

LEADING THE WAY **CampusEnergy**2022

Feb. 15-18 | Westin Boston Seaport District Hotel | Boston, Mass.



INTERNATIONAL
DISTRICT ENERGY
ASSOCIATION

THE STEAM STOPS HERE

Frank D. Perry
Cornell University

Eric E. Chrencik, PE
RMF Engineering, Inc.

John P. Williamson, PE
RMF Engineering, Inc.



LEADING THE WAY
CampusEnergy2022

Feb.15-18 | Westin Boston Seaport District Hotel | Boston, MA



Cornell University



RMF Engineering
Reliability. Efficiency. Integrity.



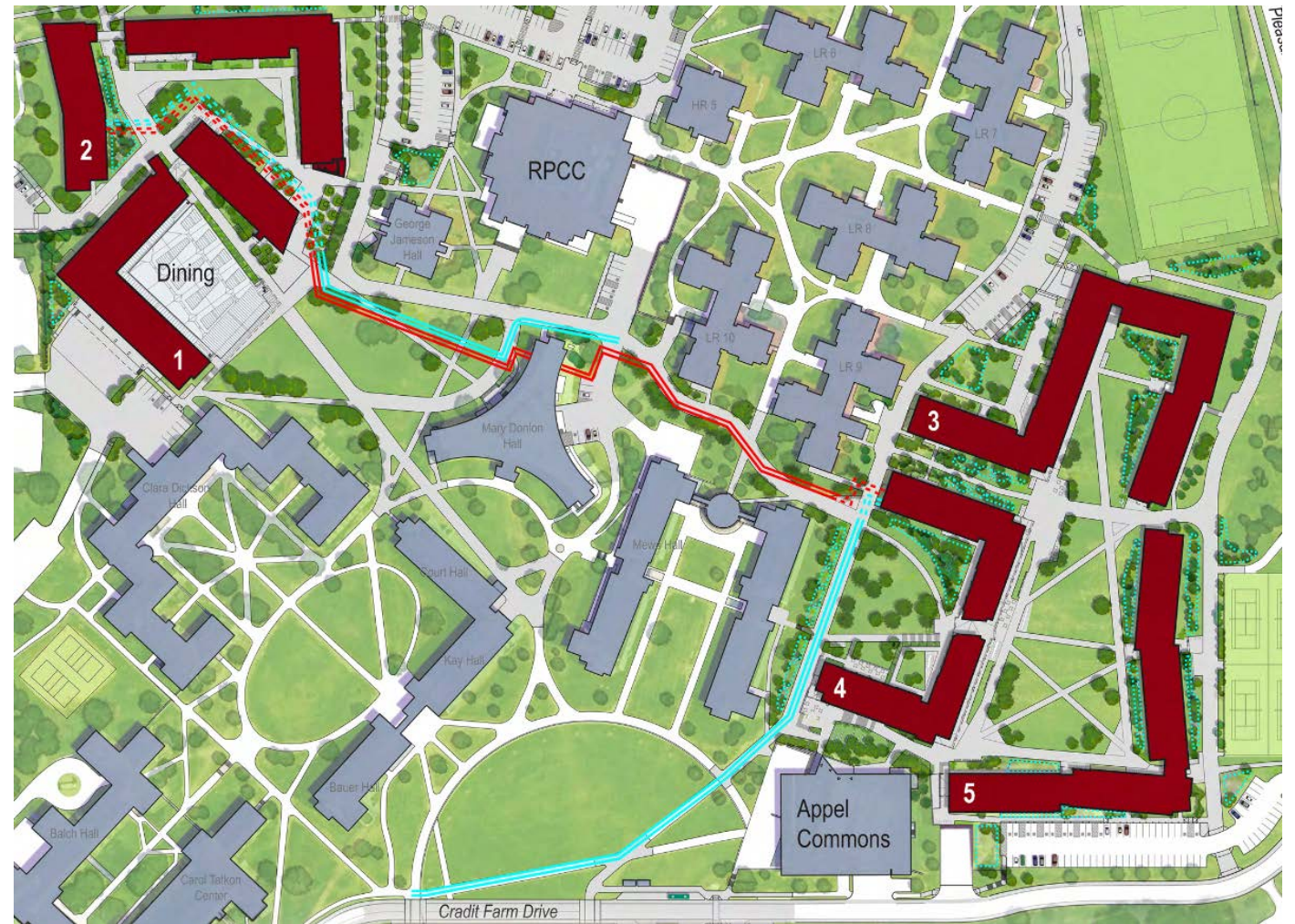
**INTERNATIONAL
DISTRICT ENERGY
ASSOCIATION**

PROJECT BACKGROUND

- **North Campus Residential Complex**

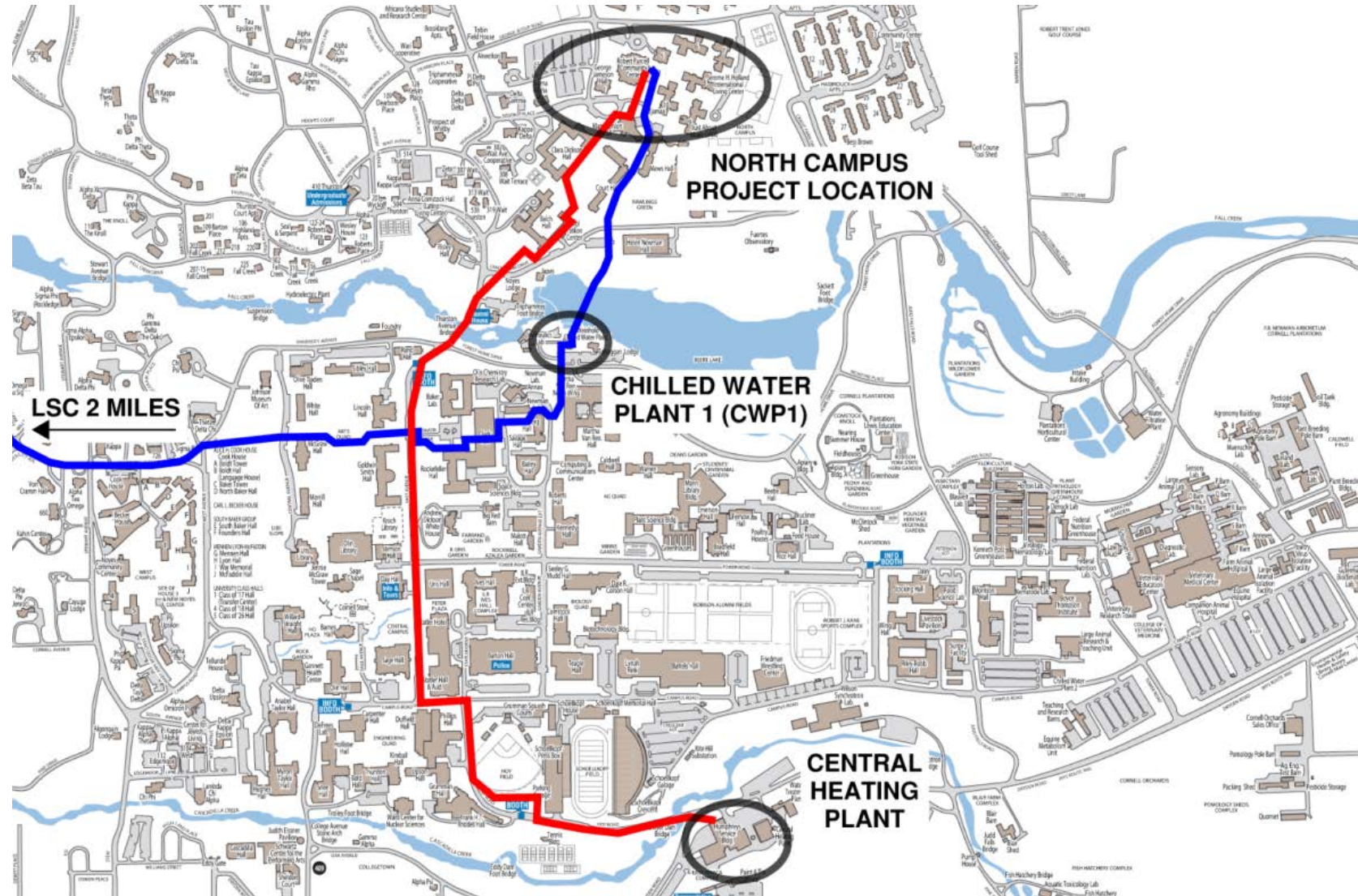
- **Five New Buildings**
- **800,000 Gsf**
- **2,000 Beds**
- **Dining Facility**

