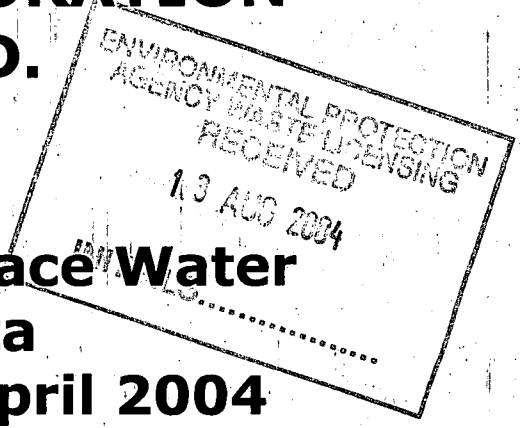


**BROWNFIELD RESTORATION
IRELAND LTD.**

**Groundwater and Surface Water
Analytical Data
(December 2003 to April 2004
Inclusive)**



**WASTE LICENCE APPLICATION
NO. 204-1**

**PROPOSED INTEGRATED WASTE
MANAGEMENT FACILITY**

AT

**WHITESTOWN LOWER
CO. WICKLOW**

AUGUST 2004

Prepared By:
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Brownfield Restoration Ireland Ltd.

Proposed Integrated Waste Management Facility

Whitestown Lower, Co. Wicklow

EPA Reference No. 204-1

**Groundwater and Surface Water Analytical Data
(December 2003 to April 2004 Inclusive)**

1.0 INTRODUCTION

Details of groundwater and surface water monitoring and laboratory analysis were provided in the March 2004 Waste Licence Application for the Whitestown Lower Site in a report entitled 'Preliminary Risk Assessment Report' (dated March 2004). This report was submitted in Appendix 9 of the March 2004 Environmental Impact Statement, and included analytical results for groundwater and surface water for the following sampling events:

- 12 December 2004
- 25 February 2004

2.0 ADDITIONAL GROUNDWATER SAMPLING AT THE SITE

Additional groundwater and surface water samples were collected on 6 April 2004, in the presence of personnel from the Environmental Protection Agency (EPA). As agreed on-site with Agency personnel, samples of groundwater and surface water were provided by the Agency to Environment & Resource Management Ltd. The following groundwater and surface water monitoring locations were sampled in this manner:

- MW-7
- MW-8
- MW-9
- MW-10
- MW-11
- SW-2
- SW-3
- SW-5

MW-2, SW-1 and SW-4 monitoring locations were sampled by ERML in the absence of the Agency. Following the April 2004 sampling event, all samples were forwarded by ERML to Alcontrol Geochem Ireland for detailed laboratory analysis.

3.0 SAMPLING RESULTS

Laboratory and field analytical results for both groundwater and surface water samples for all three monitoring events (December 2003, February 2004 and April 2004) are included in Tables 7.2 Rev B and Table 8.1 Rev B attached.

4.0 PRELIMINARY INTERPRETATION

The following is a brief interpretation of results for groundwater and surface water sampling events undertaken during the period December 2003 to April 2004 inclusive (Tables 7.2 Rev B and Table 8.1 Rev B attached).

4.1 Groundwater Results

In general, the majority of parameters measured reflect background concentrations for this type of environmental setting. However, some parameters remain slightly elevated at downgradient well locations MW-9 and MW-10, namely Ammoniacal Nitrogen at MW-9 and Manganese at MW-10

4.2 Surface Water Results

As reported in the March 2004 Preliminary Risk Assessment, with the exception of some bacteriological parameters, the surface water quality both upstream and downstream of the site, is generally of good quality. However, in the April 2004 sampling event, some analytical parameters both upstream and downstream of the site have slightly disimproved.

Ammoniacal Nitrogen concentrations at upstream locations SW1 and SW2 are slightly elevated (0.2 mg/l at both locations), when compared to downstream locations SW3, SW4 and SW5 (<0.05 mg/l at all 3 locations). An elevated Chromium result was also observed upstream at SW-2 (0.138 mg/l).

It is also noted that a slightly elevated Diesel Range Organic result was observed at SW-5 (0.049 mg/l), which is located immediately downstream of the Whitestown Lower site.

