April 28, 2008

Evan Anderman
830 St. Paul St.
Denver, CO 80209

Final proposal for installation of a geothermal heating and cooling system for your new home on 830 St. Paul Street

Dear Evan,

We have completed an evaluation of the heating and cooling load of the new home plans based on the air ACCA & ASHRAE standard - Manual J-8 heating/cooling system design standard. Based on those results and our conversations, we offer the following system for your consideration. There are a few geothermal heat pump system options that are appropriate for your home.

The overall system will comprise a high-end geothermal air system for most of the home's heating and all of the cooling, with a small hot water geo/radiant floor system for the basement and some key areas, like the living room.

There are three options for cooling, varying in number of zones and upfront cost:

1) Two zones for top floor, two zones for main floor cooling with Envision unit
    a. Basement cooling does not have its own zone—only takeoffs from main floor ducting
2) One zone for top floor, two zones for main floor, one zone for basement with Envision unit
    a. Basement cooling with its own zone and separate ducting
3) Two zones for top floor, two zones for main floor with Envision unit, one zone for basement
    a. Basement cooling uses a Synergy3 heat pump, which provides all of the hot water for radiant heating as well as cooling with forced air

Options 1 and 2 assume that we can reduce the total cooling load by 10% (less than 5 tons), like we discussed, through better windows, overhangs, etc. Otherwise, Option 3 will be the only choice available that can handle the total cooling load on the hottest days.

WaterFurnace Envision Series – Very high efficiency, forced air geothermal system

In this configuration, the majority of your home would be heated and cooled by a single, large, WaterFurnace Envision Series 072 in the mechanical room. The 072 will have enough capacity to fully heat the first and second floors, and enough cooling capacity for the entire house. The Envision is capable of up to four comfort zones. In your case, for instance, we would likely use

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two zones upstairs, two zones downstairs. If extra cooling is desired in the future basement, we can do takeoffs off of the first floor units. The other two cooling options are described in more detail below.

The Envision is the newest, quietest and most efficient of the WaterFurnace line of heat pump units. The Envision Series geothermal unit is a complete heating and cooling system that provides air to a duct delivery system and features two-stage compressor operation and a three-speed ECM2 blower fan.

The two-stage operation greatly increases annual efficiency in our relatively mild Colorado climate. During the mild heating and cooling times of the year, the unit runs a majority of the time on low stage, increasing the system efficiency by ~20%. An additional advantage of having the ECM2-powered fan occurs when the system is not heating or cooling. The ECM2 fan can operate at a very low power draw (~65 watt light bulb) and circulate the air in your house continuously at a constant flow rate. The four advantages of this are the following:

- It keeps the temperatures balanced so there are no hot and cold spots.
- If you have a heat recovery fresh air ventilation unit it will continuously add fresh air into your house.
- The air in your house is constantly getting filtered.
- If you have a whole house humidifier the air is maintaining the correct moisture levels.

ClimateMaster GSW Series – High efficiency, water-to-water geothermal system

The remainder of the heating would be provided by a ClimateMaster GSW series water-to-water heat pump that provides hot water for radiant floor heating (smaller than the Envision unit above). The GSW Water-to-Water Series offers high efficiency with advanced features, extremely quiet operation and application flexibility at competitive prices.

In this case, you will have hydronic radiant floors in the area where it makes the most sense—the basement. In an underground space, you need very little cooling and you can also install your piping in the slab, without the added cost of gypcrete. Also, you will have very little passive solar gain so “overshooting” and thermal lag are not issues.

The GSW will also have enough capacity for some radiant floor heating in other parts of the home, such as the living room.

Loop Field

Based on your estimated heating needs, the geothermal system heat energy and cooling capability will be provided by a single loop field of 4-5 boreholes, 5” in diameter and 200 to 300 feet deep. The boreholes will be spaced 15’ apart in a line or array formation, whichever

configuration best suits your lot. Two pipes will run underground (3-5 ft depth) from the loop field through the basement or crawl space wall into the mechanical room. The most cost-effective and efficient installation is two side-by-side heat pumps off of a single loop, if possible.

