11	9.6	10	13.8	12	10	9.0	11.0	11.0
Thallium	µg/l																<0.1		
Time			11.2	10.4	10.5		10.35	11.4	10	12.25	11:45	11.30	11:15	10:35	10:50	11:10	10:55	10:50	10:55
Tin	µg/l																<1		
T.O.C.	mg/l	10	49.3	6.8	6.3	8.3	5.6	7.8	4.3	3.7	6.9	8.3	18.1	4.9	7.3	10.4	109.0	4.5	6.0
T.O.N	mg/l N				0.13				<0.08				<0.08				1.25		
Total Suspended Solids	mg/l																		
Uranium	µg/l																1.25		
Vanadium	µg/l																<0.5		
Zinc	µg/l	100			19.9				18.1				31.2				5.2		
Water Level m OD		103.38	97.88	97.78	97.68	97.98	97.88	97.88	97.78	97.68	97.68	103.38	97.68	97.58	97.78	97.68	98.28	98.08	97.08

	Whiteriver Landfill Site																			
	GROUNDWATER QUALITY																			
PARAMETERS	RESULTS																			
Monitoring Point:	BH13A																			
	DOWNSTREAM BEDROCK																			
	Units	Trigger Level	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date
Alkalinity	mg/CaCO3	NAC	07-Oct-08	13-Jan-09	21-Apr-09	14-Jul-09	06-Oct-09	21-Jan-10	14-Apr-10	06-Jul-10	11-Oct-10	18-Jan-11	05-Apr-11	19-Jul-11	10-Oct-11	10-Jan-12	25-Apr-12	18-Jul-12	10-Oct-12	
Aluminium	µg/l				332				344				264				320			
Ammonia	mg/l N	0.2	0.1	0.03	0.04	0.08	0.03	0.04	<0.03	0.04	0.05	0.05	0.03	0.04		<0.03	0.05	<0.03	0.15	
Antimony	µg/l																<0.5			
Arsenic	µg/l																<0.5			
Barium	µg/l																48.9			
Beryllium	µg/l																<0.5			
B.O.D.	mg/l O2				<50															
Boron	µg/l	1000							20.7				19.8				19.5			
Cadmium	µg/l	5			<0.1				<0.1				<0.1				<0.1			
Calcium	mg/l Ca	200			79.9				76.87				75.45				77.57			
C.O.D.	mg/l O2											25.6								
Chloride	mg/l Cl	20	24	22	22	22	21	22	21	33	22	23	23	22		22	22	26	21	
Chromium	µg/l	30			2.6				<1				1				<0.5			
Cobalt	µg/l																<0.5			
Coliform Bacteria	no/100ml		170	54	5															
Conductivity	µS/cm @ 25	800	656	658	659	660	662	668	663	665	602	688	672	660		672	654	723	772	
Copper	µg/l	30			2				1				1.9				0.5			
Cyanide	µg/l	0.01			<0.05				<0.05				<0.05				<0.05			
D.O.	% Saturation		53	<10	42	40	35	32	36	nm	41	39	38	51		67	48	38	54	
E_Coli	no/100ml		7	0	0															
Fluoride	mg/l	1			<0.150				<0.150				<0.150				<0.150			
Iron	µg/l				156.6				230.4				691.2				<10			
Lead	µg/l	10			<1				<1				0.6				<0.5			
Magnesium	mg/l Mg	50			23.96				25.53				25.36				26.14			
Manganese	µg/l				264.5				330.4				235.5				225.4			
Mercury	µg/l	1			<0.1				<0.1				<0.05				<0.05			
Molybdenum (µg/l)																	1.2			
Nickel	µg/l	20			<1				<1				<0.5				<0.5			
Ortho-Phosphate	mg/l P	0.03			0.1				0.09				0.08				0.11			
pH		>7 or <8	7.5	7.6	7.5	7.3	7.6	7.5	7.5	7.5	7.6	7.6	7.5	7.5		7.6	7.7	7.6	7.4	
Potassium	mg/l	5			1.33				1.38				1.3				1.49			
Residue on evaporation	mg/l				409				421				524				414			
Sampling Depth	m		25.4	25.4	25.5	25.5	25.4	25.4	25.4	25.5	25.4		25.6	25.7		25.6	25.4	25.5	25.2	
Selenium	µg/l																<0.5			
Silver	µg/l																nm			
Sodium	mg/l	150			27.71				26.21				25.36				26.08			
Strontium	µg/l																241.300			
Sulphate	mg/l	50			11.6				13				14				10.7			
Suspended Solids	mg/l																			
Temp	°C		11	10	11	12	11	8.2	11	10	12	9.3	10	14		10	9.0	11.0	11.0	
Thallium	µg/l																<0.1			
Time			12:25	11:2	11:45		11:35	10:45	12	10:55		10:10	10:35	10:00		10:30	10:20	10:15	10:25	
Tin	µg/l																<1			
T.O.C.	mg/l	10	31.1	<1.5	1.8	<3.0	<3.0	3.3	<1.5	2.6	<1.5	2.7	<1.5	1.6		<1.5	78.6	<1.5	<1.5	
T.O.N	mg/l N				<0.08				<0.08				<0.08				<0.08			
Total Suspended Solids	mg/l																			
Uranium	µg/l																5.26			
Vanadium	µg/l																<0.5			
Zinc	µg/l	100			10.8				12.3				5.1				2.1			
Water Level m OD	106.01		80.61	80.61	80.51	80.51	80.61	80.61	80.61	80.51	80.61	106.01	80.41	80.31	106.01	80.41	80.61	80.51	80.81	

		Whiteriver Landfill Site																		
		GROUNDWATER QUALITY																		
PARAMETERS		RESULTS																		
Monitoring Point:		BH14																		
		DOWNSTREAM BEDROCK																		
	Units	Trigger Level	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date
Alkalinity	mg/lCaCO3	NAC	07-Oct-08	13-Jan-09	21-Apr-09	14-Jul-09	06-Oct-09	21-Jan-10	14-Apr-10	06-Jul-10	11-Oct-10	18-Jan-11	05-Apr-11	19-Jul-11	11-Oct-11	10-Jan-12	25-Apr-12	18-Jul-12	10-Oct-12	
Aluminium	µg/l				324				356				352				332			
Ammonia	mg/l N	0.2	0.32	<0.03	<0.03	0.04	<0.03	<0.03	<0.03	0.15	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.03	<0.03	0.29	
Antimony	µg/l																<0.5			
Arsenic	µg/l																<0.5			
Barium	µg/l																145.4			
Beryllium	µg/l																<0.5			
B.O.D.	mg/l O2				<50															
Boron	µg/l	1000							30.7				29.7				36.6			
Cadmium	µg/l	5			<0.1				<0.1				<0.1				<0.1			
Calcium	mg/l Ca	200			84.86				85.1				81.99				86.84			
C.O.D.	mg/l O2											19.0								
Chloride	mg/l Cl	20	17	15	15	15	15	15	16	18	17	16	20	17	15	13	17	17	16	
Chromium	µg/l	30			5				<1				2.7				<0.5			
Cobalt	µg/l																<0.5			
Coliform Bacteria	no/100ml		60	56	173															
Conductivity	µS/cm @ 25	800	652	641	638	650	645	653	654	645	584	661	647	635	725	661	657	722	773	
Copper	µg/l	30			1.2				<1				1.9				1.0			
Cyanide	µg/l	0.01			<0.05				<0.05				<0.05				<0.05			
D.O.	% Saturation		56	19	63	51	39	53	52	nm	50	67	41	66	55	75	64	67	65	
E Coli	no/100ml		2	0	<10															
Fluoride	mg/l	1			<0.150				<0.150				<0.150				<0.150			
Iron	µg/l				74.9				<10				2070.3				<10			
Lead	µg/l	10			<1				<1				1.5				<0.5			
Magnesium	mg/l Mg	50			21.33				24.12				26				20.71			
Manganese	µg/l				326.6				324.7				111.3				2.3			
Mercury	µg/l	1			<0.1				<0.1				<0.05				<0.05			
Molybdenum (µg/l)																	1.8			
Nickel	µg/l	20			<1				<1				1.6				<0.5			
Ortho-Phosphate	mg/l P	0.03			<0.02				<0.02				<0.02				0.02			
pH		>7 or <8	7.4	7.5	7.5	7.3	7.5	7.4	7.4	7.4	7.5	7.7	7.4	7.5	7.5	7.6	7.6	7.6	7.5	
Potassium	mg/l	5			1.2				1.34				1.53				1.62			
Residue on evaporation	mg/l				396				388				565				494			
Sampling Depth	m		18.8	18.7	18.9	18.9	18.8	18.7	18.8	18.8	18.8		19	19.1	19.2	19.2	18.8	18.9	18.7	
Selenium	µg/l																<0.5			
Silver	µg/l																nm			
Sodium	mg/l	150			23.15				24.79				22.69				26.84			
Strontium	µg/l																226.930			
Sulphate		50			8.4				9.9				8.6				11.3			
Suspended Solids	mg/l																			
Temp	°C		11	9.8	11	12	11	8.1	11	11	11	9.6	10	13.5	nm	10	9.0	12.0	11.0	
Thallium	µg/l																<0.1			
Time			12.1	10.55	11.1		11.2	10.55	11.2	10.35	11:15	10.45	10:50	10:20	10:20	10:45	10:35	10:30	10:50	
Tin	µg/l																<1			
T.O.C.	mg/l	10	27.1	2.1	1.6	3.4	<3.0	1.6	<1.5	<1.5	<1.5	4.6	<1.5	2.3	3.6	2.2	82.0	<1.5	2.0	
T.O.N	mg/l N				0.2				0.13				<0.08				0.16			
Total Suspended Solids	mg/l																			
Uranium	µg/l																5.67			
Vanadium	µg/l																<0.5			
Zinc	µg/l	100			4.9				5.3				4.8				2.6			
Water Level m OD	98.98		80.18	80.28	80.08	80.08	80.18	80.28	80.18	80.18	80.18	98.98	79.98	79.88	79.78	79.78	80.18	80.08	80.28	







APPENDIX H

SURFACE WATER MONITORING RESULTS




Whiteriver Landfill Site

SURFACE WATER QUALITY

RESULTS

PARAMETERS	Units	SW1																							
		Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date		
Monitoring Point:																									
Alkalinity	mg/l CaCO3	328			280			304																	
Aluminium	µg/l																				15.2				
Ammonia	mg/l N	8.29	3.55	0.56	1.37	0.68	0.75	0.56	1.04	0.57	0.58	0.43		0.03	1.33	6.33		0.48	1.84	0.32	1.24	2.69			
Antimony	µg/l																				<0.5				
Arsenic	µg/l																				1.48				
Barium	µg/l																				105.8				
Beryllium	µg/l																				<0.5				
B.O.D.	mg/l O2	23.8		4.5	5.4	174.9	7.4	<50	50.2	24.7	4.3	2.8					31.5			13.1	174.7	4.9	15.5	9.5	
Boron	µg/l	<50			<50			6.2					14.3				12.3			28.1			20.1		
Cadmium	µg/l	<0.10			<0.10			<0.1					<0.1				<0.1						<0.1		
Calcium	mg/l Ca	89.84			98			108.98					104.52				100.79	4.0	108.39			91.46			
C.O.D.	mg/l O2	90	220	42	35	801	30	37	288	98	40	18					162			78	266	46	155	60	
Chloride	mg/l Cl	41	28	28	32	40	25	32	36	54	29	31					33	30	60	40	36	28	23	27	
Chromium	µg/l	<1			<1			1.7									<0.5			0.8			<0.5		
Cobalt	µg/l																						<0.5		
Coliform Bacteria	no/100ml																								
Conductivity	µS/cm @ 25	824	652	498	659	444	574	692	604	954	522	677					657	640	879		632	675	604	582	745
Copper	µg/l	5.1			2.2			3									<0.5		5.3				2.1		
Cyanide	mg/l																								
D.O.	% Saturation	81	45	80	60	72	88	84		69	60	89	86				36	94	58		78	51	77	43	75
E. Coli	no/100ml																								
Fluoride	mg/l																								
Iron	µg/l	935.9			418.4			586.5					372.8				<10		962.8				98.0		
Lead	µg/l	14.6			<1			1.6					<1				<0.5		1.5				<0.5		
Magnesium	mg/l Mg	10.16			11.69			11.69					13				9.76		17.87				10.17		
Manganese	µg/l	332.7			124.8			96					126.1				2.1		644.8				108.8		
Mercury	µg/l	<0.10			<0.10			<0.1					<0.1				<0.05		<0.05				<0.05		
Molybdenum (µg/l)	µg/l																								
Nickel	µg/l	7.9			2			3.2					1.4				<0.5		2.1				1.5		
Ortho-Phosphate	mg/l P	0.63			0.4			0.47					0.26				<0.02		1.45				0.14		
pH		7.8	7.6	7.8	7.8	7.3	7.8	8		7.4	7.8	7.8	8.1				7.3	7.9	7.9		7.6	7.4	8.2	7.6	7.9
Potassium	mg/l	19.99			10.97			12.71					7.92				0.46		51.45				8.15		
Residue on evaporation																									
Sampling Depth	m																								
Selenium	µg/l																								
Silver	µg/l																								
Sodium	mg/l	21.89			17.92			16.98					15.56										15.26		
Strontium	µg/l																						151.610		
Sulphate	mg/l SO4	52.2			28.1			19.5					17.5										22.9		
Suspended Solids	mg/l							12																	
Temp	°C	11.4	16.8	6.5	6	11.9	5	10.3		14.1	13.2	5.6	7				9.0	4.1	12.8		16.7	9.6	9.9	15.8	14.2
Thallium	µg/l																								
Time		12.1	12.35	12.35	12.15	13	12.55	13.1					14.3	12.45	12.15						10:00	13:05	10:00	10:15	10:45
Tin	µg/l																								
T.O.C.	mg/l							11.6																	
T.O.N	mg/l N	0.9			1.93			2.15					1.2						0.17				1.77		
Total Suspended Solids	mg/l	37	51	8	21	1410		26		363	61	11	9								30	11	66	54	93
Uranium	µg/l																							0.55	
Vanadium	µg/l																							0.51	
Zinc	µg/l	6.7			<1			9.1					5.9				6.1		18.1				2.5		

