Identification of sources and processes in a low-level radioactive waste site adjacent to landfills: groundwater hydrogeochemistry and isotopes

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SUPPLEMENTARY PAPERS

Supplementary Paper S1 Electrical Resistivity Tomography (ERT) profiles.

Supplementary Paper S2 Details of well construction.

Supplementary Paper S3 Groundwater major physico-chemical parameters, ion concentrations and charge balance error (CBE%). All cations analysed by ICP-AES except for Mg^{2+} in the first 3 samplings analysed by ICP-MS.

Supplementary Paper S4 Groundwater and surface water information with well location, screened interval and abbreviated water type.

Supplementary Paper S5 Selected groundwater minor and trace element concentrations. Al, Mn and Fe analysed by ICP-AES, the rest of elements by ICP-MS. BDL (below detection limit); no data represent not analysed elements.

Supplementary Paper S6 Groundwater dissolved organic carbon (DOC), stable isotopes ($\delta^{13}\text{C}_{\text{DOC}}$, $\delta^{13}\text{C}_{\text{DIC}}$, water $\delta^{18}\text{O}$ and $\delta^2\text{H}$, sulfate $\delta^{34}\text{S}$ and $\delta^{18}\text{O}$), calculated deuterium excess (*d*-excess), $^{87}\text{Sr}/^{86}\text{Sr}$ and tritium (^3H). Note ^3H is reported in Bq L^{-1} ($1 \text{ Bq L}^{-1} = 8.47 \text{ TU}$).

Supplementary Paper S7 Water stable isotopes for leachate samples from Harrington's Quarry. The *d* is the calculated deuterium excess for the corresponding samples.

Supplementary Paper S8 Calculated saturation indexes for common mineral phases in LFLS groundwater. Cal = Calcite, Dol = Dolomite, Sid = Siderite, Gyp = Gypsum, Hem = Hematite, Goe = Goethite, Qtz = Quartz, Bar = Barite, Cha = Chalcedony, Hal = Halite, Illi = Illite, Kao = Kaolinite.

Supplementary Paper S1 Electrical Resistivity Tomography (ERT) profiles.

An Electrical Resistivity Tomography (ERT) campaign was carried out using a SAS 4000 Terrameter with ABEM Lund system (Dahlin 1996). The Wenner-Schlumberger electrode array was selected due to the lateral continuity of the layers (Szalai *et al.* 2009). The apparent resistivity data was inverted with the software RES2DINV (Loke *et al.* 1996).

In the resistivity sections, Hawkesbury Sandstone is indicated at depth displaying an electrical resistivity above 160 ohm.m, with the central part of profile 1 (Figure A1), having a lower resistivity. This corresponds with materials generally grading conformably upwards from the Hawkesbury sandstone and overlaid by the shale lens. Above the Hawkesbury Sandstone, the shale displays lower electrical resistivity (20–30 ohm.m) with a thickness of approximately 14 metres along the studied sections. The deepening of this layer towards North is seen in profile 1, while profiles 2 and 3 show a similar thickness (Figure A1). Drilling during BH well construction was used to map the shale layer and its thickness (Mumme 1974) with a good agreement with the ERT profiles. The shale mapping showed a thinning of the shale layer to the NW of the site. The soil layer is more resistive than the shale (120–150 ohm.m) and more heterogeneous; this is better shown in profiles 2 and 3 (Figure A1b, c). These heterogeneities are typical in soils due to their unconsolidated nature, and enhanced by the presence of trenches. The soil layer is very thin at the south of the studied area and thickens towards the north, following the dipping of the shale lens.

Figure SP1 (A, B, C) Electrical resistivity profiles with location of transects within the LFLS site. Profiles are oriented following the numeric legend in the profiles. The electrode spacing was 5 m with a total of 64 electrodes for profile 1 and 32 electrodes for profiles 2 and 3.

Supplementary Paper S2 Details of well construction.

Detailed information on well construction is given in Hughes *et al.* (2011) and multiple reports cited therein. In summary, several generations of observation bores are present on the LFLS (Figure 1c). The earliest bores, numbered “BH” or “OS”, were established in the 1960s prior to, or during, waste disposal operations (AAEC 1966). These are unscreened open bores partially lined with asbestos cement with the exception of BHF, which is PVC-lined and suspected to have been installed in 1984. The “D” series, established in the mid 1970s, are PVC-lined boreholes mostly 3 m depth (up to 6 m), screened from the surface and mostly located around the trench area (Isaacs & Mears 1977). No information is available on the type of gravel pack used in the BH, OS and D series wells. The “MB” series established in 1988 covers the fenced perimeter and has a key borehole in the centre between both trench areas (MB16). The MB wells are variable in depth (4–7 m) with most cutting through the weathered shale and probably stopping with core refusal at a harder level (siderite-rich mudstone or parent shale). The MB series was fitted with basalt gravel-packs. P1s is the only borehole screened entirely within the shale layer. CW is screened in a fine sandstone layer intercalated within the shale, with potentially more shale below the screen. The P1d and P2d are the only boreholes that are screened within the underlying Hawkesbury sandstone down to 22 and 36 m, respectively. A number of wells were developed during 2009 (CH series) with screens in the zone 2.5–4.5 m deep, just below an indurated mudstone layer. The “P”, “CW” and “CH” series were developed according to Australian borehole construction guidelines (LWBC 2003).

ADDITIONAL REFERENCES

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Supplementary Paper S3: Groundwater major physico-chemical parameters, ion concentrations and charge balance error (CBE%). All cations analysed by ICP-AES except for Mg^{2+} in the first 3 samplings analysed by ICP-MS

	Temp	pH	TDS	Eh	DO	Na ⁺	K ⁺	Ca ²⁺	Mg ²⁺	F ⁻	Cl ⁻	Br ⁻	HCO ₃ ⁻	NO ₃ ⁻	SO ₄ ²⁻	Si	CBE %
	°C		mg L ⁻¹	mV	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	
2007																	
DCE-07-02-BH10	15.6	5.27	155	424	0.24	52.1	0.98	0.66	1.0	0.05	66	0.65	14.0	0.1	19	7.2	-1.7
DCE-07-01-BHF	16.9	5.18	346	253	0.30	96.6	3.78	2.90	12.0	0.06	201	0.67	8.5	<0.1	20	4.2	-6.8
DCE-07-19-CW	18.9	5.67	1518	289	1.80	488	7.98	8.65	23.6	1.00	580	3.1	106.1	0.1	300	23.2	-1.3
DCE-07-05-MB11	18.7	5.22	150	393	2.20	41.5	0.67	3.22	6.8	0.05	62	0.38	6.7	0.3	28	7.5	2.0
DCE-07-06-MB12	16.5	5.14	172	383	1.65	45.5	1.20	4.67	5.0	0.04	26	0.24	16.5	<0.1	73	18.8	2.6
DCE-07-07-MB13	15.5	5.16	103	387	0.37	28.3	1.37	2.66	2.9	0.04	33	0.23	11.6	0.3	23	6.4	1.4
DCE-07-08-MB14	17.3	5.71	444	281	1.18	117	4.44	9.81	22.0	0.07	200	0.61	23.5	0.3	66	9.1	0.6
DCE-07-09-MB15	18.5	5.72	808	356	0.71	248	3.32	8.46	8.5	0.49	155	1.2	12.3	0.4	370	23.9	-1.2
DCE-07-10-MB16	16.5	5.38	148	294	0.32	43.0	0.91	2.42	2.9	0.07	29	1.1	35.7	0.1	33	13.9	3.4
DCE-07-11-MB17	15.5	5.37	139	410	0.31	39.3	0.46	1.87	2.0	0.04	40	0.6	32.9	<0.1	22	8.1	-3.6
DCE-07-12-MB18	18.1	6.18	415	343	1.80	87.1	1.92	8.41	11.8	0.33	180	1.2	14.6	<0.1	110	10.9	-18.6
DCE-07-13-MB19	16.6	5.81	2210	188	0.43	580	14.7	97.3	74.7	0.08	1080	3.5	150.1	0.1	210	13.9	-1.1
DCE-07-14-MB20	13.7	5.65	221	242	0.47	39.8	9.10	18.80	8.0	0.05	68	0.33	50.8	0.1	26	4.5	3.7
DCE-07-15-MB21	14.4	6.04	203	275	0.53	52.8	3.99	7.61	4.9	0.03	63	0.33	38.3	0.4	32	4.7	1.6
DCE-07-03-OS2	13.0	5.83	131	288	3.90	29.6	2.30	10.60	2.9	<0.01	39	0.35	32.6	0.7	14	5.5	4.5
DCE-07-04-OS3	16.0	5.37	110	357	0.26	33.3	0.59	2.40	1.4	0.01	32	0.39	21.9	0.2	18	7.1	1.8
DCE-07-17-P1D	18.7	5.34	6309	235	0.65	1953	8.30	41.28	338.2	<0.01	3500	10.0	68.6	0.1	390	19.9	3.0
DCE-07-16-P1S	17.9	4.40	2056	359	0.56	800	6.56	7.99	88.2	0.18	700	2.10	-	0.5	450	36.6	19.1
DCE-07-18-P2D	18.5	4.91	3196	340	0.74	1060	17.8	29.20	129.3	0.60	1500	5.20	44.3	<0.1	410	21.6	6.9
Mar-08																	
DCE-08-14-BH10	20.0	5.00	288	295	0.71	90.1	1.83	2.50	3.1	0.06	129	1.8	11.6	<0.01	48	17.4	-5.3
DCE-08-33-BHA	18.0	7.58	1849	24	0.86	420	11.2	35.70	52.3	0.30	766	2.1	468.2	<0.1	93	2.7	-11.4
DCE-08-13-BHF	18.0	5.40	560	250	0.37	163	6.39	3.80	10.8	0.10	241	1.4	34	<0.01	96	12.0	-5.2
DCE-08-31-CW	19.1	5.49	1734	329	2.44	489	10.5	10.70	29.1	1.10	779	3.7	108.3	<0.1	302	23.6	-10.3
DCE-08-17-MB11	21.4	5.18	213	354	0.90	58.0	1.26	3.99	8.5	0.04	116	0.42	6.5	0.08	18	9.7	-4.0
DCE-08-18-MB12	20.0	5.42	175	286	0.96	41.4	1.55	6.82	5.6	0.04	42	0.27	11.9	0.04	66	15.9	-2.0
DCE-08-19-MB13	20.6	4.93	163	349	0.62	41.9	1.95	5.13	7.0	0.04	57	0.40	10.5	0.25	39	14.5	2.6
DCE-08-20-MB14	19.9	5.03	542	353	1.90	119	5.07	12.10	28.5	0.07	248	0.76	9.1	0.08	111	15.0	-4.9
DCE-08-21-MB15	21.4	5.26	232	335	1.58	58.5	1.21	7.06	8.3	0.06	53	0.54	22.6	0.15	81	22.3	0.8
DCE-08-22-MB16	20.3	5.20	134	297	0.37	37.3	1.02	3.37	3.3	0.06	31	1.0	23.5	0.14	33	13.3	3.8
DCE-08-23-MB17	21.5	5.03	150	326	0.51	45.3	0.62	2.31	2.2	0.05	42	0.99	17.6	<0.01	39	17.7	0.1
DCE-08-24-MB18	20.6	6.01	854	305	2.42	186	5.13	39.80	21.0	0.40	268	2.0	119.0	<0.1	213	15.6	-7.9
DCE-08-25-MB19	17.5	5.78	1712	167	1.11	368	13.4	68.2	60.8	0.17	895	3.0	144.0	<0.1	156	12.9	-10.9

