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Office of Environmental Enforcement (Waste),
Environmental Protection Agency,
McCumiskey House,
Richview,
Clonskeagh,
Dublin 14

27th March 2009

RE: 2008 Annual Environmental Report - Greenstar Ltd. - Knockharley Landfill (Reg. No. W0146-01)

Dear Sir/Madam,

Please find enclosed an original and 2 no. copies of the 2008 Annual Environmental Report (AER) for the above referenced facility. The AER file has been uploaded to the EPA website and is a true copy of the original Annual Environmental Report. The AER/PRTR emissions data reporting workbook has also been uploaded to the EPA website.

If you have any queries, please call me.

Yours sincerely,

Michael Watson

0804812/MW/MG
Encs.
c.c. (x2) Mr. Reinhard Wilkes, Greenstar Ltd. (Knockharley Landfill)

email. info@ocallaghanmoran.com Website: www.ocallaghanmoran.com

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ANNUAL ENVIRONMENTAL REPORT

FOR

GREENSTAR LTD.

KNOCKHARLEY LANDFILL

LICENCE NO. W0146-01

JANUARY – DECEMBER 2008

Prepared For: -

Greenstar Ltd.,
Knockharley Landfill,
Knockharley,
Co. Meath.

Prepared By: -

O' Callaghan Moran & Associates,
Granary House,
Rutland Street,
Cork.

27th March 2009

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1. INTRODUCTION

This is the 2008 Annual Environmental Report (AER) for Greenstar Ltd.'s (Greenstar) non-hazardous residual landfill at Knockharley, Navan, County Meath. It covers the twelve month period from 1st January 2008 to 31st December 2008. The facility received its Waste Licence (W0146-01) in March 2003 and began accepting residual waste in December 2004.

The content of the AER is based on *Schedule F* of the Waste Licence and the report format follows guidelines set in the "Guidance Note for Annual Environmental Report" issued by the Environmental Protection Agency (Agency).

2. SITE DESCRIPTION

2.1 Site Location and Layout

The site is located in a rural area, approximately 1.5 km north of Kentstown Village and 7 km south of Slane. The licensed area encompasses 135.2 ha. The landfill footprint, where waste is deposited in engineered landfill cells, is located in the centre of the site and will eventually occupy an area of approximately 25 ha. A buffer of 100 m is maintained between the active landfill footprint and the site boundary. The fill areas are more than 250 m from all occupied dwellings.

The facility will be developed in seven phases. The initial phase, which was completed in December 2004, involved the completion of four engineered landfill cells (Cells 1-4), the construction of an access road from the N2, the provision of the supporting infrastructure (waste reception area, leachate holding lagoons and site offices), groundwater and surface water control measures, and initial landscape works. An additional two cells (Cells 5 & 6) were completed in July 2006 and Cells 7 to 10 were constructed in 2007.

Subsequent phases will involve the construction of additional engineered cells, the expansion of the active gas management and flaring system, progressive landscape works and the capping and restoration of completed landfill cells. None of the completed cells have been restored or capped at this stage.

2.2 Waste Types & Volumes

Only non-hazardous, solid, residual waste is accepted for disposal. Hazardous and liquid wastes are not accepted. All wastes delivered to the facility are subject to Waste Acceptance Procedures that have been approved by the Agency, as specified in Condition 5.3 of the Waste Licence.

The facility is licensed to accept 200,000 tonnes of waste per annum. The following waste types and volumes, as specified in Schedule A of the Waste Licence, can be accepted: -

- Household (100,000 tonnes),
- Commercial (45,000 tonnes),
- Industrial (30,000 tonnes),
- Construction & Demolition (25,000 tonnes).

2.3 Waste Activities

The facility is a full containment landfill, which is designed to accept treated waste for final disposal. The waste activities carried out during the reporting period were: -

- Disposal (landfilling) of wastes,
- Recovery of wastes for removal off-site and recycling, and
- Recovery of certain inert wastes on-site for engineering purposes and use as daily cover.

2.4 Waste Received & Consigned

A breakdown of the different types and quantities of wastes received and consigned from the facility in 2008 and previous years are shown in Tables 2.1, 2.2 and 2.3.

Table 2.1 Waste Received 2008

European Waste Code Categories	Description	Tonnes
Waste for disposal		
EWC 19 12 12	Residual municipal and commercial waste	101,380.76
EWC 19 13 02	Mixed waste from soil remediation	9,107.30
EWC 20 03 01	Mixed municipal waste	23,126.38
EWC 20 03 07	Mixed construction and demolition waste	144.44
Total waste for disposal		*133,758.88*
Waste for recovery		
EWC 11 01 10	Industrial filter cake	230.30
EWC 16 03 04	Stabilised inorganic filter cake	388.28
EWC 17 01 01	Industrial filter cake	106.84
EWC 17 05 04	Soil and stones	17,800.62
EWC 17 09 04	Mixed construction and demolition waste	1,814.24
EWC 19 03 05	Stabilised inorganic filter cake	5.38
EWC 19 05 01	Off-specfication compost	6,780.52
EWC 19 09 02	Filter cake from water treatment	8.12
EWC 19 12 07	Woodchip	6,183.50
EWC 19 12 09	Minerals - Fines	16,821.46
EWC 19 12 12	Minerals - Fines	9,953.64
Total waste for recovery		*60,092.90*

Table 2.2 Waste Consigned 2008

European Waste Code Categories	Description	Tonnes	Destination
EWC 16 05 04*	Gas Cylinders	0.26	Calor Gas Ltd.
EWC 19 12 12	C&I dry mixed	3.46	Greenstar Ltd. Millennium Park
EWC 19 07 03	Leachate	15,547.72	Navan Waste Water Treatment
Total waste consigned		*15,551.44*	

Table 2.3 Waste Received 2004 to 2007

European Waste Code Categories	2004	2005	2006	2007
Waste for disposal				
EWC 02 02 03	-	7.00	-	
EWC 19 12 12	-	98,125.18	-	92,009.82
EWC 20 03 01	909.54	37,988.84	133,119.48	44,144.59
EWC 18 02 03	-	0.22	-	
EWC 20 01 99				27.50
Total waste for disposal	*909.54*	*136,121.24*	*133,119.48*	*136,181.91*
Waste for recovery				
EWC 19 12 09	371.24	25,434.80	22,924.03	24,926.73
EWC 19 12 07	112.94	7,358.34	7,397.28	9,534.76
EWC 19 05 03	-	120.22	2,754.10	2,990.30
EWC 17 05 04	-	-	26,622.46	22,314.04
EWC 17 09 04	-	768.88	-	2,743.12
EWC 11 01 10				103.96
EWC 19 12 02				176.06
Total waste for recovery	*484.18*	*33,682.24**	*59,697.87*	*62,788.97*

2.5 Landfill Capacity

The most recent topographic survey for the landfill cell footprint is included in Appendix 1. The total capacity of the facility is estimated to be 3,282,500 m^3. It is estimated that approximately 776,500 m^3 of void space has been used. The remaining capacity is approximately 2,506,000 m^3.

2.6 Method of Deposition of Wastes

2.6.1 Waste Acceptance

The waste accepted for disposal is residual waste from the Northeast region, from household, commercial and industrial sources. At present the majority of waste is delivered to the facility by two waste contractors based in County Meath. Both contractors have systems in place whereby the recyclable fraction is either collected separately, or else separation is carried out manually at their facilities. Both contractors have the infrastructure in place to compost biodegradable wastes, including food waste.

All waste is delivered to the site in Heavy Goods Vehicles (HGV) provided with the appropriate covers to prevent loss of load. Each vehicle first proceeds to the incoming weighbridge where it is weighed. The weighbridge operator and/or the facility manager may, at their own discretion, request the load to be tipped in the Waste Inspection Area. The vehicles then proceed to the active waste disposal area, where waste is deposited under the direction of a banksman. The vehicles weigh out at the outgoing weighbridge and receive an individual weighbridge docket before exiting the site.

Each landfill cell is divided into a number of 'grids', which are used to identify the areas where waste is deposited. Each load is assigned the relevant grid number.

2.6.2 Working Face

Waste is deposited close to and above the advancing tipping face. In accordance with Condition 5.6.1 the active face is confined to a height of 2.5 metres after compaction, a width of 25 metres and a slope no greater than 1 in 3. Deposited waste is spread in shallow layers on the inclined surface and compacted. The steel-wheeled compactors operate on the gradient of the more shallow face, pushing thin layers of waste and applying compaction pressure to them.

The site operatives inspect the deposited waste for items that are not acceptable under the Waste Licence, such as tyres, gas bottles, batteries etc. These are removed and stored in appropriate areas for later removal from the site.

Each day's waste input is deposited to form a 'block', which is compacted and covered. The following day a new 'block' of waste is deposited adjacent to this block. This ordered method of waste deposition enables areas, which have been filled and are to be left for a period, to be progressively restored over the site life, minimising the areas of active waste deposition.

3. ENVIRONMENTAL MONITORING

Greenstar implements a comprehensive environmental monitoring programme to assess the significance of emissions from site activities. The programme includes groundwater, surface water, leachate, landfill gas, noise, dust and particulate monitoring and a biological assessment of the Kentstown Stream and Nanny River. The monitoring locations are shown on Figure 3.1.

The monitoring results, including the full laboratory reports, were submitted to the Agency at quarterly intervals in the reporting period. This section presents a summary of the monitoring with summary graphs showing trends included in Appendix 2.

3.1 Groundwater Monitoring

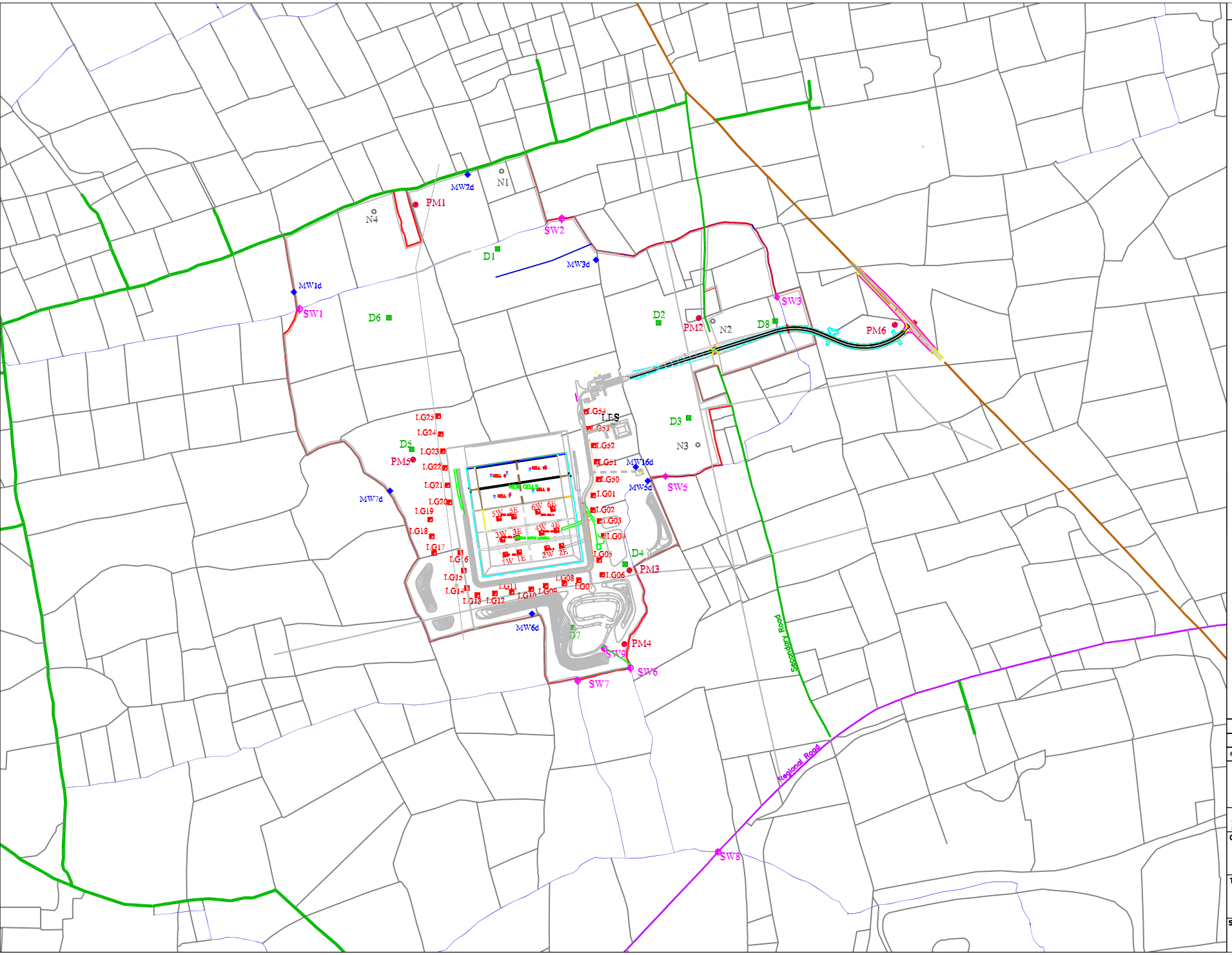
3.1.1 Groundwater Levels

Groundwater levels were measured in each of the seven monitoring wells specified in the Waste Licence (MW1d – MW6d and MW16d) on four occasions during the reporting period. The wells are all screened exclusively in the bedrock. The monitoring confirmed that the direction of groundwater flow in the bedrock aquifer is from the north west to the south east. The monitoring also identified artesian conditions in MW-5d.

3.1.2 Groundwater Quality

Groundwater quality was monitored in the on-site monitoring wells and reported to the Agency at quarterly intervals. The sampling was carried out in accordance with internationally accepted techniques and control procedures and the analyses were completed by a laboratory using standard and internationally accepted procedures.

The 2008 results were generally consistent with those obtained during the monitoring completed before the start of site development works with any measurements above the baseline ranges recorded in both upgradient and downgradient wells. The groundwater monitoring programme confirms that the site activities are not impacting on groundwater quality.



NOTES

No	Id	Eastings	Northings
	DUST		
1	D1	297278	267774
2	D2	297744	267560
3	D3	297831	267284
4	D4	297648	266867
5	D5	297030	267194
6	D6	296964	267575
7	D7	297587	266678
8	D8	298081	267565
	GROUNDWATER		
9	MW1D	296689	267649
10	MW2D	297191	267988
11	MW3D	297562	267742
12	MW5D	297712	267102
13	MW6D	297377	266718
14	MW7D	296967	267074
15	MW16D	297678	267143
	NOISE		
16	N1	297290	267999
17	N2	297901	267565
18	N3	297858	267207
19	N4	296921	267882
	SURFACE WATER		
20	SW1	296706	267600
21	SW2	297464	267862
22	SW3	298087	267653
23	SW5	297764	267116
24	SW6	297663	266262
25	SW7	297510	266575
26	SW8	297916	266029
27	SW9	297587	266621
	PM10		
28	PM1	297030	267909
29	PM2	297833	267591
30	PM3	297656	266894
31	PM4	297656	266630
32	PM5	297035	267170
33	PM6	298434	267576
	LANDFILL GAS		
34	LG01	297555	267061
35	LG02	297554	267018
36	LG03	297559	266975
37	LG04	297563	266928
38	LG05	297572	266874
39	LG06	297581	266831
40	LG07	297513	266815
41	LG08	297472	266806
42	LG09	297418	266799
43	LG010	297376	266789
44	LG011	297319	266781
45	LG012	297271	266777
46	LG013	297220	266772
47	LG014	297190	266793
48	LG015	297181	266843
49	LG016	297150	266895
50	LG017	297095	266894
51	LG018	297088	266942
52	LG019	297084	266991
53	LG020	297140	267041
54	LG21	297134	267090
55	LG22	297126	267140
56	LG23	297120	267188
57	LG24	297114	267238
58	LG25	297107	267289
59	LG50	297570	267107
60	LG51	297564	267158
61	LG52	297556	267205
62	LG53	297541	267253
63	LG54	297532	267302

MONITORING LOCATIONS LEGEND:
- Denotes landfill gas monitoring location
- Denotes groundwater monitoring location
- Denotes surfacewater monitoring location
- Denotes noise monitoring location
- Denotes dust monitoring location
- Denotes PM10 monitoring location
- Denotes leachate monitoring location

REV	DATE	DESCRIPTION	DRN	CHKD	APP
B	28/05/08	LFG	MW	JOC	JOC
A	29/11/04	ISSUE	MW	JOC	JOC

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CLIENT
GREENSTAR LTD

TITLE
MONITORING LOCATIONS
KNOCKHARLEY
LANDFILL

SCALE
1:5,000
A3

FIGURE 3.1

REV.
B

3.2 Surface Water Monitoring

The site lies within the Nanny River catchment, close to the catchment divide with the River Boyne. The Nanny catchment is characterised by sudden high flows coinciding with high rainfall periods and particularly low flows in the drier summer months.

3.2.1 Visual Assessment

Greenstar carries out weekly inspections of the surface water drainage system. The inspections completed in the reporting period did not identify the presence of any impact on the drainage system associated with site activities.

3.2.2 Chemical Assessment

The surface water monitoring was conducted quarterly at the eight monitoring locations specified in the Waste Licence and reported to the Agency on a quarterly basis. The sampling was carried out in accordance with internationally accepted techniques and control procedures, the analyses were completed by a laboratory using standard and internationally accepted procedures.

Monitoring prior to site development established that the water quality is seasonally affected by the surrounding land use, including agriculture and septic tanks. These impacts are reflected in the elevated and variable Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), and ammonia levels. Continuous monitoring at the outfall of the surface water lagoon has not shown any impact by the site activities. The 2008 results confirm that this remains the case and that site activities are not impacting on surface water quality.

3.3 Leachate

The monitoring programme involves the collection and testing of leachate samples from the collection sumps and the storage lagoon. The 2008 results indicate an increase in leachate strength throughout the monitoring period, which is expected given the age of the facility. Leachate is removed off site to a Waste Water Treatment Plant (WWPT) as agreed with the Agency.

3.4 Landfill Gas (LFG)

The gas monitoring programme includes measurements of methane, carbon dioxide, oxygen and atmospheric pressure in wells located both outside and inside the waste body on a monthly basis. The wells are at 50 m intervals around the landfill footprint and two per

hectare within the cells. The locations of the 30 external wells (LG-01 – LG-25 and LG-50 to LG-54) were agreed in advance with the Agency and are shown on Figure 3.1.

Two of the wells (LG-03 and LG-04) had to be removed to allow the installation of the landfill gas flare in Q4 2005. These wells and wells LG-20 to LG-25 on the western side of the footprint and LG-50 to LG-54 on the eastern side of the footprint were installed in August 2008 and were monitored monthly thereafter.

The additional perimeter wells were installed as Condition 3.20.1 of the Licence requires the installation of perimeter LFG monitoring boreholes at 50m intervals around the periphery of the landfill footprint. Greenstar completed the construction of four (4) additional cells (Cells 7-10) in 2008 and has plans for additional Cells in the future, and therefore the additional wells were required.

3.4.1 Outside the Waste Body

The 2008 monitoring did not identify any evidence of gas migration from the landfill cells. Since monitoring began in 2004 high concentrations of naturally occurring carbon dioxide have been detected in the in-situ subsoils and these were confirmed in 2008. High concentrations of carbon dioxide can occur naturally at shallow depths of up to 2 metres due to microbiological activity associated with the roots of many types of vegetation, providing concentrations of up to 7% by volume in certain soils such as the silty clays that underlie the site.

3.4.2 Inside the Waste Body

Methane levels varied from 15.1 to 64.0 %v/v, carbon dioxide levels varied from 11.3 to 60.3 %v/v, while oxygen levels varied from 0.0 to 18.0 %v/v.

3.5 Noise Survey

Noise surveys were conducted on four occasions at the locations specified in Table D.1.1 of the Waste Licence (Ref. Figure 3.1). The surveys were carried out in accordance with International Standards Organisation 1996: Acoustics-description and Measurement of Environmental Noise (Parts 1, 2 and 3).

The results at the noise sensitive locations indicate that noise from the site complied with the licence limits. Slightly elevated levels were recorded in February and June 2008 at monitoring location N2 (60 dB and 58 dB respectively), however in the context of the local noise environment, emissions from the facility are more accurately represented by the L_{A90} parameter. $L_{A90\ 30\ min}$ levels at this measurement station were 39 dB and 43 dB respectively and therefore within the licence limits on both occasions.

3.6 Dust Monitoring

Dust deposition is monitored monthly at eight monitoring locations (D1 to D8) as specified in Table D.1.1 of the Waste Licence (Ref. Figure 3.1). All of the 2008 monitoring results were less than the deposition limit set in the licence (350 mg/m^2/day).

3.7 PM_{10}

PM_{10} levels were monitored on four occasions at the locations specified in Table D.1.1 (Figure 3.1) in March, June, August and December. All measurements were below the trigger level of 50 µ/m^3.

3.8 Meteorological Monitoring

Average rainfall, temperature, humidity and wind speed and direction for the monitoring period were obtained from the Meteorological Station at Dublin Airport located approximately 30 km from the facility is presented in Table 3.1.

Table 3.1 Meteorological Data: Dublin Airport – 2008

Rainfall	
Total Annual	942.6 mm
Maximum month (August)	189.9 mm
Minimum month (February)	14.7 mm
Temperature	
Mean Daily	9.4°C
Mean Daily Maximum (August)	15.2°C
Mean Daily Minimum (December)	4.4°C
Wind (Knots)	
Frequency of calms	3.3%
Prevailing direction	South West
Prevailing sector	South West

The total annual rainfall is 942.6 mm. The winds are predominantly from the south west sector.

3.9 Biological Monitoring

The annual biological assessment of the Kentstown Stream and Nanny River was carried out in accordance with Condition 8.11 of the licence on the 4th July 2008 and a full copy of the report is included in Appendix 2. Two control sites and two receptor sites were surveyed on each water course using the EPA Q-rating system for the assessment of rivers and streams. Benthic macro-invertebrates were sampled qualitatively at the four sites using kick-sampling and based on the results, the water quality of each site was determined using the EPA Q-rating scheme. Similarly, the SSRS (small stream risk score) of each site was calculated.

The findings of the study indicate that biological water quality at the control site on the Knockharley Stream has declined but improved at the receptor site downstream of the landfill. A similar scenario was observed in the River Nanny with the small stream risk score for the control site declining, while that of the receptor site increased. The recorded Q-values for the River Nanny remained stable since the previous survey (2007) but biological water quality at both sites is 'Unsatisfactory'. The results of the current study compare favourably with the most recent EPA result for this part of the River Nanny.

There is no evidence that the landfill operations are having any effect on the water quality of the receptor streams. It is likely that diffuse sources of pollution, such as agricultural inputs, are the main causes of pollution in these watercourses. Variations in such inputs, environmental factors, and (to a lesser degree) timing and micro-location of sampling have probably all contributed to the variation in results obtained over the past five years.

4. SITE DEVELOPMENT WORKS

4.1 Tank, Pipeline and Bund Testing

An inspection and testing of the leachate lagoon and oil bund was carried out by Fehily Timoney & Co. in May 2008. A copy of the report is included in Appendix 3.

4.2 Summary of Resource & Energy Consumption

Table 4.1 presents an estimate of the resources used on-site in 2008 OCM completed an Energy Efficiency Audit of the facility in compliance with Condition 2.5.1 of the Licence in Q1 2007. The audit was carried out in accordance with the Agency's "Guidance Note on Energy Efficiency Auditing" (2003). The Audit report recommended the development of a documented energy policy statement as this is considered fundamental to the successful implementation of any management system as it provides the framework for the introduction and maintenance of energy efficiency and conservation measures in the day to day operation of the facility. An energy management policy document was developed in 2008, a copy of which is included in Appendix 4.

A landfill is a significant source of greenhouse gas emissions, not through the use of fossil fuels, but as a result of the production and flaring of landfill gas. However, to address this it is intended to install a landfill gas utilisation plant at the facility in 2009, which will mean that the facility will have a negative carbon footprint.

Table 4.1 Resources Used On-Site

Resources	Quantities
Diesel (green)	125,104 litres
Electricity	206,400 kWh
Hydraulic/Engine Oil	150 litres
Mains Water	72,625 litres
Odour Neutralisers	2,000 litres

4.3 Site Developments

Installation of the first phase of capping around the perimeter of Cells 1-6 was completed during 2008. A carbon filtration unit was installed at the leachate lagoon to eliminate any emissions of odorous air during pumping from the lagoon into the leachate tankers.

In April 2009 construction of Cells 11 and 12 will commence. Partial permanent capping will take place on Cells 1 to 4 commencing in April 2009. The installation of gas utilisation infrastructure will commence in April 2009.

5. EMISSIONS

5.1 Leachate

Water balance calculations were prepared using guidance in the Agency's Landfill Manual-Landfill Site Design and are based on total rainfall data from the onsite met station and the volumes of waste deposited at the site during the reporting period. The calculations are presented in Table 5.1.

It was assumed that all of the incident rainfall on the active cells had the potential to generate leachate. An absorptive capacity of 0.07 m^3/tonne was used based on a waste density of 0.8 tonnes/m^3.

The calculations indicate that approximately 22,701 m^3 of leachate was generated in 2008. 15,547.72 m^3 of leachate was removed from the facility during the reporting period. The balance is stored in the base of the landfill cells and the storage lagoon.

5.2 Landfill Gas

It is estimated that approximately 1,290 m^3 / hour of landfill gas (methane and carbon dioxide) was generated at the facility over the reporting period. This overall estimate is derived from predictive gas generation model GasSim Version 1.54 the results of which are included in Appendix 5. The actual volume of methane and carbon dioxide burned was 1,080 m^3 / hour as measured by the flare and based on a mixture of 45% methane and 35% carbon dioxide. Input data for the model are the site specific values, i.e. size of the site, operational period, quantity and type of waste.

5.3 Surface Water

Rainfall on the undeveloped parts of the site discharges directly to the surface water drainage system. Rainfall on active fill areas is collected in the leachate collection system. The surface drainage from all roads is directed to the surface water retention pond via an oil interceptor. Drainage from the waste inspection and quarantine bays is directed to the leachate lagoon. The retention pond design and capacity meets the requirements of the Waste Licence. The inlet to the pond is fitted with a Class 1 Full Oil interceptor.

Table 5.1 Annual Leachate Volume Calculations

Yr.	*Active*	*Active*	*Waste*	*Active*	*Intermediate*	*Intermediate*	*Intermediate*	*Final*	*Restored*	*Restored*	*Liquid*	*Total*	*Cummulative*	*Absorptive*	*Cummulative*	*Cummulative*	*Annual*
	Cell No.	*Area*	*Input*	*Infiltration*	*Restoration*	*Restored* Area	*Infiltration*	*Restoration*	*Area*	*Infiltration*	*Waste*	*Leachate*	*Leachate*	*Capacity*	*Absorptive*	*Leachate*	*Leachate*
		(m^2)	*(t)*	*(m^3)*	*Cell No.*	*(m^2)*	*(m^3)*	*Cell No.*	*(m^2)*	*(m^3)*	*(m^3)*	*(m^3)*	*(m^3)*	*(m^3)*	*Capacity*	*Generation*	*Generation*
2005	1,2	17,813	132,000	8,016		0	0	0	0	0	0	8,016	8,016	9,240	9,240	-1,224	-1,224
2006	1,2,3,4	35,628	133,119	16,033		0	0	0	0	0	0	16,033	24,048	9,318	18,558	5,490	6,714
2007	1,2,3,4,5, 6	53,441	136,182	24,048		0	0	0	0	0	0	24,048	48,096	9,533	28,091	20,006	14,516
2008	1,2,3,4,5, 6,7,8	71,254	133,759	32,064		0	0	0	0	0	0	32,064	80,161	9,353	28,214	51,947	22,701
Cell area ($m^{2)}$						8,907		Estimated maximum waste input (t/year)						200,000			
Total rainfall (m/year)						0.9426		Liquid waste input (t/year)						0			
Effective Rainfall post vegetation (m/year)						0.338		Final Infiltration						0.1	10% of Effective Rainfall per annum		
Density of *in-situ* waste ($t/m^{3)}$						0.8		Intermediate Infiltration						0.6	60% of Effective Rainfall per annum		
Absorptive capacity (m^3/t)						0.07		Calculations are based on a 11 year landfill operation.									
Effective Rainfall before vegetation assumed to be (m)						0.45											

6. NUISANCE CONTROL

Greenstar is committed to operating in the best possible manner, using the best available techniques to minimise impacts to the environment and local residential neighbours. The potential sources of nuisance at a landfill facility are odour, vermin, birds, flies, mud, dust, litter and odours.

6.1 Odour

Good operational practices on-site are the main controls to avoid odour nuisances. The handling, depositing and covering of waste at the facility is carried out in accordance with the Agency's Landfill Manual "Landfill Operational Practices". In addition Greenstar have developed a site specific Odour Management Plan (KNKP 033) a copy of which is included in Appendix 6. The plan specifies the operational requirements for the waste placement, the landfill gas management infrastructure and addresses all aspects of odour control.

Any loads with a particular potential for generation of odours are rejected in accordance with the waste acceptance procedures, which are in operation at the facility as submitted to and agreed by the Agency in December 2004.

The waste delivery trucks are unloaded at the working face and the waste is compacted within 3 to 4 minutes. The level areas of the working face are covered on a continuous basis during the day. The slope of the working face is covered completely with artificial cover sheets at the end of each working day, which can easily be removed again the following day prior to commencement of operations.

6.2 Vermin / Flies / Insects

The methods used for vermin control are as detailed in Nuisance Inspection Procedure (KNKP 32) in Appendix 6. A specialist contractor is employed by Greenstar to carry out a vermin control programme. Measures used include internal and external bait boxes, rodenticides and insect control measures. The specialist contractor visits the site at regular intervals throughout the year to inspect the control measures and assess their effectiveness. These control measures have found to be successful.

6.3 Birds

Greenstar employs one of the leading bird control specialists, Falcon Bird Control Services, who operate a seven day dawn to dusk programme. An aviary is provided at the site, which houses the birds of prey used by the contractor. The main aim of the Programme is to create an association of danger, so that birds choose not to fly around the area where bird control is active. This association is achieved using a variety of methods such as visual and audible deterrents in compliance with the licence. To date these measures have proven to be successful.

