



# There's Got to Be Something Better!

## *Innovative Closed Loop Boreholes*

*Presented Live at the  
NY-GEO 2023  
Conference  
Albany, New York on  
April 27, 2023*

### **Moderator:**

Andrew Piper / *NYSERDA*

### **Panel:**

Rob Jensen / *Agreenability (Twister)*  
Dave Hermantin / *(Rygan Application)*  
Bill Buschur / *Waterless Geothermal*  
Jean-Francois Lavoie / *Versaprofiles*

# A BIG THANK YOU to This Year's Sponsors!

PLATINUM - PRESENTING



TOP JOBS



GOLD



BRONZE



MIX N MINGLE



WIFI



LUNCH



SILVER



EXHIBITOR BINGO



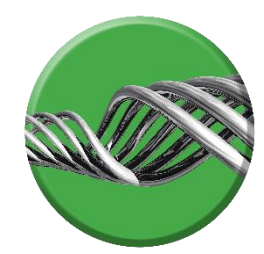
BREAKFAST



COFFEE BREAK



We Couldn't Do It Without You! • [www.ny-geo.org](http://www.ny-geo.org)



# TWISTER™ Vertical Ground Loop



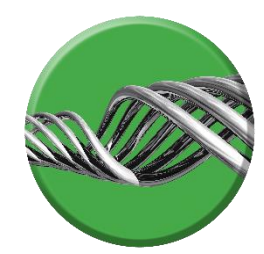


A large coil of black Twister™ High Efficiency Earth Loop cable is shown lying on a lawn in a wooded area. The cable is coiled into a large, circular shape, with a single length of cable extending outwards to the right. The background features green trees and a small body of water. The text "TWISTER™" is displayed in a white box in the upper right corner, and "High Efficiency Earth Loop" is displayed in a white box in the lower right corner.

**TWISTER™**

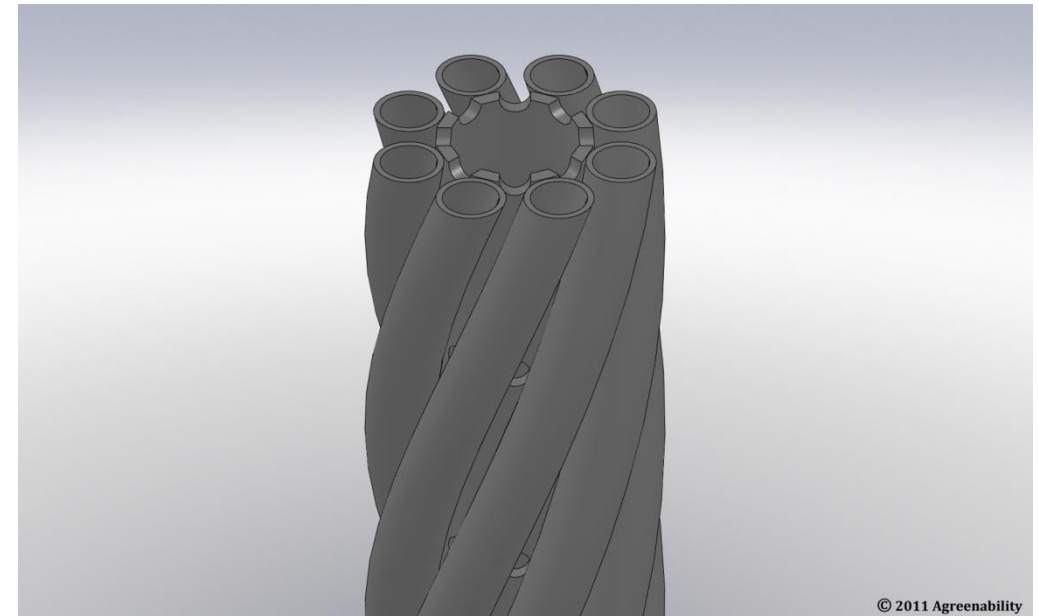
**High Efficiency  
Earth Loop**





# TWISTER

The **TWISTER** is a type of ground source heat exchanger that utilizes a unique spiral design with 4 individual loops of pipe. The design increases the amount of heat transfer between the ground and the heat exchanger, which improves the efficiency and lowers installation cost. The TWISTER system is designed to be compact and easy to install, making it an attractive option for both residential and commercial applications.

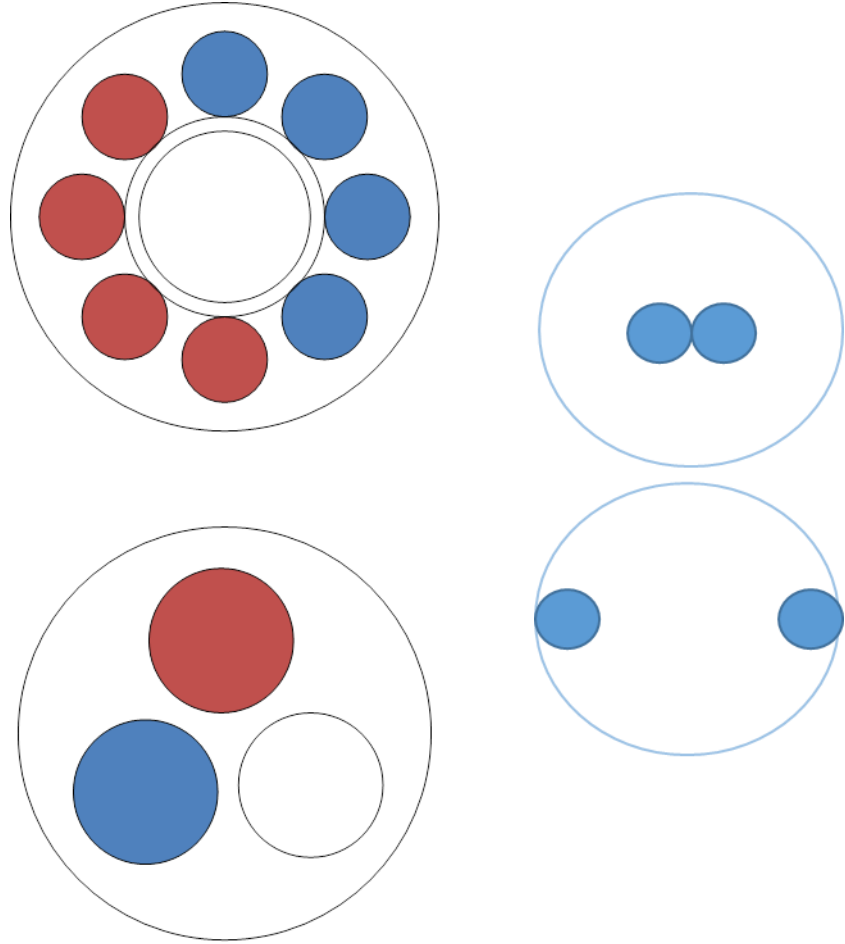




# There's Got to Be Something Better!

## How does TWISTER work? By utilizing the entire BOREHOLE

- **TWISTER™** Reduces **BTR** by up to 80% compared to standard by...
  - Maximizing heat transfer surface area
  - Minimizing annular space.
  - Minimizing thermal resistance of pipe



