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Reconnecting With Our Membership

A great amount of change has become the norm for IGSHPA. We recently elected our first Board of Directors and held our first formation meeting in Stillwater February 20-21. As we evolve into a member-centric and member-driven organization, we must keep the basics of research and standards-based training in front of us. The analogy that comes to mind is keeping the buses running as you plan and execute for the next generation of mass transit.

I am greatly impressed with our new industry based structure comprised of the Board of Directors, new Advisory Council, re-purposed committees, industry segments, and affiliated organizations. The talent and commitment from all our industry based people has been outstanding. The near term will be exciting and sometimes even chaotic. The longer outlook is very bright.

Perhaps our greatest area of change has been in advocacy of the GSHP technology. IGSHPA was a major supporter of the “Go Go Geo Challenge” managed by Western Farmers Electric Cooperative for that project in 2014. We are evolving to the next generation in the series we call “Go Go Geo Schools”. This project will focus on the K-12 schools in Oklahoma as an advocacy program for GSHP technology. This project will be managed through IGSHPA with sponsorship from the major utilities in Oklahoma and regional manufacturers of GSHP equipment. With this we are building a model that can be used elsewhere. A model that targets a segment of society with education of the capabilities of GSHP along with financial support for the capital cost and first cost related to the ground-source heat exchanger.

This issue of GeoOutlook contains an article about the retrofit of Bishop Kelley High School where 50-year-old buildings are now utilizing the technology and reaping the benefits. Our schools initiative will look to examples such as this for guidance in our project. Other articles in this issue show why effective training is so important to our industry and will remain our core as we go through many changes.
IGSHPA Members Elect Inaugural Board of Directors

by Erin Portman

January 15 concluded the election process for the inaugural board of directors. Continuing the process that was started during the 2014 Technical Conference and Expo in Baltimore, Maryland, IGSHPA staff conducted the election process for the Board of Directors from November through January. Members elected six board of directors from a pool of candidates and then the elected board of directors selected two-at-large members.

The Board of Directors met February 20-21, 2015, in Stillwater, Oklahoma, at IGSHPA headquarters for a planning and procedural meeting. During this time, the board elected the following board members to hold officer positions: John Turley—President, Garen Ewbank-Vice President, Jeremy Cotten-Secretary, and Allan Skouby-Treasurer. Other board members include Michael Albertson, John Henrich, Dr. Dan Fisher, Don Penn, Cary Smith, and Bob Ingersoll.

Allan Skouby-Distributor
Allan Skouby has been in the geothermal heat pump industry for more than 30 years. He has been the owner and co-owner of GeoPro, Inc. in Bowie, Texas, for 18 years and is the owner and president of Geothermal Resource Technologies, and co-owner of Geo-Connections, Inc. He is also a member of ASHRAE.

Michael Albertson-Manufacturer
Michael Albertson has installed his first geothermal system over 30 years ago and has since sold, designed and installed thousands of geothermal systems nationwide and abroad. Michael Albertson joined WaterFurnace International in 2007 and currently holds the title of Senior Vice President Sales & Marketing. Albertson is a member of multiple professional organizations including but not limited to ASHRAE, AEE, and NGWA.

Garen Ewbank-Architect/Engineer/Designer
Garen is the managing member of Ewbank Geo Testing, LLC, and pioneered direct measurement of the thermal conductivity of the earth for the ground-source heat pump industry. Ewbank is a Lifetime Member of AEE, a member of ASHRAE, and a board member and president of the Oklahoma Chapter of the AEE.

Jeremy Cotten-Utilities
Jeremy Cotten has been employed at the Tennessee Valley Authority since 2001 and throughout his tenure he has actively supported the use of geothermal technologies in the Tennessee Valley. He has actively promoted geothermal technologies in the commercial market working with design engineers, architects, and school boards in an effort to develop their understanding of the technology. He is a member of ACEEE and CEE.

John Turley-Dealers/Contractors
John Turley is President of Middleton Geothermal Services LLC in Hilton Head, South Carolina. He consults in many facets of the GSHP industry including training and education, commercial design assistance, remediation and product market development. Previous to Middleton, he was a consultant in the Houston office of Data Resources Inc. working with customers in the electric utility and oilfield service industries.

Jack Henrich-GHEX
Jack Henrich has been with Bergerson-Caswell, Inc. since 1968 and is currently its president. He is a past president of NGWA, and a past president of the Minnesota Water Well Association. He is a licensed driller in numerous states. Bergerson-Caswell is a leader in the design and installation of all types of ground-source heat exchangers.