- **Aggressive Energy Conservation and Sustainability Goals**



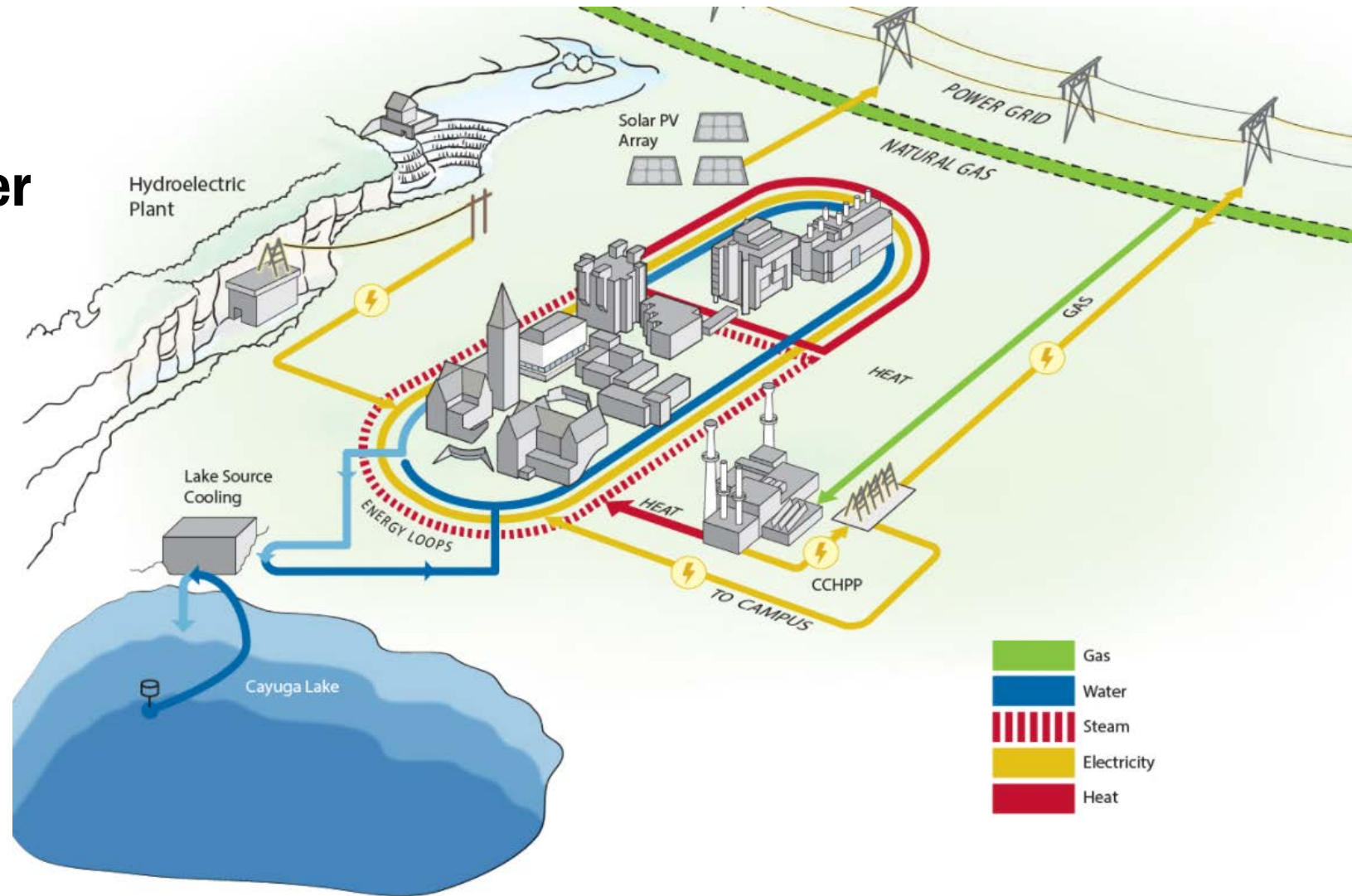
HEATING AND COOLING

- **Central Heating Plant**
 - Steam
 - Electricity
 - Chilled Water
- **Lake Source Cooling (LSC) Plant**
- **Chilled Water Plant 1**