During drilling, a drilling mud is used. According to your needs, we offer three types of mud control. First (local control) is to dig a trench near the drilling where the mud can flow and then have it mixed with your site dirt when it dries. There is no charge for this service. Second (on-site control) is to have the mud suctioned into a truck for deposit elsewhere on your land away from the drilling site. Third (off-site control) is to have the mud suctioned into a truck for disposal off site. The last two options are not included in this proposal. Off-site mud control is common for urban retrofits, but is up to the builder's preference for new construction.

Premium Air Duct System

We will design and install a complete air duct distribution system optimized for use with geoexchange systems. This quote includes the complete duct system for the first and second floors; we can discuss zoning the basement separately if desired. There will be 4 thermostats controlling the main floor and upper floor. We take great care in the details of the installation of our duct systems to minimize duct leakage and noise and to ensure comfortable air flow. The duct system includes a kitchen stove venting duct (hood not included) able to handle up to 300 cfm requirements. This duct system price also includes a total of 6 bathroom and laundry room vents and low sone fans (will vary depending on your actual number). The advantages of our premium ducting system are the following:

- Air flow returns in all major areas.
- Proper air velocity and diffusers. Good air flow in your rooms.
- Well fitted and sealed ducts to prevent air leakage. Excellent air delivery efficiency.
- Attention to duct curves and geometry. A quiet system.

Duct Option 2:

This option would include the basement as a separate zone, rather than using takeoffs from the top floor. However, you will sacrifice a second zone on the top floor, meaning that the master bedroom area will control the heating/cooling upstairs, rather than using a separate zone for the other bedrooms. Also, the price reflects the additional ducting in the basement.

Duct Option 3:

This option would include a total of five cooling zones, with two on the top floor, with two on the main floor, and one in the basement. The main difference is that now we are using two heat pumps for cooling, rather than one. Note that this setup offers much more total cooling capacity.

We replace the water-to-water heat pump in this case with a heat pump that can provide both hot water and cool air for cooling, a Synergy3 046. No chilled water tank is necessary in this case. Like the Envision, the Synergy3 also features the ECM2 fan for cooling or ventilation.

Hydronic Radiant In-floor Heating

We design and install complete high end radiant heating distribution systems that are designed to optimize the use of the geo system. Systems are designed room by room with special attention to load variation and piping spacing. We use high quality Tekmar controls, Grundfos and Taco pumps and Hepex tubing.

We recommend a three-zone system—two zones in the basement (east/west), and one zone for the living area. Our bid below includes approximately 625 square feet in the living room and 2,500 square feet in the basement.

While we are happy to work with the radiant contractor of your choice, we prefer turnkey installations where only one company is responsible for the entire heating system. The radiant system will include a radiant buffer tank, indoor/outdoor reset controls for keeping the tank at the optimum temperature, pumps and valves, and piping. There may be an additional charge for coordination time with a separate contractor if necessary.

Healthy Indoor Air Quality Options to Consider

Dynamic Electronic Air Cleaner
This high performance air cleaner is used in hospitals and institutional buildings. It removes bacteria, smoke and volatile organic compounds that pass through the standard filters. See attached sheet at the end of the proposal for details.

Whole House Humidifier
This high performance humidifier uses water only when necessary and has low power requirements. See attached sheet at the end of the proposal for details.

Heat Recovery Fresh Air Ventilation System
Good homes are generally built or remodeled very tightly (i.e. little air leakage around windows, doors, roof etc.) these days. A tight house collects more humidity and pollution than one with a lot of air infiltration. An energy recovery fresh air ventilation system is designed to expel stale air and pull fresh air from the outdoors while minimizing heat loss. The fresh air is circulated through your home via the duct system. The unit is mounted in the mechanical area with the exhaust pulled from a central location of the home and the fresh air delivered to the return air at the geo exchange unit.