		6" Bore Comparison		
		BTR (hr F ft/Btu)		
	TWISTER	1 1/4"	3/4"	
<b>Grout 0.4</b>	0.1494	0.2790	0.4290	
Pipe	0.0176	0.0707	0.0710	
<b>Total</b>	<b>0.1670</b>	<b>0.3500</b>	<b>0.5000</b>	
<b>Grout 1.0</b>	0.0623	0.1213	0.1773	
Pipe	0.0176	0.0707	0.0710	
<b>Total</b>	<b>0.0799</b>	<b>0.1920</b>	<b>0.2480</b>	

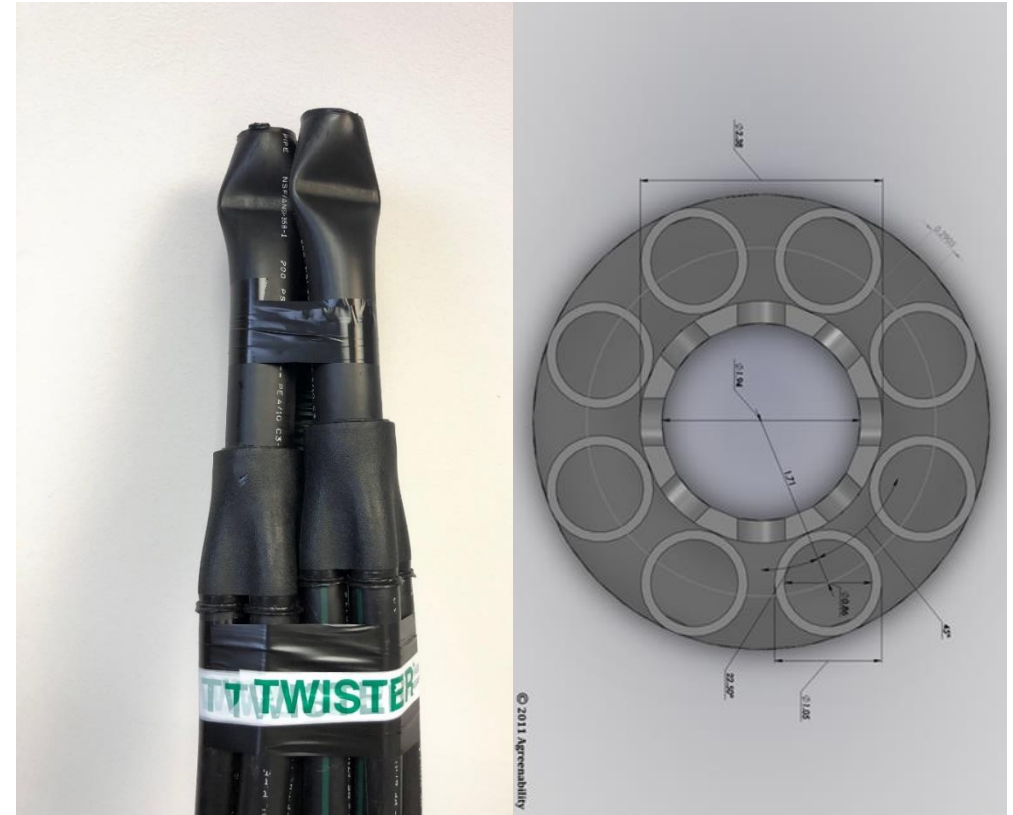




# TWISTER™

## Description

- Four individual  $\frac{3}{4}$ " loops (HDPE 4710) **Standard Loop Material, Standard Warranty.**
- Twisted around a central 2" perforated grout conduit.
- Delivered in coils for easy transportation and installation.
- all pipes are fused and manifolded at the factory.





# TWISTER™

## Benefits...

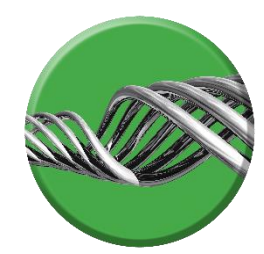
- 20-50% less drilling
  - Average 20% reduction in loop field cost.
  - Save Time
  - Less Space
  - Less Complicated.
    - Avoid Difficult Drilling
      - Water, Caverns, Unstable Geology.

## Advantages of the design...

- More efficient heat exchange.
- Same installation method as a standard loop.
- Superior Grouting through the center conduit.







# Installation Process

**Designed to install  
with the same  
simplicity as standard  
HDPE loops.**

\*\*Video available at  
[www.agreenability.com](http://www.agreenability.com)





# Superior Grouting

## Advantages of center conduit grouting...

- Unobstructed pathway for the tremie.
- Reliable Bottom-up grouting.
  - Once TWISTER is installed, grouting can take place anytime.
  - Conduit protects pathway from hole collapses.
  - Easy insertion with no hang-up in fractures.
- Properly dispersed gout.
  - Tested and approved by NJDEP.

