

Ground and Surface Water Physico-chemical, Major Ion and Isotope Chemistry, Sandia Mountains,
Sandia Ranger District, New Mexico

Explanation for physico-chemical and ion chemistry

* Specific conductance (SC) was calculated from conductivity (C) if italicized. For every degree change in water temperature (WT), there is approximately a 2% change in conductivity. To convert raw conductivity measurement to specific conductance, the following equation was used: $SC=C/1+(0.02*(WT-25))$ (YSI Incorporated, 2009).

** Instrument used 1: Oakton600, 2: YSI Pro Plus 3: YSI Pro DSS

*** Mass Balance Equation:

$$100 * ((2 * Ca^{++}(\text{mg/l})/40.08) + (2 * Mg^{++}(\text{mg/l})/24.305) + (Na^+(\text{mg/l})/22.99) + (K^+(\text{mg/l})/39.0983) - (HCO_3^-(\text{mg/l})/61) - (Cl^-(\text{mg/l})/35.453) - (2 * SO_4^-(\text{mg/l})/96.06)) / ((2 * Ca^{++}(\text{mg/l})/40.08) + (2 * Mg^{++}(\text{mg/l})/24.305) + (Na^+(\text{mg/l})/22.99) + (K^+(\text{mg/l})/39.0983) - (HCO_3^-(\text{mg/l})/61) - (Cl^-(\text{mg/l})/35.453) - (2 * SO_4^-(\text{mg/l})/96.06))$$

ICP/OES Detection Limits

Element	IDL (mg/L)	MDL (mg/L)	Wavelength (λ) (nm)
Al	0.0280	0.280	396.153
As	0.0250	0.250	188.979
B	0.0048	0.048	249.772
Ba	0.0013	0.013	455.403
Be	0.0007	0.007	313.107
Ca	0.0100	0.100	317.933
Cd	0.0027	0.027	228.802
Co	0.0070	0.070	228.616
Cr	0.0071	0.071	267.716
Cu	0.0054	0.054	324.752
Fe	0.0062	0.062	259.939
K	0.0500	0.500	766.49
Li	0.0500	0.500	610.362
Mg	0.0030	0.030	280.271

Element	IDL (mg/L)	MDL (mg/L)	Wavelength (λ) (nm)
Mn	0.0014	0.014	257.61
Mo	0.0079	0.079	202.031
Na	0.0690	0.690	589.592
Ni	0.0150	0.150	231.604
Pb	0.0420	0.420	220.353
Se	0.0750	0.750	196.026
Si	0.0120	0.120	251.611
Sr	0.0008	0.008	421.552
V	0.0064	0.064	310.23
Zn	0.0018	0.018	213.857
U	0.3000	0.500	385.958

IDL = Instrument Detection Limit
MDL = Method Detection Limit
MDL = IDL * 10

IC Detection Limits

Element	MDL (mg/L)	Retention Time (Approx.)
F	0.01	3.943
Cl	0.05	5.931
NO ₂	0.01	7.052
Br	0.01	8.733
NO ₃	0.01	9.894
PO ₄	0.01	13.845
SO ₄	0.05	16.250

Retention Time Approximation is from averages of 4 standards and ICBV

Tritium (³H) Detection Limit

Detection Limit, 9.5 x enrichment, 1500 minutes counting 0.5

Explanation of tritium data: The detection limit, 0.5 TU, is calculated as 0 + 2 sigma for low-counting samples, and applies for 10-fold enrichment and 1500 minutes of counting. Lower limits are possible for higher enrichment factors.

A sample with a mean calculated TU value between 0 and 1 sigma, say 0.20 ± 0.35 TU, is reported thus: <0.9 TU (= 0.2 + 2 x 0.35). A sample with a mean calculated TU value between 1 and 2 sigma, say 0.51 ± 0.38, is reported thus: <1.3 (Apparent 0.5), where 1.3 = 0.51 + 2 x 0.38, rounded. Samples with calculated TU values greater than 2 are reported thus: 1.1 ± 0.4 TU.