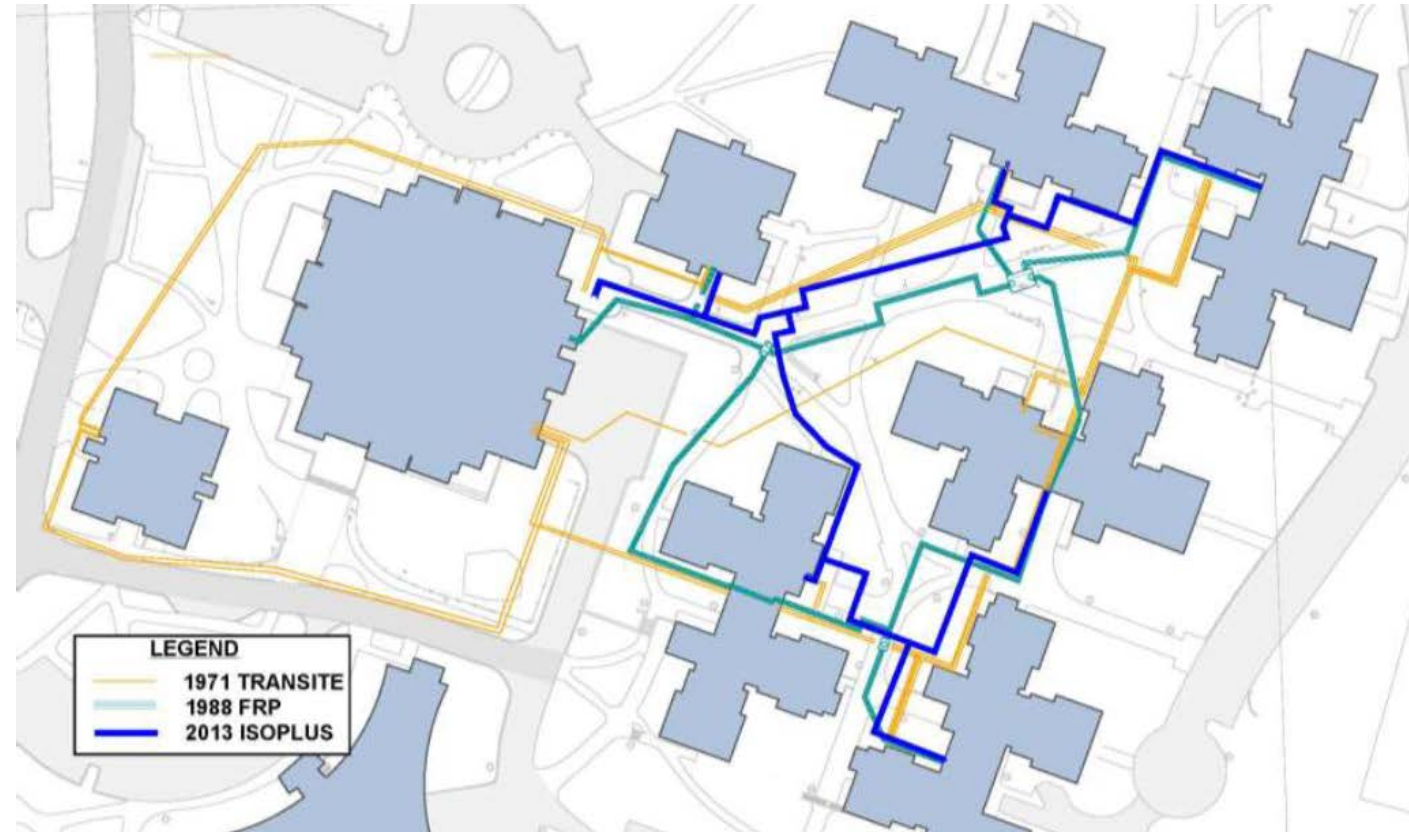
DISTRIBUTION NETWORKS

- 12+ Miles of Steam
- 9 Miles of Chilled Water
- 1+ Mile of Hot Water
- 14+ Miles of Electrical Ductbanks



PROJECT BACKGROUND

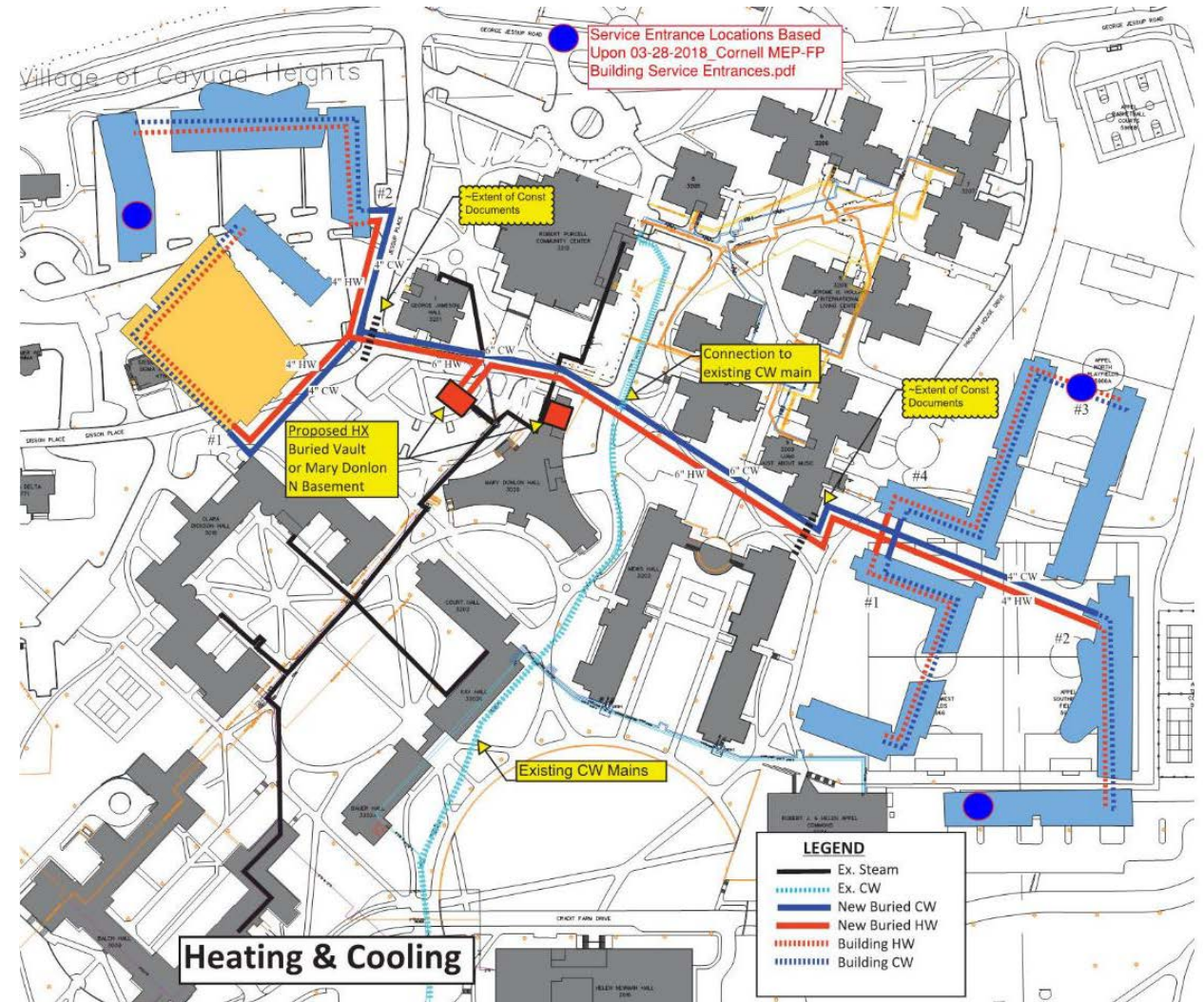
- **Climate Action Plan**
- **Campus Hot Water Goal**
- **Campus Wide Steam Network – Can't Replace All Steam Overnight**
- **Existing Hot Water Distribution Undersized for Additional New Load**



