

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES
BENEFICIAL USE FIELD REPORT

RECEIVED
OCT 01 2013
DEPT. OF WATER RESOURCES
SOUTHERN REGION

A Beneficial Use Field Report is prepared by a water right examiner as the result of an examination to clearly confirm and establish the extent of the beneficial use of water established in connection with a permit during the development period authorized by the permit and any extensions of time previously approved.

A. GENERAL INFORMATIONPermit No. 37-223341. Owner Tracy Flaherty and Tim Flaherty Phone No. (208) 788-6788Current address 165 Golden Eagle Drive2. Examiner's name Charles G. Brockway EXAM DATE 11/24/20093. Accompanied by Larry with Western States Geothermal Email _____

Address _____

Relationship to permit holder Designer / installer Phone No. _____4. Source Groundwater tributary to _____**B. OVERLAP REVIEW**1. Other water rights with the same place of use 37-85632. Other water rights with the same source and point of diversion None**C. DIVERSION AND DELIVERY SYSTEM**

1. Point(s) of Diversion:

Ident. No.	Gov't Lot	¼	¼	¼	Sec	Twp	Rge	County	Method of Determination/Remarks
			SW	NW	5	3N	18E	Blaine	GPS

2. Place(s) of Use: Method of determination _____

Twp	Rge	Sec	NE				NW				SW				SE				Totals
			NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	
3N	18E	5							Heat										
3N	18E	5							Cool										

3. **Delivery System Diagram:** Indicate all major components and distances between components. Indicate weir size/ditch size/pipe diameter (inside), as applicable. Use the space provided or ☐ see attached.

Scale: 1" = _____

- ☒ Copy of USGS Quadrangle attached showing location(s) of point(s) of diversion and place(s) of use (**required**)
☒ Aerial photo attached (required for irrigation of 10+ acres)
☒ Photo of diversion and system attached

4.

Well or Diversion Identification No.*	Motor Make	Hp	Motor Serial No.	Pump Make	Pump Serial No. or Discharge Size
Pumping well	Franklin	7.5	Model 100FA75S-P	Franklin	2" discharge

*Code to correspond with no. on map and aerial photo

D. FLOW MEASUREMENTS

1.

Measurement Equipment	Type	Make	Model No.	Serial No.	Size	Calib. Date

2. **Measurements:** _____
 See attached narrative _____

See attached narrative

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Has the permit holder met all conditions of permit approval, including any mitigation requirements and/or measuring device installation requirements? ☒ Yes ☐ No If no, what must be done to meet the permit requirements?

[illegible]

F. FLOW CALCULATIONS☒ Additional computation sheets attached

Measured Method:

See attached narrative

G. VOLUME CALCULATIONS

1. Volume Calculations for Irrigation:

$$V_{I,R} = (\text{Acres Irrigated}) \times (\text{Irrigation Requirement}) = \underline{n/a}$$

$$V_{D,R} = [\text{Diversion Rate (cfs)}] \times (\text{Days in Irrigation Season}) \times 1.9835 = \underline{n/a}$$

$$V = \text{Smaller of } V_{I,R} \text{ and } V_{D,R} = \underline{n/a}$$

2. Volume Calculations for Other Uses:

See attached narrative

H. RECOMMENDATIONS**1. Recommended Amounts**

Beneficial Use	Period of Use		Rate of Diversion	Annual Volume
	From	To	Q (cfs)	V (afa)
Heating	1/1	12/31	0.25	92.0
Cooling	1/1	12/31	0.25	92.0
Totals:			0.25	92.0

2. Recommended Amendments☐ Change P.D. as reflected on page 1☐ Add P.D. as reflected on page 1☒ None☐ Change P.U. as reflected on page 1☐ Add P.U. as reflected on page 1☐ Other**I. AUTHENTICATION**

Field Examiner's Signature

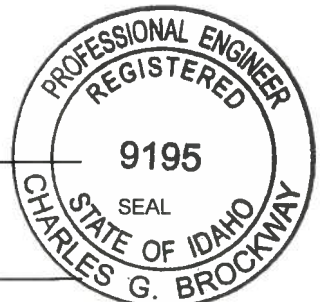


Date

10/1/2013

Reviewer

Date



**Narrative for Beneficial Use Examination
Water Permit No. 37-22334
Tracy and Timothy Flaherty**

Brockway Engineering, PLLC
C. G. Brockway, P.E.

October 1, 2013

Description

The system includes one (1) pumping well and one (1) injection well for a closed-loop heating and cooling system for a residence and ancillary facilities located on Lot 5 of Gimlet Terrace subdivision. The two wells are located at the southern end of the lot. Two other wells are located on the property which are unrelated to permit 37-22334 (see attached map). Information regarding the system configuration, general operation, and square footages was obtained from Ron Pierce, a geothermal specialist and designer of the system. Mr. Pierce indicated he designed the system for approximately 100 gpm. A site inspection was made on November 24, 2009.

A Franklin submersible pump in the pumping well delivers water via 330 feet of 3" HDPE discharge line to the house. The HDPE pipe runs another 50 feet through the crawl space to a dedicated basement room containing the heating/cooling equipment. Two heat exchangers and five heat pumps provide heating for the following areas: 25,000 s.f. home and barn, swimming pool, spa, and up to 15,000 s.f. of snow melting on pavement areas and tennis court. Cooling is provided for the home and barn. The "barn" is not an agricultural facility but contains sleeping quarters and a large area for social gatherings.

A 3-phase converter and variable-speed drive operates the well pump based on system pressure to meet heating or cooling demand. The pump was operating at maximum speed (60 Hz) during field exam and the system pressure was 21.0 psi based on sensor and pressure gauge. The operator indicates that when the system runs, it almost always operates at full speed in the wintertime, and something less than full speed in the summertime. Each of the five heat exchangers is designed for approximately 20 gpm.

