GL02773-10

Table 1.—Thermal springs originating in the Madison Group.

No.	Name	T.	R.	Sec.	Tract	Discharge (gpm)	Temp °C	ΔH_1 (18°C) (billion Btu/yr.)	ΔH_2 (10°C) (billion Btu/yr.)	Source and comments
1.	Anderson's	3 S.	13 E.	29	ABAB	10 45	21 25	0.24 2.5	0.87 5.3	MBMG Analysis 72-861; Madison.
2.	Bear Creek	9 S.	9 E.	19	DB	30	32	3.3	5.2	Madison
3.	Bear Mouth No. 1	11 N.	14 W.	11	DCCCD	?	?			Madison
4.	Bear Mouth No. 2	11 N.	13 W.	18	AB	?	15			MBMG Analysis 72-109; Madison
5.	Brooks	17 N.	18 E.	19	DBDBB	68,000	19.5 21	810. 1,610.	5,100. 5,910.	MBMG Analysis 75M1510; Madison (?) through Kootenai (Cretaceous). Water used for irrigation.
6.	Brown's	8 S.	9 W.	30	DCB N½	360	22 42	11.4 >25.	34. >33.	Madison (?) under Tertiary volcanics. Discharge reported in USGS Prof. Paper 492; visual estimate in August 1975 was 3,000 gpm.
7.	Chico	6 S.	8 E.	1	CDCD	>130	48	>31.	>39.	Analysis by USGS; Madison (?) through Tertiary volcanics and sediments. Water used for resort.
8.	Corwin (LaDuke)	8 S.	8 E.	32	CDBA	500	65	186.	220.	Analysis by USGS; Madison (?) along fault. Water unused (July 1975); previously used for space heating.
9.	Durfee Creek No. 1	12 N.	22 E.	13	DDD	1	19 23	0.008 0.039	0.071 0.102	MBMG Analysis 73-842; spring near Madison-Pennsylvanian contact. Water used for livestock.
10.	Durfee Creek No. 2	12 N.	23 E.	19	BB	15,000	22	470.	1,420.	Spring near Madison-Pennsylvanian contact.
11.	Gallatin Canyon	6 S.	4 E.	33	BCC	?	?			Best location currently available; Madison.
12.	Garrison	10 N.	9 W.	19	Center	?	25			MBMG Analysis 72-868; Madison. Water not used (8/8/72).
13.	Giant Springs	21 N.	4 E.	33	BDAC	90,000	12	–	1,420	Not a "warm" spring, but included for purposes of comparison.
14.	Landusky No. 1	25 N.	24 E.	32	DABCC	950 1,250	18 20	– 19.7	60. 99.	MBMG Analysis 73-844; spring near Madison-Jurassic contact. 1,250 gpm flow measured by MBMG in May 1977.
15.	Landusky No. 2	25 N.	24 E.	32	DACAA	?	?			Spring near Madison-Jurassic contact.
16.	Landusky Plunge	24 N.	24 E.	12	CDDAB	3,200	24	152.	350	MBMG Analysis 73-843; spring near Madison-Jurassic contact. Flow measured by MBMG in May 1977. Domestic and livestock water use.
17.	Little Warm Springs No. 1	26 N.	26 E.	30	DABD	?	?			Spring near Madison-Jurassic contact.
18.	Little Warm Springs No. 2	26 N.	26 E.	32	ACAAA	1,200 5,000	26 26	76. 320.	152. 640.	MBMG Analysis 73-841; spring near Madison-Jurassic contact. 5,000 gpm flow measured by MBMG in May 1977. Domestic and livestock use.
19.	Little Warm Springs No. 3	26 N.	26 E.	32	ADB	1,200	22	38.	114.	MBMG Analysis 73-879; spring near Madison-Jurassic contact. Water used for irrigation.
20.	Lodgepole No. 1	26 N.	25 E.	24	CAAD	1,500	29	130.	230.	MBMG Analysis 73-878; these three Lodgepole springs issue from the Madison Group. We have a second analysis (MBMG 73-840), but the location is not precise enough to assign it to the proper spring. Total flow for all three springs was estimated at 3,000 gpm, yielding ΔH_1 and ΔH_2 values of 284 and 474 billion Btu's per year, respectively. Prof. Paper 492 lists flow at 10,000 gpm, and some estimates have been as high as 50,000 gpm.
21.	Lodgepole No. 2	26 N.	25 E.	24	CABD	?	32			
22.	Lodgepole No. 3	26 N.	25 E.	24	DBC	?	32			
23.	Lovell	8 S.	9 W.	28	BD	1,125	22	36.	107.	Tertiary sediment adjacent to Madison outcrop. Tertiary volcanics to west. Location corrected from that in USGS Prof. Paper 492.
24.	New Biltmore	4 S.	7 W.	28	BDA	100	54	28.	35.	Analysis by USGS; Madison.
25.	Nimrod	11 N.	15 W.	14	CDAA	100	19 22	0.79 3.2	7.1 9.5	MBMG Analysis 72-112; Cambrian or Mississippian limestone along faults—spring issues from Tertiary sediments.
26.	Staudenmeyer's Spring No. 1	13 S.	2 W.	17	CB	3,200	27	230.	430.	Spring adjacent to contact between Tertiary (?) volcanics and limestone of uncertain age. Flow estimated with float and watch. Composite of four warm springs and one cold spring.
27.	Staudenmeyer's Spring No. 2	13 S.	2 W.	18	ACC	900	26	57.	114.	Spring issues from silicified limestone (?) of uncertain age. Staudenmeyer's springs are used for flood irrigation of hay.
28.	Staudenmeyer's Spring No. 3	13 S.	2 W.	18	BAD	2,400	22	76.	230.	Spring issues near contact of volcanics and limestone.
29.	Sun River	22 N.	10 W.	26	CABA	500	29	43.	75.	Madison, Jurassic, or Kootenai.
30.	Warm Springs State Hospital	5 N.	10 W.	24	A	150	77	70.	80.	Analysis by USGS; source beneath Tertiary sediments. Ca/Na ratio suggests limestone aquifer contact. Water being considered for space heating.