Table 8.1/Rev B: Chemical Analysis of Surface Water at Whitestown Site, December 2003 - April 2004

PARAMETER	UNIT	SW-1			SW-2			SW-3			SW-4			SW-5			
		12/12/03	25/02/04	06/04/04	12/12/03	25/02/04	06/04/04	12/12/03	12/12/03 (Duplicate)	25/02/04	06/04/04	12/12/03	25/02/04	06/04/04	12/12/03	25/02/04	06/04/04
Metals																	
Boron	B mg/l	<0.05	0.015	<0.01	<0.05	<0.01	<0.01	<0.05	<0.05	<0.01	<0.01	<0.05	<0.01	<0.01	-	<0.01	<0.01
Cadmium	Cd mg/l	<0.0004	<0.0004	-	<0.0004	<0.0004	-	<0.0004	<0.0004	<0.0004	-	<0.0004	<0.0004	-	-	<0.0004	-
Chromium (Total)	Cr mg/l	<0.05	<0.05	<0.001	<0.05	<0.05	0.128	<0.05	<0.05	<0.05	0.008	<0.05	<0.05	<0.001	-	<0.05	<0.001
Copper	Cu mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.010	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005	<0.005
Iron	Fe mg/l	0.038	<0.001	-	0.07	<0.001	-	0.068	0.082	<0.001	-	0.059	<0.001	-	-	<0.001	-
Lead	Pb mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005	<0.005
Magnesium	Mg mg/l	3.72	3.81	4.07	3.12	3.33	3.45	3.23	3.29	3.32	3.52	3.32	3.44	3.55	-	3.39	3.56
Manganese	Mn mg/l	0.003	0.007	0.012	<0.001	0.007	0.031	<0.001	<0.001	0.008	<0.001	0.003	0.008	0.010	-	0.008	<0.011
Mercury	Hg mg/l	<0.00005	-	-	<0.00005	-	-	<0.00005	<0.00005	-	-	<0.00005	-	-	-	-	-
Nickel	Ni mg/l	<0.01	<0.0008	0.0013	<0.01	<0.0008	0.0011	<0.01	<0.01	<0.0008	0.0011	<0.01	<0.0008	0.0011	-	<0.0008	0.0011
Zinc	Zn mg/l	0.01	0.018	<0.005	0.006	0.013	0.051	0.006	0.006	0.012	<0.005	<0.005	0.012	<0.005	-	0.010	<0.005
Hydrocarbons																	
Diesel Range Organics	mg/l	<0.01	-	-	<0.01	-	<0.01	<0.01	<0.01	<0.01	-	<0.01	-	-	-	-	0.049
Mineral Oil	mg/l	<0.01	-	-	<0.01	-	<0.01	<0.01	<0.01	-	-	<0.01	-	-	-	-	<0.01
Petrol Range Organics (C5-C9)	mg/l	<0.01	-	-	<0.01	-	<0.01	<0.01	<0.01	-	-	<0.01	-	-	-	-	<0.01
Petrol Range Organics (C10+)	mg/l	<0.01	-	-	<0.01	-	<0.01	<0.01	<0.01	-	-	<0.01	-	-	-	-	<0.01
Benzene	mg/l	<0.01	<0.001	-	<0.01	<0.001	<0.01	<0.01	<0.01	<0.001	-	<0.01	<0.001	-	-	<0.001	<0.01
Toluene	mg/l	<0.01	<0.001	-	<0.01	<0.001	<0.01	<0.01	<0.01	<0.001	-	<0.01	<0.001	-	-	<0.001	<0.01
Ethylbenzene	mg/l	<0.01	<0.001	-	<0.01	<0.001	<0.01	<0.01	<0.01	<0.001	-	<0.01	<0.001	-	-	<0.001	<0.01
p/m-Xylene	mg/l	<0.01	<0.001	-	<0.01	<0.001	-	<0.01	<0.01	<0.001	-	<0.01	<0.001	-	-	<0.001	-
o-Xylene	mg/l	<0.01	<0.001	-	<0.01	<0.001	-	<0.01	<0.01	<0.001	-	<0.01	<0.001	-	-	<0.001	-
Total Xylene	mg/l	<0.01	-	-	<0.01	-	<0.01	<0.01	<0.01	-	-	<0.01	-	-	-	-	<0.01
Organics - List I/II																	
VOC's	mg/l	all <0.001	-	-	-	-	-	all <0.001	-	-	-	-	-	-	-	-	<0.001
Semi VOC's	mg/l	all <0.001	-	-	-	-	-	all <0.001	-	-	-	-	-	-	-	-	<0.001
Pesticides	mg/l	all <0.00001	-	-	-	-	-	all <0.00001	-	-	-	-	-	-	-	-	-
Bacteriological Parameters																	
Faecal Coliforms	no. /100 ml	832	21	-	858	212	-	728	1170	192	-	917	216	-	-	95	-
Total Coliforms	no. /100 ml	24000	204	-	14000	780	-	20000	10000	936	-	17000	842	-	-	1092	-
Faecal Streptococci	no. /100 ml	2184	40	-	-	-	-	2028	-	-	-	-	-	-	-	52	-
Total Viable Count @ 22C	no. /100 ml	7890	176	-	-	-	-	5360	-	-	-	-	-	-	-	204	-
Total Viable Count @ 37C	no. /100 ml	2560	324	-	-	-	-	1800	-	-	-	-	-	-	-	204	-