	Temp	pH	TDS	Eh	DO	Na ⁺	K ⁺	Ca ²⁺	Mg ²⁺	F ⁻	Cl ⁻	Br ⁻	HCO ₃ ⁻	NO ₃ ⁻	SO ₄ ²⁻	Si	CBE %
	°C		mg L ⁻¹	mV	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	
DCE-08-26-MB20	17.5	5.82	364	235	0.51	49.9	14.1	31.40	13.2	0.06	70	0.53	121.4	0.1	60	10.7	0.7
DCE-08-27-MB21	18.6	5.82	1009	284	0.44	187	10.3	67.6	35.0	<0.1	305	1.5	102.8	<0.1	299	11.0	-6.1
DCE-08-32-MB22	21.5	6.02	387	294	3.17	77.8	2.66	10.30	27.3	0.03	140	0.38	97.7	<0.01	15	7.0	7.0
DCE-08-15-OS2	21.5	6.02	227	294	3.17	33.2	3.13	28.60	4.1	0.04	38	0.46	98.0	0.31	21	11.7	2.5
DCE-08-16-OS3	20.5	5.45	303	160	0.26	57.6	1.67	12.50	5.1	0.02	32	1.1	128.8	<0.01	51	21.4	-1.0
DCE-08-28-P1D	18.6	5.15	6806	284	0.50	1810	8.68	41.60	376.7	0.40	4030	11.0	28.7	<0.1	419	20.6	-3.4
DCE-08-29-P1S	20.1	4.00	3392	403	0.58	898	8.05	8.73	120.6	0.50	1860	4.8	8.9	<0.1	470	41.1	-10.9
DCE-08-30-P2D	19.3	5.62	1983	252	1.26	548	12.9	14.50	52.5	0.60	1000	2.9	67.3	<0.1	269	18.1	-8.1
Sep-Nov 2008																	
DCE-08-157-BH10	15.0	5.31	482	170	9.94	136	2.16	2.16	5.6	0.08	150	2.9	40.4	<0.05	140	12.3	-8.5
DCE-08-175-BHA	18.0	7.96	3536	-75	0.55	972	15.7	53.8	90.9	0.23	2000	5.8	286.2	<0.05	110	3.7	-10.1
DCE-08-176-BHB	17.5	7.15	5297	-61	0.29	1310	21	123	256.5	0.36	3300	22	85.4	<0.05	130	1.6	-6.7
DCE-08-156-BHF	17.6	4.91	572	329	6.00	165	4.76	3.59	14.0	0.12	300	1.6	13.4	<0.05	68	12.0	-7.5
DCE-08-174-CW	19.0	5.58	1852	268	3.36	556	9.86	10.60	31.5	1.20	760	3.9	138.7	<0.05	340	21.0	-5.7
DCE-08-160-MB11	18.9	5.24	121	279	2.58	31.7	0.57	2.23	3.9	0.05	25	0.41	12.4	<0.05	45	9.8	-0.6
DCE-08-161-MB12	16.3	5.02	201	267	4.16	52.2	1.12	5.28	6.6	0.04	39	0.26	11.0	<0.05	86	16.3	0.6
DCE-08-162-MB13	15.7	5.20	141	349	3.11	39.8	1.44	3.91	6.1	0.05	40	0.29	13.4	<0.05	36	10.8	8.2
DCE-08-163-MB14	17.0	5.61	543	238	3.64	139	3.45	8.69	26.3	0.09	240	0.64	24.5	<0.05	98	21.3	-2.3
DCE-08-164-MB15	17.5	5.26	240	313	2.14	63.8	1.19	7.40	8.8	0.07	61	0.44	22.1	<0.05	75	22.9	3.5
DCE-08-165-MB16	17.2	5.17	131	249	1.13	34.5	0.71	2.34	2.8	0.06	27	0.84	29.2	0.14	33	9.1	-1.3
DCE-08-166-MB17	17.5	5.17	193	302	2.99	53.7	0.66	4.16	3.1	0.04	36	1.3	16.0	<0.05	78	24.1	-1.6
DCE-08-167-MB18	18.3	6.23	236	237	2.47	59.1	1.24	7.06	4.3	0.19	59	0.31	75.0	0.18	30	10.6	-3.2
DCE-08-168-MB19	16.5	5.77	1656	270	1.11	416	12.8	62.90	46.4	0.17	810	2.8	101.8	0.31	200	13.9	-6.1
DCE-08-169-MB20	15.6	5.90	185	162	3.07	31.9	7.79	13.80	4.8	0.07	35	0.31	62.9	0.16	28	5.8	1.3
DCE-08-170-MB21	16.4	5.16	145	238	6.29	36.6	4.47	4.25	3.9	<0.05	50	0.28	24.2	0.20	21	3.0	0.0
DCE-08-158-OS2	17.6	6.34	148	231	7.38	29.7	2.25	12.20	2.9	<0.05	35	0.43	41.6	1.00	23	4.7	1.0
DCE-08-159-OS3	17.3	4.97	106	324	4.53	29.7	0.45	1.63	1.4	<0.05	29	0.49	14.6	<0.05	23	5.5	-0.4
DCE-08-171-P1D	19.5	5.39	7081	193	0.74	1880	7.95	39.20	377.2	0.28	4200	9.8	59.0	<0.05	480	19.3	-5.6
DCE-08-172-P1S	18.1	3.99	4063	417	1.82	1280	7.27	8.89	109.9	0.44	2100	5.9	9.2	<0.05	530	33.9	-3.4
DCE-08-173-P2D	20.3	5.81	2639	213	1.74	756	14.1	18.90	67.9	0.61	1300	4.0	124.8	<0.05	350	16.0	-7.3
DCE-08-177-D14	19.2	4.43	180	332	2.96	52.0	2.15	0.53	0.0	<0.05	45	0.70	5.9	<0.05	73	24.2	-9.5
DCE-08-180-JTC	14.7	4.85	458	287	7.18	119	6.53	3.62	15.8	0.07	210	0.89	3.5	<0.05	98	3.4	-7.9