EXISTING NORTH CAMPUS HOT WATER

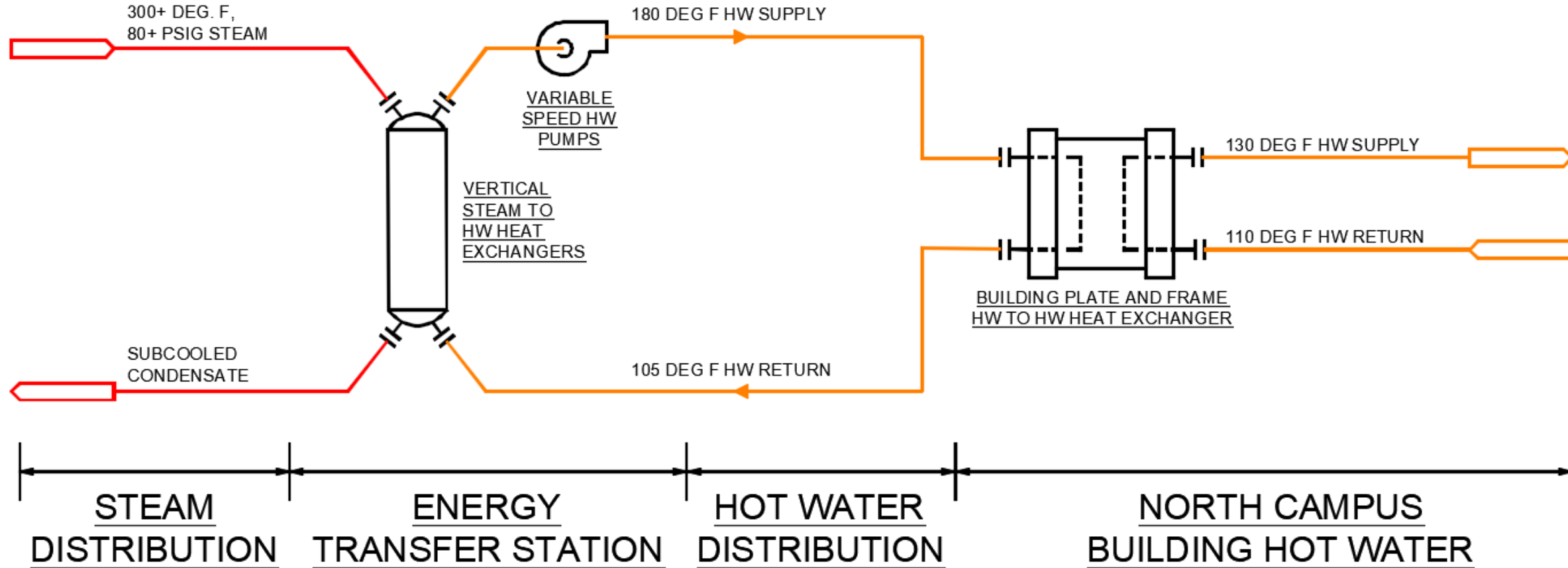
NORTH CAMPUS HEATING OPTIONS

- Extend High Pressure Steam
- Hot Water Generators (Gas And Electric)
- Geothermal
- Steam To Hot Water Heat Exchangers



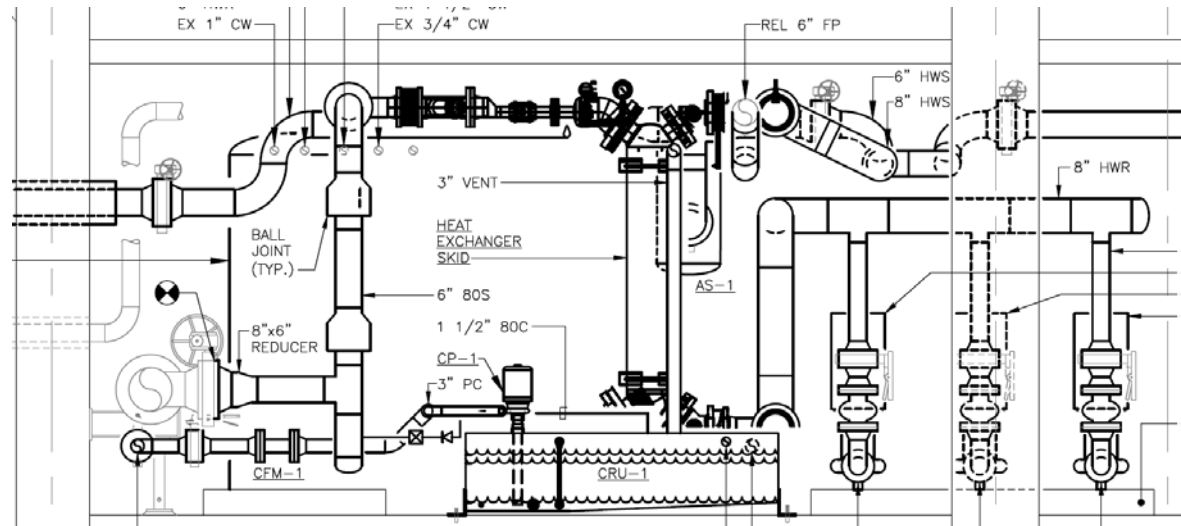
APPROACH

- Hybrid Energy Transfer Station (ETS)



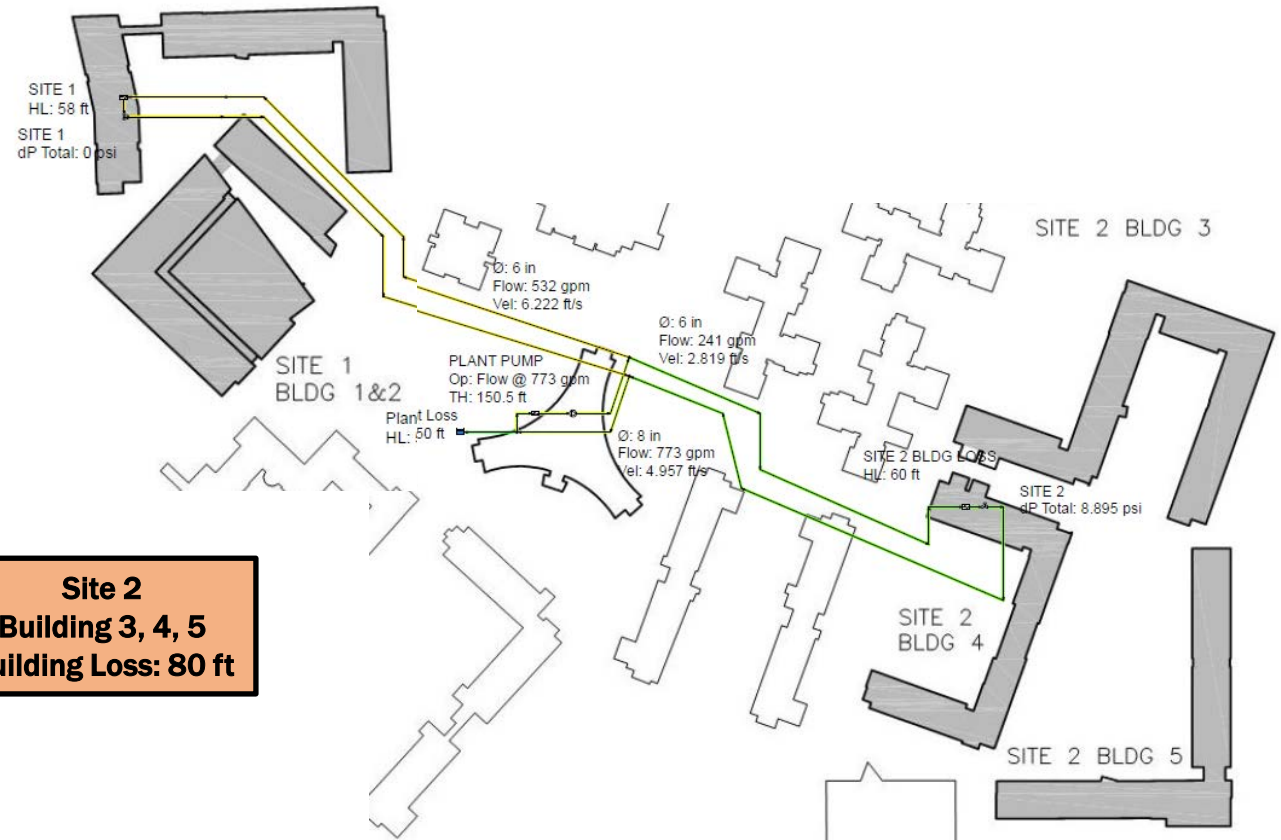
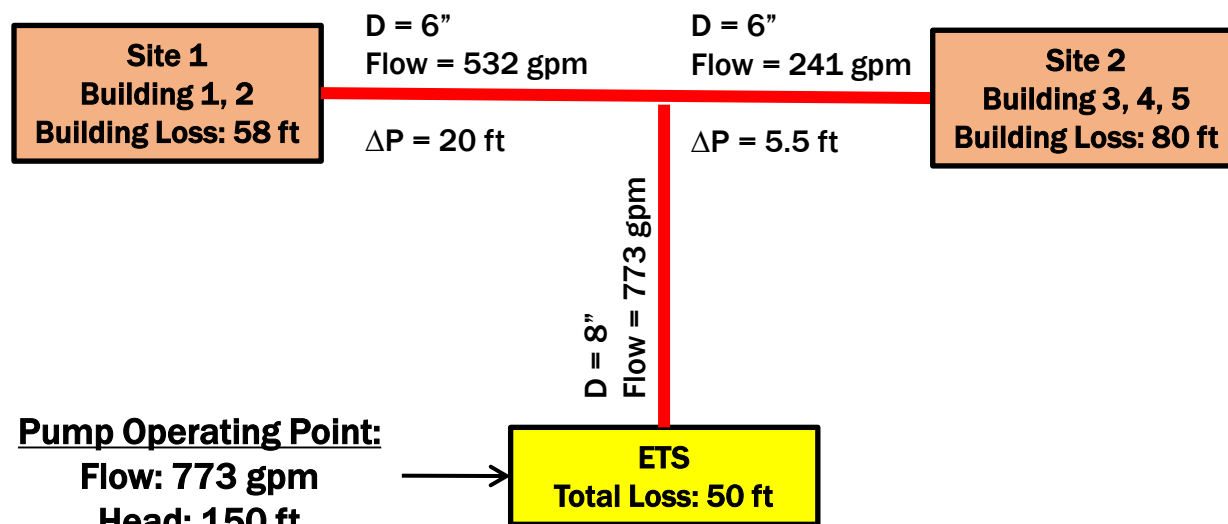
CHALLENGES AND CONSIDERATIONS