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Sample ID	Sample Location	Sample Date	Water Temperature °C	pH	Specific Conductivity* µS/cm	Dissolved solids mg/l	Dissolved Oxygen mg/l	Instrument**
D1207003	Armijo Spring	4/23/2012	8.4	6.57	541	271	n.a.	1
D1207029	Border East	6/26/2012	17.9	7.32	1263	632	10.56	1
D1207027	Border West	6/19/2012	18.5	7.92	1371	891	7.03	2
D1207036	Canoncito	7/11/2012	10.7	6.91	495	248	n.a.	1
D1207015	Capulin Spring	6/13/2012	n.a.	6.71	1670	835	n.a.	1
D1307073	Capulin Spring	6/8/2013	10.9	6.64	1810	905	n.a.	1
D1207002	Cienga Spring	4/19/2012	10.0	6.63	564	282	n.a.	1
D1207031	Cienga Spring	7/5/2012	8.1	6.71	612	306	8.87	1
D1207008	Cole Springs	5/21/2012	10.0	7.16	590	295	7.82	1
D1307070	Ellis Spring Box	6/1/2013	7.2	6.92	657	427	7.04	2
D1207016	Faulty Trail	6/13/2012	n.a.	6.88	1040	520	n.a.	1
D1207025	Grants West	6/19/2012	19.7	7.93	1203	782	6.02	2
D1207030	Hobbies Central	6/26/2012	22.3	7.46	472	236	7.12	1
D1207038	LH at CDT	7/21/2012	9.8	7.45	606	394	4.85	2
D1307082	LH at CDT	7/13/2013	11.3	7.90	629	315	n.a.	1
D1307087	LH at CDT	8/22/2013	10.2	8.15	659	428	8.3	2
D1407105	LH at CDT	5/21/2014	7.4	7.61	631	316	n.a.	1
D1207040	LH at Ellis Box	7/21/2012	7.4	7.47	623	405	7.28	2
D1307081	LH at Ellis box	7/13/2013	7.1	6.79	657	329	n.a.	1
D1307089	LH at Ellis box	8/22/2013	7.3	7.29	691	449	8.9	2
D1407107	LH at Ellis Box	5/21/2014	7.3	7.07	652	326	n.a.	1
D1207039	LH Camp Spr Box	7/21/2012	7.0	7.36	644	419	7.93	2
D1307067	LH Camp Spr Box	6/1/2013	10.7	7.20	668	434	5.57	2
D1307080	LH Camp Spr Box	7/13/2013	8.7	6.82	654	327	n.a.	1
D1307088	LH Camp Spr Box	8/22/2013	8.5	7.29	688	447	8	2
D1407106	LH Camp Spr Box	5/21/2014	7.2	6.68	618	309	n.a.	1
D1207041	LH Downstream #1	7/28/2012	12.3	7.5	652	424	5.77	2
D1207042	LH Downstream #2	7/28/2012	9.2	7.2	682	443	6.35	2
D1207043	LH Downstream #3	7/28/2012	11.7	8.04	662	430	8.5	2
D1207044	LH Downstream #4	7/28/2012	11.3	7.7	638	415	7.77	2
D1207045	LH Downstream #5	7/28/2012	9.2	7.42	620	403	7.58	2
D1207046	LH Downstream #6	7/28/2012	9.0	7.9	696	452	8.6	2
D1207047	LH Downstream #7	7/28/2012	10.0	7.87	640	416	8.23	2
D1207048	LH Downstream #8	7/28/2012	11.9	8.11	626	407	8.06	2
D1307068	LH Picnic	6/1/2013	15.0	8.05	580	377	6.81	2