	Temp	pH	TDS	Eh	DO	Na ⁺	K ⁺	Ca ²⁺	Mg ²⁺	F ⁻	Cl ⁻	Br ⁻	HCO ₃ ⁻	NO ₃ ⁻	SO ₄ ²⁻	Si	CBE %
	°C		mg L ⁻¹	mV	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	mg L ⁻¹	
2009																	
DCE-09-77-BH10	18.6	5.41	323	231	3.56	78.2	1.33	0.87	1.82	0.05	91	1.3	112.1	<0.1	36	15.6	1.8
DCE-09-76-BHF	20.5	5.28	979	291	0.64	278	7.16	6.13	20.8	0.18	460	3.0	21.0	0.1	180	13.0	-8.6
DCE-09-94-CW	26.5	5.54	1656	323	2.05	513	9.48	10.50	25.4	1.50	640	3.5	122.7	<0.1	330	23.8	-3.5
DCE-09-80-MB11	20.0	5.23	271	360	2.35	81.1	1.00	5.88	9.02	0.06	140	0.49	13.5	<0.1	20	10.9	0.0
DCE-09-81-MB12	23.7	5.09	271	378	1.91	72.9	1.17	6.95	6.7	0.06	45	0.32	7.8	<0.1	130	28.9	0.0
DCE-09-82-MB13	24.5	5.22	104	388	1.79	31.1	1.03	2.13	2.18	0.05	30	0.23	6.2	<0.1	31	13.0	2.4
DCE-09-83-MB14	19.1	5.87	1721	196	1.95	444	6.96	26.50	55.3	0.05	610	2.3	95.9	<0.1	470	14.8	-5.4
DCE-09-84-MB15	20.1	5.34	694	342	2.08	181	2.75	17.40	10.2	0.32	120	1.2	31.1	<0.1	330	23.3	-5.5
DCE-09-85-MB16	20.4	5.14	155	308	0.78	45.1	0.98	1.93	1.99	0.06	30	1.3	25.5	<0.1	46	22.1	2.3
DCE-09-86-MB17	20.2	5.07	199	362	2.40	57.0	0.61	3.92	2.82	0.05	38	1.3	14.2	0.2	80	26.9	-0.6
DCE-09-87-MB18	22.3	6.04	860	302	2.26	217	4.49	31.30	16.5	0.68	240	2.1	127.7	0.7	220	14.3	-3.9
DCE-09-88-MB19	16.7	5.60	2197	340	3.72	600	14.1	61	49	0.18	1100	3.9	85.1	1.7	280	19.1	-6.6
DCE-09-89-MB20	16.1	5.52	288	326	1.23	56.6	6.59	21.90	7.49	0.06	66	0.47	46.1	<0.1	81	6.8	1.2
DCE-09-90-MB21	16.2	5.79	1005	330	0.39	180	11.0	81.3	38.1	0.02	310	1.6	43.0	<0.1	340	9.1	-4
DCE-09-79-OS3	26.3	5.36	149	308	1.22	41.7	0.68	3.19	1.33	0.02	29	0.85	34.8	<0.1	37	13.0	-0.9
DCE-09-91-P1D	28.2	5.37	6737	246	1.57	1820	7.98	44.7	331	0.20	4000	9.9	35.7	<0.1	460	20.2	-5.8
DCE-09-92-P1S	20.9	3.87	3756	514	2.49	1130	7.56	9.32	95.2	0.05	2000	5.4	0.0	<0.1	500	38.0	-7.2
DCE-09-78-P2D	23.1	5.82	2607	236	2.16	771	14.8	22.30	71.6	0.27	1310	3.8	109.2	0.2	300	17.9	-4.7
DCE-09-95-CH17	21.7	3.86	2706	540	2.42	826	14.3	7.34	74.6	0.02	1600	7.1	0.0	10	160	41.0	-6
DCE-09-96-CH18	20.9	4.49	648	394	3.48	200	5.48	1.15	5.59	0.05	140	8.7	5.2	0.3	280	43.7	-2.7
DCE-09-97-CH21	18.1	4.57	534	387	6.00	156	4.24	0.70	2.64	0.03	52	2.2	15.2	<0.1	300	48.1	-5
DCE-09-98-CH30	18.6	4.29	333	495	4.58	97.0	1.25	1.06	3.22	0.04	39	1.6	-	<0.1	190	48.3	-5.1
DCE-09-99-CH31	18.3	5.58	1528	296	1.93	441	14.0	11.20	20.9	0.13	460	6.1	154.5	<0.1	410	24.1	-4.4
DCE-09-100-LHQ	19.9	6.97	6258	78	2.80	987	457	64.7	109.0	0.76	1490	9.5	3129.6	<0.1	3	14.8	-8.9
DCE-09-101-MW13	19.7	4.60	4788	386	0.44	1590	21	10.80	122.0	0.44	2600	9.9	-	<0.1	430	29.3	-1.2
DCE-09-103-MB301	20.8	6.61	1978	314	6.91	381	7.32	105	94.7	0.01	900	2.3	425.8	0.3	62	5.3	-6.6
DCE-09-105-D14	29.5	5.49	178	126	1.61	49.7	4.20	2.35	2.53	0.03	43	0.50	32.6	0.4	41	22.5	0.8
DCE-09-107-D18	20.8	5.09	158	256	0.92	41.1	0.59	0.39	0.995	0.02	25	0.97	23.6	0.2	62	22.4	-8.4

Supplementary Paper S4 Groundwater and surface water information with well location, screened interval and abbreviated water type.

	Sample Date	Northing S	Easting E	Ground Elevation m (AHD)	Well depth m (toc)	Standing water level m (toc)	Screen depth From to m BGL	Water type
2007								
DCE-07-02-BH10	14/08/07	6232117.6	313300.1	128.89	6.0	0.66	1.15–6.00	Na–Cl
DCE-07-01-BHF	16/08/07	6231996.0	313324.4	131.79	11.7	1.33	0–11.60	Na–Cl
DCE-07-19-CW	15/08/07	6232125.6	313213.1	129.51	12.5	3.89	5.9–11.4	Na–Cl
DCE-07-05-MB11	15/08/07	6231816.4	313172.9	132.33	7.4	3.97	1.00–7.30	Na–Cl
DCE-07-06-MB12	16/08/07	6231802.4	313268.1	129.05	4.8	2.90	0.60–476	Na–SO ₄
DCE-07-07-MB13	14/08/07	6231881.2	313279.8	129.50	5.9	1.21	0.30–5.90	Na–Cl
DCE-07-08-MB14	10/08/07	6231916.9	313188.6	132.54	6.3	2.78	0.45–6.25	Na–Cl
DCE-07-09-MB15	15/08/07	6232014.3	313202.7	133.37	6.8	3.34	0.45–6.80	Na–SO ₄
DCE-07-10-MB16	17/08/07	6232004.1	313271.7	132.79	5.9	1.68	0.50–5.90	Na–Cl
DCE-07-11-MB17	14/08/07	6232098.7	313312.2	129.55	4.8	0.96	0.50–4.80	Na–Cl
DCE-07-12-MB18	15/08/07	6232112.8	313216.9	129.99	5.9	3.34	0.40–5.86	Na–Cl
DCE-07-13-MB19	16/08/07	6232112.6	313370.2	128.87	6.1	3.13	0.20–5.80	Na–Cl
DCE-07-14-MB20	16/08/07	6231989.9	313362.0	131.52	5.1	0.79	0.45–4.80	Na–Cl
DCE-07-15-MB21	16/08/07	6231910.0	313351.3	129.95	4.3	0.53	0.30–4.20	Na–Cl
DCE-07-03-OS2	17/08/07	6231933.9	313296.3	131.05	1.3	0.70	open base	Na–Cl
DCE-07-04-OS3	14/08/07	6232055.5	313313.9	131.08	3.9	0.76	open base	Na–Cl
DCE-07-17-P1D	28/08/07	6231839.4	313270.9	128.92	22.0	3.36	15.00–22.06	Na–Cl
DCE-07-16-P1S	17/08/07	6231834.3	313270.4	128.94	5.9	2.34	2.10–5.83	Na–Cl
DCE-07-18-P2D	28/08/07	6232162.1	313232.2	127.84	33.7	11.22	29.00–36.44	Na–Cl
Mar-08								
DCE-08-14-BH10	27/03/08	6232117.6	313300.1	128.89	6.0	0.76	1.15–6.00	Na–Cl
DCE-08-33-BHA	31/03/08	6232155.4	313269.5	127.56	10.4	2.05	0–10.4	Na–Cl
DCE-08-13-BHF	28/03/08	6231996.0	313324.4	131.79	11.7	1.93	0–11.60	Na–Cl
DCE-08-31-CW	26/03/08	6232125.6	313213.1	129.51	12.5	4.08	5.9–11.4	Na–Cl
DCE-08-17-MB11	26/03/08	6231816.4	313172.9	132.33	7.4	3.44	1.00–7.30	Na–Cl
DCE-08-18-MB12	28/03/08	6231802.4	313268.1	129.05	4.8	2.04	0.60–476	Na–SO ₄
DCE-08-19-MB13	28/03/08	6231881.2	313279.8	129.50	5.9	1.40	0.30–5.90	Na–Cl
DCE-08-20-MB14	26/03/08	6231916.9	313188.6	132.54	6.3	2.70	0.45–6.25	Na–Cl
DCE-08-21-MB15	26/03/08	6232014.3	313202.7	133.37	6.8	3.50	0.45–6.80	Na–SO ₄
DCE-08-22-MB16	28/03/08	6232004.1	313271.7	132.79	5.9	1.95	0.50–5.90	Na–Cl
DCE-08-23-MB17	27/03/08	6232098.7	313312.2	129.55	4.8	1.06	0.50–4.80	Na–Cl
DCE-08-24-MB18	26/03/08	6232112.8	313216.9	129.99	5.9	3.34	0.40–5.86	Na–Cl
DCE-08-25-MB19	31/03/08	6232112.6	313370.2	128.87	6.1	2.16	0.20–5.80	Na–Cl
DCE-08-26-MB20	31/03/08	6231989.9	313362.0	131.52	5.1	1.55	0.45–4.80	Na–HCO ₃
DCE-08-27-MB21	31/03/08	6231910.0	313351.3	129.95	4.3	1.41	0.30–4.20	Na–Cl
DCE-08-32-MB22	31/03/08	6231792.6	313317.3	127.71	2.0	1.18	0.55–1.99	Na–Cl
DCE-08-15-OS2	28/03/08	6231933.9	313296.3	131.05	1.3	0.99	open base	Na–HCO ₃
DCE-08-16-OS3	27/03/08	6232055.5	313313.9	131.08	3.9	1.02	open base	Na–HCO ₃
DCE-08-28-P1D	27/03/08	6231839.4	313270.9	128.92	22.0	2.80	15.00–22.06	Na–Cl
DCE-08-29-P1S	28/03/08	6231834.3	313270.4	128.94	5.9	2.22	2.10–5.83	Na–Cl
DCE-08-30-P2D	27/03/08	6232162.1	313232.2	127.84	33.7	13.15	29.00–36.44	Na–Cl
Sep-Nov 2008								
DCE-08-157-BH10	29/09/08	6232117.6	313300.1	128.89	6.0	0.65	1.15–6.00	Na–Cl
DCE-08-175-BHA	3/10/08	6232155.4	313269.5	127.56	10.4	2.54	0–10.4	Na–Cl
DCE-08-176-BHB	8/10/08	6232147.3	313329.7	127.60	10.7	0.63	0–10.4	Na–Cl
DCE-08-156-BHF	30/09/08	6231996.0	313324.4	131.79	11.7	1.43	0–11.60	Na–Cl
DCE-08-174-CW	26/09/08	6232125.6	313213.1	129.51	12.5	4.06	5.9–11.4	Na–Cl
DCE-08-160-MB11	25/09/08	6231816.4	313172.9	132.33	7.4	3.44	1.00–7.30	Na–SO ₄
DCE-08-161-MB12	2/10/08	6231802.4	313268.1	129.05	4.8	1.75	0.60–476	Na–SO ₄
DCE-08-162-MB13	1/10/08	6231881.2	313279.8	129.50	5.9	1.20	0.30–5.90	Na–Cl

