



COMMERCIAL STRATEGIES FOR GEOHERMAL HEAT PUMPS



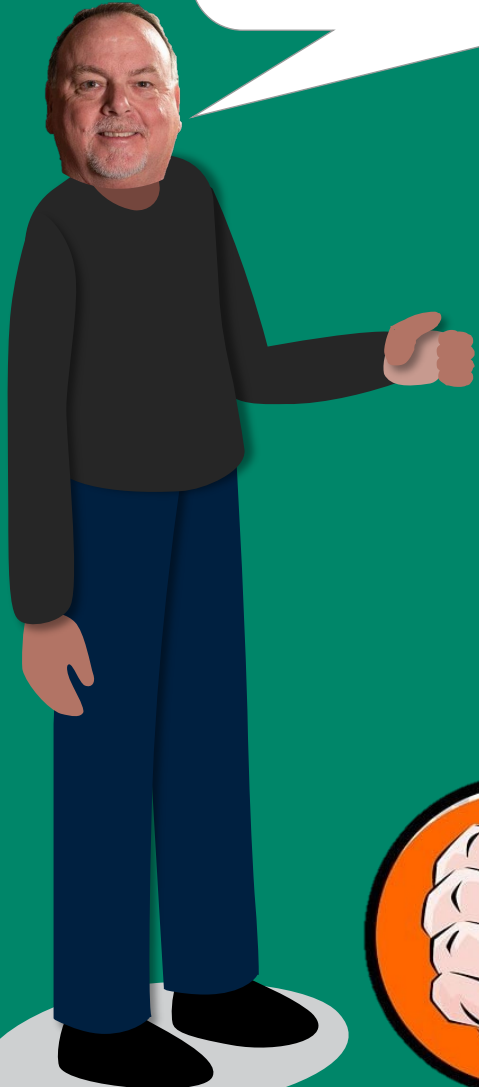
YOUR PRESENTER TODAY

MIKE KAPPS

Certified Geothermal Designer (CGD)
Regional Sales Engineer

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What about Geothermal?



YOUR RESPONSE....

An integrated design approach provides you and your customer the best possibility of making geothermal make sense for the project financially.

The Inflation Reduction Act provides tax credits that can make geothermal systems affordable.

Become the geothermal champion in your region.



Rules of thumb can ruin the opportunity...

You need 1 Ton/400 sq ft – 200' Borehole/ton
- \$25 per ft of Borehole = **DEAD PROJECT**



TAKEAWAYS FOR TODAY

IRA 2023

COMMERCIAL GEOTHERMAL
Tax Guide 2023



Introduce/reintroduce your customers to the concept of geothermal

Utilize our latest updated tax incentive documents

Visit [energy.gov](https://www.energy.gov) to learn more about EERE resources

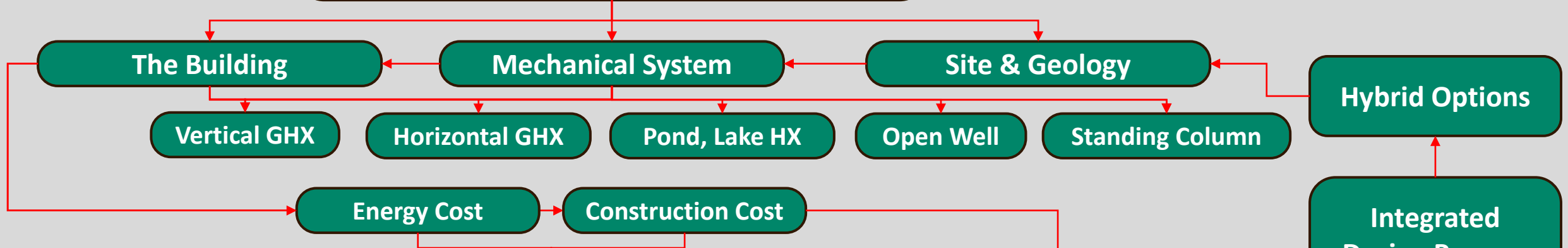
Identify your geothermal champion, become a Certified Geothermal Designer – CGD

LET'S DISCUSS FEASIBILITY



FEASIBILITY

Client Desires a GeoExchange System



CONFIRMATION

Test Drill / Excavation TC Test

DESIGN

Design GHX Design System

Specs & Drawings

IMPLEMENTATION

Construction QA / QC

OPERATION

Commissioning

Operator Training

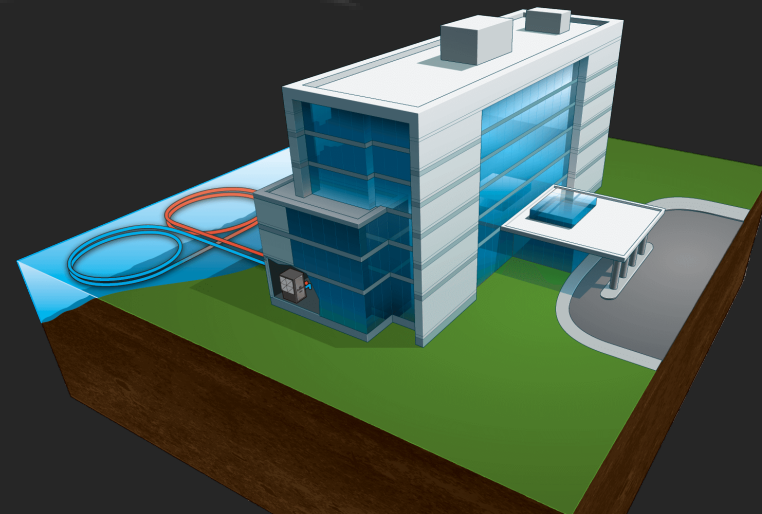
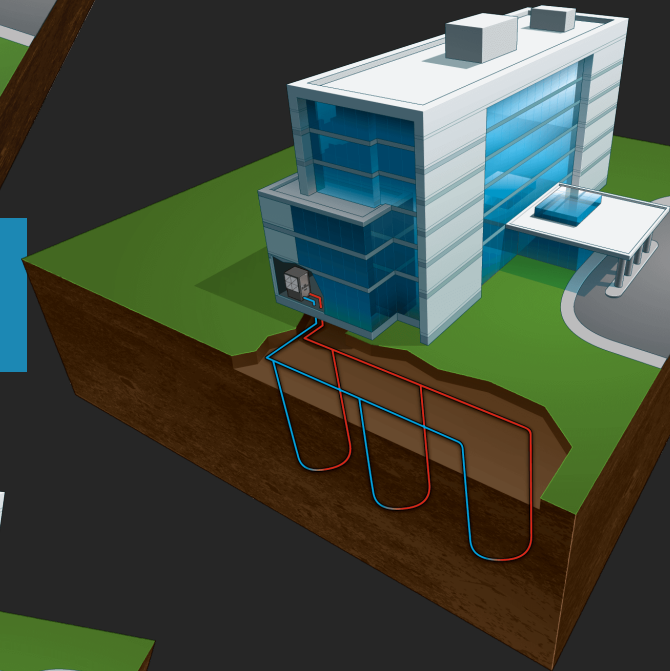
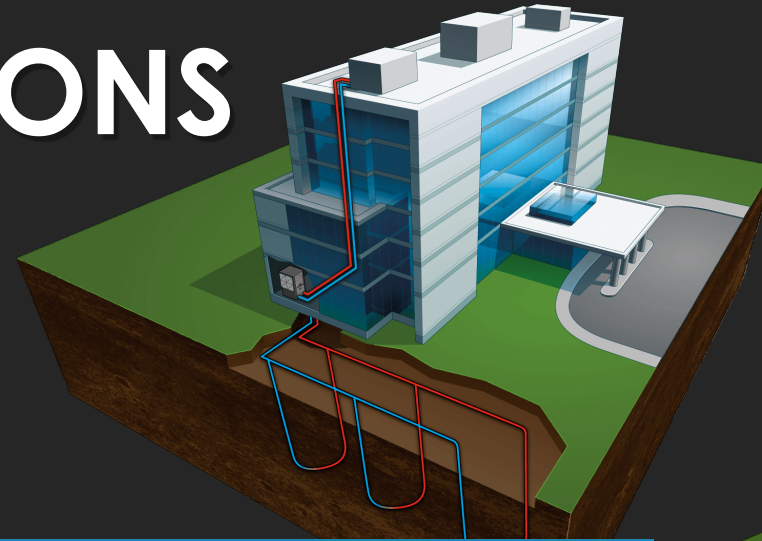
Design Conventional HVAC system if capital cost is too high or site unsuited for Geo