- Heating Capacity
- Domestic Hot Water Loads
- Space/Height Constraints
- Equipment Selections
- Phasing
- Distribution Piping Materials



HW LOADS AND HYDRAULICS

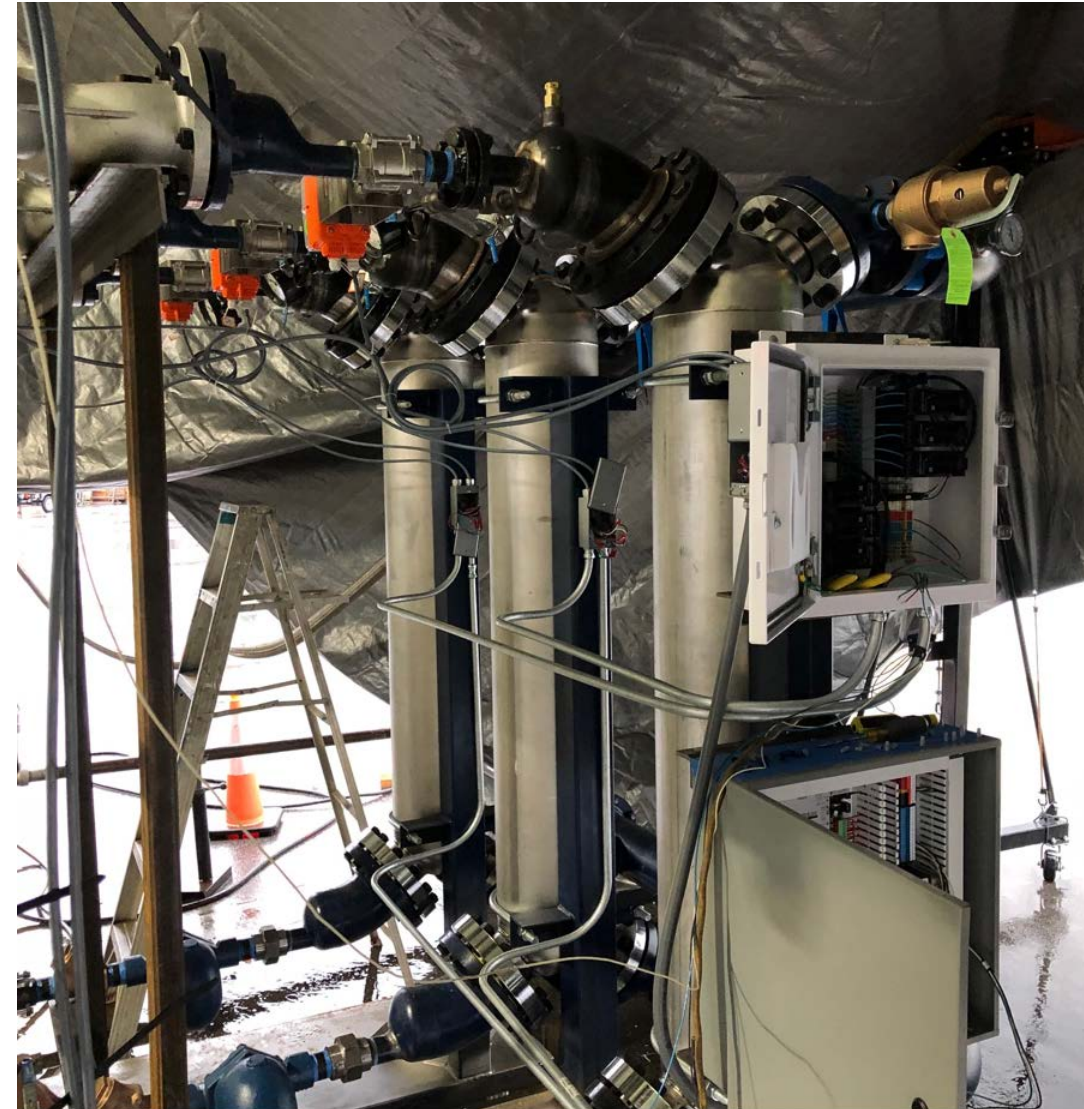
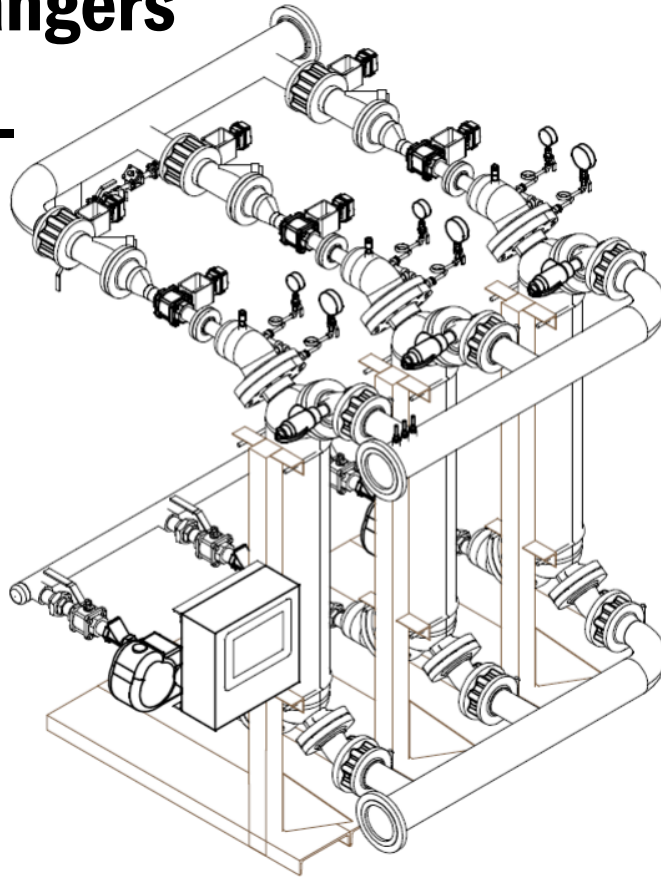
- Three heat exchangers at 10,000 MBH each
- Sized three pumps at 390 gpm, 150 ft each
- Pipe Sizing



