Executive Summary

The Army Administration Facility is a new government office building located in the heart of the mid-Atlantic region, serving as a Command Headquarters for the U.S. Army. The 97,000 square foot facility will house approximately 400 personnel of the U.S. Army Legal Service Agency (USALSA) and JAG Corps. The purpose of this report is to analyze alternative solutions to the mechanical systems in the Army Administration Facility to assess possible benefits in first or annual utility costs, efficiencies, or energy consumption. Additional investigations into two non-mechanical breadth topics were also conducted. A Trane TRACE™ 700 Version 6.2 model was used to perform the energy load analysis and energy consumption per the actual design values provided in the design documents submitted by the mechanical engineers at Southland Industries. The model constructed of the existing systems was then used as a means of comparison for the mechanical redesigns.

The alternative topics of study in this report include installing a geothermal heat pump to handle the heating and cooling loads. The heating coils used throughout the Army Administration Facility are supplied by (2) gas-fired boilers and the cooling coils are fed by an evaporative condensing chiller. The replacement of the heating and cooling sources with a geothermal system decreased the annual energy usage by 4% but increased the annual utility costs by 5% due to the additional costs of electricity over natural gas. With an added initial investment of $41,170 to install the system, a ground-source heat pump system would not be recommended for this facility.

An alternative depth study was also analyzed to test the benefits provided by a chilled water thermal storage system. In conjunction with the evaporative condensing chiller, a thermal storage system could be implemented to utilize a chiller that creates and stores chilled water in a storage tank during cheaper off-peak hours to be used during peak loads. Both partial and full storage cycles were analyzed and concluded that partial storage would provide the most benefits saving 672,055 kBtu/yr and thus roughly $50,000 annually over the existing system. With an initial investment of $466,093, the partial storage system can expect to see a payback after 7 years. The full storage system saved 259,474 kBtu/yr and $39,263 annually over the existing system. With an initial investment of $527,693, the full storage system would expect to see a payback after 10 years.

Among the geothermal system, full storage and partial storage thermal storage systems, the partial storage yielded the most economical results and would be a valuable alternative.

The two breadths evaluated in this report include an acoustical and an architectural analysis. For the acoustical breadth, sound attenuation calculations through the wall between the penthouse and the adjacent offices were performed and determined that the noise criterions in the occupied spaces are acceptable per industry standards. However, if there was a desire for lower sound levels, the use of Green Glue or moving the penthouse to the roof are viable options. For the architectural breadth, the penthouse was moved to the fourth floor roof and the area where the penthouse was located was enclosed, gaining 2,700 SF of occupiable space. The ceiling heights were also raised to allow for more plenum space and a screening device was designed to hide the now visible penthouse. The stratified thermal storage tank was incorporated into the parking garage and is now an architectural feature.