COMMERCIAL 4 CLOSED LOOP OPTIONS

Vertical Loop

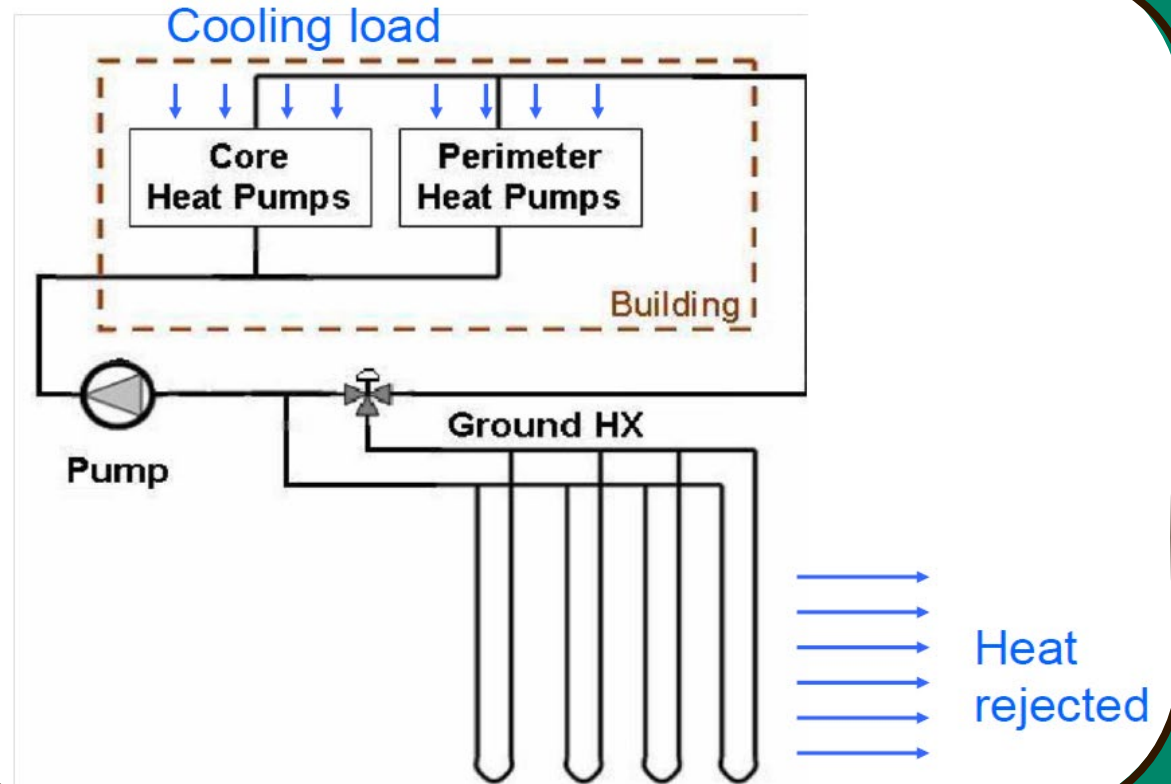
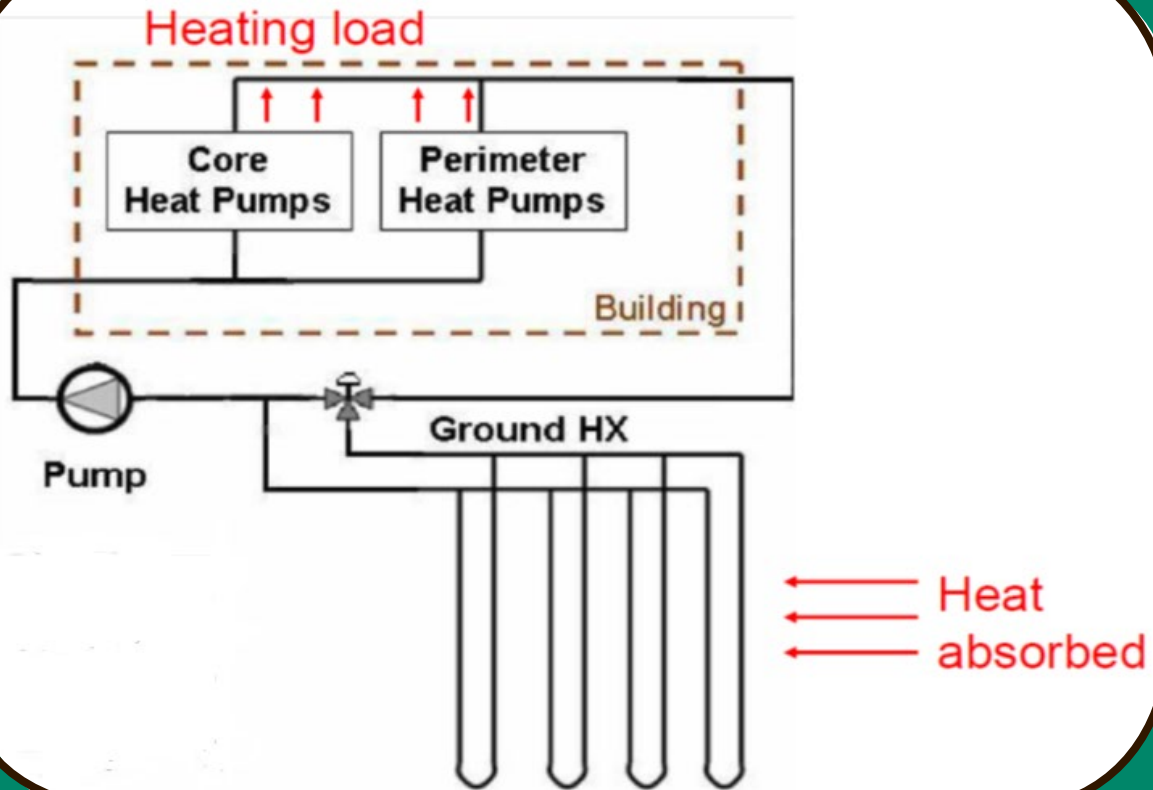
Pond/ Lake / Plate Water Loop

Hybrid Loop



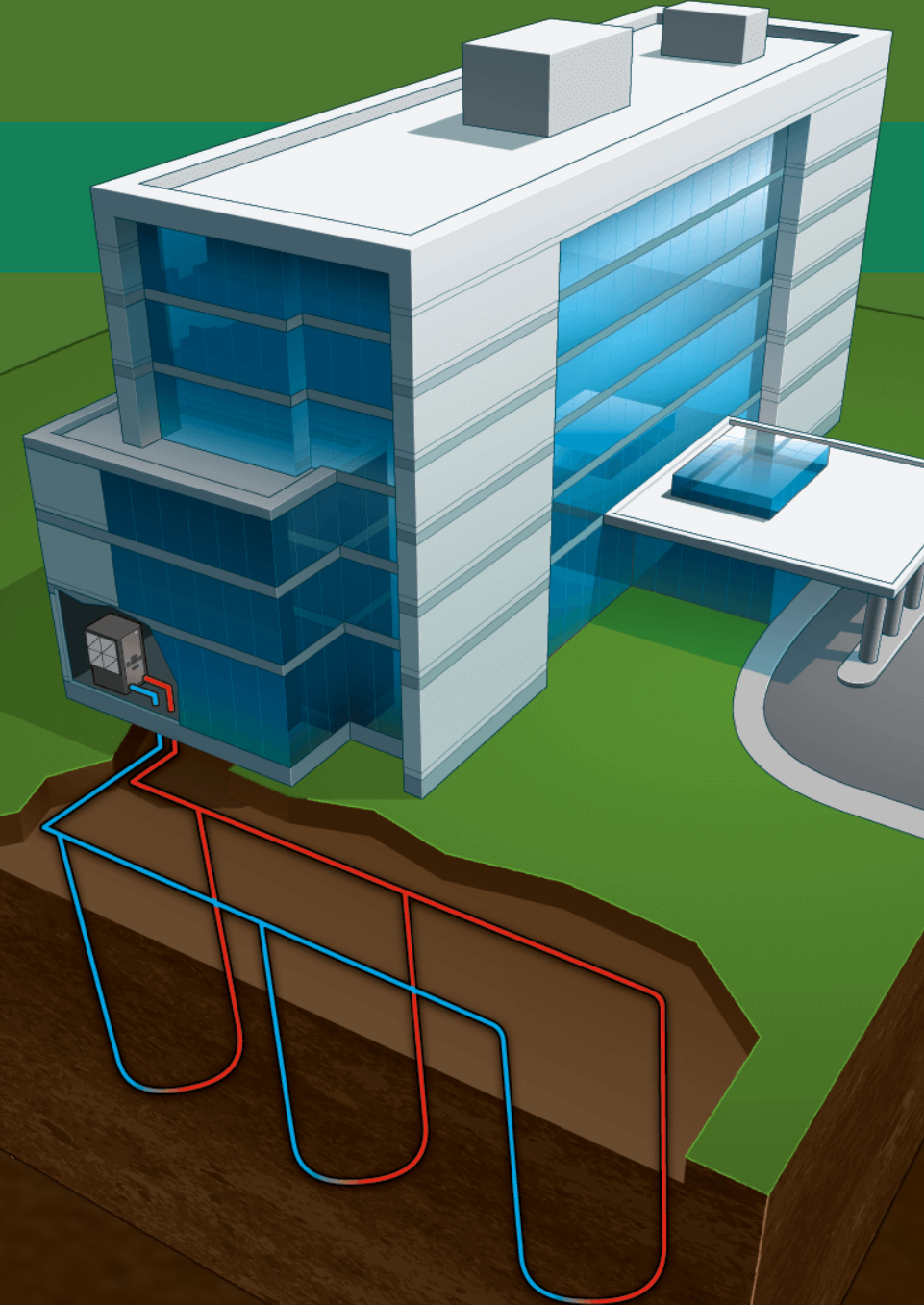
GEOHERMAL HEAT PUMP SYSTEM

WHAT IS IT. HOW IT WORKS.



VERTICAL LOOPS

- Most popular Loop Configuration
- Smallest Land requirement
- Overburden is minimum / Rock
- Stable deep earth Temperature
- Tends to be the most expensive Closed loops
- Requires special skills set and equipment