Dry

	Whiteriver Landfill Site																					
	SURFACE WATER QUALITY																					
PARAMETERS	RESULTS																					
Monitoring Point:	SW2A																					
	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date
	Units	03-Jul-07	15-Jan-08	08-Apr-08	07-Oct-08	13-Jan-09	21-Apr-09	14-Jul-09	06-Oct-09	21-Jan-10	14-Apr-10	06-Jul-10	11-Oct-10	18-Jan-11	05-Apr-11	19-Jul-11	11-Oct-11	10-Jan-12	25-Apr-12	18-Jul-12	10-Oct-12	
Alkalinity	mg/l CaCO3	0.39		280			280				224		290		300				220			
Aluminium	µg/l												<5									
Ammonia	mg/l N		0.23	0.08	0.12	0.6	<0.03	0.16	0.09	0.09	0.16		0.03	1.23	1.31		0.1	0.03	0.05	5.84	0.16	
Antimony	µg/l												<0.5									
Arsenic	µg/l												<0.5									
Barium	µg/l												153.6						86.2			
Beryllium	µg/l												<0.5									
B.O.D.	mg/l O2		<2	1.7	8.5	2.7	<50	2.2	1.6	2.1	1.6				7.6		5.3	22.6	3.3	6.7	2.1	
Boron	µg/l			<50			2.4				19		12.3		26.2				19.7			
Cadmium	µg/l			<0.10			<0.1				<0.1		<0.1		<0.1				<0.1			
Calcium	mg/l Ca	52		95.9			95.36				96.78		100.79	2.4	105.18				90.03			
C.O.D.	mg/l O2	19	21	19	49	17	<10	31	10	22	17						36	59	23	68	24	
Chloride	mg/l Cl		40	44	51	53	40	52	36	53	65		33	70	120		48	47	37	35	31	
Chromium	µg/l			<1			<1				<1		<0.5		1.1				<0.5			
Cobalt	µg/l												<0.5									
Coliform Bacteria	mg/l																					
Conductivity	µS/cm @ 25	440	530	662	602	685	662	651	632	636	689		657	762	953		615	664	626	676	705	
Copper	µg/l			12.3			2.8				2.5		<0.5		4.2				2			
Cyanide	mg/l												<0.05									
D.O.	% Saturation	79	69	86	82	90	105	87	87	95	124		36	96	96		93	67	88	85	66	
E. Coli	no/100ml																					
Fluoride	mg/l												<0.150									
Iron	µg/l			307.9			239.4				213		<10		858.1				58.9			
Lead	µg/l			<1			<1				<1		<0.5		1.8				<0.5			
Magnesium	mg/l Mg			12.38			13.8				13.04		9.76		14.13				10.73			
Manganese	µg/l			128.4			124.7				126.9		2.1		266.7				134.2			
Nickel	µg/l			<0.10			<0.1				<0.1		<0.05		<0.05				<0.05			
Molybdenum (µg/l)													<0.5									
Mercury	µg/l			2.2			2.8				1.5		<0.5		1.8				1.6			
Ortho-Phosphate	mg/l P			0.1			0.05				0.06		<0.02		0.34				0.04			
pH		7.8	7.7	8.1	7.7	8	8	7.7	8.2	8	8.6		7.3	8.0	8.1		8.1	7.8	8.3	7.7	7.7	
Potassium	mg/l			5.8			3.99				5.22		0.46		22.4				5.04			
Sodium	mg/l												366									
Sampling Depth	mg/l												6.9									
Selenium	µg/l												<0.5									
Silver	µg/l												<0.5									
Residue on evaporation				30.33			24.81				26.26		16.54		56.89				20.34			
Strontium	µg/l												144.190									
Suspended Solids	mg/l			38.4			56.3				39		18.2		47.2				55			
Sulphate	mg/l SO4					<5																
Temp	°C	16.9	6.4	6.8	12.2	5.2	11.9	16.5	13.3	5.6	8.5		9.0	4.1	14.9		16.6	9.5	10.4	16.1	13.5	
Thallium	µg/l												<0.1									
Time		12.5	12	12.3	12.2	12.15	12.2		13.25	11.55	12.3		11:35	13:15	12:35		12:15	11:45	11:05	11:45	11:35	
Tin	µg/l												2.80									
Total coliforms	no/100ml												70.3									
T.O.N	mg/l N			1.53			0.75				1.13		1.06		1.61				1.42			
Total Suspended Solids	mg/l	20	16	15	55		8	20	36	12	8			6	7		40	10	19	10	7	
Uranium	µg/l												0.64									
Vanadium	µg/l												<0.5									
Zinc	µg/l			<1			4.2				3.4		6.1		9.2				2.4			

Dry



Whiteriver Landfill Site

SURFACE WATER QUALITY

RESULTS

Monitoring Point:	Units	SW3																					
		Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date	Date
Alkalinity	mg/l CaCO3	03-Jul-07	15-Jan-08	08-Apr-08	07-Oct-08	13-Jan-09	21-Apr-09	14-Jul-09	06-Oct-09	21-Jan-10	14-Apr-10	06-Jul-10	11-Oct-10	18-Jan-11	05-Apr-11	19-Jul-11	11-Oct-11	10-Jan-12	25-Apr-12	18-Jul-12	10-Oct-12		
Aluminium	µg/l										148		290						135				
Ammonia	mg/l N							0.56	0.72	0.12	0.44		0.03	5.38			0.04	<0.03	0.04	0.55	0.13		
Antimony	µg/l												<0.5										
Arsenic	µg/l												<0.5										
Barium	µg/l												153.6						66.1				
Beryllium	µg/l												<0.5										
B.O.D.	mg/l O2							<2.0	<1.5	4.6	<1.5						<1.5	<1.5	3.7	3.8	<1.5		
Boron	µg/l												12.3						30.3				
Cadmium	µg/l											<0.1	<0.1						<0.1				
Calcium	mg/l Ca										72.78		100.79	5.5					69.86				
C.O.D.	mg/l O2							32	<10	38	<10						13	14	25	32	12		
Chloride	mg/l Cl							22	28	30	20		33	46			18	21	22	27	19		
Chromium	µg/l										<1		<0.5						<0.5				
Cobalt	µg/l												<0.5										
Coliform Bacteria	mg/l																						
Conductivity	µS/cm @ 25							550	547	598	524		657	815			599	506	515	518	601		
Copper	µg/l										2.4		<0.5						2.3				
Cyanide	mg/l												<0.05										
D.O.	% Saturation							85	67	87	98		36	89			nm	86	77	112	62		
E. Coli	no/100ml																						
Fluoride	mg/l												<0.150										
Iron	µg/l										48.4		<10						20				
Lead	µg/l										<1		<0.5						<0.5				
Magnesium	mg/l Mg										9.76		9.76						9.01				
Manganese	µg/l										45.7		2.1						68.7				
Nickel	µg/l										<0.1		<0.05						<0.05				
Molybdenum (µg/l)													<0.5										
Mercury	µg/l										3.2		<0.5						2				
Ortho-Phosphate	mg/l P										<0.02		<0.02						<0.02				
pH								7.8	8	7.9	7.9		7.3	7.9			7.8	8	8.2	8.2	8.2		
Potassium	mg/l										2.55		0.46						3.23				
Sodium	mg/l												366										
Sampling Depth	mg/l												6.9										
Selenium	µg/l												<0.5										
Silver	µg/l												<0.5										
Residue on evaporation											16.95		16.54						18.75				
Strontium	µg/l												144.190										
Suspended Solids	mg/l											94.2		18.2					103.8				
Sulphate	mg/l SO4																						
Temp	°C							17.6	13	5.5	8.3		9.0	6.8			14	7	10	17.0	11.0		
Thallium	µg/l												<0.1										
Time										13.3	13.2	14.2		11:35	14:20			13:25	12:30	11:15	11:00	11:10	
Tin	µg/l												2.80										
Total coliforms	no/100ml												70.3										
T.O.N	mg/l N										0.58		1.06						0.14				
Total Suspended Solids	mg/l							14	<5	42	<5			15			<5	8	5	<5	<5		
Uranium	µg/l												0.64										
Vanadium	µg/l												<0.5										
Zinc	µg/l										2.4		6.1						2.3				

Dry

APPENDIX I

GAS MONITORING RESULTS

Device ID	Date/Time (UK)	CH4	CO2	O2
PZ1 WHIT	27/01/2012 14:32	0	0	20.6
PZ2 WHIT	27/01/2012 14:43	0	1.4	19.1
PZ3 WHIT	27/01/2012 14:44	0	0.7	20.3
PZ4 WHIT	27/01/2012 14:45	0	0.9	20.1
PZ5 WHIT	27/01/2012 14:46	0	1.9	19.6
PZ54 WHI	27/01/2012 14:47	0	1	20
PZ53 WHI	27/01/2012 14:49	0	1.2	19.5
PZ52 WHI	27/01/2012 14:50	0	1.3	19.5
PZ51 WHI	27/01/2012 14:52	0	0.3	20.2
PZ50 WHI	27/01/2012 14:54	0	0.8	19.7
PZ49 WHI	27/01/2012 14:55	0	3.4	17.7
PZ48 WHI	27/01/2012 14:56	0	2.6	18.7
PZ47 WHI	27/01/2012 14:58	0	2.7	18.2
PZ46 WHI	27/01/2012 14:59	0	4.6	17.2
PZ45 WHI	27/01/2012 15:00	0	0.6	19.9
PZ44 WHI	27/01/2012 15:01	0	0.6	19.9
PZ43 WHI	27/01/2012 15:02	0	0.9	19.8
PZ43 WHI	27/01/2012 15:03	0	0.9	19.6
PZ42 WHI	27/01/2012 15:03	0	0.6	19.8
PZ41 WHI	27/01/2012 15:05	0	0.8	19.6
PZ40 WHI	27/01/2012 15:26	0	0.4	19.8
PZ39 WHI	27/01/2012 15:29	0	0.8	19.5
PZ38 WHI	27/01/2012 15:31	0	0.6	19.7
PZ37 WHI	27/01/2012 15:39	0	0.3	19.9
PZ36 WHI	27/01/2012 15:40	0	1.5	18.5
PZ35 WHI	27/01/2012 15:42	0	0.5	19.8
PZ34 WHI	27/01/2012 15:44	0	2.2	18.4
PZ33 WHI	27/01/2012 15:46	0	3.1	16.5
PZ32 WHI	27/01/2012 15:47	0	1.3	19.1
PZ31 WHI	27/01/2012 15:48	0	2.4	18.4
PZ30 WHI	27/01/2012 15:49	0	2.6	18.3
PZ29 WHI	27/01/2012 15:50	0	1.4	19.1
PZ28 WHI	27/01/2012 15:50	0	2.1	18
PZ26 WHI	27/01/2012 15:51	0	0	20.5
PZ25 WHI	27/01/2012 15:52	0	0	20.5
PZ24 WHI	27/01/2012 15:53	0	0	20.6
PZ23 WHI	27/01/2012 15:54	0	0	20.6
PZ22 WHI	27/01/2012 15:55	0	0	20.6
PZ21 WHI	27/01/2012 15:56	0	0	20.6
PZ11 WHI	27/01/2012 15:57	0	0	20.6
PZ12 WHI	27/01/2012 15:58	0	0	20.7
PZ13 WHI	27/01/2012 15:59	0	0	20.7
PZ14 WHI	27/01/2012 15:59	0	0	20.7
PZ15 WHI	27/01/2012 16:00	0	0	20.7
PZ16 WHI	27/01/2012 16:02	0	0	20.7