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Sample ID	Sample Location	Ca ⁺⁺ mg/l	Mg ⁺⁺ mg/l	Na ⁺ mg/l	K ⁺ mg/l	HCO ₃ ⁻ mg/l	SO ₄ ⁻⁻ mg/l	Cl ⁻ mg/l	Mass Balance*** %
D1207003	Armijo Spring	98.65	4.25	2.66	0.61	346.58	8.04	1.80	-4.4
D1207029	Border East	149.30	30.00	60.14	3.64	365.49	166.33	156.23	-4.7
D1207027	Border West	123.40	32.18	61.28	3.16	318.14	148.58	143.15	-3.3
D1207036	Canoncito	107.65	3.96	4.04	0.87	328.27	15.61	2.49	1.0
D1207015	Capulin Spring	204.17	5.36	86.25	1.04	401.49	7.73	262.20	0.9
D1307073	Capulin Spring	232.40	5.82	85.22	1.32	405.15	9.73	274.29	4.1
D1207002	Cienga Spring	98.55	4.53	6.78	0.82	336.81	10.26	13.01	-4.2
D1207031	Cienga Spring	109.16	4.82	6.85	0.81	315.46	13.08	17.26	1.9
D1207008	Cole Springs	106.90	4.57	3.86	0.75	356.95	15.88	2.45	-2.9
D1307070	Ellis Spring Box	111.40	3.39	14.05	1.03	274.09	9.52	48.70	3.3
D1207016	Faulty Trail	143.85	11.03	31.42	1.52	417.36	39.17	92.36	-3.9
D1207025	Grants West	114.90	26.47	45.22	2.53	286.78	137.12	113.32	-3.9
D1207030	Hobbies Central	79.23	11.54	7.33	0.87	294.96	18.24	11.19	-2.7
D1207038	LH at CDT	97.36	3.00	11.31	0.83	302.77	9.64	36.79	-4.9
D1307082	LH at CDT	106.40	3.14	12.37	0.95	275.67	9.65	49.65	0.1
D1307087	LH at CDT	109.80	3.22	18.30	b.d.	271.16	9.72	66.27	0.3
D1407105	LH at CDT	103.38	2.81	14.74	0.59	303.86	7.59	39.74	-1.7
D1207040	LH at Ellis Box	104.70	2.97	11.32	0.87	273.36	9.89	35.30	2.6
D1307081	LH at Ellis box	105.30	3.13	11.91	0.88	282.87	9.58	54.73	-2.6
D1307089	LH at Ellis box	111.80	3.21	17.53	b.d.	289.59	9.71	64.97	-1.2
D1407107	LH at Ellis Box	105.81	2.93	17.31	0.64	303.86	7.77	42.62	-0.4
D1207039	LH Camp Spr Box	103.00	2.91	22.99	0.84	294.47	9.82	36.71	2.7
D1307067	LH Camp Spr Box	101.70	3.18	13.51	1.00	289.59	9.54	49.25	-3.1
D1307080	LH Camp Spr Box	101.60	3.16	12.17	0.88	285.93	9.54	47.27	-2.8
D1307088	LH Camp Spr Box	112.20	3.22	18.16	0.50	289.34	9.71	66.41	-1.1
D1407106	LH Camp Spr Box	104.41	2.70	13.48	0.85	300.81	7.50	36.78	-0.7
D1207041	LH Downstream #1	101.50	3.00	11.60	0.74	288.73	9.11	39.92	-1.8
D1207042	LH Downstream #2	99.46	3.15	12.49	0.77	287.39	9.05	40.14	-2.1
D1207043	LH Downstream #3	99.11	3.24	12.41	0.76	287.39	9.17	40.15	-2.2
D1207044	LH Downstream #4	93.15	3.30	13.38	0.78	261.76	8.85	41.02	-1.0
D1207045	LH Downstream #5	102.00	3.88	8.18	0.88	283.97	9.87	29.63	0.8
D1207046	LH Downstream #6	101.60	3.63	13.85	0.87	285.56	9.52	46.53	-1.6
D1207047	LH Downstream #7	95.51	3.61	11.27	0.79	276.41	9.64	36.81	-1.7
D1207048	LH Downstream #8	94.15	3.61	11.85	0.78	257.86	9.59	37.78	0.3
D1307068	LH Picnic	89.88	3.91	12.99	0.98	255.42	10.32	43.09	-2.0

