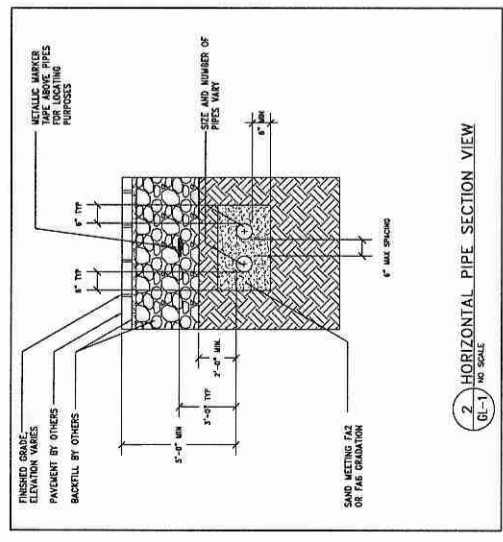
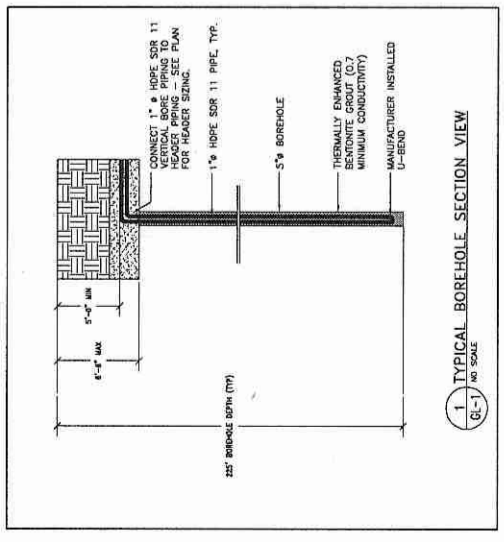


- GROUND LOOP NOTES:**
1. PROVIDE 4 VERTICALLY INSTALLED GROUND LOOP HEAT EXCHANGERS TO SERVE THE NEW GSHP SYSTEM.
 2. LOOP FIELD SHALL BE 20' X 20'.
 3. COORDINATE FINAL HOLE LAYOUT WITH SITE CONDITIONS.
 4. VERTICAL PIPING SHALL BE 1" DUCTILE IRON PIPE FULL DEPTH THERMALLY ENHANCED BENTONITE GROUT (THERMAL CONDUCTIVITY OF 0.7 OR HIGHER). SHALL BE MANUFACTURED AND TESTED PER GSHPA STANDARDS AND SHALL BE GSHPA 508-11.
 5. ALL PIPE JOINTS SHALL BE MADE BY GSHPA ARTI-FREEZE SOLUTION SHALL BE A 20K BY VOLUME PROPYLENE GLYCOL.