Device ID	Date/Time (UK)	CH4	CO2	O2
PZ1 WHIT	03/02/2011 14:06	0	0	21
PZ2 WHIT	03/02/2011 13:07	0	0.4	20.8
PZ3 WHIT	03/02/2011 13:08	0	1.8	19.5
PZ4 WHIT	03/02/2011 13:09	0	0.5	20.8
PZ5 WHIT	03/02/2011 13:10	0	3.5	17.1
PZ54 WHI	03/02/2011 13:12	0	0.3	20.8
PZ53 WHI	03/02/2011 13:13	0	0.9	18.9
PZ52 WHI	03/02/2011 13:14	0	0.7	20.4
PZ51 WHI	03/02/2011 13:16	0	0	21
PZ50 WHI	03/02/2011 13:17	0	1.3	20.2
PZ49 WHI	03/02/2011 13:19	0	1.2	19.4
PZ48 WHI	03/02/2011 13:20	0	1.3	19.9
PZ47 WHI	03/02/2011 13:21	0	1.4	20.3
PZ46 WHI	03/02/2011 13:23	0	4.6	17.4
PZ45 WHI	03/02/2011 13:24	0	1	19.8
PZ44 WHI	03/02/2011 13:25	0	0.2	20.8
PZ43 WHI	03/02/2011 13:26	0	0.8	20.4
PZ42 WHI	03/02/2011 13:28	0	0.6	20.5
PZ41 WHI	03/02/2011 13:29	0	1	20
PZ40 WHI	03/02/2011 13:31	0	0.1	20.9
PZ39 WHI	03/02/2011 13:32	0	0.4	20.8
PZ38 WHI	03/02/2011 13:34	0	0.2	20.8
PZ37 WHI	03/02/2011 13:35	0	0.1	21
PZ36 WHI	03/02/2011 13:36	0	0.5	20.4
PZ35 WHI	03/02/2011 13:38	0	0.2	20.9
PZ34 WHI	03/02/2011 13:39	0	2	15.8
PZ33 WHI	03/02/2011 13:41	0	0.2	20.3
PZ32 WHI	03/02/2011 13:42	0	1.4	20.2
PZ31 WHI	03/02/2011 13:44	0	0.5	20.6
PZ30 WHI	03/02/2011 13:45	0	0.6	20.7
PZ29 WHI	03/02/2011 13:47	0	0.3	20.8
PZ28 WHI	03/02/2011 13:48	0	4.4	18
PZ26 WHI	03/02/2011 13:50	0	0	21
PZ25 WHI	03/02/2011 13:51	0	0.1	21
PZ24 WHI	03/02/2011 13:52	0	0.1	20.9
PZ23 WHI	03/02/2011 13:54	0	0.4	20.7
PZ22 WHI	03/02/2011 13:55	0	1.7	18.2
PZ21 WHI	03/02/2011 13:57	0	0	20.9
PZ11 WHI	03/02/2011 13:58	0	0	21
PZ12 WHI	03/02/2011 13:59	0	0	21
PZ13 WHI	03/02/2011 14:00	0	0	21
PZ14 WHI	03/02/2011 14:01	0	0	21
PZ15 WHI	03/02/2011 14:02	0	0	21
PZ16 WHI	03/02/2011 14:03	0	0	21

Device ID	Date/Time (UK)	CH4	CO2	O2
PZ1 WHIT	09/03/2012 15:59	0	0	21.1
PZ2 WHIT	09/03/2012 15:11	0	0.6	20.3
PZ2 WHIT	09/03/2012 15:11	0	0.6	20.2
PZ3 WHIT	09/03/2012 15:12	0	2.4	18
PZ4 WHIT	09/03/2012 15:13	0	1.2	19.6
PZ5 WHIT	09/03/2012 15:14	0	4.4	15
PZ54 WHI	09/03/2012 15:15	0	0.3	20.4
PZ53 WHI	09/03/2012 15:16	0	0.5	20.1
PZ52 WHI	09/03/2012 15:17	0	1	19.3
PZ51 WHI	09/03/2012 15:18	0	0.4	20.3
PZ50 WHI	09/03/2012 15:20	0	2.7	18.1
PZ49 WHI	09/03/2012 15:21	0	2	18
PZ48 WHI	09/03/2012 15:22	0	4.2	17.4
PZ47 WHI	09/03/2012 15:23	0	1.5	19.6
PZ46 WHI	09/03/2012 15:24	0	5.7	12.4
PZ45 WHI	09/03/2012 15:25	0	0.8	19.8
PZ44 WHI	09/03/2012 15:26	0	0.3	20.5
PZ43 WHI	09/03/2012 15:27	0	0.6	20.2
PZ42 WHI	09/03/2012 15:28	0	0	20.7
PZ41 WHI	09/03/2012 15:29	0	1.4	19.3
PZ40 WHI	09/03/2012 15:31	0	0.6	20.1
PZ39 WHI	09/03/2012 15:32	0	0	20.9
PZ38 WHI	09/03/2012 15:33	0	0.2	20.7
PZ37 WHI	09/03/2012 15:34	0	0.1	20.8
PZ36 WHI	09/03/2012 15:35	0	1.3	19.4
PZ35 WHI	09/03/2012 15:36	0	0.5	20.3
PZ34 WHI	09/03/2012 15:37	0	0.8	20.3
PZ33 WHI	09/03/2012 15:39	0	0.9	19.5
PZ32 WHI	09/03/2012 15:40	0	2.3	19
PZ31 WHI	09/03/2012 15:41	0	2	19.1
PZ30 WHI	09/03/2012 15:42	0	1	19.4
PZ29 WHI	09/03/2012 15:44	0	0.5	20.3
PZ28 WHI	09/03/2012 15:48	0	5.2	15.9
PZ26 WHI	09/03/2012 15:50	0.2	1.1	17.5
PZ25 WHI	09/03/2012 15:51	0	0.1	21
PZ24 WHI	09/03/2012 15:51	0	0	21.2
PZ23 WHI	09/03/2012 15:52	0	0	21.1
PZ22 WHI	09/03/2012 15:53	0	0	21
PZ21 WHI	09/03/2012 15:54	0	0	21
PZ11 WHI	09/03/2012 15:54	0	0	21.1
PZ12 WHI	09/03/2012 15:55	0	0	21.1
PZ13 WHI	09/03/2012 15:56	0	0	21.1
PZ14 WHI	09/03/2012 15:56	0	0	21.1
PZ15 WHI	09/03/2012 15:57	0	0	21.1
PZ16 WHI	09/03/2012 15:58	0	0	21.1

ID	DATE	CH4 %	CO2 %	O2 %	BALANCE %
PZ1 WHIT	13/04/2012 12:57	0	0	0	21.4 78.6
PZ2 WHIT	13/04/2012 12:09	0	0	0	21 79
PZ3 WHIT	13/04/2012 12:09	0	0	0	21 79
PZ4 WHIT	13/04/2012 12:11	0	1.2	0	20.2 78.6
PZ5 WHIT	13/04/2012 12:12	0	2.9	0	19 78.1
PZ54 WHI	13/04/2012 12:13	0	0.6	0	20.4 79
PZ53 WHI	13/04/2012 12:14	0	1.1	0	19.6 79.3
PZ52 WHI	13/04/2012 12:15	0	0.8	0	20.2 79
PZ51 WHI	13/04/2012 12:17	0	0.6	0	20.4 79
PZ50 WHI	13/04/2012 12:18	0	2.3	0	19.1 78.6
PZ49 WHI	13/04/2012 12:19	0	3.8	0	18.8 77.4
PZ48 WHI	13/04/2012 12:20	0	4.3	0	17.5 78.2
PZ47 WHI	13/04/2012 12:22	0	2.8	0	17.8 79.4
PZ46 WHI	13/04/2012 12:23	0	9	0	9.4 81.6
PZ45 WHI	13/04/2012 12:24	0	0.8	0	19.5 79.7
PZ44 WHI	13/04/2012 12:25	0	0.3	0	20.4 79.3
PZ43 WHI	13/04/2012 12:27	0	0.8	0	19.9 79.3
PZ42 WHI	13/04/2012 12:28	0	1.2	0	20 78.8
PZ41 WHI	13/04/2012 12:29	0	1.2	0	19.7 79.1
PZ40 WHI	13/04/2012 12:31	0	0.9	0	19.8 79.3
PZ39 WHI	13/04/2012 12:32	0	2	0	19.3 78.7
PZ38 WHI	13/04/2012 12:33	0	0.4	0	20.2 79.4
PZ37 WHI	13/04/2012 12:34	0	0.4	0	20.5 79.1
PZ36 WHI	13/04/2012 12:36	0	1.3	0	19.8 78.9
PZ35 WHI	13/04/2012 12:39	0	0.6	0	20.3 79.1
PZ34 WHI	13/04/2012 12:40	0	2.4	0	15.7 81.9
PZ33 WHI	13/04/2012 12:41	0	1.5	0	17.8 80.7
PZ32 WHI	13/04/2012 12:42	0	2	0	19.2 78.8
PZ31 WHI	13/04/2012 12:43	0	0.8	0	20.3 78.9
PZ30 WHI	13/04/2012 12:44	0	1.9	0	16.1 82
PZ29 WHI	13/04/2012 12:46	0	0.9	0	20.3 78.8
PZ28 WHI	13/04/2012 12:47	0	4.5	0	18.2 77.3
PZ26 WHI	13/04/2012 12:49	0	1	0	20.2 78.8
PZ25 WHI	13/04/2012 12:49	0	0.4	0	20.2 79.4
PZ24 WHI	13/04/2012 12:50	0	0.1	0	21.1 78.8
PZ23 WHI	13/04/2012 12:51	0	0	0	21.1 78.9
PZ21 WHI	13/04/2012 12:52	0	0.2	0	20.8 79
PZ11 WHI	13/04/2012 12:53	0	0	0	21.2 78.8
PZ12 WHI	13/04/2012 12:54	0	0	0	21.2 78.8
PZ13 WHI	13/04/2012 12:54	0	0	0	21.2 78.8
PZ14 WHI	13/04/2012 12:55	0	0	0	21.3 78.7
PZ15 WHI	13/04/2012 12:56	0	0	0	21.3 78.7
PZ16 WHI	13/04/2012 12:57	0	0	0	21.3 78.7

MAY						
ID	DATE	CH4	CO2	O2	BALANCE	
		%	%	%	%	
PZ2 WHIT	29/05/2012 10:54		0	2.2	19	78.8
PZ3 WHIT	29/05/2012 10:55		0	2.4	18.6	79
PZ4 WHIT	29/05/2012 10:56		0	1.5	20.1	78.4
PZ5 WHIT	29/05/2012 10:57		0	3	18.4	78.6
PZ54 WHI	29/05/2012 10:59	0.1	1.4		20	78.5
PZ53 WHI	29/05/2012 11:00		0	1	19.5	79.5
PZ52 WHI	29/05/2012 11:01		0	1.6	19.8	78.6
PZ51 WHI	29/05/2012 11:05		0	0.7	20.2	79.1
PZ50 WHI	29/05/2012 11:07		0	2.9	18.4	78.7
PZ49 WHI	29/05/2012 11:08		0	4.1	18.6	77.3
PZ48 WHI	29/05/2012 11:09		0	6.3	14.4	79.3
PZ47 WHI	29/05/2012 11:10	0.1	6.1		16.7	77.1
PZ46 WHI	29/05/2012 11:11	0.1	11.1		8.5	80.3
PZ45 WHI	29/05/2012 11:12	0.1	0.4		20.1	79.4
PZ44 WHI	29/05/2012 11:13	0.1	1		19.9	79
PZ43 WHI	29/05/2012 11:15	0.1	0.3		20.2	79.4
PZ42 WHI	29/05/2012 11:16	0	1.5		19.7	78.8
PZ41 WHI	29/05/2012 11:17	0.1	2		19.2	78.7
PZ40 WHI	29/05/2012 11:18	0.1	1.5		19.4	79
PZ39 WHI	29/05/2012 11:19	0	0.9		19.5	79.6
PZ38 WHI	29/05/2012 11:20	0.1	0.9		19.4	79.6
PZ37 WHI	29/05/2012 11:21	0	0.1		20.3	79.6
PZ36 WHI	29/05/2012 11:22	0.1	2		19.1	78.8
PZ35 WHI	29/05/2012 11:23	0	0.9		19.8	79.3
PZ34 WHI	29/05/2012 11:24	0.1	1.4		18.7	79.8
PZ33 WHI	29/05/2012 11:25	0.1	1.7		17.9	80.3
PZ32 WHI	29/05/2012 11:27	0	2.9		17.9	79.2
PZ31 WHI	29/05/2012 11:28	0	1.4		19.6	79
PZ30 WHI	29/05/2012 11:29	0.1	1.9		18.7	79.3
PZ29 WHI	29/05/2012 11:31	0	1.2		19.6	79.2
PZ28 WHI	29/05/2012 11:32	0	5.9		16.1	78
PZ26 WHI	29/05/2012 11:34	0	1.6		19.2	79.2
PZ25 WHI	29/05/2012 11:35	0.1	0.1		20.6	79.2
PZ24 WHI	29/05/2012 11:36	0	0		20.8	79.2
PZ23 WHI	29/05/2012 11:37	0	0		20.8	79.2
PZ22 WHI	29/05/2012 11:38	0	0		20.9	79.1
PZ21 WHI	29/05/2012 11:39	0	0.2		20.7	79.1
PZ11 WHI	29/05/2012 11:40	0	0		21	79
PZ12 WHI	29/05/2012 11:40	0	0		20.8	79.2
PZ13 WHI	29/05/2012 11:41	0	0		20.9	79.1
PZ14 WHI	29/05/2012 11:41	0	0		21	79
PZ15 WHI	29/05/2012 11:42	0	0		20.8	79.2
PZ16 WHI	29/05/2012 11:43	0.1	0		21.2	78.7

