

## Executive Summary:

This senior thesis is based upon analysis and research performed over the fall and spring semesters. It is based upon the original mechanical systems design of Mueller Associates. Their design was used as the base case for my mechanical analysis of the building. The entire building was simulated using Trane's TRACE 700 energy simulation program. Once the building was entered the program was run with the original configuration of air handling units connected to VAV boxes all supported by a chilled water plant and heating water plant. Next the simulation was run using zone mounted heat pumps connected to a runaround loop. The heating and cooling loads from this simulation were then entered into RETScreen International's Ground-Source Heat Pump Project Model to obtain the amount of the geothermal heat exchange piping required to meet these loads. This program was run in two configurations, one to meet the cooling needs and the other to meet the heating needs. Ultimately the heating demand loop field was chosen in conjunction with a cooling tower. This hybrid system provides the energy savings of the geothermal system for the majority of the year and utilizes the cooling capacity of the cooling tower during peak loads.

Through a construction management analysis this hybrid system provided a lower present value and did not have any major impact on the constructability of the building. Major equipment and system components were the basis for the first cost analysis. Energy consumption based upon the TRACE simulation provided a life cycle cost. These two financial analyses were then entered into the Engineering Economic Analysis by Carrier to provide a present worth value for both systems. Through my analysis it was determined that the proposed geothermal system had a present value that was \$840,640.00 lower than the base case. Through my site and schedule evaluation it was determined that the proposed geothermal system would not have a negative impact on the constructability of the building project.