The set point for the pressure is 30 psi. If the heating/cooling load cannot be met with heat exchangers, supplemental natural-gas boilers or air conditioning units will activate, which is typically the case in the wintertime. The injection well cap was removed and it was verified that water was returning to the aquifer via this well.

A review of the two drilling records (attached) indicates that the surface alluvial material was cased out and the aquifer being utilized is within the basement rock formation. This is the case for both wells, so the water injected is returning to the same aquifer from whence it was pumped. The water is being injected close to the location of pumping – the wells are separated by a distance of 143 feet.

Well information

Pumping well:

10" steel surface casing with sanitary cap.
Casing extends to 70 feet BGS, 10" open hole in rock to 185 feet BGS
Well Tag No. D0050820
Drilling Permit No. 857017
Franklin submersible pump, 7.5 HP, 90-gpm rated unit, Model 100FA7S6-PE
3" pitless adapter

Injection well:

8" steel surface casing with vented sanitary cap
Casing extends to 52 feet BGS, 8" open hole in rock to 102 feet BGS
Well Tag No. D0050817
Drilling Permit No. 857016
3" pitless adapter

Diversion Rate

Flow measurement was impractical. No flow meter is installed or required. The pumping rate was estimated using the pump performance curve with measured pumping lift and system pressure, as described below.

The pumping level was measured with an electric probe at 47.97 feet below the top of casing, or 46.27 feet below ground surface. The level was stable and the pump was operating at maximum speed. The static water level reported by the driller in July 2009 was 44 feet. The system pressure measured in the basement utility room near the inlet was 21 psi, according to both the pressure sensor and the analog gauge at the same location. The pressure sensor is located near the ceiling of the basement at an elevation approximately equal to the exterior ground elevation. The ground surface from the well to the house rises gradually, and the elevation difference is a maximum of 20 feet. Head loss in the pump column and 340 feet of 3" C-900 PVC pipe from the well to the house, including minor losses, was estimated using Darcy-Weisbach friction and appropriate minor loss coefficients (see attached calculations). The intersection of the calculated system curve and the performance curve of the pump is the operating point of the system, which is 137 gpm or 0.30 cfs at 125 feet total dynamic head.

Annual Volume Estimation

Pursuant to recommendation by IDWR staff, an extension of time to file proof of beneficial use was obtained in December 2009. The purpose of the extension was to allow the system to be pumped for a number of years to provide data which could be used to develop an appropriate annual volume to be licensed. During this time, a flow meter was not installed on the system. The only recorded data which could be used to estimate pumping volume are the cumulative energy consumption and the cumulative run time, both of which are recorded by the variable-frequency drive unit. As of September 20, 2013, these values were 61,900 KWh and 12,623 hours, respectively. The activation date, according to the operator, was August 10, 2009, which is the date water actually began to be pumped to the system.

Approach 1 (power consumption): Using the pump curve information, the operating efficiency of the pump is about 49%. With this efficiency, the power in KW required by the pump is given by

$$P = \frac{\gamma QH}{737e} = \frac{62.4(0.30)(125)}{737(0.53)} = 5.99 \text{ KW}$$

In one hour, the volume pumped at a rate of 0.30 cfs is 0.02479 ac-ft. The power consumption coefficient (PCC) is therefore 241.6 KWh / ac-ft. Dividing this value into the total KWh yields an estimate volume of 256.2 ac-ft.

Approach 2 (run time): Using the cumulative run time, assuming that the pump runs at full speed delivering 0.30 cfs whenever it activates, the total volume is estimated to be 0.30 cfs x 12623 hrs x 3600 sec/hr / 43560 ft³/ac-ft = 313.0 ac-ft.

The difference between the two calculated volumes may reasonably be explained by the fact that the pump will sometimes operate at less than full speed, so the run time approach would be expected to over-estimate the volume pumped. The volume of 256.2 ac-ft is likely the more accurate estimate.

The volume was pumped over a period from August 10, 2009 to September 30, 2013, a period of 1,512 days. During this period, the operator recorded that the system did not operate from approximately October 2012 through April 2013 (212 days), and from September 1 through September 30, 2013 (30 days). During these times, the well system was manually disengaged and the supplemental boilers and/or cooling systems were being used exclusively. Subtracting 212 days and 30 days from the gross duration of 1,512 days yields an operating duration of 1,270 days. The average daily pumping volume was 256.2 ac-ft / 1270 days = 0.2017 ac-ft/day. On an annualized basis this equates to 73.6 ac-ft.

Geothermal systems utilized for heating and cooling should be licensed for an annual volume sufficient to cover years where heating and/or cooling loads are significantly higher than average. This is analogous to licensing an irrigation right for a per-acre volume sufficient to cover the highest-demand crop during a year which is hot and dry, not the average-use crop during an average year. No observed pumping volume exists for years with higher or lower heating/cooling loads than those prevailing in the past 3 years. The primary indicator of required heating or cooling load is ambient air temperature. For the three available full years of usage (2010-2012), the monthly temperature at the Ketchum Ranger Station has generally been close to the mean, but slightly cooler in the summer months and slightly warmer in the winter months (see attached plot). This indicates that the actual recorded usage is likely close to or slightly lower than the average annual demand, and would not be an appropriate value to use for licensing purposes.

The designer of the system indicates that in his opinion a reasonable worst-case design year (colder than average winter and warmer than average summer) would result in the system operating at full capacity for November through March (assume the permit amount or 0.25 cfs or 112 gpm), and with two of the five heat exchangers (40 gpm) for cooling from June through August. Other months of the year, the system would likely not operate or would operate very minimally. With these assumptions, the total annual

volume would be 92 acre-feet or 25% greater than the annualized volume estimated above from the power usage. This appears to be a reasonable number to account for climatic variability given that the observed period is an average or lower-than-average demand period.