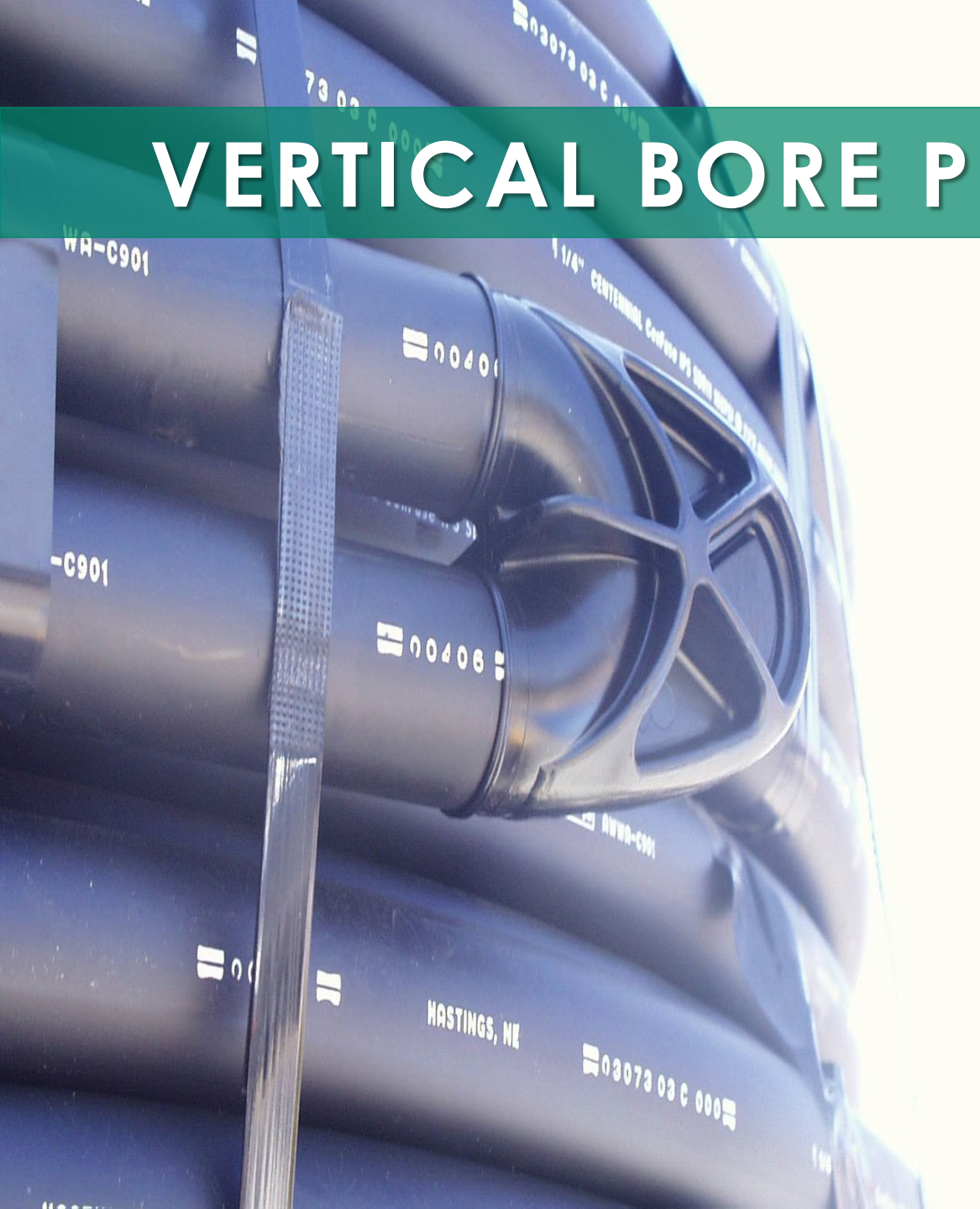


COMMERCIAL VERTICAL GROUND LOOP DRILLING



**THE SIZE, TIMELINE OF THE JOB WILL DETERMINE
RESOURCES REQUIRED**

VERTICAL BORE PIPE MATERIAL U BEND



HDPE PIPE
1" – 1 1/4"

BOREHOLE WITH PIPE U-BEND INSTALLED

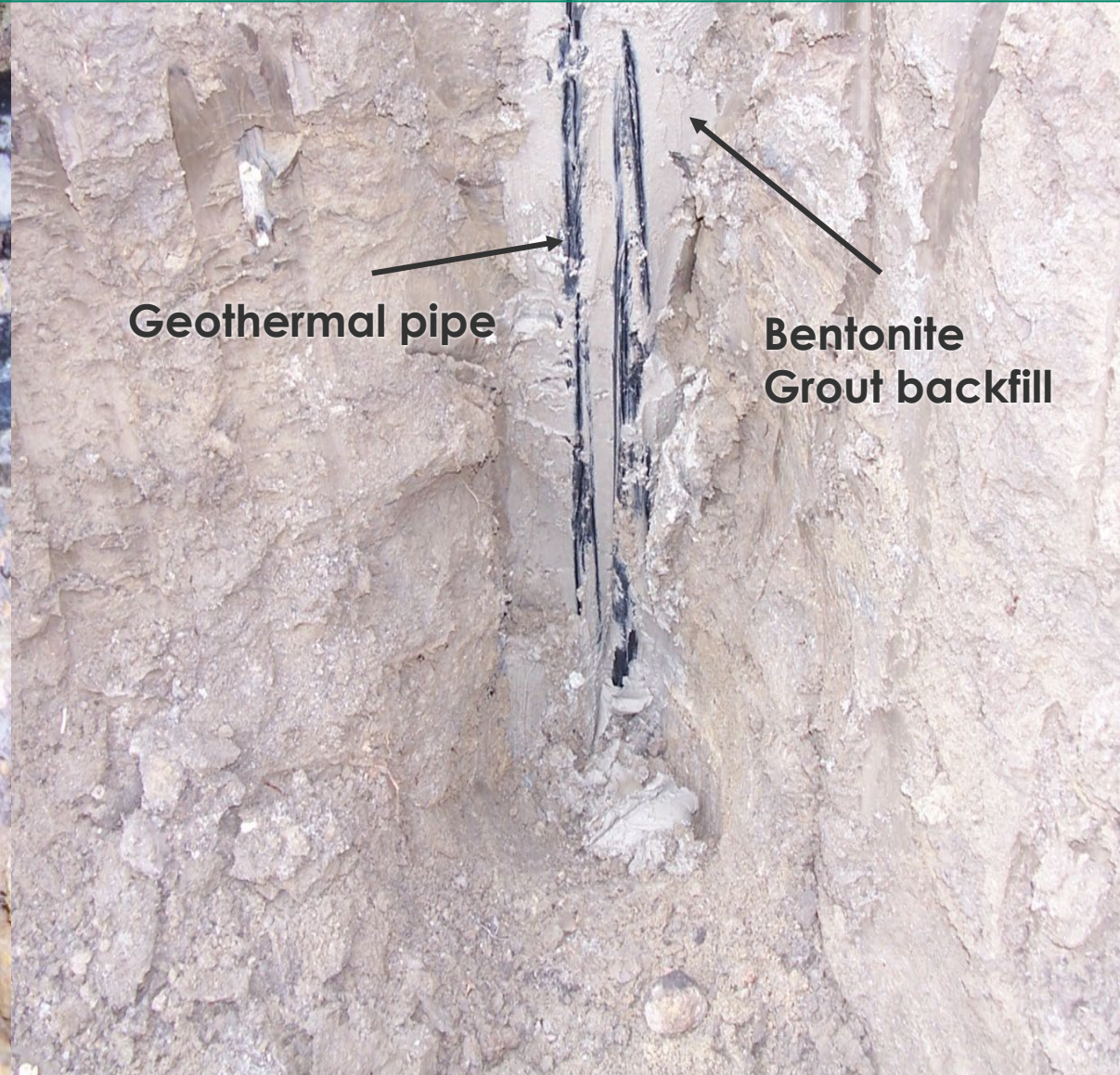
PROPER BORE
BACKFILL/GROUTING IS
CRITICAL FOR SYSTEM
PERFORMANCE
GROUT PROVIDES HEAT
TRANSFER FROM THE
BOREHOLE TO
GEOHERMAL LOOP and
PROTECTS AQUIFER
CONTAMINATION

