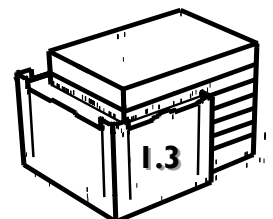
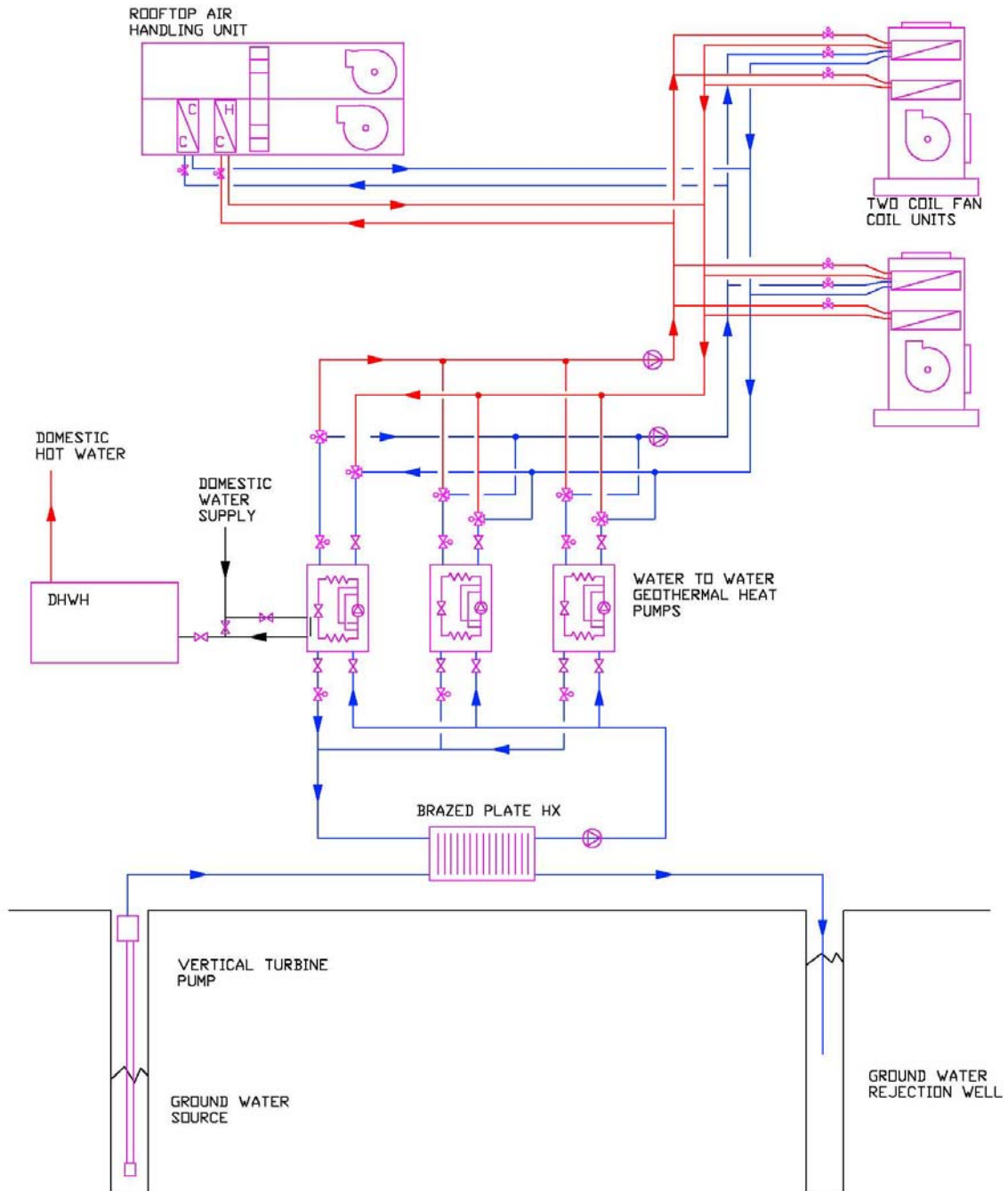
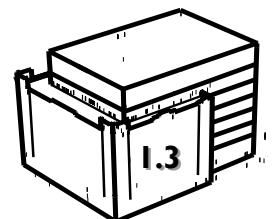
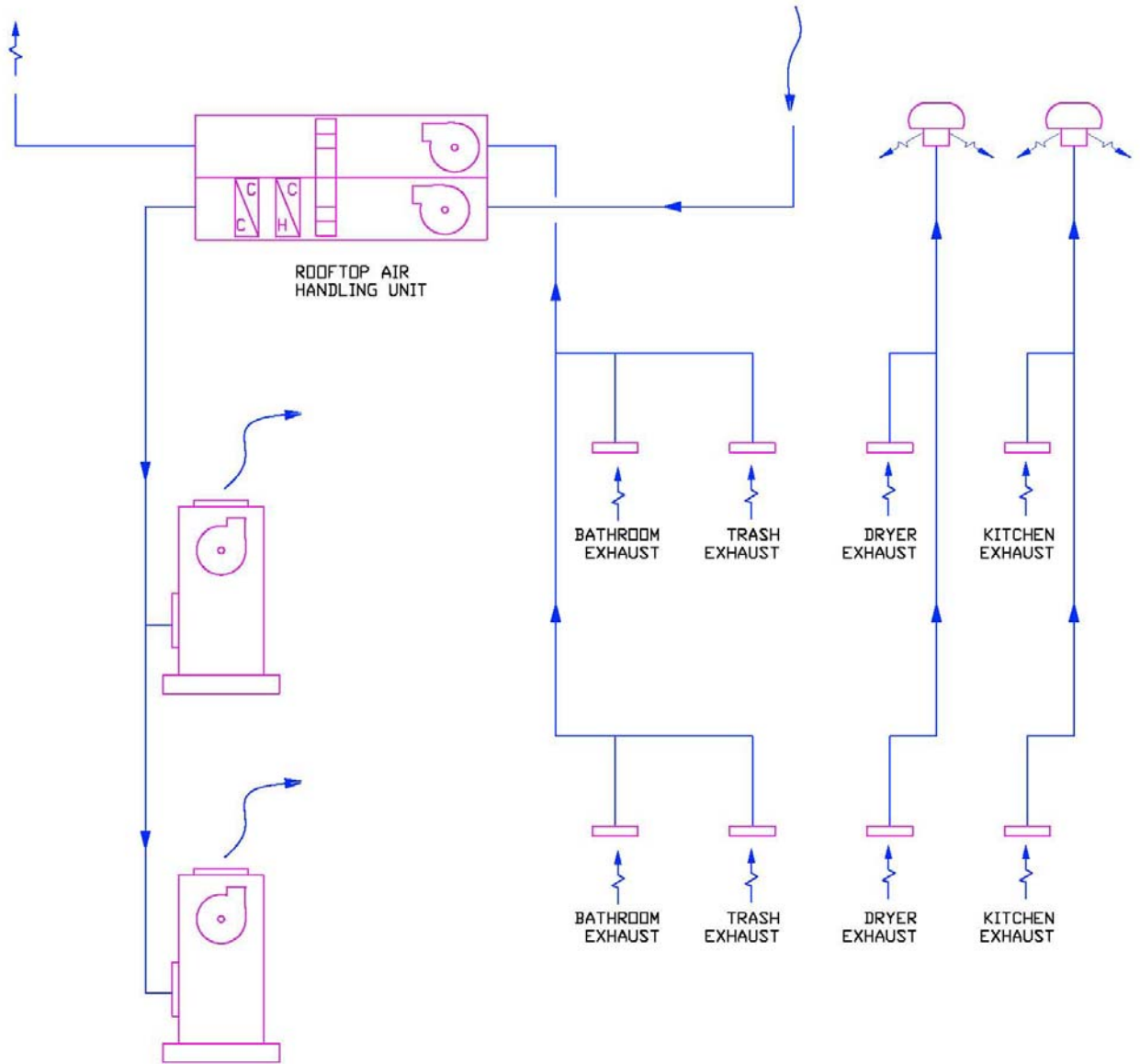