Jun-12

ID	DATE	CH4 %	CO2 %	O2 %	
PZ1 WHIT	11/06/2012 11:11	0	0	20.3	
PZ2 WHIT	11/06/2012 11:12	0	1.5	19	
PZ3 WHIT	11/06/2012 11:14	0	3	15.8	
PZ4 WHIT	11/06/2012 11:15	0	2	18.6	
PZ5 WHIT	11/06/2012 11:16	0	3.8	15.9	
PZ54 WHI	11/06/2012 11:19	0	1	19.1	
PZ53 WHI	11/06/2012 11:20	0	0.5	20	
PZ52 WHI	11/06/2012 11:21	0	0.7	19.8	
PZ51 WHI	11/06/2012 11:23	0	0.8	19.8	
PZ50 WHI	11/06/2012 11:25	0	0.1	20.2	
PZ49 WHI	11/06/2012 11:26	0	6.5	13.1	
PZ48 WHI	11/06/2012 11:28	0	4.4	15.5	
PZ47 WHI	11/06/2012 11:30	0	2.4	18.6	
PZ46 WHI	11/06/2012 11:31	0	6.7	13.6	
PZ45 WHI	11/06/2012 11:32	0	0.6	19.6	
PZ44 WHI	11/06/2012 11:34	0	0.1	20.2	
PZ43 WHI	11/06/2012 11:35	0	0.4	20	
PZ42 WHI	11/06/2012 11:36	0	0.3	20.1	
PZ41 WHI	11/06/2012 11:38	0	1.1	18.9	
PZ40 WHI	11/06/2012 11:39	0	1.6	19.1	
PZ39 WHI	11/06/2012 11:41	0	3	18.9	
PZ38 WHI	11/06/2012 11:42	0	0.3	20.2	
PZ37 WHI	11/06/2012 11:44	0	0.1	20.3	
PZ36 WHI	11/06/2012 11:47	0	0.6	19.8	
PZ35 WHI	11/06/2012 11:48	0	0.3	20.2	
PZ34 WHI	11/06/2012 11:54	0	1.3	18.4	
PZ33 WHI	11/06/2012 11:54	0	1.3	18.3	
PZ33 WHI	11/06/2012 11:55	0	0.9	18.7	
PZ32 WHI	11/06/2012 11:56	0	3.5	18.2	
PZ31 WHI	11/06/2012 11:57	0	2.7	17.8	
PZ30 WHI	11/06/2012 11:59	0	1.7	19	
PZ29 WHI	11/06/2012 12:01	0	1.3	19.3	
PZ28 WHI	11/06/2012 12:03	0	6.8	9.7	
PZ27 WHI	11/06/2012 12:07	0	0.6	20.3	
PZ26 WHI	11/06/2012 12:07	0	0.6	20.3	
PZ25 WHI	11/06/2012 12:09	0	0	20.6	
PZ24 WHI	11/06/2012 12:10	0	0	20.6	
PZ23 WHI	11/06/2012 12:11	0	1	19.6	
PZ22 WHI	11/06/2012 12:16	0	0	20.4	
PZ21 WHI	11/06/2012 12:19	0	0.2	20.4	
PZ11 WHI	11/06/2012 12:21	0	0	20.6	
PZ12 WHI	11/06/2012 12:23	0	0	20.6	
PZ13 WHI	11/06/2012 12:25	0	0	20.6	
PZ14 WHI	11/06/2012 12:27	0	0	20.6	
PZ15 WHI	11/06/2012 12:29	0	0	20.7	

Pz number	Date	CH4	CO2	O2
PZ1 WHIT	27/07/2012 00:00	0	0.1	23.2
PZ2 WHIT	27/07/2012 00:00	0	0.6	19.4
PZ3 WHIT	27/07/2012 00:00	0	1.2	19.2
PZ4 WHIT	27/07/2012 00:00	0	1.8	20.1
PZ5 WHIT	27/07/2012 00:00	0	0.2	19.8
PZ54 WHI	27/07/2012 00:00	0	0.6	19.5
PZ53 WHI	27/07/2012 00:00	0	0.9	19.2
PZ52 WHI	27/07/2012 00:00	0	0.2	20.1
PZ51 WHI	27/07/2012 00:00	0	0.3	20
PZ50 WHI	27/07/2012 00:00	0	0.3	20
PZ49 WHI	27/07/2012 00:00	0	1	19.7
PZ48 WHI	27/07/2012 00:00	0	0.2	20.1
PZ47 WHI	27/07/2012 00:00	0	0.6	199.3
PZ46 WHI	27/07/2012 00:00	0	3.7	17.4
PZ45 WHI	27/07/2012 00:00	0	1.3	18.4
PZ44 WHI	27/07/2012 00:00	0	0.2	20.2
PZ43 WHI	27/07/2012 00:00	0	1.3	19.6
PZ42 WHI	27/07/2012 00:00	0	1.1	19.8
PZ42 WHI	27/07/2012 00:00	0	0.2	19.7
PZ41 WHI	27/07/2012 00:00	0	0.5	19.6
PZ40 WHI	27/07/2012 00:00	0	0.1	20
PZ39 WHI	27/07/2012 00:00	0	0.4	19.9
PZ38 WHI	27/07/2012 00:00	0	0.1	20.1
PZ37 WHI	27/07/2012 00:00	0	0.1	20.2
PZ36 WHI	27/07/2012 00:00	0	0.5	19.4
PZ35 WHI	27/07/2012 00:00	0	0.2	20
PZ34 WHI	27/07/2012 00:00	0	1.1	19
PZ33 WHI	27/07/2012 00:00	0	0.2	19.9
PZ33 WHI	27/07/2012 00:00	0	1.3	19.2
PZ32 WHI	27/07/2012 00:00	0	0.5	19.8
PZ31 WHI	27/07/2012 00:00	0	1.4	18.8
PZ30 WHI	27/07/2012 00:00	0	1.5	18
PZ29 WHI	27/07/2012 00:00	0	0.2	20
PZ28 WHI	27/07/2012 00:00	0	2.3	18.2
PZ27 WHI	27/07/2012 00:00	0	0.1	20.1
PZ25 WHI	27/07/2012 00:00	0	0.1	20.2
PZ24 WHI	27/07/2012 00:00	0	0.2	19.9
PZ23 WHI	27/07/2012 00:00	0	0.5	19.7
PZ22 WHI	27/07/2012 00:00	0	1.4	19.1
PZ21 WHI	27/07/2012 00:00	0	0.1	20.1
PZ11 WHI	27/07/2012 00:00	0	0.1	20.2
PZ12 WHI	27/07/2012 00:00	0	0.1	20.2
PZ13 WHI	27/07/2012 00:00	0	0	20.2
PZ14 WHI	27/07/2012 00:00	0	0.1	20.2
PZ15 WHI	27/07/2012 00:00	0	0.1	20.2
PZ16 WHI	27/07/2012 00:00	0	0.1	20.2

Device ID	Empty	Date/Time (UK)	CH4	CO2	O2	Peak CH4
PZ1 WHIT		06/08/2012 00:00	0	0	21	0
PZ2 WHIT		06/08/2012 00:00	0	0.3	20.8	0
PZ3 WHIT		06/08/2012 00:00	0	1.7	19.8	0
PZ4 WHIT		06/08/2012 00:00	0	0.4	20.8	0
PZ5 WHIT		06/08/2012 00:00	0	2.6	18.8	0
PZ54 WHI		06/08/2012 00:00	0	0	20.8	0
PZ53 WHI		06/08/2012 00:00	0	1.1	19	0
PZ52 WHI		06/08/2012 00:00	0	0.5	20.3	0
PZ51 WHI		06/08/2012 00:00	0	0.1	20.8	0
PZ50 WHI		06/08/2012 00:00	0	0.8	20.2	0
PZ49 WHI		06/08/2012 00:00	0	1.1	19.6	0
PZ48 WHI		06/08/2012 00:00	0	1.3	20	0
PZ47 WHI		06/08/2012 00:00	0	1.2	19.9	0
PZ46 WHI		06/08/2012 00:00	0	3.9	17.6	0
PZ45 WHI		06/08/2012 00:00	0	1	20	0
PZ44 WHI		06/08/2012 00:00	0	0	20.6	0
PZ43 WHI		06/08/2012 00:00	0	0.7	20.2	0
PZ42 WHI		06/08/2012 00:00	0	0.6	20.5	0
PZ42 WHI		06/08/2012 00:00	0	0.6	20.2	0
PZ41 WHI		06/08/2012 00:00	0	0.9	19.9	0
PZ40 WHI		06/08/2012 00:00	0	0.1	20.9	0
PZ39 WHI		06/08/2012 00:00	0	0.3	20.6	0
PZ38 WHI		06/08/2012 00:00	0	0.3	20.6	0
PZ37 WHI		06/08/2012 00:00	0	0.1	20.9	0
PZ36 WHI		06/08/2012 00:00	0	0.5	20.5	0
PZ35 WHI		06/08/2012 00:00	0	0.3	20.8	0
PZ34 WHI		06/08/2012 00:00	0	2.1	17.6	0
PZ33 WHI		06/08/2012 00:00	0	0.2	20.3	0
PZ32 WHI		06/08/2012 00:00	0	1.2	20.4	0
PZ31 WHI		06/08/2012 00:00	0	0.5	20.5	0
PZ30 WHI		06/08/2012 00:00	0	0.2	20.3	0
PZ29 WHI		06/08/2012 00:00	0	0.3	20.8	0
PZ28 WHI		06/08/2012 00:00	0	3.9	18.4	0
PZ26 WHI		06/08/2012 00:00	0	0	21	0
PZ25 WHI		06/08/2012 00:00	0	0	20.9	0
PZ24 WHI		06/08/2012 00:00	0	0	21	0
PZ23 WHI		06/08/2012 00:00	0	0	20.8	0
PZ22 WHI		06/08/2012 00:00	0	1.5	18.7	0
PZ21 WHI		06/08/2012 00:00	0	0	20.9	0
PZ11 WHI		06/08/2012 00:00	0	0	21	0
PZ12 WHI		06/08/2012 00:00	0	0	21	0
PZ13 WHI		06/08/2012 00:00	0	0	21	0
PZ14 WHI		06/08/2012 00:00	0	0	21	0
PZ15 WHI		06/08/2012 00:00	0	0	21	0
PZ16 WHI		06/08/2012 00:00	0	0	21	0

Device ID	Empty	Date/Time (UK)	CH4	CO2	O2	Peak CH4
PZ1	WHIT	06/09/2012 00:00	0	0	21	0
PZ2	WHIT	06/09/2012 00:00	0	0.3	20.8	0
PZ3	WHIT	06/09/2012 00:00	0	1.4	19.8	0
PZ4	WHIT	06/09/2012 00:00	0	0.4	20.8	0
PZ5	WHIT	06/09/2012 00:00	0	2.9	18.8	0
PZ54	WHI	06/09/2012 00:00	0	0.2	20.8	0
PZ53	WHI	06/09/2012 00:00	0	1.2	19	0
PZ52	WHI	06/09/2012 00:00	0	0.5	20.3	0
PZ51	WHI	06/09/2012 00:00	0	0.1	20.8	0
PZ50	WHI	06/09/2012 00:00	0	0.8	20.2	0
PZ49	WHI	06/09/2012 00:00	0	1.1	19.6	0
PZ48	WHI	06/09/2012 00:00	0	1.3	20	0
PZ47	WHI	06/09/2012 00:00	0	1.2	19.9	0
PZ46	WHI	06/09/2012 00:00	0	5.1	17.6	0
PZ45	WHI	06/09/2012 00:00	0	1	20	0
PZ44	WHI	06/09/2012 00:00	0	0.3	20.6	0
PZ43	WHI	06/09/2012 00:00	0	0.7	20.2	0
PZ42	WHI	06/09/2012 00:00	0	0.6	20.5	0
PZ42	WHI	06/09/2012 00:00	0	0.6	20.2	0
PZ41	WHI	06/09/2012 00:00	0	0.9	19.9	0
PZ40	WHI	06/09/2012 00:00	0	0	20.9	0
PZ39	WHI	06/09/2012 00:00	0	0.3	20.6	0
PZ38	WHI	06/09/2012 00:00	0	0.3	20.6	0
PZ37	WHI	06/09/2012 00:00	0	0	20.9	0
PZ36	WHI	06/09/2012 00:00	0	0.5	20.5	0
PZ35	WHI	06/09/2012 00:00	0	0.3	20.8	0
PZ34	WHI	06/09/2012 00:00	0	1.5	17.6	0
PZ33	WHI	06/09/2012 00:00	0	0.4	20.3	0
PZ32	WHI	06/09/2012 00:00	0	1.2	20.4	0
PZ31	WHI	06/09/2012 00:00	0	0.5	20.5	0
PZ30	WHI	06/09/2012 00:00	0	0.6	20.3	0
PZ29	WHI	06/09/2012 00:00	0	0.3	20.8	0
PZ28	WHI	06/09/2012 00:00	0	3.9	18.4	0
PZ26	WHI	06/09/2012 00:00	0	0	21	0
PZ25	WHI	06/09/2012 00:00	0	0	20.9	0
PZ24	WHI	06/09/2012 00:00	0	0	21	0
PZ23	WHI	06/09/2012 00:00	0	0	20.8	0
PZ22	WHI	06/09/2012 00:00	0	1.5	18.7	0
PZ21	WHI	06/09/2012 00:00	0	0	20.9	0
PZ11	WHI	06/09/2012 00:00	0	0	21	0
PZ12	WHI	06/09/2012 00:00	0	0	21	0
PZ13	WHI	06/09/2012 00:00	0	0	21	0
PZ14	WHI	06/09/2012 00:00	0	0	21	0
PZ15	WHI	06/09/2012 00:00	0	0	21	0
PZ16	WHI	06/09/2012 00:00	0	0	21	0