LEGEND

" - " = No data reported or no analyses conducted

< = Less Than

Bold underlined values are considered above background concentrations

Table 8.1/Rev B: Chemical Analysis of Surface Water at Whitestown Site, December 2003 - April 2004

PARAMETER	UNIT	SW-1			SW-2			SW-3				SW-4			SW-5			
		12/12/03	25/02/04	06/04/04	12/12/03	25/02/04	06/04/04	12/12/03	12/12/03 (Duplicate)	25/02/04	06/04/04	12/12/03	25/02/04	06/04/04	12/12/03	25/02/04	06/04/04	
FIELD ANALYSIS																		
General Water Quality Parameters																		
Colour	-	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	-	Clear	Clear
Field Conductivity	µS/cm	321	280	342	261	235	281	234	234	231	277	234	243	284	-	233	296	
Odour	-	None	None	None	None	None	None	None	None	None	None	None	None	None	-	None	None	
pH	-	8.45	7.80	7.80	8.36	8.10	7.44	8.26	8.26	7.90	7.29	8.18	7.90	7.48	-	8.00	6.53	
Temperature	°C	10.9	7.5	10.6	10.7	6.2	11.4	10.7	10.7	7.0	11.4	12.2	8.1	11.1	-	6.1	9.9	
LABORATORY ANALYSIS																		
General Water Quality Parameters																		
BOD	O ₂ mg/l	3	4	3	3	3	<2	2	<2	4	<2	<2	4	<2	-	5	20	
COD	O ₂ mg/l	108	<15	<15	159	<15	<15	17	24	<15	<15	79	<15	<15	-	<15	<15	
Laboratory Conductivity	µS/cm	314	381	330	244	313	285	235	244	318	282	238	316	289	-	310	287	
Dissolved Oxygen	O ₂ mg/l	7.6	-	-	7.2	-	-	7.2	7.7	-	-	7.3	-	-	-	-	-	
pH	-	7.43	7.98	7.92	7.45	8.05	8.04	7.43	7.25	8.00	8.04	7.34	8.05	8.07	-	8.03	8.00	
Total Alkalinity	CaCO ₃ mg/l	120	-	-	110	-	-	90	63	-	-	80	-	-	-	-	-	
Total Oxidised Nitrogen	O ₂ mg/l	3.6	-	-	2.7	-	-	2.8	2.5	-	-	3.8	-	-	-	-	-	
Total Suspended Solids	mg/l	<10	-	-	<10	-	-	<10	<10	-	-	12	-	-	-	-	-	
Total Phenols	mg/l	-	<0.0005	-	-	-	-	-	-	-	-	-	<0.0005	-	-	<0.0005	-	
Total Organic Carbon	C mg/l	20	<2	3	19	<2	3	18	22	<2	2	20	<2	2	-	<2	2	
Inorganics																		
Ammoniacal Nitrogen	N mg/l	<0.2	0.11	0.20	<0.2	0.09	0.20	<0.2	<0.2	0.09	<0.05	<0.2	0.12	<0.05	-	0.16	<0.05	
Nitrate	NO ₃ mg/l	15.3	19.4	14.8	11.5	16.6	14.4	12.0	10.5	16.2	11.9	12.0	15.3	17.0	-	16.5	11.4	
Nitrite	NO ₂ mg/l	0.2	<0.05	<0.05	0.25	<0.05	0.13	0.27	0.23	<0.05	0.09	0.27	<0.05	0.08	-	<0.05	0.06	
Calcium	Ca mg/l	40.3	-	-	29.2	-	-	32.2	32.0	-	-	32.7	-	-	-	-	-	
Chloride	Cl mg/l	12	12	12	12	11	11	11	11	11	11	11	11	11	-	11	11	
Fluoride	F mg/l	<0.1	-	-	<0.1	-	-	<0.1	<0.1	-	-	<0.1	-	-	-	-	-	
Potassium	K mg/l	2.8	1.0	0.6	2.6	1.0	0.8	2.6	2.6	1.0	0.8	2.2	1.4	1.0	-	1.0	0.8	
Sodium	Na mg/l	8.3	9.2	9.2	7.5	8.6	8.5	7.3	7.3	8.5	8.5	7.5	8.5	8.5	-	8.6	8.4	
Sulphate	SO ₄ mg/l	14	11	11	13	9	9	13	12	9	9	16	9	9	-	9	9	
Phosphorous	P mg/l	0.07	-	-	0.16	-	-	<0.05	<0.05	-	-	0.12	-	-	-	-	-	
Total Orthophosphate	PO ₄ mg/l	0.12	-	-	0.11	-	-	0.17	0.76	-	-	0.36	-	-	-	-	-	