6.4 Dust

Dust and mud control measures were implemented at the start of the construction phase of the site and continued into the operational phase. These measures include the use of a wheelwash, road sweeper and the use of a water bowser to dampen access roads and stockpiles during periods of dry weather. To date these measures have proven to be successful.

6.5 Litter

Litter is controlled by fencing which was installed around the landfill footprint as specified in the waste licence. Portable litter fencing is also used at the working face, which can be moved to various points around the working face depending on the wind direction. As part of operational controls all litter is collected at the end of the working day and litter has not been an issue at the facility.

7. ENVIRONMENTAL INCIDENTS AND COMPLAINTS

7.1 Incidents

There were no incidents on-site during the reporting period.

7.2 Register of Complaints

Greenstar maintains a register of complaints in compliance with Condition 10.14. Details of all complaints received during the reporting period and the action taken by Greenstar are available at the facility. A graph showing the composition of the 338 complaints is included in Appendix 7.

8. ENVIRONMENTAL MANAGEMENT SYSTEM

8.1 Management Structure

The Management Structure as required by Condition 2.2.1 of the waste licence was submitted to the Agency on 14th December 2004, before the start of waste activities and updated in each AER.

8.1.1 Site Management Structure

The day to day management of the facility and supervision of waste activities are the responsibility of the Facility Manager, nominated Deputy Manager(s) and the site operatives. The positions and names of the persons who provide management and supervision are set out below: -

- Facility Manager, Reinhard Wilkes,*
- Assistant Landfill Manager, Heather Miller*,
- Site Foreman, Robert Hughes,*
- Chargehand, Sean Smith*,
- Weighbridge Operator, Michael Noone,
- General Operatives, Donal Blaney and Ainars Elbergs,
- Administrator, Tanya Keoghan.

* Nominated Deputies

The following Plant Operators, including suitably experienced and qualified replacement staff will be supplied by the Plant Hire Contractor, Renton Plant: -

- Plant Operators, Patrick Maguire, Martin Maguire.

8.1.2 Responsibilities

Greenstar, as the licensee, is responsible for ensuring that the requisite resources are provided to operate the facility in accordance with the objective of the EMP and the Waste Licence conditions.

The General Manager or nominated Deputy is responsible for ensuring that the day to day operation of the facility is carried out in accordance with the EMP, the Waste Licence conditions and the Operating Procedures.

The General Manager or nominated Deputy is responsible for ensuring that the environmental monitoring programme is carried out and reports submitted to the Agency in accordance with the schedule in the EMP and the Waste Licence conditions.

The General Manager or nominated Deputy is responsible for arranging that the specified engineering works, the leachate and landfill gas management programmes and the restoration programmes are properly implemented.

The General Manager or nominated Deputy is responsible for ensuring that the Corrective Action Procedures, Emergency Response Procedures and Contingency Arrangements specified in the EMP and the Waste Licence are implemented.

The General Manager or nominated Deputy is responsible for arranging appropriate training programmes for all facility personnel and for maintaining training records.

The General Manager, nominated Deputy and designated staff are responsible for implementing the waste acceptance procedures, including the assessment of suitability of the waste for disposal and recording the data specified in the Waste Licence. They are responsible for receiving and recording complaints from members of the public at the facility and informing the Facility Manager or nominated Deputy of the complaints.

The General Manager, nominated Deputy, Site Foreman and designated staff are responsible for ensuring compliance with conditions relating to waste inspection, placement and nuisance control (e.g. daily cover, litter, dust, vermin, birds).

8.1.3 Staff Training

All Training was carried out as scheduled in the training plan for 2008:

Spill and Chemical Awareness Training for all staff.

EMS and Environmental Awareness Training for all staff.

European Computers Drivers Licence completed by Site Foreman, Chargehand, Weighbridge Operator and Administrator.

FAS Waste Management Training for Assistant Manager.

CIWM Landfill Gas Management Course for Assistant Manager, Site Foreman and Chargehand.

TOC equipment calibration and maintenance training for Chargehand.

Boom and Scissor mobile elevating platform training for Chargehand and one Operative.

Approved advanced EMS Auditor course for Assistant Manager.

Any facility staff who performs duties which involve interpretation of monitoring results or site inspections, will receive the appropriate training by the General Manager or nominated deputy, prior to carrying out such duties.

All facility staff will receive further training in their individual areas of activity. This training will comprise theoretical sessions as well as practical training. All such training will be recorded and documented in individual training files.

8.2 EMP

Condition 2.3 requires Greenstar to submit a proposal for a documented Environmental Management System (EMS) to the Agency for its approval three months prior to the start of waste activities at the site. The EMS proposal completed as part of the Environmental Management Plan was sent to the Agency on the 23rd July 2004 and was approved on the 23rd December 2004.

8.2.1 Schedule of Objectives 2008

Table 8.1 describes the implementation of the objectives and targets in the reporting period.

8.2.2 Schedule of Objectives 2009

Greenstar has set a schedule of targets and objectives for 2009. These are presented in Table 8.2.

8.3 Communications Programme

The Communications Programme required by Condition 2.4.1 of the waste licence, was established three months before the start of waste activities and has been submitted to the Agency.

Table 8.1 Progress Report on Schedule of Objectives and Targets for 2008

Ref.	Objective	Target	Deadline	Responsibility	Progress
1	Gas management	Hold Gas Management meetings every 6 months to review existing infrastructure and discuss maintenance and upgrading as required.	On-going	FM	2 meetings were held in 2008
2	Restoration and aftercare	On completion of landfilling within a phase, each phase will be individually assessed as to the capping measures required, e.g. intermediate or final.	On-going	FM	On-going
		EPA approval of restoration and after care proposal.	Awaiting EPA response	FM	Still awaiting response
3	Comply with Licence requirements in relation to leachate management	Continue to monitor and control leachate.	On-going	FM	On-going
		Submit proposals for recirculation of leachate to the EPA for their approval.	June 2008	FM	SEW submitted and approved for leachate recirculation infrastructure
		Implement recirculation of leachate at the landfill and continually assess and upgrade infrastructure as necessary.	Dec 2008	FM	Recirculation to commence following permanent capping works
		Assess the potential for alternatives outlets for leachate, e.g. Anaerobic Digestion	Dec 2011	FM	On-going
4	Ensure that the site is landscaped in accordance with Licence conditions	Maintain and continue to improve all on site landscaping and the wetland area.	On-going	FM	On-going
		Employ a landscape contractor to assess plantations, replace failed trees/plants and improve the overall general appearance of the landfill site.	On-going	FM	On-going

Ref.	Objective	Target	Deadline	Responsibility	Progress
5	Improve public relations at the landfill	Review relationship with neighbours and interested parties on a continual basis and produce annual public relations report.	Annually and on-going	FM	On-going
		Review the number and composition of complaints to determine any trends.	Quarterly and on-going	FM	Carried out quarterly
		Establish a newsletter for distribution to local people at regular intervals.	First issue 2008	FM	Issue 1 circulated Sept 2008
		Continue to hold regular meetings with local residents.	Quarterly On-going	FM	On-going
		Continue to maintain the Community Development Fund through the Community Liaison Committee	On-going	FM	On-going
		Continue to provide sponsorship of interested local parties, clubs, etc.	On-going	FM	On-going
6	Reduce energy usage on site	Carry out an annual review of energy usage	Annually On-going	FM	Annual review undertaken in June 2008
		Employ an energy consultant to carry out a follow up energy audit and report every 3 years	June 2010	FM	Scheduled for 2010
		Prepare an Energy Policy Statement for the site.	June 2008	FM	Prepared Dec 2008
		Implement an Energy Awareness Programme incorporating the recommendations from the 2007 energy audit.	Ongoing	FM	Awareness programme is on-going

Table 8.8 Schedule of Objectives and Targets for 2009

Ref.	Objective	Aspect	Target	Deadline	Responsibility
1	Gas Management	1. Generation of LFG 7. Release of LFG	Hold Gas Management meetings every 6 months to review existing infrastructure and discuss maintenance and upgrading as required.	On-going	AM/FM
2	Leachate Management	2. Generation of leachate	Submit proposals for recirculation of leachate to the EPA for their approval.	Feb 2009	FM
			Implement recirculation of leachate at the landfill and continually assess and upgrade infrastructure as necessary.	When EPA approved	FM
			Assess the potential for alternatives outlets for leachate, e.g. Anaerobic Digestion	Dec 2011	FM
3	Landscaping	4. Generation of GHG's 14. Emissions to air 17. Visual Impact	Maintain and continue to improve all on site landscaping and the wetland area.	On-going	FM
			Employ a landscape contractor to assess plantations, replace failed trees/plants and improve the overall general appearance of the landfill site.	On-going (seasonal)	FM
4	Public Relations	5/9/12. Generation of dust 6. Birds/vermin/flies 7. Release of LFG 8/13. Litter 16/18.Noise 17. Visual Impact	Review relationships with neighbours and interested parties on a continual basis and produce annual public relations report.	Annually and on-going	AM/FM
			Review the number and composition of complaints to determine any trends.	Quarterly and on-going	FM
			Establish a newsletter for distribution to local people at regular intervals.	On-going bi-annual publication	AM
			Continue to hold regular meetings with local residents.	Quarterly On-going	AM/ FM

Ref.	Objective	Aspect	Target	Deadline	Responsibility
5	Education and Environmental Awareness	5/9/12. Generation of dust 6. Birds/vermin/flies 7. Release of LFG 8/13. Litter 16/18.Noise 17. Visual Impact	Actively encourage site visits from interested parties i.e. local community groups, schools, clubs, etc.	On-going	AM
			Continue to provide sponsorship of interested local parties, clubs, etc.	On-going	FM
			Keep Public Information Room updated and current.	On-going	AM
6	Reduce energy usage on site	3/10/15. Use of energy 4. Generation of GHG's	Carry out an annual review of energy usage	Annually On-going	AM/FM
			Employ an energy consultant to carry out a follow up energy audit and report every 3 years	June 2010	FM
			Prepare an Energy Policy Statement for the site.	Completed	AM/ FM
			Implement an Energy Awareness Programme incorporating the recommendations from the 2007 energy audit.	Begins 2009	AM/ FM

9. OTHER REPORTS

9.1 Financial Provision

Greenstar has accrued sufficient funds, to provide for any potential environmental liabilities at this facility. Greenstar also has adequate insurance cover for environmental liabilities to €6,350,000 for any one occurrence, which will apply to "sudden identifiable and unintended incidents".

A financial guarantee, as required by condition 12.2.2 of the Waste Licence was in place during 2008. The guarantee was renewed in December 2008 and is now valid until December 2009.

9.2 Landscape Programme

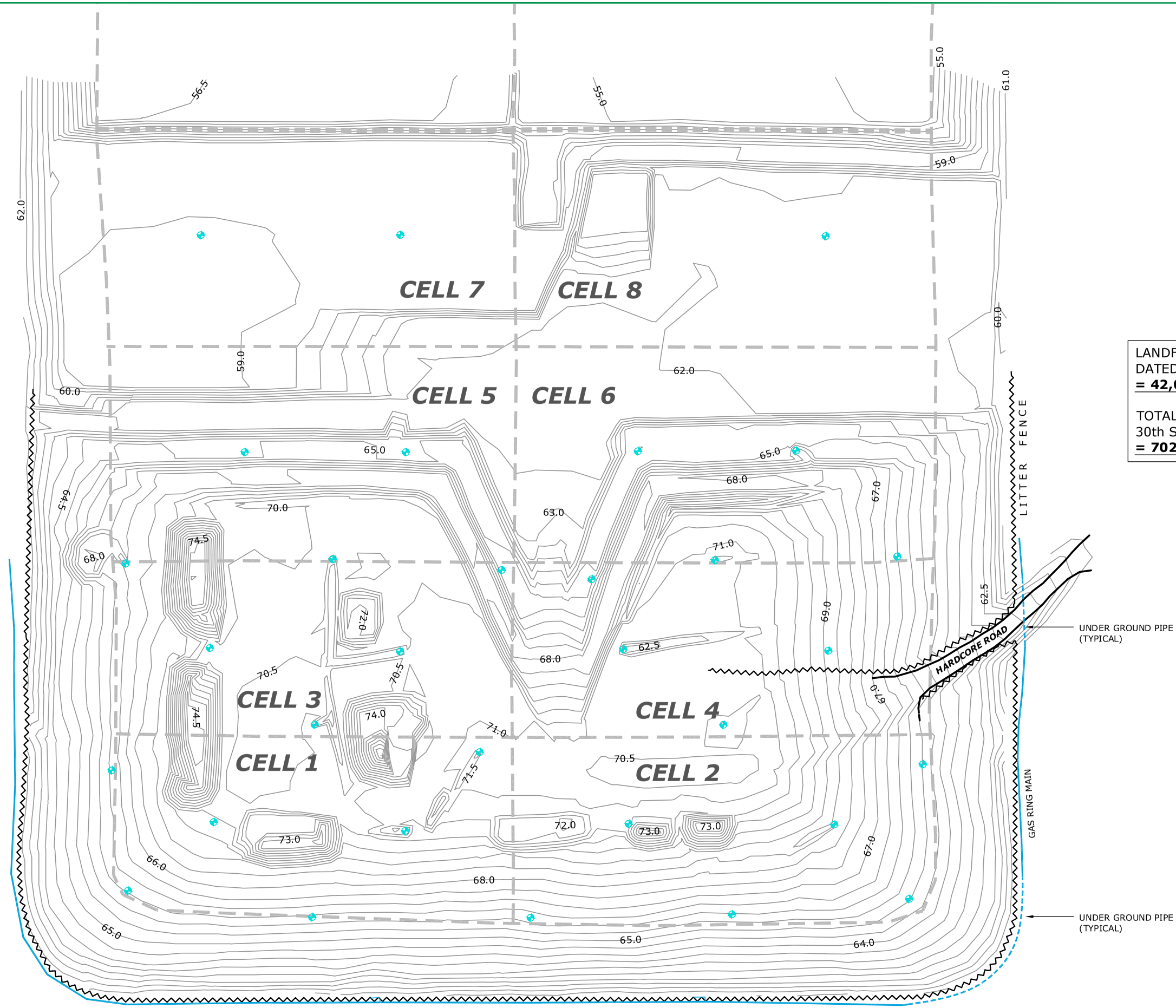
The planting programme was initiated in 2004 and completed in 2005. Approximately 180,000 trees have been planted over 112 acres. Greenstar submitted a landscape proposal to the Planning Authority in December 2002 and to the Agency in March 2005. It is estimated that up to 97% of all trees planted have established. Replacement of failed plants has commenced in January 2006, and 4,500 trees were re-planted in 2008. There is a 3% die-back rate at the facility.

9.3 European Pollutant Release and Transfer Register

Under the European Pollutant Release and Transfer Register Regulation (EC) No. 166/2006 Greenstar are required to submit information annually to the Agency. A copy of the information submitted to the Agency via the web-based data reporting system is included in Appendix 8.

APPENDIX 1

Topographic Survey



LANDFILL VOID CONSUMED BETWEEN SURVEYS DATED 1st JULY 2008 AND 30th SEPTEMBER 2008
= 42,000m3

TOTAL WASTE PLACED TO DRAINAGE STONE ON THE 30th SEPTEMBER 2008
= 702,000m3

Golder Associates
TOWN CENTRE HOUSE, DUBLIN ROAD, NAAS, CO. KILDARE
TEL.: 045 874411 - FAX:045 874549 - www.golder.com

Client: greenstar	Title: WASTE CONDITIONS SURVEYED 30th SEPTEMBER 2008				Project number 05.719.239	Issue to	Date	Revision
Location: KNOCKHARLEY LANDFILL CO. MEATH					File Location GREENSTAR/KNOCKHARLEY/GOLDER DWGS /WS/09/01	TO CLIENT	OCT. '08	A
Project: QUARTERLY WASTE VOLUME SURVEY	Scale 1:600 A1 1:1,200 A3	Created by CC	Engineer TVM	Reviewed by GP	ORDNANCE SURVEY IRELAND LICENCE NUMBER **AR0056008**			

Drawing **W-S 09/1**

APPENDIX 2

Monitoring Results

Groundwater Results

Parameter	Units	MW1d	MW1d	MW1d	MW1d
		Q1	Q2	Q3	Q4
pH	pH units	7.9	7.8	7.81	7.56
Conductivity	mS/cm	0.556	0.573	0.637	0.629
Temperature	°C	10.6	11.7	11.6	8.4
Ammoniacal Nitrogen	mg/l	0.4	<0.3	0.5	0.2
Dissolved Oxygen	mg/l	7.9	2.2	10.8	9
Chloride	mg/l	22	21	30	24
Potassium	mg/l	3.2	4.6	3.2	3.7
Sodium	mg/l	38	49	45.9	40
Iron	mg/l	<0.05	<0.05	2.267	0.01
Total Organic Carbon	mg/l	1.7	0.7	<2	<2
Total Oxidised Nitrogen	mg/l	0.3	<0.3	<0.3	<0.3
Total Phenols	µg/l	<0.005	<0.005	<0.01	<0.01
Mercury	µg/l			<0.05	
Total Solids	mg/l			342	
Total Chromium	mg/l			<0.05	
Total Phosphorous	mg/l			0.11	
Boron	µg/l			38	
Cadmium	µg/l			<0.4	
Calcium	mg/l			56.1	
Copper	µg/l			17	
Lead	µg/l			9	
Magnesium	mg/l			24.12	
Manganese	µg/l			333	
Zinc	µg/l			19	
Fluoride	mg/l			0.4	
Sulphate	mg/l			41	
VOC	µg/l			<5	
SVOC	µg/l			<1	
Pesticides	µg/l			<0.01	
Total Cyanide	mg/l			<0.05	
Total Alkalinity	mg/l			260	
Total Coliforms	/100ml	>100	1	1200	*
Faecal Coliforms	/100ml	>100	3	7	*

* Due to an incorrect incubation period applied by the laboratory results are not available

Parameter	Units	MW2d	MW2d	MW2d	MW2d
		Q1	Q2	Q3	Q4
pH	pH units	7.9	7.6	7.51	7.63
Conductivity	mS/cm	0.592	0.613	0.684	0.676
Temperature	°C	10.9	11.8	11	10.1
Ammoniacal Nitrogen	mg/l	<0.3	<0.3	0.4	<0.2
Dissolved Oxygen	mg/l	1	2.1	9.7	9.2
Chloride	mg/l	16	16	23	18
Potassium	mg/l	2.1	2.9	2.3	2.5
Sodium	mg/l	38	43	41.4	36.7
Iron	mg/l	<0.05	<0.05	0.346	0.004
Total Organic Carbon	mg/l	1.5	1	2	<2
Total Oxidised Nitrogen	mg/l	<0.3	<0.3	<0.3	<0.3
Total Phenols	µg/l	<0.005	<0.005	<0.01	<0.01
Mercury	µg/l			<0.05	
Total Solids	mg/l			401	
Total Chromium	mg/l			<0.05	
Total Phosphorous	mg/l			0.09	
Boron	µg/l			55	
Cadmium	µg/l			<0.4	
Calcium	mg/l			80.3	
Copper	µg/l			4	
Lead	µg/l			5	
Magnesium	mg/l			19.83	
Manganese	µg/l			25680	
Zinc	µg/l			14	
Fluoride	mg/l			0.5	
Sulphate	mg/l			74	
VOC	µg/l			<5	
SVOC	µg/l			<1	
Pesticides	µg/l			<0.01	
Total Cyanide	mg/l			<0.05	
Total Alkalinity	mg/l			240	
Total Coliforms	/100ml	3	0	400	*
Faecal Coliforms	/100ml	1	0	5	*

* Due to an incorrect incubation period applied by the laboratory results are not available

Parameter	Units	MW3d	MW3d	MW3d	MW3d
		Q1	Q2	Q3	Q4
pH	pH units	7.8	7.5	7.47	7.6
Conductivity	mS/cm	0.688	0.696	0.785	0.784
Temperature	°C	10.2	11.5	10.9	10.3
Ammoniacal Nitrogen	mg/l	<0.3	<0.3	0.6	0.7
Dissolved Oxygen	mg/l	2.3	1	10.7	9.3
Chloride	mg/l	21	22	35	25
Potassium	mg/l	2.8	3.9	3.1	3.4
Sodium	mg/l	45	55	53.1	48.3
Iron	mg/l	<0.05	<0.05	1.185	<0.002
Total Organic Carbon	mg/l	1.2	0.8	<2	<2
Total Oxidised Nitrogen	mg/l	<0.3	0.3	<0.3	<0.3
Total Phenols	µg/l	<0.005	<0.005	<0.01	<0.01
Mercury	µg/l			<0.05	
Total Solids	mg/l			1043	
Total Chromium	mg/l			<0.05	
Total Phosphorous	mg/l			0.19	
Boron	µg/l			40	
Cadmium	µg/l			<0.4	
Calcium	mg/l			85.18	
Copper	µg/l			1	
Lead	µg/l			3	
Magnesium	mg/l			21.6	
Manganese	µg/l			144	
Zinc	µg/l			15	
Fluoride	mg/l			0.3	
Sulphate	mg/l			271	
VOC	µg/l			<5	
SVOC	µg/l			<1	
Pesticides	µg/l			<0.01	
Total Cyanide	mg/l			<0.05	
Total Alkalinity	mg/l			200	
Total Coliforms	/100ml	0	0	400	*
Faecal Coliforms	/100ml	0	0	<1	*

* Due to an incorrect incubation period applied by the laboratory results are not available

Parameter	Units	MW5d	MW5d	MW5d	MW5d
		Q1	Q2	Q3	Q4
pH	pH units	7.6	7.6	7.53	7.53
Conductivity	mS/cm	0.547	0.554	0.619	0.621
Temperature	°C	9.8	11.7	11	9
Ammoniacal Nitrogen	mg/l	<0.3	<0.3	0.6	0.4
Dissolved Oxygen	mg/l	1.8	1.6	9.6	9.2
Chloride	mg/l	15	16	24	19
Potassium	mg/l	2.2	2.8	2.2	2.3
Sodium	mg/l	25	29	27.7	25.8
Iron	mg/l	<0.05	<0.05	0.021	<0.002
Total Organic Carbon	mg/l	1.4	2.5	<2	<2
Total Oxidised Nitrogen	mg/l	<0.3	<0.3	<0.3	<0.3
Total Phenols	µg/l	<0.005	<0.005	<0.01	<0.01
Mercury	µg/l			<0.05	
Total Solids	mg/l			274	
Total Chromium	mg/l			<0.05	
Total Phosphorous	mg/l			<0.05	
Boron	µg/l			46	
Cadmium	µg/l			<0.4	
Calcium	mg/l			76.23	
Copper	µg/l			<1	
Lead	µg/l			<1	
Magnesium	mg/l			15.14	
Manganese	µg/l			249	
Zinc	µg/l			5	
Fluoride	mg/l			0.6	
Sulphate	mg/l			19	
VOC	µg/l			<5	
SVOC	µg/l			<1	
Pesticides	µg/l			<0.01	
Total Cyanide	mg/l			<0.05	
Total Alkalinity	mg/l			270	
Total Coliforms	/100ml	0	0	130	*
Faecal Coliforms	/100ml	0	0	13	*

* Due to an incorrect incubation period applied by the laboratory results are not available

Parameter	Units	MW6d	MW6d	MW6d	MW6d
		Q1	Q2	Q3	Q4
pH	pH units	7.6	7.6	7.32	7.57
Conductivity	mS/cm	0.569	0.558	0.723	0.663
Temperature	°C	10.9	13.1	11.2	10.1
Ammoniacal Nitrogen	mg/l	<0.3	<0.3	0.9	0.8
Dissolved Oxygen	mg/l	1.8	<0.5	9.9	9.1
Chloride	mg/l	12	15	14	14
Potassium	mg/l	3.5	6.3	2.9	2.8
Sodium	mg/l	27	36	19	21.6
Iron	mg/l	<0.05	0.15	0.866	0.005
Total Organic Carbon	mg/l	0.7	3.4	3	2
Total Oxidised Nitrogen	mg/l	0.4	<0.3	<0.3	<0.3
Total Phenols	µg/l	<0.005	<0.005	<0.01	<0.01
Mercury	µg/l			<0.05	
Total Solids	mg/l			4319	
Total Chromium	mg/l			0.06	
Total Phosphorous	mg/l			1.87	
Boron	µg/l			34	
Cadmium	µg/l			<0.4	
Calcium	mg/l			99.23	
Copper	µg/l			2	
Lead	µg/l			2	
Magnesium	mg/l			23.43	
Manganese	µg/l			504	
Zinc	µg/l			5	
Fluoride	mg/l			0.2	
Sulphate	mg/l			43	
VOC	µg/l			<5	
SVOC	µg/l			<1	
Pesticides	µg/l			<0.01	
Total Cyanide	mg/l			<0.05	
Total Alkalinity	mg/l			330	
Total Coliforms	/100ml	0	>100	1300	*
Faecal Coliforms	/100ml	0	390	5	*

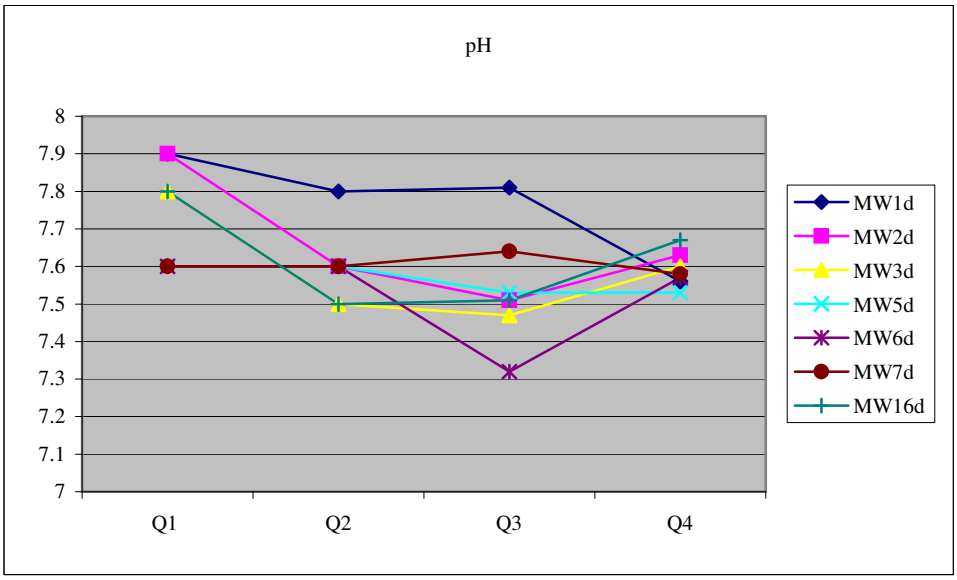
* Due to an incorrect incubation period applied by the laboratory results are not available

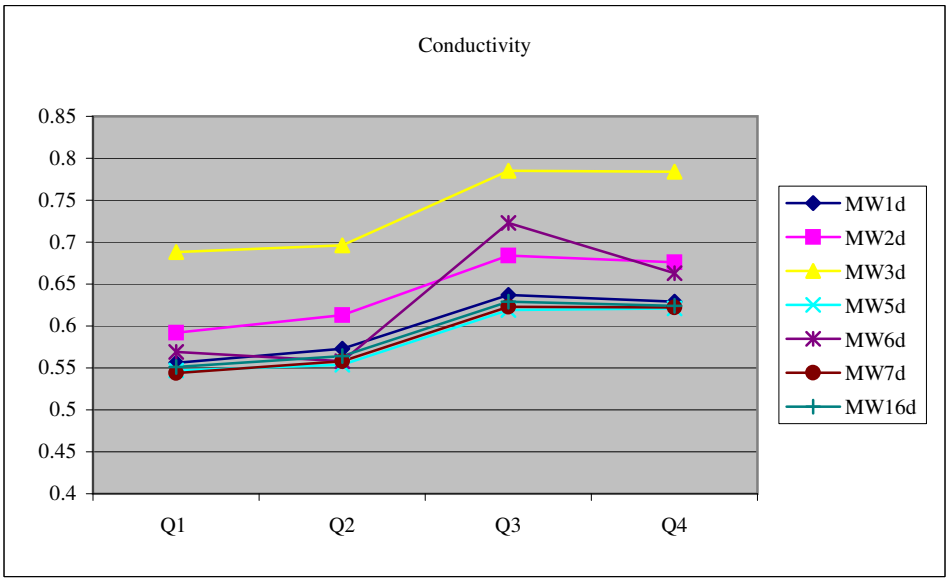
Parameter	Units	MW7d	MW7d	MW7d	MW7d
		Q1	Q2	Q3	Q4
pH	pH units	7.6	7.6	7.64	7.58
Conductivity	mS/cm	0.544	0.558	0.623	0.622
Temperature	°C	10.8	13.3	10.9	9.9
Ammoniacal Nitrogen	mg/l	<0.3	<0.3	0.5	0.5
Dissolved Oxygen	mg/l	2.3	2	10.7	8.8
Chloride	mg/l	13	14	20	16
Potassium	mg/l	2.4	3.2	2.9	3.1
Sodium	mg/l	52	67	59.5	55.5
Iron	mg/l	<0.05	<0.05	0.156	0.01
Total Organic Carbon	mg/l	0.7	2.4	<2	<2
Total Oxidised Nitrogen	mg/l	0.3	<0.3	<0.3	<0.3
Total Phenols	µg/l	<0.005	<0.005	<0.01	<0.01
Mercury	µg/l			<0.05	
Total Solids	mg/l			390	
Total Chromium	mg/l			<0.05	
Total Phosphorous	mg/l			<0.05	
Boron	µg/l			45	
Cadmium	µg/l			<0.4	
Calcium	mg/l			56.64	
Copper	µg/l			6	
Lead	µg/l			2	
Magnesium	mg/l			15.78	
Manganese	µg/l			481	
Zinc	µg/l			36	
Fluoride	mg/l			0.2	
Sulphate	mg/l			57	
VOC	µg/l			<5	
SVOC	µg/l			<1	
Pesticides	µg/l			<0.01	
Total Cyanide	mg/l			<0.05	
Total Alkalinity	mg/l			270	
Total Coliforms	/100ml	4	32	4400	*
Faecal Coliforms	/100ml	1	4	60	*

