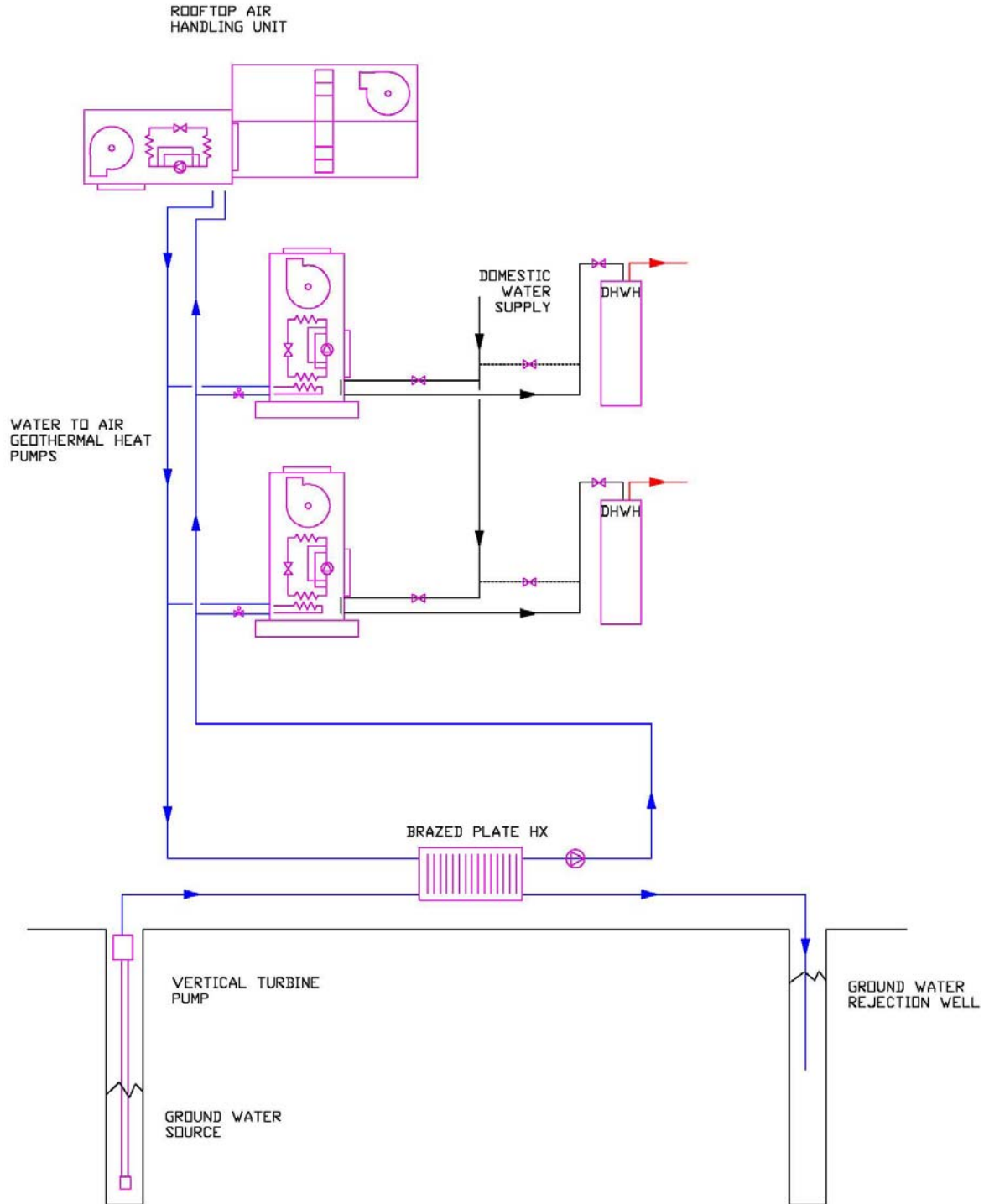
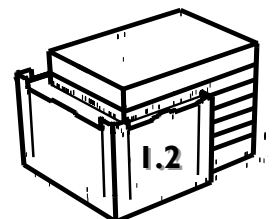