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Sample ID	Sample Location	Si mg/l	F ⁻ mg/l	Br ⁻ mg/l	Fe ⁺⁺ mg/l	SI Calcite log Q/K	SI Gypsum log Q/K	SI Quartz log Q/K	CO ₂ (g) fugacity
D1207003	Armijo Spring	4.58	0.81	0.20	b.d.	0.201	0.002	1.557	0.041
D1207029	Border East	7.30	0.63	0.51	b.d.	2.813	0.043	1.636	0.013
D1207027	Border West	7.16	0.65	0.47	b.d.	8.993	0.033	1.549	0.003
D1207036	Canoncito	4.48	0.70	b.d.	b.d.	0.620	0.005	1.371	0.024
D1207015	Capulin Spring	4.06	0.51	0.32	b.d.	1.119	0.003	0.669	0.051
D1307073	Capulin Spring	3.33	0.61	b.d.	b.d.	0.598	0.004	1.014	0.044
D1207002	Cienga Spring	4.61	0.74	b.d.	b.d.	0.249	0.003	1.457	0.038
D1207031	Cienga Spring	4.87	0.70	b.d.	b.d.	0.303	0.004	1.679	0.030
D1207008	Cole Springs	4.91	0.73	b.d.	b.d.	1.273	0.005	1.550	0.016
D1307070	Ellis Spring Box	2.19	0.67	b.d.	b.d.	0.479	0.003	0.787	0.018
D1207016	Faulty Trail	6.17	0.72	0.35	b.d.	1.424	0.011	1.015	0.040
D1207025	Grants West	7.22	0.60	0.50	b.d.	8.366	0.030	1.485	0.003
D1207030	Hobbies Central	7.77	0.59	0.41	b.d.	2.617	0.004	1.449	0.009
D1207038	LH at CDT	2.83	0.41	b.d.	b.d.	2.075	0.003	0.900	0.008
D1307082	LH at CDT	1.94	0.92	0.65	b.d.	6.322	0.003	0.573	0.003
D1307087	LH at CDT	2.98	0.39	0.07	b.d.	10.880	0.003	0.919	0.001
D1407105	LH at CDT	2.65	0.61	b.d.	b.d.	2.983	0.002	0.940	0.005
D1207040	LH at Ellis Box	2.59	0.43	b.d.	b.d.	1.946	0.003	0.920	0.006
D1307081	LH at Ellis box	1.91	0.60	b.d.	b.d.	0.320	0.003	0.690	0.024
D1307089	LH at Ellis box	2.95	0.42	b.d.	b.d.	1.358	0.003	1.054	0.010
D1407107	LH at Ellis Box	2.66	0.66	0.09	b.d.	0.768	0.002	0.951	0.016
D1207039	LH Camp Spr Box	2.59	0.44	b.d.	b.d.	1.530	0.003	0.938	0.008
D1307067	LH Camp Spr Box	2.09	0.70	b.d.	b.d.	1.128	0.003	0.639	0.012
D1307080	LH Camp Spr Box	1.92	0.69	b.d.	b.d.	0.365	0.003	0.644	0.023
D1307088	LH Camp Spr Box	2.94	0.43	0.08	b.d.	1.419	0.003	0.994	0.010
D1407106	LH Camp Spr Box	2.69	0.63	0.04	b.d.	0.245	0.002	0.967	0.030
D1207041	LH Downstream #1	3.02	0.59	b.d.	b.d.	2.538	0.002	0.859	0.007
D1207042	LH Downstream #2	3.04	0.61	b.d.	b.d.	1.046	0.002	0.995	0.012
D1207043	LH Downstream #3	3.22	0.60	b.d.	b.d.	8.684	0.002	0.932	0.002
D1207044	LH Downstream #4	3.42	0.66	b.d.	b.d.	3.363	0.002	1.014	0.004
D1207045	LH Downstream #5	3.45	0.67	b.d.	b.d.	1.858	0.003	1.128	0.007
D1207046	LH Downstream #6	3.04	0.65	0.13	b.d.	5.802	0.003	0.998	0.003
D1207047	LH Downstream #7	3.43	0.63	b.d.	b.d.	5.171	0.003	1.076	0.003
D1207048	LH Downstream #8	3.45	0.60	b.d.	b.d.	8.895	0.002	0.987	0.002
D1307068	LH Picnic	2.80	0.78	b.d.	b.d.	8.140	0.003	0.700	0.002