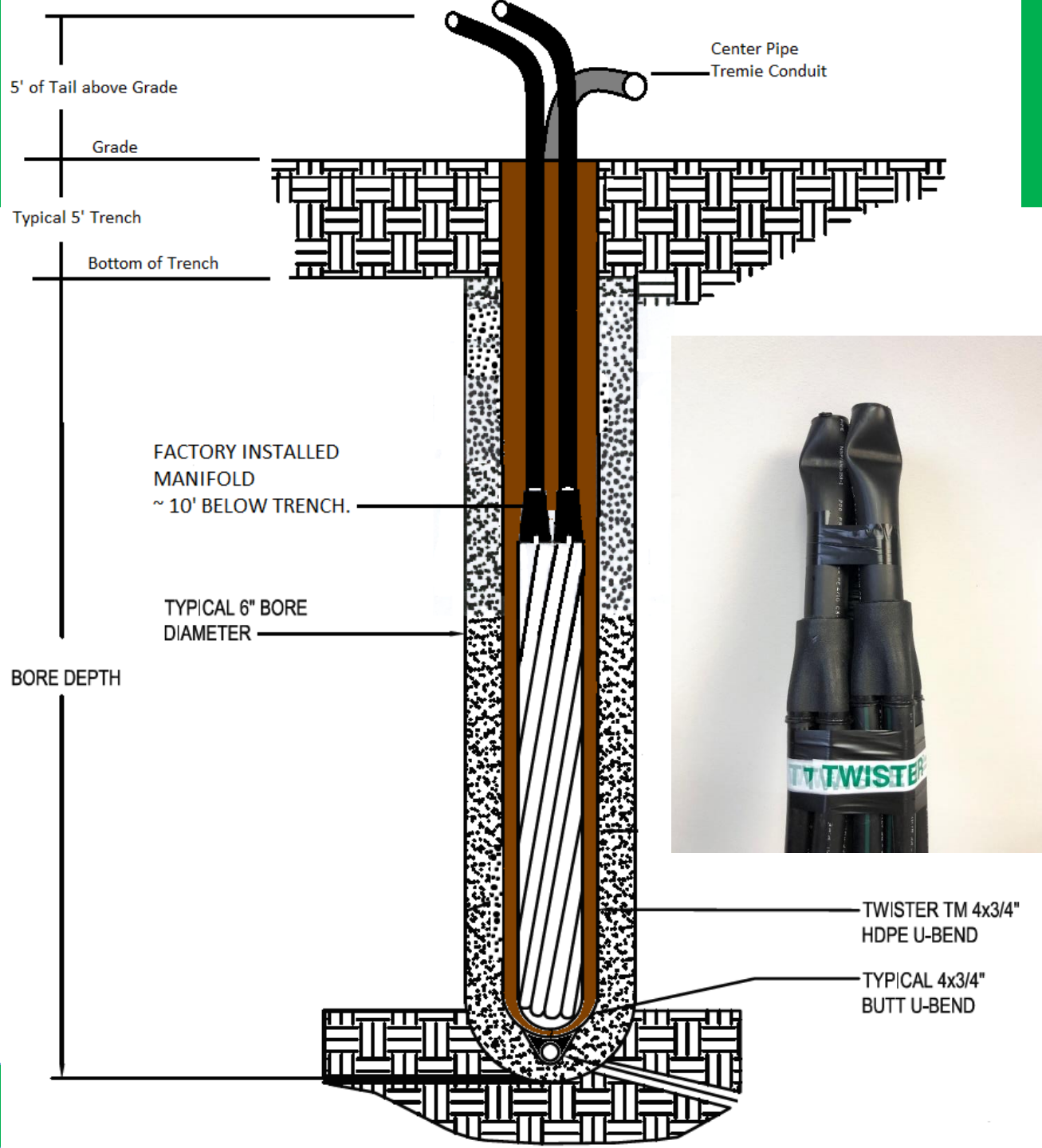




# Trenches

## Trenching is simple with factory installed, below grade, manifold.

- Four 3/4" pipes for supply and return each set if four connected to a manifold that collect to a 1 1/4" pipe.
- Trench connections are identical to standard 1 1/4" loops.
- Simple and trusted heat fusion.







# TWISTER Economics

TWISTER™ is a premium priced product.

- Savings are derived from the reduction in drilling and other parts of the loop field.
  - Average drilling prices \$20/ft - \$25/ft or more.
  - Grout \$3-4/gal.
  - Pipe \$2.00/ft of bore.
  - Trenches \$15/ft-\$20/ft.
  - Casing \$25/ft
- Analysis a project: School 210 Bores @ 400' of 1 ¼" redesigned with 140 Bores @ 400' of TWISTER.





# TWISTER Economics

U-bend HDPE Pipe			TWISTER		
Drilling Costs		Units	Drilling Costs		
Borehole Diameter	6	in	Borehole Diameter	6	in
Borehole Depth	400	ft	Borehole Depth	400	ft
Number of Boreholes	210		Number of Boreholes	140	
Total Loop Length of System	84000	ft	Total Loop Length of System	56000	ft
Price of drilling	\$20.00	U.S. dollars/foot	Price of drilling	\$20.00	U.S. dollars/foot
<b>Total Drilling Costs</b>	<b>\$1,680,000.00</b>		<b>Total Drilling Costs</b>	<b>\$1,120,000.00</b>	
Material Costs			Material Costs		
Total Volume of Grout Needed	104490.97	Gallons	Total Volume of Grout Needed	57812.10	Gallons
Price of Grout	\$3.50	\$/gallon	Price of Grout	\$3.50	\$/gallon
Total Grout Costs	\$365,718.40		Total Grout Costs	\$202,342.36	
Price of Pipe per foot	\$2.00		Price of Pipe per foot	\$5.50	
Total Pipe Costs	\$168,000.00		Total Pipe Costs	\$308,000.00	
<b>Total Material Costs</b>	<b>\$533,718.40</b>		<b>Total Material Costs</b>	<b>\$510,342.36</b>	
<b>Total Costs (Drilling,Material)</b>	<b>\$2,213,718.40</b>		<b>Total Costs (Drilling,Material)</b>	<b>\$1,630,342.36</b>	
Cost of well per foot	\$26.35		<b>\$ Savings</b>	<b>\$583,376.04</b>	<b>26.35%</b>

Drilling \$560k Saved  
 Total material cost unchanged

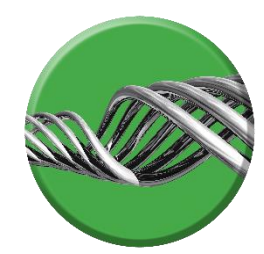


# TWI\$TER Economics

## Trenching and Casing offers Additional Savings

<b>Casing Savings</b>			<b>Casing Savings</b>		
Casing Cost	\$25		Casing Cost	\$25	
Feet of casing per hole	50		Feet of Casing per hole	50	
Casing cost Job	\$ 262,500.00		Casing Cost Job	\$ 175,000.00	
			Additional Savings Casing	\$ 87,500.00	
<b>Trenching Savings</b>			<b>Trenching Savings</b>		
Trench Cost per foot	\$20		Trench Cost per foot	\$20	
Feet of trench per hole	20		Feet of trench per hole	20	
Trenching cost Job	\$ 84,000.00		Trenching cost Job	\$ 56,000.00	
			Additional Savings Trenching	\$ 28,000.00	