Dr. Dan Fisher-OSU Appointee
Dr. Daniel Fisher is the Department Head of Mechanical and Aerospace Engineering at Oklahoma State University-College of Engineering, Architecture and Technology. He has been at OSU since 1999 and is a professional engineer. He has numerous journal articles, presented at numerous conferences and has co-authored two books in regards to HVAC systems. His research areas include Building and Thermal Systems Research Group, building energy analysis, load calculation, numerical heat transfer, and fluid flow, and thermal system simulation and design.

Don Penn-Architect/Engineer/Designer
Don Penn is president of Image Engineering Group, Ltd., and Don Penn Consulting Engineer in Grapevine, Texas. He is a professional mechanical and electrical engineer licensed in 49 states and a Certified GeoExchange Designer and Trainer. Since 1991, he has designed more than 250 school projects involving geothermal heat pump systems for school districts in Texas. His professional memberships include ASHRAE, Texas Society of Professional Engineers, National Society of Professional Engineers, and the International Conference of Building Officials.

Cary Smith-Distributor
Cary Smith is a founding Principal of Sound Geothermal Corporation and currently serves as president and CEO for SGT, a design engineering firm, manufacturer’s representative, and distributor for ground-source heat pump equipment and accessories. Cary has been a pioneer in development of hybrid geothermal systems and community hybrid systems. Cary is a member of ASHRAE, NGWA, and the Utah State Chapter Board of Trustees for AEE.

Bob Ingersoll-Ex-Officio
Bob Ingersoll is the current director of the International Ground Source Heat Pump Association. He has a Bachelor of Science degree in industrial engineering and has more than 30 years’ worth of engineering and management experience. Prior to joining IGSHPA, he was the support services manager for 9 years in CEAT at OSU.

Visit the IGSHPA website for more detailed biographies on the board of directors.
Tracey Ogden

Tracey Ogden has been around drilling for quite awhile. Ogden started in the groundwater and renewable energy industry in 1994. She first worked for T.J. Ogden Co., now Ogden Wells. They primarily perform exploratory drilling and mining for groundwater systems in domestic, commercial and municipal sectors.

A large part of Ogden’s background came through more than 20 years in sales and marketing with Ogden Wells in Tewksbury, Massachusetts. A groundwater exploration company working with rotary, cable tool and drive and wash well techniques, Ogden Wells performed pump design, water filtration, water sampling, geothermal, hydro-fracturing, air-burst technology, prolonged pump tests, inspections and service.

By 1997, Ogden says she saw a great opportunity to both diversify and to secure a larger presence with the renewable energy sector. She took IGSHPA training in Utah, studying in a class held by Terry Proffer.

“The transition from drilling water wells to geo bores was a natural fit,” Ogden says. She says that she has been involved in more than a thousand geothermal bores since 1997.

In 2002, Ogden started her own business, a Massachusetts Certified Women in Business Enterprise in the Boston area called Geothermal Drilling of New England. In 2005, GDNE acquired the name, drilling logs and select equipment to the R.E. Chapman Company. She says Chapman, established in 1938, was the only union drilling shop in New England.

She is proud to have been recognized with national certification in 2013 by the National Women Business Owners Corporation, an elite organization established to recognize women in business throughout the United States.

Ogden believes her affiliations with WBE and the NWBOC have proven to be beneficial and have allowed her to diversify in the drilling and renewable industry. Her background has solidly established Ogden in the drilling industry. Ogden served as director of the Massachusetts Groundwater Association from 2009 to 2012, where she represented groundwater professionals in the state. She worked closely with legislative bodies to be the voice of the groundwater industry.

As a co-founder of the non-profit New England Geothermal Professional Association, Ogden strived to increase public awareness about geothermal systems as reliable alternative energy sources that would allow a reduction in the dependence on fossil fuels. As vice-president from January 2011 to December 2012, Ogden led efforts to be a unified voice for information on ground-source heat pump systems throughout the New England area. Her experience with geothermal and in negotiating contracts was vital to the organization.

Out of a personal concern for the environment, Ogden serves on the board of the Merrimack Valley Clean Tech Round Table, a group of professionals in the renewable energy sector unified and dedicated to increasing local awareness about renewable technologies and incentives available in the region.

Along with being an IGSHPA Geothermal Accredited Installer since 1997, Ogden holds many other licenses and certifications.

She is U.S. Department of Labor, OSHA 10 licensed; carries certification as a Butt and Socket Fusion Technician through Drisco Pipe; has a U.S. Department of Transportation Crane Operator Certificate; and has Johnson
Ogden also has North American Technician Excellence licensing; holds a license as New Hampshire Small Water Systems Operator through New Hampshire DES; carries Hazcom/GHS certification; has American Ground Water Trust certification in Geothermal Heating and Cooling, Design and Regulation; and is Hazwoper 40 OSHA licensed.

She is a LEED Associate through the U. S. Green Building Council; and is also LEED AP BD+C licensed through the U. S. Green Building Council.