	Sample Date	Northing S	Easting E	Ground Elevation m (AHD)	Well depth m (toc)	Standing water level m (toc)	Screen depth From to m BGL	Water type
DCE-08-163-MB14	26/09/08	6231916.9	313188.6	132.54	6.3	2.58	0.45–6.25	Na–Cl
DCE-08-164-MB15	25/09/08	6232014.3	313202.7	133.37	6.8	3.35	0.45–6.80	Na–Cl
DCE-08-165-MB16	8/10/08	6232004.1	313271.7	132.79	5.9	0.72	0.50–5.90	Na–Cl
DCE-08-166-MB17	30/09/08	6232098.7	313312.2	129.55	4.8	0.92	0.50–4.80	Na–SO ₄
DCE-08-167-MB18	26/09/08	6232112.8	313216.9	129.99	5.9	2.29	0.40–5.86	Na–Cl
DCE-08-168-MB19	3/10/08	6232112.6	313370.2	128.87	6.1	1.51	0.20–5.80	Na–Cl
DCE-08-169-MB20	7/10/08	6231989.9	313362.0	131.52	5.1	0.27	0.45–4.80	Na–HCO ₃
DCE-08-170-MB21	7/10/08	6231910.0	313351.3	129.95	4.3	0.14	0.30–4.20	Na–Cl
DCE-08-158-OS2	30/09/08	6231933.9	313296.3	131.05	1.3	0.74	open base	Na–Cl
DCE-08-159-OS3	30/09/08	6232055.5	313313.9	131.08	3.9	0.77	open base	Na–Cl
DCE-08-171-P1D	2/10/08	6231839.4	313270.9	128.92	22.0	2.58	15.00–22.06	Na–Cl
DCE-08-172-P1S	1/10/08	6231834.3	313270.4	128.94	5.9	1.94	2.10–5.83	Na–Cl
DCE-08-173-P2D	3/10/08	6232162.1	313232.2	127.84	33.7	13.35	29.00–36.44	Na–Cl
DCE-08-177-D14	2/10/08	6231988.1	313234.5	132.96	2.6	1.17	0–3.00	Na–SO ₄
DCE-08-180-JTC	8/10/08	6231726.6	313411.1	125.84	surface water	N/A	N/A	Na–Cl
2009								
DCE-09-77-BH10	22/10/09	6232117.6	313300.1	128.89	6.0	1.07	1.15–6.00	Na–Cl
DCE-09-76-BHF	10/11/09	6231996.0	313324.4	131.79	11.7	2.19	0–11.60	Na–Cl
DCE-09-94-CW	21/10/09	6232125.6	313213.1	129.51	12.5	4.60	5.9–11.4	Na–Cl
DCE-09-80-MB11	23/10/09	6231816.4	313172.9	132.33	7.4	3.95	1.00–7.30	Na–Cl
DCE-09-81-MB12	3/11/09	6231802.4	313268.1	129.05	4.8	2.32	0.60–476	Na–SO ₄
DCE-09-82-MB13	3/11/09	6231881.2	313279.8	129.50	5.9	1.25	0.30–5.90	Na–Cl
DCE-09-83-MB14	23/10/09	6231916.9	313188.6	132.54	6.3	3.14	0.45–6.25	Na–Cl
DCE-09-84-MB15	29/10/09	6232014.3	313202.7	133.37	6.8	4.13	0.45–6.80	Na–SO ₄
DCE-09-85-MB16	9/11/09	6232004.1	313271.7	132.79	5.9	2.37	0.50–5.90	Na–SO ₄
DCE-09-86-MB17	22/10/09	6232098.7	313312.2	129.55	4.8	1.40	0.50–4.80	Na–SO ₄
DCE-09-87-MB18	21/10/09	6232112.8	313216.9	129.99	5.9	3.96	0.40–5.86	Na–Cl
DCE-09-88-MB19	29/10/09	6232112.6	313370.2	128.87	6.1	2.57	0.20–5.80	Na–Cl
DCE-09-89-MB20	6/11/09	6231989.9	313362.0	131.52	5.1	1.41	0.45–4.80	Na–Cl
DCE-09-90-MB21	6/11/09	6231910.0	313351.3	129.95	4.3	1.60	0.30–4.20	Na–Cl
DCE-09-79-OS3	10/11/09	6232055.5	313313.9	131.08	3.9	1.25	open base	Na–Cl
DCE-09-91-P1D	12/11/09	6231839.4	313270.9	128.92	22.0	3.60	15.00–22.06	Na–Cl
DCE-09-92-P1S	11/11/09	6231834.3	313270.4	128.94	5.9	2.61	2.10–5.83	Na–Cl
DCE-09-78-P2D	20/11/09	6232162.1	313232.2	127.84	33.7	13.95	29.00–36.44	Na–Cl
DCE-09-95-CH17	28/10/09	6232182.9	313374.5	126.19	4.2	1.24	3.2–4.1	Na–Cl
DCE-09-96-CH18	22/10/09	6232107.3	313306.4	129.33	4.0	1.67	3.05–3.95	Na–SO ₄
DCE-09-97-CH21	27/10/09	6232068.0	313298.9	130.53	5.4	1.87	3.42–4.32	Na–SO ₄
DCE-09-98-CH30	28/10/09	6231966.8	313265.6	132.26	4.2	1.18	2.9–3.8	Na–SO ₄
DCE-09-99-CH31	28/10/09	6231948.8	313248.9	131.94	7.0	1.94	5.65–6.7	Na–Cl
DCE-09-100-LHQ	16/11/09	6232257.0	313172.0	126.21	7.1	5.41	0–7.10	Na–HCO ₃
DCE-09-101-MW13	30/10/09	6232252.0	313214.0	125.30	5.5	3.63	2.50 to 5.50	Na–Cl
DCE-09-103-MB301	30/10/09	6231872.0	312859.0	137.00	26.5	22.01	19.00–25.00	Na–Cl
DCE-09-105-D14	12/11/09	6231988.1	313234.5	132.96	2.6	1.60	0–3.00	Na–Cl
DCE-09-107-D18	13/11/09	6232029.2	313265.1	132.53	3.1	1.80	0–3.00	Na–SO ₄

Supplementary Paper S5 Selected groundwater minor and trace element concentrations. Al, Mn and Fe analysed by ICP-AES, the rest of elements by ICP-MS. BDL (bellow detection limit); no data represent not analysed elements.

