Final Technical Report (FTR) for DOE/EERE

Project Title:	RiverHeath: Neighborhood Loop Geothermal Exchange System
Covering Period:	January 29, 2010 - June 30, 2015
Approved Project Period:	1/29/2010 – 6/30/2015
Submission Date:	07/11/2016
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DOE Project Team:	DOE Contracting Officer - Mark Geall DOE Project Officer - Project Engineer -

07/11/2016

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Signature Date

Acknowledgement: *This material is based upon work supported by the Department of Energy under Award Number* DE-EE0003005.

Executive Summary: This grant funded the construction of a river-based geothermal exchange system at both lower capital infrastructure cost and also lower operational cost than current geothermal exchange systems. The project was completed in two phases. The first phase, an apartment building called Evergreen, was completed in June 2014. The river-based geothermal exchange system provides the heating and cooling system for this building. The second phase, an apartment building called Prairie, will be complete in October 2016. As a result of this grant, both the Wisconsin Department of Natural Resources and the U.S Army Corps of Engineers have agreed that a river-based geothermal system is feasible and does not unduly impact the riverway. River-based geothermal exchange systems could provide highly efficient heating and cooling systems for buildings situated along waterways, as long as they are designed and permitted properly.

HISTORY: Based on the recommendation of the project's architects, RiverHeath hired a geothermal engineering firm to perform a feasibility study for the geothermal exchange system. The feasibility study determined both the technical capability of using the river as a location for the heat exchanger plates and also the cost effectiveness of the river-based strategy. In a report titled: "Geothermal Feasibility Study and Renewable Technologies Assessment", the engineering firm determined that the river-based geothermal exchange system would be less expensive to install than a more traditional vertical bore system. The study compared conventional furnaces, a vertical bore system, and the river based heat exchanger system. The initial cost of the river based system was less expensive than the initial cost of the vertical bore system. Both geothermal systems reduced building operating costs significantly. The study showed a favorable seven-year payback period for the river-based system.

Wisconsin Department of Natural Resources (DNR) issued a Chapter 30 Permit on October 3, Les2008, permitting the project to move forward. The United States Army Corps of Engineers concurred with the DNR in a General Permit issued October 15, 2008. The City of Appleton approved the Implementation Plan and Development Agreement on July 15, 2009. DNR reviewed and approved the geothermal exchange

system. Phase One construction, the Evergreen building, began in summer 2013 and was completed in June 2014. Phase Two construction, the Prairie building, began in summer 2015, and will be complete in September 2016. Both buildings operate using the river-based geothermal exchange heating and cooling system. The system has been working efficiently and according to design specifications.

LESSONS LEARNED: There were two sources of delay on this project: project financing and permitting. The permitting delays were at all levels: federal (NEPA), state, and city. The permitting delays were caused by unfamiliarity with geothermal systems, and were resolved by the exchange of technical and operating data. For example, the DNR was concerned about the system's impact on the river. The engineering firm explained that the river water flowed over the geothermal plates at over 1000 cu / second, making any temperature increase negligible. For project financing, the banks changed their underwriting standards through the recession, making construction projects difficult to start. There was also concern that the system would not be as dependable as a more traditional HVAC system. Those concerns were resolved, because the system has been operating efficiently for over a year. As geothermal systems gain greater adoption, these barriers should fall.

CONFERENCE PROCEEDINGS: The Wisconsin State Energy Office invited RiverHeath to present a case study on the geothermal exchange system at the Wisconsin Geothermal Roundtable, which took place on May 24, 2016. See the attached conference agenda. Issues discussed included: the lower capital infrastructure cost and shorter payback for river-based geothermal systems, the reliability of the system, and the replicability of similar systems on other waterways.

PHOTO UPDATES:

Here is the site in the original condition (Fall 2008) prior to demolition or filling of the industrial canal. The site sits just below the bridge adjacent to the river. You can see the canal to the north of the bridge and the warehouse structures still intact.

These site prep shots are from October 2010.