Proposal 2: Open Loop Geothermal for Water Source Central Plant Heat Pumps and Heat Recovery Ventilation and Humidifier

Heating and Cooling System Schematic



Ventilation Schematic



Proposal 2 System Summary

One of the exploitable assets of this building is the fact that there is a continuous water source under the building. (C-1b) I have 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 can be 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 central cooling/heating plant is water to water heat pumps, which feed a circulating hot water loop and a circulating chilled water loop. Fan coil units are used in the spaces to heat and cool. They are two coil FCU's, with a preheat coil, and a four pipe heating/coil. This is done to sufficiently heat the air with the 110 degree water that is coming off the heat pumps and to keep fan costs low with a variable volume supply system.

The same ventilation is provided as the design model, except a rooftop steam humidifier is added to the roof top units to humidify dry winter air, and a sensible wheel setup 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:

1. 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.

2. Sustainability

Assets:

-Efficient heat pumps:

The water to water heat pumps are very efficient and have good unloading curves

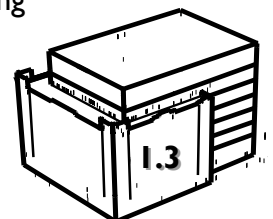
-Efficient Gas Boiler

The natural gas fired condensing boiler is up to 98% efficient. (E-1)

-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:

-Pollution

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

3. Space Conditions and Controllability

Assets:

-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

Fan coil 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 be receiving 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 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:

-Responsibility ambiguity:

Condo owners cannot modify the mechanical systems easily, and disputes cannot be attributed directly to each residence.

-Billing management:

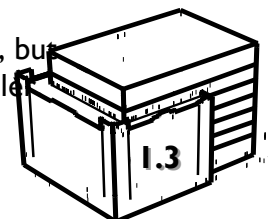
The utility cannot charge the apartments directly, so the owner must manage this.

-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, this should have a better mechanical efficiency, but all of the power is coming from the grid, which may be less efficient than the design boiler



Compared to the first proposal, we're gaining efficiency, but we're losing independence for the condominium owners.

