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Fauquier High Moves to Geothermal

By Kaylie Lathe





The ability to schedule temperature points for different parts of a building and significant energy savings were the driving factors for the new ground-source heat pump installation in a Virginia high school.

Fauquier High School of Warrenton, Va., recently completed renovations and a new facility with ground-source heat pump technology and other energy efficient features that meet LEED standards, says Warren Darrell, construction director for Fauquier County Public Schools. In addition to a GSHP system, energy efficient lighting and recycled materials were used in the buildings.

The renovated buildings were originally built in 1965 and 1979. The GSHP system will heat and cool about 144,000 square feet of new and renovated space. Construction and renovations began in 2011. The building addition was partially occupied in February 2013 and fully occupied by August 2013. Renovations will be completed during summer 2014.

The geoexchange field for Fauquier High School is located beneath a parking lot with a 380-foot base and a width that varies from 90-150 feet. Northern Virginia Drilling of Manassas, Va., dug 16 trenches and drilled 160 boreholes at 550 feet deep with a diameter of 6 inches each for the system. Each borehole contains two

Careful planning went into the placement of the piping that would later be enclosed by the manifold building.

(Courtesy of Warren Darrell, Fauquier High School)

1-1/4 inch HDPE pipes, joined by a U-bend. Thermally enhanced bentonite grout was chosen to surround the pipes. Lawrence Perry and Associates of Roanoke, Va., designed the closed loop system that uses only potable water.

The piping for each loop is connected to 1-1/4 to 3-inch supply and return pipes, which run to supply and return manifolds in an above ground building. Water flows from the manifold building to the high school building mechanical room through underground 8-inch supply and return pipes.

A parking lot disguises the geoechange field that consists of 16 trenches and 160 boreholes for Fauquier High School.

(Courtesy of Warren Darrell, Fauquier High School)

Darrell remembers the challenges of the installation. “Our site was very rocky,” Darrell said. “It had metamorphic rock, a lot of fractured rock and groundwater.” Scott Miller, owner of Northern Virginia Drilling, also recalls how groundwater presented challenges. “We were hitting anywhere between 125 and 175 GPM in each borehole, so we had to use large sediment pumps and filter bags to clean the water to acceptable standards,” Miller said.

An advantage of the abundant groundwater, Darrell says, is good thermal performance of the below ground heat exchange field. “Our pre-development average below ground temperature was 57 degrees all year

around, enabling our heat pumps to operate very efficiently.”

“The borefield was more remote from the building than what we typically design,” Richard Hughes said. “There was a little more distance for the piping to run from the borefield to the main mechanical room.” Hughes is the lead mechanical engineer from Lawrence Perry and Associates.

“The contractor did a good job of directional underground boring beneath a stream to route the main supply and return pipes from the

(Opposite) Northern Virginia Drilling of Manassas, Va., dug 16 trenches for 160 boreholes to be drilled.

(Courtesy of Warren Darrell, Fauquier High School)







The GSHP system heats and cools all 144,000 square feet of the new and renovated space of Fauquier High School.

(Courtesy of Stephanie Rollow, Whiting-Turner Contracting Company)

manifold building to the mechanical room,” Darrell said.

To complete the system, WaterFurnace and AAON heat pumps were installed in the building. These included 96 ceiling hung and floor mounted water-source heat pumps inside, 10 rooftop water-source heat pumps and 6 rooftop ventilation units. All heat pumps use R-410A, a non-ozone depleting refrigerant. The total cooling capacity tonnage is 392 tons with a rated cooling capacity at 90 degrees Fahrenheit entering water temperature. The total heating capacity is 4,392 MBH.

The renovation and installation were completed in August 2013, but this was only phase one of three for Fauquier High School, Hughes explains.

“We’ve designed two additional phases of the project,” Hughes said. “A renovation of the performing arts wing that includes the band and choral rooms, renovation of the science wing and arts wing. All of these additional phases have been added on to the original project.”

The decision to make Fauquier High School the first school in the district to have a geo installation came after Darrell and school officials researched ground-source technology. Darrell spoke with several school districts and others who have used GSHPs, including York County Public Schools in Virginia and Montgomery Public Schools in

Maryland. He also spoke to the City of Charlottesville in Virginia.

Industry publications, including those from IGSHPA, were also consulted during the research period. While many resources were used, Darrell found speaking with other schools to be the most beneficial in the decision that ground-source heat pump technology was the best option.

“Before we started renovating Fauquier High School, the entire building used 68,300 BTU per square foot per year, including electricity, natural gas, oil and propane,” Darrell said. “During the period November 2012 through October 2013, the separately metered addition and renovation used 31,000 BTU per square foot, mostly in the form of electricity.”

While Darrell and officials believe the

energy monitoring will show even better results, they are hesitant to say anything definite until they have monitored their energy bills further.

“It appears that our new efficient systems will result in considerably reduced energy consumption and cost, however, since our new building was only partially occupied until August 2013, we are cautious about the results and will continue to monitor energy consumption and cost,” Darrell said. He is enthusiastic about the lower maintenance cost that will come as a benefit from the installation.

Students gain access to all classrooms and office areas using the large open stairway.

(Courtesy of Stephanie Rollow, Whiting-Turner Contracting Company)



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“We will get lower total energy bills and lower maintenance costs because most of the equipment is indoors and we don’t have a cooling tower,” Darrell said. “We find cooling towers to be very maintenance intensive and problematic.” Darrell’s enthusiasm continues when speaking about room-by-room temperature control, another huge advantage with GSHP systems.