**THANK YOU**

# System and Project Site Review



*High Performance Geo Xchange*







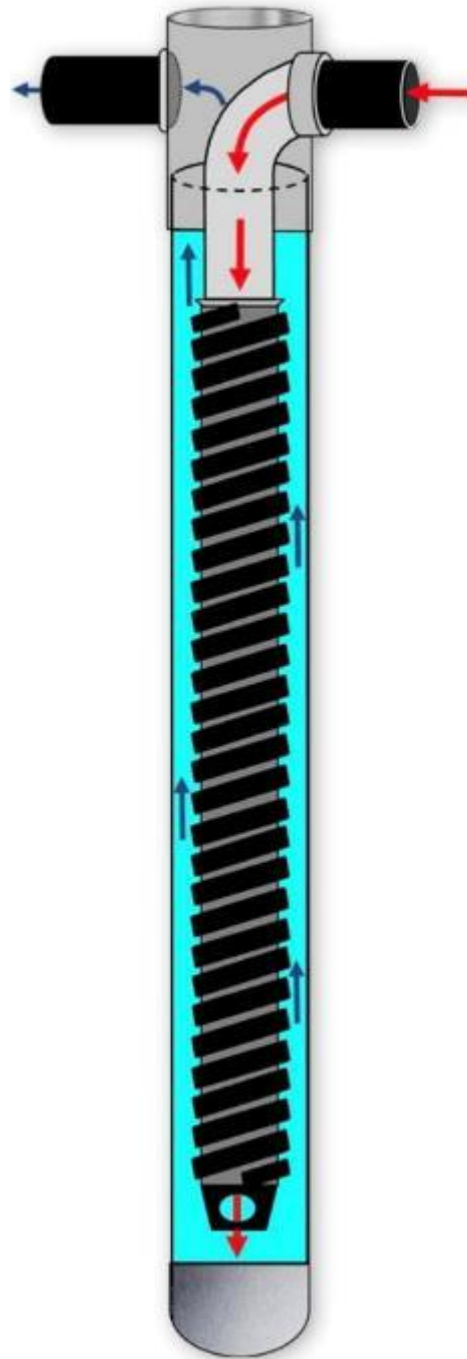
*High Performance Geo Xchange*

**Coaxial arrangement**

**Fiberglass outer case**

**Chemical fused connections**

**Standard or deep bore systems**





**Boston University**

**Data Science Center**

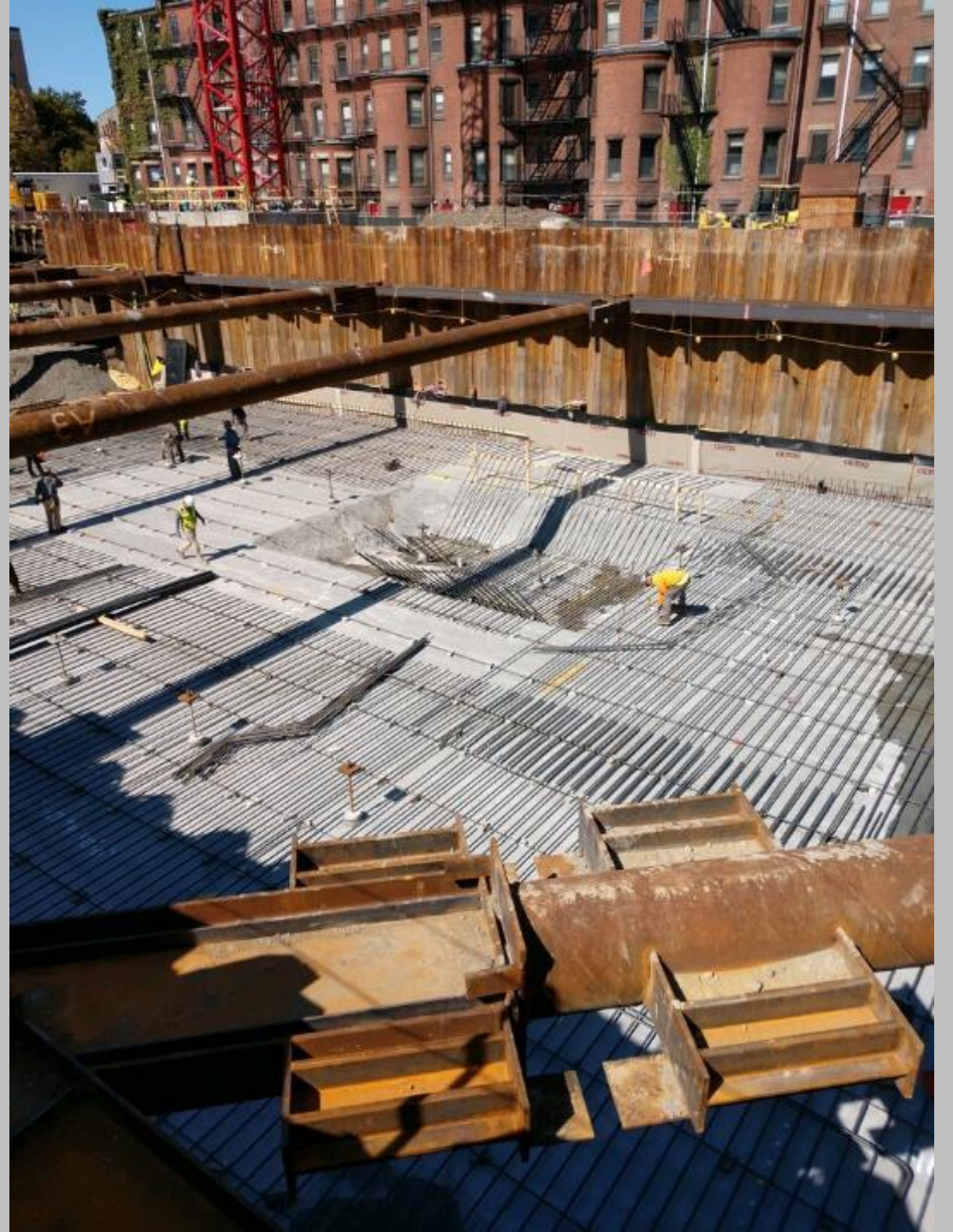
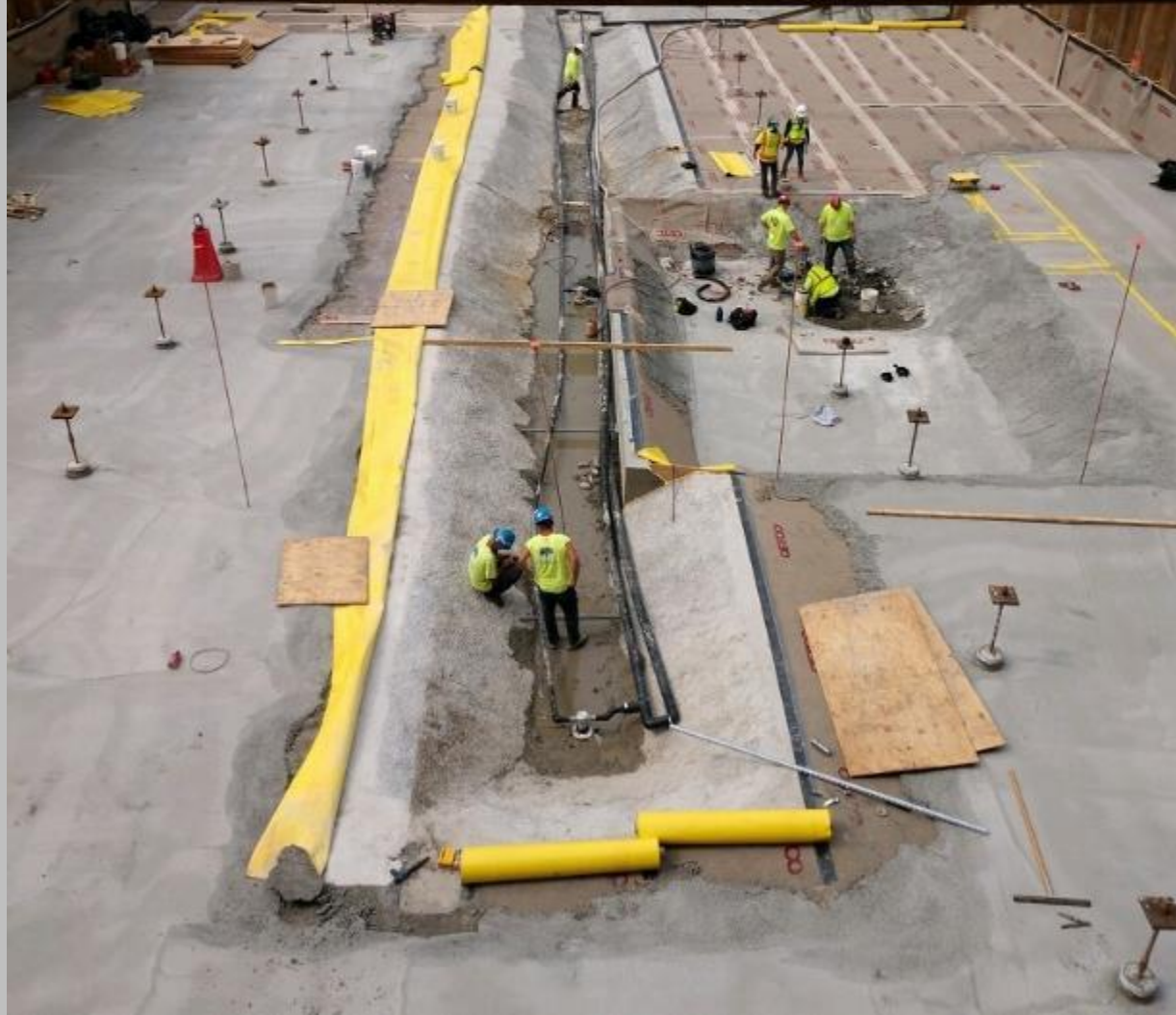
**19 Stories**