Table 7.2/Rev B: Chemical Analysis of Groundwater at Whitestown Site
December 2003 - April 2004

Monitoring Well Location	UNIT	MW-1 12/12/03	MW-2 12/12/03	MW-2 06/04/04	MW-3 12/12/03	MW-4 12/12/03	MW-5 12/12/03	MW-6 12/12/03	MW-7 12/12/03	MW-7 06/04/04	MW-8 12/12/03	MW-8 06/04/04	MW-9 12/12/03	MW-9 06/04/04	MW-10 12/12/03	MW-10 06/04/04	MW-11 12/12/03	MW-11 06/04/04	MW-12 12/12/03	MW03-2 12/12/03	MW03-3 12/12/03	MW03-4 12/12/03	MW03-5 12/12/03	MW04-1 25/02/04	MW04-2 25/02/04	MW04-3 25/02/04	MW04-4 25/02/04	MW04-5 25/02/04	
Presumed Screen Location		O/B	B/R	B/R	B/R	O/B	O/B	O/B	O/B	O/B	O/B	O/B	O/B	O/B	O/B	O/B	B/R	B/R	B/R	B/R	O/B	B/R	B/R	B/R	B/R	B/R	B/R	O/B-B/R	O/B-B/R
Well location in relation to waste		U/G	U/G	U/G	U/G	U/G	U/G	D/G	D/G	D/G	D/G	D/G	D/G	D/G	U/G	U/G	U/G	U/G	U/G	D/G	D/G	U/G	U/G	U/G	U/G	U/G	U/G	D/G	D/G
Metals																													
Boron	B mg/l	-	-	<0.01	<0.05	<0.05	-	-	-	<0.01	-	<0.01	<0.05	<0.01	<0.05	<0.01	-	<0.01	-	<0.05	<0.05	-	-	<0.01	<0.01	<0.01	0.037	0.107	
Cadmium	Cd mg/l	-	-	-	<0.0004	<0.0004	-	-	-	-	-	-	<0.0004	<0.0004	-	-	-	-	-	<0.0004	<0.0004	-	-	<0.0004	<0.0004	<0.0004	<0.0004	0.0006	
Chromium (Total)	Cr mg/l	-	-	<0.001	<0.05	<0.05	-	-	-	<0.001	-	<0.001	<0.00005	0.002	0.06	<0.001	-	0.005	-	<0.05	0.04	-	-	<0.05	<0.05	<0.05	<0.05	0.07	
Copper	Cu mg/l	-	-	<0.005	<0.005	<0.005	-	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005	-	<0.005	<0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	
Cyanide (Total)	Cn mg/l	-	-	-	<0.05	<0.05	-	-	-	-	-	-	<0.05	-	<0.05	-	-	-	-	<0.05	<0.05	-	-	-	-	-	-	-	
Iron	Fe mg/l	-	-	-	<0.001	0.001	-	-	-	-	-	-	0.025	-	0.124	-	-	-	-	<0.001	0.002	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	
Lead	Pb mg/l	-	-	<0.005	<0.005	<0.005	-	-	-	<0.005	-	<0.005	<0.005	<0.005	<0.005	<0.005	-	<0.005	-	0.005	<0.005	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	
Magnesium	Mg mg/l	-	-	3.77	4.83	2.37	-	-	-	3.02	-	6.17	9.49	11.10	3.83	7.02	-	4.63	-	12.79	16.99	-	-	4.52	4.41	3.65	12.36	12.85	
Manganese	Mn mg/l	-	-	0.013	0.005	0.005	-	-	-	0.017	-	0.214	0.831	0.731	0.399	1.280	-	0.014	-	0.81	2.112	-	-	0.011	0.006	0.006	0.015	1.562	
Mercury	Hg mg/l	-	-	-	<0.00005	<0.00005	-	-	-	-	-	-	<0.00005	-	<0.00005	-	-	-	-	<0.00005	<0.00005	-	-	-	-	-	-	-	
Nickel	Ni mg/l	-	-	0.0009	<0.01	<0.01	-	-	-	0.0062	-	0.0028	<0.01	0.0146	<0.01	0.0041	-	0.0018	-	<0.01	0.011	-	-	<0.0008	<0.0008	<0.0008	0.0028	0.0070	
Zinc	Zn mg/l	-	-	0.006	0.009	0.029	-	-	-	<0.005	-	<0.005	0.01	<0.005	0.013	<0.005	-	<0.005	-	0.023	0.006	-	-	0.013	0.009	0.013	0.014	0.010	
Hydrocarbons																													
Diesel Range Organics	mg/l	-	-	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	<0.01	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-	-	-	-	-