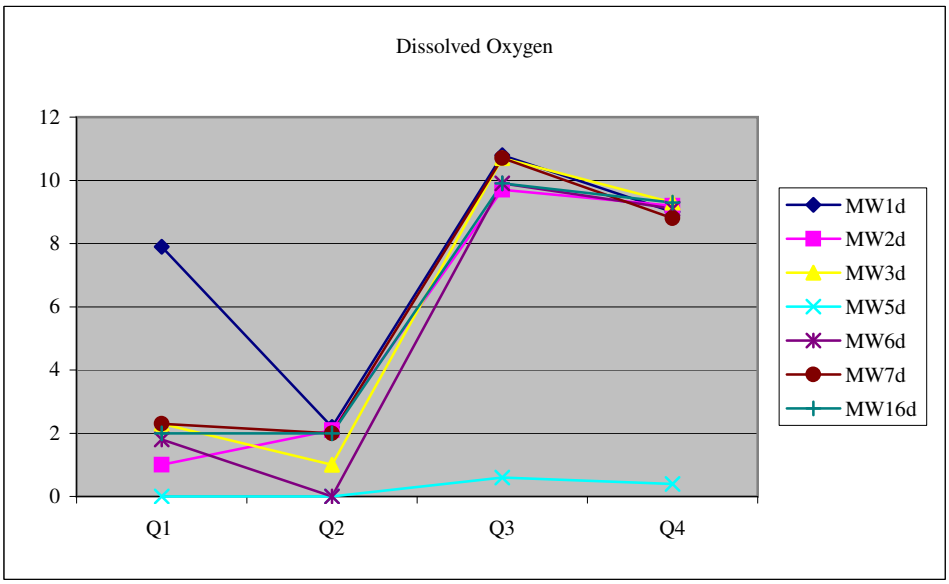
* Due to an incorrect incubation period applied by the laboratory results are not available

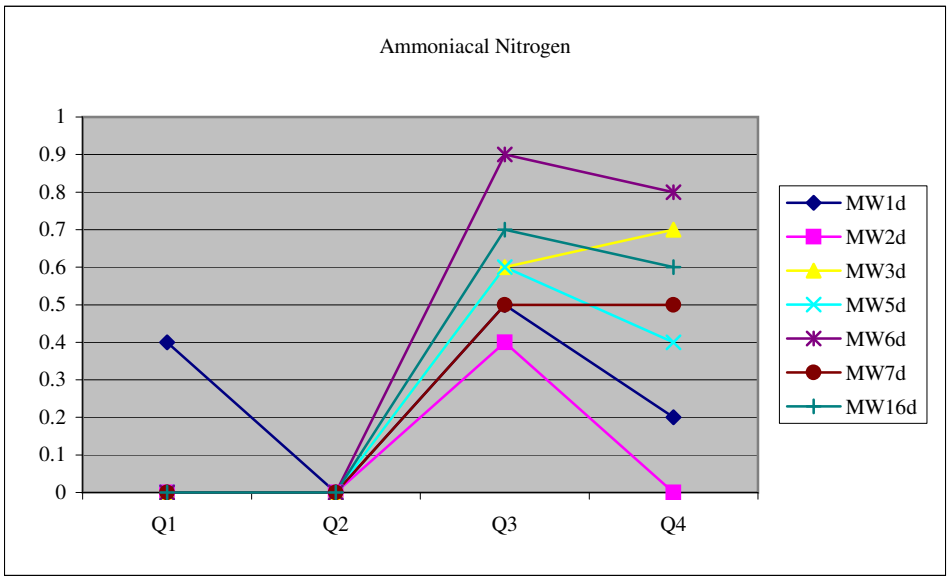
Parameter	Units	MW16d	MW16d	MW16d	MW16d
		Q1	Q2	Q3	Q4
pH	pH units	7.8	7.5	7.51	7.67
Conductivity	mS/cm	0.551	0.564	0.629	0.624
Temperature	°C	10.9	12	11.2	8.4
Ammoniacal Nitrogen	mg/l	<0.3	<0.3	0.7	0.6
Dissolved Oxygen	mg/l	2	2	9.9	9.3
Chloride	mg/l	15	15	22	18
Potassium	mg/l	2.3	3.1	2.6	2.8
Sodium	mg/l	25	30	28.2	25.9
Iron	mg/l	<0.05	<0.05	<0.002	<0.002
Total Organic Carbon	mg/l	1.3	1.5	<2	<2
Total Oxidised Nitrogen	mg/l	<0.3	<0.3	<0.3	<0.3
Total Phenols	µg/l	<0.005	<0.005	<0.01	<0.01
Mercury	µg/l			<0.05	
Total Solids	mg/l			348	
Total Chromium	mg/l			<0.05	
Total Phosphorous	mg/l			<0.05	
Boron	µg/l			54	
Cadmium	µg/l			<0.4	
Calcium	mg/l			82.61	
Copper	µg/l			<1	
Lead	µg/l			<1	
Magnesium	mg/l			17.21	
Manganese	µg/l			241	
Zinc	µg/l			7	
Fluoride	mg/l			0.5	
Sulphate	mg/l			30	
VOC	µg/l			<5	
SVOC	µg/l			<1	
Pesticides	µg/l			<0.01	
Total Cyanide	mg/l			<0.05	
Total Alkalinity	mg/l			270	
Total Coliforms	/100ml	0	1	100	*
Faecal Coliforms	/100ml	0	0	1	*

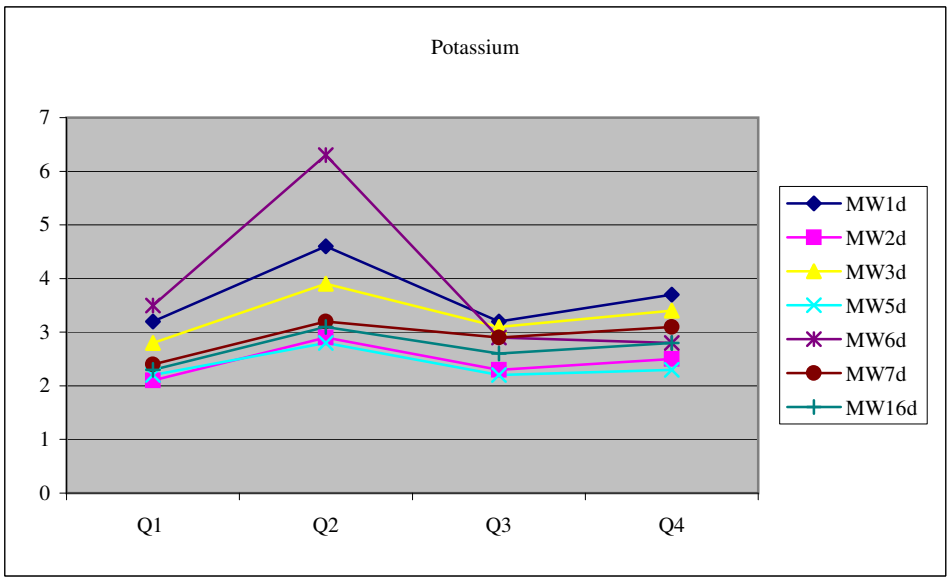
* Due to an incorrect incubation period applied by the laboratory results are not available

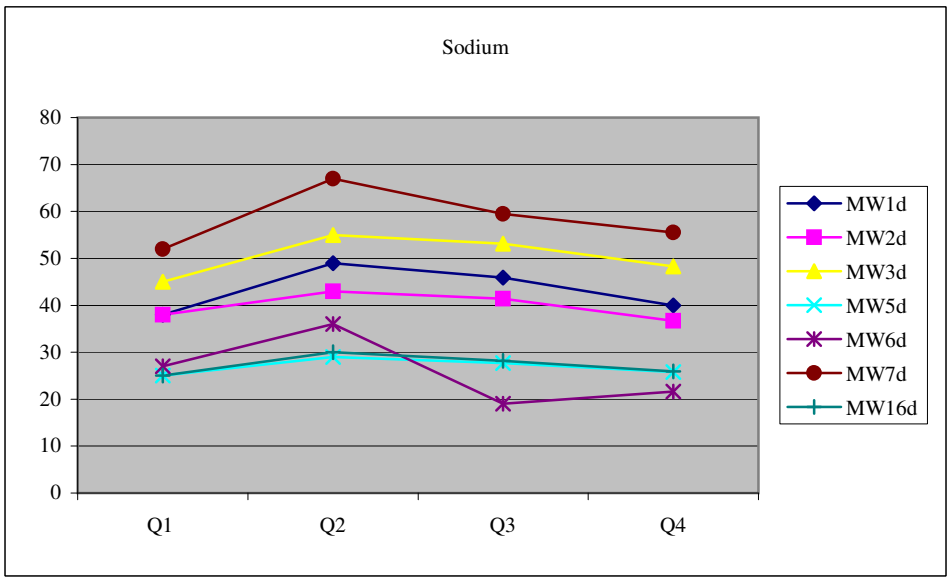

pH
8
7.9
7.8
7.7
7.6
7.5
7.4
7.3
7.2
7.1
7
Q1
Q2
Q3
Q4
MW1d
MW2d
MW3d
MW5d
MW6d
MW7d
MW16d

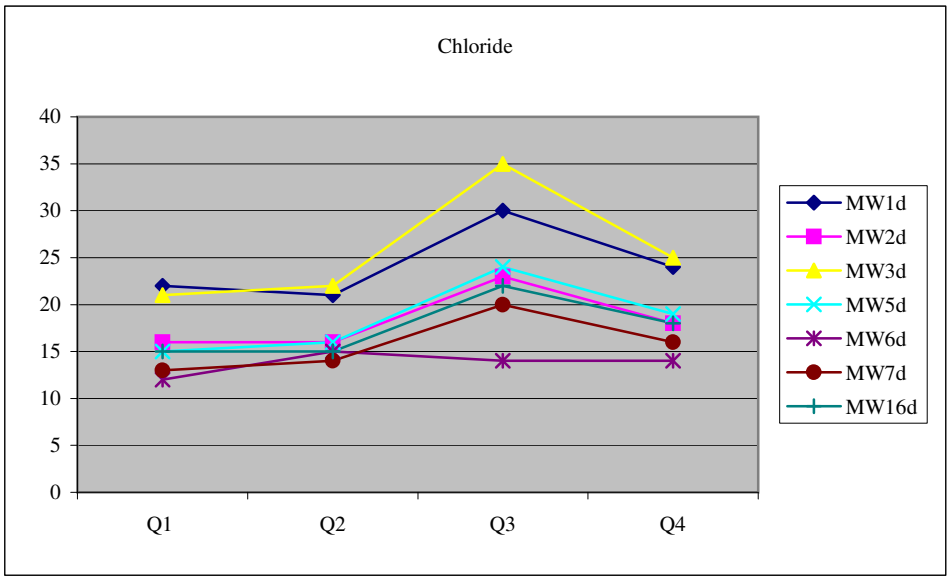

Conductivity
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
Q1
Q2
Q3
Q4
MW1d
MW2d
MW3d
MW5d
MW6d
MW7d
MW16d

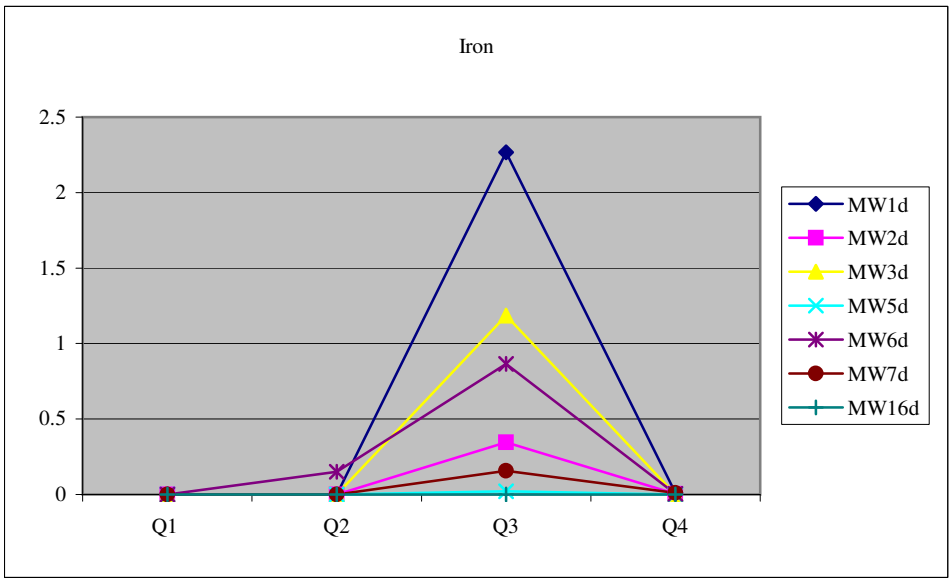

Dissolved Oxygen
12
10
8
6
4
2
0
Q1
Q2
Q3
Q4
MW1d
MW2d
MW3d
MW5d
MW6d
MW7d
MW16d

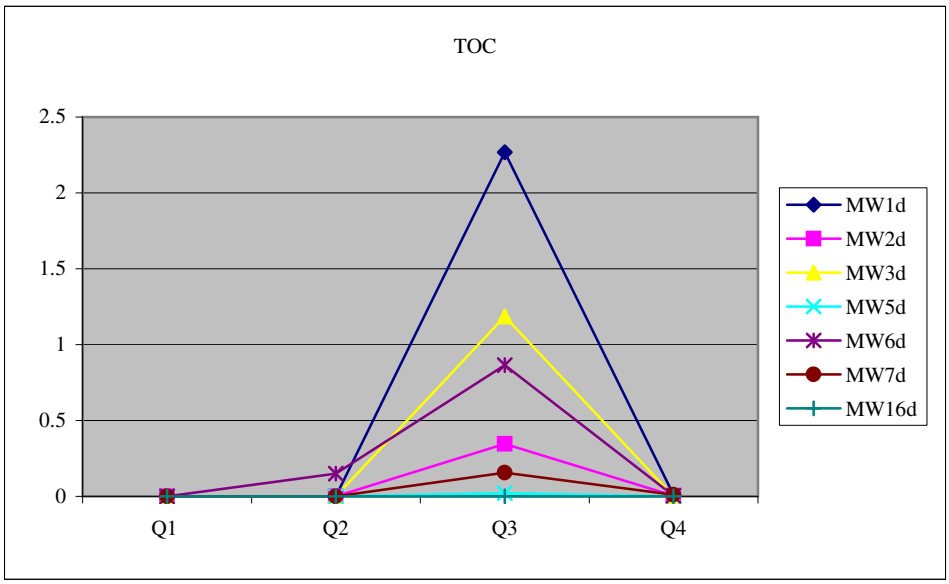

Ammoniacal Nitrogen
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Q1
Q2
Q3
Q4
MW1d
MW2d
MW3d
MW5d
MW6d
MW7d
MW16d

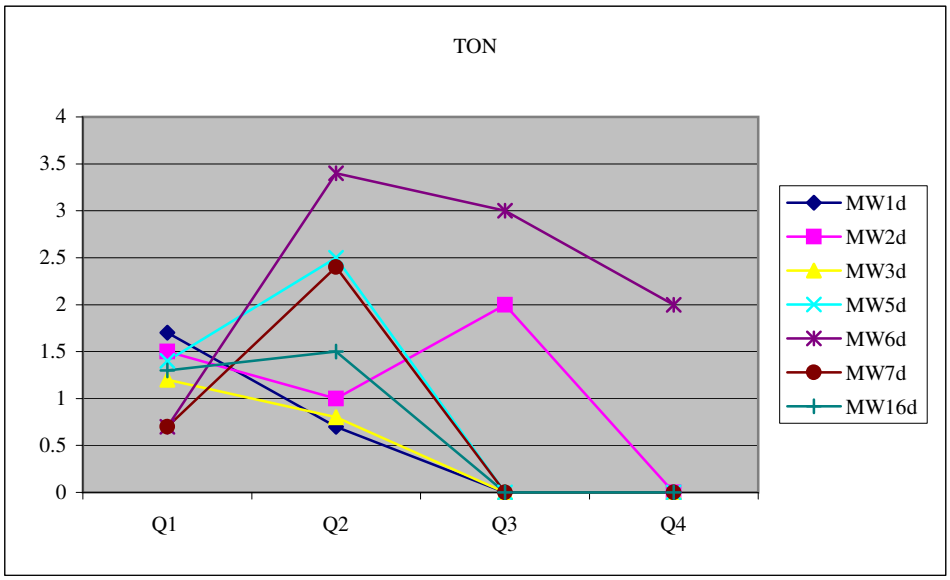

Potassium
7
6
5
4
3
2
1
0
Q1
Q2
Q3
Q4
MW1d
MW2d
MW3d
MW5d
MW6d
MW7d
MW16d

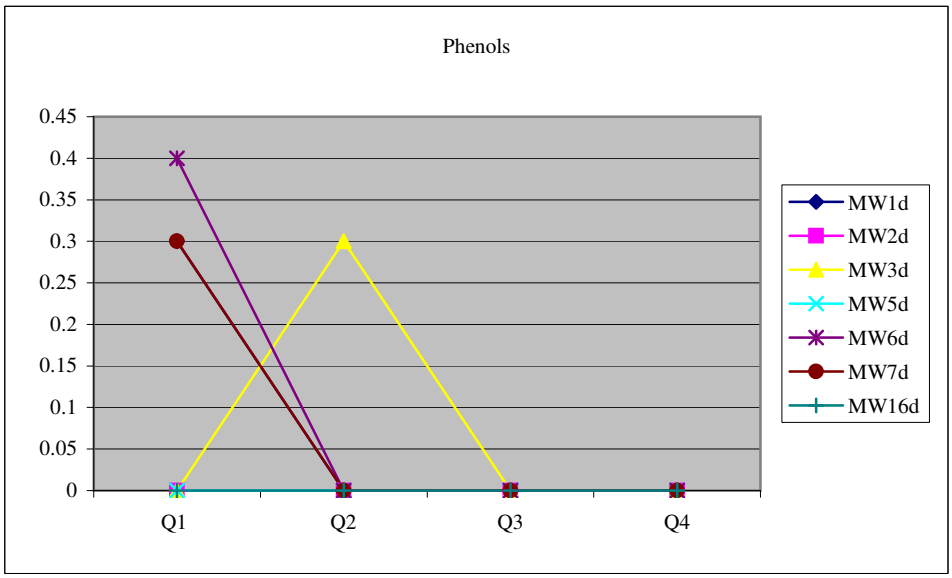

Sodium
80
70
60
50
40
30
20
10
0
Q1
Q2
Q3
Q4
MW1d
MW2d
MW3d
MW5d
MW6d
MW7d
MW16d

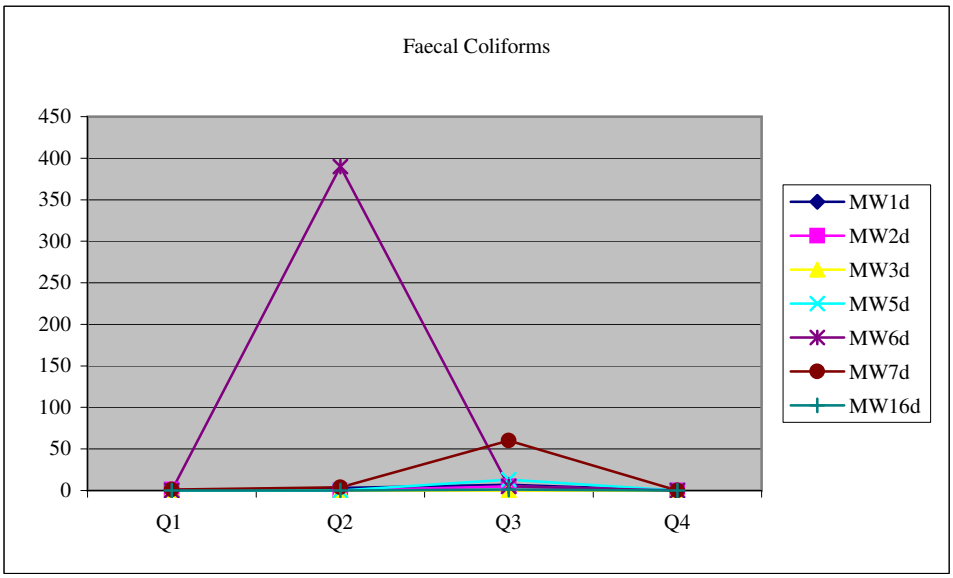

Chloride
40
35
30
25
20
15
10
5
0
Q1
Q2
Q3
Q4
MW1d
MW2d
MW3d
MW5d
MW6d
MW7d
MW16d

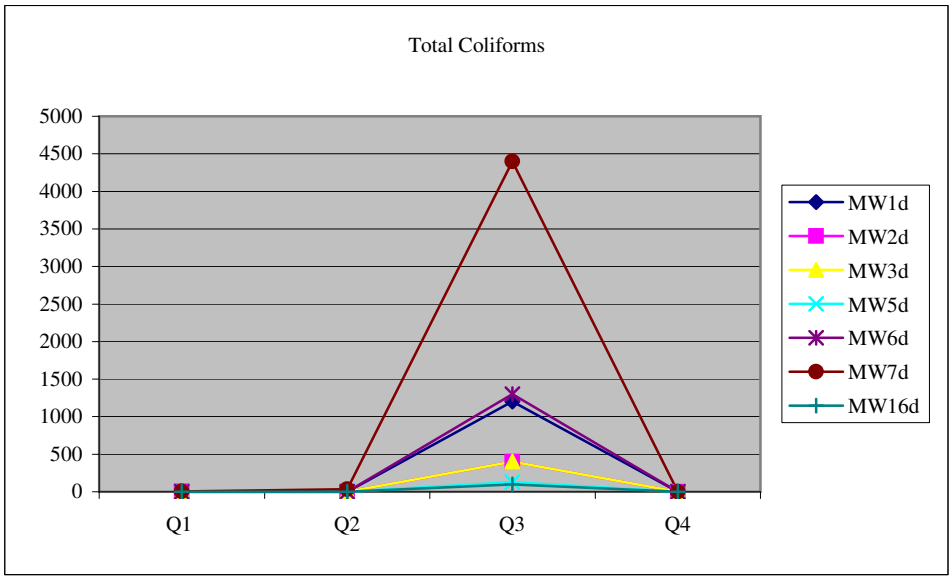

Iron
2.5
2
1.5
1
0.5
0
Q1
Q2
Q3
Q4
MW1d
MW2d
MW3d
MW5d
MW6d
MW7d
MW16d


TOC
2.5
2
1.5
1
0.5
0
Q1
Q2
Q3
Q4
MW1d
MW2d
MW3d
MW5d
MW6d
MW7d
MW16d


TON
4
3.5
3
2.5
2
1.5
1
0.5
0
Q1
Q2
Q3
Q4
MW1d
MW2d
MW3d
MW5d
MW6d
MW7d
MW16d


Phenols
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Q1
Q2
Q3
Q4
MW1d
MW2d
MW3d
MW5d
MW6d
MW7d
MW16d


Faecal Coliforms
450
400
350
300
250
200
150
100
50
0
Q1
Q2
Q3
Q4
MW1d
MW2d
MW3d
MW5d
MW6d
MW7d
MW16d


Total Coliforms
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Q1
Q2
Q3
Q4
MW1d
MW2d
MW3d
MW5d
MW6d
MW7d
MW16d

Surface Water Results

Parameter	Units	SW1	SW1	SW1	SW1
		Q1	Q2	Q3	Q4
pH	pH units	8.1	8	8.13	8.02
Conductivity	mS/cm	0.47	0.578	0.626	0.682
Temperature	°C	5	15.1	13.7	8.5
Ammoniacal Nitrogen	mg/l	1.8	<0.3		<0.2
Dissolved Oxygen	mg/l	3.3	3.8	10.2	8.2
Chloride	mg/l	17	24	22	32
Total Suspended Solids	mg/l	10	14	<10	<10
BOD	mg/l	<1	<1	<2	5
COD	mg/l	26	20	27	32
Potassium	mg/l				6.8
Sodium	mg/l				15.1
Total Oxidised Nitrogen	mg/l				2.6
Calcium	mg/l				106.8
Cadmium	µg/l				<0.4
Chromium	mg/l				<0.05
Copper	µg/l				4
Iron	µg/l				30
Lead	µg/l				<1
Magnesium	mg/l				7.838
Manganese	µg/l				<1
Mercury	µg/l				<0.05
Sulphate	mg/l				17
Zinc	µg/l				13
Total Alkalinity	mg/l				340
Total Phosphorous	mg/l				0.28

Parameter	Units	SW2	SW2	SW2	SW2
		Q1	Q2	Q3	Q4
pH	pH units	7.7	7.8	7.64	8
Conductivity	mS/cm	0.435	0.571	0.591	0.622
Temperature	°C	4.7	14.7	14.1	8.5
Ammoniacal Nitrogen	mg/l	1.3	<0.3		<0.2
Dissolved Oxygen	mg/l	2.1	5.6	10	9.1
Chloride	mg/l	13	25	14	20
Total Suspended Solids	mg/l	11	18	<10	<10
BOD	mg/l	<1	3	<2	4
COD	mg/l	20	<20	<15	18
Potassium	mg/l				4.4
Sodium	mg/l				10.8
Total Oxidised Nitrogen	mg/l				1.8
Calcium	mg/l				103.4
Cadmium	µg/l				<0.4
Chromium	mg/l				<0.05
Copper	µg/l				3
Iron	µg/l				27
Lead	µg/l				<1
Magnesium	mg/l				7.481
Manganese	µg/l				1
Mercury	µg/l				<0.05
Sulphate	mg/l				17
Zinc	µg/l				12
Total Alkalinity	mg/l				320
Total Phosphorous	mg/l				<0.05

Parameter	Units	SW3	SW3	SW3	SW3
		Q1	Q2	Q3	Q4
pH	pH units	7.8	7.7	7.75	7.9
Conductivity	mS/cm	0.436	0.582	0.584	0.674
Temperature	°C	4.7	15.1	14.5	8.9
Ammoniacal Nitrogen	mg/l	1.1	<0.3		<0.2
Dissolved Oxygen	mg/l	2.9	3.5	9.8	8.9
Chloride	mg/l	17	27	19	21
Total Suspended Solids	mg/l	17	12	11	<10
BOD	mg/l	3	3	<2	<2
COD	mg/l	39	<20	38	<15
Potassium	mg/l				4.1
Sodium	mg/l				12.2
Total Oxidised Nitrogen	mg/l				1.5
Calcium	mg/l				112
Cadmium	µg/l				<0.4
Chromium	mg/l				<0.05
Copper	µg/l				2
Iron	µg/l				18
Lead	µg/l				<1
Magnesium	mg/l				8.356
Manganese	µg/l				1
Mercury	µg/l				<0.05
Sulphate	mg/l				18
Zinc	µg/l				13
Total Alkalinity	mg/l				320
Total Phosphorous	mg/l				0.18

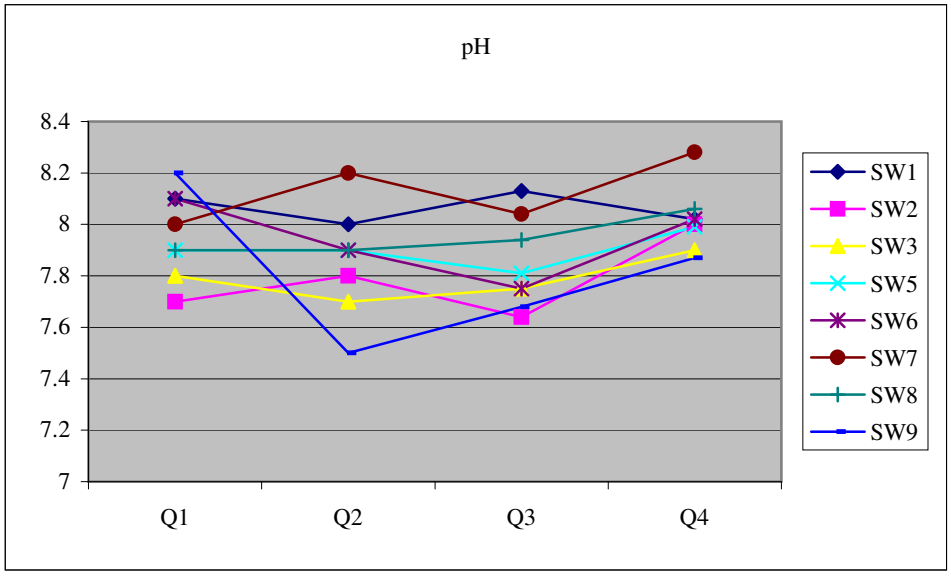
Parameter	Units	SW5	SW5	SW5	SW5
		Q1	Q2	Q3	Q4
pH	pH units	7.9	7.9	7.81	7.99
Conductivity	mS/cm	0.43	0.587	0.599	0.69
Temperature	°C	5	15	14.6	8.7
Ammoniacal Nitrogen	mg/l	1.3	<0.3		<0.2
Dissolved Oxygen	mg/l	2.9	3.3	9.6	9.2
Chloride	mg/l	17	25	19	23
Total Suspended Solids	mg/l	15	2	10	<10
BOD	mg/l	<1	1	<2	<2
COD	mg/l	29	21	33	<15
Potassium	mg/l				4.1
Sodium	mg/l				12.6
Total Oxidised Nitrogen	mg/l				1.3
Calcium	mg/l				118.4
Cadmium	µg/l				<0.4
Chromium	mg/l				<0.05
Copper	µg/l				2
Iron	µg/l				18
Lead	µg/l				<1
Magnesium	mg/l				8.632
Manganese	µg/l				4
Mercury	µg/l				<0.05
Sulphate	mg/l				18
Zinc	µg/l				12
Total Alkalinity	mg/l				330
Total Phosphorous	mg/l				0.23