REVISIONS

DATE	PURPOSE
02/19/11	CONSTR./PERMIT
04/19/11	PERMIT REVISION

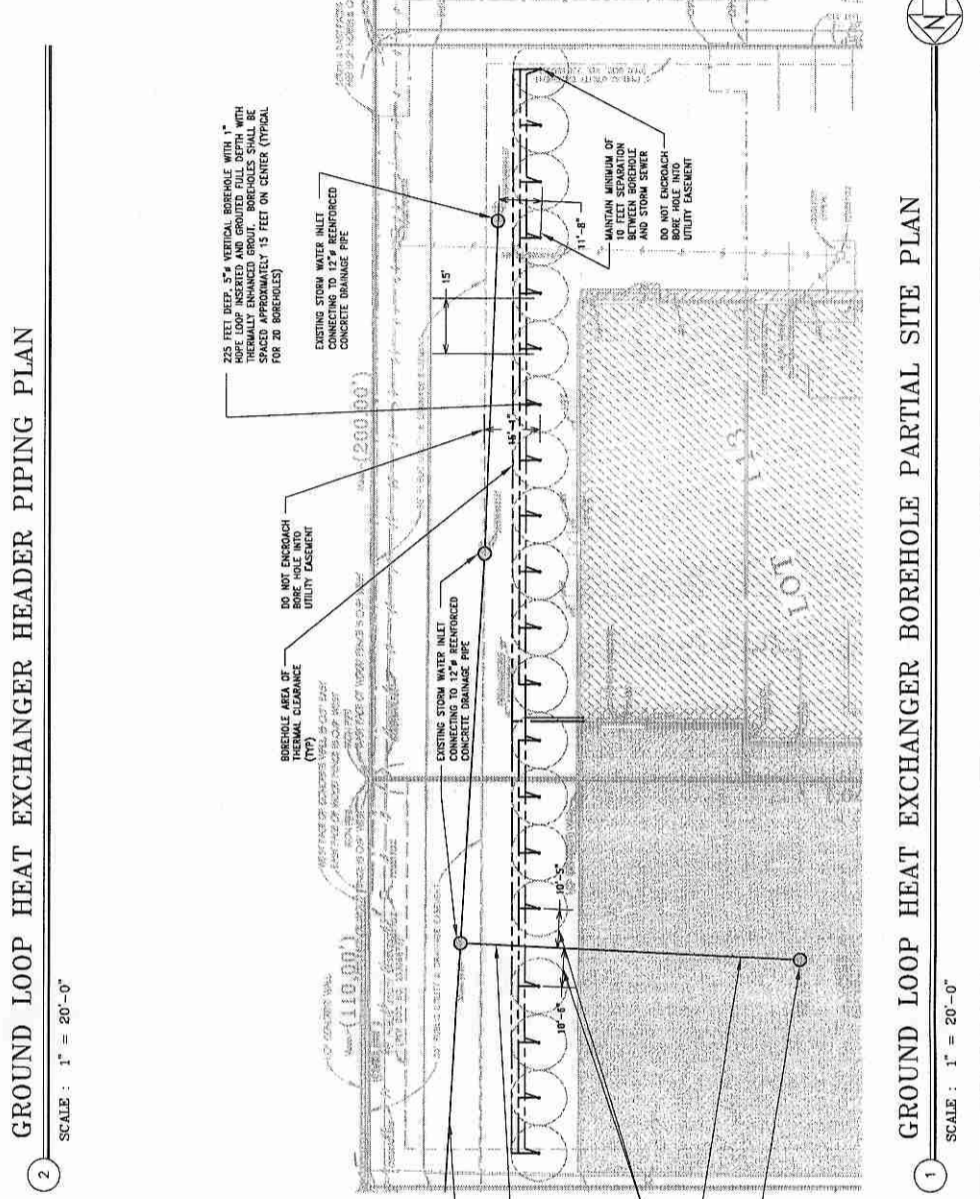
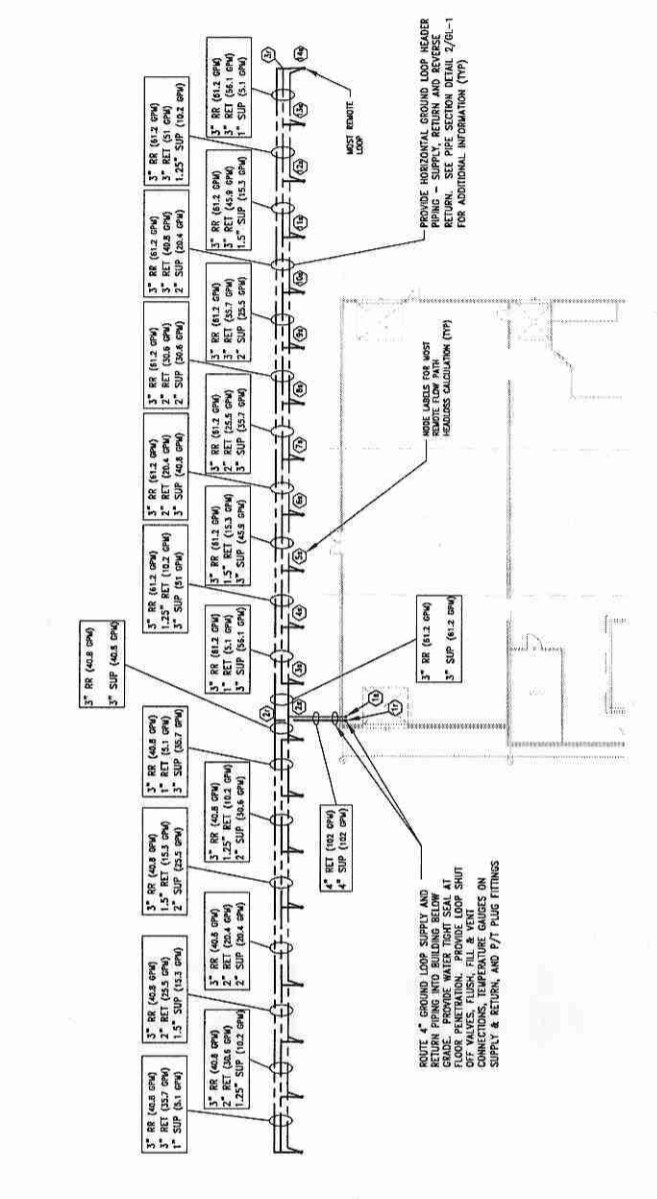
ARCHITECTURAL CONSULTING ENGINEERS
 HVAC ■ Life-Safe Buildings ■ Geo-Thermal ■ Sustainable Design
 Oak Park, Illinois 60472
 Tel: 708.524.0272 Fax: 708.524.5114