	Be µg L ⁻¹	Al µg L ⁻¹	Mn µg L ⁻¹	Fe µg L ⁻¹	Sr µg L ⁻¹	I µg L ⁻¹	U µg L ⁻¹
Aug-07							
DCE-07-02-BH10	0.188	64.1	0.184	0.09	0.003	47	0.053
DCE-07-01-BHF	0.260	237.5	1.120	1.63	0.078	174	0.074
DCE-07-19-CW	12.174	50.2	1.530	0.07	0.074	493	0.053
DCE-07-05-MB11	0.132	20.9	0.296	0.05	0.047	5	0.013
DCE-07-06-MB12	0.089	36.3	0.081	0.04	0.054	31	0.08
DCE-07-07-MB13	0.062	54.5	0.081	0.31	0.034	9	0.049
DCE-07-08-MB14	0.376	89.0	0.681	7.32	0.189	283	0.013
DCE-07-09-MB15	10.909	197.8	1.180	0.70	0.125	608	0.024
DCE-07-10-MB16	0.050	26.9	0.087	1.92	0.041	3180	0.051
DCE-07-11-MB17	0.025	40.0	0.060	0.05	0.03	168	0.099
DCE-07-12-MB18	0.964	15.3	0.122	0.02	0.331	250	0.021
DCE-07-13-MB19	0.106	14.2	7.790	2.40	1.522	125	0.062
DCE-07-14-MB20	0.031	109.6	0.493	0.87	0.212	221	0.049
DCE-07-15-MB21	0.009	44.2	0.082	0.08	0.115	61	0.042
DCE-07-03-OS2	0.005	28.1	0.002	0.06	0.04	22	0.044
DCE-07-04-OS3	0.018	16.1	0.015	0.17	0.009	465	0.074
DCE-07-17-P1D	17.517	81.2	27.100	145	0.361	678	0.093
DCE-07-16-P1S	8.905	5112.3	6.470	8.21	0.117	338	1.765
DCE-07-18-P2D	3.871	1098.1	4.230	17.00	0.368	369	0.204
Mar-08							
DCE-08-14-BH10	0.212	86.5	0.530	0.25	0.009	660	0.1
DCE-08-33-BHA	0.014	4.9	1.500	10.60	0.329	190	0.362
DCE-08-13-BHF	0.246	81.2	2.530	4.02	0.059	1140	0.05
DCE-08-31-CW	11.622	50.5	2.000	0.13	0.089	650	0.083
DCE-08-17-MB11	0.175	40.6	0.600	0.11	0.058	20	0.02
DCE-08-18-MB12	0.092	39.1	0.200	0.03	0.064	90	0.056
DCE-08-19-MB13	0.114	75.1	0.200	0.15	0.093	150	0.043
DCE-08-20-MB14	0.313	90.1	0.500	0.16	0.269	250	0.019
DCE-08-21-MB15	10.410	188.6	0.200	0.13	0.121	580	0.022
DCE-08-22-MB16	0.052	39.6	0.100	0.34	0.048	1680	0.055
DCE-08-23-MB17	0.053	34.6	<0.1	0.40	0.039	1380	0.125
DCE-08-24-MB18	5.839	91.0	1.600	0.05	0.548	500	0.032
DCE-08-25-MB19	0.323	17.1	6.100	2.07	1.134	170	0.095
DCE-08-26-MB20	0.036	38.4	1.100	3.49	0.449	330	0.07
DCE-08-27-MB21	0.016	14.0	1.600	0.24	0.983	730	0.056
DCE-08-32-MB22	0.088	149.8	0.500	4.18	0.191	70	0.224
DCE-08-15-OS2	0.004	12.6	<0.1	0.07	0.065	90	0.057
DCE-08-16-OS3	0.020	29.1	<0.1	17.90	0.039	6980	0.309
DCE-08-28-P1D	29.285	181.0	22.200	122.00	0.354	670	0.265
DCE-08-29-P1S	9.027	4540.4	6.800	9.81	0.12	710	1.848
DCE-08-30-P2D	1.345	94.8	2.400	15.80	0.161	240	0.07
Sep-Nov 2008							
DCE-08-157-BH10	0.246	84.7	1.460	3.87	0.011	1100	0.048
DCE-08-175-BHA	0.027	3.2	1.350	7.56	0.241	210	0.485
DCE-08-176-BHB	0.022	1.7	4.710	61.90	0.700	140	

	Be $\mu\text{g L}^{-1}$	Al $\mu\text{g L}^{-1}$	Mn $\mu\text{g L}^{-1}$	Fe $\mu\text{g L}^{-1}$	Sr $\mu\text{g L}^{-1}$	I $\mu\text{g L}^{-1}$	U $\mu\text{g L}^{-1}$
DCE-08-156-BHF	0.382	140.9	1.950	1.34	0.082	770	0.03
DCE-08-174-CW	12.743	40.2	1.960	0.395	0.091	640	0.047
DCE-08-160-MB11	0.086	27.9	0.164	0.061	0.026	<10	0.025
DCE-08-161-MB12	0.092	57.8	0.124	0.01	0.072	70	0.055
DCE-08-162-MB13	0.094	89.5	0.153	0.146	0.066	90	0.054
DCE-08-163-MB14	0.278	68.8	0.368	3.19	0.243	80	0.014
DCE-08-164-MB15	0.652	39.3	0.355	0.078	0.168	270	0.033
DCE-08-165-MB16	0.061	41.0	0.077	0.367	0.033	1330	0.056
DCE-08-166-MB17	0.045	34.7	0.131	0.092	0.041	1500	0.07
DCE-08-167-MB18	0.045	2.8	0.033	0.003	0.116	10	0.014
DCE-08-168-MB19	0.294	16.7	6.920	2.91	0.857	130	0.061
DCE-08-169-MB20	0.035	119.7	0.522	0.553	0.146	130	0.07
DCE-08-170-MB21	0.013	122.0	0.106	0.232	0.075	50	0.063
DCE-08-158-OS2	0.010	21.2	0.008	0.04	0.038	20	0.035
DCE-08-159-OS3	0.028	12.5	0.016	0.113	0.008	840	0.082
DCE-08-171-P1D	18.172	45.8	20.600	122.0	0.355	670	0.033
DCE-08-172-P1S	7.674	4144.2	8.080	11.10	0.106	1080	1.427
DCE-08-173-P2D	1.577	75.2	2.970	24.3	0.192	310	0.075
DCE-08-177-D14	bdl	bdl	0.016	0.705	bdl	3890	bdl
DCE-08-180-JTC	0.335	404.1	0.812	0.269	0.068	40	0.032
Oct-Nov 2009							
DCE-09-77-BH10		40.0	0.368	0.599	0.003	250	
DCE-09-76-BHF		120.0	6.860	3.24	0.095	650	
DCE-09-94-CW		40.0	2.020	0.128	0.075	710	
DCE-09-80-MB11		40.0	0.674	0.018	0.063	20	
DCE-09-81-MB12		60.0	0.200	0.03	0.065	160	
DCE-09-82-MB-13		40.0	0.069	0.053	0.025	50	
DCE-09-83-MB14		40.0	2.680	25.9	0.490	2070	
DCE-09-84-MB15		40.0	1.130	0.27	0.214	1020	
DCE-09-85-MB16		bdl	0.058	2.30	0.023	2080	
DCE-09-86-MB17		bdl	0.127	0.37	0.043	1050	
DCE-09-87-MB18		50.0	0.923	0.015	0.379	230	
DCE-09-88-MB19		60.0	10.400	1.50	0.619	160	
DCE-09-89-MB20		bdl	0.778	2.20	0.230	190	
DCE-09-90-MB21		bdl	1.810	0.114	0.978	450	
DCE-09-79-OS3		bdl	0.027	1.10	0.009	1690	
DCE-09-91-P1D		bdl	23.500	139.0	0.299	270	
DCE-09-92-P1S		3650.0	7.740	8.76	0.096	710	
DCE-09-78-P2D		30.0	3.460	28.7	0.199	230	
DCE-09-95-CH17		5390.0	6.860	12.5	0.092	760	
DCE-09-96-CH18		230.0	0.164	1.57	0.014	9700	
DCE-09-97-CH21		100.0	0.075	1.26	0.007	9000	
DCE-09-98-CH30		200.0	0.019	0.488	0.007	7100	
DCE-09-99-CH31		70.0	4.620	24.2	0.095	27100	
DCE-09-100-LHQ		40.0	0.182	11.0	0.531	5500	
DCE-09-101-MW13		1970.0	3.380	23.4	0.173	12200	
DCE-09-103-MB301		bdl	0.136	0.018	0.379	280	
DCE-09-105-D14		70.0	0.050	2.31	0.029	2260	
DCE-09-107-D18		bdl	0.019	3.22	0.004	1540	

Supplementary Paper S6 Groundwater dissolved organic carbon (DOC), stable isotopes ($\delta^{13}\text{C}_{\text{DOC}}$, $\delta^{13}\text{C}_{\text{DIC}}$, water $\delta^{18}\text{O}$ and $\delta^2\text{H}$, sulfated $\delta^{34}\text{S}$ and $\delta^{18}\text{O}$), calculated deuterium excess (*d*-excess), $^{87}\text{Sr}/^{86}\text{Sr}$ and tritium (^3H). Note ^3H is reported in Ba L^{-1} ($1 \text{ Ba L}^{-1} = 8.47 \text{ TU}$).

