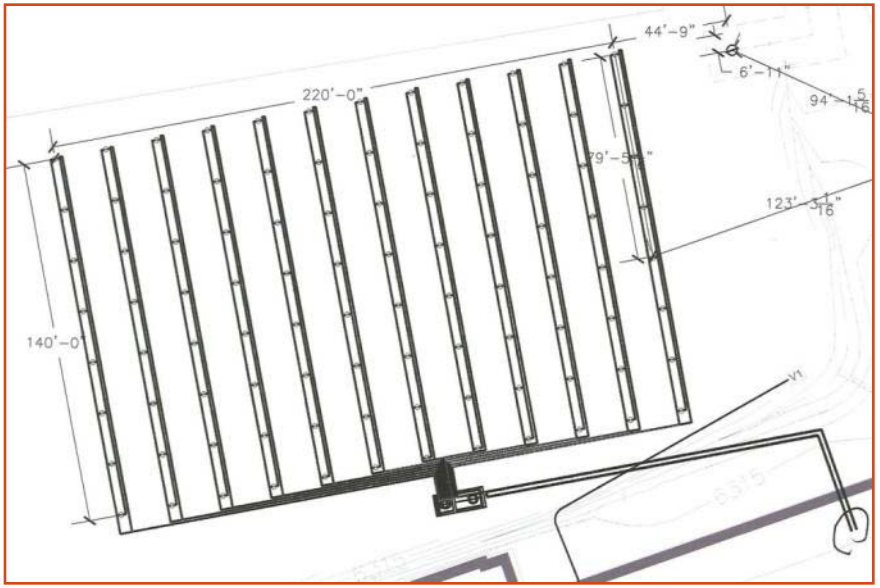
CNCC Craig Campus Geothermal Project – Craig, Colorado

96-well closed loop GHP well field
to provide geothermal energy as a common utility for a new community college campus.

Dr. John Boyd, President CNCC

Overview

- Project Conceptual Development
- Energy Audit Findings – *Justifies GHP vs. Traditional HVAC*
- Design and Construction of Well Field
- Campus Construction
- Monitoring & Reporting

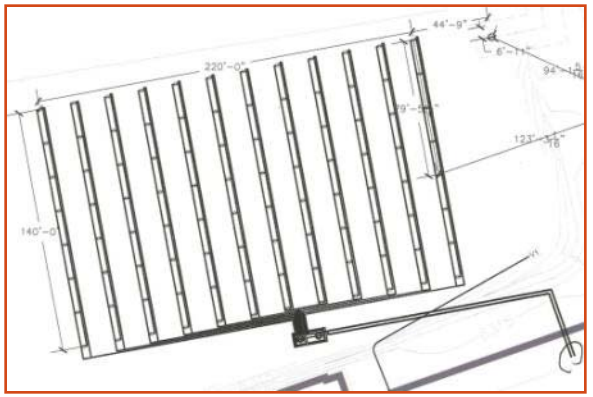


Project Conceptual Development

- CNCC working with ESCO Chevron Energy Solutions on Energy Performance Contract for Rangely, CO main campus.
- Chevron suggested feasibility study of GHP technology for new Craig Campus and conducted energy analysis modeling with Architect and Engineers.
- Grant application was successful.

Energy Audit Findings

- Test Well Resulted in Formation Thermal Conductivity = 1.28 Btu/hr-ft-°F
- Compared Economics of GHP with Traditional HVAC design. Analysis used engineering design data with Trace 700 modeling.
  - Results: GHP Closed-loop vertical well configuration life-cycle cost analysis result was positive.
- GHP system for Academic Building and the Career Technical Center buildings requires loop water flow of 1,050 gpm.
- Initial well field configuration was 82-wells @ 400-ft deep, but final design is 96-wells @ 375-ft deep.



Energy Audit Findings

- Energy Analysis demonstrated the following results:
  Alternative 1: "Baseline" traditional HVAC
  Alternative 2: GHP System with Rooftop Unit approach

ENERGY COMPARISON			
	Description	Electric Energy Use (kwh)	Natural Gas Use (kbtu)
Alternative	Annual Use		
1	Baseline (ASHRAE 90.1-04 Bldg)	926,791	2,372,539
2	GSHP (RTU Approach)	712,520	169,053

HEATING / COOLING LOAD COMPARISON			
	Peak Cooling (tons)	Block Cooling (tons)	Peak Heating (Mbh)
Alternative			
1	204.4	138.3	3,233.3
2	135.2	135.2	3,010.8