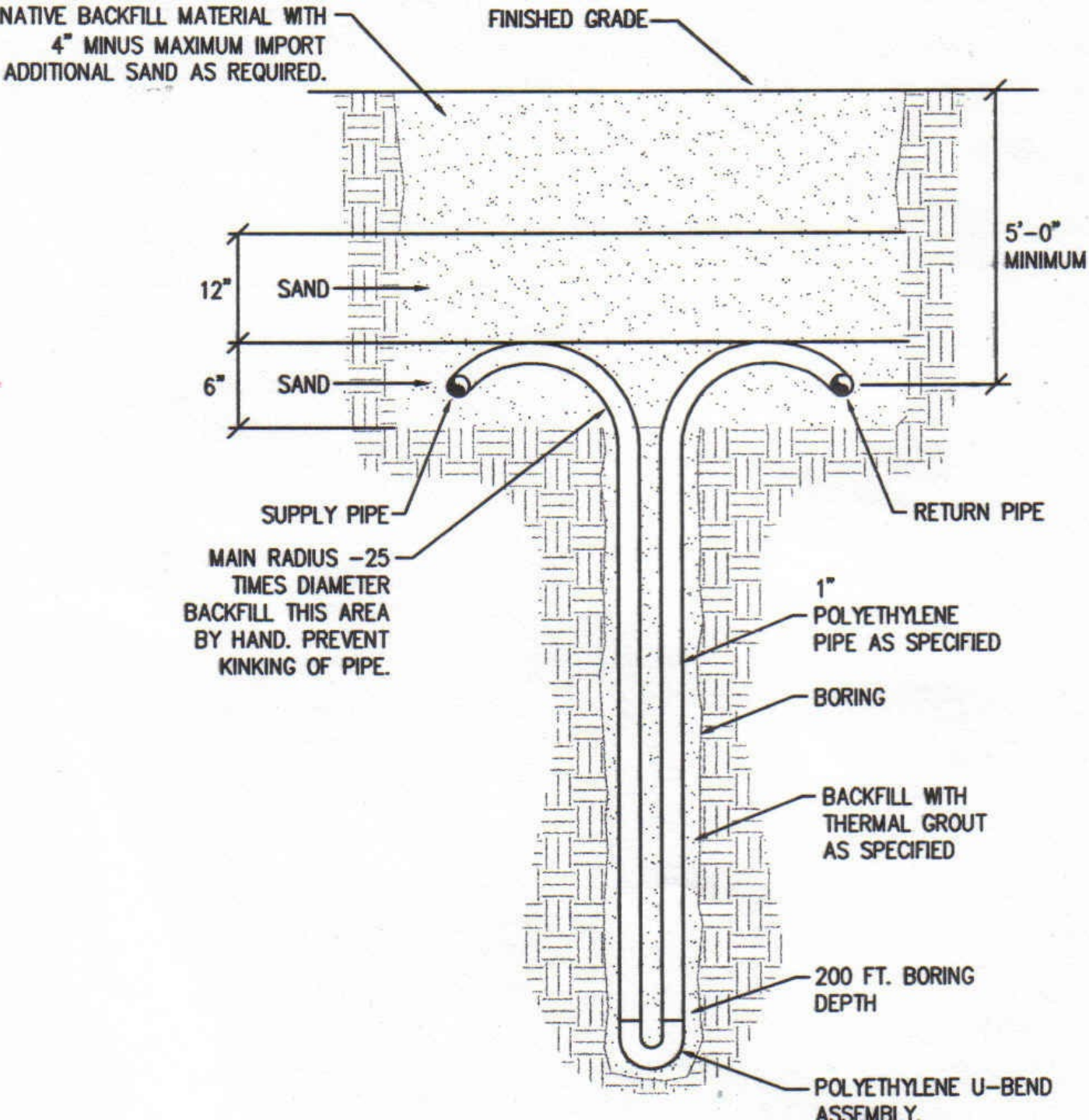
Vertical bore without grout backfill



Geothermal pipe

**Bentonite
Grout backfill**





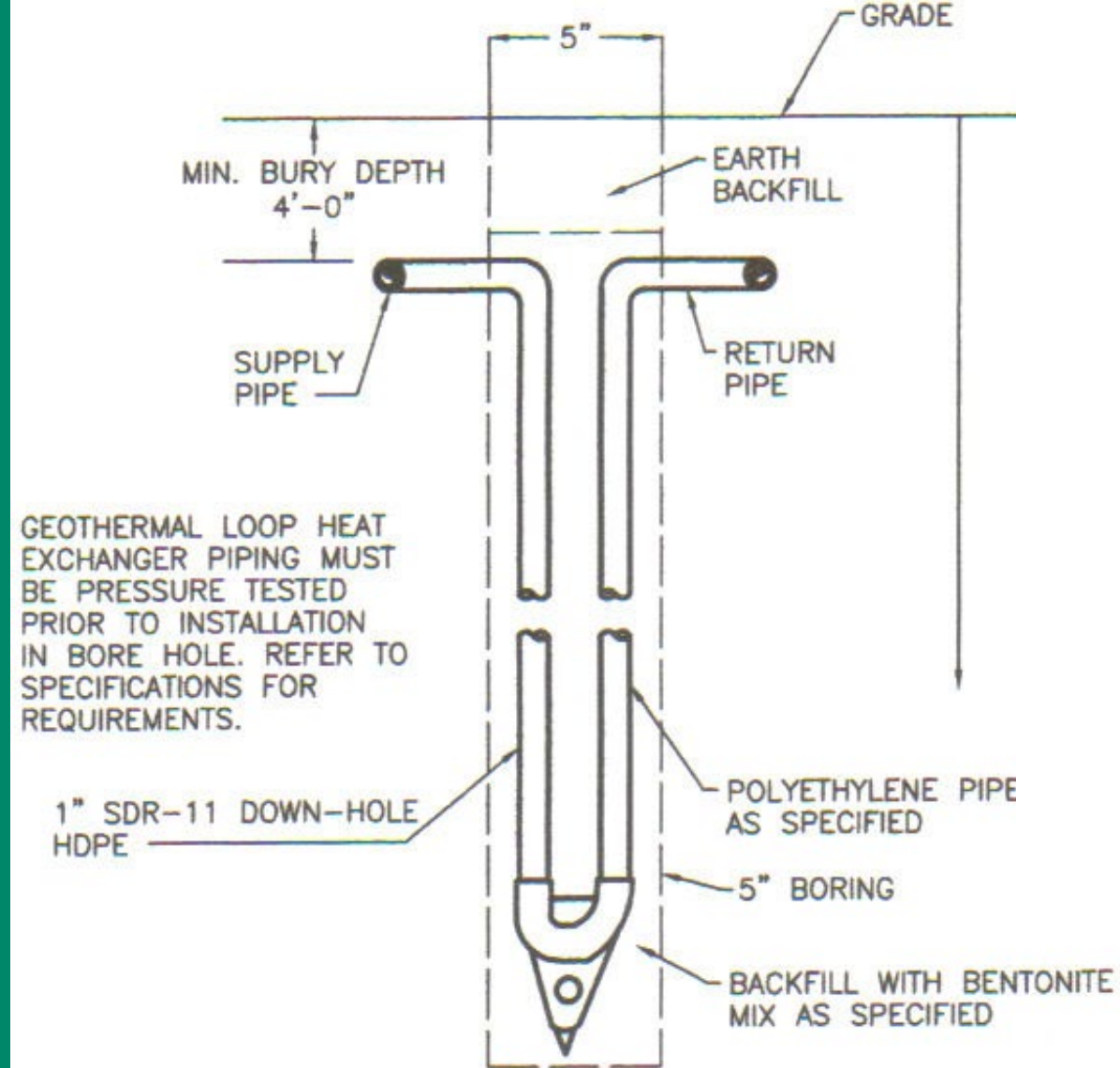
TYPICAL VERTICAL WELL PIPE DETAIL

EQUIPMENT EFFICIENCY MAKES A DIFFERENCE

Bore Dept (feet)	Heat Pump Manufacturer	Additional Bore Feet Required	Added Cost \$25/lf
300	ClimateMaster	0	
325	Less efficient manufacture	1650	\$68,750

DUE TO THE DIFFERENT LEVELS OF EFFICIENCIES PROVIDED BY THE HEAT PUMP MANUFACTURERS, EXCHANGER WILL BE DIFFERENT DEPENDING ON THE MANUFACTURE OF THE HEAT PUMP THAT ARE INSTALLED. CLIMATEMASTER IS BASIS OF DESIGN.

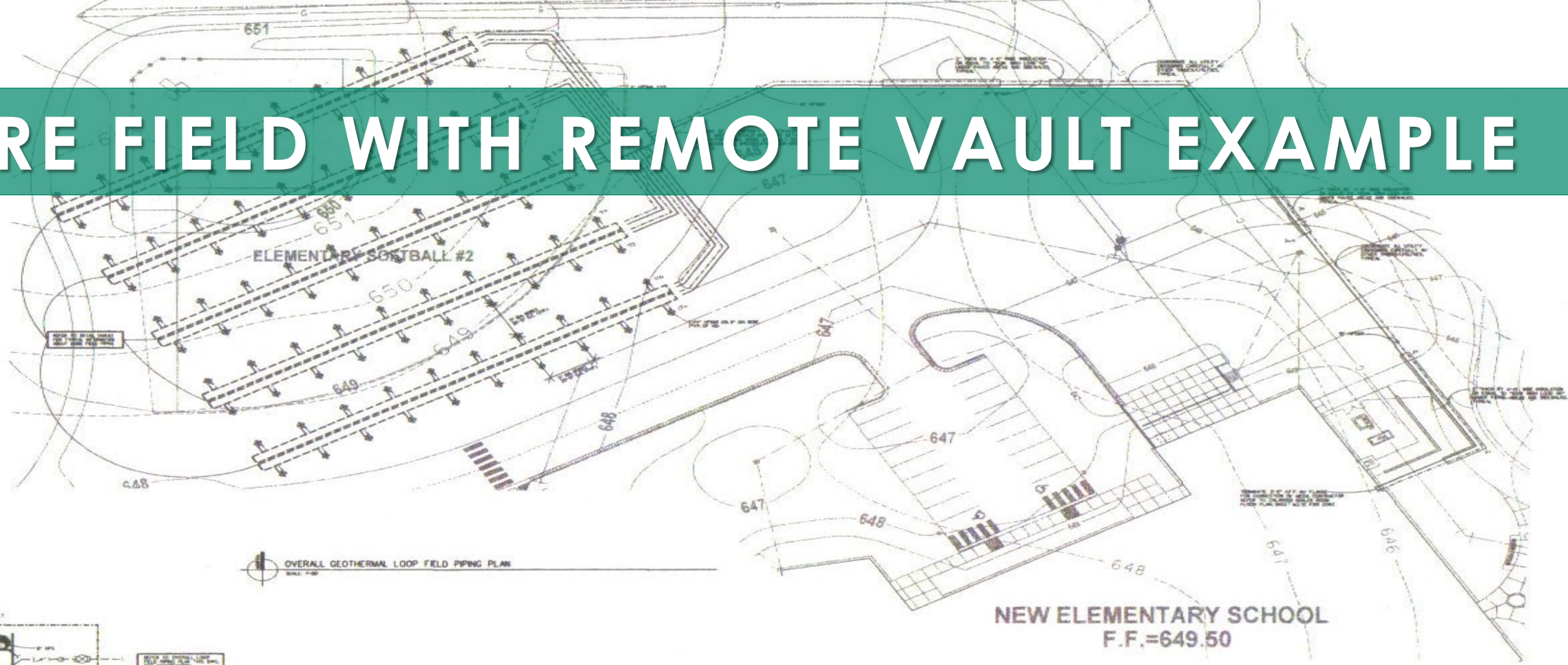
Equipment selection, GSHP design are integrated



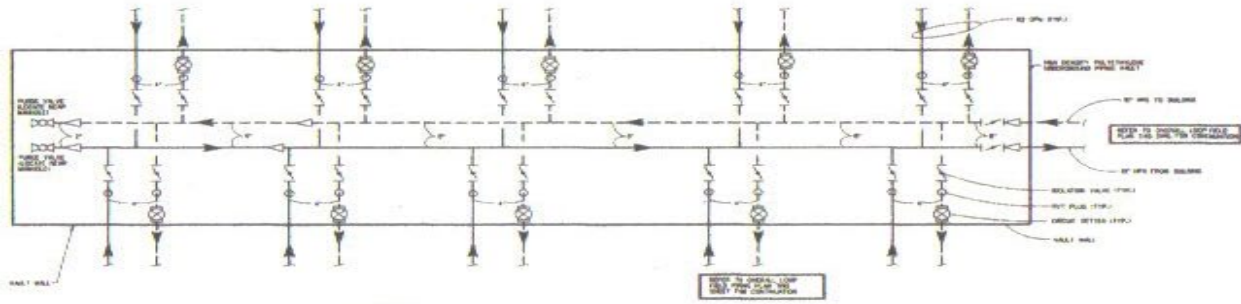
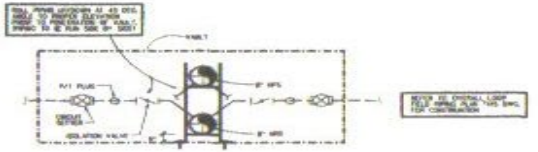
TYPICAL BORING DETAIL

N.T.S.