	DOC	$\delta^{13}\text{C}_{\text{DOC}}$	$\delta^{13}\text{C}_{\text{DIC}}$	$\delta^{18}\text{O}$	$\delta^2\text{H}$	<i>d</i> -excess	$\delta^{34}\text{S}_{\text{SO}_4}$	$\delta^{18}\text{O}_{\text{SO}_4}$	$^{87}\text{Sr}/^{86}\text{Sr}$	^3H
	mg L^{-1}	‰ VPDB	‰ VPDB	‰ VSMOW	‰ VSMOW	‰ VSMOW	‰ VCDT	‰ VSMOW		Bq L^{-1}
2007										
DCE-07-02-BH10	6.28	-18.3	-19.4	-4.61	-23.4	13.5				159
DCE-07-01-BHF	8.03	-19.3	-19.8	-4.86	-24.4	14.5				152
DCE-07-19-CW	40.49	-11.3	-26.9	-4.68	-23.5	14.0				710
DCE-07-05-MB11	3.84	-20.3	-28.5	-4.78	-22.7	15.5				3
DCE-07-06-MB12	17.91	-21.7	-26.2	-4.53	-21.5	14.8				3
DCE-07-07-MB13	7.84	-14.2	-26.3	-4.51	-19.8	16.3				470
DCE-07-08-MB14	7.15	-21.3	-26.7	-4.97	-24.1	15.6				34
DCE-07-09-MB15	17.26	-20.2	-20.2	-4.80	-26.0	12.4				105
DCE-07-10-MB16	48.42	-25.8	-10.9	-4.91	-22.5	16.8				2310
DCE-07-11-MB17	7.99	-26.2	-15.3	-4.69	-21.3	16.3				196
DCE-07-12-MB18	8.53	-16.3	-26.4	-4.73	-23.2	14.6				85
DCE-07-13-MB19	9.03	-21.2	-18.9	-5.41	-27.8	15.5				402
DCE-07-14-MB20	8.12	-27.2	-12.0	-4.75	-19.5	18.5				3
DCE-07-15-MB21	6.54	-16.5	-24.3	-5.15	-22.9	18.3				14
DCE-07-03-OS2	6.60	-14.6	-25.1	-4.52	-21.8	14.4				342
DCE-07-04-OS3	6.57	-11.1	-11.0	-4.88	-24.7	14.4				291
DCE-07-17-P1D	29.65	-16.5	-29.1	-4.87	-25.5	13.5				125
DCE-07-16-P1S	18.01	-21.5	-27.0	-4.64	-23.3	13.8				41
DCE-07-18-P2D	26.05	-17.9	-25.3	-4.83	-25.1	13.5				108
Mar-08										
DCE-08-14-BH10	2.02	-22.7	-18.6	-4.20	-20.1	13.6	22.7	4.6	0.710968	477
DCE-08-33-BHA	14.79	-24.6	-16.8	-5.23	-26.0	15.8	27.6	9.4		52
DCE-08-13-BHF	3.51	-24.0	-19.8	-4.97	-25.5	14.3	21.7	8.9	0.710983	643
DCE-08-31-CW	6.10	-23.8	-11.1	-4.76	-23.5	14.6	21.1	14.7	0.709519	543
DCE-08-17-MB11	0.15	-25.6	-18.8	-4.84	-24.8	13.9	20.9	11.5		0
DCE-08-18-MB12	0.17	-25.3	-21.5	-4.37	-20.3	14.7	22.0	13.8		1
DCE-08-19-MB13	0.67	-23.4	-14.9	-4.24	-20.3	13.7	21.2	15.2		501
DCE-08-20-MB14	0.46	-25.5	-21.2	-4.96	-25.0	14.7	23.1	12.5		22
DCE-08-21-MB15	0.55	-25.0	-20.4	-4.55	-24.0	12.4	21.0	14.4		13
DCE-08-22-MB16	0.68	-24.5	-13.2	-4.94	-23.2	16.3	21.7	13.4		1589
DCE-08-23-MB17	6.15	-23.3	-15.6	-4.51	-21.7	14.4				272
DCE-08-24-MB18	6.75	-23.3	-13.3	-4.77	-23.8	14.3				1318
DCE-08-25-MB19	10.98	-22.2	-19.5	-5.09	-28.0	12.8	23.1	14.1		361
DCE-08-26-MB20	20.76	-18.7	-10.5	-4.80	-23.5	14.9	21.0	15.4		0
DCE-08-27-MB21	12.61	-23.1	-17.2	-4.37	-21.5	13.5	21.7	13.2		260
DCE-08-32-MB22	13.07	-25.4	-22.1	-4.79	-26.2	12.1				0
DCE-08-15-OS2	1.20	-23.8	-13.6	-4.15	-19.7	13.6				273
DCE-08-16-OS3	2.52	-23.2	-9.0	-4.61	-21.7	15.2	24.7	9.4	0.711145	663
DCE-08-28-P1D	7.44	-25.8	-17.6	-4.74	-26.2	11.7	21.2	14.5	0.711138	118
DCE-08-29-P1S	8.51	-24.6	-21.6	-4.65	-25.1	12.1	23.1	15.1	0.711026	29
DCE-08-30-P2D	7.68	-25.0	-18.2	-4.98	-27.9	12.0	20.0	13.3	0.710189	87
Sep-Nov 2008										
DCE-08-157-BH10			-19.1	-4.68	-21.3	16.2				1924
DCE-08-175-BHA			-11.4	-5.31	-28.1	14.4				53
DCE-08-176-BHB			-13.5	-5.30	-29.5	12.9				59
DCE-08-156-BHF			-21.9	-4.93	-22.0	17.4			0.711066	514
DCE-08-174-CW			-11.4	-5.14	-26.0	15.1				593
DCE-08-160-MB11			-22.1	-4.95	-24.8	14.8				7

DOC	$\delta^{13}\text{C}_{\text{DOC}}$	$\delta^{13}\text{C}_{\text{DIC}}$	$\delta^{18}\text{O}$	$\delta^2\text{H}$	d-excess	$\delta^{34}\text{S}_{\text{SO}_4}$	$\delta^{18}\text{O}_{\text{SO}_4}$	$^{87}\text{Sr}/^{86}\text{Sr}$	^3H
mg L ⁻¹	‰ VPDB	‰ VPDB	‰ VSMOW	‰ VSMOW	‰ VSMOW	‰ VCDT	‰ VSMOW		Bq L ⁻¹
DCE-08-161-MB12		-21.9	-4.59	-22.0	14.7				2
DCE-08-162-MB13		-15.2	-4.43	-21.9	13.6				457
DCE-08-163-MB14		-22.6	-4.85	-23.6	15.3				12
DCE-08-164-MB15		-21.6	-4.55	-23.2	13.2				26
DCE-08-165-MB16		-15.4	-5.14	-25.5	15.6				1363
DCE-08-166-MB17		-18.8	-4.74	-23.3	14.6				397
DCE-08-167-MB18		-18.0	-4.63	-22.5	14.5				30
DCE-08-168-MB19		-21.2	-5.21	-28.3	13.4				321
DCE-08-169-MB20		-10.7	-4.15	-18.3	14.9				11
DCE-08-170-MB21		-17.1	-4.18	-18.1	15.3				15
DCE-08-158-OS2		-14.5	-4.42	-21.7	13.7				335
DCE-08-159-OS3		-13.9	-4.85	-24.0	14.9				317
DCE-08-171-P1D		-18.3	-5.09	-27.7	13.0				102
DCE-08-172-P1S		-23.2	-5.02	-27.1	13.1				33
DCE-08-173-P2D		-18.8	-5.23	-29.4	12.5				101
DCE-08-177-D14		-20.8	-4.83	-22.3	16.4				451
DCE-08-180-JTC		-22.5	-4.26	-19.8	14.3			0.711025	25
2009									
DCE-09-77-BH10		-19.0	-4.08	-16.6	16.1				275.5
DCE-09-76-BHF		-20.6	-4.63	-21.9	15.2	21.5	13.7		1833
DCE-09-94-CW		-11.2	-5.13	-23.3	17.8				1256
DCE-09-80-MB11		-19.6	-4.55	-21.1	15.3				2
DCE-09-81-MB12		-22.7	-4.43	-20.5	14.9	21.5	16.8		0
DCE-09-82-MB-13		-15.0	-4.02	-16.0	16.2	20.9	15.1		355
DCE-09-83-MB14		-21.6	-5.06	-26.1	14.3	22.1	13.9		137
DCE-09-84-MB15		-21.4	-4.93	-25.3	14.1	21.5	15.4		211
DCE-09-85-MB16		-12.2	-5.05	-22.9	17.5	21.8	13.9		3290
DCE-09-86-MB17		-18.4	-4.46	-20.6	15.1				489
DCE-09-87-MB18		-16.4	-4.61	-23.1	13.8				2059
DCE-09-88-MB19		-21.5	-5.33	-28.8	13.8	21.7	15.3		572
DCE-09-89-MB20		-11.9	-3.97	-16.1	15.7	20.1	15.1		4
DCE-09-90-MB21		-18.5	-4.09	-17.1	15.7	20.6	13.2		279
DCE-09-79-OS3		-11.5	-4.61	-20.7	16.2				476
DCE-09-91-P1D		-18.4	-4.99	-28.8	11.2	21.4	14.4		109
DCE-09-92-P1S		-23.0	-5.11	-26.6	14.3	22.6	16.7		37
DCE-09-78-P2D		-18.7	-5.04	-26.7	13.6	20.6	14.7		91
DCE-09-95-CH17		-22.5	-5.38	-30.0	13.0	21.5	13.3	0.71648	14
DCE-09-96-CH18		-19.5	-5.24	-22.8	19.2			0.71580	2585
DCE-09-97-CH21		-14.5	-5.38	-18.4	24.7	21.3	16.3	0.71752	12165
DCE-09-98-CH30		-13.5	-5.05	-15.8	24.6	21.1	14.4	0.71433	12489
DCE-09-99-CH31		-16.1	-4.78	-20.9	17.3	21.5	13.8	0.71347	8287
DCE-09-100-LHQ			-4.85	3.5	42.4				267
DCE-09-101-MW13		-1.9	-5.08	-17.0	23.7	21.9	14.4	0.71159	22
DCE-09-103-MB301		-11.9	-4.84	-25.8	13.0	19.3	11.7		8
DCE-09-105-D14		-18.3	-4.22	-19.0	14.8	21.4	13.8		696
DCE-09-107-D18		-14.7	-4.82	-23.3	15.3	21.5	15.2		366