ETS HEAT EXCHANGERS

Vertical Heat Exchangers

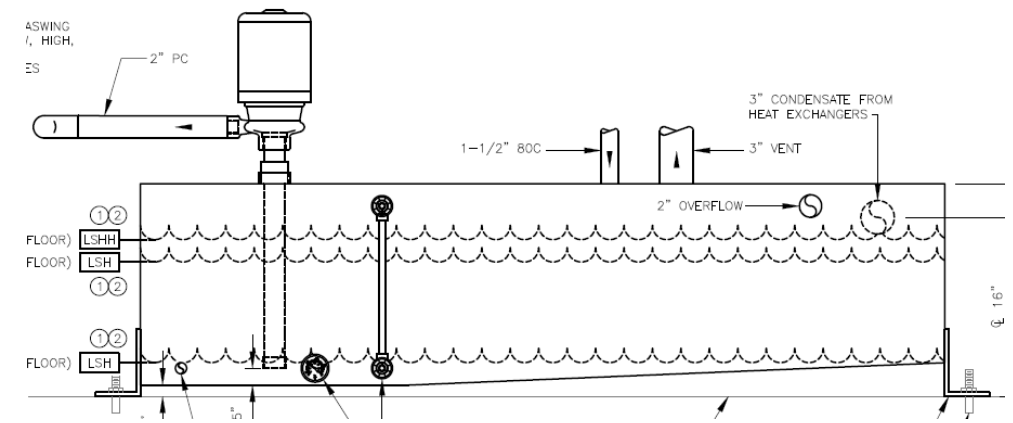
- **Flooded vs. Non-Flooded**
- **No PRV**
- **Sub-cooled Condensate**
- **High Turndown**
- **Cost Effective**
- **Factory Testing**



EQUIPMENT



Vertical Inline Pumps with VFDS



Custom Stainless Condensate Receiver

CONTROLS



**New ETS
Control System**



**Modulating and 2-Position
Steam Control Valves**



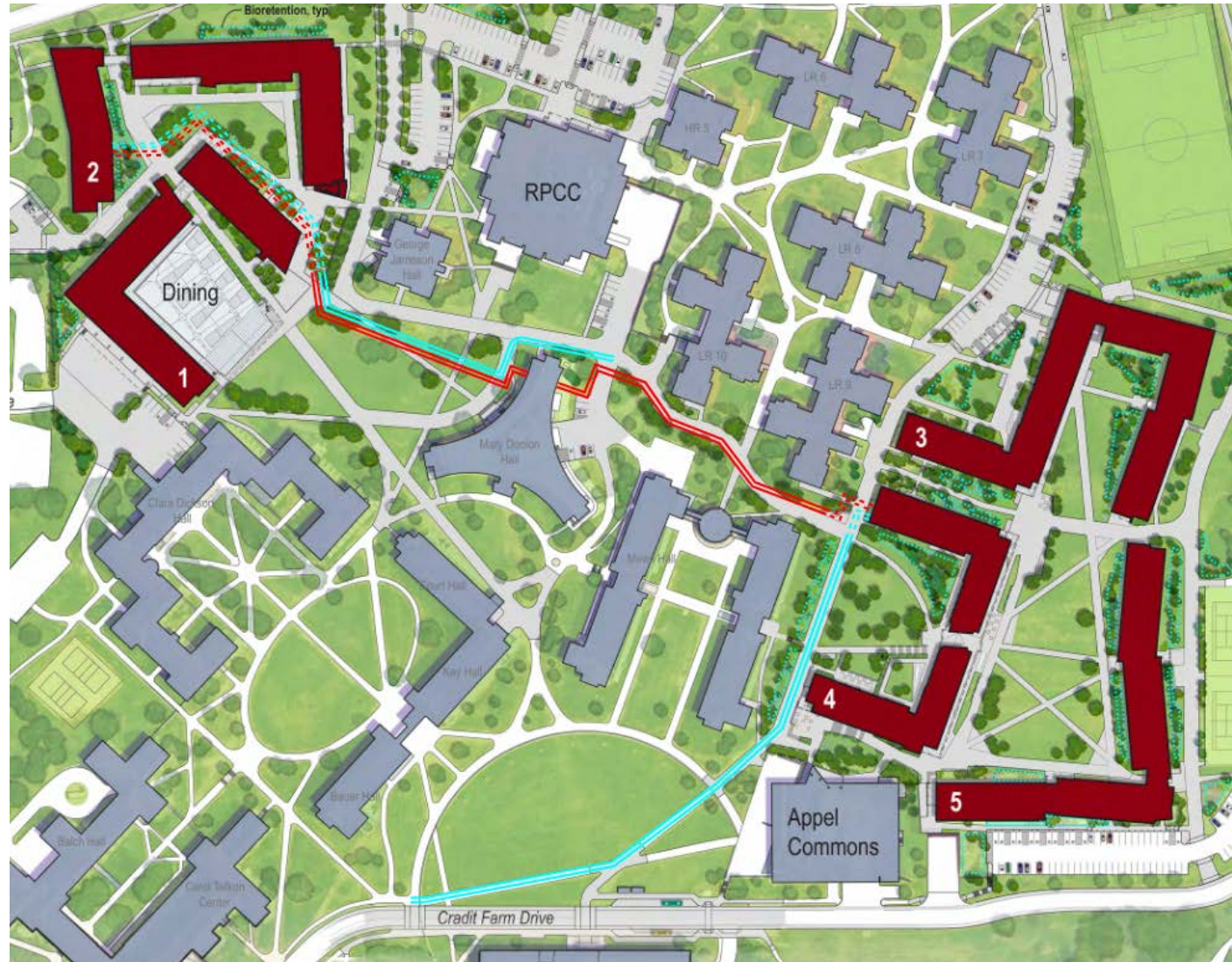
**Hot Water and
Condensate Metering
for Each Site 1 & 2**

PHASING

- **Steam Isolation Valves Installed by Cornell in the Summer**
- **Pre-Purchased Heat Exchanger Skid and Condensate Receiver**



NORTH CAMPUS THERMAL DISTRIBUTION



HOT WATER DISTRIBUTION PIPING MATERIALS

- **Double Wall Steel Pre-Fabricated Piping System**
- **PEX Piping**
- **EN253 Piping System**
 - **Cost Effective**
 - **Campus Experience**
 - **Flexibility with Higher Temperature Limits**