“The system lends itself quite well to room-by-room temperature control, which is important in a school, especially a high school because of different schedules and events that happen in the evenings and on weekends,” Darrell said.

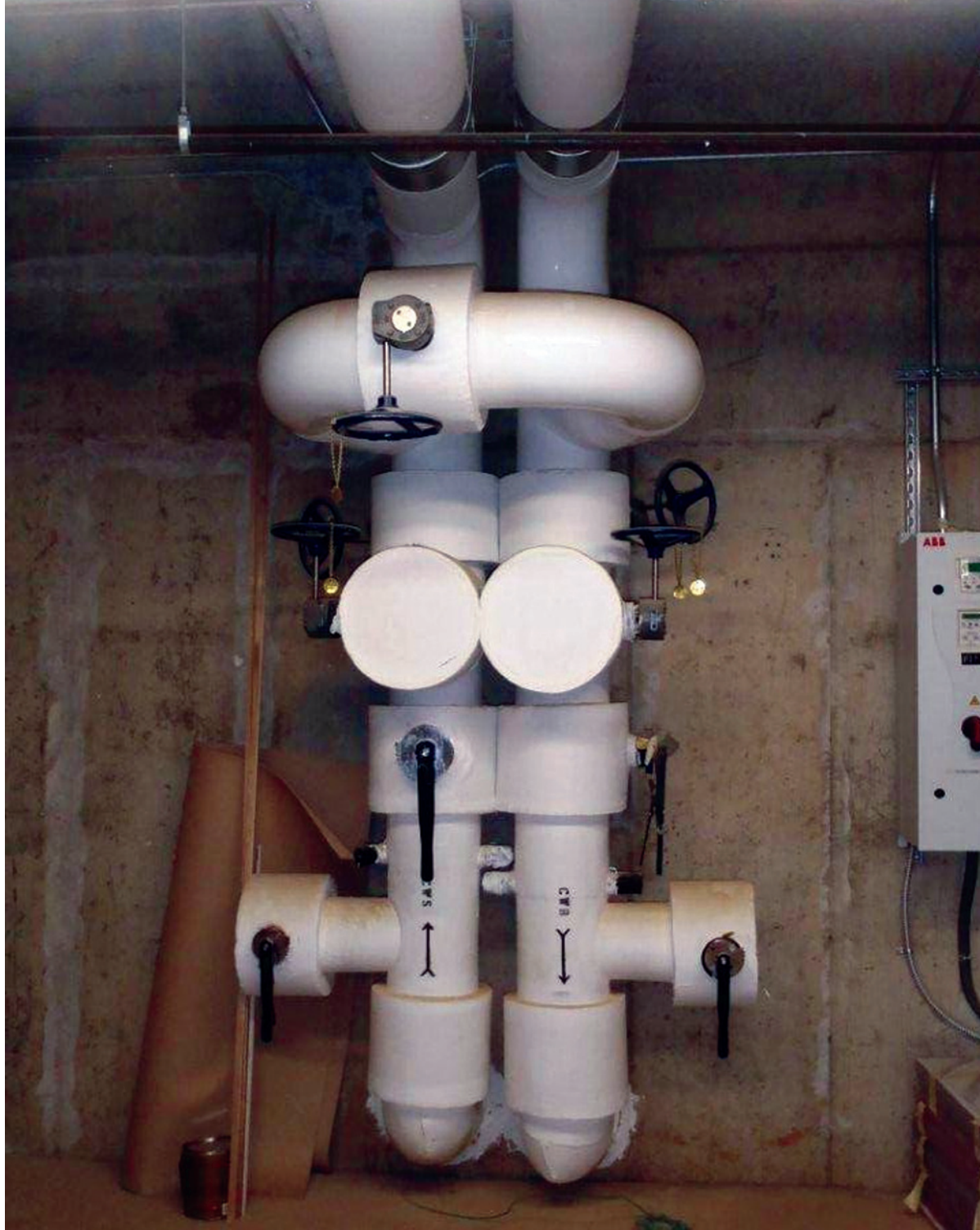
Water flows from the manifold building to the high school mechanical room through underground 8-inch supply and return pipes.

(Courtesy of Warren Darrell, Fauquier High School)

Trenching progressed nicely despite the difficulties presented by rocky terrain.

(Courtesy of Warren Darrell, Fauquier High School)





Making the energy saving features visible to the students was important for Fauquier High School. Signs can be found all over the school explaining the sustainable features, such as the energy saving lighting and the recycled materials used in construction. Diagrams and signs also explain how the ground-source heat pump system

works and the efficiency it brings. A learning session was conducted during construction for the science teachers and any other faculty who were interested and two presentations about the system have been given to science classes.

While this is Fauquier County's first encounter with geothermal in schools,

Piping in the mechanical room for the supply and return needs of the geothermal system allows for needed access.

(Courtesy of Warren Darrell, Fauquier High School)

others involved in the project were more experienced. Schools have been a major part of business for Lawrence Perry and Associates, Hughes says. Northern Virginia Drilling, the driller for FHS's project, does both commercial and residential installations, and has experience in other educational projects.

Officials at Fauquier High School plan to continue monitoring the energy bills in order to get a more accurate reading on the energy savings. Darrell remains optimistic that geothermal was the right choice for Fauquier High School.

Editor's note: Virginia's York County Schools were highlighted in the 2013 Geo Schools issue, Volume 10, Number 1.

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