Device ID	Empty	Date/Time (UK)	CH4	CO2	O2	Peak CH4
PZ1	WHIT	16/10/2012 00:00	0	0	20.9	0
PZ2	WHIT	16/10/2012 00:00	0	0	20.8	0
PZ3	WHIT	16/10/2012 00:00	0	1.1	20.1	0
PZ4	WHIT	16/10/2012 00:00	0	0.4	20.8	0
PZ5	WHIT	16/10/2012 00:00	0	2.2	19.3	0
PZ54	WHI	16/10/2012 00:00	0	0.2	20.8	0
PZ53	WHI	16/10/2012 00:00	0	1	19.2	0
PZ52	WHI	16/10/2012 00:00	0	0.6	20.2	0
PZ51	WHI	16/10/2012 00:00	0	0	20.9	0
PZ50	WHI	16/10/2012 00:00	0	0.8	20.2	0
PZ49	WHI	16/10/2012 00:00	0	1.3	19.4	0
PZ48	WHI	16/10/2012 00:00	0	0.9	20.4	0
PZ47	WHI	16/10/2012 00:00	0	1.2	20	0
PZ46	WHI	16/10/2012 00:00	0	5.1	17.7	0
PZ45	WHI	16/10/2012 00:00	0	0.8	19.9	0
PZ44	WHI	16/10/2012 00:00	0	0	20.9	0
PZ43	WHI	16/10/2012 00:00	0	0.8	19.9	0
PZ42	WHI	16/10/2012 00:00	0	0.6	20.5	0
PZ42	WHI	16/10/2012 00:00	0	0.6	20.3	0
PZ41	WHI	16/10/2012 00:00	0	1	20	0
PZ40	WHI	16/10/2012 00:00	0	0	20.9	0
PZ39	WHI	16/10/2012 00:00	0	0.2	20.5	0
PZ38	WHI	16/10/2012 00:00	0	0.3	20.5	0
PZ37	WHI	16/10/2012 00:00	0	0	20.9	0
PZ36	WHI	16/10/2012 00:00	0	0.4	20.6	0
PZ35	WHI	16/10/2012 00:00	0	0.3	20.7	0
PZ34	WHI	16/10/2012 00:00	0	1.6	17.7	0
PZ33	WHI	16/10/2012 00:00	0	0.3	20.2	0
PZ32	WHI	16/10/2012 00:00	0	1.1	20.4	0
PZ31	WHI	16/10/2012 00:00	0	0.5	20.4	0
PZ30	WHI	16/10/2012 00:00	0	0.5	20.2	0
PZ29	WHI	16/10/2012 00:00	0	0.2	20.8	0
PZ28	WHI	16/10/2012 00:00	0	3.7	18.5	0
PZ26	WHI	16/10/2012 00:00	0	0	20.9	0
PZ25	WHI	16/10/2012 00:00	0	0	20.9	0
PZ24	WHI	16/10/2012 00:00	0	0	20.9	0
PZ23	WHI	16/10/2012 00:00	0	0	20.9	0
PZ22	WHI	16/10/2012 00:00	0	1.3	19	0
PZ21	WHI	16/10/2012 00:00	0	0	20.9	0
PZ11	WHI	16/10/2012 00:00	0	0	20.9	0
PZ12	WHI	16/10/2012 00:00	0	0	21	0
PZ13	WHI	16/10/2012 00:00	0	0	20.9	0
PZ14	WHI	16/10/2012 00:00	0	0	21	0
PZ15	WHI	16/10/2012 00:00	0	0	21	0
PZ16	WHI	16/10/2012 00:00	0	0	21	0

Device ID	Empty	Date/Time (UK)	CH4	CO2	O2	Peak CH4
PZ1	WHIT	06/11/2012 00:00	0	0	21	0
PZ2	WHIT	06/11/2012 00:00	0	0.3	20.8	0
PZ3	WHIT	06/11/2012 00:00	0	1.5	20	0
PZ4	WHIT	06/11/2012 00:00	0	0.4	20.8	0
PZ5	WHIT	06/11/2012 00:00	0	2.6	18.8	0
PZ54	WHI	06/11/2012 00:00	0	0	20.9	0
PZ53	WHI	06/11/2012 00:00	0	1	19.1	0
PZ52	WHI	06/11/2012 00:00	0	0.5	20.3	0
PZ51	WHI	06/11/2012 00:00	0	0	20.9	0
PZ50	WHI	06/11/2012 00:00	0	0.8	20.2	0
PZ49	WHI	06/11/2012 00:00	0	1.1	19.6	0
PZ48	WHI	06/11/2012 00:00	0	1.3	20	0
PZ47	WHI	06/11/2012 00:00	0	1.2	19.9	0
PZ46	WHI	06/11/2012 00:00	0	3.2	18.1	0
PZ45	WHI	06/11/2012 00:00	0	1	20	0
PZ44	WHI	06/11/2012 00:00	0	0	20.6	0
PZ43	WHI	06/11/2012 00:00	0	0.7	20.2	0
PZ42	WHI	06/11/2012 00:00	0	0.4	20.4	0
PZ42	WHI	06/11/2012 00:00	0	0.6	20.2	0
PZ41	WHI	06/11/2012 00:00	0	0.9	19.9	0
PZ40	WHI	06/11/2012 00:00	0	0	20.9	0
PZ39	WHI	06/11/2012 00:00	0	0.3	20.6	0
PZ38	WHI	06/11/2012 00:00	0	0.3	20.6	0
PZ37	WHI	06/11/2012 00:00	0	0.1	20.9	0
PZ36	WHI	06/11/2012 00:00	0	0.5	20.5	0
PZ35	WHI	06/11/2012 00:00	0	0.3	20.8	0
PZ34	WHI	06/11/2012 00:00	0	1.4	18.9	0
PZ33	WHI	06/11/2012 00:00	0	0.2	20.3	0
PZ32	WHI	06/11/2012 00:00	0	1.2	20.4	0
PZ31	WHI	06/11/2012 00:00	0	0.5	20.5	0
PZ30	WHI	06/11/2012 00:00	0	0.2	20.3	0
PZ29	WHI	06/11/2012 00:00	0	0.3	20.8	0
PZ28	WHI	06/11/2012 00:00	0	3.9	18.4	0
PZ26	WHI	06/11/2012 00:00	0	0	21	0
PZ25	WHI	06/11/2012 00:00	0	0	20.9	0
PZ24	WHI	06/11/2012 00:00	0	0	21	0
PZ23	WHI	06/11/2012 00:00	0	0	20.8	0
PZ22	WHI	06/11/2012 00:00	0	1.3	19.2	0
PZ21	WHI	06/11/2012 00:00	0	0	20.9	0
PZ11	WHI	06/11/2012 00:00	0	0	21	0
PZ12	WHI	06/11/2012 00:00	0	0	21	0
PZ13	WHI	06/11/2012 00:00	0	0	21	0
PZ14	WHI	06/11/2012 00:00	0	0	21	0
PZ15	WHI	06/11/2012 00:00	0	0	21	0
PZ16	WHI	06/11/2012 00:00	0	0	21	0

ID	DATE	CH4 %	CO2 %	O2 %
PZ1 WHIT	13/12/2012 00:00	0	0	21.4
PZ2 WHIT	13/12/2012 00:00	0	0	21
PZ3 WHIT	13/12/2012 00:00	0	0	21
PZ4 WHIT	13/12/2012 00:00	0	1.1	20.5
PZ5 WHIT	13/12/2012 00:00	0	2.2	18.9
PZ54 WHI	13/12/2012 00:00	0	0.4	20.5
PZ53 WHI	13/12/2012 00:00	0	0.9	20.1
PZ52 WHI	13/12/2012 00:00	0	0.8	20.2
PZ51 WHI	13/12/2012 00:00	0	0.6	20.4
PZ50 WHI	13/12/2012 00:00	0	2.3	19.1
PZ49 WHI	13/12/2012 00:00	0	3.8	18.8
PZ48 WHI	13/12/2012 00:00	0	4.3	17.5
PZ47 WHI	13/12/2012 00:00	0	2.8	17.8
PZ46 WHI	13/12/2012 00:00	0	3.7	18.3
PZ45 WHI	13/12/2012 00:00	0	0.8	19.5
PZ44 WHI	13/12/2012 00:00	0	0.3	20.4
PZ43 WHI	13/12/2012 00:00	0	0.8	19.9
PZ42 WHI	13/12/2012 00:00	0	0.7	20.6
PZ41 WHI	13/12/2012 00:00	0	0.9	20.1
PZ40 WHI	13/12/2012 00:00	0	0.9	19.8
PZ39 WHI	13/12/2012 00:00	0	1.8	19.2
PZ38 WHI	13/12/2012 00:00	0	0.4	20.2
PZ37 WHI	13/12/2012 00:00	0	0.4	20.5
PZ36 WHI	13/12/2012 00:00	0	1.3	19.8
PZ35 WHI	13/12/2012 00:00	0	0.6	20.3
PZ34 WHI	13/12/2012 00:00	0	2.4	15.7
PZ33 WHI	13/12/2012 00:00	0	1.5	17.8
PZ32 WHI	13/12/2012 00:00	0	2	19.2
PZ31 WHI	13/12/2012 00:00	0	0.8	20.3
PZ30 WHI	13/12/2012 00:00	0	1.9	16.1
PZ29 WHI	13/12/2012 00:00	0	0.9	20.3
PZ28 WHI	13/12/2012 00:00	0	4.5	18.2
PZ26 WHI	13/12/2012 00:00	0	0.9	20.2
PZ25 WHI	13/12/2012 00:00	0	0.3	20.2
PZ24 WHI	13/12/2012 00:00	0	0.1	21.1
PZ23 WHI	13/12/2012 00:00	0	0	21.1
PZ21 WHI	13/12/2012 00:00	0	0.2	20.8
PZ11 WHI	13/12/2012 00:00	0	0	21.2
PZ12 WHI	13/12/2012 00:00	0	0	21.2
PZ13 WHI	13/12/2012 00:00	0	0	20.9
PZ14 WHI	13/12/2012 00:00	0	0	20.9
PZ15 WHI	13/12/2012 00:00	0	0	21.1
PZ16 WHI	13/12/2012 00:00	0	0	21.3

APPENDIX J

SLOPE STABILITY ASSESSMENT



DOCUMENT CONTROL SHEET

Client	Louth County Council					
Project Title	Whiteriver Landfill					
Document Title	Slope Stability Report 2012					
Document No.	IBR0385					
This Document Comprises	DCS	TOC	Text	List of Tables	List of Figures	No. of Appendices
	1	1	3	2	0	2

Rev.	Status	Author(s)	Reviewed & Approved By	Issue Date
1.0	Final	Helen Halliday <hr/> Helen Halliday, Senior Engineer	<hr/> Andrew Baskin, Director	August 2012

Contents

1.0	Introduction	1
1.1	Conceptual Stability Model	1
1.1.1	<i>Existing Waste Slope</i>	1
2.0	STABILITY RISK ASSESSMENT	1
2.1	Risk Screening	1
2.2	Data Summary	2
2.3	Factors of Safety	2
2.4	Parameters for Final Waste Mass Stability	2
2.5	Analyses	2
2.6	Assessment	3

1.0 INTRODUCTION

Under condition 8.13 of Waste License 60-2 for Whiteriver Landfill requires an annual Slope Stability Assessment. This report details the slope stability assessment undertaken at Whiteriver in 2012.

The report is based on the annual topographical survey of the site and a site walkover. The topographical survey was undertaken in April 2012 and the site walkover was conducted in July 2012.