Table 2.—Chemical composition of thermal springs originating in the Madison Group.

Spring number	1	4	5	7	8	9	12	14	16	18	19	20	20, 21 or 22?	24	25	30
Temperature (°C)	25	15	19.5	42	65	19	25	21	24	26	22.5	26	30.6	53	19	77
Laboratory pH	7.84	7.69	7.68	7.38*	6.52*	8.08	7.30	8.03	8.09	8.06	7.92	7.96	8.06	6.76*	7.63	6.46*
Specific conductance (μmho/cm)	414	610	882	379	2,460	2,535	737	801	1,262	2,082	1,823	1,430	1,980	2,160	856	1,510
SiO_2 (mg/l)	12.2	16	8.9	34	49	12.8	18.2	18.2	17.8	16	15.9	14.5	16.3	46	21	56
Fe (mg/l)	<.01	0.03	<.01	–	–	0.09	<.01	<.01	<.01	0.10	<.01	<.01	<.01	––	0.01	–
Mn (mg/l)	<.01	0.01	<.01	<.02	0.02	0.02	<.01	<.01	<.01	<.01	<.01	<.01	<.01	0.03	0.01	0.05
Ca (mg/l)	47	89	133	35	320	533	77	266	161	289	276	187	268	290	126	220
Mg (mg/l)	23	28	40.3	8.8	58	165	35	86	65	110	91	69	96	73	36	22
Na (mg/l)	1.6	7.6	3.4	35	230	14	24	39	24	72	66.3	52.5	75	160	15.5	120
K (mg/l)	1.3	1.8	1.4	6.8	23	3.2	5.2	9.0	6.7	13.3	10.4	8.5	13	24	3.4	26
HCO_3 (mg/l)	88	220	195	170*	297*	59	59	109	101	101	196	153	81	226*	168	258*
SO_4 (mg/l)	139	163	336	41	1,200	1,870	335	982	620	1,140	936	650	1,062	1,100	340	670
Cl (mg/l)	0.5	1.5	0.95	10	45	4.1	3.4	18.8	9.5	59	42	38	57	46	2.7	5.0
F (mg/l)	0.4	0.5	1.3	0.9	3.6	1.8	1.3	1.5	1.6	1.4	1.7	0.9	1.1	3.3	0.8	3.9
NO_3 (mg/l)	0.3	0.2	0.8	–	–	ND	0.2	1.1	1.1	0.1	ND	1.7	0.1	–	0.4	–
B (mg/l)	–	–	–	0.06	0.46	–	–	–	–	–	–	–	–	0.92	–	0.10
Al (mg/l)	–	–	–	–	<.001	–	–	–	–	–	–	–	–	0.002	–	<.001
Li (mg/l)	<.01	–	–[1]	0.03	0.24	0.04	0.15	0.09	0.05	0.14	–	–	0.14	0.18	–	0.36
H_2S* (mg/l)	–	–	–	0.6	<1.	–	–	–	–	–	–	–	–	1.1	–	0.7
NH_4* (as N, mg/l)	–	–	–	<.1	0.22	–	–	–	–	–	–	–	–	0.2	–	<.1
Total Dissolved Solids (calculated, mg/l)	313	527	622	256	2,076	2,665	558	1,531	1,008	1,806	1,635	1,175	1,669	1,856	715	1,251
Total hardness as $CaCO_3$ (mg/l)	211	334	498	124	1,038	1,998	335	1,014	669	1,171	1,056	747	1,059	1,025	462	640
Total alkalinity as $CaCO_3$ (mg/l)	72	180	195	139	244	48	48	89	83	83	161	125	67	185	138	212
Sodium Adsorption Ratio	0.0	0.2	0.0	1.4	3.1	0.1	0.6	0.5	0.4	0.9	0.9	0.8	1.0	2.2	0.3	2.1

*Field determination; ND-Not detected; – Not determined;

[1] Value of 0.02 mg/l on previous sample; analyses for spring 7, 8, 24, and 30 from U.S. Geological Survey Open-File Report 76-480.