HOT WATER DISTRIBUTION PIPING MATERIALS

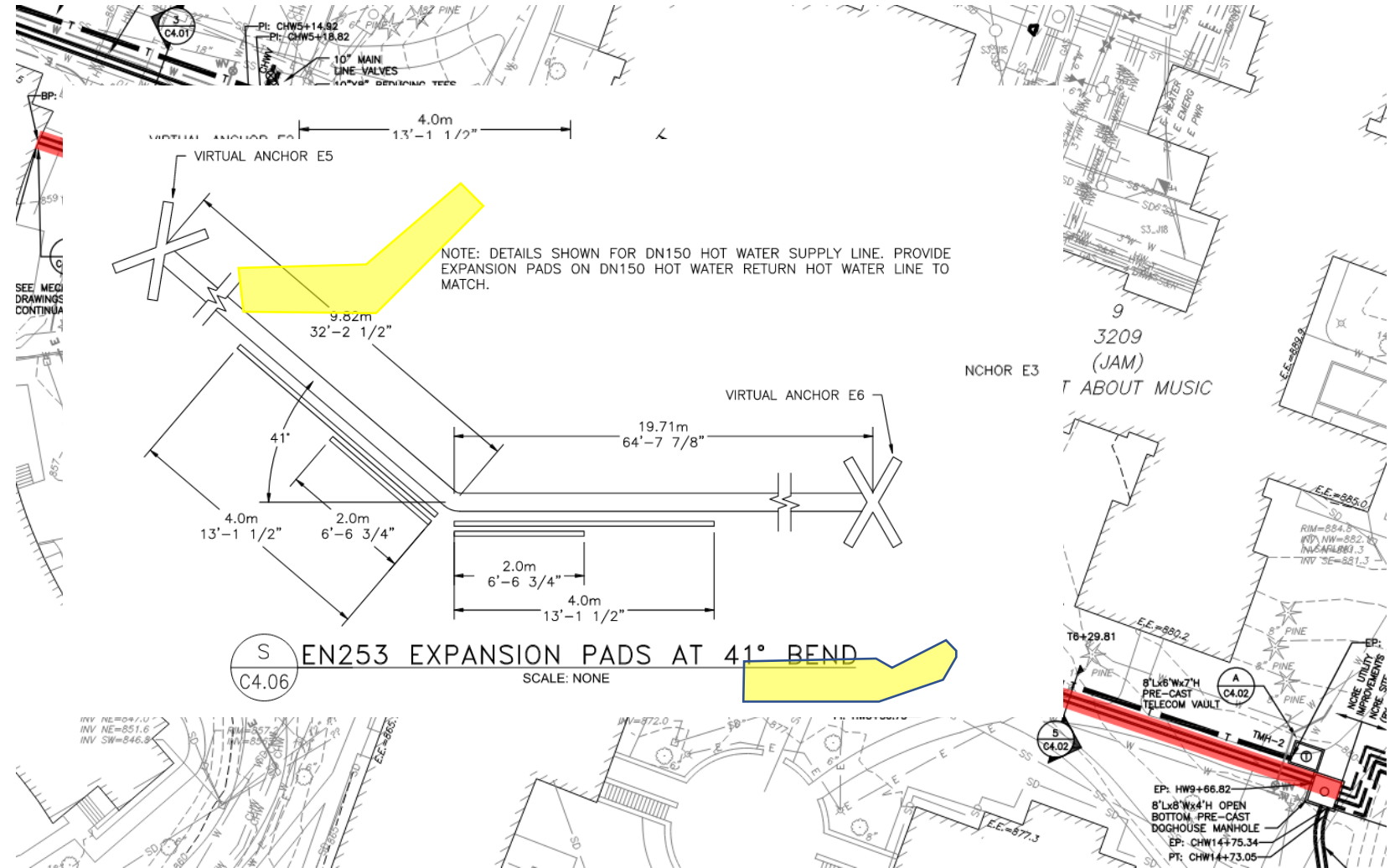
- **EN253**
 - Up to 250F Operating Temperature
 - Insulation and HDPE Jacket Bond to Service Pipe Supporting Thermal Expansion
 - Single Wall System and Thinner Wall - Faster Weld Time
 - Flexible - Gradual Bends Accomplished Without Fitting
 - Standard Leak Detection



HOT WATER DISTRIBUTION PIPING MATERIALS

- **EN253**

- **Direct Buried Anchors Are Not Needed**
- **Expansion Loops or Z Bends Are Not Needed**



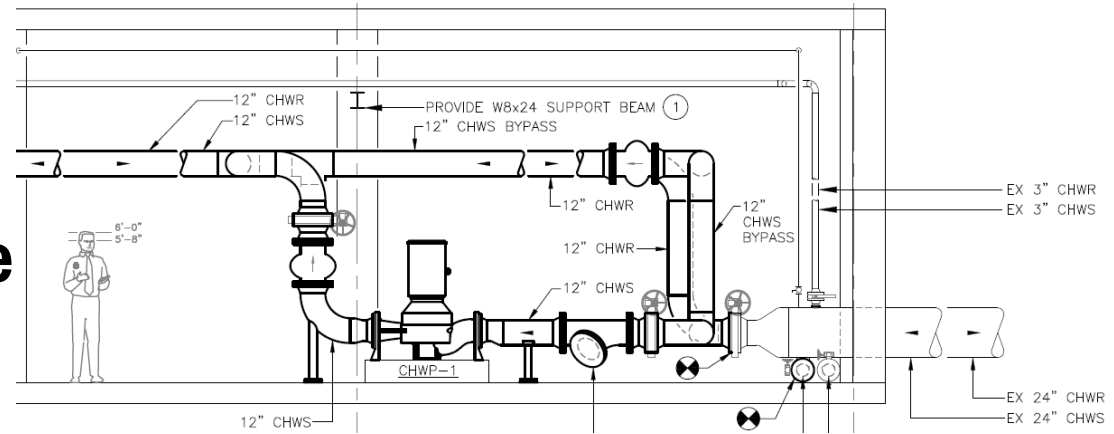
WHILE WE WERE THERE

- **Domestic Water**
 - Deferred Maintenance/Upgrades with HDPE Piping
- **Telecommunications**
 - PVC Encased with Concrete
- **Temporary Fire Lane**
 - To Support Site 2 Construction
- **Chilled Water**
 - HDPE Piping



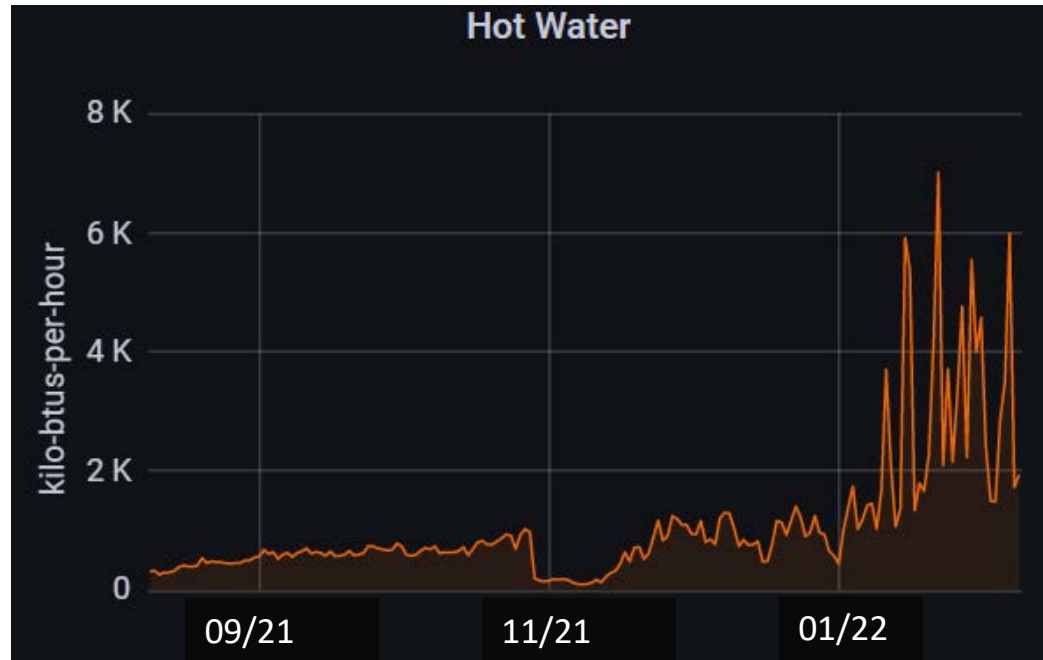
LAKE SOURCE CHILLED WATER AND CWP1

- **0.1 KW/Ton LSC**
- **Existing 14" HDPE Chilled Water Lines Under Lake Beebe**
- **Booster Pump Strategy**
- **North Campus Enabling**