**345,000 sq. feet**

**31 HPGX Bores @  
1,500 ft.**











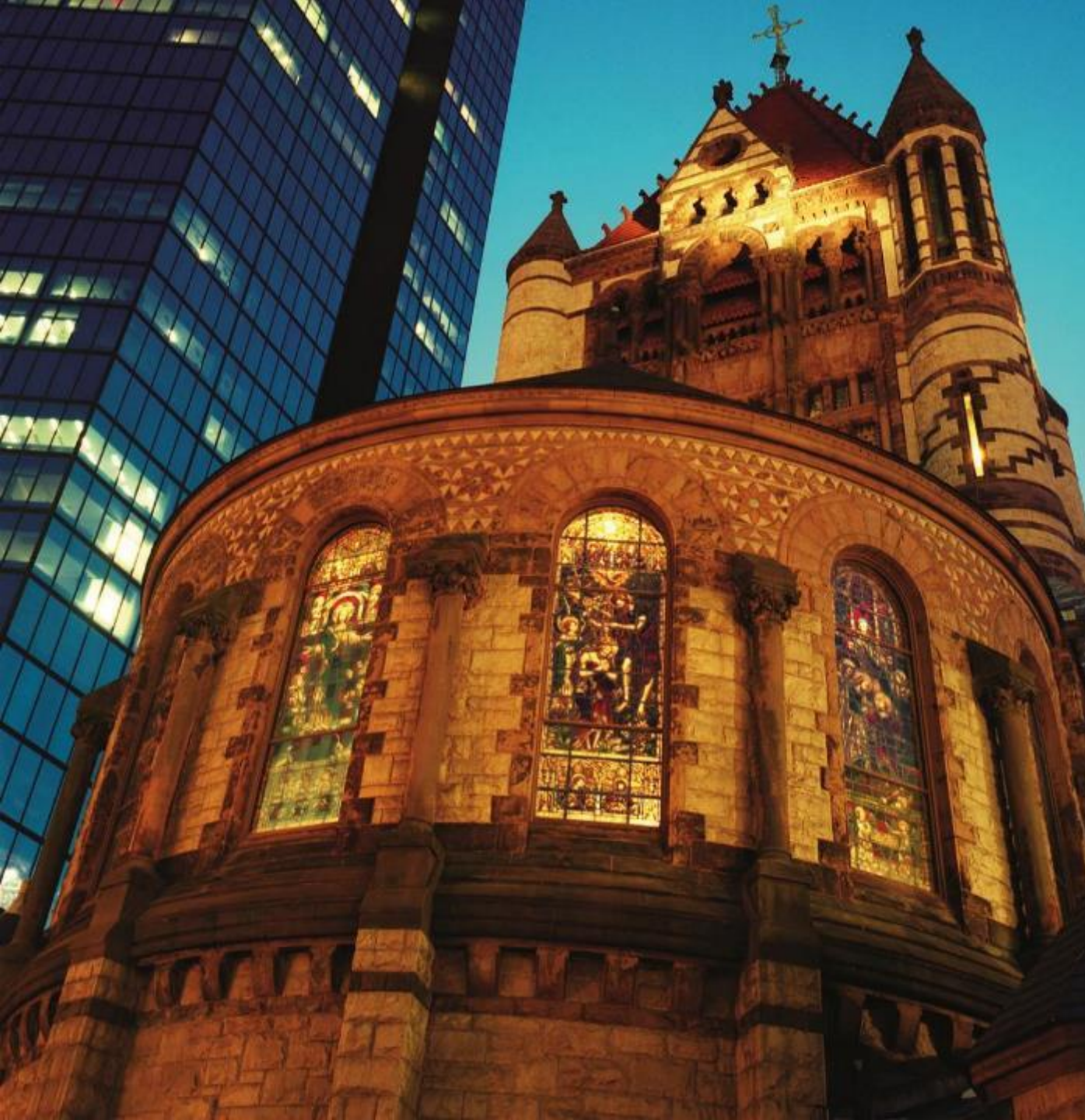












**Trinity Church**

**Boston, MA**

**National Historic Landmark**

**6 HPGX Bores @ 1,500ft.**

**Utilized existing bores previously  
used as standing column wells**







**Frank Lloyd Wright's Unity Temple  
Chicago, IL  
National Historic Landmark**







**Longfellow House**

**Cambridge, MA**

**National Historic  
Landmark**

**8 HPGX Bores**

**Utilized existing  
bores previously  
used as standing  
column wells**

**Awarded for Excellence in Engineering  
2012**

**ACEC**

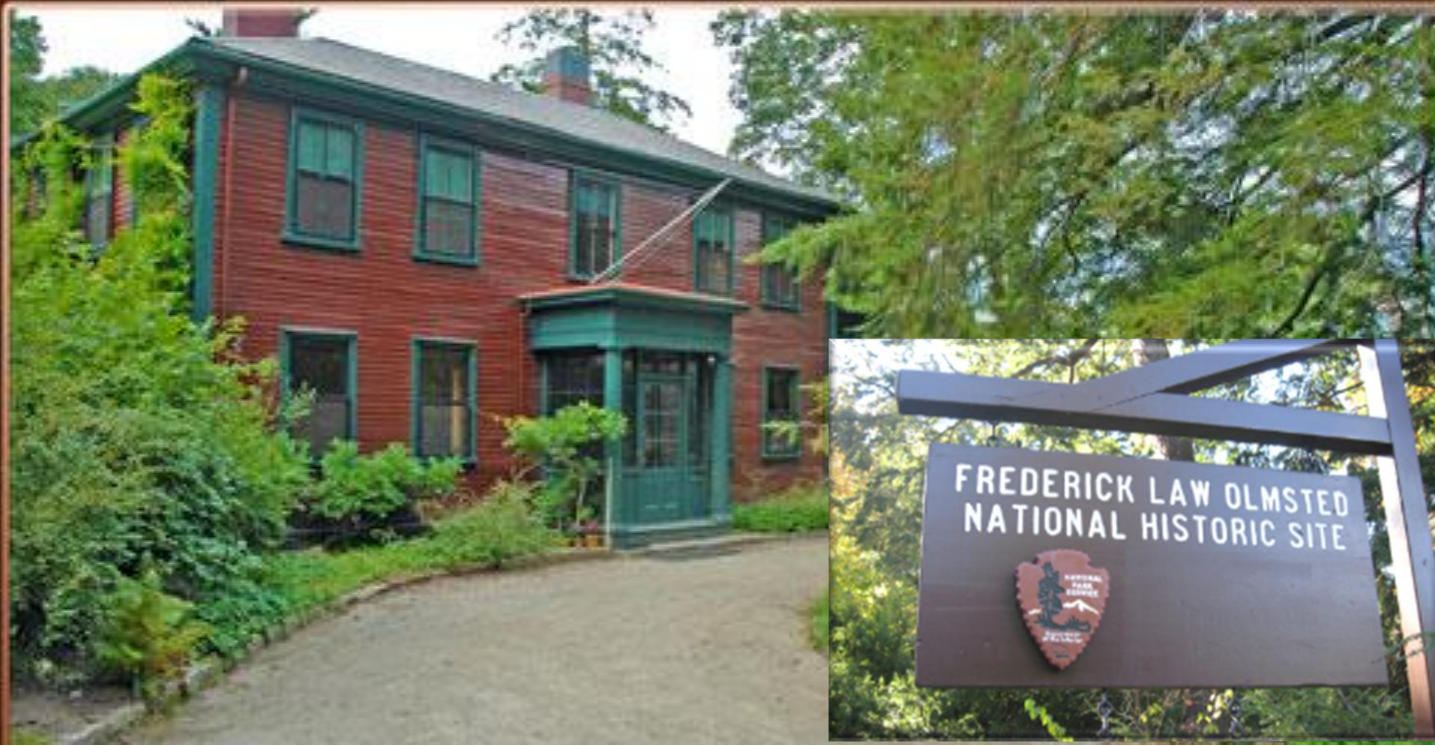
AMERICAN COUNCIL OF ENGINEERING COMPANIES

100 Years of Excellence

HPGX Geothermal - Longfellow House



# Fredrick Law Olmsted House Cambridge, MA National Historic Landmark





# Tower Block Housing Manchester, England







## **Darien Library, Stamford, CT**

Darien Library is a *Library Journal* Five Star Library and among the busiest public libraries in the Connecticut with over 1,300 people visiting on an average day. Darien maintains LEED Gold certification utilizing 14,500 linear feet (4,400M) of Rygan HPGX to support a 145-ton (510kw) heat load.











# 2023 Geothermal Conference

There's got to be something better! Innovative Closed Loop Boreholes



Bill Buschur

Total Green Mfg. Corp.

St. Henry, OH 45883

[www.WaterlessGeothermal.com](http://www.WaterlessGeothermal.com)



# ADVANTAGES OF A DIRECT EXCHANGE LOOP FIELD

THE **EARTH LOOP** IS THE  
**HEART**  
OF A **GEOHERMAL**  
**SYSTEM**

**The Performance of every system depends on an effective ground heat exchanger design!**



# PRE-ENGINEERED EARTH LOOPS



**Diagonal Pattern**



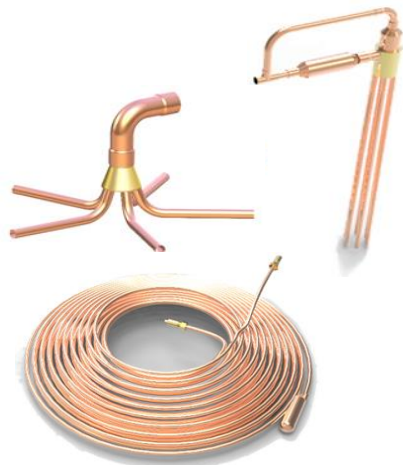
**Vertical Pattern**



**Horizontal Trench**



**Directional Bore**



- **All Earth Loop Systems are Factory Built**
- **Less Stress for the Installer/Designer**
- **Smaller Loop/Pipe Diameters**
- **Designed to Ensure Proper Oil Return**
- **Designed for Equal Distribution throughout the field**