She studied Business Communication at New Hampshire College, where she also played NCAA2 softball.
New Cambridge School Chooses Geothermal

By Janet F. Reeder

Marc Reid, Glenn Kush and Joshua Rathbun work together to trip out the well after the well is drilled to 520 feet.

(Courtesy of Tracey Ogden/ GDNE)
Geothermal Drilling of New England has done its share of drilling and installing geothermal school projects. The one they are wrapping up early in 2015 has already received attention and accolades as a Zero Energy Building candidate.

President and owner of GDNE, Tracey Ogden says she had firsthand knowledge about this school project that helped her to bid it accordingly. And she was involved in a test well and thermal conductivity testing early on in the project.

“I drill quite a bit in the Boston area. Boston is basically a city that has been filled in. It is Cambridge argillite, which is very, very fast drilling,” Ogden says.

The City of Cambridge, Massachusetts, held a groundbreaking ceremony for Dr. Martin Luther King, Jr. Elementary School and Putnam Avenue Upper School in June of 2013. Prior to the ceremony, the city’s project architect, Perkins Eastman, presented city officials with its Feasibility Study for the new Dr. Martin Luther King, Jr. construction project.

Three options were considered with the final decision made to replace the existing structure with a new energy efficient Net Zero building design. During the design phases, the occupants participated in the
building programming, which included education of what a Net Zero design consists of, and why their actions when using the building will help control the energy consumption.

Construction Manager at Risk, the Rich-Caulfield Venture, began abatement of hazardous materials and demolition of the old school in April 2013.

(Below) GDNE Fusion Technician Joshua Rathbun fuses the 6-inch HDPE supply and return line off the side of the vault. This connection will tie into the building and the mechanical room. (Courtesy of Tracey Ogden/GDNE)

John Rich, superintendent with W.T. Rich Company is the general contractor for the project. W.T. Rich Company, out of Newton, Massachusetts, has worked on schools and government buildings, just wrapping up the renovation of a police station in Cambridge’s Central Square before starting the MLK project. Rich has seen typical delays largely attributed to the small construction site and most recently the more than six foot of snow that has blanketed the Boston area for nearly a month.

“Initially we thought we would be finished in May 2014,” Ogden says. She drilled 65 bores at 520 feet. “They pushed us off quite a bit.”

Ogden says the boreholes, in soft metamorphic rock, each produced 100 gallons a minute of water or more.
during drilling and involved a lot of containment.

“The job had a very tight space requirement so there wasn’t enough room to bring in much equipment,” Ogden said. “We went to a one rig setup with a rig tender, a support vehicle and a 20,000 gallon containment tank.”

Ogden says there was a lot of downtime on the site. GDNE used 34,000 feet of 6” pipe for the boreholes and another 5-6,000 feet of piping for getting inside the building and for the
The vault and piping used by GDNE was supplied by ISCO.

Interior GSHP installation work will be done by E. Amanti & Sons, Inc., of Salem, Massachusetts. Specifications call for 96 Daikin Applied SmartSource water source heat pumps, HP-2H and 2V through HP-6H and 6V, and two Daikin Applied Enfinity water source heat pumps, HP-1H. Manufacturers supplier Stebbins Duffy, Inc., in Peabody, Massachusetts, will also supply 11 spare units.

**Lead driller Glenn Kush cleans the roller bit of debris from large weather broken rock that was keeping it from spinning.**

(Courtesy of Tracey Ogden/ GDNE)
CDM Smith did all of the exterior design for the geothermal loopfield and all engineering work for the geothermal exchange. Max Rolandi, with CDM Smith, says there was nothing in particular different in regard to the drilling or geothermal installation. It was a first time for CDM Smith to work with GDNE. Rolandi says the MLK project was also a first geothermal project for CDM Smith.

A highlight of the project for Ogden was the use of GeoPro’s new carbon-enhanced grout. Ogden worked with Ryan Carda to accept the first delivery of the product to New England.

“We loved it,” Ogden said. “We liked the way it performed. We were going to a 1.4 conductivity on this project, which is one of the highest I have seen.” She says that products are definitely changing and improving.

“From 15 years ago, it is like night and day,” she says.

“We have a lot of experienced people on this project,” Ogden said. “Of course, I want our part to go off without a hitch, but not just for me. I want this to continue to roll forward. I want geothermal to be mainstream.”

Ogden says that one of the outstanding aspects of the MLK project involves the mindset of the community and area.

Graphic from Perkins Eastman illustrates that the boreholes were drilled deeper than the historic Custom House Tower, a familiar building in the Boston area. GDNE drilled each borehole an additional 20 feet to allow soft rock and debris to fall below the depth where the vertical heat exchanger would be installed to 500 feet.