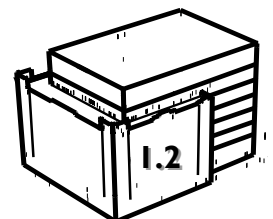
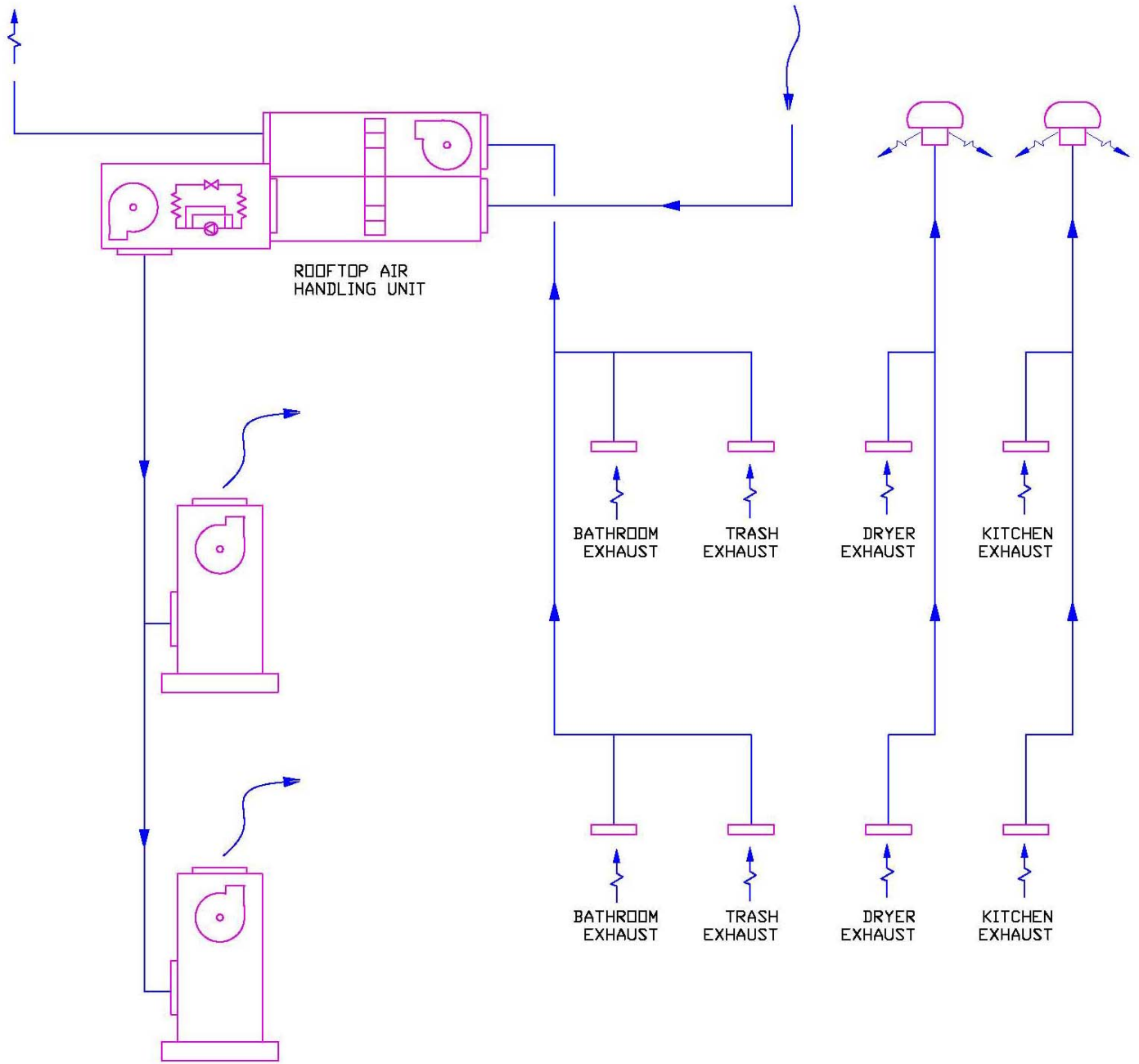