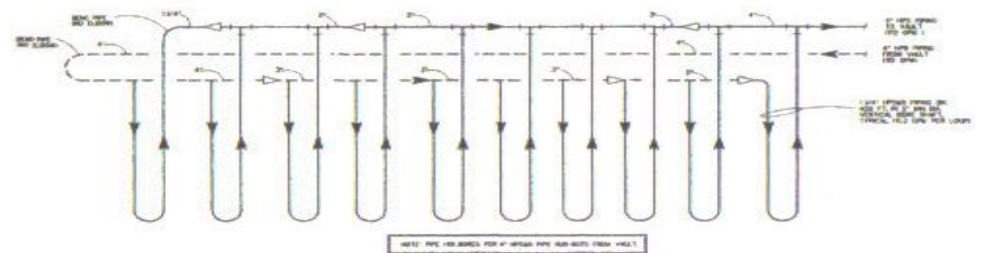
BORE FIELD WITH REMOTE VAULT EXAMPLE



OVERALL GEOTHERMAL LOOP FIELD PIPING PLAN
SCALE: 1/8" = 1'-0"



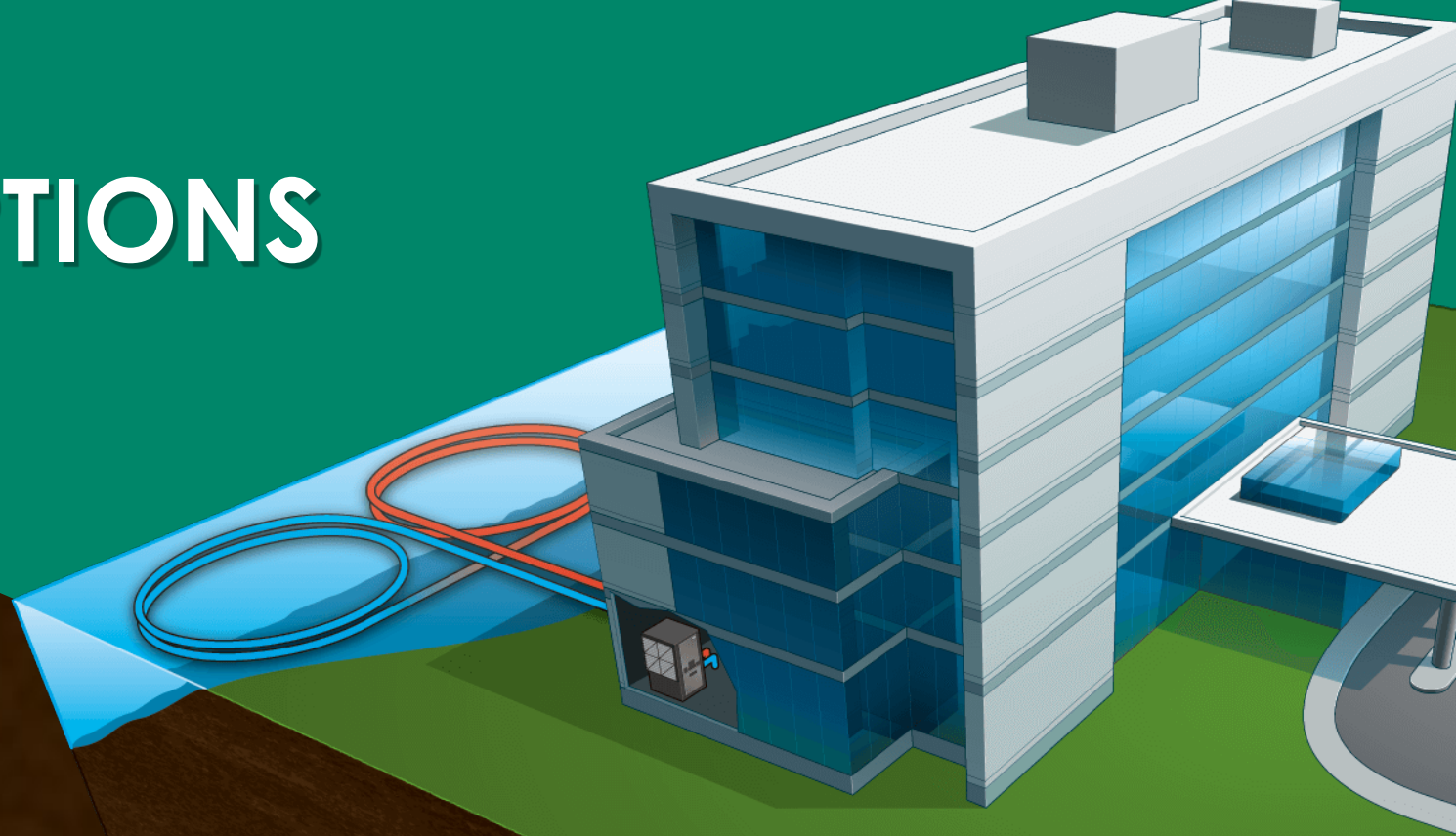
2 VAULT PIPING SCHEMATIC
M1.01 NOT TO SCALE