The slopes assessed for stability are the most recently completed slopes. These are slopes in the central area of the site, Phase 5, Cell 2A, and 1A. Locations of the sections analysed are shown on Drawing IBR0385/001, Appendix A.

1.1 CONCEPTUAL STABILITY MODEL

1.1.1 Existing Waste Slope

The requirement for waste filling in Phase 5, Cell 2 and Cell 1 was that filling should be undertaken at not more than 1 vertical:3 horizontal.

2.0 STABILITY RISK ASSESSMENT

2.1 RISK SCREENING

The slopes in Phase 5 Cell 3A, 3B, 2B and 1B have been considered previously, in April 2010 and 2011. A site walkover survey of these slopes is undertaken to determine if there are any visible changes in the slope geometry or indications of instability.

A site walkover of these slopes was undertaken on Wednesday 4th July 2012. No visible changes to the slope geometry or slope instability features were noted in the capped area of the site. Photographs from the site survey of these slopes are included in Appendix B.

A small very localised area of veneer failure was evident at the east side of the access track over Cell 4B to the tiphead was observed, however it is not reflective of any deep seated instability in the access road. It should continue to be examined during stability assessment surveys.

Analysis of the remaining waste slopes in Phase 5 Cells 2A and 2B are examined using Slope/W.

2.2 DATA SUMMARY

Waste properties are derived from literature¹.

1 D R V Jones, D Taylor & N Dixon (1997). Shear Strength of Waste and its use in Landfill Stability analysis. Proc. Geoenvironmental Engineering Conf., Yong & Thomas (eds.) Thomas Telford, pp99-117

2.3 FACTORS OF SAFETY

A Factor of Safety of 1.3 is required for the stability of the waste slope. Eurocode 7 requires the use of partial factors of 1.25 for friction angle (ϕ) and effective cohesion (c') therefore 1.3 is deemed suitable for an overall factor of safety.

2.4 PARAMETERS FOR FINAL WASTE MASS STABILITY

The parameters used in the temporary waste slope analysis are shown in Table 1 below:

Table 1 Summary of the Parameters used in the Annual Capping Analysis

Material	Unit Weight γ , (kN/m ³)	Effective Cohesion, c' (kPa)	Friction Angle, ϕ' (degrees)
Waste Based on RPS landfill analysis experience	10	5	25
Waste/LLDPE Interface Material testing	9.2	0	19
Boulder Clay	18	5	30

2.5 ANALYSES

Stability analyses was carried out on two sections through the site for examination of the waste slope mass stability, see Drawing IBR0385/002, Appendix A.

Sections A-A and B-B (Appendix A) represent three sections through the Waste Slopes of Phase 5, Cell 2A, 2B and Cell 1A. They have a range of grades, Section A-A from 1v:2.8h to

1v:7.1h and Section B-B from 1v:3.1h to 1v:4.9h on the filled waste slopes. Stability analysis has been carried out for both sections.

An Ru value of 0.2 is included to represent the undrained nature of the waste, while a porewater pressure line up to 1m in the waste layer is included to represent the Leachate head in the landfill cells.

All sections show rotational failures within a satisfactory factor of safety.

2.5.1 Waste Slope Analysis

A summary of the Slope/W runs for the waste slopes is presented in Table 2.

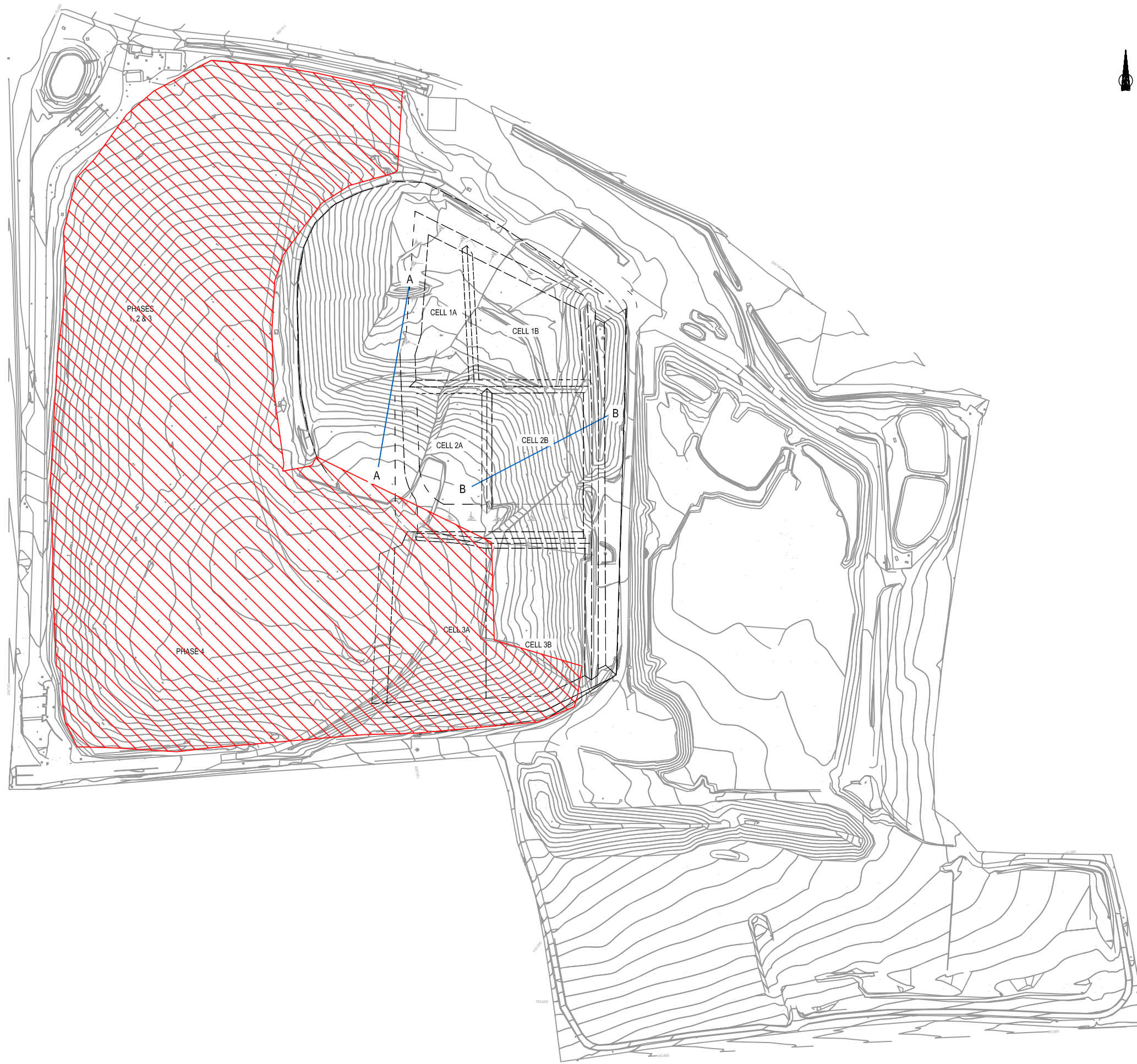
Table 1 Summary of the Waste Slope Stability

Reference	Scenario Description	Factor of Safety for Critical Circular Slip Failure
A-A	Waste Slope, Cell 2A, 1v:2.8 h to 1v:7.1h & Ru=0.2	1.9
B-B	Waste Slope, Cell 2B, 1v:3.1h to 1v:4.9h & Ru=0.2	2.3

2.6 ASSESSMENT

The analysis for the final waste slopes suggests that the factors of safety for the filling of waste are satisfactory. In addition a site walkover survey and examination of the waste slope's as illustrated in the photographs in Appendix B evidenced no apparent slope instability on these recently filled slope.

APPENDIX A
Drawings
Slope/W Analysis





NOTES

1. Verifying Dimensions.
The contractor shall verify dimensions against such other drawings or site conditions as pertain to this part of the work.
2. Existing Services.
Any information concerning the location of existing services indicated on this drawing is intended for general guidance only. It shall be the responsibility of the contractor to determine and verify the exact horizontal and vertical alignment of all cables, pipes, etc. (both underground and overhead) before work commences.
3. Issue of Drawings.
Hard copies, dwf and pdf will form a controlled issue of the drawing. All other formats (dwg, dxf etc.) are deemed to be an uncontrolled issue and any work carried out based on these files is at the recipient's own risk. RPS will not accept any responsibility for any errors arising from the use of these files, either by human error by the recipient, listing of un-dimensioned measurements, compatibility issues with the recipient's software, and any errors arising when these files are used to aid the recipient's drawing production, or setting out on site.


4. Datum: Malin Head

5. Key:

 Area of Permanent Capping

 Slope Model Sections

rev	amendments	drawn	date

	Elmwood House	T	+44 (0) 28 90 667914
	74 Boucher Road	F	+44 (0) 28 90 668286
	Belfast	W	www.rpsgroup.com/ireland
	BT12 6RZ	E	ireland@rpsgroup.com

Client

Louth County Council

Project

Whiteriver 2012 Slope Stability

Title

Slope W Model Section Locations

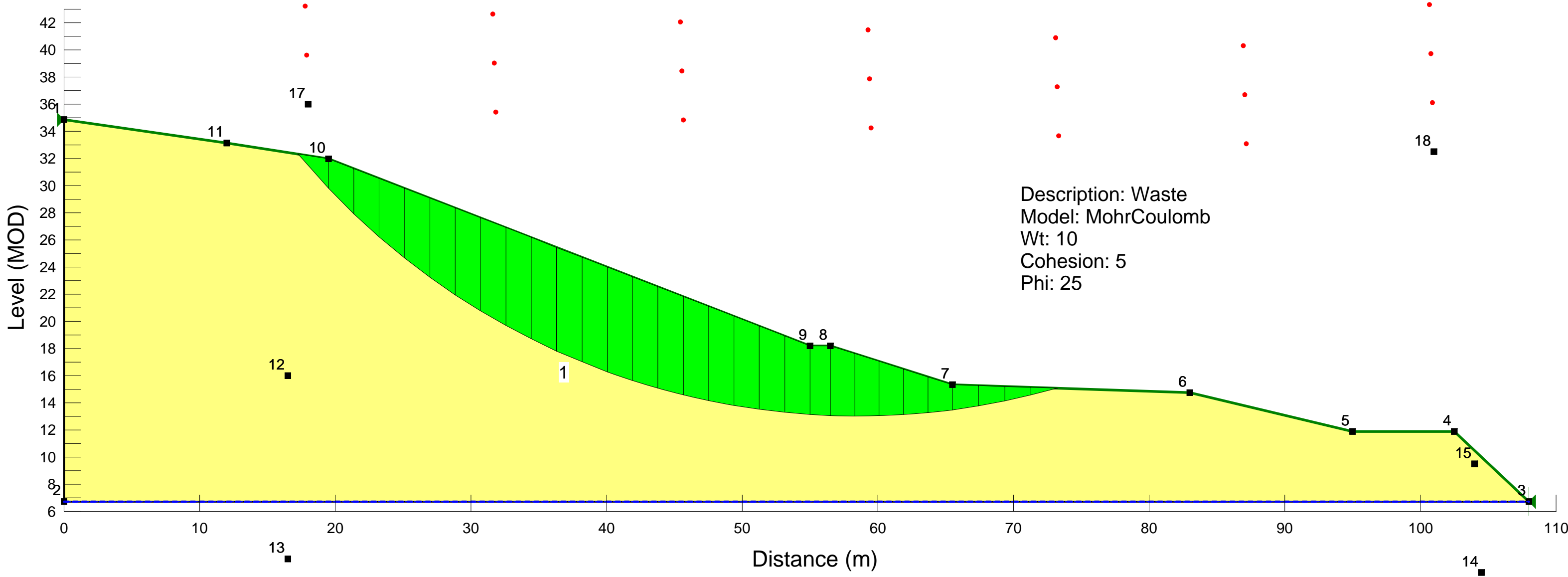
Drawing Status	Sheet Size	Drawing Scale
Preliminary	A3	1:2,500