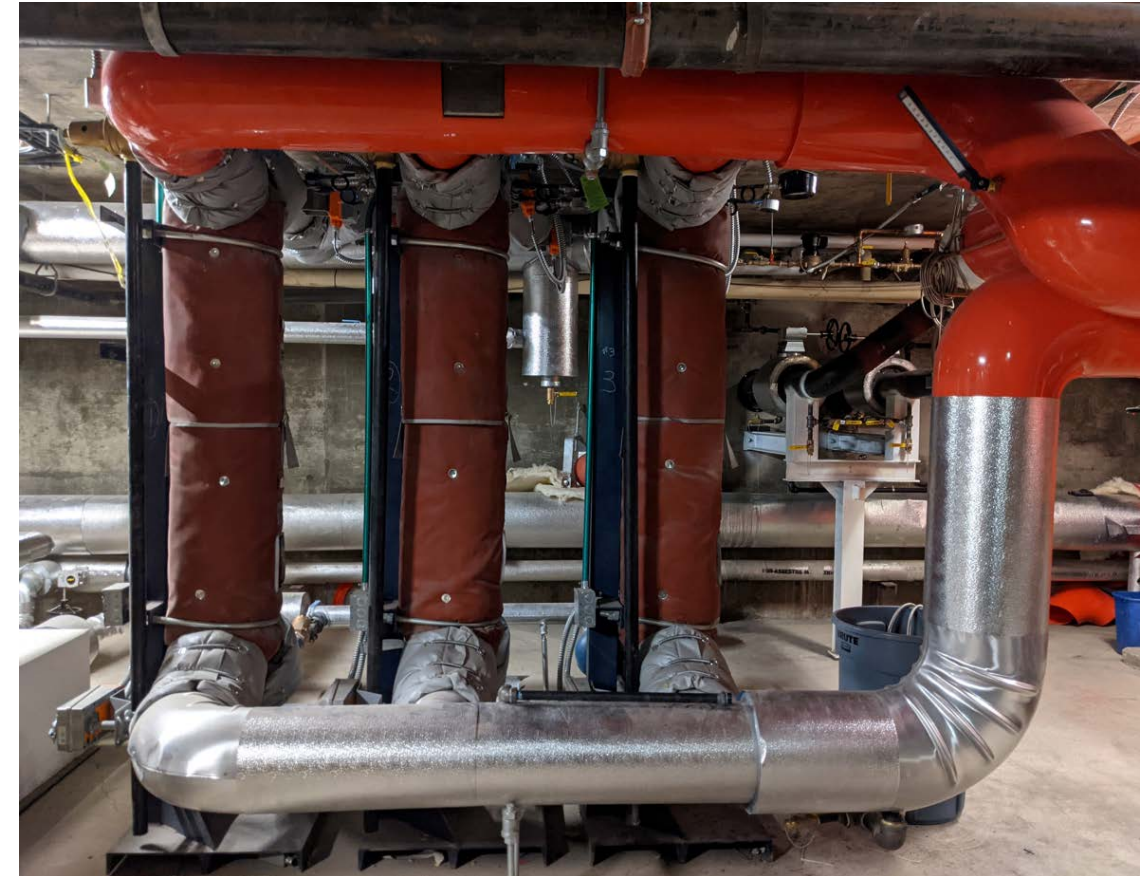


RESULTS

- Site 1 partially occupied In 2021 – Success
- Site 2 online Fall 2022



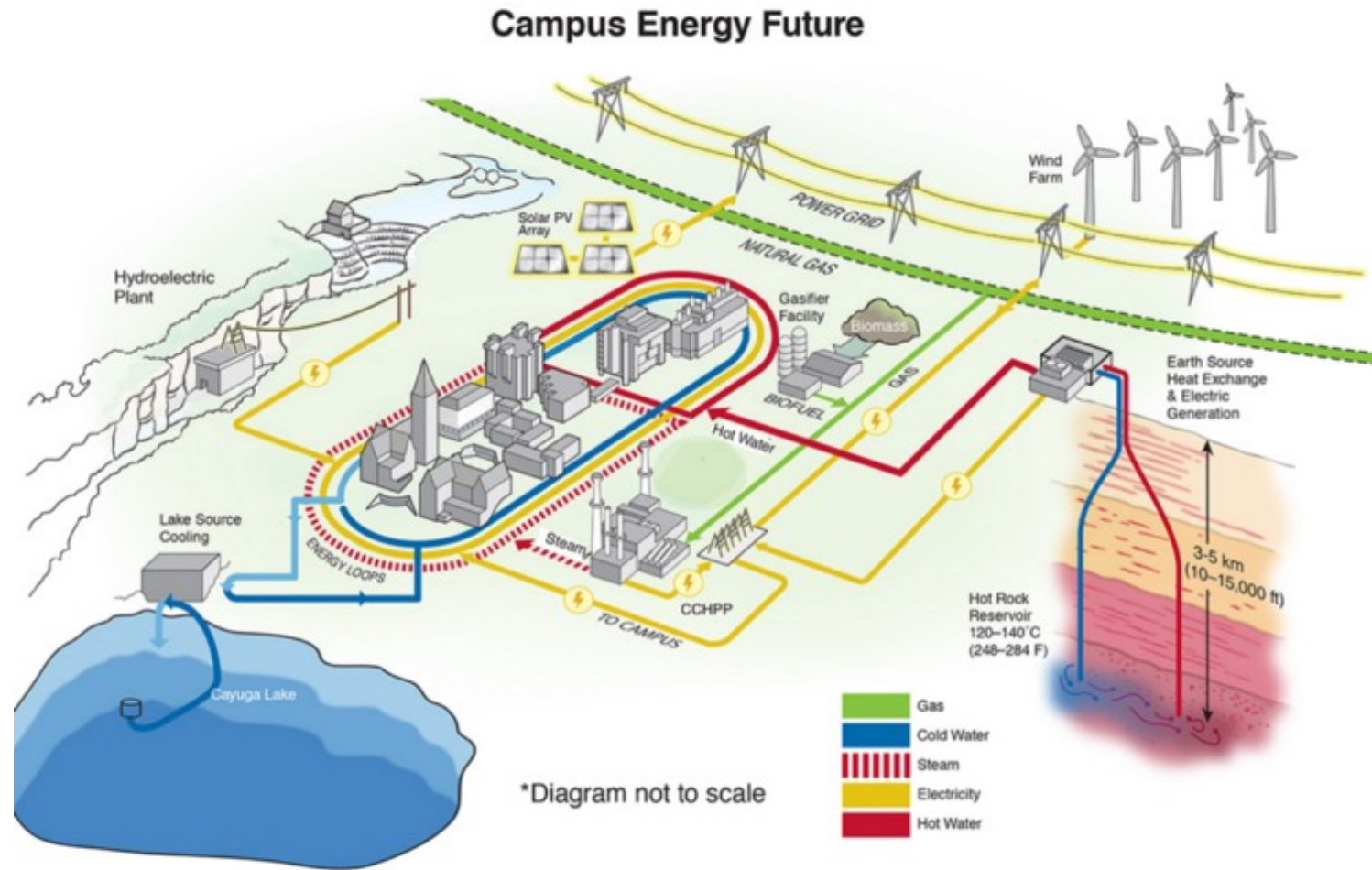
SITE 1 TREND DATA



VERTICAL HEAT EXCHANGERS

RESULTS AND EXPECTATIONS

- This project is the First Big Step as Part of the Steam to Hot Water Campus Wide Transition
- Flexibility for Hot Water System Expansion
- Provides Future Growth to Earth Source Heat Options
- Supports the University's Climate Action Plan



THANK YOU!

Frank D. Perry
Energy Piping Distribution
Program Manager
fdp1@cornell.edu

Eric E. Chrencik, PE
Mechanical Project
Manager
eric.chrencik@rmf.com

John P. Williamson, PE
Utility Distribution
Engineer
john.williamson@rmf.com