1 TYPICAL BORE PIPING DETAIL (REVERSE RETURN)

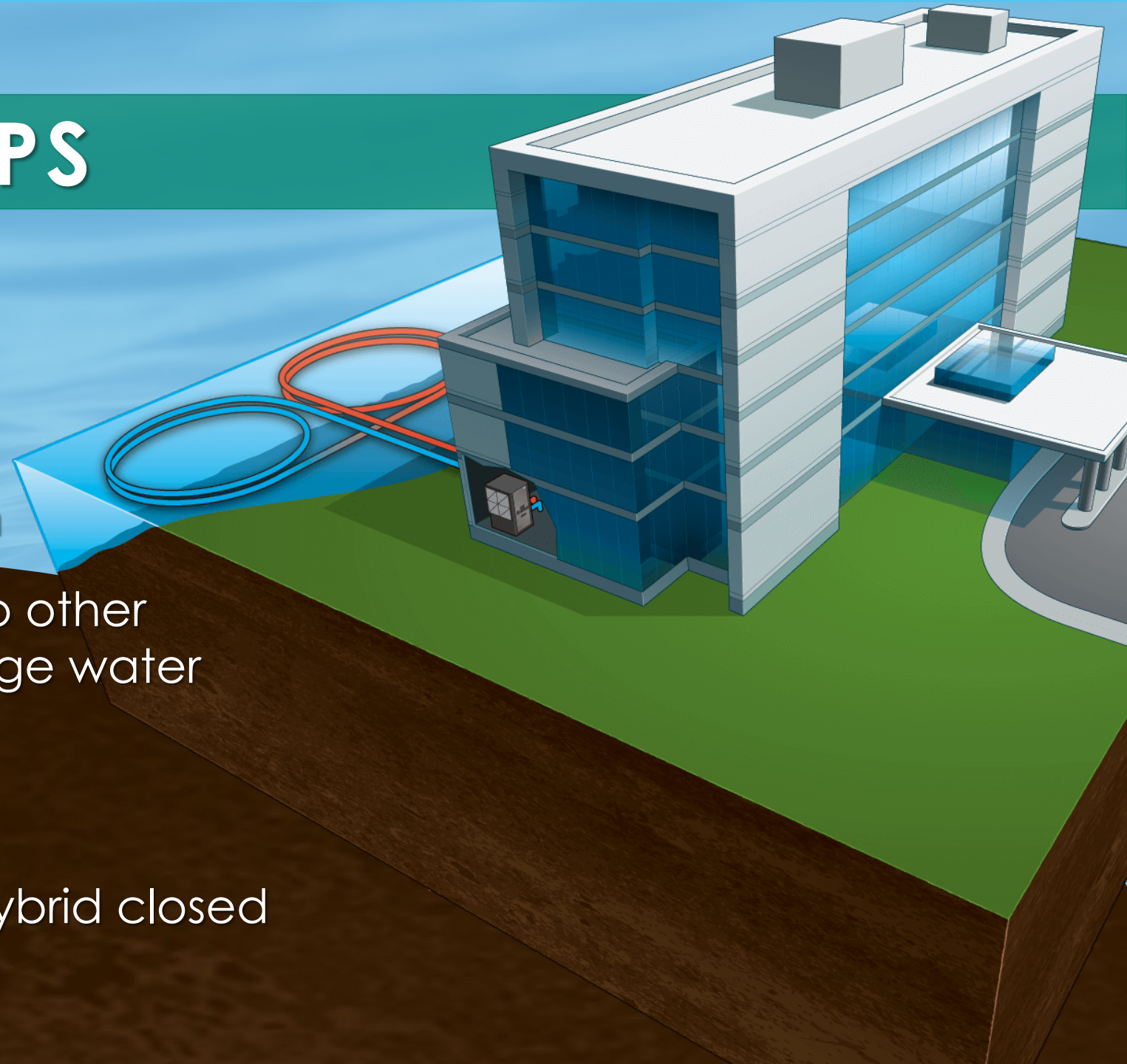
DESIGN DETAILS MATTER FOR CLEAR BIDDING AND INSTALLATION

COMMERCIAL CLOSED LOOP OPTIONS



Pond / Lake / Plate Body of Water Loop

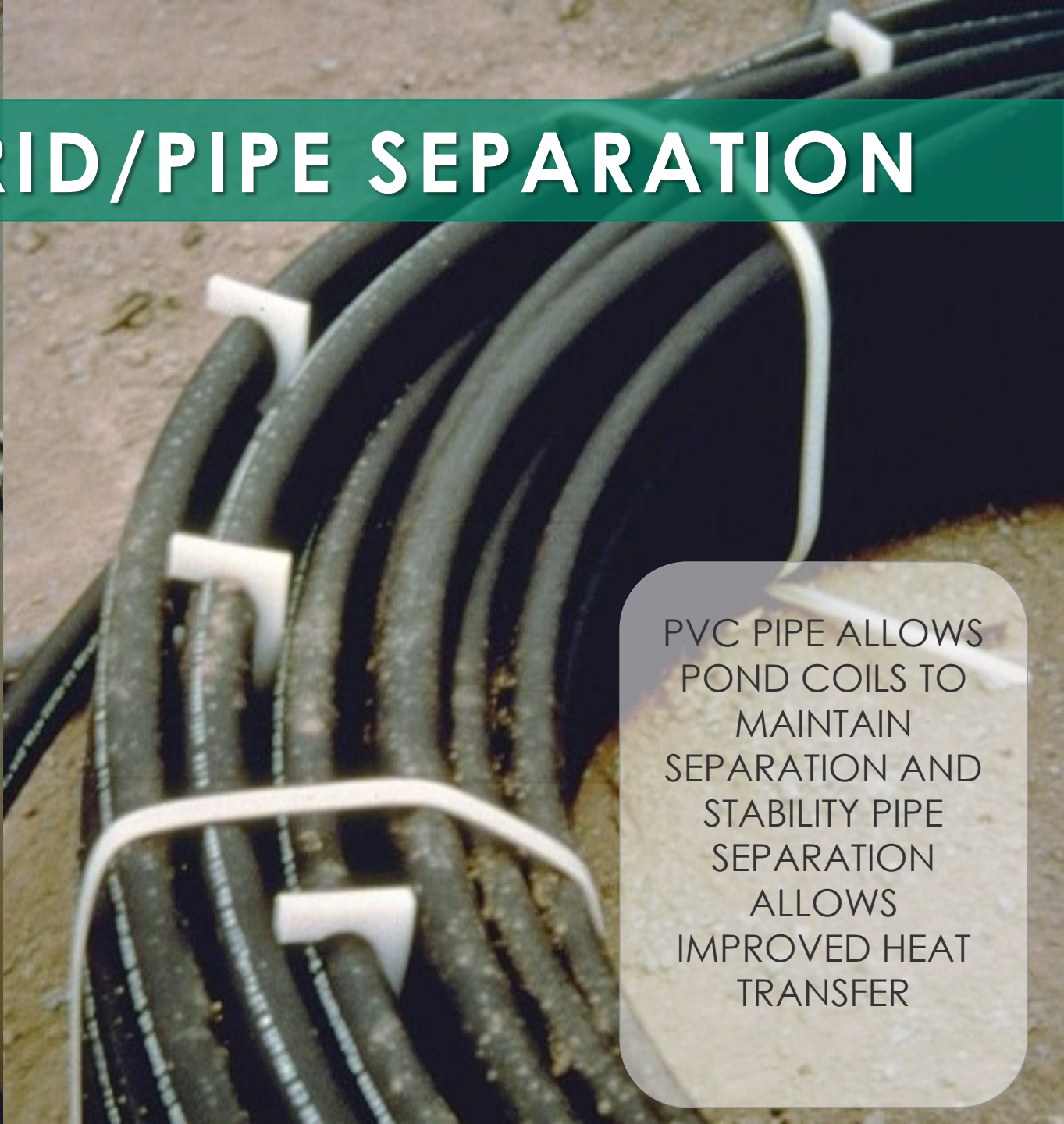
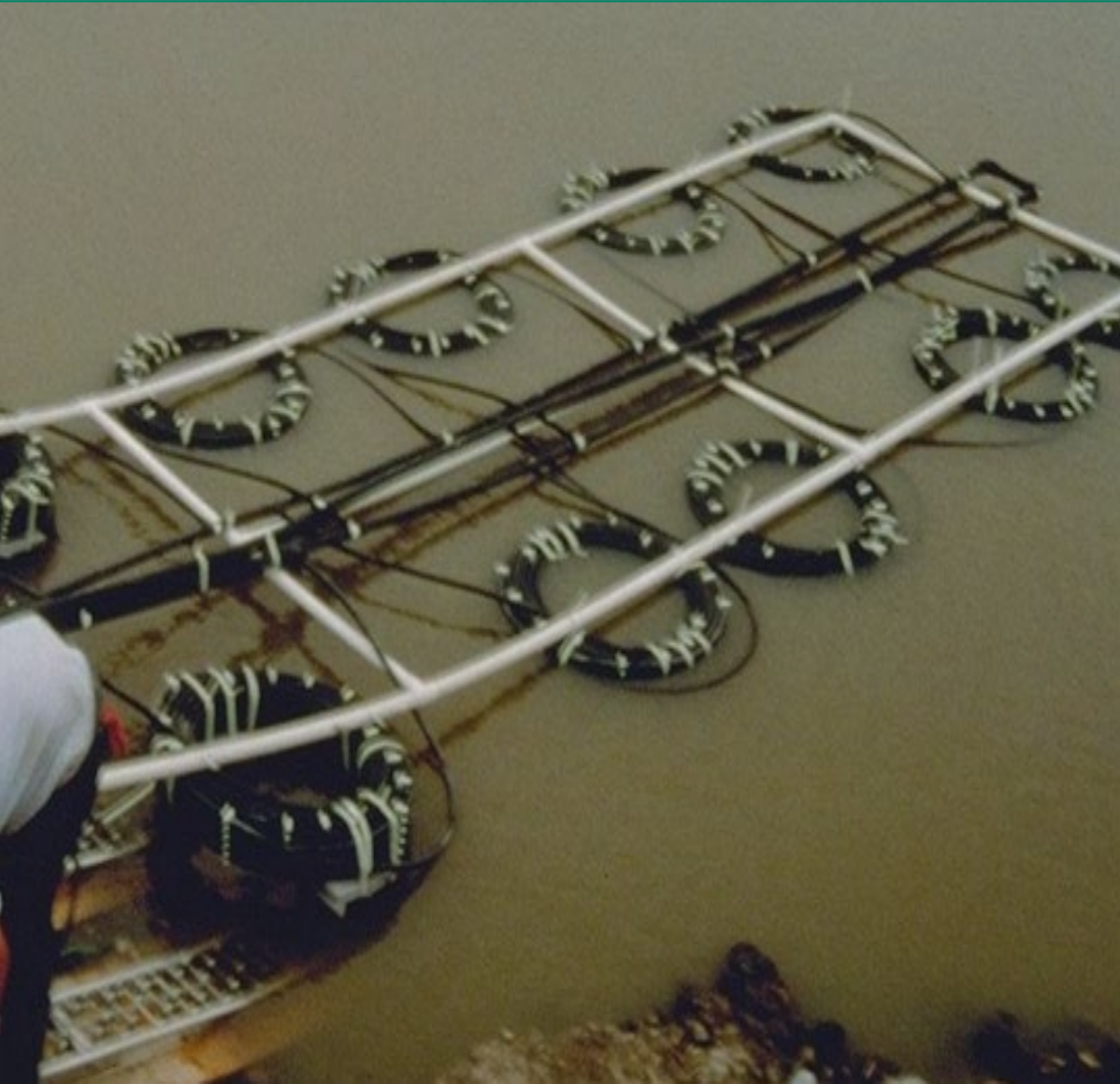
POND LOOPS



Pond Loop Heat Pump System

- Cost effective alternative to other closed loop systems (average water depth of 8 - 10')
- Full loop design
- Can be utilized as part of hybrid closed loop system strategy