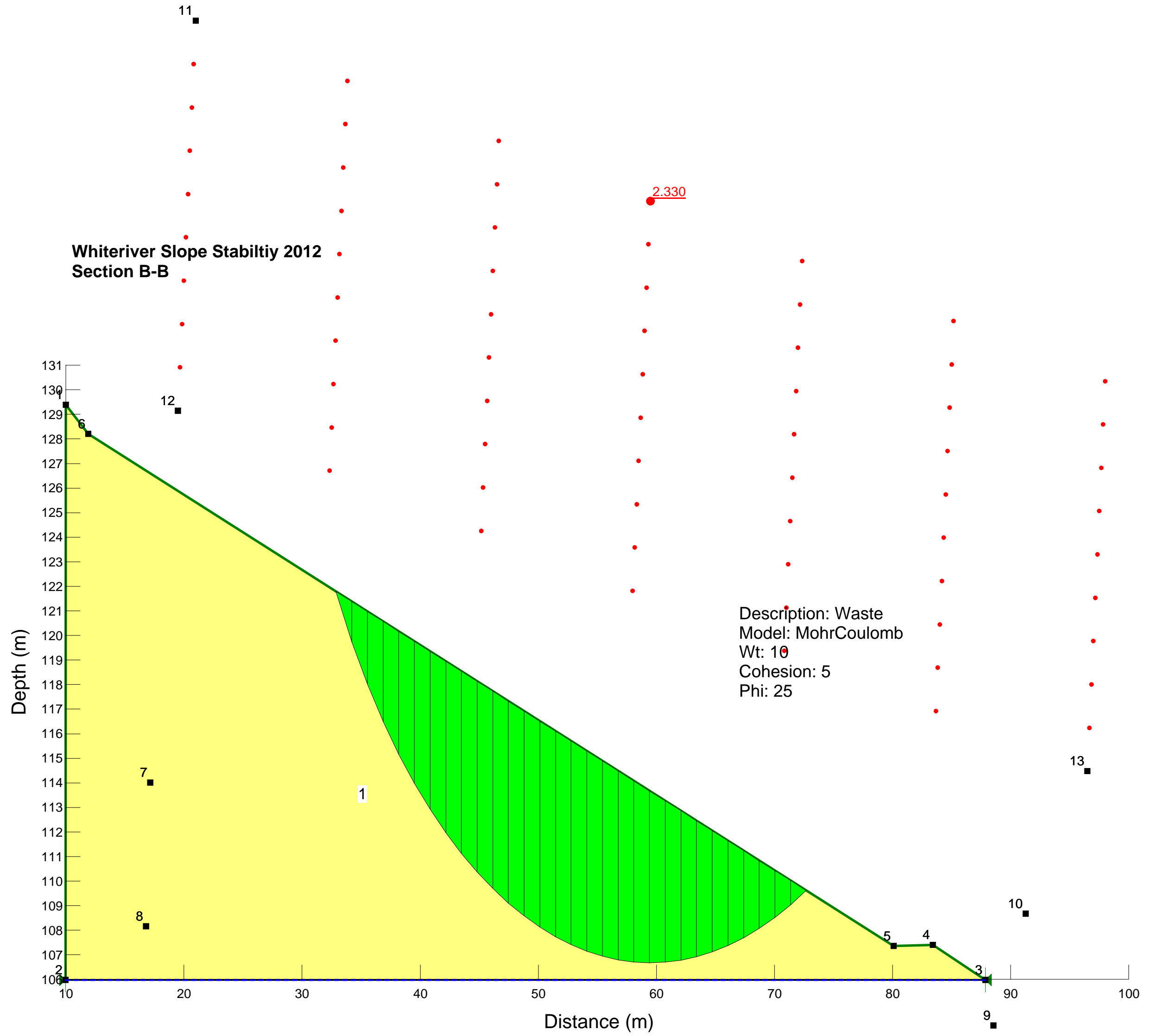
Drawing Number	Rev
IBR0385 /001	-

Project Leader	Drawn By	Date	Initial Review
A Baskin	P McMath	17/06/2012	H Halliday

Whiteriver Slope Stability 2012
Section A-A

Description: Waste
Model: MohrCoulomb
Wt: 10
Cohesion: 5
Phi: 25





APPENDIX B
Photographs



Photograph 1: Capped Area Cell 1,2 & 3



Photograph 2: Capped Area Phase 4



Photograph 3: Capped Area Phase 5, Cell 3



Photograph 4 : Temporary Cap Phase 5 Cell 3



Photograph 5: Existing Waste Slope Cell 2B

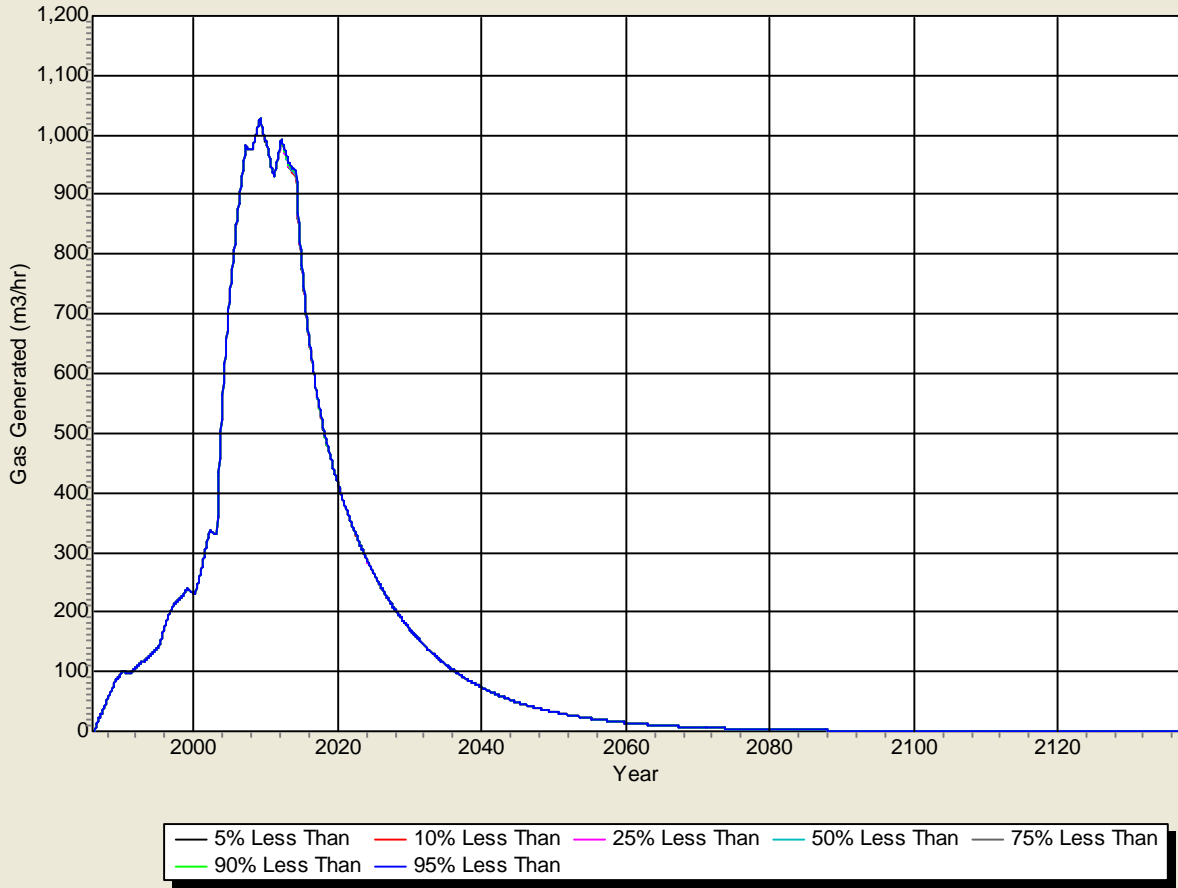


Photograph 6: Existing Filling area Cell "A"

APPENDIX K

**ESTIMATED ANNUAL GAS YIELD
OBJECTIVES AND TARGETS**

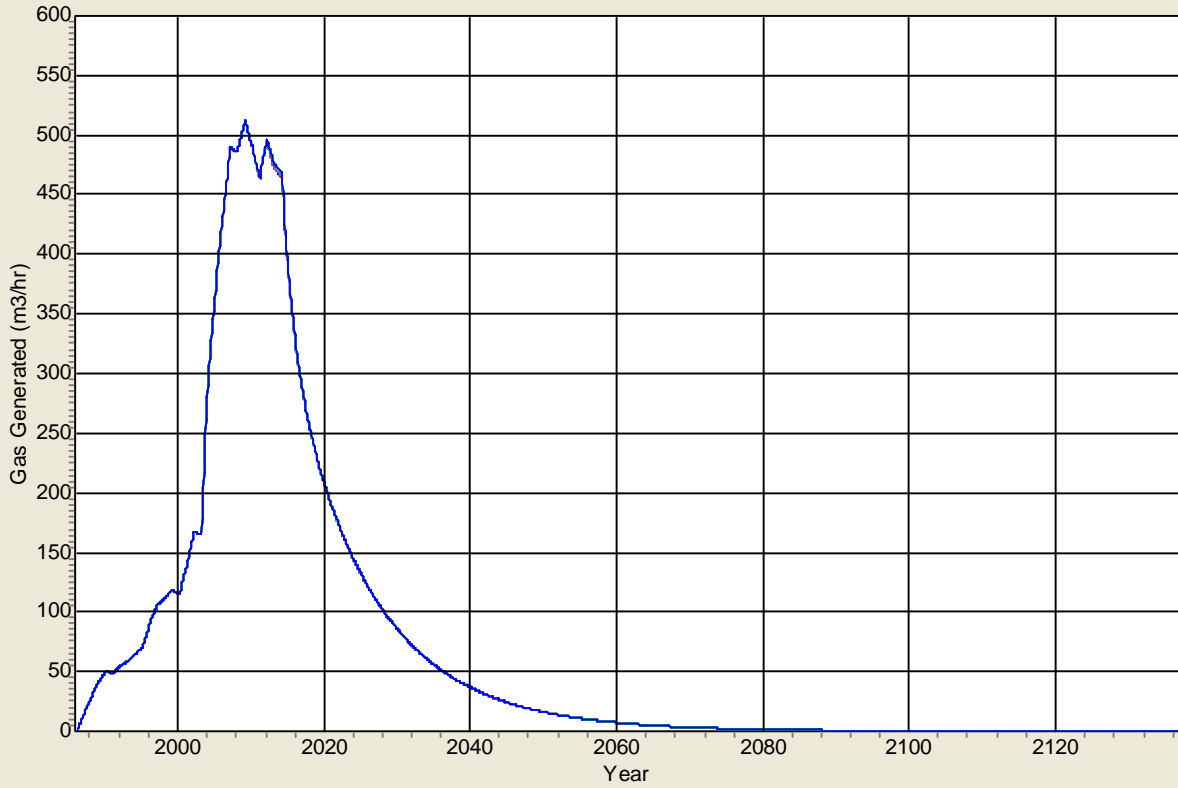
Total LFG
Total: Total Bulk LFG Produced



16/04/2013 16:10:11

400 IBR Jobs\BR0380 Whiteriver GasSim PI Report\BR0380 Working Files PI Report 2012\BR0380 Whiteriver Landfill 2012 PI Re

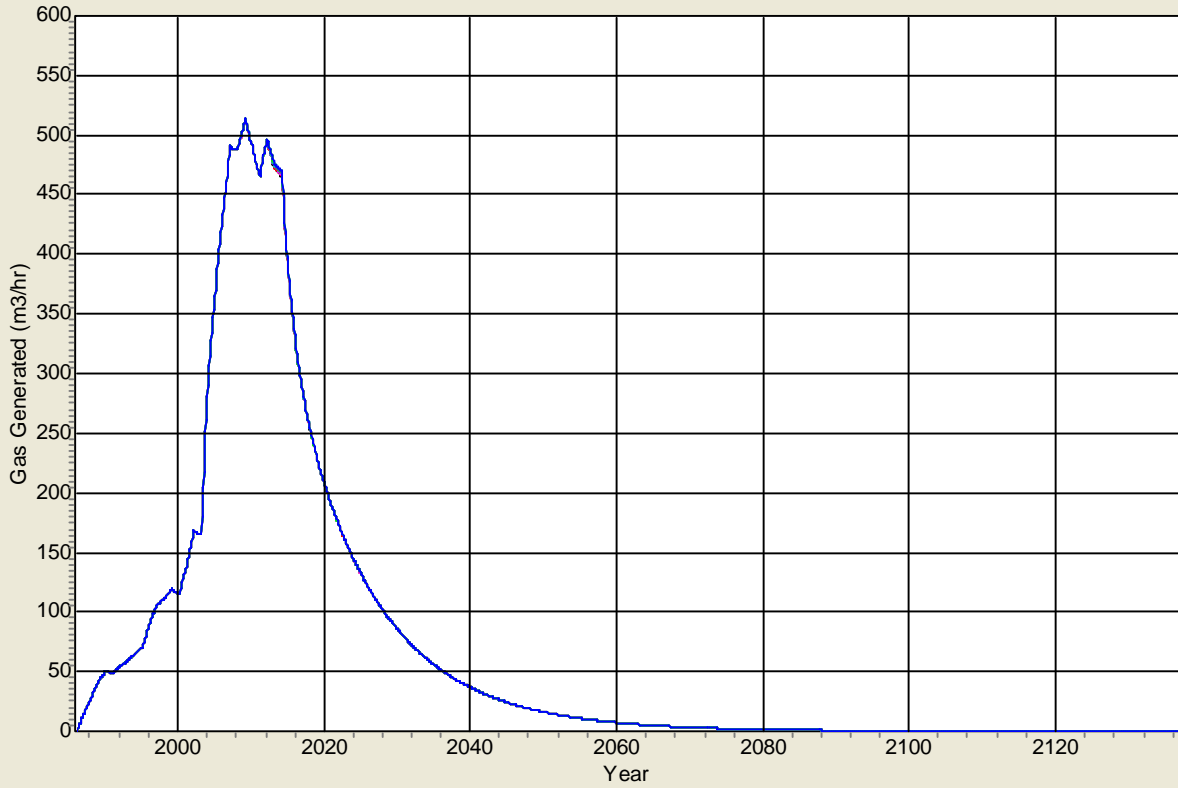
Methane
Total: Methane Produced



— 5% Less Than — 10% Less Than — 25% Less Than — 50% Less Than — 75% Less Than
— 90% Less Than — 95% Less Than