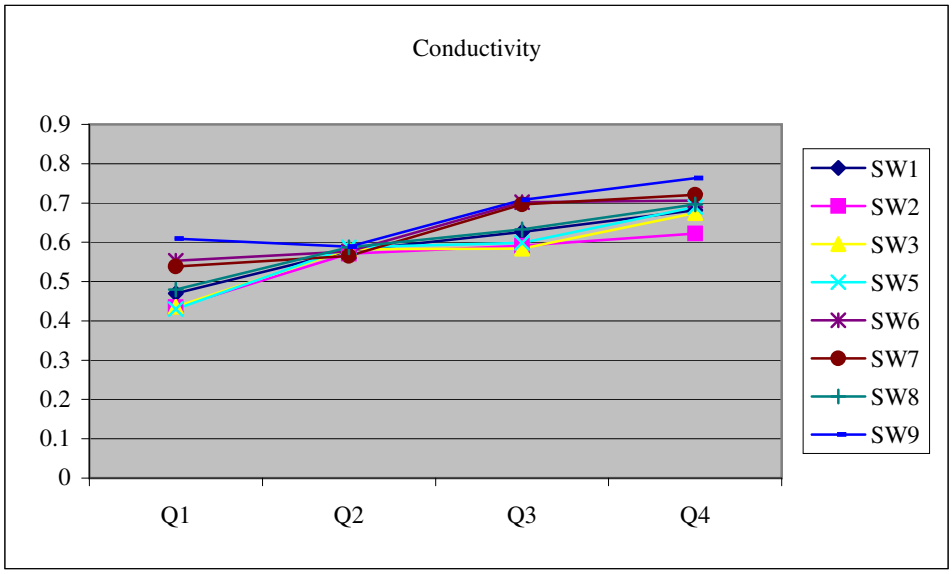
Parameter	Units	SW6	SW6	SW6	SW6
		Q1	Q2	Q3	Q4
pH	pH units	8.1	7.9	7.75	8.02
Conductivity	mS/cm	0.553	0.577	0.702	0.706
Temperature	°C	4.5	13.9	15.8	8.1
Ammoniacal Nitrogen	mg/l	0.9	<0.3		<0.2
Dissolved Oxygen	mg/l	2.8	4.9	9.7	9
Chloride	mg/l	14	23	14	18
Total Suspended Solids	mg/l	25	11	<10	<10
BOD	mg/l	1	<1	2	<2
COD	mg/l	37	<20	<15	18
Potassium	mg/l				3.6
Sodium	mg/l				10.6
Total Oxidised Nitrogen	mg/l				1
Calcium	mg/l				116.9
Cadmium	µg/l				<0.4
Chromium	mg/l				<0.05
Copper	µg/l				2
Iron	µg/l				11
Lead	µg/l				<1
Magnesium	mg/l				9.825
Manganese	µg/l				1
Mercury	µg/l				<0.05
Sulphate	mg/l				65
Zinc	µg/l				11
Total Alkalinity	mg/l				290
Total Phosphorous	mg/l				0.12

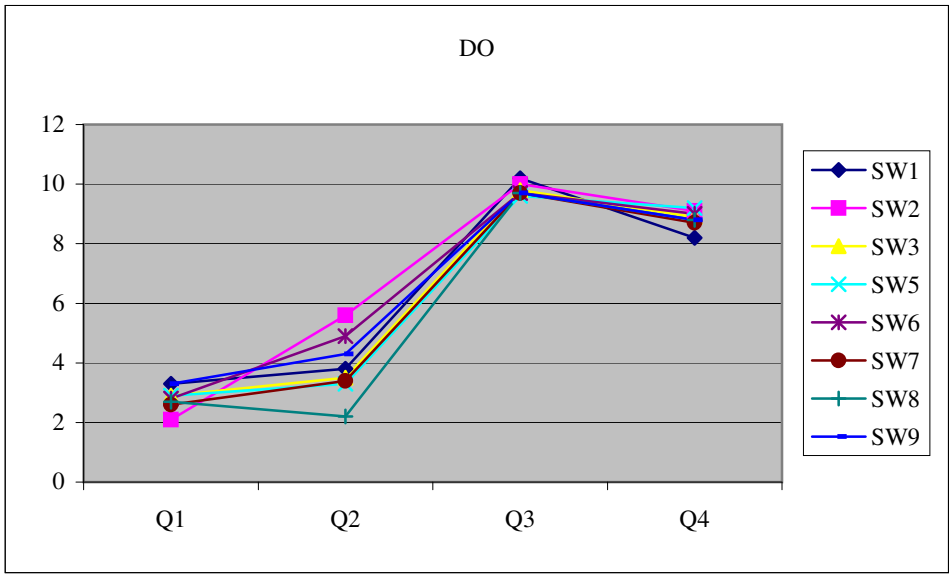
Parameter	Units	SW7	SW7	SW7	SW7
		Q1	Q2	Q3	Q4
pH	pH units	8	8.2	8.04	8.28
Conductivity	mS/cm	0.538	0.565	0.696	0.721
Temperature	°C	4.6	14	14.6	8.2
Ammoniacal Nitrogen	mg/l	0.8	<0.3		0.9
Dissolved Oxygen	mg/l	2.6	3.4	9.7	8.7
Chloride	mg/l	21	23	25	27
Total Suspended Solids	mg/l	15	2	10	10
BOD	mg/l	<1	<1	<2	<2
COD	mg/l	26	<20	21	<15
Potassium	mg/l				6.9
Sodium	mg/l				10.4
Total Oxidised Nitrogen	mg/l				3.3
Calcium	mg/l				115.1
Cadmium	µg/l				<0.4
Chromium	mg/l				<0.05
Copper	µg/l				6
Iron	µg/l				25
Lead	µg/l				<1
Magnesium	mg/l				11.05
Manganese	µg/l				1
Mercury	µg/l				<0.05
Sulphate	mg/l				15
Zinc	µg/l				12
Total Alkalinity	mg/l				370
Total Phosphorous	mg/l				0.5

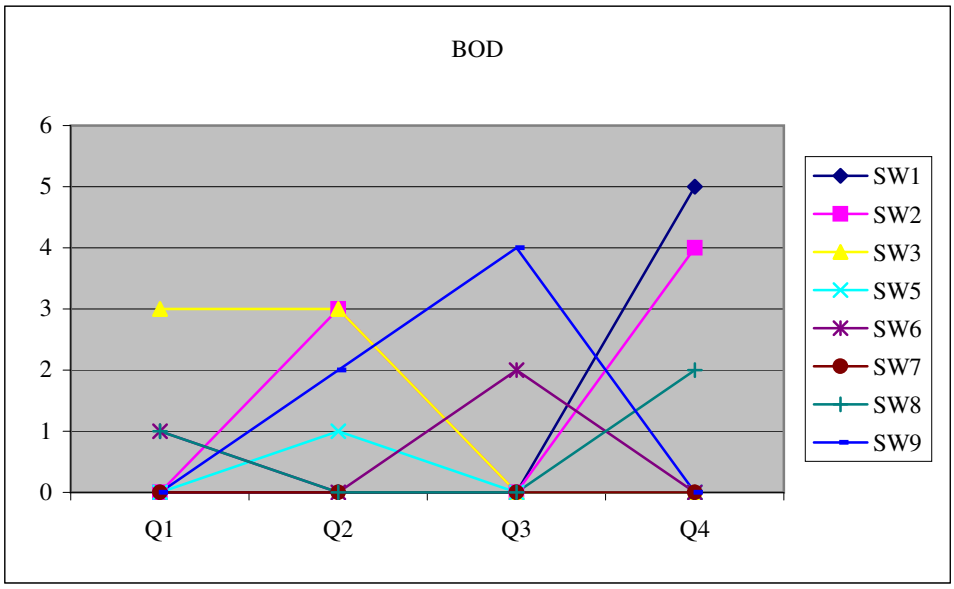
Parameter	Units	SW8	SW8	SW8	SW8
		Q1	Q2	Q3	Q4
pH	pH units	7.9	7.9	7.94	8.06
Conductivity	mS/cm	0.48	0.587	0.633	0.696
Temperature	°C	4.5	15.2	14.6	8.9
Ammoniacal Nitrogen	mg/l	0.6	<0.3		0.2
Dissolved Oxygen	mg/l	2.7	2.2	9.7	8.8
Chloride	mg/l	17	25	20	23
Total Suspended Solids	mg/l	19	8	22	<10
BOD	mg/l	1	<1	<2	2
COD	mg/l	30	25	29	<15
Potassium	mg/l				4.4
Sodium	mg/l				11.2
Total Oxidised Nitrogen	mg/l				1.6
Calcium	mg/l				114.7
Cadmium	µg/l				<0.4
Chromium	mg/l				<0.05
Copper	µg/l				2
Iron	µg/l				24
Lead	µg/l				<1
Magnesium	mg/l				9.882
Manganese	µg/l				<1
Mercury	µg/l				<0.05
Sulphate	mg/l				23
Zinc	µg/l				11
Total Alkalinity	mg/l				330
Total Phosphorous	mg/l				0.23

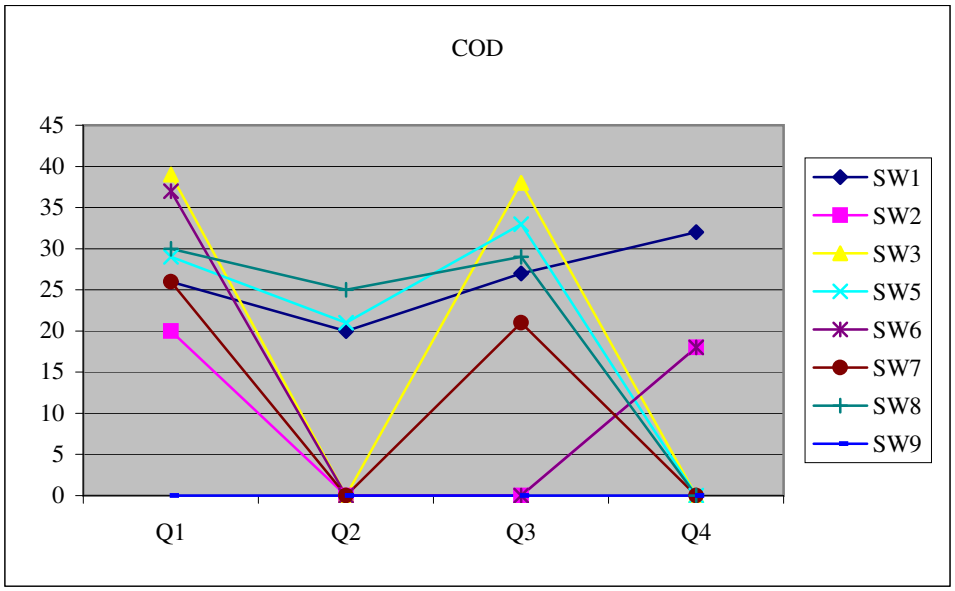
Parameter	Units	SW9	SW9	SW9	SW9
		Q1	Q2	Q3	Q4
pH	pH units	8.2	7.5	7.68	7.87
Conductivity	mS/cm	0.609	0.589	0.708	0.763
Temperature	°C	4.8	20	17.5	8
Ammoniacal Nitrogen	mg/l	0.6	<0.3		<0.2
Dissolved Oxygen	mg/l	3.3	4.3	9.7	8.8
Chloride	mg/l	12	10	14	10
Total Suspended Solids	mg/l	15	35	<10	<10
BOD	mg/l	<1	2	4	<2
COD	mg/l	<20	<20	<15	<15
Potassium	mg/l				2.9
Sodium	mg/l				8.6
Total Oxidised Nitrogen	mg/l				<0.3
Calcium	mg/l				124
Cadmium	µg/l				<0.4
Chromium	mg/l				<0.05
Copper	µg/l				3
Iron	µg/l				11
Lead	µg/l				<1
Magnesium	mg/l				14.76
Manganese	µg/l				<1
Mercury	µg/l				<0.05
Sulphate	mg/l				238
Zinc	µg/l				10
Total Alkalinity	mg/l				180
Total Phosphorous	mg/l				<0.05

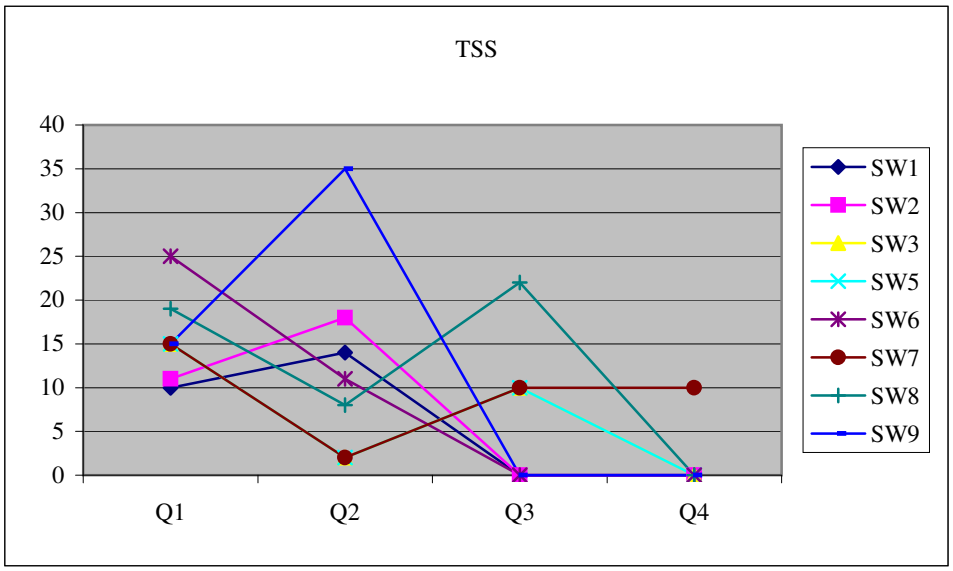

pH
8.4
8.2
8
7.8
7.6
7.4
7.2
7
Q1
Q2
Q3
Q4
SW1
SW2
SW3
SW5
SW6
SW7
SW8
SW9

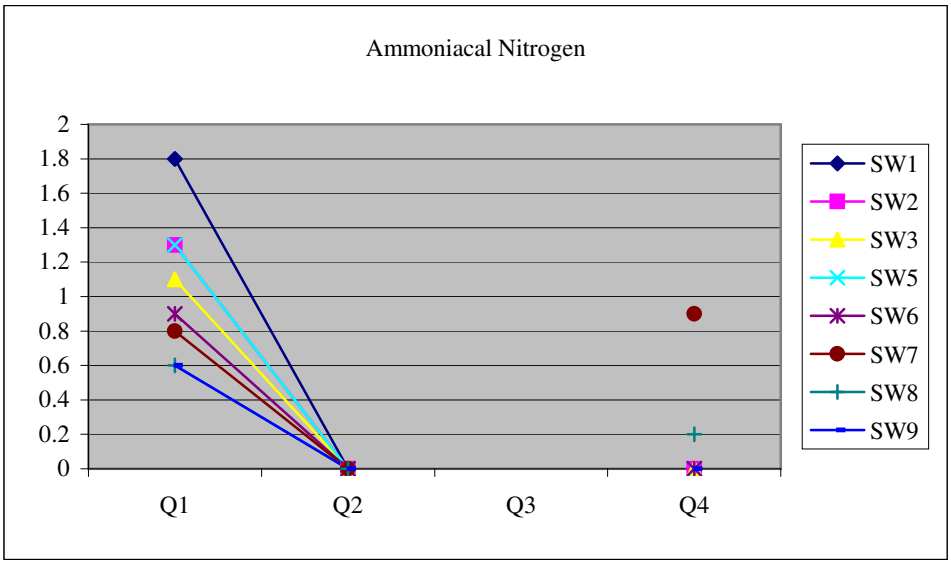

Conductivity
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Q1
Q2
Q3
Q4
SW1
SW2
SW3
SW5
SW6
SW7
SW8
SW9

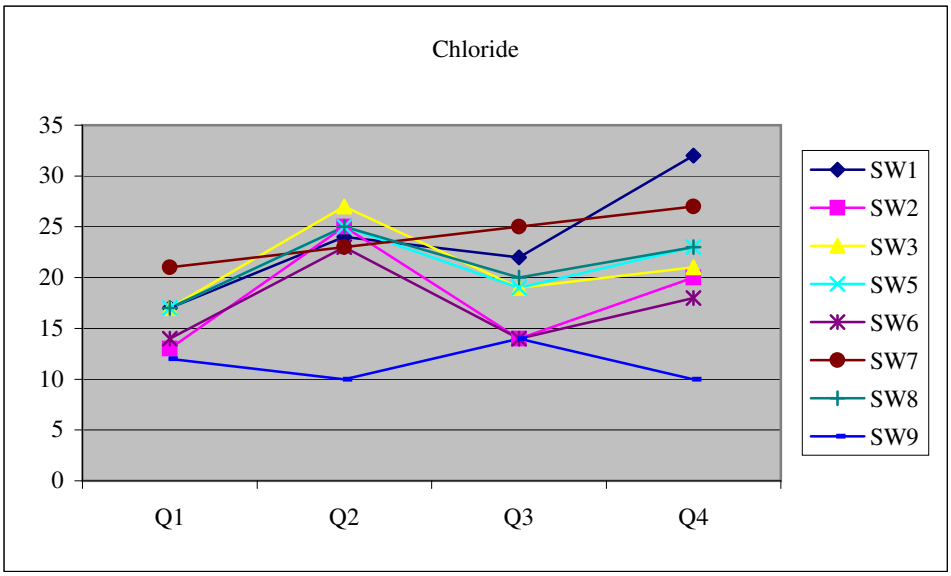

DO
12
10
8
6
4
2
0
Q1
Q2
Q3
Q4
SW1
SW2
SW3
SW5
SW6
SW7
SW8
SW9


BOD
6
5
4
3
2
1
0
Q1
Q2
Q3
Q4
SW1
SW2
SW3
SW5
SW6
SW7
SW8
SW9


COD
45
40
35
30
25
20
15
10
5
0
Q1
Q2
Q3
Q4
SW1
SW2
SW3
SW5
SW6
SW7
SW8
SW9


TSS
40
35
30
25
20
15
10
5
0
Q1
Q2
Q3
Q4
SW1
SW2
SW3
SW5
SW6
SW7
SW8
SW9


Ammoniacal Nitrogen
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Q1
Q2
Q3
Q4
SW1
SW2
SW3
SW5
SW6
SW7
SW8
SW9


Chloride
35
30
25
20
15
10
5
0
Q1
Q2
Q3
Q4
SW1
SW2
SW3
SW5
SW6
SW7
SW8
SW9

Leachate Results

Parameter	Units	LE1	LE1	LE1	LE1
		Q1	Q2	Q3	Q4
pH	pH units	7.33	7.9	7.4	7.7
Conductivity	mS/cm	10.5	12.5	10.4	14.5
Ammoniacal Nitrogen	mg/l	607	994	765	1354.4
Chloride	mg/l	1272	1660	1150	1889
Total Oxidised Nitrogen	mg/l	<0.3	<0.3	*	5.4
BOD	mg/l	2020	127	305	932
COD	mg/l	4065	1740	1760	3030
Mercury	µg/l				NDP
Sodium	mg/l				1651
Potassium	mg/l				692.1
Total Phosphorous	mg/l				4.84
Boron	mg/l				4.229
Cadmium	µg/l				<0.4
Calcium	mg/l				284.5
Chromium	µg/l				226
Copper	µg/l				26
Iron	mg/l				32
Lead	µg/l				<1
Magnesium	mg/l				749.2
Manganese	mg/l				126
Zinc	µg/l				3
Fluoride	mg/l				5.9
Sulphate	mg/l				304
Total Cyanide	mg/l				<0.05
OrthoPhosphate	mg/l				12.07
Total Alkalinity	mg/l				5200
Faecal Coliforms	cfu/100ml				200
Total Coliforms	cfu/100ml				200

* It was not possible to analyse for TON due to interference from the sample matrix.

Parameter	Units	LE2	LE2	LE2	LE2
		Q1	Q2	Q3	Q4
pH	pH units	7.45	7.6	7.6	7.7
Conductivity	mS/cm	11	10.5	10.3	11
Ammoniacal Nitrogen	mg/l	606.7	769	759	810.9
Chloride	mg/l	1222	1550	1210	1226
Total Oxidised Nitrogen	mg/l	<0.3	<0.3	*	5.4
BOD	mg/l	2029	129	160	205
COD	mg/l	4140	1370	1620	1744
Mercury	µg/l				NDP
Sodium	mg/l				1127
Potassium	mg/l				518.6
Total Phosphorous	mg/l				4.45
Boron	mg/l				NDP
Cadmium	µg/l				NDP
Calcium	mg/l				NDP
Chromium	µg/l				208
Copper	µg/l				5
Iron	mg/l				NDP
Lead	µg/l				NDP
Magnesium	mg/l				NDP
Manganese	mg/l				NDP
Zinc	µg/l				NDP
Fluoride	mg/l				4
Sulphate	mg/l				642
Total Cyanide	mg/l				<0.05
OrthoPhosphate	mg/l				12.62
Total Alkalinity	mg/l				3720
Faecal Coliforms	cfu/100ml				<1
Total Coliforms	cfu/100ml				2500

* It was not possible to analyse for TON due to interference from the sample matrix.

Parameter	Units	LE3	LE3	LE3	LE3
		Q1	Q2	Q3	Q4
pH	pH units	7.38	7.7	7.6	7.86
Conductivity	mS/cm	11	11.8	10.7	18.5
Ammoniacal Nitrogen	mg/l	646.2	871	810	1606.6
Chloride	mg/l	1281	1590	1160	2208
Total Oxidised Nitrogen	mg/l	<0.3	<0.3	*	5.5
BOD	mg/l	1990	152	288	152
COD	mg/l	4020	1660	1840	3226
Mercury	µg/l				NDP
Sodium	mg/l				1781
Potassium	mg/l				870.4
Total Phosphorous	mg/l				8.64
Boron	mg/l				NDP
Cadmium	µg/l				NDP
Calcium	mg/l				NDP
Chromium	µg/l				437
Copper	µg/l				20
Iron	mg/l				NDP
Lead	µg/l				NDP
Magnesium	mg/l				NDP
Manganese	mg/l				NDP
Zinc	µg/l				NDP
Fluoride	mg/l				6.5
Sulphate	mg/l				365
Total Cyanide	mg/l				<0.05
OrthoPhosphate	mg/l				28.84
Total Alkalinity	mg/l				7410
Faecal Coliforms	cfu/100ml				<1
Total Coliforms	cfu/100ml				400

* It was not possible to analyse for TON due to interference from the sample matrix.
NDP - No Determination Possible

Parameter	Units	LE4	LE4	LE4	LE4
		Q1	Q2	Q3	Q4
pH	pH units	7.41	7.8	7.8	7.58
Conductivity	mS/cm	11	12.2	10.7	13
Ammoniacal Nitrogen	mg/l	583.9	1030	799	891.2
Chloride	mg/l	1369	1720	1260	1694
Total Oxidised Nitrogen	mg/l	<0.3	<0.3	*	5
BOD	mg/l	2050	147	151	641
COD	mg/l	4174	2430	155	2540
Mercury	µg/l				NDP
Sodium	mg/l				1623
Potassium	mg/l				692.9
Total Phosphorous	mg/l				4.68
Boron	mg/l				NDP
Cadmium	µg/l				NDP
Calcium	mg/l				NDP
Chromium	µg/l				224
Copper	µg/l				13
Iron	mg/l				NDP
Lead	µg/l				NDP
Magnesium	mg/l				NDP
Manganese	mg/l				NDP
Zinc	µg/l				NDP
Fluoride	mg/l				5.9
Sulphate	mg/l				376
Total Cyanide	mg/l				<0.05
OrthoPhosphate	mg/l				10.13
Total Alkalinity	mg/l				4775
Faecal Coliforms	cfu/100ml				100
Total Coliforms	cfu/100ml				10000

* It was not possible to analyse for TON due to interference from the sample matrix.
NDP - No Determination Possible

Parameter	Units	LE5	LE5	LE5	LE5
		Q1	Q2	Q3	Q4
pH	pH units	7.49	7.6	7.4	7.2
Conductivity	mS/cm	8	7.38	8.7	11
Ammoniacal Nitrogen	mg/l	342.1	431	618	483.9
Chloride	mg/l	1173	1010	813	1687
Total Oxidised Nitrogen	mg/l	<0.3	<0.3	*	0.6
BOD	mg/l	224	167	1220	1301
COD	mg/l	854	860	2430	2709
Mercury	µg/l				NDP
Sodium	mg/l				1031
Potassium	mg/l				365.8
Total Phosphorous	mg/l				2.12
Boron	mg/l				2.595
Cadmium	µg/l				<0.4
Calcium	mg/l				393.3
Chromium	µg/l				55
Copper	µg/l				235
Iron	mg/l				11900
Lead	µg/l				<1
Magnesium	mg/l				148200
Manganese	mg/l				8.639
Zinc	µg/l				26
Fluoride	mg/l				0.9
Sulphate	mg/l				40
Total Cyanide	mg/l				<0.05
OrthoPhosphate	mg/l				0.63
Total Alkalinity	mg/l				3344
Faecal Coliforms	cfu/100ml				100
Total Coliforms	cfu/100ml				10000

* It was not possible to analyse for TON due to interference from the sample matrix.
NDP - No Determination Possible

Parameter	Units	LE6	LE6	LE6	LE6
		Q1	Q2	Q3	Q4
pH	pH units	7.37	7.6	7.4	7.5
Conductivity	mS/cm	11	10.5	9.73	14
Ammoniacal Nitrogen	mg/l	474.5	769	718	946
Chloride	mg/l	1455	1550	1150	1940
Total Oxidised Nitrogen	mg/l	<0.3	<0.3	*	5.8
BOD	mg/l	2104	129	201	661
COD	mg/l	4212	1370	266	2799
Mercury	µg/l				NDP
Sodium	mg/l				1765
Potassium	mg/l				736.9
Total Phosphorous	mg/l				5.74
Boron	mg/l				NDP
Cadmium	µg/l				NDP
Calcium	mg/l				NDP
Chromium	µg/l				234
Copper	µg/l				64
Iron	mg/l				NDP
Lead	µg/l				NDP
Magnesium	mg/l				NDP
Manganese	mg/l				NDP
Zinc	µg/l				NDP
Fluoride	mg/l				5.2
Sulphate	mg/l				360
Total Cyanide	mg/l				<0.05
OrthoPhosphate	mg/l				6.61
Total Alkalinity	mg/l				5238
Faecal Coliforms	cfu/100ml				100
Total Coliforms	cfu/100ml				30000

* It was not possible to analyse for TON due to interference from the sample matrix.
NDP - No Determination Possible

Parameter	Units	LE7	LE7	LE7	LE7
		Q1	Q2	Q3	Q4
pH	pH units	N/A	N/A	7.1	7.25
Conductivity	mS/cm	N/A	N/A	7.88	11
Ammoniacal Nitrogen	mg/l	N/A	N/A	525	486.8
Chloride	mg/l	N/A	N/A	714	1639
Total Oxidised Nitrogen	mg/l	N/A	N/A	*	0.6
BOD	mg/l	N/A	N/A	**	1742
COD	mg/l	N/A	N/A	321	2961
Mercury	µg/l				NDP
Sodium	mg/l				1023
Potassium	mg/l				353.5
Total Phosphorous	mg/l				2.08
Boron	mg/l				2.625
Cadmium	µg/l				<0.4
Calcium	mg/l				413.5
Chromium	µg/l				55
Copper	µg/l				5
Iron	mg/l				13900
Lead	µg/l				<1
Magnesium	mg/l				149500
Manganese	mg/l				9.35
Zinc	µg/l				21
Fluoride	mg/l				1.2
Sulphate	mg/l				47
Total Cyanide	mg/l				<0.05
OrthoPhosphate	mg/l				0.42
Total Alkalinity	mg/l				3450
Faecal Coliforms	cfu/100ml				1500
Total Coliforms	cfu/100ml				3000

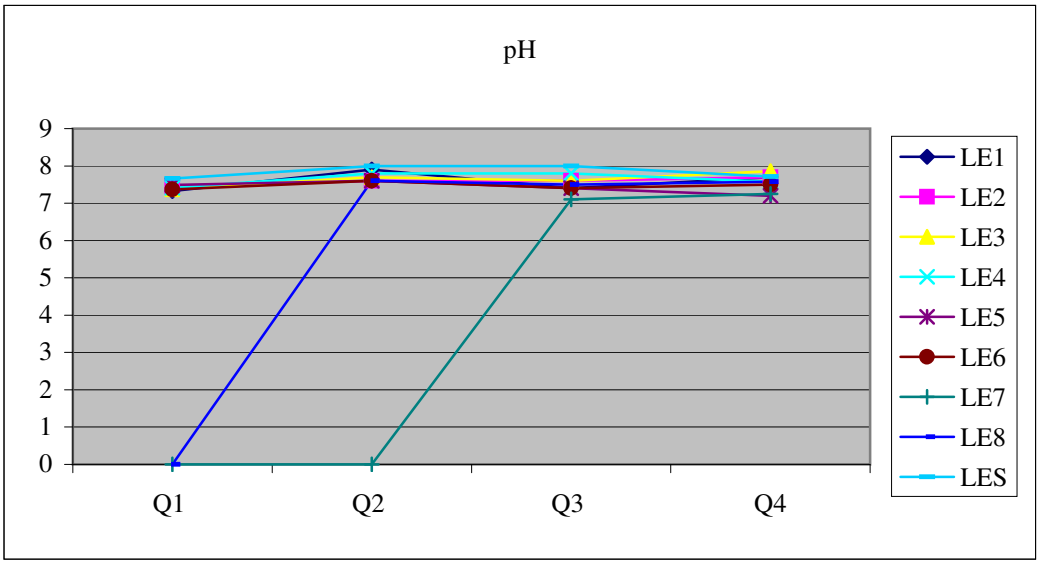
* It was not possible to analyse for TON due to interference from the sample matrix.
** No BOD results due to under dilution of the sample in the laboratory, the expected result
NDP - No Determination Possible