Supplementary Paper S7 Water stable isotopes for leachate samples from Harrington's Quarry. The *d* is the calculated deuterium excess for the corresponding samples.

	$\delta^{18}\text{O}\text{‰}$ VSMOW	$\delta^2\text{H}\text{‰}$ VSMOW	d-excess
CEH-08-056	-5.19	1.0	42.5
JJH-08-017	-5.00	2.5	42.5
JJH-08-019	-4.89	4.4	43.5
JJH-08-020	-4.95	11.6	51.1
JJH-08-023	-4.95	1.8	41.3
JJH-09-001	-5.36	15.7	58.6
JJH-09-007	-5.31	14.6	57.1
DCE-09-100-LHQ	-4.85	3.5	42.4

Supplementary Paper S8 Calculated saturation indexes for common mineral phases in LFLS groundwater. Cal = Calcite, Dol = Dolomite, Sid = Siderite, Gyp = Gypsum, Hem = Hematite, Goe = Goethite, Qtz = Quartz, Bar = Barite, Cha = Chalcedony, Hal = Halite, Illi = Illite, Kao = Kaolinite.

	si_Cal	si_Dol	si_Sid	si_Gyp	si_Hem	si_Goe	si_Qtz	si_Bar	si_Cha	si_Hal	si_Illi	si_Kao
DCE-07-02-BH10	-5.27	-10.15	-3.89	-4.11	4.38	1.21	0.20	-1.46	-0.26	-6.98	-3.85	2.02
DCE-07-01-BHF	-4.98	-9.10	-2.98	-3.57	0.45	-0.76	-0.05	-0.45	-0.51	-6.26	-2.63	2.88
DCE-07-19-CW	-3.09	-5.47	-2.95	-2.23	1.77	-0.10	0.66	-0.16	0.22	-5.17	-4.85	-0.48
DCE-07-05-MB11	-4.92	-9.25	-4.47	-3.29	2.83	0.43	0.17	-0.42	-0.28	-7.12	-5.87	0.19
DCE-07-06-MB12	-4.51	-8.75	-4.32	-2.74	1.49	-0.24	0.61	-0.14	0.15	-7.46	-4.01	1.38
DCE-07-07-MB13	-4.85	-9.44	-3.53	-3.41	3.52	0.78	0.15	-0.48	-0.31	-7.54	-4.64	1.32
DCE-07-08-MB14	-3.51	-6.43	-1.39	-2.60	5.88	1.95	0.28	0.09	-0.18	-6.19	0.21	4.41
DCE-07-09-MB15	-3.96	-7.66	-2.78	-2.06	6.45	2.24	0.68	0.74	0.23	-6.01	-0.70	3.36
DCE-07-10-MB16	-4.19	-8.06	-2.05	-3.33	3.25	0.64	0.47	-0.38	0.02	-7.43	-4.08	1.33
DCE-07-11-MB17	-4.35	-8.45	-3.68	-3.59	3.99	1.01	0.25	-0.72	-0.20	-7.32	-3.69	2.12
DCE-07-12-MB18	-3.31	-6.21	-3.68	-2.42	5.83	1.93	0.34	0.26	-0.11	-6.36	-1.46	2.67
DCE-07-13-MB19	-1.81	-3.49	-1.22	-1.46	1.83	-0.07	0.48	0.62	0.02	-4.84	-1.07	2.68
DCE-07-14-MB20	-2.94	-6.07	-2.05	-2.60	1.94	-0.01	0.03	0.08	-0.44	-7.10	-0.54	4.07
DCE-07-15-MB21	-3.05	-6.09	-2.79	-2.88	3.52	0.78	0.04	-0.33	-0.43	-7.00	0.43	4.75
DCE-07-03-OS2	-3.17	-6.74	-3.19	-3.04	2.33	0.19	0.13	-0.90	-0.34	-7.45	-0.57	4.18
DCE-07-04-OS3	-4.40	-8.80	-3.30	-3.55	3.29	0.66	0.19	-0.56	-0.27	-7.49	-3.99	1.89
DCE-07-17-P1D	-3.08	-4.96	-0.37	-1.90	4.20	1.11	0.63	0.16	0.19	-3.81	-0.50	3.44
DCE-07-16-P1S				-2.29	0.55	-0.71	0.89	-0.02	0.44	-4.84	-2.71	2.29
DCE-07-18-P2D	-3.80	-6.68	-1.80	-1.80	3.58	0.80	0.64	0.28	0.19	-4.46	-1.72	2.67
DCE-08-14-BH10	-5.03	-9.69	-3.78	-3.23	-0.41	-1.20	0.52	-0.58	0.07	-6.48	-3.65	1.79
DCE-08-33-BHA	0.08	0.59	1.64	-2.15	8.06	3.04	-0.26	0.06	-0.71	-5.11	-1.67	1.28
DCE-08-13-BHF	-4.08	-7.46	-1.81	-2.86	2.48	0.25	0.39	0.36	-0.06	-5.97	-2.10	2.56
DCE-08-31-CW	-3.17	-5.64	-2.87	-2.16	2.60	0.31	0.67	-0.18	0.22	-5.04	-6.34	-1.70
DCE-08-17-MB11	-4.85	-9.08	-4.16	-3.42	2.19	0.10	0.24	-0.49	-0.20	-6.72	-3.91	1.63
DCE-08-18-MB12	-4.15	-8.11	-4.25	-2.63	-0.01	-1.00	0.48	0.06	0.03	-7.30	-1.74	3.07
DCE-08-19-MB13	-4.80	-9.17	-4.07	-2.96	0.71	-0.64	0.43	0.09	-0.01	-7.16	-4.00	1.54
DCE-08-20-MB14	-4.50	-8.35	-4.13	-2.33	1.24	-0.37	0.46	0.48	0.01	-6.11	-3.55	1.51
DCE-08-21-MB15	-4.02	-7.67	-3.50	-2.56	2.09	0.05	0.60	0.33	0.16	-7.06	-0.12	4.50
DCE-08-22-MB16	-4.34	-8.41	-3.09	-3.18	1.23	-0.38	0.40	-0.23	-0.05	-7.47	-4.16	1.39
DCE-08-23-MB17	-4.79	-9.31	-3.30	-3.28	1.48	-0.26	0.50	-0.44	0.06	-7.26	-5.05	0.80
DCE-08-24-MB18	-1.94	-3.87	-2.62	-1.62	4.36	1.19	0.46	0.66	0.02	-5.90	0.27	3.91
DCE-08-25-MB19	-1.95	-3.71	-1.27	-1.67	0.96	-0.51	0.43	0.56	-0.02	-5.10	-2.25	1.73
DCE-08-26-MB20	-2.16	-4.45	-0.91	-2.11	4.29	1.16	0.35	0.67	-0.11	-7.01	0.29	4.08
DCE-08-27-MB21	-2.03	-4.08	-2.25	-1.31	3.59	0.80	0.34	1.05	-0.11	-5.84	-0.87	3.07
DCE-08-32-MB22	-2.47	-4.21	-0.64	-3.20	8.20	3.10	0.10	-0.30	-0.34	-6.53	2.18	6.01
DCE-08-15-OS2	-1.98	-4.51	-2.38	-2.52	4.71	1.36	0.32	-0.51	-0.12	-7.45	0.12	4.12
DCE-08-16-OS3	-2.84	-5.78	-0.47	-2.53	1.32	-0.34	0.60	0.21	0.16	-7.29	-0.95	3.59
DCE-08-28-P1D	-3.68	-6.13	-1.00	-1.89	4.62	1.32	0.63	0.14	0.18	-3.86	-4.18	0.41
DCE-08-29-P1S	-5.91	-10.39	-3.62	-2.27	-0.04	-1.01	0.90	0.09	0.45	-4.45	-5.80	-0.11
DCE-08-30-P2D	-3.12	-5.41	-0.86	-2.12	4.93	1.47	0.55	0.37	0.10	-4.90	-3.21	0.92
DCE-08-157-BH10	-4.39	-8.15	-1.90	-2.92	-1.27	-1.61	0.45	-0.05	-0.02	-6.25	-2.94	2.22
DCE-08-175-BHA	0.41	1.32	1.66	-2.08	6.50	2.26	-0.12	-0.25	-0.57	-4.38	-1.97	0.40
DCE-08-176-BHB	-0.45	-0.31	1.44	-1.83	3.96	0.99	-0.47	-0.02	-0.92	-4.06	-2.74	0.74
DCE-08-156-BHF	-5.00	-9.16	-3.18	-3.03	1.31	-0.33	0.39	0.07	-0.06	-5.87	-4.87	0.66
DCE-08-174-CW	-2.99	-5.24	-2.21	-2.13	1.96	-0.01	0.62	-0.12	0.17	-5.00	-6.28	-1.67
DCE-08-160-MB11	-4.78	-9.06	-4.09	-3.23	-0.80	-1.39	0.28	-0.36	-0.16	-7.63	-4.93	0.95
DCE-08-161-MB12	-4.77	-9.21	-5.24	-2.64	-4.49	-3.23	0.55	0.19	0.09	-7.23	-4.38	1.23
DCE-08-162-MB13	-4.60	-8.79	-3.78	-3.09	1.77	-0.1	0.38	0.05	-0.08	-7.32	-2.86	2.51
DCE-08-163-MB14	-3.67	-6.62	-1.86	-2.51	3.01	0.52	0.65	0.40	0.20	-6.04	-0.01	3.97
DCE-08-164-MB15	-4.07	-7.81	-3.79	-2.57	0.45	-0.76	0.68	0.37	0.22	-6.95	-3.39	1.67
DCE-08-165-MB16	-4.48	-8.64	-3.04	-3.33	-0.91	-1.44	0.28	-0.31	-0.18	-7.55	-5.29	0.73
DCE-08-166-MB17	-4.53	-8.95	-3.93	-2.77	-0.30	-1.14	0.70	0.07	0.24	-7.25	-3.63	1.75
DCE-08-167-MB18	-2.54	-5.05	-3.69	-2.95	0.91	-0.53	0.33	-0.55	-0.12	-6.99	-2.20	2.16
DCE-08-168-MB19	-2.17	-4.23	-1.29	-1.58	4.67	1.35	0.48	0.87	0.02	-5.09	-2.41	1.62
DCE-08-169-MB20	-2.69	-5.62	-1.86	-2.67	0.53	-0.72	0.11	0.04	-0.35	-7.48	1.11	5.22

