

## 8.0 Proposed Redesign:

The angle taken in the proposed redesign of South Jefferson High School is that of the green design initiative. A driver for green design is lowering the total cost of ownership in terms of resource management and energy efficiency. Green design is also recognized for the increased productivity from a building that is comfortable and enjoyable and provides healthy conditions. Comfortable occupants are less distracted, able to focus better on their tasks/activities, and appreciate the physiological benefits good green design provides.

### -Chilled Water Plant

Calculated cooling capacities of the packaged DX roof top units were developed in the Trane TRACE 700 software and can be seen in Figure 2. This data shows that the total peak load cooling tonnage is 590.4 tons. This load is handled completely by the roof top units condensing units. Installing a central chilled water plant in which the condensing units could be replaced by two 300 ton chillers, would result in a significant annual energy savings,

Plant	System	Peak Plant Loads		Block Plant Loads		
		Main Coil ton	Peak Total ton	Time Of Peak mo/hr	Main Coil ton	Block Total ton
Cooling plant - 001		585.9	590.4	7/12	573.2	577.7
	AHU-8	6.4	10.9	7/12	6.4	10.9
	AHU-2	82.4	82.4	7/12	81.5	81.5
	AHU-3	30.2	30.2	7/12	30.2	30.2
	AHU-4	68.1	68.1	7/12	68.1	68.1
	AHU-5	40.7	40.7	7/12	40.7	40.7
	AHU-6	20.5	20.5	7/12	20.5	20.5
	AHU-7	49.3	49.3	7/12	47.5	47.5
	AHU-1	72.7	72.7	7/12	72.7	72.7
	AHU-9	37.1	37.1	7/12	36.6	36.6
	AHU-10	42.2	42.2	7/12	42.2	42.2
	AHU-11	10.0	10.0	7/12	4.5	4.5
	AHU-12	32.6	32.6	7/12	32.6	32.6
	AHU-13	46.1	46.1	7/12	44.4	44.4
	AHU-14	47.6	47.6	7/12	45.4	45.4
Building totals		585.9	590.4		573.2	577.7

Building peak load is 590.4 tons.

**Building maximum block load of 577.7 tons occurs in July at hour 12 based on system simulation.**

Table 5 – Design Cooling Load

### -Ground Source Heat Pump

Once the results of adding the chilled water system are analyzed a ground source heat pump system will replace the existing fan powered boxes. Ground source heat pump systems take advantage of the earth's relatively constant

temperatures just below its surface (a range of 45° to 65°F). In the heating season, a fluid in the loop collects heat from the earth and transfers that heat to the building. The system then uses electrically driven compressors and heat exchangers to concentrate the heat and release it at a higher temperature into the building. The data will be compared to both the original mechanical system and the design with chilled water only.

#### **-Air-to-Air Heat Recovery**

Next, air-to-air heat recovery utilizing heat exchange enthalpy wheels will be integrated into the air-handling equipment or added through the use of energy recovery ventilators. The total HVAC system installed cost should lower because central heating and cooling equipment may be reduced in sized. Including a total energy wheel will reduce humidification costs in cold weather. Results for heat recovery will be calculated as an additional alternative, and as an incorporated component in the other two alternatives. Humidity control will be incorporated along with the enthalpy wheels in order to maintain humidity levels below 60%, ideally between 30% and 50%. The density of school population results in large amounts of outdoor air must move through the building to assure proper ventilation. If the air is not properly conditioned, small amounts of moisture in the outdoor air can lead to too much moisture indoors and moisture-related problems during the spring, summer, and fall.

#### **-Software**

Trane Trace 700 software package will be used to perform building load energy analysis and life cycle cost estimation.