Summary and Conclusions

The Lighting Depth Study looked at the redesign of four main spaces in the existing Grand Oaks Assisted Living Facility. All space met the design criteria that was established and referenced from the IESNA and ASHRA 90.1. The overall lighting program provides an atmosphere that maintains and elegant residential ambiance to the given spaces. The lighting control scheme provides system flexibility while giving personal control, something which one has at their own home. The ISO-LINE figures, Pseudo Color, and Renderings show how the lighting design performs and gives an artistic representation of what the spaces could look like if the design were to be implemented.

The Mechanical Feasibility Study's purpose was to look at the energy savings that might be realized by installing a 2-pipe geothermal heat pump system in place of the Current System, which utilizes 4-pipe fan coil units that receive chilled water supply from a roof-top air cooled chilling unit, and heating hot water supply from two medium pressure steam-to-water converters. The theory behind the geothermal system makes it something of interest to study. The ability to use the relatively constant temperature of the ground as a source of energy makes a strong case when looking at the energy savings a system of this type could afford. As noted, several assumptions had to be made, but with the support and reasons that I gave for making these assumptions, I feel that they are sound, and at times conservative. The final design that I propose will make use of (89) water-to-air heat pumps that are of the size of 1-2 tons, and (2) 20 ton water-to-water heat pumps that satisfy the needs of the Energy Recovery Air Handling Unit. The ground loop will consist of 200 vertically drilled wells, assuming 1-ton capacity per well, spaced 12-feet apart and located under the building foundation. Each well will be filled with U-bent Polyethylene pipe and then back filled with a grouting material. The 2-pipe horizontal loop will be housed on the fourth floor with vertical pipe risers supplying the subsequent lower floors where the various heat pumps are located in individual tenant suites. The current design for condensate return piping will be maintained, and heat pumps will be outfitted with a condensate pipe connection. To avoid any mold or bacteria build up during summer months, when there may be a constant moisture condition present in the condensate pan, the heat pumps will have 13 watt - ultraviolet light that turns on for 15 minutes a day, thereby killing any mold or bacteria spores.

After comparing the two energy bills, it can be seen that the Geothermal System that I propose has the potential to save around $3900/month during the summer billing rate structure, while in the winter month, it could cost around $1600/month more to operate. The geothermal heat-pump design is likely to have a higher initial cost than the current system, but with the suggested energy savings this high initial cost could be offset by annual energy savings afforded by my proposed system. The cost analysis for this system can be found in the Construction Management Report found in the pages to follow. The implications of my proposed mechanical

system offer the opportunity to explore a different electrical distribution method to the Assisted Living Facility Addition. With the elimination of the roof top chiller, I eliminate a major piece of equipment that previously influenced the electrical distribution system.

The Electrical Depth Study: The existing design extended four normal power feeders from the existing, 2000 amp Switchboard, two of those feeders served Elevators #4 and #5, one of those feeders served a 180kw Roof Top Rotary Screw Chilling Unit, and one served the 600A MDP. With my proposed mechanical design, the Roof Top Chiller was eliminated, thereby removing any concern for a sage in the electrical voltage seen by other equipment in the building during the Chiller start-up period. It is assumed based on the characteristics of the heat-pumps, which were thoroughly explain in the Mechanical Feasibility Study, that at no time will they *all* be operating, starting, or stopping. However, with the Chiller running at full capacity during the extreme design days, i.e. – a very hot and humid day, pulling 180kw of power, a large strain would have been placed on my design by only extending one normal power feeder to a MDP. Therefore, by re-evaluating the Mechanical System and suggesting an alternative method for heating and cooling, I was able to reduce the cost associated with the Electrical Distribution System, and save approximately $61,250.

The Construction Management Breadth Study found the higher initial cost of the Geothermal System can be offset by the amount of money it saves in electricity cost on a yearly basis. With the assumptions I made in the Mechanical Feasibility Study, two annual electric bills could be developed from which I could suggest a possible payback period of 4 ½ - 7 ½ years on the higher initial investment in the Geothermal System. I also found that the Net Present Value of the electric savings could be from $115,000 - $331,000 over a 25 year projected life; and that the investment in the Geothermal System could yield a 13% - 22.5% Rate of Return. Because the Assisted Living Facility Addition has yet to be built, I had to make some assumptions about the electric bills that each of the two mechanical systems might produce. But, given my assumptions, I feel that this cost analysis demonstrates the potential savings that could be offered by the proposed Geothermal System.