Parameter	Units	LE8	LE8	LE8	LE8
		Q1	Q2	Q3	Q4
pH	pH units	N/A	7.6	7.5	7.58
Conductivity	mS/cm	N/A	10.6	10.1	14
Ammoniacal Nitrogen	mg/l	N/A	798	747	953.9
Chloride	mg/l	N/A	1520	1180	1905
Total Oxidised Nitrogen	mg/l	N/A	<0.3	*	4.9
BOD	mg/l	N/A	120	149	781
COD	mg/l	N/A	1390	158	2667
Mercury	µg/l				NDP
Sodium	mg/l				1511
Potassium	mg/l				612.7
Total Phosphorous	mg/l				4.48
Boron	mg/l				NDP
Cadmium	µg/l				NDP
Calcium	mg/l				NDP
Chromium	µg/l				228
Copper	µg/l				40
Iron	mg/l				NDP
Lead	µg/l				NDP
Magnesium	mg/l				NDP
Manganese	mg/l				NDP
Zinc	µg/l				NDP
Fluoride	mg/l				5.4
Sulphate	mg/l				263
Total Cyanide	mg/l				<0.05
OrthoPhosphate	mg/l				10.21
Total Alkalinity	mg/l				5278
Faecal Coliforms	cfu/100ml				200
Total Coliforms	cfu/100ml				1400

* It was not possible to analyse for TON due to interference from the sample matrix.
NDP - No Determination Possible

Parameter	Units	LES	LES	LES	LES
pH	pH units	7.66	8	8	7.71
Conductivity	mS/cm	9	7.57	7.85	10
Ammoniacal Nitrogen	mg/l	512.5	456	476	655.5
Chloride	mg/l	1171	1110	986	1297
Total Oxidised Nitrogen	mg/l	<0.3	<0.3	<0.3	6
BOD	mg/l	123	97	60	131
COD	mg/l	773	780	87	1227
Mercury	µg/l				NDP
Sodium	mg/l				1078
Potassium	mg/l				428.2
Total Phosphorous	mg/l				3.12
Boron	mg/l				NDP
Cadmium	µg/l				NDP
Calcium	mg/l				NDP
Chromium	µg/l				144
Copper	µg/l				2
Iron	mg/l				NDP
Lead	µg/l				NDP
Magnesium	mg/l				NDP
Manganese	mg/l				NDP
Zinc	µg/l				NDP
Fluoride	mg/l				4.2
Sulphate	mg/l				399
Total Cyanide	mg/l				<0.05
OrthoPhosphate	mg/l				11.41
Total Alkalinity	mg/l				3800
Faecal Coliforms	cfu/100ml				200
Total Coliforms	cfu/100ml				20000

NDP - No Determination Possible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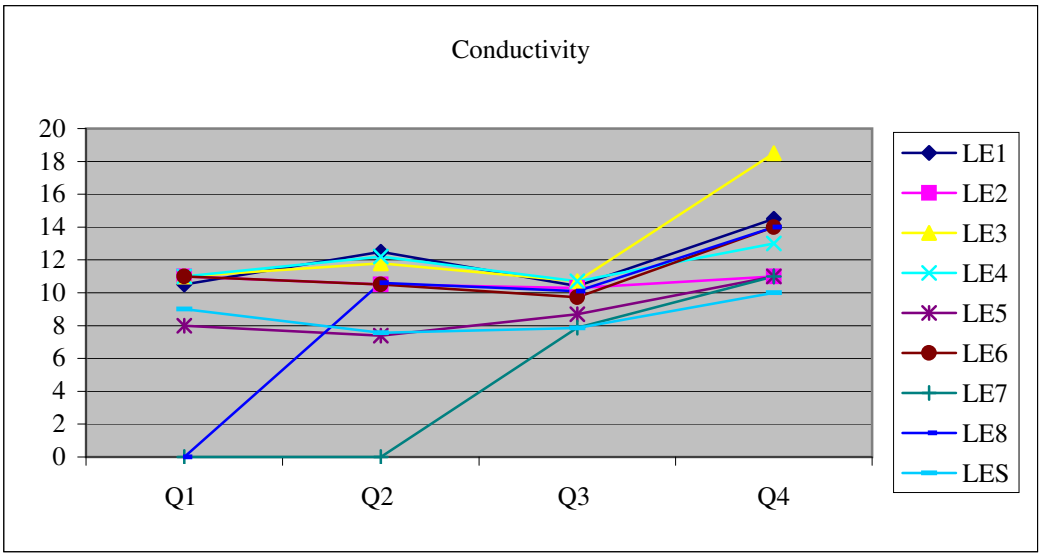
9
8
7
6
5
4
3
2
1
0
Q1
Q2
Q3
Q4
LE1
LE2
LE3
LE4
LE5
LE6
LE7
LE8
LES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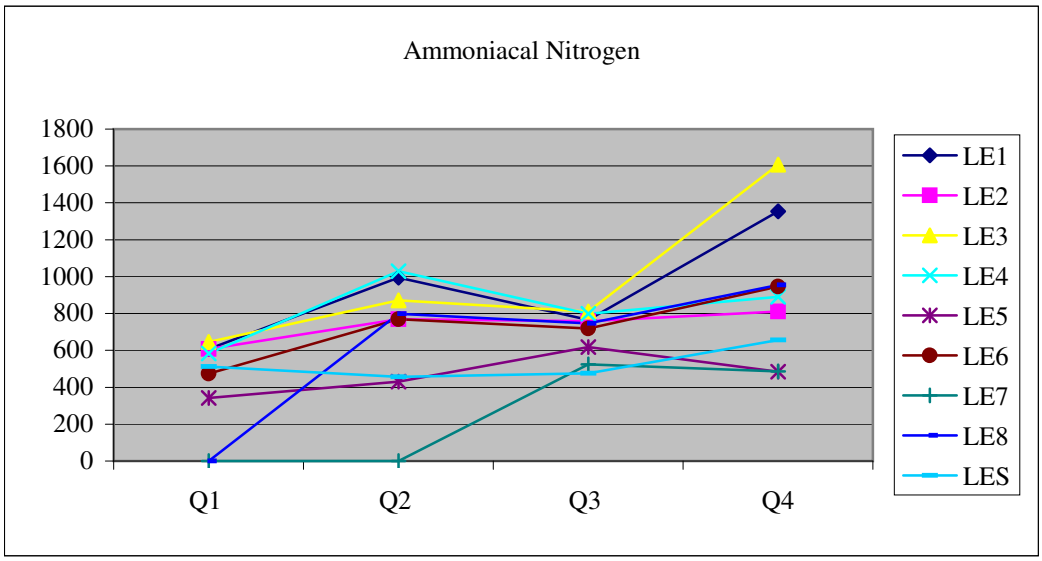
20
18
16
14
12
10
8
6
4
2
0
Q1
Q2
Q3
Q4
LE1
LE2
LE3
LE4
LE5
LE6
LE7
LE8
LES


Ammoniacal Nitrogen
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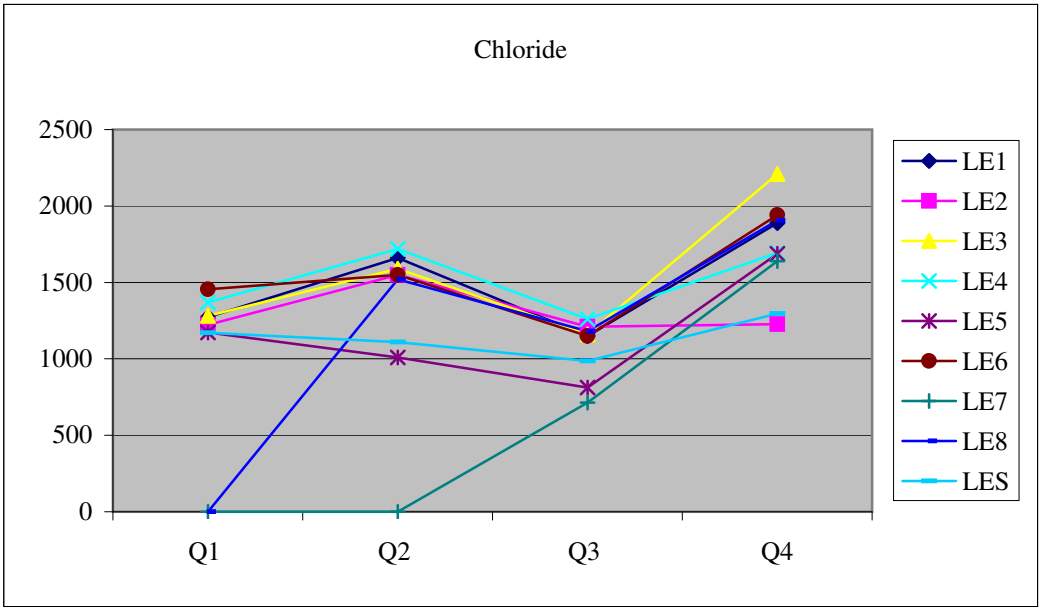
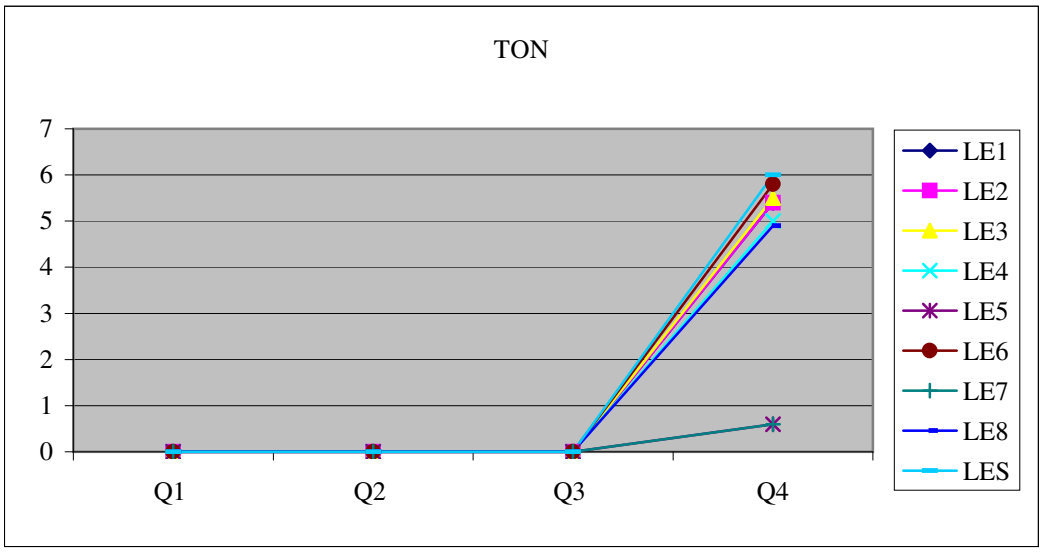
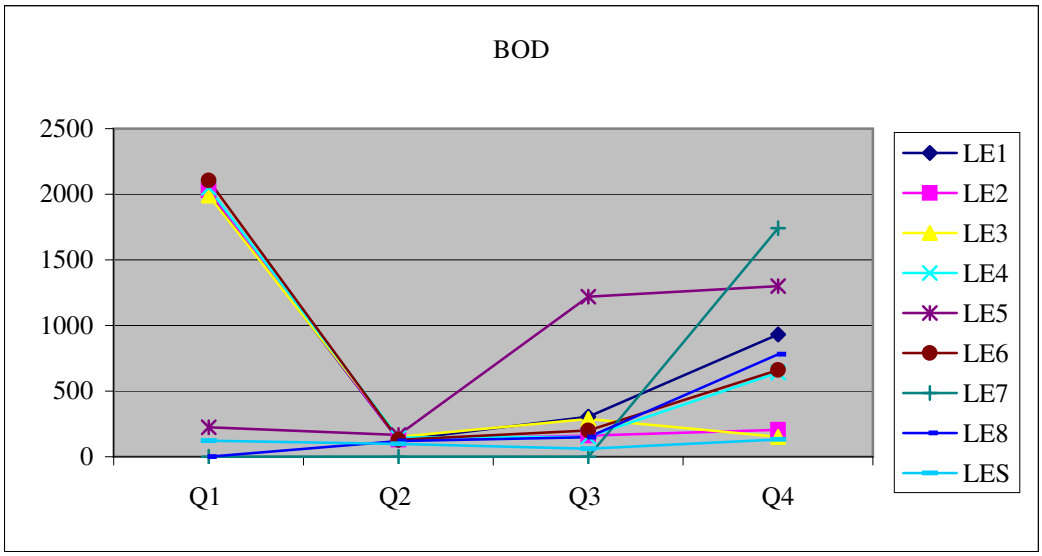
1600
1400
1200
1000
800
600
400
200
0
Q1
Q2
Q3
Q4
LE1
LE2
LE3
LE4
LE5
LE6
LE7
LE8
LES


Chloride
2500
2000
1500
1000
500
0
Q1
Q2
Q3
Q4
LE1
LE2
LE3
LE4
LE5
LE6
LE7
LE8
LES


TON
7
6
5
4
3
2
1
0
Q1
Q2
Q3
Q4
LE1
LE2
LE3
LE4
LE5
LE6
LE7
LE8
LES


BOD
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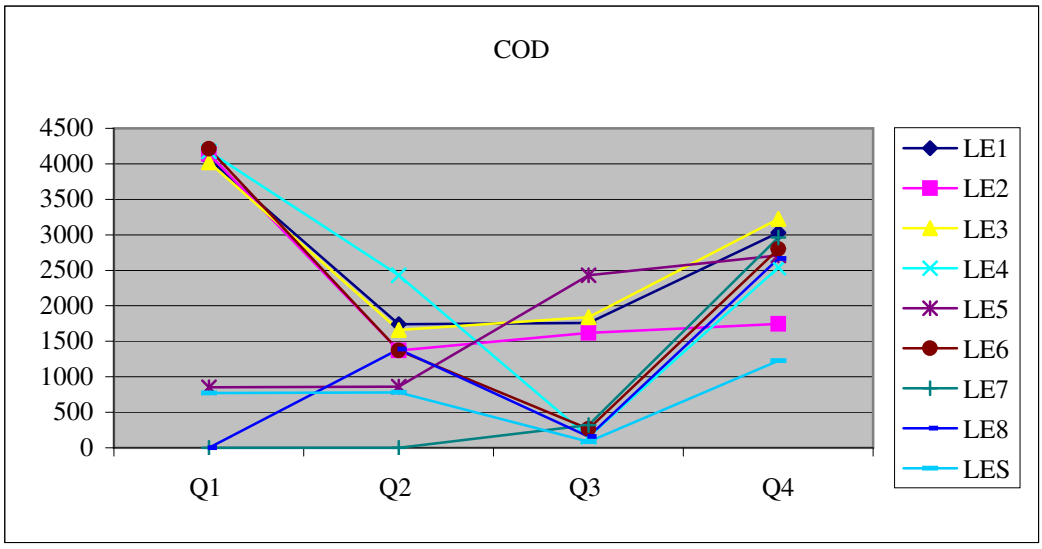
2000
1500
1000
500
0
Q1
Q2
Q3
Q4
LE1
LE2
LE3
LE4
LE5
LE6
LE7
LE8
LES


COD
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4000
3500
3000
2500
2000
1500
1000
500
0
Q1
Q2
Q3
Q4
LE1
LE2
LE3
LE4
LE5
LE6
LE7
LE8
LES

Dust Results

	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08
	33 Days	28 Days	28 Days	28 Days	34 Days	28 Days	33 Days	28 Days	33 Days	30 Days	29 Days	29 Days
D1	<10	159	*	38	125	169	*	49	106	48	<10	<10
D2	<10	153	46	*	*	20	221	61	44	57	48	48
D3	<10	130	37		119	23	71	26	<10	39	49	49
D4	<10	122	17	28	*	<10	<10	79	<10	37	35	35
D5	17	329	*	*	*	*	*	*	21	*	169	169
D6	60	*	*	*	*	*	*	*	63	*	*	*
D7	<10	119	124	12	106	56	85	23	31	27	75	75
D8	<10	**	<10	31	126	40	131	264	70	70	<10	<10

Noise Results

Q1

Location	Time	Measured Noise Levels (dB re. 2x10-5 Pa)			Comments
		L_{Aeq}	L_{A10}	L_{A90}	
N1	1502-1532	46	45	35	No emissions audible from landfill facility. Offsite civil or agricultural plant operating several hundred metres to West continuously audible and dominant in background. Intermittent passing traffic. Birdsong. Passing aircraft.
N2	1613-1643	60	53	39	Landfill plant audible continuously at low level. Not audibly tonal or impulsive. Sporadic truck movements on access road and at weighbridge area audible. Intermittent local traffic. Birdsong. National road N2 traffic faintly audible continuously in background. Passing aircraft.
N3	1421-1451	50	49	40	Compactor at landfill audible continuously at low level on breeze (N3 downwind of cell). Emissions not audibly tonal or impulsive. Sporadic truck movements audible on access road and at weighbridge area. Lawnmower audible continuously at house to NE until 1440. Birdsong. Chainsaw in distance audible at low level. Occasional dog barking at nearby houses. Passing aircraft, particularly passing helicopter x1, significantly loud.
N4	1536-1606	44	44	33	No emissions audible from landfill facility. Offsite civil or agricultural plant operating several hundred metres to W continuously audible and dominant in background, more significant than at N1. Intermittent passing traffic. Birdsong. Passing aircraft.

Q2

Location	Time	Measured Noise Levels (dB re. 2x10-5 Pa)			Comments
		L_{Aeq}	L_{A10}	L_{A90}	
N1	1305-1335	47	47	41	Distant N2 traffic noise to E & SE continuously dominant in background. Greenstar plant emissions occasionally slightly audible on breeze. Ejector trailer x1 more clearly audible for 2 min. Birdsong. Rustling vegetation. Sporadic local traffic. Sporadic aircraft. Bird scarers x 3 on 8-9 min cycle audible in distance to SE. Occasional dog barking locally.
N2	1415-1445	58	55	43	No site emissions audible. N2 traffic continuously dominant to E. Bird scarers audible several hundred metres to SE. Birdsong. No Greenstar emissions audible apart from sporadic truck movements on access road. Sporadic local traffic. Local car x1 manoeuvring at nearby gate.
N3	1224-1254	49	47	41	No emissions audible from facility. N2 traffic to E & SE dominant continuously in background. Birdsong. Bird scarers significant at 2-300 m to SE. Sporadic aircraft.
N4	1339-1409	44	45	38	Distant N2 traffic noise to E & SE continuously dominant in background. Greenstar plant emissions occasionally slightly audible on breeze. Birdsong. Rustling vegetation. Sporadic local traffic. Sporadic aircraft. Bird scarers audible in distance to SE.

Q3

Location	Time	Measured Noise Levels (dB re. 2x10-5 Pa)			Comments
		L_{Aeq}	L_{A10}	L_{A90}	
N1	1607-1637	48	47	33	Sporadic plant emissions slightly audible from Greenstar site. Sporadic local traffic. Domestic ground works audible at adjacent site. Birdsong. Dog barking nearby occasionally.
N2	1527-1557	52	50	36	Road sweeper truck audible on access road. Sporadic truck movements on access road also audible. Ejector trailer x 1 clearly audible from within site. Birdsong. Sporadic local traffic.
N3	1402-1432	44	46	37	Emissions from onsite plant audible occasionally on breeze, not significant. Sporadic truck movements on site access road audible. Agricultural plant operating offsite several hundred metres to S continuously audible in background. N2 traffic to NE continuously audible. Birdsong.
N4	1640-1710	47	43	32	Sporadic plant emissions slightly audible from Greenstar site. Sporadic local traffic. Hedge cutting slightly audible 500 m to W. Sheep bleating repeatedly to N.

Q4

Location	Time	Measured Noise Levels (dB re. 2x10-5 Pa)			Comments
		L_{Aeq}	L_{A10}	L_{A90}	
N1	0921-0951	48	46	38	Greenstar plant slightly audible on breeze. Sporadic local traffic. Birdsong. Overhead aircraft.
N2	0846-0916	47	48	38	Greenstar plant slightly audible on breeze. Sporadic local traffic. Birdsong. Overhead aircraft.
N3	0804-0834	46	47	43	Onsite plant occasionally audible at low level on breeze, not significant. Sporadic truck movements on access road audible. N2 traffic slightly audible in background. Also occasional vehicle movements audible on third class road to E. Birdsong. Overhead aircraft.
N4	1000-1030	53	47	37	Greenstar plant faintly audible occasionally at low/slight level, not significant. Sporadic truck movements on site access road also audible at low level. Sporadic local traffic. N2 traffic faintly audible continuously. Birdsong. Overhead aircraft.

PM_{10} Results

Location	PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Concentration ($\mu g/m^3$)	PM_{10} Concentration ($\mu g/m^3$)
	Q1	**Q2**	**Q3**	**Q4**
Location PM1	22	12	14	12
Location PM2	20	10	18	19
Location PM3	24	12	15	11
Location PM4	28	9	16	19
Location PM5	19	7	10	21
Location PM6	24	7	13	23
Limit Value	**50**	**50**	**50**	**50**

Landfill Gas Results

	09/01/2008	06/02/2008	06/03/2008	03/04/2008	08/05/2008	06/06/2008	08/08/2008	05/09/2008	24/09/2008	08/10/2008	07/11/2008	05/12/2008
Sample Station Number	**CH_4 (% v/v)**	**CH_4 (% v/v)**	**CH_4 (% v/v)**	**CH_4 (% v/v)**	**CH_4 (% v/v)**	**CH_4 (% v/v)**	**CH_4 (% v/v)**	**CH_4 (% v/v)**	**CH_4 (% v/v)**	**CH_4 (% v/v)**	**CH_4 (% v/v)**	**CH_4 (% v/v)**
LG-01	0	0	0.2	0	0	0	0	0	0	0	0	0
LG-02	0	0	0.2	0	0	0	0	0	0	0	0	0
LG-03	-	-	-	-	-	-	-	0	0	0	0	0
LG-04	-	-	-	-	-	-	-	0	0	0	0	0
LG-05	0	0	0	0	0.1	0.1	0	0	0	0	0	0
LG-06	0	0	0	0	0	0	0	0	0	0	0	0
LG-07	0	0	0	0	0	0	0	0	0	0	0	0
LG-08	0	0	0	0	0	0	0	0	0	0	0	0
LG-09	0	0	0	0	0	0	0	0	0	0	0	0
LG-10	0	0	0	0	0	0	0	0	0	0	0	0
LG-11	0	0	0	0	0	0	0	0	0	0	0	0
LG-12	0	0	0	0	0	0	0	0	0	0	0	0
LG-13	0	0	0	0	0	0	0	0	0	0	0	0
LG-14	0	0	0	0	0	0	0	0	0	0	0	0
LG-15	0	0	0	0	0	0	0	0	0	0	0.1	0
LG-16	0	0	0	0	0	0	0	0	0	0	0	0
LG-17	0	0	0	0	0	0	0	0	0	0	0	0
LG-18	0	0	0	0	0	0	0	0	0	0	0	0
LG-19	0	0	0	0	0	0	0	0	0	0	0	0
LG-20	-	-	-	-	-	-	-	0	0	0	0	0
LG-21	-	-	-	-	-	-	-	0	0	0	0	0
LG-22	-	-	-	-	-	-	-	0	0	0	0	0
LG-23	-	-	-	-	-	-	-	0	0	0	0	0
LG-24	-	-	-	-	-	-	-	0	0	0	0	0
LG-25	-	-	-	-	-	-	-	0	0	0	0	0
LG-50	-	-	-	-	-	-	-	0	0	0	0	0.2
LG-51	-	-	-	-	-	-	-	0	0	0	0	0
LG-52	-	-	-	-	-	-	-	0	0	0	0	0
LG-53	-	-	-	-	-	-	-	0	0	0	0	0
LG-54	-	-	-	-	-	-	-	0	0	0	0	0

	09/01/2008	06/02/2008	06/03/2008	03/04/2008	08/05/2008	06/06/2008	08/08/2008	05/09/2008	24/09/2008	08/10/2008	07/11/2008	05/12/2008
Sample Station Number	**CO_2 (% v/v)**	**CO_2 (% v/v)**	**CO_2 (% v/v)**	**CO_2 (% v/v)**	**CO_2 (% v/v)**	**CO_2 (% v/v)**	**CO_2 (% v/v)**	**CO_2 (% v/v)**	**CO_2 (% v/v)**	**CO_2 (% v/v)**	**CO_2 (% v/v)**	**CO2 (% v/v)**
LG-01	0	0.1	0	0.3	0	0	0	0	2.4	5.1	6.6	5.4
LG-02	0	0	0	1	0.2	0	0.1	0.5	4.2	5.2	6.2	3.5
LG-03	-	-	-	-	-	-	-	0.5	0.4	0	3.9	0
LG-04	-	-	-	-	-	-	-	0.6	5.1	3.6	1.7	2.1
LG-05	0.6	0.4	0.2	0.9	0.1	0	0.3	0.5	0.6	0.8	1.1	0.5
LG-06	0	0	0	0.1	0	0	0	0	0	0	1	0.6
LG-07	0.4	1.9	0.2	1.8	0	0.5	4.6	0.3	1.9	2	3.2	2.5
LG-08	0	0	0	0.3	0	0	0	0	0.3	0.5	2	2
LG-09	0	0	0	0.1	0	0	0	0	0.5	1	1.3	0.3
LG-10	0.1	1.7	0.2	1.9	0	0	0.2	0.3	0	0	0.2	0
LG-11	0	0	0	0.1	0	0	0	0	0	0	0	0
LG-12	0	0	0	0.1	0	0	0	0	0	0.6	0.8	0.2
LG-13	0	0	0	0.1	0	0	0	0	0.2	0	0.4	0
LG-14	1	1.1	0.2	1	0	0	0.3	0.3	0.6	0	0.1	0
LG-15	0	0	0	0.3	0	0	0.8	0.8	0.5	0	2.9	2.4
LG-16	0	0	0.1	0.1	0	0	0	0	1	1.5	2.2	2
LG-17	1.1	1.3	0.2	1.6	0	0.4	0.9	0.5	0.1	0.5	1.5	0.9
LG-18	0	0	0.2	0.1	0	0	0	0	0	1	0	0
LG-19	0	0	0	0.1	0	0	0	0	0.1	0.2	0.1	0.1
LG-20	-	-	-	-	-	-	-	0.8	0	2.4	2.3	2.2
LG-21	-	-	-	-	-	-	-	0.5	0.1	0.4	0.4	0.4
LG-22	-	-	-	-	-	-	-	0.9	0.3	0	0.5	0
LG-23	-	-	-	-	-	-	-	0.6	1.2	1.9	1.9	0.9
LG-24	-	-	-	-	-	-	-	0.3	0.7	1.5	1.6	0.9
LG-25	-	-	-	-	-	-	-	0.2	1.2	0.9	1.3	0.9
LG-50	-	-	-	-	-	-	-	2.1	2.7	1.7	2.8	0.6
LG-51	-	-	-	-	-	-	-	3.5	4.7	3.3	4.8	2
LG-52	-	-	-	-	-	-	-	3.3	3.6	4.1	3.4	2.3
LG-53	-	-	-	-	-	-	-	3	4.6	4.5	3.7	2.1
LG-54	-	-	-	-	-	-	-	3.9	4	3.8	4.1	3.7

	09/01/2008	06/02/2008	06/03/2008	03/04/2008	08/05/2008	06/06/2008	08/08/2008	05/09/2008	24/09/2008	08/10/2008	07/11/2008	05/12/2008
Sample Station Number	**O_2 (% v/v)**	**O_2 (% v/v)**	**O_2 (% v/v)**	**O_2 (% v/v)**	**O_2 (% v/v)**	**O_2 (% v/v)**	**O_2 (% v/v)**	**O_2 (% v/v)**	**O_2 (% v/v)**	**O_2 (% v/v)**	**O_2 (% v/v)**	**O_2 (% v/v)**
LG-01	21	21.4	20.9	18.4	20.4	20.3	21	21	19	16.8	12.1	10.2
LG-02	20.7	21.6	18.6	18.4	19.5	19.6	20.9	20.9	9.5	5.1	2.2	8.5
LG-03	-	-	-	-	-	-	-	20	20.5	20.8	3.6	20.8
LG-04	-	-	-	-	-	-	-	20.1	14.5	15.1	19.2	17.8
LG-05	19.8	20.8	20.4	18.2	19.6	20.3	20.9	20.9	20.2	20	19.4	19.8
LG-06	20.8	21.2	20.7	18.4	20.5	20.3	21.1	21	20.7	20.1	19.7	19.6
LG-07	18.7	18.4	19.8	18.2	20.1	19.7	15.9	20	19.4	16.8	18.6	18
LG-08	20.7	21.3	20.6	18.5	20.3	20.3	21	21	20.7	18.1	18.8	15.4
LG-09	20.7	21.2	20.6	18.4	20.3	20.4	21	21	20.4	19.8	17.1	19.3
LG-10	20.3	19.5	19.9	18.2	20.3	20.4	20.9	20.3	20.1	20	21	20.7
LG-11	20.7	21.5	20.6	18.4	20.3	20.4	21	21	20.8	20.9	21	20.7
LG-12	20.7	21.2	20.6	18.4	20.3	20.4	20.8	20.8	20	20.6	20.3	20.4
LG-13	20.7	21.3	20.6	18.4	20.3	20.4	21	21	20.1	20.9	20.8	20.6
LG-14	16.4	15.4	17.9	18.2	20.3	20.2	20.8	20.8	19.5	20.9	21	20.6
LG-15	20.7	21	20.4	18.3	19.7	20	19.8	19.8	19.5	20.5	16	14.2
LG-16	20.8	21.3	20.5	18.3	20.3	20.3	20.8	20.8	19	19.3	18.3	17.3
LG-17	13.7	12.5	14.2	17.8	19.4	19.5	19.8	20.1	20.1	19	17.7	17.3
LG-18	20.7	21	20.5	18.1	20.3	20.3	20.8	20.8	20	19.5	21.1	20.6
LG-19	20.7	21.1	20.5	18.3	20.3	20.3	21	21	20.1	18.1	21.1	20.5
LG-20	-	-	-	-	-	-	-	18.5	20	17.3	17.6	16.6
LG-21	-	-	-	-	-	-	-	19.8	20.1	20.7	20.9	20.3
LG-22	-	-	-	-	-	-	-	18.8	20.5	20.9	20.8	20.5
LG-23	-	-	-	-	-	-	-	19	18.6	16.6	19.1	19.3
LG-24	-	-	-	-	-	-	-	20.1	20.2	19.9	19.5	19.3
LG-25	-	-	-	-	-	-	-	20.1	16	18.7	18.7	16
LG-50	-	-	-	-	-	-	-	17.1	12.2	6.8	2.8	15
LG-51	-	-	-	-	-	-	-	17	14.6	15.7	16.5	16.9
LG-52	-	-	-	-	-	-	-	17.3	15.8	16	17.9	17.9
LG-53	-	-	-	-	-	-	-	17.5	10.1	10.3	14.1	15.5
LG-54	-	-	-	-	-	-	-	17	14	15.3	14.2	13.8

