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Mechanical Option
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York, PA
3/25/2011

Presentation Outline

I. Project Background
    a. Project Team and Building Stats (1)
        i. Project team: Architect, Engineers
        ii. Building Stats: stories, area, cost, location
    b. Building Layout (2)
        i. Basic floor layout
II. Existing Mechanical Summary
    a. Mechanical Room (1)
        i. Chiller, Boilers
    b. Office Floors (1)
        i. AHU's, VAV
    c. Classroom/Lab Floors(1)
        i. AHU's, FCU
    d. Greenhouse Building(1)
        i. FCU, WIH, etc.
III. Design Objectives (1)
    a. Lower Energy Consumption
    b. Reduce system cost/maintenance
    c. Comparison of system performance
IV. Ground Source Heat Pumps (14-15)
    a. Heating/Cooling Separate studies
    b. Borehole Sizing/layout
    c. Energy Consumption/Cost
    d. Construction Breadth
        i. Borehole cost, Life Cycle cost
        ii. Construction Schedule Change
V. Chilled Beams (4)
    a. Energy Consumption/Cost
    b. Run around Coil System
VI. System Comparison (4)
    a. Energy Consumption/Cost differences between new and as-designed
    b. Final Thoughts/Recommendations
VII. Acknowledgements (1)

About 31-32 slides

APPELL LIFE SCIENCES

York College of Pennsylvania

Joshua Martz | Dr. Srebric | April, 11 2011

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- EXISTING MECHANICAL SUMMARY
- DESIGN OBJECTIVES
- GROUND SOURCE HEAT PUMPS
- CHILLED BEAMS
- SYSTEM COMPARISON
- ACKNOWLEDGEMENTS

Project Background

Project Team

Owner:	York College of Pennsylvania
Architect:	RLPS, Ltd.
CM:	Kinsley Construction
Structural:	Macintosh Engineering
Civil:	LSC Design, Inc.
MEP:	JDB Engineering

Project Information

Size:	102,000 SF
Location:	York, Pa
Cost:	$16 million
Stories:	3/Basement
Construction Date:	January 2010-August 2011
Delivery Method:	D-B-B/CM gives GMP

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Borehole Sizing

Cooling Length:

$$L_c = \frac{q_a * R_{ga} + (q_{lc} - 3.41W_c)(R_b + PLF_m * R_{gm} + R_{gd} * F_{sc})}{t_g - \frac{t_{wi} - t_{wo}}{2} - t_p}$$

Heating Length:

$$L_h = \frac{q_a * R_{ga} + (q_{lh} - 3.41W_h)(R_b + PLF_m * R_{gm} + R_{gd} * F_{sc})}{t_g - \frac{t_{wi} - t_{wo}}{2} - t_p}$$

Design Information

Cooling Design Information			
Entering Water Temperature (F)	Leaving Water Temperature (F)	Cooling Load (Btu/hr)	Borehole Length (ft)
75	85	1594800	12615

Heating Design Information			
Entering Water Temperature (F)	Leaving Water Temperature (F)	Cooling Load (Btu/hr)	Borehole Length (ft)
50	40	1260563	14204

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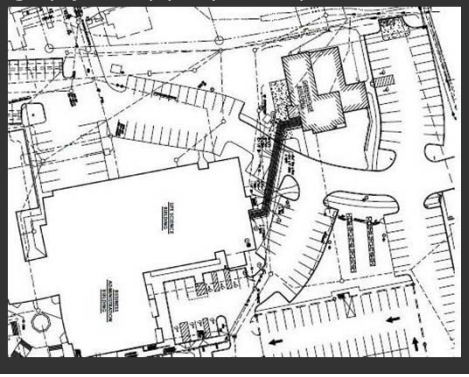
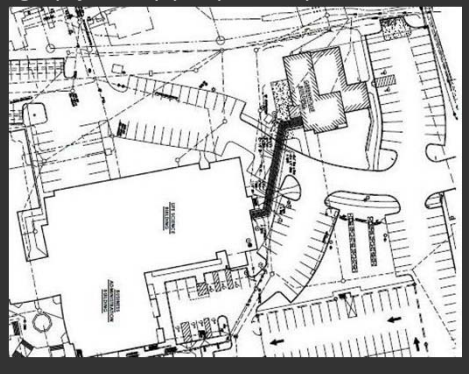
Borehole Layout

Cooling: (layout of pipes per AHU)



Heating: (layout of pipes per AHU)



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Borehole Optimization

Assumptions

Pipe: 1” High Density Polyethylene (HDPE)
- $0.69/ft (40 ft lengths)
- Welding
  - $4.79/weld
  - $40.25/day per machine
- Grout:
  - Cooling: $2775
  - Heating: $3125

Earth Auger Data		
Length Feet	Daily Output Feet/day	Rental $/week
$L_{bore}<225$	1800	12,190
$225<L_{bore}<325$	1200	14,840
$L_{bore}>325$	900	16,960

Cooling:

Chart of Best Option for Boreholes

Heating:

Chart of Best Option for Boreholes