

Black Mountain Technology

444 NE Ravenna Blvd • Seattle • Washington 98115

May 11, 2007

Steve Lester
State of Idaho Department of Water Resources
2735 Airport Way
Boise, Idaho 83705

Re: Permit No. 65-23111

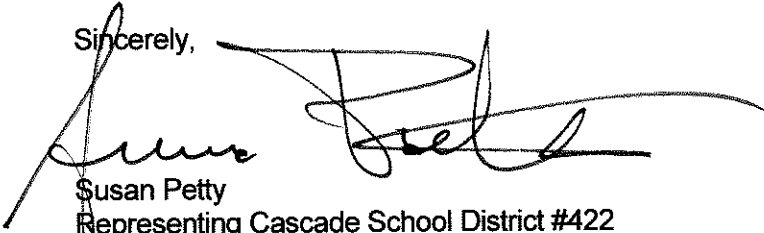
Dear Mr. Lester:

I have reviewed and amended the attached permit No. 65-23111 as requested in your letter dated April 30, 2007. In addition, I am attaching supplemental information regarding:

1. Justification of the amount of water - technical information on the system design for the proposed geothermal heating system for the district offices and highschool.
2. Non-consumptive use – Explanation of the non-consumptive use system for heat removal from the geothermal water to be produced and injected for the system.

I found a small error in the calculation of the flow rate requested. We had intended to request 1.37 cubic feet per second (615 gpm) of fluid flow, which was incorrectly calculated in acre-ft per year and then converted to 1.34 cfs. I have corrected the flow rate on the application.

Sincerely,


Susan Petty
Representing Cascade School District #422
Black Mountain Technology

RECEIVED

MAY 14 2007

WATER RESOURCES
WESTERN REGION



Memo

To: Steve Lester
From: Susan Petty for Cascade School District #422
CC: Elsie Kraus
Date: May 9, 2007
Re: Supplemental information for Application for Permit 65-2311

Justification for Water Use Flow Rate

The project proposes to use geothermal groundwater from a well drilled on Cascade School District #422 property as a source for heating and cooling through a heat pump at the central office of the District. Both the high school at the same site and the School District offices would be heated and cooled.

For this process groundwater is pumped from the source well through piping to the central heating system where a heat pump either takes the heat out of the water or rejects heat from the cooling system to the water. The water is then piped to the injection well where it is returned to the same aquifer. The water then moves through the aquifer back to the production well, either picking up heat if it is cooler than the rocks of the aquifer or cooling off if it is hotter than aquifer rocks. No water is consumed in the process. Nothing is added to the water in the process. The temperature only changes. If the well spacing is right, the returning water has reached the original aquifer temperature before it is pumped back out of the producing well.

The amount of water needed depends on the temperature. A geothermal resource is present in the Cascade area which flows up from depth along faults and fractures associated with the Payette and Cascade faults. Groundwater temperatures in the vicinity of the School District offices range from ~45°F to ~99°F. Geochemistry suggests that the parent water supplying the geothermal aquifers could be as hot as 116°F. (Table 1) The geochemistry also shows that the water in the vicinity of the school district which will be used for heating and cooling is of geothermal origin.

Table 1
Geochemical Geothermometers in C

	11889-1 McGregor Spring #1 11/06/06	11889-2 McGregor Spring #2 11/06/06	11889-3 McGregor #3 Carbarton HS 11/06/06	11889-4 Liesure Time Resort Well 11/06/06	11889-5 Cascade City Hall, Mixture of 3 City wells	11889-6 Cascade City Geothermal Test Well 11/07/06
Measured temperature	40	51	72	26	10	22
T - Chalcedony (deg C)	34	79	89	32	56	62
T - Quartz (deg C) (no steam loss)	66	108	117	64	87	93
T - Quartz (deg C) (max steam loss)	72	108	116	70	90	95
T - K ² /Mg (deg C)	N/A	N/A	N/A	N/A	N/A	N/A
T - Na/K (deg C) (Truesdale)	36	27	53	-24	195	-6
T - Na/K (deg C) (Amorrson)	48	40	65	-12	202	6
T - NKC (deg C)	97	92	111	46	137	61
T-Na/K (deg C) Fournier	86	77	101	27	223	45

For the heat pump conditions planned for the school district, the range of flow rates for the possible temperatures is from 0.72 cubic feet per second (cfs) for the highest possible temperatures to 1.37 cfs with a 12F temperature drop through heat pump for the coolest. The chart below (Table 2) shows the calculated flow rate for a range of possible temperatures. For this reason, 1.37 cfs is being requested.

Justification for Non-consumptive Use

The water produced for this project will be circulated through a heat pump and then injected back into the aquifer from which it was produced. Only the heat content of the water will be modified. During the summer cooling season, heat will be added to the water, while during the winter heat will be removed from the water. The total volume of water will remain unchanged. Therefore, there is no consumptive use for this water.

Table 2

Required Ground Water Temp. & Flow Calculation for Cascade Schools GWSHP System

Existing Building Heating Load (MBH): 4,185
 Heating Load Safety Factor: 1.05
 Design Building Heating Load (MBH): 4,394
 Amount of Heating Load Served by Compressors: 0.3
 Amount of Heating Load Served by Geothermal Loop (MBH): 3,076

Building Water				Ground Water			
Building Water Temperature Loop, (°F)	Building Loop Temp Change, °F	Design Building Loop Flow, GPM	P&F HX Approach Temperature Difference, °F	Ground Water Temperature, °F	Ground Water Temperature Change, °F	Design Ground Water Loop Flow, GPM	Design Ground Water Loop Flow, CFS
45	10	615	3	48	8	769	1.71
45	11	559	3	48	9	684	1.52
45	12	513	3	48	10	615	1.37
55	11	559	3	58	9	684	1.52
55	12	513	3	58	10	615	1.37
55	13	473	3	58	11	559	1.25
55	12	513	3	68	10	615	1.37
65	12	513	3	68	11	559	1.25
65	13	473	3	68	12	513	1.14
65	14	439	3	73	12	513	1.14
70	12	513	3	78	11	559	1.25
75	12	513	3	78	12	513	1.14
75	13	473	3	78	13	473	1.05
75	14	439	3	88	12	513	1.14
85	12	513	3	88	13	473	1.05
85	13	473	3	88	14	439	0.98
85	14	439	3	98	12	513	1.14
95	15	410	3	108	16	384	0.86
105	16	384	3	118	17	362	0.81
115	17	362	3	123	18	342	0.76
125	18	342	3	123	19	324	0.72
120	20	308	3				

Comment: The amount of flow required from a well depends on the temperature of the water. We have made some assumptions about the temperature of the water in order to compute target flows. We expect to find water around 70°F, and for a typical system 70°F water will require a flow of about 513 GPM. However we could get temperatures much lower or higher, since there are wells in the area that have temperatures from 52°F to 99°F. Just outside of town there are surface flows exceeding 160°F. We are expecting design flow rates between 400 and 600 GPM.

Black Mountain Technology

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