POND CIRCUIT GRID/PIPE SEPARATION

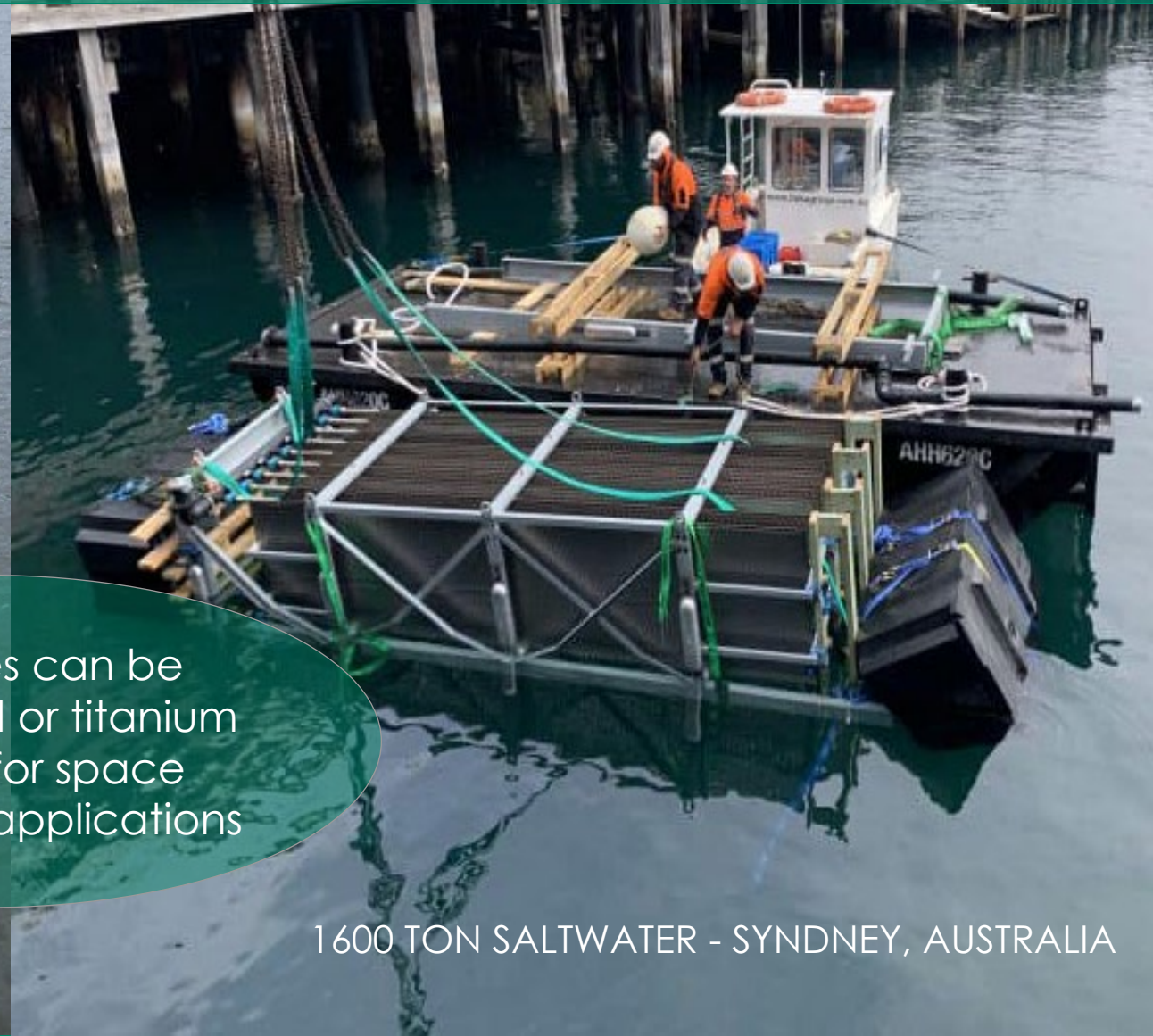


PVC PIPE ALLOWS
POND COILS TO
MAINTAIN
SEPARATION AND
STABILITY PIPE
SEPARATION
ALLOWS
IMPROVED HEAT
TRANSFER

PLATE STYLE POND LOOPS



2000 TON FRESH WATER APPLICATION



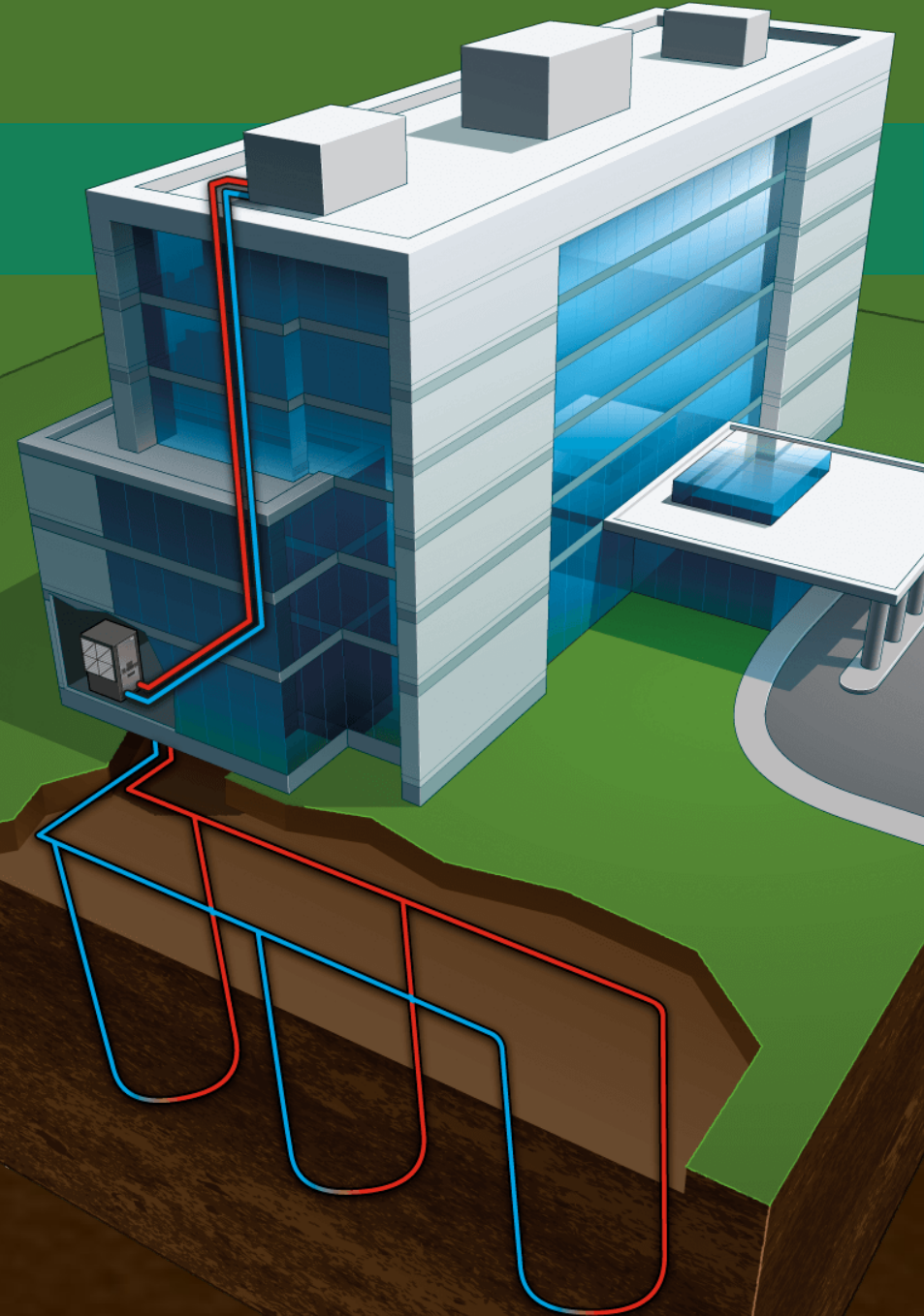
1600 TON SALTWATER - SYDNEY, AUSTRALIA

Lake Plates can be
stainless steel or titanium
– optimal for space
constrained applications

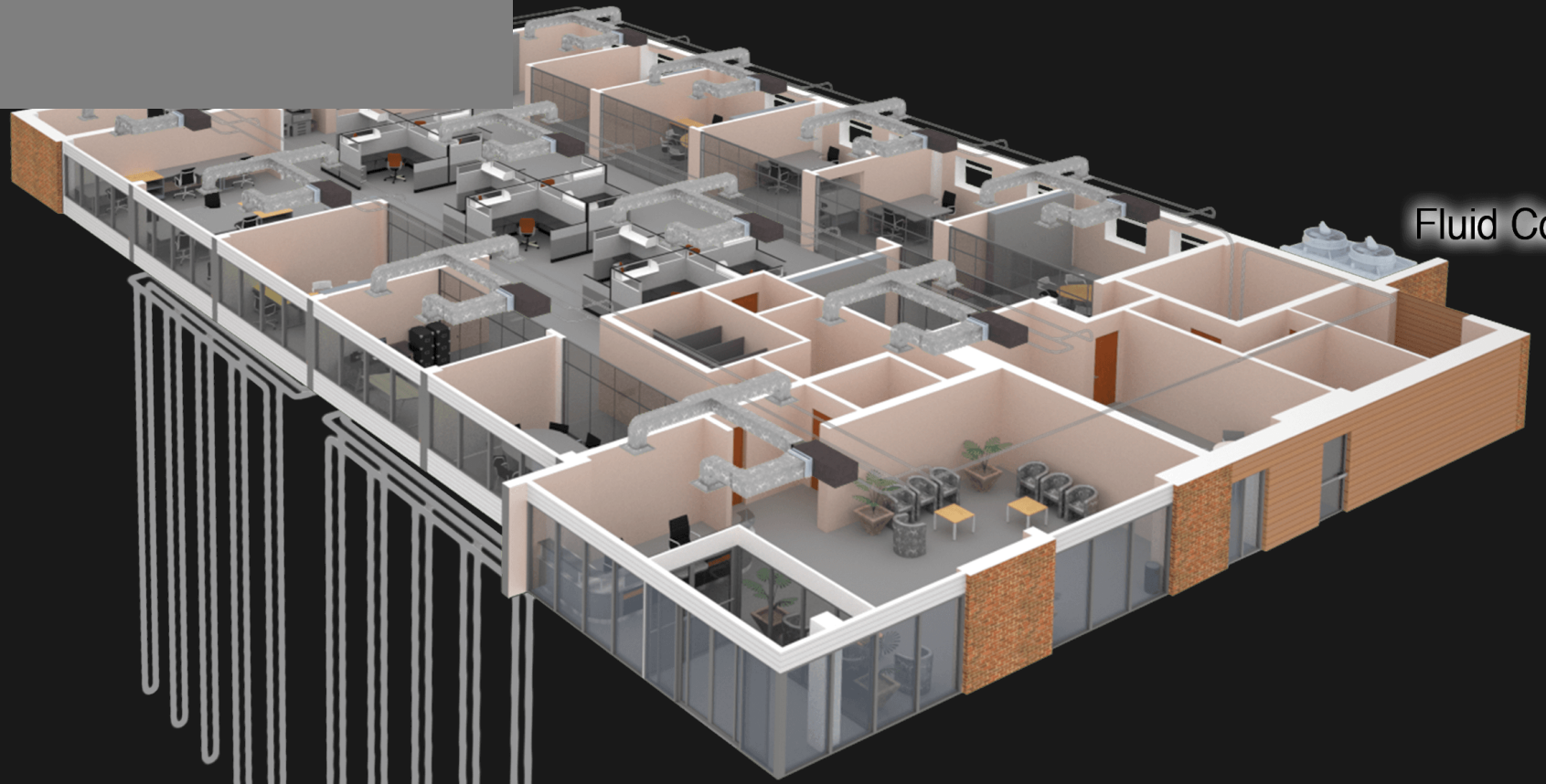
HYBRID GROUND LOOPS

Cooling tower or dry cooler rejects excess system heat during peak cooling demand

- Strategic ground loop design
- Provides heat of extraction needed to handle entire heating load
- Provides heat of rejection option for cooling load design optimization