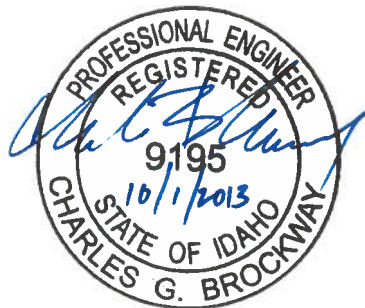
The designer indicates that he believes there may have been an engineering report of some kind performed for this system. If he is able to locate the report, the information will be forwarded to the Department if it is relevant to water usage.

Estimated Impact on Aquifer

The drawdown in the pumping well is approximately 3 to 4 feet. If the aquifer is uniform, injection into the east well will induce a commensurate increase in water level at that point, and the two effects will superimpose in the local vicinity of the wells. The wells are 143 feet apart, whereas the nearest domestic well is at least 200 feet from the pumping well.

An estimate of potential impact on surrounding wells was made by analyzing a simple 2-well couplet using the Theis equation. Two wells separated by 143 feet were analyzed, one withdrawing at a rate of 0.25 cfs and other injecting at the same rate. The aquifer was assumed to be uniform and of infinite lateral extent, with a saturated depth of 115 feet and storativity of 0.15. Aquifer hydraulic conductivity was estimated to be 60 ft/day based on applying Theis with the known drawdown.

The point of maximum impact is at the residence 312 west of the pumping well. The residence to the south is nearer but approximately equidistant from both wells; thus the net effect there is nearly zero. At the residence to the west, the maximum impact is 0.19 feet. This magnitude of impact will not adversely affect the domestic well pumping.



FLAHERTY RESIDENCE - GIMLET TERRACE

Well to heat exchange system in basement

Brockway Engineering, PLLC 12/3/09

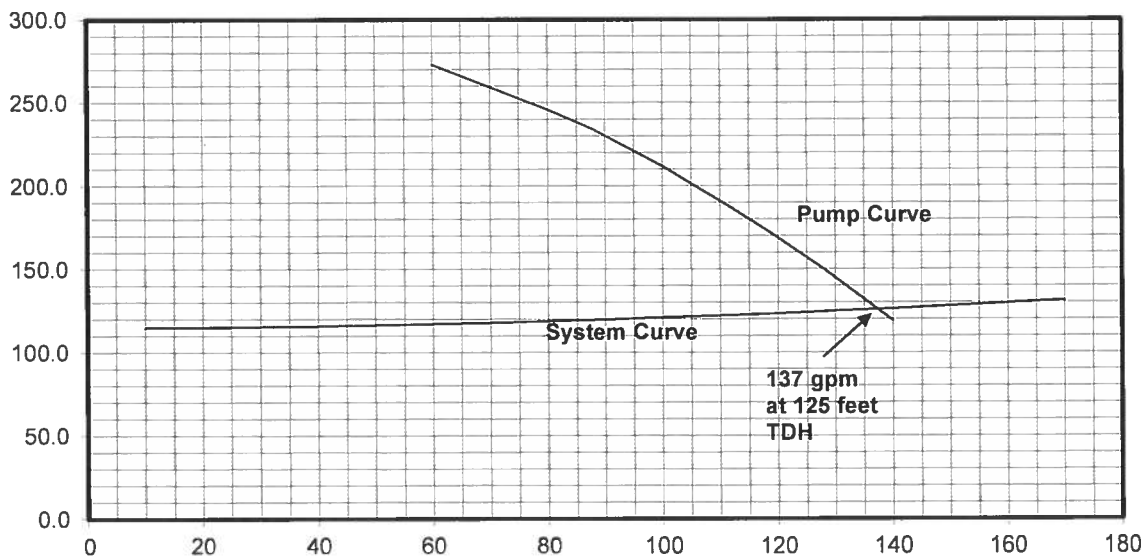
Well pumping lift to ground sfc 46.3 feet (measured)
 Elevation difference 20 feet (estimated)
 Pressure at end of mainline 21 psi (measured)

Pump column
 I.D. 0.25 feet
 Length 105 feet
 Minor loss coefficient 2.3 check valve, pitless
 Pipe area 0.049 ft²
 Absolute roughness 2E-04 ft