Proposal I: Open Loop Geothermal for Water Source Packaged Terminal Heat Pumps and Heat Recovery Ventilation and Humidifier Heating and Cooling System Schematic



Ventilation Schematic





Proposal I System Summary

One of the exploitable assets of this building is the fact that there is a continuous water source under the building. (Geotechnical Report A-1b) The first proposed to use this heat source and heat sink asset for open loop geothermal configurations. Two wells under the East and West sides of the building are fitted with a vertical turbine pump and discharge to use ground water to provide a heat sink and heat source for the building. This ground water is used to condition the building indirectly through the use of a heat exchanger, which accomplishes two things; it prevents scaling and corrosive properties from damaging the heat pumps directly, and saves pumping cost by allowing simultaneous cooling and heating operations to regulate the building loop temperature instead of pumping fresh water to it at the same temperature. Since the ground water is expected to be 55.4 deg F year round, this is used to relieve the central building circulating condenser loop when it sees a large heating or cooling load, and maintain the condenser loop temperature between 50 and 60 deg F. Also, a pressure tank is used to “store” pump energy by storing pumped ground water and keeping it pressurized before it goes through the heat exchanger. This will extend the life of the ground pump by preventing it from operating continuously

The same ventilation is provided as the design model, except a rooftop heat pump unit is used, steam humidifier is added to humidify dry winter air, and an sensible wheel rooftop unit is constructed to reclaim conditioning from the high volume of exhaust air.

Critiques of the Proposed System

Relative to the design goals, these are the factors that impact the success of this proposal:

I. Luxury Value and Profit

Limitations:

High first cost with no return

The building design intent is high quality, but the owners will make more profit if they can invest in features that condo owners can see and touch.

High first cost of roof system

This combined enthalpy wheel, rooftop heat pump and ducting configuration is difficult and expensive

2. Sustainability

Assets:

-Efficient heat pumps:

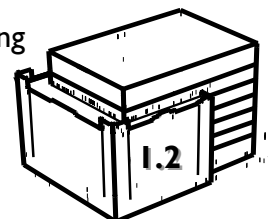
The water to air heat pumps have a better EER and COP than a typical packaged terminal heat pump

-LEED rating

Design documents state that the design building energy consumption will be at least 20% more efficient than the base case model. (A-4)

-Sensible heat recovery

A heat recovery wheel in the rooftop unit will decrease the OA supply tempering energy use.



-Rejected heat recovery

The heat pumps can reject heat to domestic hot water instead of to the ground loop and cut domestic hot water heating costs by 2/3

Limitations:**-Efficiency of Heat Pumps**

These heat pumps are not as efficient as a water to water chiller

-Pollution

This system, although efficient, uses grid electricity for heating and cooling

3. Space Conditions and ControllabilityAssets:**-High Ventilation**

Since New Jersey Code does not allow intermittent ventilation, the total airflow rates exceed the ASHRAE 62.1 ventilation recommendations. (A-5)

-Individual Control

Geothermal units provide individual control to the residents

-Heating air circulation

Heating is circulated by a fan instead of convection circulated fin tube radiator heat

-Building Control

The rooftop units temper the outdoor air, so even if the apartment conditioning is turned off, the apartments will not receive a large ventilation load. Tempering the constant ventilation therefore prevents pipes from freezing and mold growth, without overriding the individual apartment systems.

-Humidification

Winter relative humidity is kept at 50% by adding a humidifier

Limitations:**-High expense to temper the large outdoor air flow****-Heating air temperature complaints**

Typically, the temperature of packaged geothermal heat pumps heating air is lower than typical. However, this is not considered an issue since the zone heating load is minimized by tempering the OA supply, and there are not typically complaints for this temperature zone of the country.

4. Owner's Responsibility:Assets:**-Responsibility clarity:**

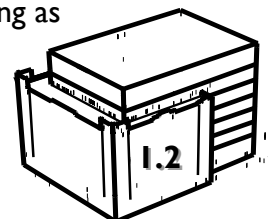
Condo owners have full responsibility for maintaining their heat pumps.

-Billing management:

The utility can charge the apartments for energy use more directly

Limitations:**-High management requirement:**

The open loop heat pump will likely require as much maintenance and monitoring as a typical chiller/boiler plant system



Challenges for the success of this proposal:

Compared to the original design, we're gaining mechanical independence for energy billing, but we're losing the efficiency of a central chiller. We gaining fan control year round, but we're losing more potential for LEED points for total energy use. The second proposal was designed in mind to address more of these limitations.