RENOVATION FOR:
 MADISON CONSTRUCTION COMPANY
 1667 SOUTH 70TH CT
 ORLAND PARK, ILLINOIS

DRAWING: GROUND LOOP HEAT EXCHANGER BOREHOLE PLAN

DATE: 02/13/11
 DESIGN: MEN
 DRAWN: DAN
 CHECK: MEN

PROJECT NO. 11109
 SHEET NUMBER: GL-1



HEAD LOSS FOR 20% FRICTION IN GROUND LOOP VOLUME AT 20°F (Proposed Construction Detail)

Flow Rate (gpm)	Flow Rate (ft³)	Friction Length (ft)	Equivalent Length (ft)	Nominal Inside Diameter (in)	Hydraulic Factor	20% P. Gyr'd Factor	Head Loss (ft)	
35	22.00	20	1.25	2.500	1.15	0.885	1.15	0.33
35	22.00	40	2.50	2.500	1.15	0.885	1.15	0.33
35	22.00	60	3.75	2.500	1.15	0.885	1.15	0.33
35	22.00	80	5.00	2.500	1.15	0.885	1.15	0.33
35	22.00	100	6.25	2.500	1.15	0.885	1.15	0.33
35	22.00	120	7.50	2.500	1.15	0.885	1.15	0.33
35	22.00	140	8.75	2.500	1.15	0.885	1.15	0.33
35	22.00	160	10.00	2.500	1.15	0.885	1.15	0.33
35	22.00	180	11.25	2.500	1.15	0.885	1.15	0.33
35	22.00	200	12.50	2.500	1.15	0.885	1.15	0.33
35	22.00	220	13.75	2.500	1.15	0.885	1.15	0.33
35	22.00	240	15.00	2.500	1.15	0.885	1.15	0.33
35	22.00	260	16.25	2.500	1.15	0.885	1.15	0.33
35	22.00	280	17.50	2.500	1.15	0.885	1.15	0.33
35	22.00	300	18.75	2.500	1.15	0.885	1.15	0.33
35	22.00	320	20.00	2.500	1.15	0.885	1.15	0.33
35	22.00	340	21.25	2.500	1.15	0.885	1.15	0.33
35	22.00	360	22.50	2.500	1.15	0.885	1.15	0.33
35	22.00	380	23.75	2.500	1.15	0.885	1.15	0.33
35	22.00	400	25.00	2.500	1.15	0.885	1.15	0.33
35	22.00	420	26.25	2.500	1.15	0.885	1.15	0.33
35	22.00	440	27.50	2.500	1.15	0.885	1.15	0.33
35	22.00	460	28.75	2.500	1.15	0.885	1.15	0.33
35	22.00	480	30.00	2.500	1.15	0.885	1.15	0.33
35	22.00	500	31.25	2.500	1.15	0.885	1.15	0.33
35	22.00	520	32.50	2.500	1.15	0.885	1.15	0.33
35	22.00	540	33.75	2.500	1.15	0.885	1.15	0.33
35	22.00	560	35.00	2.500	1.15	0.885	1.15	0.33
35	22.00	580	36.25	2.500	1.15	0.885	1.15	0.33
35	22.00	600	37.50	2.500	1.15	0.885	1.15	0.33
35	22.00	620	38.75	2.500	1.15	0.885	1.15	0.33
35	22.00	640	40.00	2.500	1.15	0.885	1.15	0.33
35	22.00	660	41.25	2.500	1.15	0.885	1.15	0.33
35	22.00	680	42.50	2.500	1.15	0.885	1.15	0.33
35	22.00	700	43.75	2.500	1.15	0.885	1.15	0.33
35	22.00	720	45.00	2.500	1.15	0.885	1.15	0.33