Energy Audit Findings

- Cost Savings

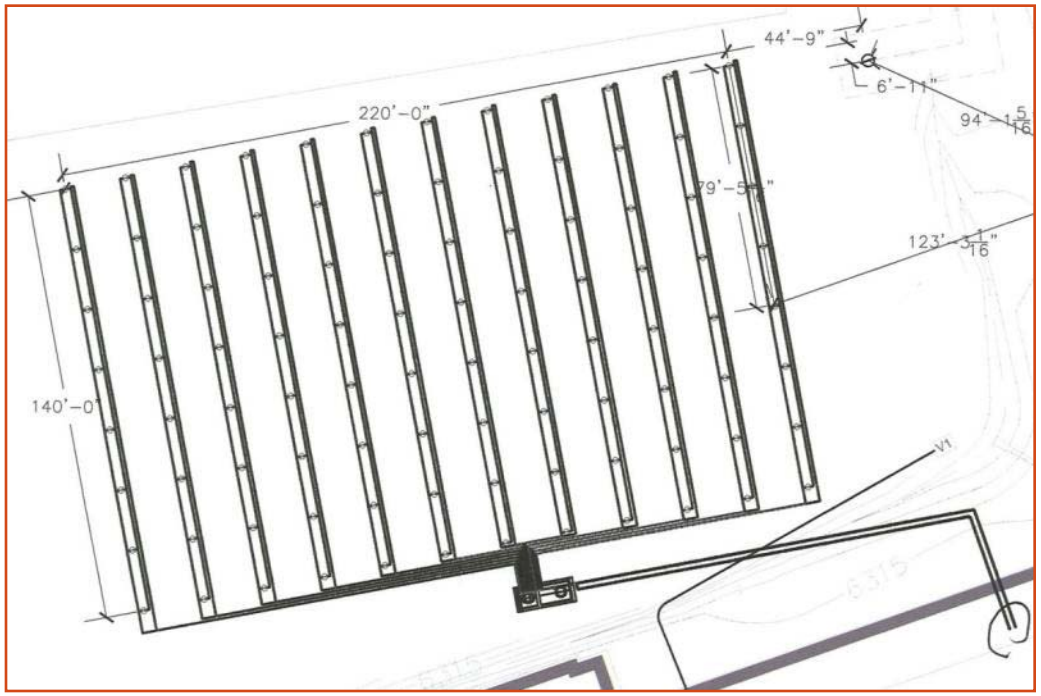
		Electric Energy Use ($)	Natural Gas Use ($)	Electric Demand ($)	Totals ($)
Alternative	Cost Savings				
1	Baseline (ASHRAE 90.1-04 Bldg)	$ -	$ -	$ -	$ -
2	GSHP (RTU Approach)	$ 18,524	$ 19,311	$ -	$ 37,835

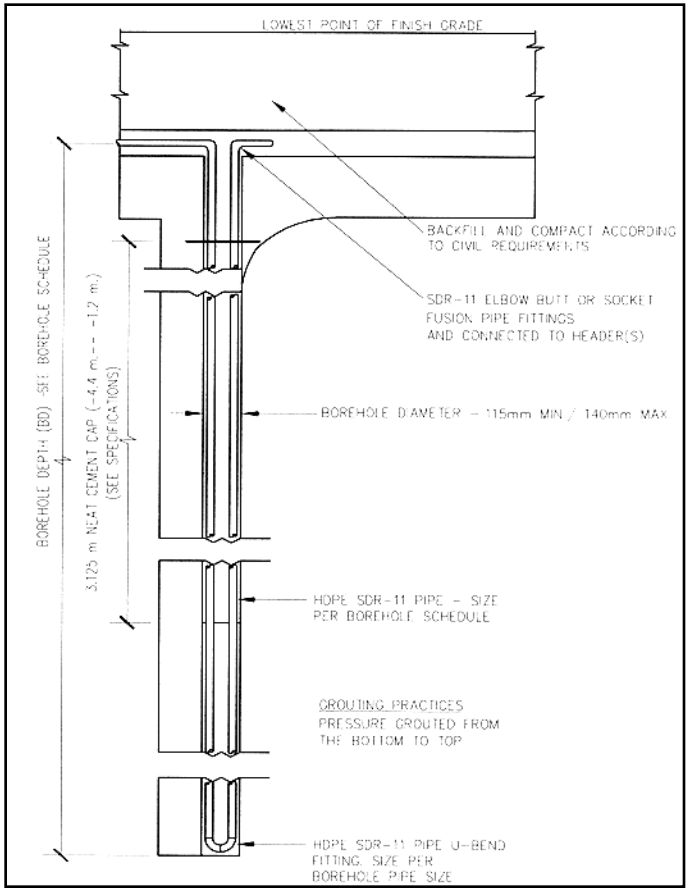
- Emissions

ENVIRONMENTAL IMPACT COMPARISON			
Emissions	CO2 (lbm/yr)	SO2 (gm/yr)	Nox (gm/yr)
Alternative			
1	2,995,721	4,039	4,528
2	2,317,546	3,125	3,503
Reductions	CO2 (lbm/yr)	SO2 (gm/yr)	Nox (gm/yr)
Alternative			
1	-	-	-
2	678,175	914	1,025

Design and Construction of Well Field

- Well Field Construction commenced March 2010 and is nearly complete.
- 96-Wells, 375-feet deep.





Design and Construction of Well Field

Campus Buildings Construction

LEARNING RESOURCE CENTER / SOUTHERN ENTRY

Campus Buildings Construction

EAST ENTRY / CAREER TECH

Monitoring & Reporting

Summary of Data to be gathered for Analysis:

Academic Building

- Whole building electric meter (kWh & kW).
- Whole building natural gas meter (Therms).

Career Tech Building

- Whole building electric meter (kWh & kW).
- Whole building natural gas meter (Therms).

GSHP Loop:

- Combined supply loop temperature supply (°F).
- Combined return loop temperature return (°F).
- Combined loop flow (GPM).

- Data from these meters can be used on an on-going basis to identify GSHP loop efficiency