16/04/2013 16:10:11

Carbon Dioxide
Total: Carbon Dioxide Produced



— 5% Less Than — 10% Less Than — 25% Less Than — 50% Less Than — 75% Less Than
— 90% Less Than — 95% Less Than

16/04/2013 16:10:11

APPENDIX L

OBJECTIVES AND TARGETS

Document number: L-AL-FOR-002-02	Title: Objectives, Targets and EMP Review Form
Issue Date: 09/09/08	Issued by: GS/ NMCC / HC Approved by: GS

OBJECTIVES, TARGETS AND EMP REVIEW FORM

Objective: Reduce pressure on non-renewable fossil fuels used to generate electricity.				
Target: Devise strategy to utilise landfill gas as a fuel for the generation of electricity / energy				
Linked to aspect(s) No: 4 & 3				
EMP No: 1 (WR)	Overall Responsibility: Senior Engineer <small>(The above named person shall check the status of each task until closed out)</small>	Start Date: Nov' 09 <small>(Tasks shall be checked regularly from the above date until closed out)</small>		
Task	Details	Due Date	Task responsibility	Status
A	Review business case and devise procurement strategy	Mar 2010.	Senior Engineer	Not complete
Reviewed by: DH Date: 16/3/10 <small>(Upon reaching the due date a task with a status of not complete shall be reissued below using the initial task lettering whereby checking shall continue)</small>				
A	Review business case and devise procurement strategy	May 2010.	Senior Engineer	Complete
Reviewed by: DH Date: 15/10/10 <small>(Upon reaching the due date a task with a status of not complete shall be reissued below using the initial task lettering whereby checking shall continue)</small>				
B	Appoint the design consultant	Dec 2010	Senior Engineer	Complete
Reviewed by: DH Date: 30/6/11 <small>(Upon reaching the due date a task with a status of not complete shall be reissued below using the initial task lettering whereby checking shall continue)</small>				
C	Apply to the ESB for grid connection.	Dec 11	Senior Engineer	Complete
D	Review the proposal from ESB and determine viability of project.	April 12	Senior Engineer	Complete
E	Appoint a design build operate company.	Dec 2012	Senior Engineer	Complete
Reviewed by: DH / HC Date: 13/2/13 <small>(Upon reaching the due date a task with a status of not complete shall be reissued below using the initial task lettering whereby checking shall continue)</small>				
F	Begin generation of electricity.	June 13	Senior Engineer	
Reviewed by: Date: <small>(Upon reaching the due date a task with a status of not complete shall be reissued below using the initial task lettering whereby checking shall continue)</small>				

Notes:

Estimated cost and funding available to implements objectives

- Depends on procurement strategy adopted.

Payback from Project

- Simple payback for Grid Connection occurs within four years.

16/3/10:

Document number: L-AL-FOR-002-02	Title: Objectives, Targets and EMP Review Form
Issue Date: 09/09/08	Issued by: GS/ NMCC / HC Approved by: GS

Consultants have been appointed to review the business case and report back, expected in the next few weeks. EMS Leader has extended timeframe.

15/10/10:

Oct 2010 tender has been issued for a consultant to design and specifications to be put out to construction and installation tendering.

5/3/12:

The application has been made to the ESB for the grid connection. Council anticipate return of this in the coming weeks. A decision shall be made based on the proposal from this application.

The EMS has concerns over the design spec for the sites electricity generation. EMS is concerned that the landfill will not produce enough gas to sustain the viability of two 0.65 Mw generators. EMS Leader for the site has voiced these concerns with Senior Engineer.

Therefore this objective shall continue into 2013 and potentially beyond.

13/2/13:

Task D: Project was agreed and contractor assigned.

Task E: RPS selected and project underway due to begin approximately end of April 2013.

Close out reviewed by: _____ **Date:** _____

Objective tasks completed

Signature (Director): _____ **Date:** _____

Document number: L-AL-FOR-002-02	Title: Objectives, Targets and EMP Review Form
Issue Date: 09/09/08	Issued by: GS/ NMCC / HC Approved by: GS

OBJECTIVES, TARGETS AND EMP REVIEW FORM

Objective: Reduce BMW to landfill				
Target: Meet the EPA waste target for BMW to landfill. (2010 = 47% / 55%) (2013 = 30% 40%) (2016 = 15%)				
Linked to aspect(s) No: 1				
EMP No: 7 (WR)	Overall Responsibility: Landfill Manager <small>(The above named person shall check the status of each task until closed out)</small>	Start Date: Oct 10 <small>(Tasks shall be checked regularly from the above date until closed out)</small>		
Task	Details	Due Date	Task responsibility	Status
A	Calculate the % BMW landfilled each quarter and report this to the EPA.	Oct 10	D. Holmes	Complete
B	Draft a list of ways to reach the next level targets.	Dec 2011	D. Holmes	Complete
C	Continue to ensure that only treated wastes are accepted in accordance with EPA approved factors.	Oct 10	D. Holmes	Complete
Reviewed by: DH Date: 30/6/11 <small>(Upon reaching the due date a task with a status of not complete shall be reissued below using the initial task lettering whereby checking shall continue)</small>				
D	Respond to the EPA audit of June 17 th 2011.	Sep 11	D. Holmes	Complete
E	Review and amend any waste procedures and draft any new forms needed based on the actions from this audit.	Dec 11	D. Holmes / Helen Cranney	Complete
Reviewed by: DH Date: 5/3/12 <small>(Upon reaching the due date a task with a status of not complete shall be reissued below using the initial task lettering whereby checking shall continue)</small>				
F	Make the 2012 quarterly reports to EPA	Dec 2012	D. Holmes	Complete
Reviewed by: DH / HC Date: 13/2/13 <small>(Upon reaching the due date a task with a status of not complete shall be reissued below using the initial task lettering whereby checking shall continue)</small>				
G	Make the 2013 quarterly reports to EPA	Dec 2013	D. Holmes	
Reviewed by: Date: <small>(Upon reaching the due date a task with a status of not complete shall be reissued below using the initial task lettering whereby checking shall continue)</small>				

Notes:	<p>19/10/10: The current BMW waste to landfill at WR is 45.9%.</p> <p>30/6/11: The 2010 BMW waste to landfill was 47% meeting the EPA targets.</p> <p>Due to the nature of waste received in the first quarter of 2011 the BMW figure was 61% an EPA audit in June 2011 has requested an action plan to show how WR shall meet the 47% by year end. Senior management has been made aware of this issue.</p> <p>The system to gather information in relation to BMW content of waste from contractors is to be reviewed in order to meet the 47% target. EPA audit response actions shall set out the</p>
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Document number: L-AL-FOR-002-02	Title: Objectives, Targets and EMP Review Form
Issue Date: 09/09/08	Issued by: GS/ NMCC / HC Approved by: GS

plans for this. Waste procedures for the EMS may require amendment in relation to these actions.

5/3/12:

Waste Acceptance and Handling Procedure has been revised to Issue 4 to address the acceptance of incinerator bottom ash.

WR submitted an action plan to the EPA on 5th Aug of 2011. This action plan was implemented to cease the acceptance of waste from a number of streams from mid to late 2011. However this was not enough to prevent the site exceeding its 2011 targets.

WR submitted its final 2011 report to the EPA stating the exceedance of the target and have had no response.

WR have continued to make preventative plans to meet the BMW targets for 2012. These are:

- Accept incinerator bottom ash which has a 0% BMW rating
- Ceased accepting waste from the general public which had a 67% BWM rating
- Cease the acceptance of non pre-treated waste from waste collectors.

EMS Leader for WR considers that 2012s first quarter will be within the 47% target limit.

13/2/13:

The total reported for 2012 was 32.85 % this was within the target limit of 47%.

Within the 2012 reporting period the EPA increased the target limit to 55%.

The 2013 limit has been set at 40% from July.

Figures in the Target noted in **RED** represent the EPA changes to the landfill limits.

Close out reviewed by: _____ **Date:** _____

Objective tasks completed

Signature (Director): _____ **Date:** _____

Document number: L-AL-FOR-002-02	Title: Objectives, Targets and EMP Review Form
Issue Date: 09/09/08	Issued by: GS/ NMcC / HC Approved by: GS

5/3/12:

Within the three mobilisations of the existing capping contract, two are now completed and CQA confirmation held on site. Filling of Phase 5 Cell 1 will not be completed until mid 2013 and capping will follow.

A new contract is currently being developed for the capping of the entire site as the decision has been made to close after the filling of phase 5.

13/2/13:

Task D has been rendered Obsolete due to the need for a final contractor to be appointed to complete the permanent capping of the site.

Close out reviewed by: _____ **Date:** _____

Objective tasks completed

Signature (Director): _____ **Date:** _____

Document number: L-AL-FOR-002-02	Title: Objectives, Targets and EMP Review Form
Issue Date: 09/09/08	Issued by: GS/ NMCC / HC Approved by: GS

OBJECTIVES, TARGETS AND EMP REVIEW FORM

Objective: Prevent pollution to the Environment from the management of the landfill.

Target: Meet the requirements of the new Environmental Objectives (Groundwater) Regulations 2010.

Linked to aspect(s) No: 6 from 2012 register (Due to incoming legislation in Feb 2013)

EMP No: 10 (WR)	Overall Responsibility: Senior Engineer (The above named person shall check the status of each task until closed out)	Start Date: Feb 2013 (Tasks shall be checked regularly from the above date until closed out)
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Task	Details	Due Date	Task responsibility	Status
A	Hire a contractor to complete the Hydrological Assessment of the licensed area and draft necessary action plans. (Technical Amendment to site license allows 18 months from 15 th Jan 2013 to complete this assessment)	Dec 2013	Landfill Manager	
B	Seek agreement from Senior Management to report the action plans to EPA.	Mar 2014	Landfill Manager	
C	Send report to the EPA	June 2014	Landfill Manager	
D	Receive feedback from the EPA prior to start of implementation.	Dec 2015	Landfill Manager	
E	Begin the implementation of action plans. This task start and due date are dependent on the results of task D.	22 Dec 2015	Landfill Manager	

Reviewed by: _____ **Date:** _____
(Upon reaching the due date a task with a status of not complete shall be reissued below using the initial task lettering whereby checking shall continue)

Reviewed by: _____ **Date:** _____
(Upon reaching the due date a task with a status of not complete shall be reissued below using the initial task lettering whereby checking shall continue)

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Reviewed by: _____ **Date:** _____
(Upon reaching the due date a task with a status of not complete shall be reissued below using the initial task lettering whereby checking shall continue)

Notes:

Close out reviewed by: _____ **Date:** _____

Objective tasks completed
Signature (Director): _____ **Date:** _____

Document number: L-AL-FOR-002-02	Title: Objectives, Targets and EMP Review Form
Issue Date: 09/09/08	Issued by: GS/ NMCC / HC Approved by: GS

OBJECTIVES, TARGETS AND EMP REVIEW FORM

Objective: Enhance the Biodiversity of the site post closure				
Target: Include Bio diversity into the revised restoration and aftercare works for the site to be completed by end of 2015.				
Linked to aspect(s) No: 2 & 10				
EMP No: 11 (WR)	Overall Responsibility: Landfill Manager <small>(The above named person shall check the status of each task until closed out)</small>	Start Date: July 2012 <small>(Tasks shall be checked regularly from the above date until closed out)</small>		
Task	Details	Due Date	Task responsibility	Status
A	Give approval to consultants to finalise the restoration and aftercare plan.	Oct 12	R. Mc Kenna	Complete
B	Present the plan for approval to the EPA	Dec 12	R. Mc Kenna	Complete
C	Tender for a contractor to complete works	June 13	R. Mc Kenna	Complete
D	Select contractor and being the works.	Sep 2013	Contractor	Complete
E	Complete the works and signoff	June 2014	Landfill Manager	
F	Carry out ongoing maintenance	Ongoing	LLA	
Reviewed by: DH / HC Date: 13/2/13 <small>(Upon reaching the due date a task with a status of not complete shall be reissued below using the initial task lettering whereby checking shall continue)</small>				
Reviewed by: Date: <small>(Upon reaching the due date a task with a status of not complete shall be reissued below using the initial task lettering whereby checking shall continue)</small>				

Notes:	
13/2/13:	
Approval was provided and the EPA agreed the plan. Greenbelt contractor was hired and works commenced Feb 2013.	
Close out reviewed by:	Date:
Objective tasks completed	
Signature (Director): _____	Date: _____