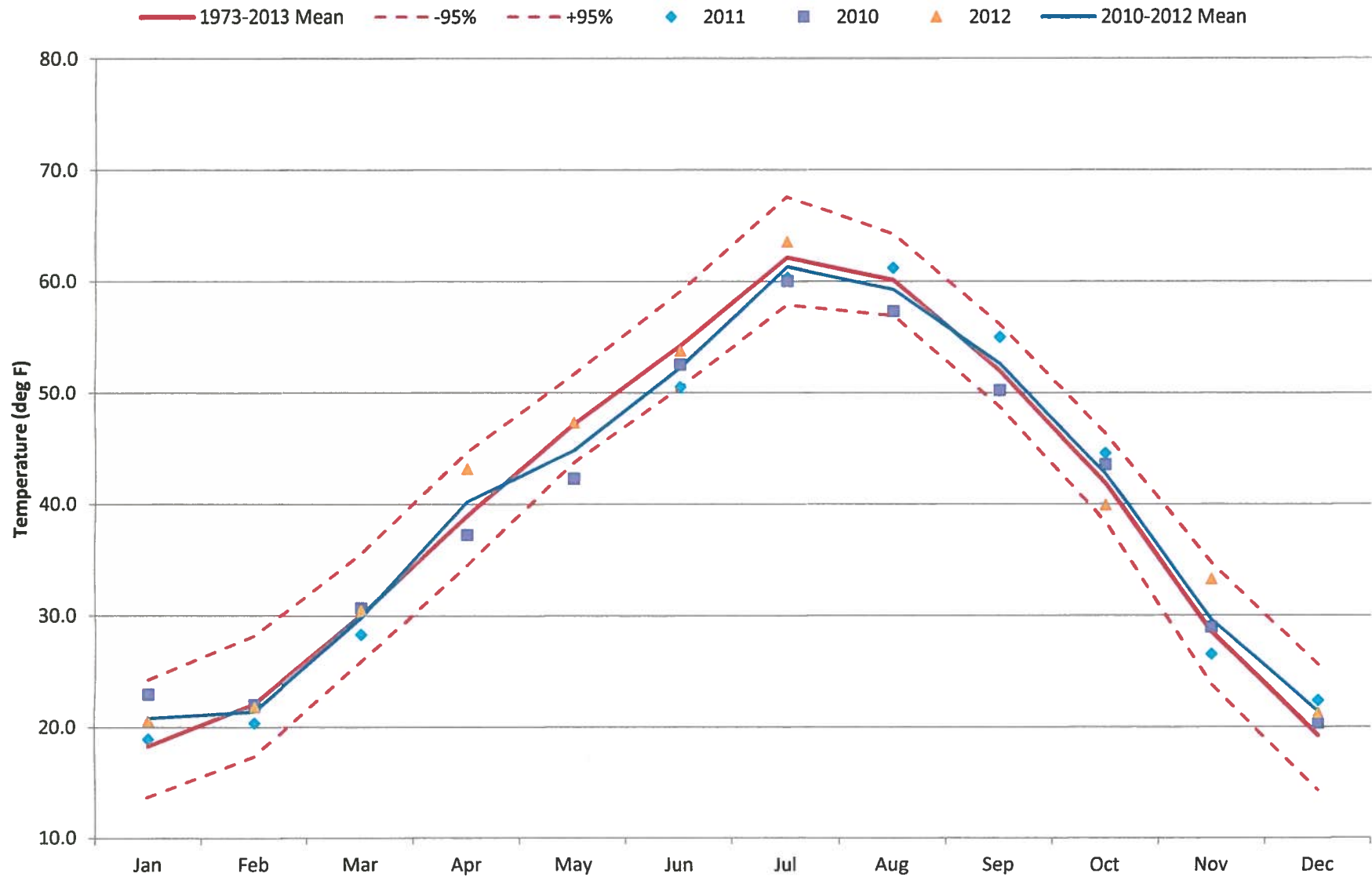
Mainline
 I.D. 0.342 feet 4" C-900
 Length 340 feet
 Minor loss coefficient 8.2 5 x 90 deg elbows, open ball valve, 50' of 3" HDPE, contraction
 Pipe area 0.092 ft²
 Absolute roughness 5E-06 ft

Pump Curve:
 Franklin 100FA7S6-PE
 (7.5 HP)

COLUMN					MAINLINE					Total		Pump Curve:	
Q (gpm)	(cfs)	V (ft/s)	Re	f	Hloss	V (ft/s)	Re	f	Hloss	Hloss	TDH	Q (gpm)	TDH (ft)
10	0.022	0.45	1.9E+04	0.0272	0.04	0.24	1.4E+04	0.0283	0.03	0.08	114.8	60	273
20	0.045	0.91	3.8E+04	0.0236	0.16	0.49	2.8E+04	0.0238	0.12	0.27	115.0	80	246
30	0.067	1.36	5.7E+04	0.0221	0.33	0.73	4.2E+04	0.0216	0.25	0.58	115.4	88	234
40	0.089	1.82	7.6E+04	0.0212	0.57	0.97	5.6E+04	0.0203	0.42	0.99	115.8	100	212
50	0.111	2.27	9.5E+04	0.0206	0.88	1.22	7.0E+04	0.0193	0.63	1.51	116.3	112	187
60	0.134	2.72	1.1E+05	0.0202	1.24	1.46	8.3E+04	0.0186	0.88	2.12	117.0	120	169
70	0.156	3.18	1.3E+05	0.0198	1.67	1.70	9.7E+04	0.0180	1.17	2.84	117.7	128	150
80	0.178	3.63	1.5E+05	0.0196	2.16	1.94	1.1E+05	0.0175	1.50	3.66	118.6	140	119
90	0.201	4.09	1.7E+05	0.0194	2.71	2.19	1.3E+05	0.0171	1.87	4.58	119.6		
100	0.223	4.54	1.9E+05	0.0192	3.32	2.43	1.4E+05	0.0167	2.28	5.60	120.7		
110	0.245	4.99	2.1E+05	0.0191	4.00	2.67	1.5E+05	0.0164	2.73	6.72	121.9		
120	0.267	5.45	2.3E+05	0.0190	4.73	2.92	1.7E+05	0.0161	3.21	7.94	123.1		
130	0.290	5.90	2.5E+05	0.0189	5.53	3.16	1.8E+05	0.0159	3.73	9.26	124.5		
140	0.312	6.35	2.7E+05	0.0188	6.39	3.40	1.9E+05	0.0157	4.28	10.67	126.0		
150	0.334	6.81	2.9E+05	0.0187	7.31	3.65	2.1E+05	0.0155	4.87	12.18	127.7		
160	0.357	7.26	3.0E+05	0.0186	8.30	3.89	2.2E+05	0.0153	5.50	13.80	129.4		
170	0.379	7.72	3.2E+05	0.0186	9.34	4.13	2.4E+05	0.0151	6.16	15.50	131.2		