# MORE CONDUCTIVE EARTH LOOP

## PLASTIC or COPPER?

PLASTIC HANDLE REDUCES HEAT TRANSFER



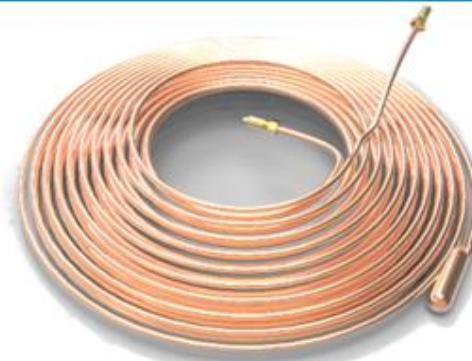
COPPER BOTTOM INCREASES HEAT TRANSFER

**MATERIALS MATTER !**

## HEAT TRANSFER RATINGS

**COPPER TUBING:**  
232 BTUH/FT

**PLASTIC TUBING:**  
(POLYETHYLENE)  
0.29 BTUH/FT



COPPER LOOP



PLASTIC LOOP

**COPPER IS OVER  
850 TIMES MORE  
CONDUCTIVE**

# LESS LOOP REQUIRED TO INSTALL PER TON

## LOWER DRILLING COST

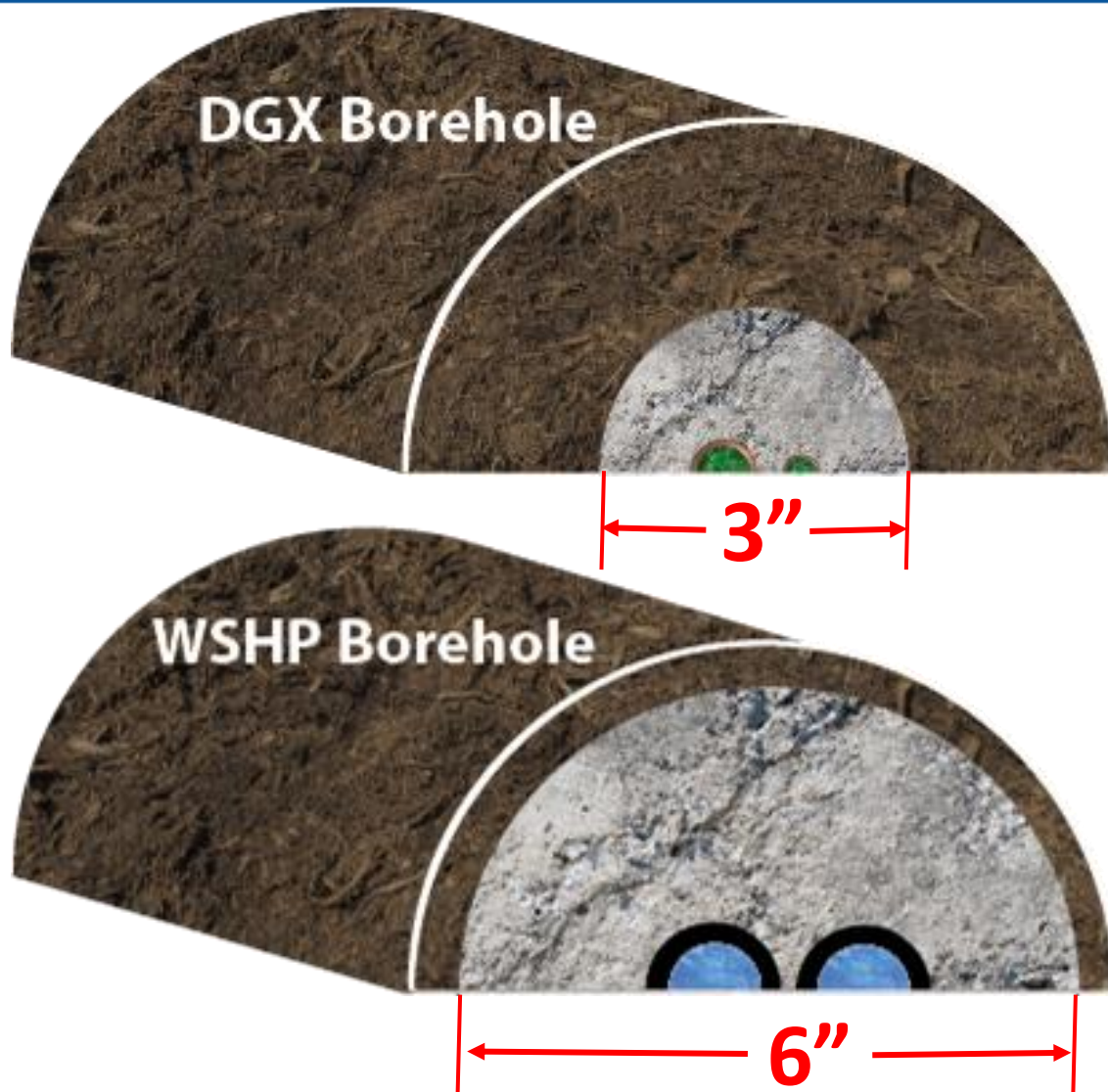
- As low as 120 feet of loop per ton



**REDUCING DRILLING COST BY:  
400 to 650 feet on a 5 ton project**



# SMALLER BOREHOLE ADVANTAGES



- **Smaller Drilling Equipment**
  - Faster Drilling
- **Skinnier Grout Column**