	si_Cal	si_Dol	si_Sid	si_Gyp	si_Hem	si_Goe	si_Qtz	si_Bar	si_Cha	si_Hal	si_Illi	si_Kao
DCE-08-170-MB21	-4.33	-8.46	-3.35	-3.27	-1.85	-1.91	-0.19	-0.58	-0.65	-7.26	-3.81	2.08
DCE-08-158-OS2	-2.44	-5.25	-2.69	-2.79	3.59	0.81	-0.01	-0.87	-0.47	-7.51	0.49	4.67
DCE-08-159-OS3	-5.12	-10.06	-4.03	-3.61	-0.47	-1.22	0.06	-0.42	-0.39	-7.58	-8.42	-1.41
DCE-08-171-P1D	-3.15	-5.03	-0.45	-1.87	3.00	0.51	0.59	0.18	0.14	-3.83	-3.87	0.50
DCE-08-172-P1S	-5.95	-10.55	-3.62	-2.25	0.23	-0.87	0.85	-0.02	0.40	-4.25	-6.61	-0.67
DCE-08-173-P2D	-2.58	-4.31	-0.25	-1.98	5.12	1.57	0.48	0.21	0.04	-4.66	-2.08	1.73
DCE-08-177-D14	-6.57		-4.18	-3.67	-1.71	-1.85	0.67		0.23	-7.17		
DCE-08-180-JTC	-5.67	-10.50	-4.55	-2.85	-2.23	-2.1	-0.11	0.16	-0.57	-6.16	-5.15	0.97
DCE-09-77-BH10	-4.11	-7.64	-2.06	-3.79	0.36	-0.81	0.49	-1.2	0.04	-6.69	-2.31	2.75
DCE-09-76-BHF	-4.24	-7.66	-2.27	-2.50	3.18	0.59	0.39	0.44	-0.06	-5.49	-3.00	1.77
DCE-09-94-CW	-2.98	-5.21	-2.67	-2.14	3.47	0.73	0.56	-0.27	0.14	-5.13	-6.30	-1.71
DCE-09-78-P2D	-2.51	-4.18	-0.18	-1.98	6.47	2.23	0.49	0.06	0.05	-4.66	-1.05	2.55
DCE-09-80-MB11	-4.35	-8.24	-4.62	-3.24	0.94	-0.52	0.31	-0.37	-0.13	-6.49	-4.19	1.35
DCE-09-81-MB12	-4.65	-9.00	-4.75	-2.40	1.47	-0.27	0.68	0.09	0.25	-7.05	-2.87	2.18
DCE-09-82-MB-13	-5.03	-9.71	-4.37	-3.39	3.34	0.67	0.32	-0.58	-0.11	-7.57	-3.44	2.02
DCE-09-83-MB14	-2.48	-4.37	-0.26	-1.63	4.86	1.44	0.46	0.82	0.02	-5.20	0.99	4.57
DCE-09-84-MB15	-3.58	-7.11	-3.13	-1.77	3.06	0.54	0.64	0.61	0.20	-6.25	-5.45	-0.39
DCE-09-85-MB16	-4.62	-8.95	-2.3	-3.29	2.90	0.46	0.62	-0.38	0.17	-7.40		
DCE-09-86-MB17	-4.67	-9.21	-3.44	-2.79	2.68	0.35	0.70	-0.11	0.26	-7.21		
DCE-09-87-MB18	-1.96	-3.89	-3.06	-1.71	3.58	0.79	0.40	0.38	-0.04	-5.88	-1.62	2.32
DCE-09-88-MB19	-2.47	-4.79	-1.86	-1.51	5.48	1.75	0.61	0.62	0.16	-4.81	-1.55	2.36
DCE-09-89-MB20	-3.05	-6.34	-1.81	-2.10	5.16	1.60	0.17	0.37	-0.29	-6.97		
DCE-09-90-MB21	-2.40	-4.89	-3.01	-1.19	4.10	1.07	0.30	1.20	-0.16	-5.85		
DCE-09-79-OS3	-3.96	-7.94	-2.17	-3.16	4.24	1.11	0.30	-0.56	-0.13	-7.46		
DCE-09-91-P1D	-3.21	-5.15	-0.49	-1.85	5.86	1.92	0.48	-0.04	0.06	-3.88		
DCE-09-92-P1S				-2.23	2.95	0.48	0.85	0.08	0.41	-4.33	-7.06	-1.01
DCE-09-95-CH17				-2.73	4.30	1.15	0.87	0.30	0.43	-4.54	-5.84	-0.12
DCE-09-96-CH18	-6.36	-11.74	-3.96	-2.99	1.41	-0.29	0.91	0.22	0.46	-6.14	-4.89	0.51
DCE-09-97-CH21	-6.06	-11.29	-3.54	-3.15	1.17	-0.4	0.99	0.05	0.54	-6.66	-5.49	0.02
DCE-09-98-CH30				-3.08	2.56	0.29	0.98	0.13	0.53	-6.98	-6.81	-0.63
DCE-09-99-CH31	-2.93	-5.33	-0.38	-2.01	6.42	2.22	0.69	0.33	0.24	-5.31	-0.45	3.30
DCE-09-100-LHQ	0.39	1.30	1.45	-3.74	5.73	1.87	0.46	-0.9	0.02	-4.57	4.22	5.36
DCE-09-101-MW13			-2.17	3.71	0.87	0.76	0.10	0.31	-5.27	-2.33	2.27	
DCE-09-103-MB301												
	-0.43	-0.61	-2.07	-1.94	7.11	2.56	-0.01	-0.02	-0.45	-5.10		
DCE-09-105-D14	-3.96	-7.49	-1.71	-3.27	-0.07	-1.05	0.49	-0.53	0.07	-7.23	0.69	4.76
DCE-09-107-D18	-5.40	-10.11	-2.23	-3.86	1.14	-0.43	0.62	-0.12	0.17	-7.52		