(Courtesy of Perkins Eastman)
“The city of Cambridge has been instrumental for the technology. Without them it wouldn’t have even gone in,” Ogden said. “Cambridge is really known for being a city of movers and thinkers.”

Energy conscious design features of the new school, in addition to the geothermal, include daylight harvesting that enables natural light to pass through the building, automatic lighting dimmer systems to help conserve energy, and a gray water storage system to help conserve water use.

The school will have all new facilities and equipment for its classrooms, library, auditorium, gymnasium, and community rooms, new outdoor play space and improved parking.

Martin Luther King Jr. School in Cambridge, Massachusetts will soon open its doors to students in a 169,000-square-foot facility hailed as a Net Energy Zero school. Due to be finished in August 2015, in time for the 2015-16 school year, the project cost the city about $84 million.

In addition to targeting Net Zero Energy, MLK is expected to achieve LEED-Platinum certification. The building is projected to have an Energy Use Intensity 60 percent less than typical educational buildings in New England. The building will save energy through proper orientation, pervasive natural light in almost every space, and high-performance roof and wall assemblies. In addition to user-specific energy saving measures, the school will offset energy demands by producing energy through photovoltaic panels mounted on the roof and south-facing facades.

Perkins Eastman’s design for the new school was driven by the idea of the school as a community, with the Lower Joshua Rathbun and David Gonsalves heat fuse supply and return lines 7-feet below grade and under the existing building in the mechanical room. The crew of pipe layers and fusion technicians laid and fused 1340 feet of 6-inch supply and return lines. (Courtesy of Tracey Ogden/ GDNE)
School and the Upper School operating as district “neighborhoods” connected by an internal thoroughfare, named King Street, from which the shared community spaces are accessed.

As one of the fastest growing segments in new construction venturing into Net Zero Building, schools have the opportunity to not only save serious energy dollars, but to incorporate energy education into their curriculum, and MLK will be doing just that.

Cambridge’s Deputy City Manager Richard C. Rossi says MLK will give the whole school community, the teachers, as well as the students and the parents the information to understand what Net Zero is all about and how they can support the energy savings effort.

Rossi sees energy savings mandates as schools build and rebuild, as an opportunity to instill the importance and the methods of conserving energy into every day life for students.

“They are going to see energy savings in how they conduct their daily lives,” Rossi said. He knows it won’t be easy to get the school to Net Zero Energy. But he believes the 144 staff and 660 students will do their part.

A key part of the MLK School’s energy savings will come through the use of the ground-source heat pump technology the project is using. Initially the project was set for 100 geothermal boreholes to support the HVAC for the school.

Architectural firm Perkins Eastman switched to a hybrid system, due to space constraints, and the geothermal borefield changed from the original 100 to 65 boreholes at 520 feet deep.
Driller Marc Reid watches the rig advance the borehole as he works to shovel the drill tailings from the area surrounding the drill stem. (Courtesy of Tracey Ogden/ GDNE)
The hybrid system will allow boilers to assist with 21 peak-temperature days per year. With a building lot of a little over 150,000-square-feet, plans were set for a building four stories tall, in order to have parking and outside play areas.

Design of the building will get the school about 60 percent of the way to Net Zero, Jana Silsby, associate principal with Perkins Eastman, says. It will take a concerted effort by all users of the building to make up the difference.

The goal energy target of 30 kBtu per square foot per year, about half the energy use of the old building, will require a real consciousness of energy usage. Building energy and water use data will be tailored for students understanding by grade and applied to curriculum. Teachers and parents will also have information available to support their efforts to reach energy use goals.

Shared faculty space and minimal extra appliances such as coffee pots are part of the scheme. A central faculty work area with kitchen and office supplies and auxiliary computer support such as scanners and fax machines is part of the design to minimize electronic electrical loads.

Ogden says that one of the ways the geothermal system will gain “visibility” is through the schools use of coin-like medallions that will eventually be placed over each of the 65 boreholes to mark them. The children and parents will be able to read about the geothermal exchange of heat and cooling from the earth along a number of educational pathways.

The forward thinking community of Cambridge will be able to instill energy awareness in their youngest citizens, hopefully ensuring a brighter energy secure future for the next generation.

And the Dr. Martin Luther King, Jr. Elementary School and Putnam Avenue Upper School will save energy dollars that can be returned to help fund education.
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1 According to LoopLink® software based on a comparison of a 6.0-ton Carrier® model GT geothermal heat pump to an 80,000 BTU, 78% AFUE propane furnace in St. Louis, Mo., with electricity costs of $0.098/kWh and propane fuel costs of $3.18/gallon as of 4/30/14.
2 According to LoopLink® software based on a comparison of a 6.0-ton Carrier® model GT geothermal heat pump to a 3.5-ton, 13-SEER air source air conditioner in St. Louis, Mo., with electricity costs of $0.098/kWh as of 4/30/14.
Bishop Kelley Embraces Renewable Energy

By Janet F. Reeder
As a private school, Tulsa’s Bishop Kelley High School has to find innovative ways to become a more sustainable campus. Finding a way to fund retrofitting GSHP in half of the campus has been challenging, but rewarding.