  - Lower Thermal Barrier to Earth
  - Less Grout Needed
- **Better Thermal Conductivity**
  - Better Heat Transfer with Earth
  - More Efficient Earth Loop

# LESS DRILLING CHALLENGES

- **Shallower Loop Depths**
  - 100 Feet Maximum Depth
- **Smaller Borehole**
  - Better Heat Transfer with Earth

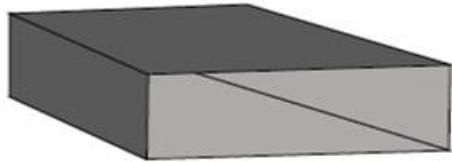




# REFRIGERANT...A MORE EFFICIENT LOOP FLUID

## THE MOST EFFICIENT WAY TO MOVE HEAT

Air



**Air Moves:**  
0.048 BTU of Heat  
per hour per pound

Water



**Water Moves:**  
8.88 BTU's of Heat  
per hour per pound

Refrigerant



**Refrigerant Moves:**  
85.38 BTU's of Heat  
per hour per pound

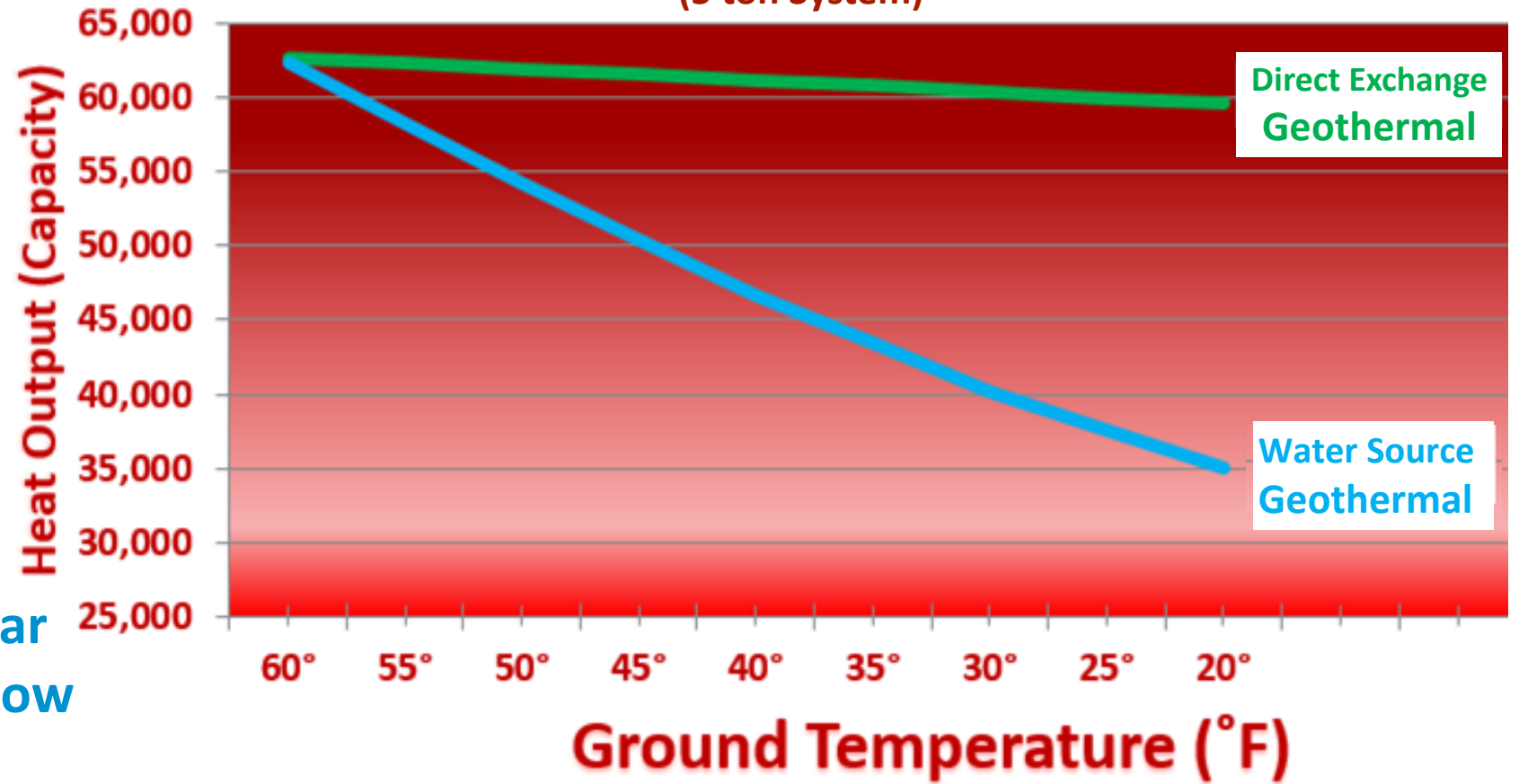
**REFRIGERANT MOVES  
NEARLY 10 TIMES  
MORE HEAT!**