Monthly Temperature at Ketchum Ranger Station



Monthly Temperature at Ketchum Ranger Station

Degrees F

Year	1 Jan	2 Feb	3 Mar	4 Apr	5 May	6 Jun	7 Jul	8 Aug	9 Sep	10 Oct	11 Nov	12 Dec	Ann Avg	Oct-Mar	Departure from avg	Apr-Sep	Departure from avg
1973							62.73	61.25	50.45		27.77	21.61					
1974	14.98	18.98	28.17					58.34		41.65	31.7	19.26		25.8	-0.8		
1975	15.95	18.09	24.34	29.32	43.07	48.73	62.98	54.82		41.4	27.68	24.15	35.5	25.3	-1.3		
1976	19.39	22.65	22.74				63.33	56.35	52.77		33.7	23.52					
1977	17.33			42.31	42.18	60.2	60.68	60.4	51.48		26.48	22.33	42.6			52.9	0.4
1978	21.37	23.22	33.06	37.36	44.17	54.05	61.61	57.38	50.3	44.78	29.64	12.34	39.1	27.4	0.8	50.8	-1.7
1979	8.84	21.18	29.94	37.08	48.08	53.48	61.37	59.66		43.86		21.85	38.5				
1980	14.66	26.31	27.15	40.87	46.63	51.36	60.94	54.85	52.26	42.08	29.42	22.52	39.1	27.0	0.4	51.2	-1.3
1981	22.39	22.2	32.79	41.2	46.1	52.89	60.71	62.81	53.05	38	31.95	20.9	40.4	28.0	1.4	52.8	0.3
1982	13.82	16.98	28.18	31.18	45.37	52.87	59.81	62.03	51.3	39.23	23.63	17.68	36.8	23.3	-3.3	50.4	-2.1
1983	21.53	23.66	30.42	33.75	46.65	52.4	57.53	62.13	51.27	43.16	27.42	11.92	38.5	26.4	-0.2	50.6	-1.9
1984	14	20.07	27.84	36.07	45.79	51.65	63.18	61.34		36.32	25.28	11.87	35.8	22.6	-4.0		
1985	15.58	13.25	25.39	41.27	49.11	56.75	66.9	57.27	46	38.68	20.05	14.42	37.1	21.2	-5.4	52.9	0.4
1986	22.19	27.64	35.74	40.02	47.02	58.27	57.79	62.5	46.22	42.4	31.15	22.47	41.1	30.3	3.7	52.0	-0.5
1987	16.52	25.38	31.9	44.58	49.44	55.67	58	58.81	54.25	45.45	32.17	18.79	40.9	28.4	1.8	53.5	1.0
1988	16.98	23.6	31.16	41.03	46.73	58.27	63.89	59.87	51.62	49.06	25.87	15.5	40.3	27.0	0.4	53.6	1.1
1989	12.06	16.84	29.94	41.27	45.9	54.63	63.21	56.89	51.43	40.4	30.17	23.29	38.8	25.5	-1.1	52.2	-0.3
1990	20.03	17.11	31.81	43.37	43.27	52.62	61.27	60.48	55.73	39.83	27.87	7.97	38.4	24.1	-2.5	52.8	0.3
1991	16.16	30.73	26.06	35.57	42.87	49.95	61.73	60.85	50.87	40.15	23.88	16.55	37.9	25.6	-1.0	50.3	-2.2
1992	18.55	27.24	36.19	40.85	50.74	55.57	57	58.65	49.9	44.16	25.33	15.9	40.0	27.9	1.3	52.1	-0.4
1993	15.03	19.16	31	36.1	50.45	49.08	51.66	56.35	50.07	42.37	23.73	17.89	36.9	24.9	-1.7	49.0	-3.5
1994	21.84	19.79	34.19	41.95	50.87	54.22	61.55	59.61	54.83	40.24	20.18	18.89	39.8	25.9	-0.7	53.8	1.4
1995	20.61	27.73	28.69	38.93	45.65	52.25	59.66	58.77	53.59			19.85	40.6			51.5	-1.0
1996	18.69	22.84	31.58	39.67	45.66	55.35	64.56	59.34	49	40.19	32.3	21.15	40.0	27.8	1.2	52.3	-0.2
1997	19.39	21.23	30.63	37.35	51.39	56.19	60.92	62.05	53.9	41.21	30.58	21.5	40.5	27.4	0.8	53.6	1.1
1998	22.02	24.16	28.69	39.83	46.68	50.75	65.89	63.73	57.15	41.18	30.62	18.77	40.8	27.6	1.0	54.0	1.5
1999	20.65	20.3	28.82	37.94		53.58	61.14	62.46	51.67	44.56	37.21	23.61	40.2	29.2	2.6		
2000	20.18	27.76	30.11		48.76	57.32	62.94	64.1	51.5		25.05	21.3	40.9				
2001	20.42	21.11	35.02	39.1	52.14		61.32	62.24	53.95	42.52	31.83	14.03	39.4	27.5	0.9		
2002	18.58	18.46	24.68	41.05	49.74	59.65	67.21	59.47	53.77	39.69	29.78	24	40.5	25.9	-0.7	55.1	2.7
2003	27.06	23.02	32.6	38.78	48.06	57.1	66.63	65.35	54.1	47.19	25.9	23.15	42.4	29.8	3.2	55.0	2.5

2004	17.21	20.84	34.29	43.42	47.34	56.27	63.05	60.26	50.95	42.52	31.47	22.53	40.8	28.1	1.5	53.5	1.1
2005	20.95		31.76	38.23	46.18	50.92	63.94	61.42	50.02	42.79	29.48	19.1	41.3			51.8	-0.7
2006	20.53	17.34	26.44	39.38	50.45	58.27	67.66	60.27	52	41.69	29.57	20.1	40.3	25.9	-0.6	54.7	2.2
2007	15.26	26.39	35.19	41.62	50.31	57.33	68.77	62.66	52.45	40.94		18.18	42.6			55.5	3.0
2008	12.23	21.6	25.82	32.65	48.05	54.28	64.68	61.92	49.48			19.62	39.0			51.8	-0.6
2009	21.69	23.12	27.48	40		53.57		59.19	56.8	37.05	29.88	16.66	36.5	26.0	-0.6		
2010	22.98	22.02	30.69	37.25	42.31	52.53	60	57.31	50.23	43.55	28.98	20.34	39.0	28.1	1.5	49.9	-2.5
2011	18.95	20.36	28.34			50.54	60.29	61.2	55	44.6	26.53	22.4	38.8	26.9	0.3		
2012	20.58	21.81	30.47	43.18	47.34	53.79	63.54			39.94	33.33	21.31	37.5	27.9	1.3		
2013	15.35	24.71	32.56											Mean	26.6	52.5	