(Photograph by Janet F. Reeder)
As President of Bishop Kelley High School, Rev. Brian O’Brien realized that the 50-plus-year-old school buildings on their Tulsa, Oklahoma, campus had pretty much the original heat and air equipment aside from a few adjustments and repairs.

“Between our guys and the HVAC contractor, we were about at the end of things and bandaging whatever we could,” O’Brien said.

“At a meeting one day we realized we really only had about a year left on our current equipment,” O’Brien said. “So we started looking at what to change it to.”

O’Brien says they started out looking at conventional systems and realized their first obstacle would be to find finances to do the upgrades.

As a private school Bishop Kelley doesn’t get state funding and anything added to the budget generally gets passed on to parents. O’Brien started out that process by checking with the Diocese of Tulsa about some financial assistance.

While meeting with representatives of the Catholic Foundation of Eastern Oklahoma, committee member Matt Coughlin told O’Brien to look into geothermal and get back to them. O’Brien admits that he thought they would give that a quick look and come back to the original plan. He knew that the technology was more expensive than what he thought a conventional system would be.

A school parent whose local manufacturing outfit uses geothermal offered to give him a tour. It didn’t take long for O’Brien to realize he probably needed more information. Still the school’s biggest obstacle was the expense.

“Since it is greener and it would save us money in the long run, we thought we had a good chance to raise the money,” O’Brien says. And he was right. The school kicked into fundraising mode and through a number of creative efforts succeeded in their goal. He says the environmental aspect of the geothermal was a huge factor in helping the school raise the needed funds.

Coughlin had geothermal in his home and was advocating it from his personal experience. He was also on the committee that would decide whether to offer financial help to the school. And in the end, he influenced a decision to make a $500,000
matching grant to Bishop Kelley for the geothermal HVAC upgrade.

“They could see proven return on investment and longer lifespan on equipment, along with lower maintenance,” O'Brien says, “so they ended up giving us more.” Bishop Kelley met the match requirement for the funding.

K&M Shillingford (KMS), a Tulsa firm that claims to be the oldest geothermal heating and air conditioning company in the United States, was contracted for the Bishop Kelley work.

Tom Nowak at KMS designed the 230-ton system working with Pete Shillingford, Jay Murphy, Ron Willis, Jeremy Garrison and Shawn Miller to get it installed.

Nowak says the short timeline of two months for each phase was challenging.

Bishop Kelley High School has a long history of excellence in the Tulsa area. Now they can add information about their new efficient and “green” geothermal system to their promotional material.

(Photo by Janet F. Reeder)

A grassy median that separates parking areas and campus buildings allows students to walk all over the geothermal borefield. The long strip is a part of the entry drive for Bishop Kelley and provided the needed space to trench and bury needed piping.

(Photo by Janet F. Reeder)
Nowak is good at problem solving and that skill came in to play on the Bishop Kelley projects.

“We looked at a district arrangement, but individual tonnages for the buildings was sufficient and most economical,” Jay Murphy said. The project that involved administration offices and classrooms had the crew dealing with ClimateMaster units were carefully placed in the tunnel to serve the administration area and classrooms. (Courtesy of Tom Nowak/KMS)
existing underground structure under the main building.

“Mechanically what they have is a big central plant and then tunnels under the building,” Murphy says. “We had to figure out how to make it simple and still zone it.” Murphy says the ducts ran down the tunnel.

“Nowak said he thought he could put a machine in the tunnel under every classroom,” Murphy said. “The guys created a trolley system to pull the units into the tunnels and came up with tools and ideas to get the project done on time.” Help came in other ways that were not as measurable, but Murphy feels surely made a difference from the very start of the project.

“Father saying a prayer over it was a really cool thing,” Murphy said.

Most outfits don’t get the experience of having a priest bless their work and equipment, he added.

The geothermal installation was all ClimateMaster equipment with one 8-ton, three 10-ton, two 12-ton, two 14-ton, and seven 20-ton units.

Environmental Loop Service, Inc., also out of Tulsa, handled the ground exchange work, drilling 115 boreholes at 400 feet deep. Trenching with 460-foot total length broke down into five circuits. Header piping was 8-inch and 1-inch piping was used for loops.

Installation cost for the geothermal was $987,414. Bishop Kelley benefited from local power utility Public Service of Oklahoma credit of over $21,000.

The project, set in three phases, started in the summer of 2012, with a new use for the school’s athletic field where 66 boreholes were drilled at 400-feet deep. All would be back to normal by game time.