# OPTIMAL LOOP PERFORMANCE

A COLD  
CLIMATE  
GEOTHERMAL

Heating Output Remains Near  
Nominal Capacities During Low  
Ground Temp. Conditions

Drop in Ground Temp = Drop in Capacity  
(5 ton System)





# SMALLER FOOTPRINT FOR SMALL LOTS

(Diagonal Loop Pattern)

## Less Disruption to the Property

3 ft. Manifold Pit/Pilot Hole



Smaller Drill Rig required



2 ft. Lineset Trench Back to House



Loops Tied into Manifold/Header



Total Loop Field Excavation



Finished Landscaping Over Loop Field





# PROVEN RESULTS



## COST OF OPERATION VERIFICATION

1,000's of systems that have a Separate Electric Meter installed

**3,200 SQ. FT.**  
HOUSTON, OH

**PLUS BASEMENT**  
**(5,200 TOTAL SQ. FT.)**



Actual Htg. & Clg. Cost **\$499.57/YR.**

**1,783 SQ. FT.**  
FT. RECOVERY, OH

**PLUS BASEMENT**  
**(3,122 TOTAL SQ. FT.)**



Actual Htg. & Clg. Cost **\$265.46/YR.**



# DELIVER BETTER SATISFACTION

- **Deliver Bigger Savings**
- **Deliver Better Comfort**
- **Offers Better Value**
- **Builds a good reputation for the Geothermal Industry**
- **Looking for Drillers partners to reach NYS 2040 goals**



# Questions?



[www.WaterlessGeothermal.com](http://www.WaterlessGeothermal.com)

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***There's Got to Be Something Better!***  
**Innovative Closed Loop Boreholes**

**Albany, NY**  
**April 27th 2023**

Jean-François Lavoie, P.E., MBA



# About Versaprofiles

With over 50 years of experience in thermoplastic extrusion, Versaprofiles offers **innovation** to make your job easier and lighten your workload. We are producing **pipe** and tubing for maple sap, **geothermal**, water and natural gas distribution applications in addition of specializing into custom made profiles. With our collective expertise in various sectors and our versatile equipment, we can bring your projects to higher level. We work closely and in a friendly atmosphere with each partner to deliver products that meet expectations and provide dedicated customer service.



# About Versaprofiles

2 production facilities south of Quebec City, QC, Canada



**VERSAPROFILES**

# About Versaprofiles

Head office / PE pipe plant

St-Lazare of Bellechasse (41 000 ft<sup>2</sup>)





# About Versaprofiles

- **15** extrusion and coextrusion lines
  - 5/16” to 10” PE pipes
  - DR 7 to DR 32,5
- In-line and off-line secondary processes:
  - Automatic coiling
  - Butt and socket fusion,



# MARKETS SERVED



**Geothermal**



**Maple sap collecting tubing**



**Engineering profiles**



**Municipal and industrial**



**Gas distribution**



**Specialized**



# GEO THERMAL PRODUCT

**VERSAPIPE**<sup>®</sup> HD100 GEO

Single U-bend : **VERTICALOOP**<sup>™</sup>

- Ø : ¾" to 2"
- DR 13,5, Dr11 and DR9
- Custom lengths (300' to 2 000')



# GEOTHERMAL PRODUCT

## TWINLOOP™ DOUBLE U-BEND LOOP

### Benefits

- Extracts 20% more heat from the ground than single loop
- Reduces overall drilling depth for a given load, leading to significant cost reduction
- Reduces the footprint of geothermal projects in space limited areas
- Loop length can be custom made to your needs
- 1 ¼ " and 1 ½ " available



TWINLOOP™





# GEOHERMAL PRODUCT

## VERSAPIPE® HD100 GEO

Pipes for headers, horizontal ties and distribution manifolds

### STICKS

Standard Length* (ft)	Resin	Diameter (in)
20, 40 & 50	<ul style="list-style-type: none"> <li>• PE4710</li> <li>• GEOPERFORMEX®V2</li> </ul>	<ul style="list-style-type: none"> <li>• ¾ to 8 IPS &amp; DIPS</li> <li>• SDR 9 to SDR 26</li> <li>• 80 PSI to 250 PSI</li> </ul>

### TITAN™ REELS & COILS

Resin	Diameter (in)
<ul style="list-style-type: none"> <li>• PE4710</li> <li>• GEOPERFORMEX®V2</li> </ul>	<ul style="list-style-type: none"> <li>• ¾ to 4 IPS &amp; DIPS</li> <li>• SDR 9 to SDR 26</li> <li>• 80 PSI to 250 PSI</li> </ul>

Standard lengths available\*

Nominal Diameter (in)	Length (ft)	
	TITAN™ REEL	COIL
¾	15,000	100, 250, 500, 1,000
1	12,000	100, 250, 500, 1,000
1 ¼	7,000	100, 250, 500, 1,000
1 ½	5,500	100, 250, 500, 1,000
2	3,000	100, 250, 500, 1,000, 2,000
3	-	100, 250, 500
4	-	100, 250, 300



# GEOHERMAL PRODUCT

**VERSAPIPE**® HD100 GEO



Certified to  
NSF/ANSI 358

- **NSF/ANSI 358-1:** *Polyethylene Pipe and Fittings for Water-Based Ground-Source (Geothermal) Heat Pump Systems*



- **CSA ANSI/CSA/IGSHPA C448 SERIES-16** *Design and installation of ground source heat pump systems for commercial and residential buildings*



# Ground loop innovation

## Versaprofiles innovation track record :

### 1. **GEOPERFORMX**® (2010-2020)

- Thermally enhanced HDPE for increased heat transfer
- 10 % to 25 % length reduction of the ground heat exchange system
- Several projects successfully completed
- **ABANDONED IN 2020**
  - *Impossible to certify per PE4710 / GEO standards*
  - *Costs*
  - *Low market acceptance*

# Ground loop innovation

Versaprofiles innovation track record :

## 2. **TWINLOOP**™ (2017 )

- Common in Europe
- Double loop extracts up to 20% more heat than single loop;
- Most efficient configurations per several technical publications
- Some installation challenges / some drillers reluctant to changes.
- Progressive market acceptance



# Ground loop innovation

## Versaprofiles innovation track record :

### 3. **2" LOOP** (2022)

- For **deeper** boreholes, larger projects
- Reduces borehole thermal resistance
- Design / Installation challenges related to 2" loops
  
- Ready for field testing

### **Innovative Closed Loop Boreholes: *There's Got to Be Something Better.***

#### ***Does it ?***

- Industry growth + market acceptance calls for standardization, not new / different products
- Drilling techniques should / can be improved for deeper and straighter holes
- **Evolution VS Revolution** : Innovative solutions exist for more efficient closed loop boreholes based on HDPE loops





***Looking forward for the panel discussion !***

**Jean-François Lavoie, P.E., MBA**