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Sample ID	Sample Location	$\delta^{18}\text{O}$ ‰ SMOW	δD ‰ SMOW	d-excess	^3H TU	^3H Error	Notes
D1207003	Armijo Spring	-12.3	-85.5	13.0	n.a.	n.a.	
D1207029	Border East	-10.8	-79.2	7.3	n.a.	n.a.	
D1207027	Border West	-10.9	-78.9	8.0	n.a.	n.a.	
D1207036	Canoncito	-12.4	-86.5	12.9	n.a.	n.a.	
D1207015	Capulin Spring	-12.6	-87.3	13.5	n.a.	n.a.	pH and Conductivity was measured in the lab
D1307073	Capulin Spring	-12.6	-86.6	14.3	n.a.	n.a.	
D1207002	Cienga Spring	-12.4	-87.1	12.1	n.a.	n.a.	
D1207031	Cienga Spring	-12.3	-87.3	10.9	n.a.	n.a.	
D1207008	Cole Springs	-12.5	-88.2	11.4	n.a.	n.a.	
D1307070	Ellis Spring Box	-12.6	-87.9	12.8	n.a.	n.a.	
D1207016	Faulty Trail	-12.2	-83.9	13.3	n.a.	n.a.	pH and Conductivity was measured in the lab
D1207025	Grants West	-10.8	-79.0	7.6	n.a.	n.a.	
D1207030	Hobbies Central	-12.2	-86.6	10.8	n.a.	n.a.	
D1207038	LH at CDT	-12.8	-86.6	16.1	n.a.	n.a.	
D1307082	LH at CDT	-12.2	-86.3	11.4	n.a.	n.a.	
D1307087	LH at CDT	-12.5	-84.9	15.1	n.a.	n.a.	
D1407105	LH at CDT	-12.4	-86.0	12.9	n.a.	n.a.	CDT removed from site
D1207040	LH at Ellis Box	-12.7	-86.1	15.4	n.a.	n.a.	
D1307081	LH at Ellis box	-11.7	-85.1	8.7	n.a.	n.a.	
D1307089	LH at Ellis box	-12.7	-87.3	14.0	n.a.	n.a.	
D1407107	LH at Ellis Box	-12.4	-85.7	13.4	n.a.	n.a.	CDT removed from site
D1207039	LH Camp Spr Box	-12.5	-87.0	13.2	n.a.	n.a.	
D1307067	LH Camp Spr Box	-12.5	-87.8	12.6	n.a.	n.a.	
D1307080	LH Camp Spr Box	-12.6	-86.7	14.1	n.a.	n.a.	
D1307088	LH Camp Spr Box	-12.9	-85.5	17.5	n.a.	n.a.	
D1407106	LH Camp Spr Box	-12.1	-86.2	11.0	n.a.	n.a.	CDT removed from site
D1207041	LH Downstream #1	-12.6	-86.9	13.7	n.a.	n.a.	
D1207042	LH Downstream #2	-12.6	-85.7	15.4	n.a.	n.a.	
D1207043	LH Downstream #3	-12.8	-86.0	16.7	n.a.	n.a.	
D1207044	LH Downstream #4	-12.5	-86.3	13.6	n.a.	n.a.	
D1207045	LH Downstream #5	-12.6	-87.3	13.5	n.a.	n.a.	
D1207046	LH Downstream #6	-13.1	-87.3	17.5	n.a.	n.a.	
D1207047	LH Downstream #7	-12.3	-86.5	11.7	n.a.	n.a.	
D1207048	LH Downstream #8	-12.6	-87.4	13.6	n.a.	n.a.	
D1307068	LH Picnic	-12.3	-87.3	11.4	n.a.	n.a.	