Phase I of the three-part project saw the school spend about $70,000 on an extensive new control system for the entire campus heating and air. That work was contracted to Johnson Controls. It was done in time for the start of school that August. And it allowed some savings by selective use of heat and air. But nothing compared to what was to come.

A memorial wall and area to reflect are important to the campus layout.
(Photo by Janet F. Reeder)
Pumping units for the borefield show the care that was taken to make the installation efficient. (Courtesy of Tom Nowak/KMS)
During the summer break of 2013, the school made the Phase II planned conversion from a boiler-chiller set up to geothermal heat and air for the main building housing administration offices and 25 classrooms.

Then in the summer of 2014, Phase III work allowed for geothermal heat and air to the cafeteria and both gymnasiums.

“Half of our square footage is now geothermal,” he says. “We know it is working because nobody is talking about it.”

What O’Brien sees now is “a definite decrease in energy bills from the quarter of a million dollars the school saw previously.” And then there is the real opportunity for Bishop Kelley students to understand the importance of renewable energy and their new geothermal system.

O’Brien says he gets questions from other private school and even public school principals all the time.

“Basically, they are interested in the cost savings,” he says.
Watson Brothers discovered the technique for uniformly creating coil loops and preparing them for ease in locating to the job site. This technique was discovered from a YouTube video that outlined how to properly coil 1-inch IPS pipe to save time. (Courtesy of Tyler Henning)
At St. Clair County Community College (SC4) in Port Huron, Mich., contractors and college students alike are learning about green buildings and technologies. The lessons are being taught in unlikely places – in a parking lot and through the use of viral videos.

Students at the college will participate in lessons on green environments stemming from a geothermal installation underneath a large parking lot on campus. The parking lot is also outfitted with bioswales and rain gardens to cleanse rainwater before it reaches nearby waterways.

In the summer of 2010, construction was completed on a geothermal system for the college’s North Building. The building, originally constructed in 1920, was served by two boiler systems, with one of those boilers systems targeted for replacement. The second, remaining boiler continues to serve locker rooms and a gymnasium.

According to local newspaper reports, SC4 will save an estimated $52,000 per year in operation expenses for the North Building’s HVAC. That cost savings is based on the system reaching 30 percent savings on energy use over the old chiller and boiler system.

“The North Building is comprised of a 30,000-square-foot, two-story classroom building with an adjacent 24,600-square-foot upper level gymnasium and lower level locker room, complete with support classrooms and weight rooms,” said Ron Chapdelaine, project designer for Peter Basso Associates, Inc. “The existing system had a heat exchanger off of the existing boiler system and a cooling tower for the cooling side of the existing water-to-air heat pump system. We looked at putting back similar equipment, but with the parking lots slated for replacement, it made sense to use a closed-loop ground-source geothermal system.”

Chapdelaine and Peter Basso Associates recommended a water-to-water heat pump manufactured by ClimaCool®, a roof-mounted energy recovery unit made by Innovent, VAV boxes from Price and pumps from Bell and Gossett.

“The designed geothermal system was based on a nominal 200-ton horizontal slinky field located under the

Coiled loops await transportation from the Watson Brothers’ warehouse to the St. Clair County Community College geothermal project. By bundling the coils six coils can be loaded on a flatbed truck.

(Courtesy of Tyler Henning)
Etna Supply’s Troy Taylor performs a fusion on the headers of the geothermal system. The headers were fused at Etna Supply’s Wixom, Michigan, facility and transported by truck daily.

(Courtesy of Tyler Henning)
renovated parking lot. Plate-and-frame heat exchanger recovery units were selected and roof-mounted with chilled water-cooling coils and hot water heating coils capable of 100-percent economizer mode of operation. The indoor units are variable air volume (VAV) boxes with hot water re heater coils within each room and CO2 sensors to monitor building occupancy outside air demand ventilation control,” said Chapdelaine.

Normally, vertical wells would suffice for a geothermal project in Michigan, but the presence of a methane field forced another approach.

“We originally looked at a vertical well system, but due to methane gas pressures at around 30 PSIG only 50 feet below the ground in the city of Port Huron, it would not allow for a vertical well system,” said Chapdelaine.

Sopha Underground Maintenance dug out three horizontal slinky fields to a depth of 8 feet and 6 inches, with each 615 feet long and 60 feet wide. In the three excavated pits, a total of more than 30 miles of piping was used to construct the slinky loops.

Not a stranger to geothermal piping installations, local contractor Watson Brothers sought more information on installing a horizontal slinky system and boosting productivity on the project. A consultation with Etna Supply, the project’s pipe and fusion machine supplier, led to the sharing of a YouTube link. The link clued Watson Brothers into a smarter way for moving and packaging the 1-inch IPS high-density polyethylene (HDPE) coiled pipe for delivery to the job site in a manner that would ease installation.