Monthly Temperature at Ketchum Ranger Station

Period of Record Statistics

Maximum number of missing days to include in statistics: 5

MEAN	18.3	22.1	30.0	39.0	47.2	54.2	62.1	60.1	52.0	41.8	28.5	19.2	39.4
S.D.	3.62	3.71	3.32	3.48	2.72	2.96	3.32	2.49	2.51	2.72	3.73	3.86	1.80
SKEW	-0.31	0.09	-0.13	-0.95	-0.12	0.13	-0.52	-0.27	-0.17	0.39	-0.30	-1.02	-0.37
MAX	27.06	30.73	36.19	44.58	52.14	60.2	68.77	65.35	57.15	49.06	37.21	24.15	42.65
MIN	8.84	13.25	22.74	29.32	42.18	48.73	51.66	54.82	46	36.32	20.05	7.97	35.50
NO YRS	40	38	39	35	34	36	38	39	35	34	36	40	37

Assuming normal distribution, frequency distribution of monthly average:

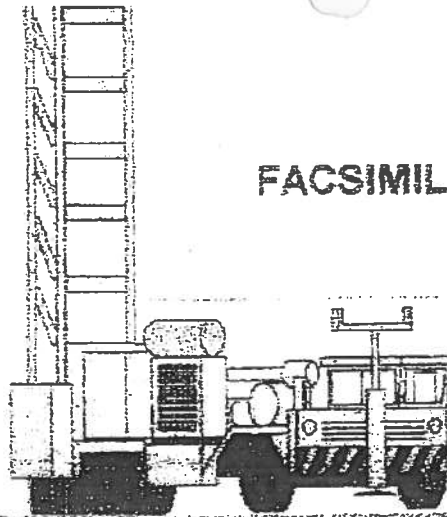
Ex Prob	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
0.05	24.3	28.2	35.5	44.7	51.7	59.1	67.6	64.2	56.1	46.3	34.7	25.6	42.4
0.1	23.0	26.8	34.3	43.4	50.7	58.0	66.4	63.3	55.2	45.3	33.3	24.2	41.7
0.2	21.4	25.2	32.8	41.9	49.5	56.7	64.9	62.2	54.1	44.1	31.7	22.5	41.0
0.5	18.3	22.1	30.0	39.0	47.2	54.2	62.1	60.1	52.0	41.8	28.5	19.2	39.4
0.8	15.3	19.0	27.3	36.0	44.9	51.7	59.3	58.0	49.9	39.6	25.4	16.0	37.9
0.9	13.7	17.3	25.8	34.5	43.7	50.4	57.9	56.9	48.8	38.4	23.8	14.3	37.1
0.95	12.4	16.0	24.6	33.2	42.7	49.4	56.6	56.0	47.8	37.4	22.4	12.9	36.5

2010-2012 avg	20.84	21.40	29.83	40.22	44.83	52.29	61.28	59.26	52.62	42.70	29.61	21.35	38.46
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37-22334

FACSIMILE COVER SHEET

Eaton Drilling & Pump Services, Inc.
P.O. Box 230
498 South Idaho St
Wendell, Idaho 83355-0230
Serving Magic Valley Since 1907
(208) 536-2223
(208) 536-2024 fax



Send to:	From:
<i>Brockway Engineers</i>	<i>Larry</i>
Attention:	Date:
<i>Chuck</i>	
Fax Number:	Phone:
<i>736-8506</i>	