Mineral Oil	mg/l	-	-	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	<0.01	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-	-	-	-	-
Petrol Range Organics (C5-C9)	mg/l	-	-	<0.01	<0.01	<0.01	-	-	-	-	-	-	<0.01	<0.01	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-	-	-	-	-
Petrol Range Organics (C10+)	mg/l	-	-	<0.01	<0.01	<0.01	-	-	-	-	-	-	<0.01	<0.01	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-	-	-	-	-
Benzene	mg/l	-	-	<0.01	<0.01	<0.01	-	-	-	-	-	-	<0.01	<0.01	<0.01	-	-	-	-	<0.01	<0.01	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	
Toluene	mg/l	-	-	<0.01	<0.01	<0.01	-	-	-	-	-	-	<0.01	<0.01	<0.01	-	-	-	-	<0.01	<0.01	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	
Ethylbenzene	mg/l	-	-	<0.01	<0.01	<0.01	-	-	-	-	-	-	<0.01	<0.01	<0.01	-	-	-	-	<0.01	<0.01	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	
Total Xylene	mg/l	-	-	<0.01	<0.01	<0.01	-	-	-	-	-	-	<0.01	<0.01	<0.01	-	-	-	-	<0.01	<0.01	-	-	-	-	-	-	-	
p/m- Xylene	mg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	
o-Xylene	mg/l	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	
Organics - List I/II																													
VOC's	mg/l	-	-	-	all <0.001	all <0.001	-	-	-	-	-	-	all <0.001	all <0.001	all <0.001	-	-	-	-	all <0.001	all <0.001	-	all <0.001	-	-	-	-	-	
except Carbon Disulphide	mg/l	-	-	-	-	0.008	-	-	-	-	-	-	-	-	-	-	-	-	-	0.008	0.013	-	0.019	-	-	-	-	-	
Semi VOC's	mg/l	-	-	-	all <0.001	all <0.001	-	-	-	-	-	-	all <0.001	<0.001	all <0.001	-	-	-	-	all <0.001	all <0.001	-	-	-	-	-	-	-	
Pesticides	mg/l	-	-	-	all <0.00001	all <0.00001	-	-	-	-	-	-	all <0.00001	-	<0.00001	-	<0.00001	-	-	<0.00001	<0.00001	-	-	-	-	-	-	-	
Bacteriological Parameters																													
Faecal Coliforms	no. /100 ml	32	<1	-	24	-	-	-	-	<1	-	-	-	-	-	-	-	-	-	<1	-	-	1	<1	<1	<1	<1	<1	
Total Coliforms	no. /100 ml	42	2	-	22	-	-	-	-	<1	-	-	-	-	-	-	-	-	-	2	-	-	<1	25	36	<1	13	2	
Faecal Streptococci	no. /100 ml	32	54	-	28	-	-	-	-	<1	-	-	-	-	-	-	-	-	-	44	-	-	22	<1	-	-	-	<1	
Total Viable Count @ 22C	no. /100 ml	4900	1680	-	1520	-	-	-	-	6320	-	-	-	-	-	-	-	-	-	4240	-	-	480	912	-	-	-	280	
Total Viable Count @ 37C	no. /100 ml	2080	20	-	240	-	-	-	-	880	-	-	-	-	-	-	-	-	-	30	-	-	20	304	-	-	-	180	

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LEGEND
 "- " = No data reported or no analyses conducted
 "<" = Less Than
 U/G = Upgradient
 D/G = Downgradient
 O/B = Overburden
 B/R = Bedrock
 Bold underlined values are considered to be above background concentrations
 MW03-1 - No analysis as well was dry
 Samples taken between December 2003 and February 2004