Watson Brothers personnel watched the video, taking notes and then set forth to replicate the process. In the shop, workers set up a rig with 4x8-
foot-long pieces of plywood with 2x4-inch pieces of wood attached at a 3-foot distance stretching the length of the rig. Together, the lengths of plywood were 45-feet long. The 1-inch HDPE coil was delivered in 500-foot coils.

The coil was designed to have a 10-inch overlap when unrolled on site so corresponding 10-inch increments were marked off on the plywood. Workers unraveled the coil on the plywood, recoiling the loops to be 3 feet wide. Once in place, the coils were zip-tied to stay in place.

“After assembly, we rolled the coil up into a ball that resembled a ‘big foot’ truck tire and tied it off with rope,” said David Dahnke, project manager for Watson Brothers. “This allowed us to roll the coil down into the field, cut the rope and unroll the slinky into place.”

The technique allowed Watson Brothers to haul six coil bundles to the site on a flatbed truck.

The headers required for the slinky field were another critical component. Etna Supply’s Troy Taylor fabricated the headers at Etna’s Wixom, Mich., location. Taylor fabricated 198 1x4-inch and 240 1x3-inch sidewall tees on the HDPE headers. The lengths of headers fused by Taylor were trucked to the site, sometimes on a daily basis.

For connecting the loops to the headers, Taylor recommended a new product – McElroy’s Socket Fusion Tooling Kit. The kit features a MultiMe® heater with microprocessor control and a dial thermometer to monitor heater temperature. By using a kit, Watson Brothers were provided heater adapters and tools specific to the size ranges commonly associated with geothermal installations. All of the components fit into a custom-sized toolbox.

“Our guys like having the ability to dictate what the temperature of the heater is,” said Dahnke. “Our other socket tooling equipment didn’t afford us that luxury.”

The project at SC4 was completed by August 23rd, the first day of the fall semester. The cost of the geothermal system, resurfacing of the parking lots, construction of bioswales and rain gardens, and resurfacing of another parking lot on campus was $4.3 million. The projects were funded by the school’s millage income.
The IGSHPA Technical Conference and Expo will feature a wide variety of geothermal community representatives, including manufacturers, contractors, distributors, drillers and other industry resources. Throughout the conference you will continually be making valuable connections for your geothermal business with other professionals. Conference events and presentations allow you to take a look at the industry on national and global levels.

Workshops and courses available include:

- Accredited Installers Workshop - Oct. 5-8 $1075
- Accredited Drillers Workshop - Oct. 5-7 $975
- Building Load Analysis and Pumping (BLA) Workshop - Oct. 5-6 $975
- Certified GeoExchange Designer (CGD) Plus Course - Oct. 5-8 $2100

*All training workshops include conference registration and a complete set of workshop materials.
Imagine a high school building that was designed and built to achieve Zero Net Energy (ZNE) use while serving as a living laboratory for its students in the virtues and practices of recycling, energy efficiency and sustainability? There is such a school in Texas and it’s named after the wife of the 36th president, Lady Bird Johnson, a woman who, in later life, dedicated herself to environmental beautification.

The Lady Bird Johnson Middle School in Irving, Texas, northwest of Dallas, utilizes a variety of sustainable technologies, including a geothermal system powered by Bosch FHP heat pumps, to achieve Net Zero Energy (NZE) energy performance. It is the first NZE public school in Texas, the first such middle school and the largest Net Zero school in the U.S. Teachers and students use the building as a teaching tool to learn about conservation and environmental protection.

Lady Bird Johnson Middle School was designed and built to be a showcase and teaching tool for renewables. The school not only includes renewable technologies for operational purposes, the renewables are part of the school’s mission and curriculum. The 152,000 sq. ft. school’s sustainable features include almost 3,000 photovoltaic solar panels (a 600kW array with an 850,000kWh annual output), a dozen wind turbines generating 2.4kW of electrical capacity, 107 water-source geothermal heat pumps sized to 20 tons, LED lighting with light shelves and daylight harvesting, high efficiency window glazing, wall and roof insulation, a water cistern for gray water recycling and irrigation of the school’s grounds, waste composting and an ENERGY STAR rated kitchen to serve the school’s 1,026 students in grades 6 through 8.

In May of 2010 the Irving Independent School District broke ground for the new school. Don Penn, PE CGD who owns his own firm, Image Engineering Group (IEG), was selected as the MEP engineer. Penn, who specializes in education and retail building projects, has consulted on some 250 geothermal school projects alone during the past 20 years.