	09/01/2008	06/02/2008	06/03/2008	03/04/2008	08/05/2008	06/06/2008	08/08/2008	05/09/2008	24/09/2008	08/10/2008	07/11/2008	05/12/2008
Sample Station Number	**CH_4 (% v/v)**	**CH_4 (% v/v)**	**CH_4 (% v/v)**	**CH_4 (% v/v)**	**CH_4 (% v/v)**	**CH_4 (% v/v)**	**CH_4 (% v/v)**	**CH_4 (% v/v)**	**CH_4 (% v/v)**	**CH_4 (% v/v)**	**CH_4 (% v/v)**	**CH_4 (% v/v)**
1E	44	28.5	37.4	34.8	52	45	56	60	58	57	57	40
1W	47.5	42.5	51.6	63	53	53	53	55.1	58	58	58	45.5
2E	20.5	34	44.7	57.4	54	44	63	60	62	56.1	63	48
2W	20	32.5		41.8	40.5	38	42.5	57.1	55	55.2	55	42.5
3E	42	35		45.7	46	47	46.5	55.1	48	52.2	46.5	34.5
3W	33.5	30.5	15.1	*	48.5	55	53	46.2	49	47	61	38
4E	38	39.5		47.8	45	40.5	41.5	59.8	48	48	48	28
4W	58	41	58.3	43.5	45.5	52	44.5	57.3	48	49	29	24
5E	-	-	41.3	35.4	43.5	48	55	56.1	51	59.6	45.5	50
5W	-	-	38.8	41.9	52	58	47.5	63.2	48	40.2	61	49
6E	-	-	29.9	31.5	31.5	48	57	61.9	64	62	60	43.5
6W	-	-	23	32.6	41	46	48	56.3	60	36.4	63	39.5

	09/01/2008	06/02/2008	06/03/2008	03/04/2008	08/05/2008	06/06/2008	08/08/2008	05/09/2008	24/09/2008	08/10/2008	07/11/2008	05/12/2008
Sample Station Number	**CO_2 (% v/v)**	**CO_2 (% v/v)**	**CO_2 (% v/v)**	**CO_2 (% v/v)**	**CO_2 (% v/v)**	**CO_2 (% v/v)**	**CO_2 (% v/v)**	**CO_2 (% v/v)**	**CO_2 (% v/v)**	**CO_2 (% v/v)**	**CO_2 (% v/v)**	**CO_2 (% v/v)**
1E	26	37	36.7	32.9	37	31	33	37.3	36	37	31	24
1W	45	40	42.6	41.5	39	36	34	36.3	35	33	32	28
2E	20	42	39.8	40.5	39	32	36	40	38	30.3	36	27
2W	16	50		42.2	38	34	31	40.2	38	33	32	27
3E	30	33		35.4	37	26	28	32.6	29	29.1	25	20.2
3W	33	30	11.3	*	31	34	29	27.4	30	25.3	31	22
4E	35	29		42.7	34	35	31	38	33	33	25	17
4W	40	38	44.5	50.4	30	40	31	39.9	35	34.1	17	18
5E	-	-	33.8	30.6	38	40	45	37.5	45	39.2	29	35
5W	-	-	33.6	32.7	37	40	31	34.7	38	29	31	30
6E	-	-	27	31.5	28	28	40	35.1	36	35	33	28
6W	-	-	20.2	34.4	35	36	36	40	38	60.3	33	31

	09/01/2008	06/02/2008	06/03/2008	03/04/2008	08/05/2008	06/06/2008	08/08/2008	05/09/2008	24/09/2008	08/10/2008	07/11/2008	05/12/2008
Sample Station Number	**O_2 (% v/v)**	**O_2 (% v/v)**	**O_2 (% v/v)**	**O_2 (% v/v)**	**O_2 (% v/v)**	**O_2 (% v/v)**	**O_2 (% v/v)**	**O_2 (% v/v)**	**O_2 (% v/v)**	**O_2 (% v/v)**	**O_2 (% v/v)**	**O_2 (% v/v)**
1E	5.3	2	0.1	2.4	0.3	1.5	1.3	0.3	1.8	1.1	2.2	4.1
1W	0.1	2.4	0.2	0.4	0	0	0.3	0.3	1.5	0.4	0.7	0.4
2E	9.8	3.6	2.9	1.8	0.2	0.7	0.2	1	0.1	2.1	0.7	2
2W	12.3	1.2		0.8	0	0.7	1.6	1	1.3	1.7	1.1	2
3E	4.8	4.4		3.8	0.7	4.8	5.3	2.1	5.4	4.6	6	7.2
3W	3.8	7	15.3	*	3.3	0.4	3.3	5.1	5.1	6.3	1.3	5.5
4E	4.3	7.3		0.7	0.3	0.8	3.4	0.5	3.9	2.1	4.3	8.4
4W	0	2.1	0.4	0.5	3	1.1	3.9	2	2.3	1.7	10	5.7
5E	-	-	2	3.2	0.7	0.6	0	2	1	0.5	3.9	0.1
5W	-	-	1.5	2.9	0.5	0	3.4	0.3	2.3	1	1.3	1.1
6E	-	-	8.6	5.2	6.3	5.4	0.1	0.3	0.3	0.5	0.6	1.4
6W	-	-	18	0.8	0	0	0.2	1.5	0.5	0.5	0.6	2.5

Biological Assessment

Biological Assessment of Kentstown Stream and Nanny River

Knockharley Landfill (W0146-01)

Annual Report 2008

Prepared on behalf of

O'Callaghan Moran & Associates
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11th August 2008

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EXECUTIVE SUMMARY

This report details a biological assessment undertaken on watercourses in the vicinity of Knockharley Landfill, Co. Meath, as part of the annual monitoring of Knockharley landfill Site (EPA License Number W0146-01).

Two control sites, one the Knockharley Stream and another on the River Nanny were examined on the 4th July, 2008. Two receptor sites were also surveyed on the same day; one on the Knockharley Stream and another on the River Nanny. Benthic macro-invertebrates were sampled qualitatively at the four sites using kick-sampling. Based on the results of the kick sampling, the water quality of each site was determined using the EPA Q-rating scheme. Similarly, the SSRS (small stream risk score) of each site was calculated.

The findings of the current study indicate that biological water quality at the control site on the Knockharley Stream has declined but improved at the receptor site downstream of the landfill. A similar scenario was observed in the River Nanny with the small stream risk score for the control site declining, while that of the receptor site increased. The recorded Q-values for the River Nanny remained stable since the previous survey but biological water quality at both sites is 'Unsatisfactory'. The results of the current study compare favorably with the most recent EPA result for this part of the River Nanny.

There is no evidence that the landfill operations are having any effect on the water quality of the receptor streams. It is likely that diffuse sources of pollution, such as agricultural inputs, are the main causes of pollution in these watercourses. Variations in such inputs, environmental factors, and (to a lesser degree) timing and micro-location of sampling have probably all contributed to the variation in results obtained over the past 5 years.

TABLE OF CONTENTS

1. Introduction

This report details a biological assessment undertaken on watercourses in the vicinity of Knockharley Landfill (EPA Waste License Registration Number W0146-01), Co Meath. This assessment was undertaken as per Condition 8.11 of the license. The scope, content and details of the contractor carrying out the assessment were previously submitted to the Agency for its approval. Samples were taken on 4th July 2008. The assessment was undertaken on behalf of O' Callaghan Moran & Associates by Ecofact Environmental Consultants Ltd.

2. Methods

Benthic, or bottom dwelling, macro-invertebrates were sampled qualitatively at the four sites using kick-sampling (Abel, 1996) on the 4th July 2008. This procedure involved the use of a 'D' shaped hand net (mesh size 0.5 mm; 350 mm diameter) which was submerged on the river bed with its mouth directed upstream. The substrate upstream of the net was then kicked for one minute in order to dislodge invertebrates, which were subsequently caught in the net. This procedure was undertaken at three points located at equal distances across the watercourse, where depth allowed. Stone washings and vegetation sweeps were also undertaken to ensure a representative sample of the fauna present at each site was collected. All samples of invertebrates were combined for each site and live sorted on the river bank for 20 minutes with the assistance of a headband magnifier. Specimens were fixed in a 10% formalin solution. Identification was undertaken in the laboratory using high-power and low-power binocular microscopes.

Specimens were identified using the keys produced by the Freshwater Biological Association. These keys included Elliott & Humpesch (1988) for mayflies, Edington & Hildrew (1995) and Wallace *et al* (2003) for caddis fly larvae, Gledhill *et al* (1993) for crustaceans, Macan (1994) for snails, Savage (1989, 1999) for bugs and Elliott & Mann (1979) for leeches. The relative abundance of invertebrates in samples was described as follows:

- Present (1 or 2 individuals);
- Scarce/Few (<1%);
- Small Numbers (<5%);
- Fair Numbers (5-10%);
- Common (10-20%);
- Numerous (25-50%);
- Dominant (50-75%);
- Excessive (>75%)

The Quality Rating (Q) System (Toner *et al*, 2005) was used to obtain a water quality rating for each site. The use of this particular biotic index allows the comparison with data published by the EPA. This method categorizes invertebrates into one of five groups, depending on their sensitivity to pollution. The higher the biological diversity and the greater the abundance of invertebrate species sensitive to organic pollution, the higher the water quality is assumed to be, and the higher the 'Q value' assigned to that sampling station. Further details on the Q-rating system are provided in Appendix 1.

The Small Stream Risk Score (SSRS) also used in the current assessment. This system was devised by the EPA as a biological monitoring tool for first and second order streams as part of the Water Framework Monitoring Programme. This system does not define the status of a stream but is a risk assessment (Walsh, 2005). The SSRS was developed based on presence of indicator mayfly species, stonefly species, caddis fly larvae and the overall abundance of Gastropods, Oligochaetes and Dipteran larvae and *Asellus*. It is believed to be an efficient indicator of pollution risk from either point or diffuse sources in small streams. The index categorises streams into three risk groups: at risk, probably at risk and not at risk according to the score it attains where > 8 = probably not at risk, 6.5-8 = probably at risk, and < 6.5 = at risk.

3. Site Location

In Table 1 and Figure 1 the location of the four sites investigated is given. Two sites were located on the Knockharley stream, which flows at the boundary of the landfill facility and two sites were located on the River Nanny which is the largest local watercourse. The two sites on the Knockharley Stream were located upstream and downstream of the landfill facility, while the two sites on the River Nanny were located upstream and downstream of the confluence of the Knockharley stream. Site photographs are provided in Plates 1-4.

As part of its rollover assessment of water quality in Irish rivers, the EPA (and their predecessors) has assessed water quality in the River Nanny since 1971 (Toner *et al*, 2005). The Knockharley stream is not assessed by the EPA, due presumably to its small size. The results of the EPA Biological Water Quality Assessments of the River Nanny during the period 1971-2005 are given in Appendix 2. The most recent EPA monitoring took place on 12th May 2005. An EPA assessment of the River Nanny is also provided in this Appendix.

4. Results

The physical characteristics of the survey sites are given in Table 2. The results of the biological assessments are given in Table 3. Common names of invertebrate species or groups are given where they are available. Table 4 provides the derived water quality ratings for the four sites investigated for the current survey and the surveys undertaken by Ecofact in previous years. The results from the individual sites are discussed below.

4.1 Site 1 Knockharley Stream (receptor)

Site 1 was located on the Knockharley Stream, less than 1 km downstream of the landfill facility. This site is shown in Plate 2. The stream at this site was 1.3 m wide and had a similar bank height. The stream was modified (deepened and channelized) and heavily shaded by a whitethorn hedgerow. Substrate in the section examined was dominated by finer substrates (gravel and silt) and there was a fair amount of leaf litter also. The section surveyed comprised of mainly of sluggish habitat. Like the previous survey undertaken by Ecofact (Ecofact, 2007) the site appeared to be clean, with no apparent filamentous algal growths. However, due to the low density vegetation cover on the banks, shading and substrate composition, habitat suitability for invertebrates was considered to be poor.

A total of 14 different macroinvertebrate families were recorded from this site, a significant increase from the previous survey when 9 families were recorded. Cased trichopteran/caddisfly larvae were well represented with fair numbers of the northern caddisfly *Limnephilus lunatus* while both the black caperer *Sericostoma personatum* and *Goera pilosa* were scarce. Caseless larvae of the trumpet-net caddisfly *Plectronemia conspersa* were present. True fly larvae of the midge and the green chironomid were found in small numbers and present, respectively. Freshwater shrimp *Gammarus deubeni* was numerous while another crustacean, the hog Louse *Asellus aquaticus* was less abundant being common. The only snail recorded was the pea mussel of which there were small numbers. Worms in the groups Oligochaeta, Nematoda (roundworms) and Platyhelminthes (flatworms) were all present. The leeches *Glossiphonia complanata* and *Erpobdella octoculata* were scarce and present, in that order. An aquatic weevil was the only member of the beetle family found and this was present.

A dissolved oxygen (D.O.) concentration of 83.9% was recorded at this site. The community was largely composed of pollution tolerant organisms. Applying the EPA biological monitoring criteria (Toner *et al*., 2005), this stretch of the Knockharley Stream is deemed to be 'Moderately Polluted, Class C (Q3)'. This is due to the absence of group 'A' organisms and the relative abundances of the other organisms. Applying the WRFB Small Streams Risk Score (SRSS) (Walsh, 2005), this stretch of site had a score of 3.2 and is therefore considered to be 'at risk'.

4.2 *Site 2 Knockharley Stream (control)*

Site 2 was a control site and was located on the Knockharley Stream, approximately 1 km upstream of the landfill facility. The Knockharley stream at this site was 1.5 m wide and had a mean depth of 10 cm. This section of stream had been deepened and channelized in the past but it has recovered well, with well vegetated banks (85%) and a good substrate mix. This substrate was comprised of cobbles (45%) and gravel (35%), and the section surveyed comprised of riffle habitat. In contrast with the previous survey, the stream had some deposits of silt where flow was reduced. Habitat for invertebrates was considered to be sub-optimal due to small stream size.

Along with three-spined stickleback *Gasterosteus aculeatus*, macroinvertebrates in 15 different families were recorded at this site. However, no group 'A' or group 'B' pollution indicators were recorded. True flies were the most diverse group with 5 taxa at larval stage recorded; midge (common), green chironomid (present), cranefly/Tipulid (common), *Dicranota sp*. (present) and moth fly/Psychodidae (present). The hog louse and freshwater shrimp were numerous and scarce, correspondingly. Fair numbers of pea mussels were recorded. Small numbers of the river limpet *Ancylus fluviatilis* were recorded and the wandering snail *Lymnaea peregra* was scarce. Flatworms and water mites were found in small numbers while oligochaete worms were present. The leeches *Glossiphonia complanata* and *Erpobdella octoculata* were both scarce with *Haemopis sanguisuga* being present. Also present was a diving beetle in sub family Colymbetinae (*Agabus sp.)* and a water scavenger beetle in subfamily Helophorinae (*Helophorus sp*.).

The dissolved oxygen (D.O.) at this site was recorded as 89.4 %. Appling the EPA biological monitoring this site is rated as 'Seriously Polluted, Class D (Q2)'. With an SSR score of 0 (no stoneflies, mayflies, caddisflies and abundance of snails, dipterans and hog louse), this part of the stream is 'at risk'. This is a control site and is not affected by the landfill facility.

4.3 Site 3 River Nanny (receptor)

This site was located less than 1 km downstream of the Knockharley stream confluence (Plate 3). This section of the Nanny has been deepened and channelized in the past. The section surveyed had a mean width of 3.5 m and had maximum depth of 70cm. water levels were low at the time of the survey. There was no evidence of any rise in water levels and indeed the river contained less water than in the previous survey undertaken in September 2007. The substrate consisted of rock, cobble, gravel and fine in percentages 15, 30, 35 and 20, respectively and kick sampling released considerable amounts of silt into the water column. Indeed, this stretch of river was noticeably silted with a thick coating on submerged aquatic vegetation. Habitat for macroinvertebrates was considered to be sub-optimal.

Three-spined stickleback was the only fish species recorded at this site when sweep netting through the vegetation at the bankside. This site had a diverse macro-invertebrate community with 19 different families recorded. Two species of mayfly were recorded; larvae of the blue-winged olive *Ephemerella ignita* were common while larvae of the large dark olive *Baetis rhodani* were scarce. Larvae of the northern caddisfly *Potamophylax latipennnis* was found in fair numbers with *Goera pilosa* in small numbers and the black caperer present (all cased species). Bloodworms or midge larvae were present as were gnat larvae (Culicidae) and caseless caddisfly larvae of the sandfly *Rhyacophila dorsalis.* Freshwater shrimp were numerous and hog louse were found in fair numbers. Small numbers of flatworms were found on the undersides of stones while the leech *Glossiphonia complanata* and the water mite were both scarce. Each of the following organisms were present: water crickets, common whirligig beetle *Gyrinus substriatus,* riffle beetle larvae of *Helmis maugei*, Oligochaete worms, pea mussels and the leech *Haemopis sanguisuga.*

This site had the richest macro-invertebrate assemblage of the 4 sites investigated. This is also the largest stream site in the survey so this would be an expected result. Although mayfly larvae of two species were recorded at this site they were of the pollution tolerant 'C' group (Ephemerellidae and *Baetis rhodani* of Baetidae). Therefore, according to EPA freshwater biological monitoring criteria, this stretch of river retains its 'Moderately Polluted'

status, i.e. Class C (Q3). A Small Stream Risk Score (SSRS) of 4.8 was calculated for this site. This implies that this stretch of stream is 'at risk', with an SSRS score of 4.8 for 2008.

4.4 Site 4 River Nanny (control)

This site was located on the River Nanny approximately 1.5 km upstream of the Knockharley stream confluence. This section of the Nanny has also been modified but has recovered well. The section surveyed had a mean wetted width of 2 m and a mean depth of 25 cm. Like the receptor site (Site 3), water levels at his site were deemed low. The substrate was considerably silted in deeper slower sections. Plate 4 shows the extent of this siltation in a pool in the surveyed stretch. Habitat for macroinvertebrates was considered to be sub-optimal due to the extent of shading and pool quality.

In addition to three-spined stickleback, 16 macroinvertebrate families were recorded at this site. Two varieties of Ephemeropteran/mayfly larvae were found; those of the large dark olive in fair numbers with a presence of blue-winged olive larvae. The most diverse group were the caddisflies (Trichopterans) with four cased species and three caseless species recorded. Fair numbers of larvae of the little black caddisfly *Agapetus fuscipes* and the northern caddisfly were recorded with small numbers of the black caperer. Northern caddisfly larvae of *Halesus digitatus* were present. The caseless caddisfly larvae composition was sandfly (scarce), trumpet-net caddisfly (present) and grey flag caddisfly (present). Numerous freshwater shrimp were recorded at this site. True fly larvae recorded were green chironomids which were scarce and cranefly larvae of *Dicranota sp*., the latter being present. River limpets, flatworms and roundworms were generally scarce. The crawling water beetle *Brychius elevatus* and water crickets were both present.

Despite the levels of silt in pools of this reach of the River Nanny, the pollution tolerant group 'E' *Chironomous sp*. and group 'D' hog louse and leeches were not found during the current survey. Though no Class 'A' pollution indicators were recorded at this site, all other factors (macroinvertebrate composition, D.O. at 88.1%, absence of algal growths) indicate that biological water quality is deemed to be at least as good as in the previous survey. Therefore it is rated as being 'Slightly Polluted, Class B (Q3-4)'. The SSRS for this site is 6.4 meaning that this part of the river is in the 'at risk category'. However, this is borderline with the 'probably at risk' category as it is near the threshold of 6.5.

5. Discussion

5.1 Knockharley Stream

The water quality of the control site on the Knockharley Stream has gradually deteriorated since 2005. It was rated as 'Moderately Polluted (Q3) in 2005, 'Seriously Polluted' (Q2-3) in 2007 and currently 'Seriously Polluted (Q2)'. This decline in water quality has also been reflected in the SSRS (small streams risk score) over the two most recent surveys when it fell from 2.4 in 2007 to 0 this year. There was an overall increase in macroinvertebrate diversity at the control site this year but this increase was brought about by an increase of 'very pollution tolerant' organisms. Also, the pollution tolerant hog louse has overtaken the freshwater shrimp in relative abundances since the 2007 survey. Identification of the cause of this pollution is outside the scope of this study but is thought to include agricultural inputs. This site is located upstream of the landfill site and would not be affected by emissions from this facility.

At the receptor site on the Knockharley Stream, approximately 4 km downstream of the control site, the macroinvertebrate community was also mainly composed of pollution tolerant organisms. The receptor site has poor physical habitat in contrast with the upstream receptor site. However, there is a more diverse range of organisms when compared to the previous survey (14 currently as opposed to 9 previously). There are two more species of group 'B' cased caddisfly larvae and a reversal in the relative abundances of the hog louse and the freshwater shrimp, the latter now more abundant. These findings show that biological water quality is improving in this part of the stream, i.e. downstream of the Knockharley facility. This is also evident with a current quality rating of Q3 this year, slightly better than Q2-3 in 2007.

The receptor site has had stable water quality between 2004 and 2007 (Q2-3). Though still in the SSRS 'at risk' category (score = 3.2) the situation is slightly better than last year when this site scored 2.8.

5.2 River Nanny

At the control site on the River Nanny, the previously recorded pollution tolerant group 'E' *Chironomous sp*. and group 'D' hog louse and leeches were not found during the current survey. Furthermore, there was an increase in the diversity and relative abundance of group 'B' cased caddisfly larvae (N=4 in 2007 to N=7 in 2008). From the current study, it was found that the water quality of the control site has not changed between 2007 and 2008 and remains 'Moderately Polluted (Q3-4)'. However, there appears to be a slight improvement in water quality but this was not enough to increase the Q-value. The SSRS for this site changed from 5.2 in 2007 to 6.4 in 2008. Should this trend continue, this part of the River Nanny will no longer be in the 'at risk category'. However, this part of the river has some siltation problems and the previously recorded group 'A' heptagenid mayfly larvae *Ecdyonurus sp*. was not recorded in the current survey. This site is upstream from the landfill facility and would not be affected by emissions from this site.

Like the previous survey, the receptor site on the River Nanny had the richest macroinvertebrate assemblage and this could be attributed to the size of the river at this location. Water levels were quite low at the time of the survey. Water quality at the receptor site dropped from Q3-4 in 2005 to Q3 in 2007 but has remained stable since then so it is still considered to be 'Moderately Polluted (Q3). However, a slight decline in water quality was recorded since the previous survey despite a small increase in family diversity. With the SSRS falling from 5.2 in 2007 to 4.8 in 2008, this stretch of stream is still 'at risk' as in the previous survey but has worsened somewhat. The relative abundance of the freshwater shrimp (group C) has remained stable in the two consecutive surveys (2007 and 2008) but that of the black caperer caddisfly (group B) has significantly decreased. These were the two most abundant organisms previously recorded at this site. Conversely, the relative abundance of the more pollution tolerant blue-winged olive mayfly (group C) has significantly increased. Also, previously recorded grey flag caddisfly larvae were not recorded during the current survey. The increase in siltation at this site could be responsible for the changes in the aquatic faunal community. This part of the Nanny River is slower flowing than the control site so its ecosystem would probably be more susceptible to increased siltation due to greater deposition of suspended solids. These can blanket over the substrate and reduce oxygen available to macroinvertebrates living in the substrate. Such siltation originates further upstream in the catchment and activities at the Knockharley landfill site are not implicated.

5.3 EPA Results

The most recent EPA report noted that the River Nanny was in an unsatisfactory state (Moderately Polluted) when surveyed in May 2005 (Toner et *al*., 2005). The nearest and most recent EPA rating for the River Nanny near the control site is at the east bridge (in Kentstown EPA site code 08/N/01/0110) when water quality was Q2-3 in 2005. This result does not match the result obtained during the survey undertaken by Ecofact (O' Connor, 2006), probably due to variations in sampling location or time of the year.

The River Nanny downstream of Nanny Bridge (EPA site code 08/N/01/0280) was rated by the EPA as Q4 in 2005 (the last published survey). This rating may have changed since then.

5.4 Monitoring

Biological surveys are usually undertaken in the summer-autumn period (June-October) when flows are relatively low and water temperatures highest (McGarrigle *et al*, 2002). The timing of the current survey therefore coincided with the worst conditions to be expected in those reaches affected by waste inputs. When monitoring by sampling for macroinvertebrates, the sample is required to identify the impact of pollution on the streams, thus if there are riffled areas these should receive preference in sampling because the fauna of riffles generally tends

to be more sensitive to pollution impacts than those characteristic of say slow-flowing pool habitats (Walsh, 2005). Some variations in sampling technique could result in small differences in the type and relative abundances of organisms collected during kick sampling. For example, slight differences in sampling locations at sampling sites could influence the macroinvertebrates recorded. Also, preceding environmental conditions can also affect the macro-invertebrate community present. However, macroinvertebrates all sites would be subject to these environmental stresses.

5.5 Conclusion

There is no evidence that the landfill operations are having any effect on the water quality of the receptor streams. It is likely that diffuse sources of pollution, such as agricultural inputs, are the main causes of pollution in these watercourses. Variations in such inputs, environmental factors, and (to a lesser degree) timing and micro-location of sampling have probably all contributed to the variation in results obtained over the past 5 years.

Table 1 Location and selected water quality characteristics of the four aquatic survey sites.

Site	1	2	3	4
Location	Downstream receptor site on the Knockharley Stream	Upstream control site on the Knockharley Stream	Downstream receptor site (Corresponds with EPA site 08/N/01/0200) on the River Nanny	Upstream control site (Corresponds with EPA site 08/N/01/0110) on the River Nanny
Temp (^{0}C)	14.3	13.2	15.1	13.6
Conductivity (mS/cm)	616	716	700	734
Dissolved oxygen (%)	83.9	89.4	93.9	88.1
Dissolved oxygen (mg/l)	8.6	9.36	9.35	9.18

Table 2 Physical characteristics of the aquatic survey sites.

Physical characteristic	Site 1	Site 2	Site 3	Site 4
Flow (cm/sec)	<5	<5	5	5
Bank height (cm)	130	60	100	85
Maximum depth (cm)	30	25	70	40
Mean depth (m)	15	10	35	25
Riffle (%)	15	50	10	30
Glide (%)	40	20	50	45
Pool (%)	45	30	40	25
Wetted width (m)	1.3	0.7	3.5	2.0
Rock (%)	10	25	15	25
Cobble (%)	10	30	30	20
Gravel (%)	10	35	35	30
Fine (%)	70	10	20	25
Shade (%)	85	35	15	40
Bank slope (^{o})	85	75	70	70
Bank cover (%)	70	85	100	90
Instream vegetation cover (%)	0	5	10	25

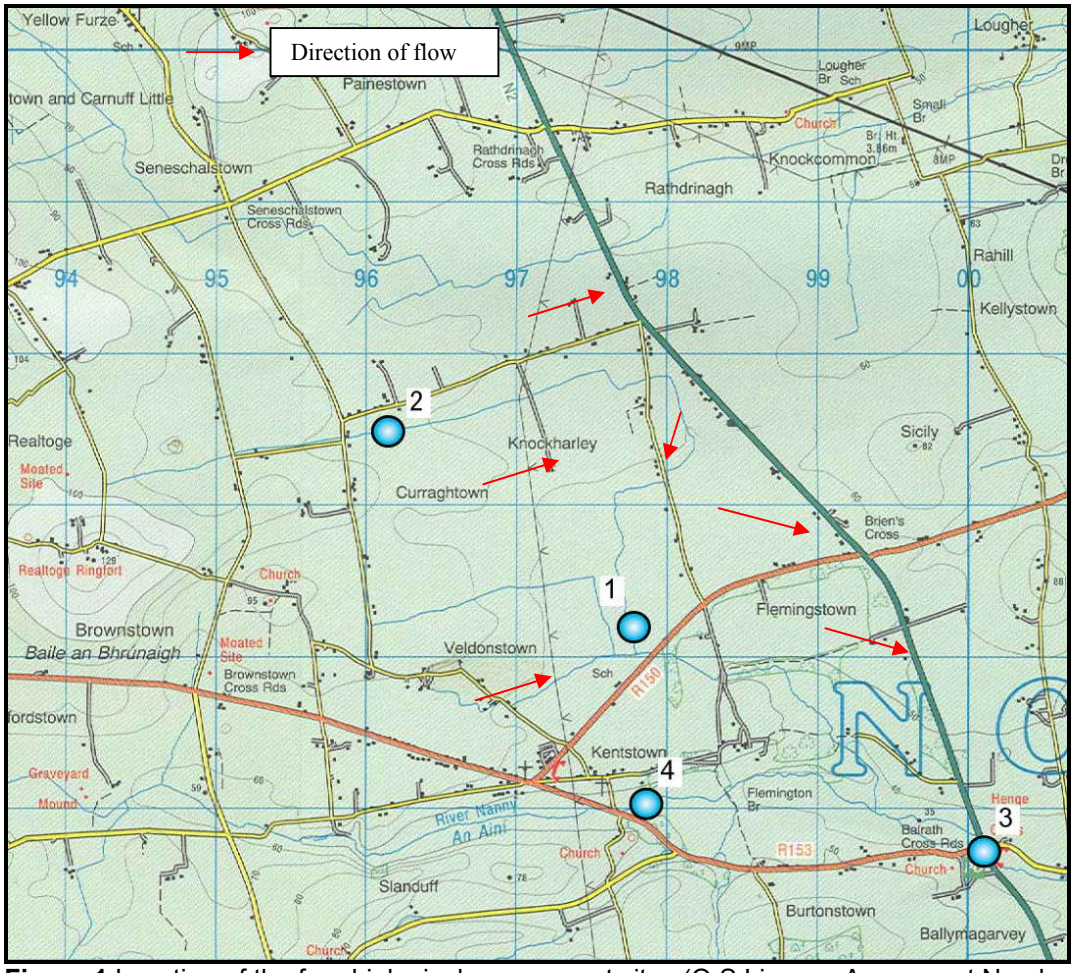

Figure 1 Location of the four biological assessment sites (O.S License Agreement Number AR0038702, Ordnance Survey Ireland, Government of Ireland).