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Sample ID	Sample Location	Sample Date	Water Temperature °C	pH	Specific Conductivity* $\mu\text{S}/\text{cm}$	Dissolved solids mg/l	Dissolved Oxygen mg/l	Instrument**
D1207014	Mud Spring	6/5/2012	12.5	7.34	568	369	3.42	2
D1207052	Mud Spring	9/11/2012	n.a.	7.49	n.a.	n.a.	n.a.	1
D1207026	Seven Springs	6/19/2012	18.8	8.01	1223	795	5.661	2
D1207009	Sulphur Springs	5/21/2012	13.9	7.47	485	243	9.50	1
D1307072	Travertine Falls	6/8/2013	12.4	7.09	1399	700	n.a.	1
D1207032	Travertine Falls	7/5/2012	13.1	7.14	615	308	7.4	1
D1307071	Tunnel Spring	6/1/2013	12.3	7.42	566	368	6.67	2

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Sample ID	Sample Location	Ca ⁺⁺ mg/l	Mg ⁺⁺ mg/l	Na ⁺ mg/l	K ⁺ mg/l	HCO ₃ ⁻ mg/l	SO ₄ ⁻⁻ mg/l	Cl ⁻ mg/l	Mass Balance*** %
D1207014	Mud Spring	104.20	8.97	10.86	1.58	398.44	4.70	5.08	-2.4
D1207052	Mud Spring	92.50	8.94	12.54	2.11	372.45	12.61	6.42	-4.8
D1207026	Seven Springs	113.90	29.88	46.02	2.55	291.17	138.01	118.00	-3.6
D1207009	Sulphur Springs	43.99	6.53	44.51	1.80	242.85	25.40	5.46	0.5
D1307072	Travertine Falls	107.90	8.60	4.84	1.03	352.07	19.94	2.54	0.6
D1207032	Travertine Falls	108.20	8.41	4.79	0.87	339.62	17.91	3.09	2.4
D1307071	Tunnel Spring	102.80	5.61	5.22	1.09	304.23	25.49	2.77	2.2

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Sample ID	Sample Location	Si mg/l	F ⁻ mg/l	Br ⁻ mg/l	Fe ⁺⁺ mg/l	SI Calcite log Q/K	SI Gypsum log Q/K	SI Quartz log Q/K	CO ₂ (g) fugacity
D1207014	Mud Spring	12.56	0.63	0.42	0.22	2.372	0.001	3.544	0.013
D1207052	Mud Spring	10.67	1.21	1.14	0.72	4.369	0.003	1.745	0.011
D1207026	Seven Springs	7.29	0.72	0.43	b.d.	9.764	0.030	1.553	0.002
D1207009	Sulphur Springs	11.28	3.57	b.d.	0.18	0.962	0.004	2.988	0.006
D1307072	Travertine Falls	3.38	0.64	b.d.	b.d.	1.135	0.006	0.959	0.019
D1207032	Travertine Falls	4.95	0.69	0.34	b.d.	1.291	0.005	1.361	0.017
D1307071	Tunnel Spring	3.62	1.02	0.08	b.d.	2.204	0.007	1.030	0.008

Ground and Surface Water Physico-chemical, Major Ion and Isotope Chemistry, Sandia Mountains, Sandia Ranger District, New Mexico

Sample ID	Sample Location	$\delta^{18}\text{O}$ ‰ SMOW	δD ‰ SMOW	d-excess	^3H TU	^3H Error	Notes
D1207014	Mud Spring	-12.4	-87.3	12.2	n.a.	n.a.	
D1207052	Mud Spring	-12.5	-88.1	11.9	n.a.	n.a.	
D1207026	Seven Springs	-11.0	-79.7	7.9	n.a.	n.a.	
D1207009	Sulphur Springs	-11.8	-83.4	11.4	n.a.	n.a.	
D1307072	Travertine Falls	-12.6	-88.8	11.8	n.a.	n.a.	
D1207032	Travertine Falls	-12.2	-88.0	9.5	n.a.	n.a.	
D1307071	Tunnel Spring	-12.5	-86.4	13.4	n.a.	n.a.	