Penn designed the school’s 10 geothermal bore fields to go under the school’s parking lot and its football-activities field, future home turf of the LBJ Eagles. The mechanical contractor on the job was Century Mechanical, another Texas firm with extensive geothermal experience. The geothermal drilling operations included drilling a total of 505 bore holes in the 10 fields, reaching down to the water table at a depth of 250 feet and installation of 50 miles of 1” HDPE pipe. All together the geothermal system can accommodate almost 600 tons of air conditioning. Over 100 Bosch FHP models EC and EV Series water source heat pumps, from 1 to 20 tons, were installed.

Penn also designed the school’s rooftop solar photovoltaic plant consisting of 65,000 sq. feet of solar panels. The solar PV plant produces over 8,000 kW a year and provides energy savings to offset the energy consumption of the rest of the building. Combined with the geothermal system, NZE use is achieved.

Opened in late 2011 in time for the new school year, the school’s energy use reduction has been dramatic: 17 KBTU per sq. ft. as opposed to 54 KBTU on average for a Texas middle school. There has been a 70 percent energy use reduction from $200,000 a year to $60,000. Since its opening Lady Bird Johnson Middle School has been “operating right on the mark,” according to Scott Layne. “It’s been a win-win situation, especially for our students. That’s what it’s all about – the kids and making a better world for all of us.”
Since the early years of the industry, flushing and purging has been considered a single activity, and when the specified 2 feet per second (FPS) flush/purge flow velocity was achieved, many considered a system flushed, purged, and ready to be placed into service. We need to think about this again, especially on larger systems!

First, consider purging. When a flow velocity of 2 FPS throughout the system is achieved, all air in the system will be removed. Contrary to past procedures about reversing flow, this is not required. The answer for that is will your purge cart achieve 2 FPS flow through the ground heat exchanger you are attempting to purge? If not, get one that will – it’s that simple.

When observing a lab “ground loop” assembled with clear piping and high and low places throughout the system headers, the impact of flow velocity is obvious. At 1 FPS the trapped air in the observed header high point elongates along the top of the pipe but remains in basically the same position. At 1.5 FPS the trapped air further elongates, and occasional bubbles will break away and follow the flow. When 2 FPS is achieved, the trapped air pocket literally explodes into bubbles and is carried away by the flow. So, if you are only interested in removing air and you have achieved a flow rate of 2 FPS throughout the system (including the largest pipe diameter), you are good to go. If you think you have properly flushed and purged a new or repaired ground heat exchanger installation, not necessarily so.

Flushing is a completely different animal. Consider the pipe in your job site lay down yard. Are the caps removed only when assembling the pipe? Were the caps removed when the pipe assembly was left overnight or over the weekend? Are you sure you cleared the fusion prep shavings from the inside of the pipe? If you answered no to any of these and numerous other, similar questions, you have no idea what is in your ground heat exchanger, and the purge carts that can achieve 2 FPS WILL NOT remove heavier contaminants.

We all probably have similar stories – mine was blowing a young rabbit out of a 4” header pipe while filling a system (he lived). Unfortunately, humorous stories like this are not the issue – heavier and more compact items are. The purge cart previously mentioned can remove some dirt, dust, and pipe shavings. It’s the rocks, sticks, and no telling what all else is in there that it can not remove. If you think I’m kidding, back in the “90s I saw a 4” Crescent Wrench blown out of a system on one of my projects – think about what that could do the impeller of a large system pump. The answer is higher FPS flow rate capacity flushing is required.

So, the first issue is cleanliness – keep the caps on the pipe, and keep systems being assembled as clean as possible. Train installers and QAQC personnel accordingly. Then, consider what you need to properly flush/purge your system with an appropriate industry professional. There are various suppliers of high FPS capacity flushing equipment and/or services available in the industry and advertising in the GeoOutlook and related industry trade publications.

Finally, unlike purging as previously described, high capacity flushing must be done with a reversible flow system. Ground heat exchanger systems are typically reverse-return parallel systems with step-down step-up pipe sizing throughout the system – from the largest diameter header to the vertical or horizontal loop piping. That 12” header on a large project may reduce all the way to ¾” or 1” pipe in the vertical boreholes or horizontal loops and then grow back to 12” at the opposite end of the system. A larger, irregularly shaped contaminant will reach a point where it can go no further as the system piping is reducing in size, but may not block or significantly restrict flow. Flow needs to be reversed to take this contaminant into progressively larger pipe diameters until it is expelled.

Air and contaminant free ground heat exchangers provide long term trouble free operation – contaminated systems don’t.

Mr. Rawlings has more than 35 years experience in the geothermal industry. He is the Director of Geothermal Services for Trison Construction, a Certified GeoExchange Designer (CGD) and an IGSHPA Accredited Installer and Trainer.
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- Don Penn, P.E. for Lady Bird Johnson Middle School NetZero Project - Irving, Texas

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