3.0 Executive Summary:

This thesis report develops redesigns for South Jefferson High School. The high school is a two story 200,000 square foot secondary education facility. The main objective of the redesigns is green design. The focal point of green design is to utilize mechanical systems that reduce energy consumption and emission, while maintaining a short life cycle payback. A secondary objective is to improve the building's indoor air quality, providing conditions that will increase student performance.

The mechanical depth portion of this report includes detailed analysis on several energy efficient design alternatives. The design alternatives include replacing existing direct expansion equipment with a more energy efficient VAV system utilizing a chilled water system. This system ends up being more expensive in first cost and maintenance costs, the energy savings are minimal, and the system does not payback in either a simple payback or life cycle payback. A ground source heat pump system is the second alternative, and an extensive change to the existing mechanical system. When comparing the ground source heat pump system to the existing VAV system, the ground source heat pump system deems much better results. The system saves approximately $20,000 in maintenance, $73,551 per year on energy consumption, and generates returns in 18.7 years. The ground source heat pump system also improves indoor air quality.

In addition to the main depth area of the report, two breadth areas have been developed. The breadth topics of this report cover lighting and construction management. The objective of the lighting breadth is to utilize more efficient luminaires and lighting controls to decrease the amount of energy consumption while still providing adequate task lighting. The construction management portion analyzes the added cost and scheduling concerns derived from installing chillers and a ground source heat pump well field and loop.

In order to provide orientation and makeup of the building, a short summary of the general building background is provided at the beginning of the report followed by information on the original mechanical systems. The analysis of the existing mechanical systems shows specific areas in which the building can be improved with possible redesign or modification. After the existing systems summary, several proposed redesigns are described and analyzed.