☐ Urgent ☐ Reply ASAP ☐ Please Comment ☐ Please Review ☐ For your information

Total pages, including cover sheet: *2*

COMMENTS

Pump Model 100FA 7.56-PE
7 1/2 H.P. 1φ Franklin Motor & Pump

Sending pump curve

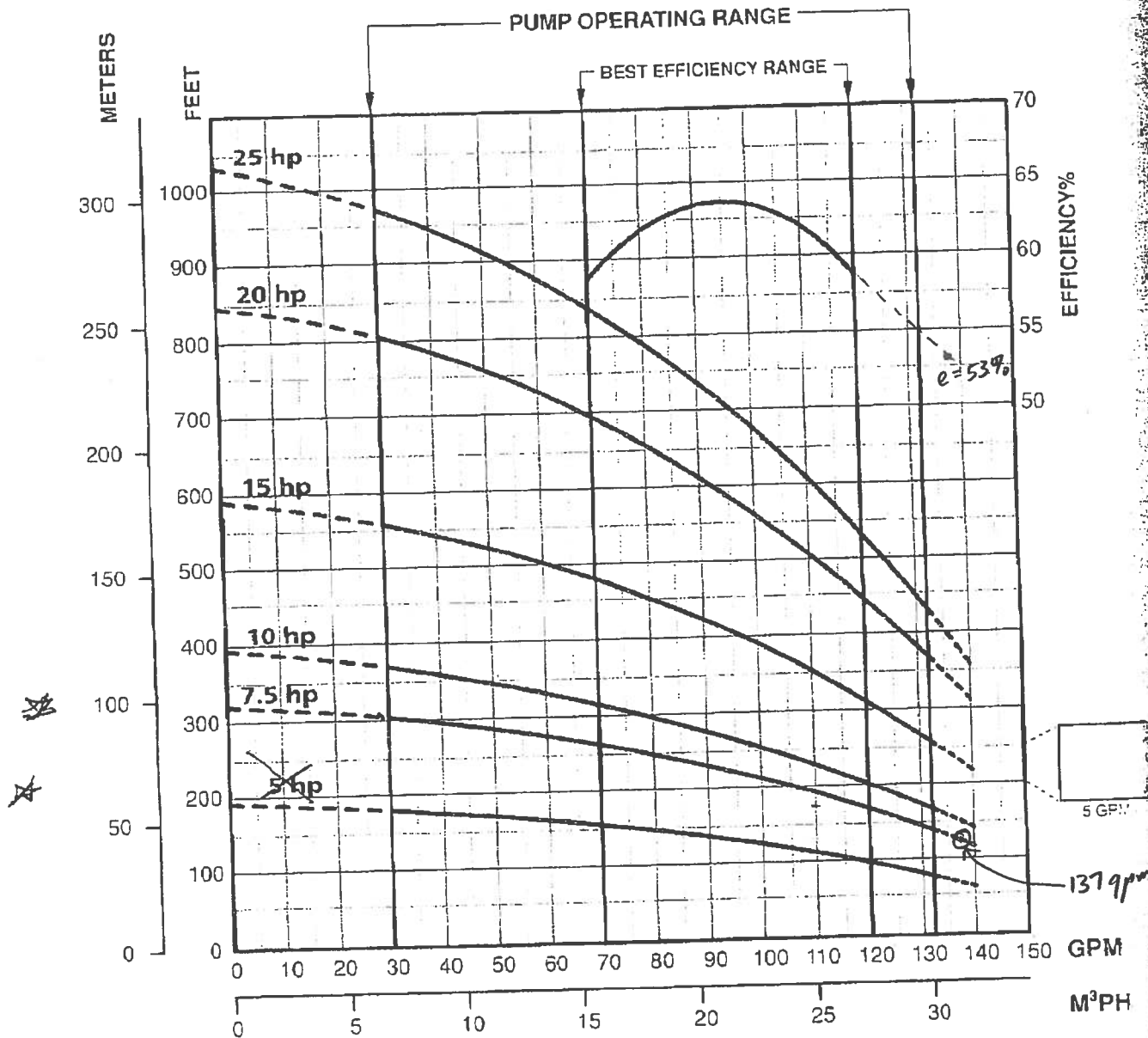
Pump set on 105' of 3" galv. drop pipe

RECEIVED

NOV 30 2009

Submersible Pumps

6" High Capacity Pumps 100 GPM Performance Curves



See Pump curves for both. Installed
~~5 H.P.~~ $7\frac{1}{2}$ H.P. Pump 5.
 Any questions call.

WELL DRAWDOWN ESTIMATION
FLAHERTY RESIDENCE - WITHDRAWAL / INJECTION COUPLET

Drawdown estimated using Theis approach

Point of maximum impact is at house 312 feet west of pumping well

z = drawdown (positive means a lowering of the water table)

Brockway Engineering, PLLC 11/25/09

Hydraulic conductivity	60 ft/day	Pumping rate	113 gpm
Saturated thickness	115 feet	Pumping time	2160 hrs
Transmissivity	51612 gpd/ft	Injection rate	-113 gpm
Storage coefficient	0.15		

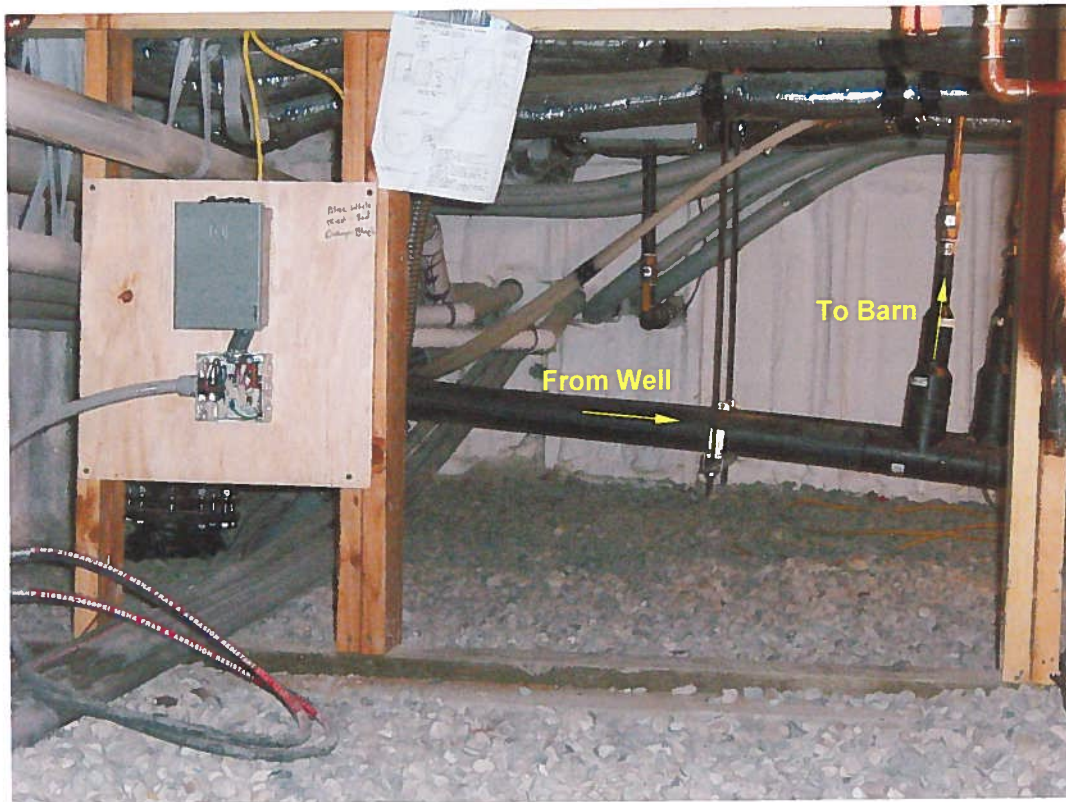
Time (days)	(hrs)	Pumping Well R = 312 feet			Injection Well R = 454 feet			Net effect z (feet)
		u	W(u)	z (feet)	u	W(u)	z (feet)	
0	0	--	--	0.00	--	--	0.00	0.00
3.75	90	1.4E-01	1.517	0.38	3.0E-01	0.909	-0.23	0.15
7.5	180	7.1E-02	2.144	0.54	1.5E-01	1.468	-0.37	0.17
11.25	270	4.7E-02	2.526	0.63	1.0E-01	1.827	-0.46	0.18
15	360	3.5E-02	2.802	0.70	7.5E-02	2.091	-0.52	0.18
18.75	450	2.8E-02	3.019	0.76	6.0E-02	2.299	-0.58	0.18
22.5	540	2.4E-02	3.196	0.80	5.0E-02	2.472	-0.62	0.18
26.25	630	2.0E-02	3.347	0.84	4.3E-02	2.619	-0.66	0.18
30	720	1.8E-02	3.478	0.87	3.7E-02	2.747	-0.69	0.18
33.75	810	1.6E-02	3.594	0.90	3.3E-02	2.861	-0.72	0.18
37.5	900	1.4E-02	3.698	0.93	3.0E-02	2.963	-0.74	0.18
41.25	990	1.3E-02	3.792	0.95	2.7E-02	3.056	-0.77	0.18
45	1080	1.2E-02	3.878	0.97	2.5E-02	3.141	-0.79	0.18
48.75	1170	1.1E-02	3.957	0.99	2.3E-02	3.219	-0.81	0.19
52.5	1260	1.0E-02	4.030	1.01	2.1E-02	3.291	-0.83	0.19
56.25	1350	9.4E-03	4.099	1.03	2.0E-02	3.359	-0.84	0.19
60	1440	8.8E-03	4.163	1.04	1.9E-02	3.422	-0.86	0.19
63.75	1530	8.3E-03	4.223	1.06	1.8E-02	3.482	-0.87	0.19
67.5	1620	7.8E-03	4.279	1.07	1.7E-02	3.538	-0.89	0.19
71.25	1710	7.4E-03	4.333	1.09	1.6E-02	3.591	-0.90	0.19
75	1800	7.1E-03	4.384	1.10	1.5E-02	3.642	-0.91	0.19
78.75	1890	6.7E-03	4.432	1.11	1.4E-02	3.690	-0.93	0.19
82.5	1980	6.4E-03	4.479	1.12	1.4E-02	3.736	-0.94	0.19
86.25	2070	6.1E-03	4.523	1.13	1.3E-02	3.779	-0.95	0.19
90	2160	5.9E-03	4.565	1.15	1.2E-02	3.822	-0.96	0.19
93.75	2250	5.6E-03	4.606	1.16	1.2E-02	3.862	-0.97	0.19