35	22.00	740	46.25	2.500	1.15	0.885	1.15	0.33
35	22.00	760	47.50	2.500	1.15	0.885	1.15	0.33
35	22.00	780	48.75	2.500	1.15	0.885	1.15	0.33
35	22.00	800	50.00	2.500	1.15	0.885	1.15	0.33
35	22.00	820	51.25	2.500	1.15	0.885	1.15	0.33
35	22.00	840	52.50	2.500	1.15	0.885	1.15	0.33
35	22.00	860	53.75	2.500	1.15	0.885	1.15	0.33
35	22.00	880	55.00	2.500	1.15	0.885	1.15	0.33
35	22.00	900	56.25	2.500	1.15	0.885	1.15	0.33
35	22.00	920	57.50	2.500	1.15	0.885	1.15	0.33
35	22.00	940	58.75	2.500	1.15	0.885	1.15	0.33
35	22.00	960	60.00	2.500	1.15	0.885	1.15	0.33
35	22.00	980	61.25	2.500	1.15	0.885	1.15	0.33
35	22.00	1000	62.50	2.500	1.15	0.885	1.15	0.33
35	22.00	1020	63.75	2.500	1.15	0.885	1.15	0.33
35	22.00	1040	65.00	2.500	1.15	0.885	1.15	0.33
35	22.00	1060	66.25	2.500	1.15	0.885	1.15	0.33
35	22.00	1080	67.50	2.500	1.15	0.885	1.15	0.33
35	22.00	1100	68.75	2.500	1.15	0.885	1.15	0.33
35	22.00	1120	70.00	2.500	1.15	0.885	1.15	0.33
35	22.00	1140	71.25	2.500	1.15	0.885	1.15	0.33
35	22.00	1160	72.50	2.500	1.15	0.885	1.15	0.33
35	22.00	1180	73.75	2.500	1.15	0.885	1.15	0.33
35	22.00	1200	75.00	2.500	1.15	0.885	1.15	0.33
35	22.00	1220	76.25	2.500	1.15	0.885	1.15	0.33
35	22.00	1240	77.50	2.500	1.15	0.885	1.15	0.33
35	22.00	1260	78.75	2.500	1.15	0.885	1.15	0.33
35	22.00	1280	80.00	2.500	1.15	0.885	1.15	0.33
35	22.00	1300	81.25	2.500	1.15	0.885	1.15	0.33
35	22.00	1320	82.50	2.500	1.15	0.885	1.15	0.33
35	22.00	1340	83.75	2.500	1.15	0.885	1.15	0.33
35	22.00	1360	85.00	2.500	1.15	0.885	1.15	0.33
35	22.00	1380	86.25	2.500	1.15	0.885	1.15	0.33
35	22.00	1400	87.50	2.500	1.15	0.885	1.15	0.33
35	22.00	1420	88.75	2.500	1.15	0.885	1.15	0.33
35	22.00	1440	90.00	2.500	1.15	0.885	1.15	0.33
35	22.00	1460	91.25	2.500	1.15	0.885	1.15	0.33
35	22.00	1480	92.50	2.500	1.15	0.885	1.15	0.33
35	22.00	1500	93.75	2.500	1.15	0.885	1.15	0.33
35	22.00	1520	95.00	2.500	1.15	0.885	1.15	0.33
35	22.00	1540	96.25	2.500	1.15	0.885	1.15	0.33
35	22.00	1560	97.50	2.500	1.15	0.885	1.15	0.33
35	22.00	1580	98.75	2.500	1.15	0.885	1.15	0.33
35	22.00	1600	100.00	2.500	1.15	0.885	1.15	0.33
35	22.00	1620	101.25	2.500	1.15	0.885	1.15	0.33
35	22.00	1640	102.50	2.500	1.15	0.885	1.15	0.33