Hybrid

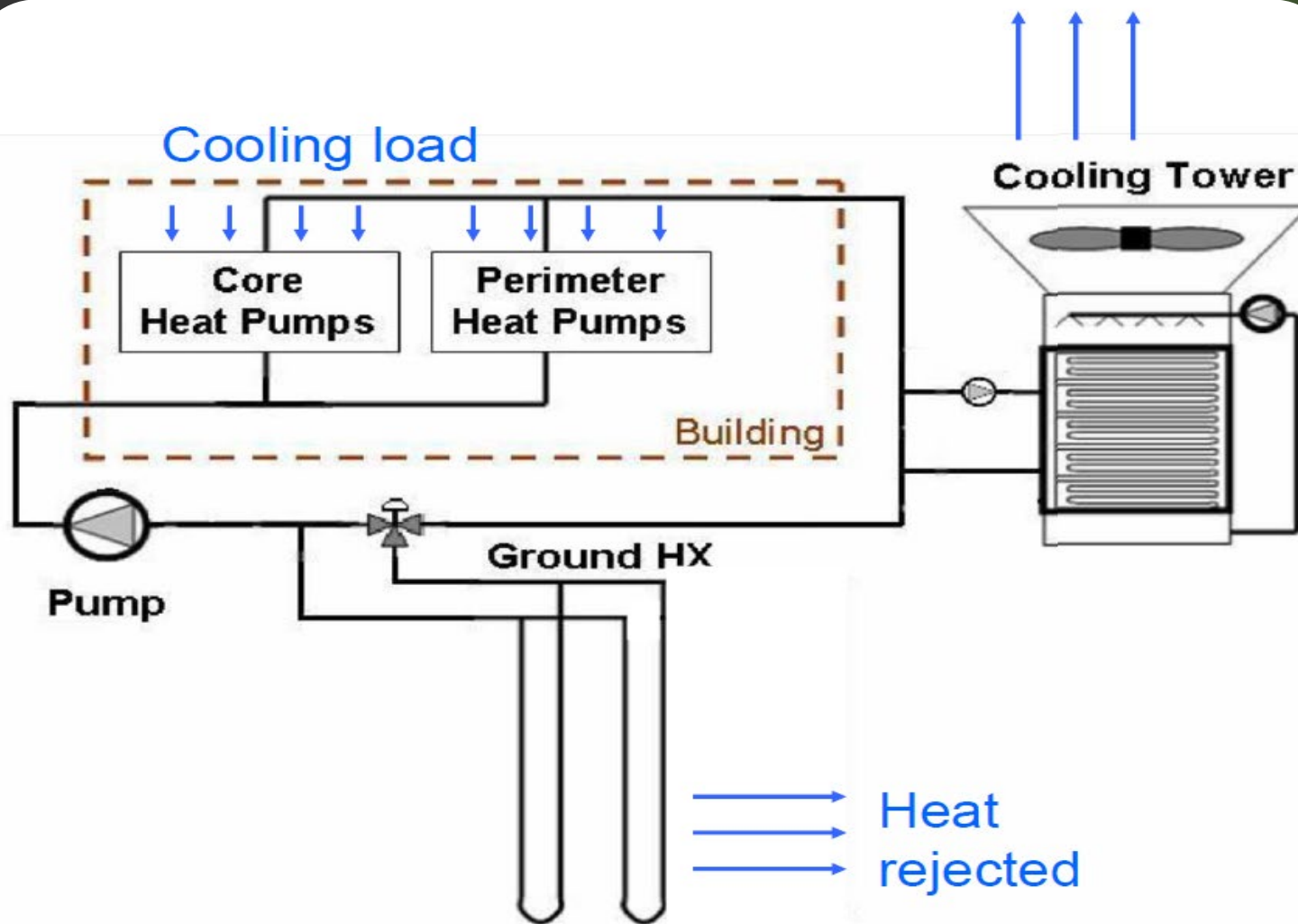


Fluid Cooler

Ground Heat Exchanger
(Vertical Loops)

COMMERCIAL CLOSED LOOP OPTIONS

HYBRID GROUND LOOP HEAT PUMP SYSTEM



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UNDERGROUND HEADER PIPE VAULTS

A vault is a buried structure that holds an external manifold for a geothermal loop-field. This buried mechanical room is where you will access your manifold by climbing down a ladder through the manway.

- Concrete or HDPE construction
- Frees up valuable space inside Mechanical room
- Reduces building penetrations
- Stopping point between loop-field and building
- Prefabricated vault saves field time
- Accommodates larger distance from building
- Easy access for flushing and purging



FREEZE PROTECTION OPTIONS

WHAT IS THE REQUIREMENT AND WHY?



Typical Anti-Freeze Products

METHANOL – least expensive and good performance, but toxic and flammable

PROPYLENE GLYCOL – non-toxic, can add pumping penalties.

ETHANOL – a natural mixture environmentally safe with lowest NFPA health warning available



THERMAL CONDUCTIVITY TEST

- ✓ Identifies the **actual ground loop performance** given a specific location and heat exchanger design
- ✓ **Testing** is conducted several days after the ground loop's installation and data is recorded over a 24–48-hour period
- ✓ **Reported data includes:**
 - ❑ Undisturbed soil temperature
 - ❑ Thermal Conductivity (TC)
 - ❑ Thermal Diffusivity
 - ❑ Drill log and time

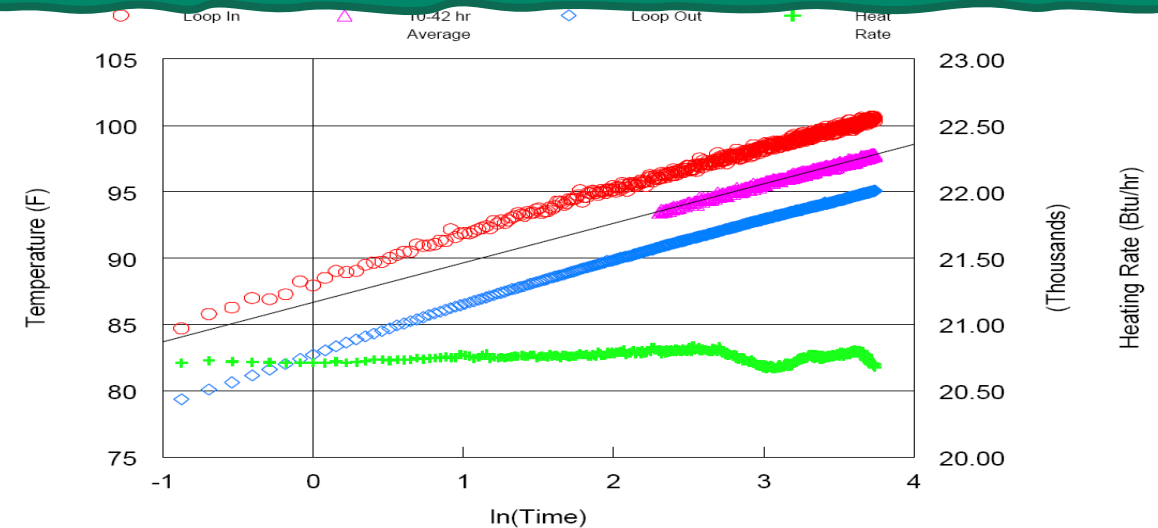
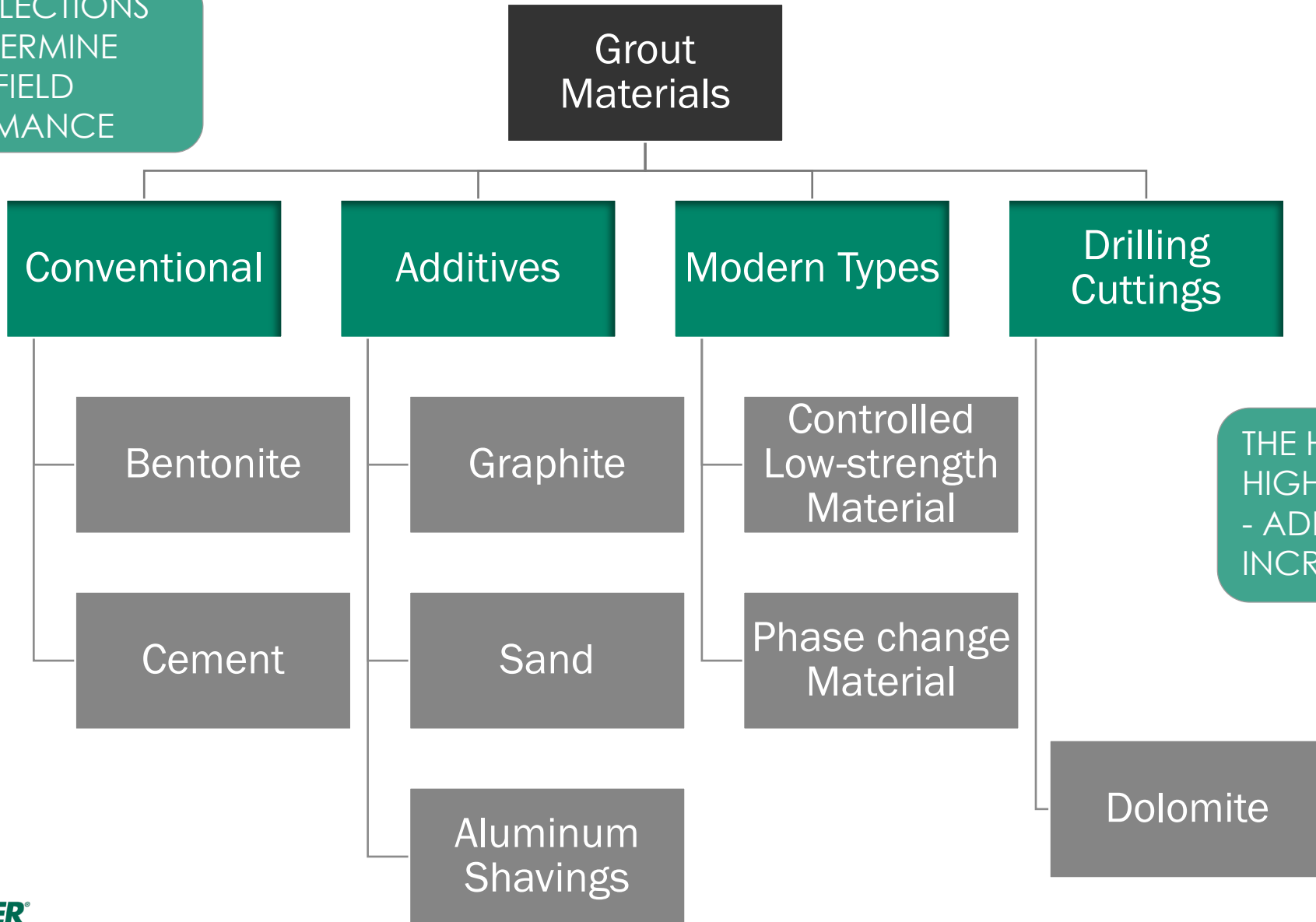


Figure 2: Temperature versus Natural Log of Time

Time Period	Slope: a_1	Average Heat Input (Btu/hr-ft)	Average Heat Input (W/ft)	Thermal Conductivity (Btu/hr-ft-°F)
10 – 42.0 hrs	2.97	51.4	15.1	1.37

GROUT SELECTIONS

GROUT SELECTIONS
WILL DETERMINE
BOREFIELD
PERFORMANCE



THE HIGHER THE SOLIDS THE
HIGHER THE TC
- ADD SILICA SANDS TO
INCREASE TC



YOU

**ARE DESIGNING
THE ENERGY SOURCE.**

**NOT SIMPLY
CONNECTING TO THE GRID.**



CLIMA COOL



ClimateCraft

YES. We would love to follow up with you.

We know you couldn't make it to all of our presentations, it's a busy week! We hope you enjoyed your time. Let us know which content you'd like us to send you and we will reach out to you next week!



Let's Talk

Scan me