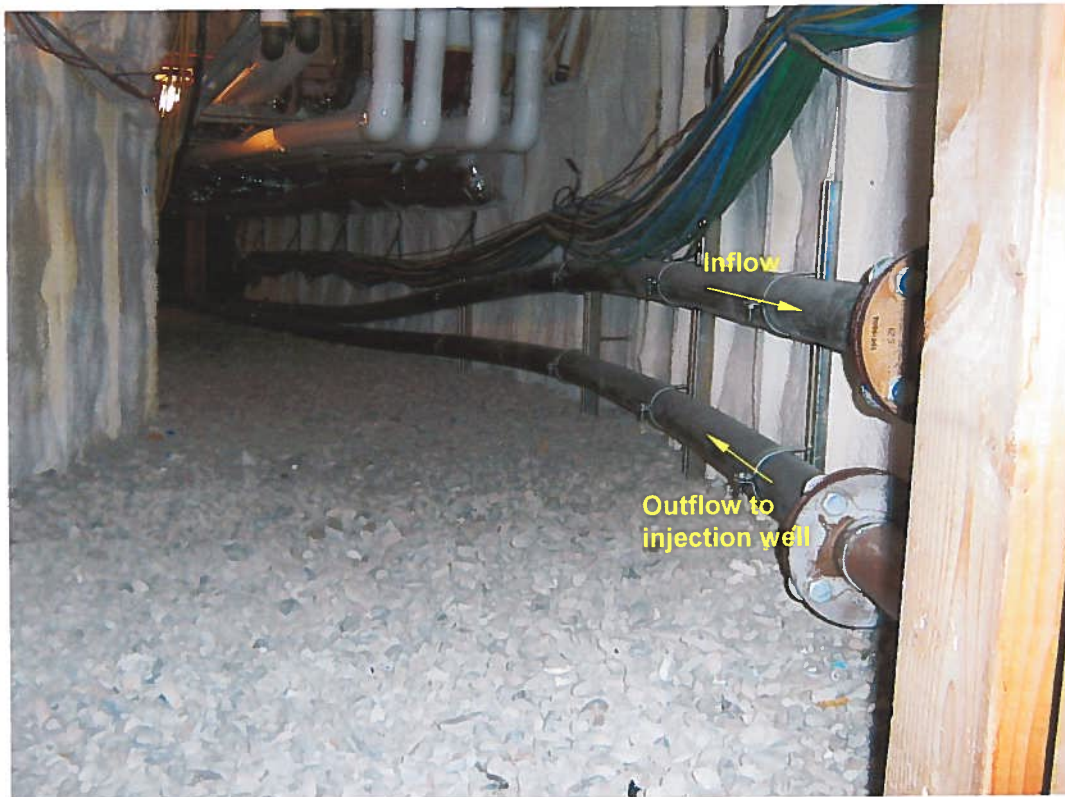
Withdrawal well, looking northeast with residential complex in background



Injection well



Pipe from well entering crawl space.



Diversion and return pipes in crawl space just before transition to copper



Pump controller – 3 phase converter and VFD



Variable-frequency drive



Inlet pressure and sensor for VFD



Piping in dedicated utility room showing five heat pumps, pump controller at extreme left



Piping at rear of heat pumps



Heat exchanger for cooling



Heat exchangers and booster pumps



Supplemental natural gas-fired boilers



Heat exchanger system for pool and spa



Heat exchanger system for barn



Example of pavement snowmelting (main entrance to house)



Tennis court with house in background and barn on extreme right. Wells are to the left of the photo



Residence looking southeast



Pool and spa



Barn