35	22.00	1660	103.75	2.500	1.15	0.885	1.15	0.33
35	22.00	1680	105.00	2.500	1.15	0.885	1.15	0.33
35	22.00	1700	106.25	2.500	1.15	0.885	1.15	0.33
35	22.00	1720	107.50	2.500	1.15	0.885	1.15	0.33
35	22.00	1740	108.75	2.500	1.15	0.885	1.15	0.33
35	22.00	1760	110.00	2.500	1.15	0.885	1.15	0.33
35	22.00	1780	111.25	2.500	1.15	0.885	1.15	0.33
35	22.00	1800	112.50	2.500	1.15	0.885	1.15	0.33
35	22.00	1820	113.75	2.500	1.15	0.885	1.15	0.33
35	22.00	1840	115.00	2.500	1.15	0.885	1.15	0.33
35	22.00	1860	116.25	2.500	1.15	0.885	1.15	0.33
35	22.00	1880	117.50	2.500	1.15	0.885	1.15	0.33
35	22.00	1900	118.75	2.500	1.15	0.885	1.15	0.33
35	22.00	1920	120.00	2.500	1.15	0.885	1.15	0.33
35	22.00	1940	121.25	2.500	1.15	0.885	1.15	0.33
35	22.00	1960	122.50	2.500	1.15	0.885	1.15	0.33
35	22.00	1980	123.75	2.500	1.15	0.885	1.15	0.33
35	22.00	2000	125.00	2.500	1.15	0.885	1.15	0.33
35	22.00	2020	126.25	2.500	1.15	0.885	1.15	0.33
35	22.00	2040	127.50	2.500	1.15	0.885	1.15	0.33
35	22.00	2060	128.75	2.500	1.15	0.885	1.15	0.33
35	22.00	2080	130.00	2.500	1.15	0.885	1.15	0.33
35	22.00	2100	131.25	2.500	1.15	0.885	1.15	0.33
35	22.00	2120	132.50	2.500	1.15	0.885	1.15	0.33
35	22.00	2140	133.75	2.500	1.15	0.885	1.15	0.33
35	22.00	2160	135.00	2.500	1.15	0.885	1.15	0.33
35	22.00	2180	136.25	2.500	1.15	0.885	1.15	0.33
35	22.00	2200	137.50	2.500	1.15	0.885	1.15	0.33
35	22.00	2220	138.75	2.500	1.15	0.885	1.15	0.33
35	22.00	2240	140.00	2.500	1.15	0.885	1.15	0.33
35	22.00	2260	141.25	2.500	1.15	0.885	1.15	0.33
35	22.00	2280	142.50	2.500	1.15	0.885	1.15	0.33
35	22.00	2300	143.75	2.500	1.15	0.885	1.15	0.33
35	22.00	2320	145.00	2.500	1.15	0.885	1.15	0.33
35	22.00	2340	146.25	2.500	1.15	0.885	1.15	0.33
35	22.00	2360	147.50	2.500	1.15	0.885	1.15	0.33
35	22.00	2380	148.75	2.500	1.15	0.885	1.15	0.33
35	22.00	2400	150.00	2.500	1.15	0.885	1.15	0.33
35	22.00	2420	151.25	2.500	1.15	0.885	1.15	0.33
35	22.00	2440	152.50	2.500	1.15	0.885	1.15	0.33
35	22.00	2460	153.75	2.500	1.15	0.885	1.15	0.33
35	22.00	2480	155.00	2.500	1.15	0.885	1.15	0.33
35	22.00	2500	156.25	2.500	1.15	0.885	1.15	0.33
35	22.00	2520	157.50	2.500	1.15	0.885	1.15	0.33
35	22.00	2540	158.75</					