Table 3 Results of the July 2008 biological assessment of the Knockharley Stream and River Nanny.

Organism	Pollution sensitivity group	Functional group	Site			
			1	2	3	4
MAYFLIES (Uniramia, Ephemeroptera)						
Baetidae						
Large dark olive *Baetis rhodani*	C	Scraper & Gathering Collector			**	****
Spiny crawler mayflies (Ephemerellidae)						
Blue-winged olive *Ephemerella ignita*	C	Gathering collector			*****	*
CASED CADDIS FLIES (Tricoptera)						
Northern caddisflies (Limnephilidae)						
Potamophylax latipennis	B	Shredder			****	****
Halesus digitatus	B	Shredder				*
Micropterna lateralis	B	Shredder				
Limnephilus lunatus	B	Shredder	****			
Glossosomatidae						
Little black caddisfly *Agapetus fuscipes*	B	Scraper				****
Goeridae						
Goera pilosa	B	Scraper	**		***	
Primitive caddisflies (Sericostomatidae)						
Black caperer *Sericostoma personatum*	B	Shredder	**		*	***
CASELESS CADDIS FLIES (Trichoptera)						
Grey flags (Hydropsychidae)						
Hydropsyche angustipennis	C	Filtering collector				*
Green sedges (Rhyacophilidae)						
The sandfly *Rhyacophila dorsalis*	C	Predator			*	**
Trumpet-net caddisflies (Polycentropodidae)						
Plectronemia conspersa	C	Filtering collector	*			*
TRUE FLIES (Diptera)						
Moth fly (Psychodidae)	C	Shredder		*		
Chironomidae						
Midge/Buzzer *Chironomous sp.*	E	Filtering collector	*	*****	*	
Green chironomid	C	Filtering collector	***	*		**
Tipulidae	C	Shredder		*****		
Dicranota sp.	C	Shredder		**		*
Mosquitos/Gnats (Culicidae)	N/A	Collector			*	

**Present, **Scarce/Few, ***Small Numbers, ****Fair Numbers, *****Common, ******Numerous, *******Dominant, ********Excessive.*

Table 3 (continued) Results of the July 2008 biological assessment of the Knockharley Stream and River Nanny.

Organism	Pollution sensitivity group	Functional group	Site			
			1	2	3	4
MUSSELS (Mollucsa, Lamellibranchiata)						
Pea Mussels (Sphaeridae)						
Pisidium sp.	D	Filtering collector	***	****	*	
CRUSTACEANS (Crustacea, Malostraca)						
Amphipods (Amphipoda, Gammaridae)						
Freshwater shrimp *Gammarus duebeni*	C	Shredder	******	**	******	******
Isopods (Order Isopoda, Asellidae)						
Hog Louse *Asellus aquaticus*	D	Shredder	*****	******	****	
SNAILS (Mollusca, Gastropoda)						
Lymnaeidae						
Wandering snail *Lymnaea peregra*	D	Shredder		**		
Ancylidae						
River limpet *Ancylus fluviatilis*	C	Grazer		***		**
SEGMENTED WORMS (Annelida, Clitellata)						
Oligochaeta	D	Collector	*	*	*	
BEETLES (Coleoptera)						
Riffle Beetles (Elminthidae)						
Helmis maugei (larvae)	C	Predator			*	
Diving beetle larvae (Dysticidae)	C	Predator				
Sub family Colymbetinae						
Agabus sp.	C	Predator/scraper		*		
Crawling water beetles (Haliplidae)						
Brychius elevatus	C	Predator				*
Water Scavenger Beetles (Hydrophilidae)						
Subfamily Helophorinae						
Helophorus sp.	C	Predator		*		
Weevils (Curculionidae)	C	Grazer	*			
Crawling water beetles (Haliplidae)						
Brychius elevatus	C	Predator				
Whirligig beetles (Gyrinidae)						
Common whirligig beetle *Gyrinus substriatus*	C	Predator			*	
BUGS (Hemiptera)						
Water crickets (Veliidae)	C	Predator			*	*
ROUNDWORMS (Nematoda)	D	Collector	*			*
FLATWORMS (Platyhelminthes)	D	Collector	*	***	***	***

**Present, **Scarce/Few, ***Small Numbers, ****Fair Numbers, *****Common, ******Numerous, *******Dominant, ********Excessive.*

Table 3 (continued) Results of the July 2008 biological assessment of the Knockharley Stream and River Nanny.

Organism	Pollution sensitivity group	Functional group	Site			
			1	2	3	4
Glossiphoniidae						
Helobdella stagnalis	D	Predator				
Glossiphonia complanata	D	Predator	**	**	**	
Erpobdellidae						
Haemopis sanguisuga	D	Predator		*	*	
Erpobdella octoculata	D	Predator	*	**		
SPIDERS (Crustacea, Arachnida)						
Water mite (Order Hydracarina)	C	Predator		***	**	
Number of different families			**14**	**15**	**19**	**16**

**Present, **Scarce/Few, ***Small Numbers, ****Fair Numbers, *****Common, ******Numerous, *******Dominant, ********Excessive.*

Table 4 Water quality rating of the four sites investigated during the September 2007 and previous biological assessments of the Knockharley Stream and the River Nanny. The SSRS and SSRS category of the two most recent surveys are also given.

	Site 1	Site 2	Site 3	Site 4
Q-value 2008	Q3	Q2	Q3	Q3-4
Q-value 2007	Q2-3	Q2-3	Q3	Q3-4
Q-value 2005	Q2-3	Q3	Q3-4	Q3
Q-value 2004	Q2-3	Q3	Q2-3	Q2-3
Rating 2008	Moderately Polluted	Seriously Polluted	Moderately Polluted	Slightly Polluted
Quality 2008	Class C	Class D	Class C	Class B
SSR Score 2008	3.2	0	4.8	6.4
SSR Score 2007	2.8	2.4	5.2	5.2
SSRS category	At risk	At risk	At risk	At risk

Plates (2008 survey)

Plate 1 Knockharley Stream downstream receptor site (Site 1).

Plate 2 Knockharley Stream upstream control site (Site 2).

Plate 3 River Nanny downstream receptor site (Site 3).

Plate 4 River Nanny upstream control site (Site 4).

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Appendix 1 EPA River Quality Classification Scheme

The Q values are a measure of the EPA's Biological River Quality classification system. The EPA conducts a rolling programme of biological surveys of selected rivers. The higher the biological diversity and the greater the abundance of invertebrate species sensitive to organic pollution, the higher the water quality is assumed to be, and the higher the 'Q value' assigned to that sampling station. The EPA's water quality classification systems are summarized below:

Table 1.1 Biological River Quality Classification and River Water Quality Class System (McGarrigle *et al* 2002).

'Q' value	Community Diversity	Water Quality	Condition*	Status	Quality
Q5	High	Good	Satisfactory	Unpolluted	Class A
Q4	Reduced	Fair	Satisfactory	Unpolluted	Class A
Q3	Much Reduced	Doubtful	Unsatisfactory	Slightly Polluted	Class B
Q2	Low	Poor	Unsatisfactory	Moderately Polluted	Class C
Q1	Very Low	Bad	Unsatisfactory	Seriously Polluted	Class D

* 'Condition' refers to the likelihood of interference with beneficial or potential beneficial use.

Class A waters are those in which problems relating to existing or potential uses are unlikely to arise. They are therefore regarded as being in a 'satisfactory' condition. Classes B, C and D are to a lesser or greater extent 'unsatisfactory' in this regard. For example, the main characteristics of Class B and C waters is eutrophication, which may interfere with the amenity, abstraction or fisheries uses of such waters. The general characteristics of waters of the various Biological Quality Classes are provided in Table A1.2.

Table A1.2 The general characteristics of waters of the various Biological Quality Classes.

Quality Classes	**Class A**		**Class B**	**Class C**	**Class D**	
Quality Ratings	**Q5**	**Q4**	**Q3-4**	**Q3**	**Q2**	**Q1**
Pollution Status	Pristine, Unpolluted	Unpolluted	Slight Pollution	Moderate Pollution	Heavy Pollution	Gross Pollution
Organic Waste Load	None	None	Light	Considerable	Heavy	Excessive
Maximum B.O.D.	Low (< 3mg/l)	Low (< 3mg/l)	Occasionally elevated	High at times	Usually High	Usually very high
Dissolved Oxygen	Close to 100% at all times	80%-120%	Fluctuates from <80% to >120%	Very unstable, Potential fish-kills	Low, sometimes zero	Very low, often zero
Annual median PO_4	0.015 mg/l	0.03 mg/l	0.045 mg/l	0.07 mg/l	> 0.1 mg/l	> 0.1 mg/l
Siltation	None	May be light	May be light	May be considerable	Usually heavy	Usually very heavy and anaerobic
'Sewage Fungus'	Never	Never	Never	May be some	Usually abundant	May be abundant
Filamentous Algae	Limited Development	Considerable growth, diverse communities	Luxuriant growths, typically Cladophora	Excesssive growths, typically Cladophora	Usually abundant	None
Macrophytes	Diverse communities, limited growths	Diverse Communities, Considerable Growths	Reduced diversity, luxuriant growths	Limited diversity, excessive growths	Tolerant species only, may be abundant	Most tolerant forms, minimal diversity
Water Quality	Highest quality	Fair Quality	Variable quality	Doubtful quality	Poor quality	Bad quality
Abstraction Potential	Suitable for all	Suitable for all	Potential problems	Advanced treatment	Low grade abstractions	Extremely limited
Fishery Potential	Game fisheries	Good game fisheries	Game fish at risk	Coarse fisheries	Fish usually absent	Fish absent
Amenity Value	Very high	High	Considerable	Reduced	Low	Zero

Appendix 2 EPA Water Quality Data for the River Nanny

Taken from Toner *et al*, 2005, with 2005 results and assessment downloaded from the EPA website www.epa.ie on 30/10/07).

River and Code : **NANNY (MEATH)** **08/N/01**
Tributary of : Sea - Laytown OS Catchment No: 160
OS Grid Ref : O 163 712

Sampling Stations — Biological Quality Ratings (Q Values)

No.	**1971**	**1974**	**1978**	**1980**	**1982**	**1986**	**1988**	**1991**	**1996**	**1998**	**2001**	**2005**
0040	-	-	-	-	-	-	-	-	2-3	2-3	2	2-3
0090	-	-	-	-	-	-	2-3	2-3	-	-	-	-
0100	-	-	-	-	-	-	-	-	-	-	-	-
0110	-	-	-	-	-	-	3	3	3	2-3	2-3	2-3
0200	-	-	-	3-4	2-3	3	3-4	3-4	-	-	-	-
0280	-	-	-	-	-	-	3	3	3	3-4	3-4	4
0300	5	4-5	3-4	3	1-2	2	-	3	-	-	-	-
0400	4-5	3-4	4	3-4	4	3-4	2-3	3	-	-	-	-
0500	3	1-2	3	3	3-4	3-4	3	3-4	3	3-4	3-4	3-4
0600	-	-	-	3-4	3	3-4	3	-	-	-	-	-
0650	-	-	-	-	-	3-4	3-4	3-4	4	4	3	-
0700	4	3-4	3	3	3-4	3-4	3-4	3	3-4	3-4	3	3-4

No.	Location	No.	Location
0040	Folistown Br	0300	Bridge near Deenes
0090	East Bridge, S. of Brownstown	0400	Upstream Bridge, Duleek
0100	West Br Kentstown	0500	Bridge N.E. of Bellewstown Ho
0110	East Bridge, Kentstown	0600	Beaumont Bridge
0200	Br just S. of Balrath X-Roads	0650	Dardistown Bridge
0280	Bridge d/s Nanny Bridge	0700	Bridge at Julianstown

EPA Assessment of the River Nanny

Despite slight improvements at three locations (0040, 0280 and 0700) the Nanny was in a mostly unsatisfactory quality condition when surveyed in May 2005. Just one location (0280) could be regarded as satisfactory as regards macroinvertebrate composition but the high Dissolved Oxygen reading recorded there (134%) indicated some enrichment also. The upper river was no longer seriously polluted at Folistown Bridge (0040) but the substratum there and also downstream at Kentstown (0110) was very heavily silted with deep banks of mud at the sides. As indicated by luxuriant algal crops and considerable bottom siltation at Bellewstown (0500) and Julianstown (0700) the lower river continued to be impacted by eutrophication and possibly land disturbance.

APPENDIX 3

Bund Integrity Report

KNOCKHARLEY RESIDUAL LANDFILL
KNOCKHARLEY
CO. MEATH

WASTE LICENCE REG. NO. W0146-01

INSPECTION AND TESTING
OF
LEACHATE LAGOON & OIL BUND
AT
KNOCKHARLEY RESIDUAL LANDFILL

Prepared for:

Greenstar
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May 2008

GREENSTAR

INSPECTION AND TESTING OF LEACHATE LAGOON & OIL BUND AT KNOCKHARLEY RESIDUAL LANDFILL

User is Responsible for Checking The Revision Status Of This Document

Rev. Nr.	Description of Changes	Prepared by:	Checked by:	Approved by:	Date:
A	Issue for Client	DMB	KB		01/05/08

Client: Greenstar

Keywords: Integrity, Lagoon, Bund

Abstract: A hydrostatic test based on the procedure outlined in BS 8007: 1987 Code of Practice for Design of Concrete Structures for Retaining Aqueous Liquids was employed for both a concrete bund and a leachate lagoon ascertaining the respective structures integrity.

TABLE OF CONTENTS

APPENDICES

1. INTRODUCTION

Fehily Timoney & Co. (FTC) was retained by Greenstar, (the Client), to assess an oil bund and leachate storage lagoon at Knockharley Residual Landfill, Knockharley, Co. Meath in accordance with Condition 3.11.6 of Waste Licence No. W0146-01.

Condition 3.11.6

> *The integrity and water tightness of all the bunds, tanks and containers and their resistance to penetration by water or other materials stored therein shall be tested and demonstrated by the licensee and shall be reported to the Agency following their installation and prior to their use as a fuel storage area. This testing shall be carried out by the licensee at least once every three years thereafter and reported to the Agency on each occasion. The licensee shall also maintain a record on the storage of fuels at the facility. A written record of all integrity tests and any maintenance or remedial work arising from them shall be maintained by the licensee.*

The assessment carried out in April 2008 was a hydrostatic test based on the procedure outlined in BS 8007: 1987 Code of Practice for Design of Concrete Structures for Retaining Aqueous Liquids. The same procedure was employed for both the bund and the lagoon test. Following completion of the test period, an additional visual inspection along the outer perimeter of the lagoon was also carried out to detect signs of degradation. An internal inspection of the bund was carried out, however; as the leachate storage lagoon is sealed with a HDPE floating cover, an inspection of the inner surfaces was not carried out. It was proposed that should the test result in failure, further actions would then be taken.

2. STRUCTURES

2.1. Leachate Lagoon

The lagoon is situated to the east of the landfill as depicted in Drawing SK001 (Appendix 1). The lagoon area is approximately 1,400 m^2.

Details of the construction of the lagoon are as follows;

- The lagoon was constructed in 2002/03 with a combination of 2mm HDPE liner and a 1m layer of compacted clay laid to the same specification as the clay in the landfill cells. The slopes are 1V:3H.
- The slopes are lined with a 2.0mm HDPE liner. The HDPE liner is anchored in a 0.5m deep, 0.65m wide trench running along the perimeter of the lagoon.
- A floating 2mm HDPE roof liner seals the lagoon.
- The internal depth of the lagoon is approximately 3.0-3.5 meters.

2.2. Concrete Oil Bund

The bund is situated to the east of the landfill as depicted in Drawing SK001. The bund is located externally to the maintenance building and has a total capacity of 6.3 m^3. It is constructed of poured in-situ concrete founded on the external slab of the maintenance shed compound. Wall thickness is approximately 0.20 meters with an internal depth of approximately 0.41 meters.

3. INTEGRITY TEST PROCEDURE & CONCLUSION

3.1. Assessment Procedure

The same assessment procedure was undertaken for both the leachate lagoon and the concrete oil bund. The procedure for the integrity testing was designed to comply with the requirements of Section 9.2 of BS 8007:1987, the British Standard Code of Practice for design of concrete structures for retaining aqueous liquids.

This assessment requires a minimum 7-day test to be carried out for concrete structures designed and constructed to the specifications of the standard. This test standard best suits both the concrete oil bund and the leachate lagoon. The 7-day test duration and the inclusion of rainfall and evaporation rates, enable leakage rates to be determined. The rainfall and evaporation rates were determined employing the use of a partially filled impervious steel barrel located onsite and also the data obtained from Met Éireann's station point in Dublin Airport.

3.2. Assessment Details

Both tests were carried out between the 22nd and 29th April 2008. Measurements were made of the leachate level in the lagoon, water level in the bund and of the water level in the barrel on a daily basis, except at the weekend, when no measurements were taken on site.

Each structures measurement was carried out by determining the distance from an internal arbitrary fixed point. These points were used to make all measurements of their respective structures. Throughout the test duration weather conditions were generally calm and warm.

The onsite barrel measurements were compared with the rainfall and evaporation data from Dublin Airport provided by Met Éireann. The data from the barrel corresponds with the Met Éireann data indicating a net equivalent of 18.9-19mm evaporation over the duration of the test.

Incorporating the obtained meteorological data with onsite measurements the following conclusions can be drawn;

- **Leachate Lagoon**
  Net drop of 2.0mm in leachate level. This can be due to any slight wave action during test measurements.

  Visual inspections undertaken throughout the test period indicate no evidence of leakage or structural problems.

- **Concrete Oil Bund**
  Net equivalent of 19.8mm drop in water level due to evaporation.

  Visual inspections undertaken throughout the test period indicate no evidence of leakage or structural problems.

3.3. Conclusion

Both structures have passed the hydrostatic test and are deemed fit for use by Greenstar. (Certifications attached in Appendix 3.)

APPENDIX 1

Drawings

APPENDIX 2

Integrity Testing Results

INTEGRITY TESTING RESULTS

LEACHATE LAGOON

Data No.	Date	Time	Lagoon (mm)	Rainfall (mm)	Evaporation (mm)	Net Level (mm)
1	22 April 2008	11:30	1000	No rainfall or evaporation data pertains to an enclosed sealed lagoon.		1000
2	23 April 2008	10:30	1005			1005
3	24 April 2008	10:45	1003			1003
4	25 April 2008	10:15	1006			1006
5	26 April 2008	No Measurement Taken				-
6	27 April 2008					-
7	28 April 2008	12:40	1004			1004
8	29 April 2008	10:30	1002			1002
Change Over Test Duration			**2.0mm**			**Drop of 2.0mm**

CONCRETE OIL BUND

Data No.	Date	Time	Bund (mm)	Rainfall (mm)	Evaporation (mm)	Barrel (mm)	Net Level (mm)
1	22 April 2008	11:00	254	3.8	3.356	336	253.56
2	23 April 2008	10:15	254	0.6	3.936	337	257.34
3	24 April 2008	10:30	257	1.4	3.876	341	259.48
4	25 April 2008	10:00	261	0.1	2.367	344	263.27
5	26 April 2008	No Measurement Taken		0	2.699	-	-
6	27 April 2008			0.2	3.149	-	-
7	28 April 2008	12:00	268	0.8	3.009	352	270.21
8	29 April 2008	10:10	270	0	3.39	355	273.39
Change Over Test Duration			**16mm**	**Net Equivalent of 18.9mm evaporation**		**Net Equivalent of 19mm evaporation**	**Drop of 19.8mm**

Notes

1. Lagoon levels were measured from reference mark at entering manhole.
2. Bund levels were measured from a reference mark located on the inside of the bund.
3. Barrel levels were measured from an internal reference mark.
4. Net Levels incorporate the Met Éireann data supplied at the Dublin Airport Weather Station

APPENDIX 3

Test Certificates

FEHILY TIMONEY & COMPANY

CONSULTANTS IN ENGINEERING & ENVIRONMENTAL SCIENCES

CORK DUBLIN

Bund Test Report

Job Number:
Knockharley Residual Landfill, Knockharley, Co. Meath

Bund Location:
Knockharley Residual Landfill, Knockharley, Co. Meath

Bund Reference No: n/a

Bund Description:

The bund is situated to the east of the landfill. It is located externally to the maintenance building and has a total capacity of 6.3 m^3. It is constructed of poured in-situ concrete founded on the external slab of the maintenance shed compound. Wall thickness is approximately 0.20 meters with an internal depth of approximately 0.41 meters.

Details of Bund Inspection & Testing:

The bund was visually inspected by a senior civil engineer prior to the commencement of the test ascertaining the condition of the perimeter. Upon completion of the hydrostatic test a further visual assessment was carried out to determine whether any deterioration or visual leakage had occurred.

The assessment carried out in April/May 2008 was a hydrostatic test based on the procedure outlined in BS 8007: 1987 Code of Practice for Design of Concrete Structures for Retaining Aqueous Liquids.

The lagoon was monitored daily over a seven day period. No drop in level was recorded.

Recommendation

It is recommended that the bund be cleaned out thoroughly.

Conclusion

This bund has passed the retention test.

Signed, Date:

K P Bhattarai — 01 May 2008

Keshav Bhattarai
Chartered Engineer

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FEHILY TIMONEY & COMPANY

CONSULTANTS IN ENGINEERING & ENVIRONMENTAL SCIENCES

CORK DUBLIN

Lagoon Test Report

Job Number:
DE08-172-03

Lagoon Location:
Knockharley Residual Landfill, Knockharley, Co. Meath

Lagoon Reference No: n/a

Lagoon Description:

The lagoon is located to the east of the landfill. The lagoon was constructed in 2002/03 with a combination of 2mm HDPE liner and a 1m layer of compacted clay laid to the same specification as the clay in the landfill cells. The slopes are 1V:3H and are lined with a 2.0mm HDPE liner. The HDPE liner is anchored in a 0.5m deep, 0.65m wide trench running along the perimeter of the lagoon. A floating 2mm HDPE roof liner seals the lagoon. The internal depth of the lagoon is approximately 3.0-3.5 meters.

Details of Lagoon Inspection & Testing:

The lagoon was visually inspected by a senior civil engineer prior to the commencement of the test ascertaining the condition of the perimeter. Upon completion of the hydrostatic test a further visual assessment was carried out to determine whether any deterioration or visual leakage had occurred.

The assessment carried out in April/May 2008 was a hydrostatic test based on the procedure outlined in BS 8007: 1987 Code of Practice for Design of Concrete Structures for Retaining Aqueous Liquids.

The lagoon was monitored daily over a seven day period. No drop in level was recorded.

Conclusion

This lagoon has passed the hydrostatic test.

Signed, Date:

K P Bhattarai — 01 May 2008

Keshav Bhattarai
Chartered Engineer

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APPENDIX 4

Energy Management Plan

Knockharley Landfill
Energy Management Policy Statement

Greenstar regards environmental protection as an integral and essential part of good business practice. We are committed to achieving and maintaining a high standard of environmental quality in all of our operations.

In conjunction with Knockharley Landfill's Environmental Management System, this policy has been developed as a commitment to reduce the environmental impact of our activities and the energy consumption associated with these activities.

This Energy Management Policy declares intent to:

- Improve energy efficiency
- Reduce energy consumption where possible
- Reduce emissions of CO_2 and other harmful greenhouse gases
- Reduce consumption of finite fossil fuels
- Improve energy awareness

To achieve these, we shall establish:

- long-term goals
- medium-term objectives
- short-term targets
- an action plan for achieving all goals, objectives and targets
- an energy management plan to ensure continual review and improvement

Author: Heather Miller
Date: 17/12/08
Revision: 0

APPENDIX 5

Gas Sim Report

GasSim Version 1.54
Project Name : Knockharley
Client Name :

Gas	CAS	Reporting Threshold	Value to report	Amount Produced 25%	75%
Inorganics					
Ammonia	7664-41-7	1.00 t	n/a		
Asbestos	1332-21-4	1.00 kg	n/a		
Carbon Dioxide - 'chemical'	124-38-9	10,000.00 t	9,390.00 t	9,390.00 t	9,390.00 t
Carbon Dioxide - 'thermal'	124-38-9	10,000.00 t	0.00 g	0.00 g	0.00 g
Carbon disulphide	75-15-0	1.00 t	94.10 kg	25.70 kg	495.00 kg
Carbon monoxide	630-08-0	100.00 t	65.30 kg	11.30 kg	422.00 kg
Hydrogen chloride	7647-01-0	10.00 t	0.00 g	0.00 g	0.00 g
Hydrogen cyanide	74-90-8	100.00 kg	n/a		
Nitrous oxide	10024-97-2	10.00 t	n/a		
Phosgene	75-44-5	10.00 kg	n/a		
Sulphur hexafluoride	2551-62-4	10.00 kg	n/a		
Organics					
Acetaldehyde [Ethanal]	75-07-0	100.00 kg	2.89 kg	1.42 kg	7.34 kg
Acrolein	107-02-8	10.00 kg	n/a		
Acrylamide [2-Propenamide]	79-06-1	10.00 kg	n/a		
Acrylonitrile [2-Propenenitrile]	107-13-1	1.00 t	n/a		
Aldrin	309-00-2	1.00 kg	n/a		
Allyl alcohol [2-Propen-1-ol]	107-18-6	10.00 kg	n/a		
Amitrole [3-Amino-1,2,4-triazole]	61-82-5	1.00 kg	n/a		
Aniline [Benzeneamine]	62-53-3	10.00 kg	n/a		
Anthracene	120-12-7	10.00 kg	n/a		
Benzene	71-43-2	1.00 t	134.00 kg	76.00 kg	203.00 kg
Benzo(a)pyrene	50-32-8	1.00 kg	0.00 g	0.00 g	0.00 g
Benzo(b)fluoranthene	205-99-2	1.00 kg	n/a		
Benzo(g,h,i)perylene	191-24-2	1.00 kg	n/a		
Benzo(k)fluoranthene	207-08-9	1.00 kg	n/a		
Benzo butyl phthalate (BBP)	85-68-7	10.00 kg	n/a		
Benzyl chloride	100-44-7	10.00 kg	n/a		
Bromoethene	593-60-2	10.00 kg	n/a		
Butadiene [1,3-Butadiene]	106-99-0	100.00 kg	0.00 g	0.00 g	0.00 g
Butene - all isomers	-	1.00 t	682.00 g	254.00 g	1.75 kg
Carbon tetrachloride [Tetrachloromethane]	56-23-5	10.00 kg	0.00 g	0.00 g	0.00 g
Chlordane	57-74-9	1.00 kg	n/a		
Chlordecone	143-50-0	1.00 kg	n/a		
Chlororethane	75-00-3	10.00 kg	n/a		
Chloroform [Trichloromethane]	67-66-3	100.00 kg	1.78 kg	218.00 g	5.59 kg
Chloroprene	126-99-8	10.00 kg	n/a		
Chrysene	218-01-9	10.00 kg	n/a		
Crotonaldehyde	4170-30-3	10.00 kg	n/a		
Cumene hydroperoxide	80-15-9	10.00 kg	n/a		
Dibutyl phthalate	84-74-2	10.00 kg	n/a		
p-Dichlorobenzene [1,4-Dichlorobenzene]	106-46-7	1.00 kg	862.00 g	322.00 g	2.56 kg
Dichlorodiphenyltrichloroethane (DDT)	50-29-3	1.00 kg	n/a		
Dichloromethane (DCM) [Methylene chloride]	75-09-2	1.00 t	917.00 g	185.00 g	7.11 kg
Dieldrin	60-57-1	1.00 kg	n/a		
Diethyl aniline [N,N-Diethyl benzeneamine]	91-66-7	10.00 kg	n/a		
Di(2-ethylhexyl)phthalate (DEHP)	117-81-7	10.00 kg	n/a		
Diethyl ether	60-29-7	10.00 kg	n/a		
Diisopropyl ether	108-20-3	10.00 kg	n/a		
Dimethylaniline [N,N-Dimethyl benzeneamine]	121-69-7	10.00 kg	n/a		
Dimethyl sulphate	77-78-1	1.00 kg	n/a		
Dimethylformamide	68-12-2	1.00 t	n/a		
Dimethyl-o-toluidine	609-72-3	10.00 kg	n/a		
Dimethyl-p-toluidine	99-97-8	10.00 kg	n/a		
Dioxane	123-91-1	10.00 kg	n/a		
Diphenylamine	122-39-4	10.00 kg	n/a		
Endrin	72-20-8	1.00 kg	n/a		
2-Ethoxyethanol [Ethyleneglycol ethylether]	110-80-5	10.00 kg	n/a		
2-Ethoxyethyl acetate [Ethyleneglycol ethylether acetate]	111-15-9	1.00 kg	n/a		
Ethyl acrylate	140-88-5	10.00 kg	n/a		
Ethyl benzene	100-41-4	100.00 kg	n/a		
Ethyl bromide [Bromoethane]	74-96-4	10.00 kg	n/a		
1-Ethyl-3,5-dimethylbenzene	934-74-7	10.00 kg	n/a		
Ethylene [Ethene]	74-85-1	1.00 t	23.60 kg	11.50 kg	31.70 kg
Ethylene dichloride [1,2-Dichloroethane]	107-06-2	1.00 t	3.62 kg	513.00 g	40.70 kg
Ethylene oxide [1,2-Epoxyethane]	75-21-8	1.00 t	n/a		
Ethyl toluene - all isomers	25550-14-5	10.00 kg	331.00 g	85.00 g	946.00 g
Fluoranthene	206-44-0	1.00 kg	n/a		
Formaldehyde [Methanol]	50-00-0	10.00 kg	532.00 g	409.00 g	688.00 g
Heptachlor	76-44-8	1.00 kg	n/a		
Hexabromobiphenyl	36355-1-8	100.00 g	n/a		
Hexabromocyclododecane	25637-99-4	10.00 kg	n/a		
Hexachlorobenzene	118-74-1	1.00 kg	n/a		