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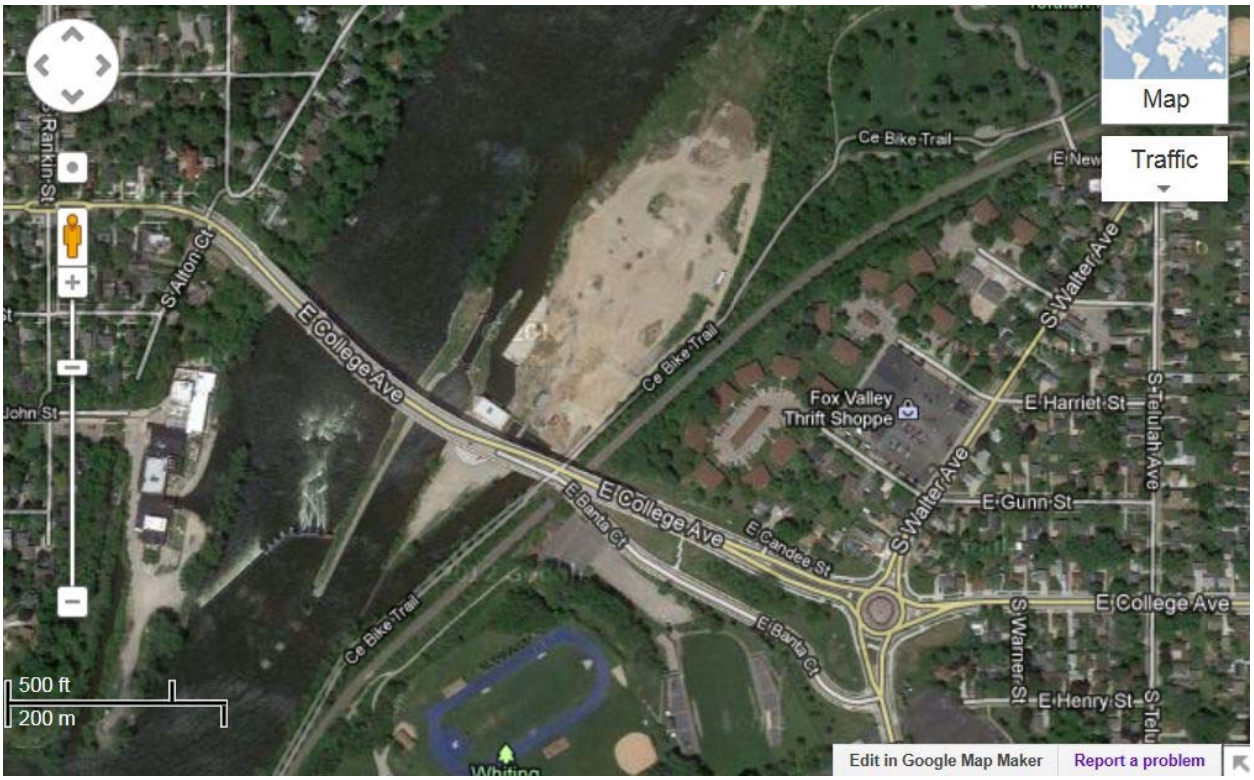
This screen grab is from Google Maps September 2012. It is a satellite shot from summer 2011. You can see the demolition is complete, and the canal is filled.



These are renderings of the project. The geothermal heat exchange plates sit in the river below the boardwalk with the curved arches.

Here is a shot from August 5, 2013:

Here is a shot from October 15, 2013:

Here is a shot from February 13, 2014: Roof complete and windows installed.

June 2014. Evergreen construction complete. Geothermal system functional.

June 2014: Geothermal exchange utilities room.

June 2014: From RiverHeath Way. Residents moved into new apartments.

From Summer 2014. Marketing Shot for Phase One: Evergreen.

Spring 2016: Phase Two: Prairie Progress.

Summer 2016: Progress on Phase Two: Prairie. You can see Evergreen in background.

Summer 2016: Prairie Progress.

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Wisconsin Geothermal Roundtable

The Wisconsin Geothermal Roundtable is an opportunity for industry professionals and interested parties to collaborate and learn more about the state of the geothermal industry in Wisconsin and the nation. Participants will hear from guest speakers about the benefits of geothermal, challenges the industry currently faces, and long-term strategies to promote and increase the use of geothermal in the state of Wisconsin.

Monona Terrace Community and Convention Center
1 John Nolen Drive, Madison, WI
Tuesday May 24th, 2016 8:45am – 12:30pm
*Registration and breakfast begin at 8:00am

Hosted by the Office of Energy Innovation (f/k/a Wisconsin State Energy Office), Wisconsin Geothermal Association, International Ground Source Heat Pump Association, and other stakeholders, the goals of the Wisconsin Geothermal Roundtable are to promote geothermal technologies in Wisconsin to increase geothermal use and installations in the state; provide a neutral resource of information on the state of the geothermal industry; explore financial opportunities to fund installations; and understand the long-term opportunities available with the use of geothermal in agriculture, manufacturing, schools, and commercial projects.

RSVP today for this **FREE** half-day event. *Registration closes May 19

View the event agenda *subject to change

Click here to learn more about geothermal

Featured speakers

Introduction
Amber Gray, Office of Energy Innovation
Representative Mike Kuglitsch

Keynote
Dr. Susan Hamm, US Department of Energy

Brief primer on geothermal
Jack Dienna, International Ground Source Heat Pump Association

State of the Geothermal Market Nationally

Bruce Walker, Fort McCoy

Mark Geall, Tanesay Development

Troy Berg, Q Energy Systems

Jeff Urlaub, MEP Associates

Leo Udee, past president, Wisconsin Geothermal Association

Ask the Experts panel

Moderator: Doug Dougherty, Geothermal Exchange Organization

Jack Dienna, IGSHPA

Manus McDevitt, Sustainable Engineering Group

David Jankowsky, Francis Renewable Energy

Brian Urlaub, Enertech

Jan Stranz, Oconto Electric Cooperative

Jason Stringer, Wisconsin Energy Conservation Corporation

Future of Geothermal

Katherine Young, National Renewable Energy Lab

Conclusion

Jack Dienna, IGSHPA

Partners

International Ground Source Heat Pump Association

Wisconsin Geothermal Association

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