Geothermal Study
at the
Ringgold Elementary School
Ringgold, Georgia

Performed For

North Georgia Electric Membership Corp.

by

Earth Energy

Construction, Inc.

January 1998

EARTH ENERGY

Construction, Inc.

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January 7, 1998

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Ron,

Having been contacted by Mr. Ed Colucci of TVA in Chattanooga, Earth Energy met with Kay Thrasher and Terry Townsend of Townsend Engineering, Inc. on December 4, 1997 for the purpose of developing a geothermal test program to determine the size of a loopfield necessary to heat and cool the new addition to the Ringgold Elementary School at Ringgold, GA. Bill Nagel and Terry Allerton of Earth Energy met with the above engineers along with Kyle Smith of the Catoosa Co. Public Schools on site to mark the location of four test holes for the program. An urgency to start was conveyed, as the project was to go to bid at the first of the year. Miller Drilling Co. of Chattanooga was contracted to drill the holes for Earth Energy as they could mobilize the week of the 15th.

On December 16, Miller Drilling Co. moved on site along with Earth Energy and commenced drilling the first hole. The first hole was located in the play area on the edge of the wooded lot. Bedrock was located at 110 feet after penetrating mainly chert. Six-inch steel casing was set to 120 feet. The drill was then advanced to 150 feet where we broke out of rock and back into chert. The driller lost all air return so the hole was abandoned and the casing pulled.

Hole 2 was located at a higher elevation close to the existing building. After penetrating several layers of chert, bedrock was located at 150 foot. Steel casing was driven to 160 feet and the hole drilled to 357 feet. Water was encountered at two levels and was estimated in excess of 100 GPM at the final level. Drilling was stopped because of slow penetration due to amount of water encountered. A high-density, 1-inch, SDR 11, polyethylene loop was placed in the borehole to a depth of 347 feet then filled with water. The borehole was then backfilled with #9 crushed stone and sealed with Bentonite hole plugs.

Hole 3 was located across the road on the fringe of the existing car parking lot. Bedrock was located at 100 feet and casing set to 108 feet. The drill was then advanced to 151 feet where we broke out of rock and back into chert. An air return could not be established so the hole was abandoned and the steel casing pulled.

Hole 4 was located across the road from the school at the lower end of the property. It was decided that we should locate bedrock with a 6-inch tri-cone bit and install a maximum length loop. The hole was completed to 150 feet without casing and a loop installed. The hole was then backfilled with #9 crushed stone and sealed from surface water with Bentonite hole plug.

Holes 1 and 3 were backfilled with #9 crushed stone and sealed with Bentonite hole plugs. The loops in hole 2 and hole 4 were pressure tested at 100 psi and flow tested for obstructions.

On Thursday the 18th Earth Energy utilized a Ewbank portable test unit for the purpose of determining the thermal conductivity of hole 2. The test was run for 10 hours during which time the water in the loop was heated with a calibrated source while supply and return temperatures were logged along with flow rates and energy inputs. This data was E-Mailed to Oklahoma, then analyzed from which they determined the thermal conductivity to be a value of **1.3 btu/degree F-hr-foot.** This is an average conductivity per foot for the borehole. This value represents the rate at which the borehole and soil will transfer heat. It is an important variable in determining the amount of ground heat exchanger required for a given system. The test equipment, methods, procedures, calculations, and interpretations is done in accordance with the recommendations and guidelines of the International Ground Source Heat Pump Association.

Recommendations:

The thermal conductivity value was given to Townsend Engineering, Inc. where they will use the number along with the building heat gain and heat loss numbers to optimally size the ground loop heat exchanger for this application.

A closed loop heat exchanger can be installed on this site, but due to water flow, the depth should be limited to 350 feet.

Due to the type of overburden, it will be very difficult to withdraw casing after loop insertion. Voids were encountered in the bedrock and this may involve double casing in some instances.

An open loop should be considered. This would be the least expensive option and adequate water flow appears to be present on this site.

Drill log for Ringgold Elementery

Hole # 1

From ft	To ft	Material
0	10	Brown Clay
10	20	Gray Clay
20	40	Chert
40	60	Gray Clay
60	85	Yellow Clay & Chert
85	90	Chert
90	112	Chert & Brown Clay
112	120	Chert 25 GPM water
120	130	Limestone
130	145	Chert & Brown Clay
145	148	Limestone
148	152	Chert

Hole # 2

From ft	To ft	Material
0	30	Gray Clay
30	60	Red Clay
60	112	Brown Chert
112	120	Chert 30 GPM water
120	160	Chert & Brown Clay
160	185	Light Gray Limestone
185	186	Broken 100 GPM water
186	192	Gray Limestone
192	210	Gray Limestone
210	230	Light Gray Limestone
230	250	Gray Limestone
250	270	Light Gray Limestone
270	271	Broken 25 GPM water
271	357	Light Gray Limestone

Hole # 3

From ft	To ft	Material
0	20	Brown Clay
20	60	Gray Clay
60	106	Chert & Brown Clay
106	107	Broken 15 GPM water
107	125	Gray Limestone
125	151	Chert & Brown Clay

Hole # 4

From ft	To ft	Material
0	10	Brown Clay
10	20	Gray Clay
20	35	Chert & Brown Clay
35	45	Red Clay
45	60	Chert & Brown Clay
60	70	Chert & Yellow Clay
70	75	Chert & Brown Clay
75	100	Chert & Brown Clay
100	125	Chert
125	147	Chert
147	148	Broken 10 GPM water
148	150	Limestone