Gas	CAS	Reporting Threshold	Value to report	Amount Produced 25%	75%
Hexachlorocyclohexane - all isomers	608-73-1	1.00 kg	0.00 g	0.00 g	0.00 g
Hexane	110-54-3	10.00 kg	n/a		
1-Hexene	592-41-6	10.00 kg	n/a		
Indeno(1,2,3-cd)pyrene	193-39-5	1.00 kg	n/a		
Iodomethane	74-88-4	10.00 kg	n/a		
Isophorone	78-59-1	10.00 kg	n/a		
Isophorone diisocyanate	4098-71-9	1.00 kg	n/a		
Isoprene	78-79-5	10.00 kg	n/a		
Lindane	58-89-9	1.00 kg	n/a		
Maleic anhydride	108-31-6	10.00 kg	n/a		
Methane	74-82-8	10.00 t	4,370.00 t	4,370.00 t	4,370.00 t
Methanol	67-56-1	100.00 kg	n/a		
2-(Methoxyethoxy)ethanol	111-77-3	10.00 kg	n/a		
2-Methoxyethanol	109-86-4	10.00 kg	n/a		
2-Methoxyethyl acetate	110-49-6	10.00 kg	n/a		
Methyl bromide [Bromomethane]	74-83-9	100.00 kg	n/a		
2-Methyl-2-butene	513-35-9	10.00 kg	n/a		
3-Methyl-1-butene	563-45-1	100.00 kg	n/a		
Methyl chloride [Chloromethane]	74-87-3	1.00 t	2.42 kg	837.00 g	7.24 kg
Methyl chloroform [1,1,1-Trichloroethane]	71-55-6	10.00 kg	48.10 kg	2.09 kg	481.00 kg
4,4'-Methylene-bis(2-chloroaniline)	101-14-4	1.00 kg	n/a		
4,4'-Methylene dianiline	101-77-9	10.00 kg	n/a		
4,4'-Methylenediphenyl diisocyanate	101-68-8	1.00 kg	n/a		
Methyl isocyanate	624-83-9	1.00 kg	n/a		
Mirex	2385-85-5	1.00 kg	n/a		
Naphthalene	91-20-3	100.00 kg	n/a		
Nitrobenzene	98-95-3	10.00 kg	n/a		
2-Nitropropane	79-46-9	1.00 kg	n/a		
Pentachlorobenzene	608-93-5	1.00 kg	n/a		
Pentachlorophenol	87-86-5	1.00 kg	n/a		
Pentane	109-66-0	100.00 kg	5.05 kg	1.53 kg	35.30 kg
Pentene - all isomers	25377-72-4	1.00 t	19.30 kg	8.85 kg	35.90 kg
Phenol	108-95-2	10.00 kg	0.00 g	0.00 g	0.00 g
Propylbenzene	103-65-1	10.00 kg	n/a		
Propylene	115-07-1	10.00 t	n/a		
Propylene oxide	75-56-9	100.00 kg	n/a		
Styrene	100-42-5	100.00 kg	n/a		
Tetrachloroethane [1,1,2,2-Tetrachloroethane]	79-34-5	10.00 kg	4.68 kg	276.00 g	47.30 kg
Tetrachloroethylene	127-18-4	100.00 kg	2.13 kg	154.00 g	38.30 kg
Tetrafluoroethylene	116-14-3	10.00 kg	n/a		
Toluene	108-88-3	100.00 kg	9.91 kg	1.20 kg	48.80 kg
Toluene diisocyanate - all isomers	-	10.00 kg	n/a		
Toxaphene	8001-35-2	1.00 kg	n/a		
Trichlorobenzene - all isomers	12002-48-1	1.00 kg	186.00 g	119.00 g	297.00 g
Trichloroethylene	79-01-6	1.00 t	25.60 kg	10.80 kg	83.10 kg
Trichlorotoluene	98-07-7	10.00 kg	n/a		
Trimellitic anhydride	552-30-7	1.00 kg	n/a		
Trimethylbenzene - all isomers	25551-13-7	10.00 kg	951.00 g	153.00 g	9.84 kg
Vinyl acetate	108-05-4	10.00 kg	n/a		
Vinyl chloride	75-01-4	1.00 t	183.00 kg	69.70 kg	560.00 kg
Xylene - all isomers	1330-20-7	1.00 t	3.99 kg	78.80 g	116.00 kg
Metals and compounds					
Antimony	7440-36-0	1.00 kg	n/a		
Arsenic	7440-38-2	1.00 kg	n/a		
Beryllium	7440-41-7	1.00 kg	n/a		
Boron	7440-42-8	1.00 t	n/a		
Cadmium	7440-43-9	1.00 kg	n/a		
Chromium	7440-47-3	10.00 kg	n/a		
Copper	7440-50-8	10.00 kg	n/a		
Lead	7439-92-1	100.00 kg	n/a		
Manganese	7439-96-5	10.00 kg	n/a		
Mercury	7439-97-6	1.00 kg	n/a		
Nickel	7440-02-0	10.00 kg	n/a		
Selenium	7782-49-2	100.00 kg	n/a		
Vanadium	7440-62-2	10.00 kg	n/a		
Zinc	7440-66-6	100.00 kg	n/a		
Other substances					
Brominated diphenylethers - penta, octa and deca	-	10.00 kg	n/a		
Chlorine and total inorganic compounds - as HCl	7782-50-5	10.00 t	n/a		
Chlorofluorocarbons (CFCs)	EDF-079	1.00 kg	261.00 kg	22.20 kg	667.00 kg
Dioxins and furans (PCDDs/PCDFs) - I-TEQ	-	0.01 g	0.00 g	0.00 g	0.00 g
Dioxins and furans (PCDDs/PCDFs) - WHO-TEQ	-	0.01 g	n/a		
Fluorine and total inorganic compounds - as HF	7782-41-4	1.00 t	n/a		
Halons	-	1.00 kg	0.00 g	0.00 g	0.00 g
Hydrobromofluorocarbons (HBFCs)	-	10.00 kg	n/a		
Hydrochlorofluorocarbons (HCFCs)	-	1.00 kg	100.00 kg	14.10 kg	366.00 kg
Hydrofluorocarbons (HFCs)	-	100.00 kg	0.00 g	0.00 g	0.00 g
Nitrogen oxides - NO and NO2 as NO2	-	100.00 t	0.00 g	0.00 g	0.00 g
Non-methane volatile organic compounds (NMVOCs)	-	10.00 t	0.00 g	0.00 g	0.00 g

Gas	CAS	Reporting Threshold	Value to report	Amount Produced 25%	75%
Particulate matter - PM2.5	-	1.00 t	n/a		
Particulate Matter - PM10	-	1.00 t	0.00 g	0.00 g	0.00 g
Particulate Matter - total	-	10.00 t	n/a		
Perfluorocarbons (PFCs)	-	10.00 kg	0.00 g	0.00 g	0.00 g
Polychlorinated biphenyls (PCBs)	1336-36-3	100.00 g	n/a		
Polychlorinated Biphenyls (PCBs) - as WHO TEQ	1336-36-3	0.01 g	n/a		
Sulphur oxides - SO2 and SO3 as SO2	-	100.00 t	0.00 g	0.00 g	0.00 g

APPENDIX 6

Odour Management Plan
Nuisance Procedure

01. Scope

This procedure addresses all aspects of odour control and landfill gas management.

02. Responsibility

The FM will implement this procedure and will, together with the site supervisor, ensure that the procedure is correctly followed. All site staff will notify the FM or the SS about any relevant observations and ensure that all required corrective action is implemented.

03. References

GS 001 Daily Site Condition Report

GS 003 Weekly Inspection Sheet

GS 005 Odour Inspection Record

GS 037 Flare Downtime Log

KNKP 23 Completion of Daily Site Condition Reports

KNKP 30 Weekly Inspection Procedure

KNKP 31 Odour Control and Monitoring

KNKP 32 Nuisance Inspection Procedure

KNKP 34 Operation of Landfill Gas Flare

Waste Licence 146-1

04. PROCEDURE

4.1. *Odour Inspections*

Odour inspections shall be carried out in accordance with Nuisance Inspection Procedure KNKP 32, as follows:

Odour Inspections shall be carried out in accordance with guidance notes on the Odour Inspection Record (GS 005) on a daily basis on and/or off site as required and any findings recorded on the Daily Site Condition Report (GS 001) and the Weekly Inspection Form (GS 003) as well as the Odour Inspection Record (GS 005).

Any odour inspections carried out following receipt of a complaint, shall have particular regard to the location to which the complaint relates and shall also have regard to any other observations or other activities in the area that could have contributed to complaints, e.g. spreading of slurry by farmers etc.

4.2. *Odour Monitoring*

All odour monitoring will be carried out in accordance with the Odour Control and Monitoring Procedure KNKP 31.

4.3. *Operational Requirements*

All operational activities shall consider the requirements as descried in the Odour Control and Monitoring Procedure KNKP 31, with particular regard to the acceptance and/or rejection of odorous loads as well as the application of daily cover material and temporary capping.

It shall be ensured that the joint between vertical bunds and horizontal layers of daily cover material and temporary capping is not less than the required 150 mm and 300 mm respectively, as it is a potentially weak point which could provide a migration path for landfill gas as well as waste odours.

Appendix 1 describes the planned phasing of waste deposition such as to minimise the potential for odour emissions.

4.4. *Landfill Gas Management*

4.4.1. Monitoring of fugitive emissions

The monitoring of fugitive emissions of landfill gas shall be carried out on a quarterly basis or as appropriate by means of PID surveys as described in the Odour Control and Monitoring Procedure KNKP 31.

The employment of thermography as a further tool of establishing potential emissions of fugitive landfill gas shall be considered on an annual basis.

4.5. *Landfill Gas Extraction*

Extraction of landfill gas shall be carried out through vertical wells, progressively constructed and retrofitted as required, as well as horizontal extraction wells.

4.5.1. Vertical Wells

Vertical landfill gas extraction wells shall be constructed, progressively with the development of the landfill, at 50 meter lateral and longitudinal centres. Additionally, vertical wells shall be drilled into the waste as required and determined by surveys of fugitive emissions, in order to minimise or eliminate landfill gas migration. The additional drilled wells shall be installed between the constructed main gas extraction wells, so as to reduce the distances between the individual wells and to increase the capture rate of landfill gas. It shall be ensured that the vertical gas wells are sealed at surface with bentonite as required in order to minimise the ingress of oxygen and the potential for migration of landfill gas.

4.5.2. Horizontal wells

In order to further enhance gas extraction and commencing in phase 2 of the landfill (i.e. cells 5 and 6 and higher), horizontal gas wells, consisting of slotted gas extraction pipes embedded in stone filled trenches of no less than 1 m^2 sections (i.e. 1 meter depth and 1 meter width), shall be installed in the surface of lifts at least 5 meters above the cell bases and, in areas with a total landfill depth of more than 18 meters, at least 5 meters below the finished waste level as appropriate. It shall be ensured

that horizontal trenches are installed as close as possible before filling the next lift of waste above in order to minimise the potential for migration of landfill gas from the trenches. Should this not be possible, a seal of bentonite shall be applied to the top of the trenches.

4.5.3. Landfill gas collection network

All vertical and horizontal landfill gas extraction wells shall be connected to the gas collection pipe network which shall consist of a 355 mm ring main around the landfill footprint and 180 mm branches laid across the landfill surface. Each individual well as well as each individual branch shall, prior the point of connection into the next higher collection level (i.e. well-branch connections and branch-ring main connections) be equipped with shut-off valves, in order to enable flow restriction or isolation of individual wells or branches.

4.5.4. Condensate removal

In order to continuously remove condensate from the landfill gas extraction network and therefore avoid uncontrolled flow restriction and pulsating, the ring main shall be connected to the gas flaring and utilisation plant via condensate knockout pots. The condensate accumulating in these pots shall be removed by pneumatic pumps and piped back into the leachate riser pipes, from where it can drain to the cell base and be removed with the leachate.

4.6. *Landfill gas utilisation and flaring plant*

The landfill gas collected in the landfill gas extraction and collection network shall, after passing through the condensate knockout pots, be flared off in an enclosed flare or utilised in gas combustion engines with electricity generation, as appropriate. The sizing of the gas utilisation and flaring equipment shall be planned ahead, in conjunction with expert consultants and subject to the appropriate planning permissions, so that no excess landfill is generated at any stage. Contingency arrangements shall be made to avoid gas venting in the case of plant failures.

The procedure KNKP 34 for the operation of landfill gas flares shall be extended to incorporate the modified enclosed gas flare currently in operation at the facility as soon as the modified operation and maintenance manual for the flare is obtained from the contractor. It shall address the operational requirements to optimise the combustion rates.

Procedure KNKP 35 (in progress – not yet finalised) describes the monitoring and balancing of landfill gas extraction wells and collection network in order to maximise the extraction of landfill gas.

Any significant downtime of landfill gas flares or other utilisation equipment shall be logged on Form GS 037, detailing as a minimum the date(s), time(s) and reason(s) for the downtime of the flare.

Title	Nuisance Inspection Procedure				
Ref	KNKP 32	**Rev**	0	**Date**	13/02/07
Issued.	RW	**App**.	RW	**Pg**	1 /3

1.0 Scope

This procedure documents the approach to be taken when carrying out nuisance inspections at the facility.

2.0 Responsibility

The FM will implement this procedure and site supervisor will ensure the procedure is correctly followed. All site staff will notify the FM or the SS about any observations and will take any other measures necessary to avoid any nuisances from arising outside the facility boundary. The Bird Control and Vermin Control Contractor and their staff will carry out all duties required under the conditions of their contracts and will notify the Facility Management of any other observations which might have the potential to give rise to nuisances outside the facility boundary.

3.0 References

Daily Site Condition Report GS 001

Weekly Inspection Sheet GS 003

Odour Inspection Record GS 005

Weekly Inspection Procedure KNKP 30

Daily Site Condition Report KNKP 23

Licence Condition 7.1: The licensee shall ensure that vermin, birds, flies, mud, dust, litter and odours do not give rise to nuisance at the facility or in the immediate area of the facility. Any method used by the licensee to control any such nuisance shall not cause environmental pollution

Licence Condition 8.14 Nuisance Monitoring: The licensee shall, at a minimum of one week intervals, inspect the facility and its immediate surrounds for nuisances caused by litter, vermin, birds, flies, mud, dust and odours.

4.0 Procedure

4.1 Litter

Litter Inspections shall be carried out and recorded as part of the weekly inspection, which is outlined in the Weekly Inspection Procedure KNKP 30 and the Procedure for completion of the Site Condition Report KNKP 23. It is of importance that the 5 individual areas, sections A to E as outlined in the Weekly Inspection Procedure and the Weekly Inspection Form GS 003, are inspected at a frequency of one per day if practicable. The presence of litter shall be noted on the Inspection Form and removed immediately if practicable. Any litter noted at or outside the boundary fence, which appears to be illegally dumped, shall be inspected for any indications of identity if possible and reported to the Facility Manager.

4.2 Vermin and Birds

Inspections for vermin shall be carried out on a weekly basis for rodents etc. and on a daily basis for birds, in particular crows. The bird control operator, who carries out regular bird control duties on site, shall assist the Site Supervisor by notifying him of any unusual observations. He shall also record any observations in the daily bird control report. Any observations made during inspections shall be recorded on the Daily Site Condition Report GS 001 and the Weekly Inspection Form GS 003.

4.3 Flies

Particularly during the warmer months, attention shall be paid to observations of flies. Any observations shall be recorded on the Daily Site Condition Report GS 001 and the Weekly Inspection Form GS 003. The Facility Manager or the Site Supervisor shall be notified immediately in order to take measures to eliminate any fly populations from establishing. The areas around the Surface Water Lagoon and the Wetland as well as the immediate vicinity of the working face shall be inspected with particular intensity, as these are the most likely locations for fly populations to develop.

4.4 Mud and Dust

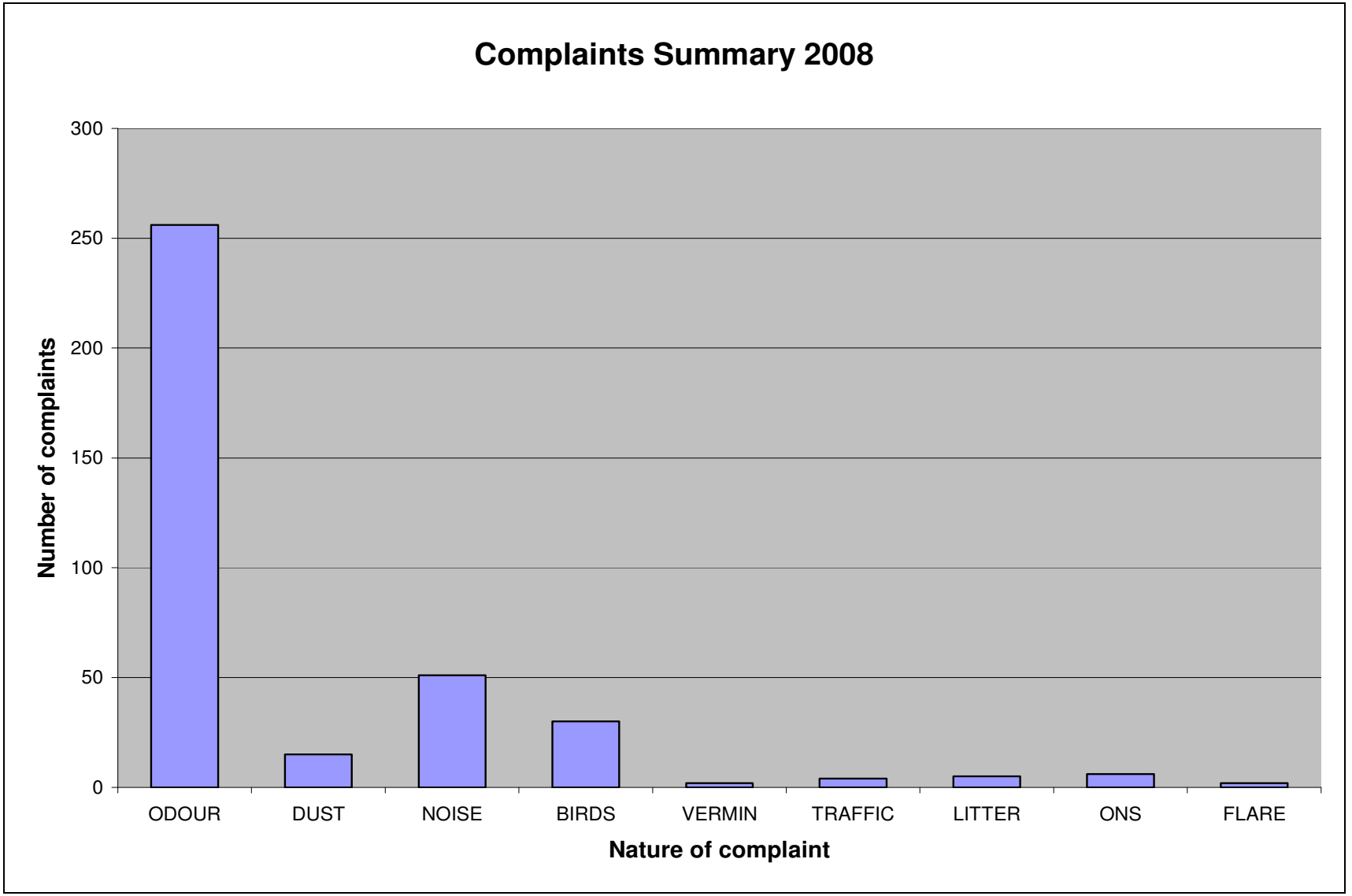
The site roads shall be inspected on a daily basis for mud or dust and any observations recorded on the Daily Site Condition Report GS 001 and the Weekly Inspection Form GS 003. Special attention shall be paid to dust during the dry months and mud during the wet months and the Site Supervisor or the Facility Manager notified immediately in order to take measures to minimise or eliminate any potential nuisances arising from mud or dust accumulating on site roads.

4.5 Odour

Odour Inspections shall be carried out in accordance with guidance notes on the Odour Inspection Record GS 005 on a daily basis on and/or off site as required and any findings recorded on the Daily Site Condition Report GS 001 and the Weekly Inspection Form GS 003 as well as the Odour Inspection Record GS 005. Any odour inspections carried out following receipt of a complaint, shall have particular regard to the location to which the complaint relates and shall also have regard to any other observations or other activities in the area that could have contributed to complaints, e.g. spreading of slurry by farmers etc.

APPENDIX 7

Complaints


Complaints Summary 2008
300
250
200
150
100
50
0
Number of complaints
ODOUR
DUST
NOISE
BIRDS
VERMIN
TRAFFIC
LITTER
ONS
FLARE
Nature of complaint

APPENDIX 8

E-PRTR Returns

Environmental Protection Agency

AER Returns Worksheet

Version 1.1.04

REFERENCE YEAR	2008

1. FACILITY IDENTIFICATION

Parent Company Name	Greenstar Holdings Limited
Facility Name	Knockharley Landfill
PRTR Identification Number	W0146
Licence Number	W0146-01

Waste or IPPC Classes of Activity

No.	class_name
3.5	Specially engineered landfill, including placement into lined discrete cells which are capped and isolated from one another and the environment.
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.
3.13	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.
4.4	Recycling or reclamation of other inorganic materials.
4.9	Use of any waste principally as a fuel or other means to generate energy.
4.11	Use of waste obtained from any activity referred to in a preceding paragraph of this Schedule.
4.13	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.
3.1	Deposit on, in or under land (including landfill).
3.4	Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons.

Address 1	Knockharley
Address 2	Navan
Address 3	(Includes Townlands of Tuiterath & Flemingstown)
Address 4	Co. Meath
Country	Ireland
Coordinates of Location	564700.000
River Basin District	IEEA
NACE Code	382
Main Economic Activity	Waste treatment and disposal
AER Returns Contact Name	Reinhard Wilkes (W0146)
AER Returns Contact Email Address	reinhard.wilkes@greenstar.ie
AER Returns Contact Position	Landfill Manager
AER Returns Contact Telephone Number	041-9821650 / 086-8189533
AER Returns Contact Mobile Phone Number	
AER Returns Contact Fax Number	
Production Volume	0.0
Production Volume Units	
Number of Installations	0
Number of Operating Hours in Year	0
Number of Employees	0
User Feedback/Comments	
Web Address	

2. PRTR CLASS ACTIVITIES

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

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

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

4.1 RELEASES TO AIR

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

RELEASES TO AIR								
POLLUTANT		METHOD				QUANTITY		
			Method Used		Flare			
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
03	Carbon dioxide (CO2)	E	Estimate	Fugitive emission based on GasSim Model	105.8427	1207104.8427	0.0	1206999.0
02	Carbon monoxide (CO)	M	PER		147.825	0.0	0.0	0.0
08	Nitrogen oxides (NOx/NO2)	M	PER		387.8928	0.0	0.0	0.0
01	Methane (CH4)	E	Estimate	Fugitive emission based on GasSim Model	2819.3184	822441.8184	0.0	819622.5

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

SECTION B : REMAINING PRTR POLLUTANTS

RELEASES TO AIR								
POLLUTANT		METHOD				QUANTITY		
			Method Used		Flare			
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
84	Fluorine and inorganic compounds (as HF)	M	PER		9.22428	9.22428	0.0	0.0
80	Chlorine and inorganic compounds (as HCl)	M	PER		33.46758	0.0	0.0	0.0

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

SECTION C : REMAINING POLLUTANT EMISSIONS (As required in your Licence)

RELEASES TO AIR								
POLLUTANT		METHOD				QUANTITY		
			Method Used		Flare			
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
351	Total Organic Carbon (as C)	M	PER		62.44128	62.44128	0.0	0.0

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

Additional Data Requested from Landfill operators

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

Landfill: Knockharley Landfill

Please enter summary data on the quantities of methane flared and / or utilised	T (Total) kg/Year	M/C/E	Method Used: Method Code	Method Used: Designation or Description	Facility Total Capacity m3 per hour	
Total estimated methane generation (as per site model)	4370000.0	E	Estimate	Estimate based on Gas Sim Model	N/A	
Methane flared	3550377.0	C	PER	Calculated based on percen	1350.0	(Total Flaring Capacity)
Methane utilised in engine/s	0.0				0.0	(Total Utilising Capacity)
Net methane emission (as reported in Section A above)	822411.8184	E	Estimate	Estimate based on Gas Sim	N/A	

4.2 RELEASES TO WATERS

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

Data on ambient monitoring of storm/surface water or groundwater, conducted as part of your licence requirements, should NOT be submitted under AER / PRTR Reporting as this

RELEASES TO WATERS								
POLLUTANT					QUANTITY			
			Method Used		SW-9			
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
79	Chlorides (as Cl)	C	EN ISO 17025	Calculated on the flow from the wetland	1459.35	1459.35	0.0	0.0
20	Copper and compounds (as Cu)	C	EN ISO 17025	Calculated on the flow from the wetland	0.3807	0.3807	0.0	0.0
24	Zinc and compounds (as Zn)	C	EN ISO 17025	Calculated on the flow from the wetland	1.269	1.269	0.0	0.0
					0.0	0.0	0.0	0.0

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

SECTION B : REMAINING PRTR POLLUTANTS

RELEASES TO WATERS								
POLLUTANT					QUANTITY			
			Method Used					
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
					0.0	0.0	0.0	0.0

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

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

RELEASES TO WATERS								
POLLUTANT					QUANTITY			
			Method Used		SW-9			
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
238	Ammonia (as N)	C	EN ISO 17025	Calculated on the flow from the wetland	46.53	46.53	0.0	0.0
240	Suspended Solids	C	EN ISO 17025	Calculated on the flow from the wetland	2220.75	2220.75	0.0	0.0
303	BOD	C	EN ISO 17025	Calculated on the flow from the wetland	285.525	285.525	0.0	0.0
338	Potassium	C	EN ISO 17025	Calculated on the flow from the wetland	368.01	368.01	0.0	0.0
341	Sodium	C	EN ISO 17025	Calculated on the flow from the wetland	1091.34	1091.34	0.0	0.0
305	Calcium	C	EN ISO 17025	Calculated on the flow from the wetland	15735.6	15735.6	0.0	0.0
357	Iron	C	EN ISO 17025	Calculated on the flow from the wetland	1.396	1.396	0.0	0.0
320	Magnesium	C	EN ISO 17025	Calculated on the flow from the wetland	1873.044	1873.044	0.0	0.0
343	Sulphate	C	EN ISO 17025	Calculated on the flow from the wetland	30202.2	30202.2	0.0	0.0
					0.0	0.0	0.0	0.0

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

4.3 RELEASES TO WASTEWATER OR SEWER

SECTION A : PRTR POLLUTANTS

OFFSITE TRANSFER OF POLLUTANTS DESTINED FOR WASTE-WATER TREATMENT OR SEWER								
POLLUTANT		METHOD			QUANTITY			
			Method Used		LE-S			
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
79	Chlorides (as Cl)	C	EN ISO 17025	Calculated on the amount of leachate removed during the year	17739.9485	17739.9485	0.0	0.0
13	Total phosphorus	C	EN ISO 17025	Calculated on the amount of leachate removed during the year	48.5088864	48.5088864	0.0	0.0
19	Chromium and compounds (as Cr)	C	EN ISO 17025	Calculated on the amount of leachate removed during the year	2.23887168	2.23887168	0.0	0.0
20	Copper and compounds (as Cu)	C	EN ISO 17025	Calculated on the amount of leachate removed during the year	0.03109544	0.03109544	0.0	0.0
83	Fluorides (as total F)	C	EN ISO 17025	Calculated on the amount of leachate removed during the year	65.300424	65.300424	0.0	0.0

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

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

OFFSITE TRANSFER OF POLLUTANTS DESTINED FOR WASTE-WATER TREATMENT OR SEWER								
POLLUTANT		METHOD			QUANTITY			
			Method Used		LE-S			
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
238	Ammonia (as N)	C	EN ISO 17025	Calculated on the amount of leachate removed during the year	8162.553	8162.553	0.0	0.0
303	BOD	C	EN ISO 17025	Calculated on the amount of leachate removed during the year	1597.52823	1597.52823	0.0	0.0
306	COD	C	EN ISO 17025	Calculated on the amount of leachate removed during the year	11143.8283	11143.8283	0.0	0.0
341	Sodium	C	EN ISO 17025	Calculated on the amount of leachate removed during the year	16760.442	16760.442	0.0	0.0
338	Potassium	C	EN ISO 17025	Calculated on the amount of leachate removed during the year	6657.5337	6657.5337	0.0	0.0
343	Sulphate	C	EN ISO 17025	Calculated on the amount of leachate removed during the year	6203.54028	6203.54028	0.0	0.0
332	Ortho-phosphate (as PO4)	C	EN ISO 17025	Calculated on the amount of leachate removed during the year	177.399485	177.399485	0.0	0.0

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

4.4 RELEASES TO LAND

SECTION A : PRTR POLLUTANTS

RELEASES TO LAND							
POLLUTANT		METHOD			QUANTITY		
			Method Used				
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year
					0.0	0.0	0.0

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

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

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

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

5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE

| PRTR# : W0146 | Facility Name : Knockharley Landfill | Filename : W0146_2008.xls | Return Year : 2008 |

27/03/2009 13:50

0

Transfer Destination	European Waste Code	Hazardous	Quantity T/Year	Description of Waste	Waste Treatment Operation	Method Used		Location of Treatment	Name and Licence / Permit No. of Recoverer / Disposer / Broker	Address of Recoverer / Disposer / Broker	Name and Address of Final Destination i.e. Final Recovery / Disposal Site (HAZARDOUS WASTE ONLY)	Licence / Permit No. of Final Destination i.e. Final Recovery / Disposal Site (HAZARDOUS WASTE ONLY)
						M/C/E	Method Used					
Within the Country	19 12 12	No	3.46	C&I Dry Mixed	R5	M	Weighed	Offsite in Ireland	Greenstar Millennium W0183-01	Millennium Business Park, Grange, Ballycoolin, Co. Dublin		
Within the Country	19 07 03	No	15547.72	Leachate	R3	M	Weighed	Offsite in Ireland	Navan Waste Water Treatment	Navan Co, Meath		
Within the Country	16 05 04	Yes	0.26	Gas Cylinders	R4	M	Weighed	Offsite in Ireland	Calor Gas	Long Mile Road, Dublin 12	Calor Gas, Long Mile Road, Dublin 12	N/A

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