Geothermal hot water preheating option

This is a system which will provide extra heat to a domestic water preheat tank. It will provide about 50% of your hot water needs. The system includes the desuperheater option on the WaterFurnace unit, a domestic water preheat tank and piping between the unit and the tank. It will work in conjunction with your electric/propane water heater

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Geothermal hot water preheating option

This is an optional sub-system within the geo unit which will provide extra free heat when running to help heat your domestic hot water. It will provide about 50% of your annual domestic hot water needs. It will work in conjunction with your electric/gas water heater. There are two possible configurations; a direct connect to an electric hot water heater setup or a preheat tank to electric/gas/or propane water heater setup. Your plumber will provide a standard 50-gallon electric tank (no element needed) for the preheat, and we will provide the desuperheater option/pump and the piping between the unit and the tank.

Figure 12: Desuperheater Installation In Preheat Tank

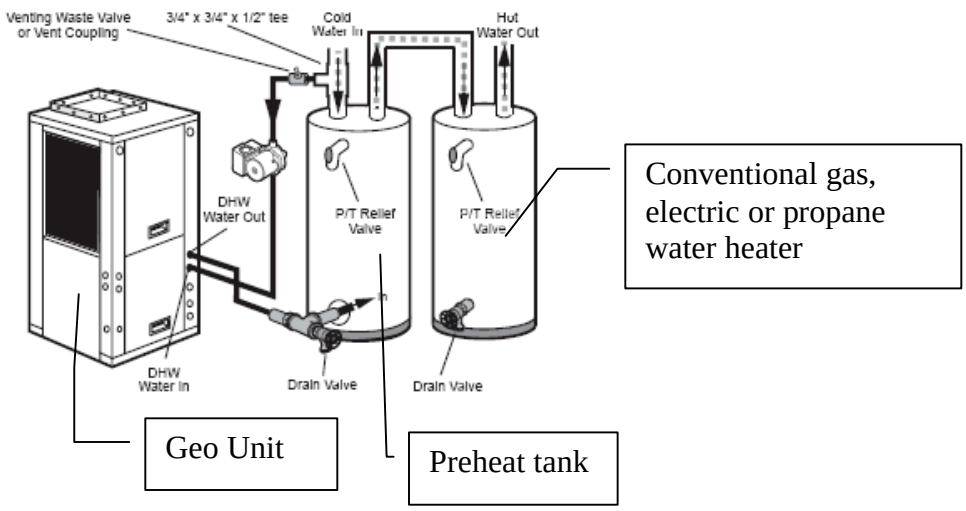
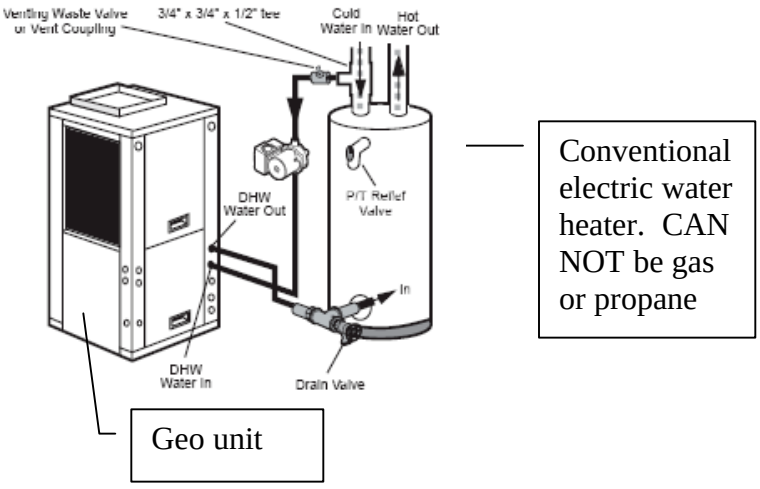


Figure 13: Typical Desuperheater Installation



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Heat Recovery Fresh Air Ventilator

Accessory for Geothermal Systems

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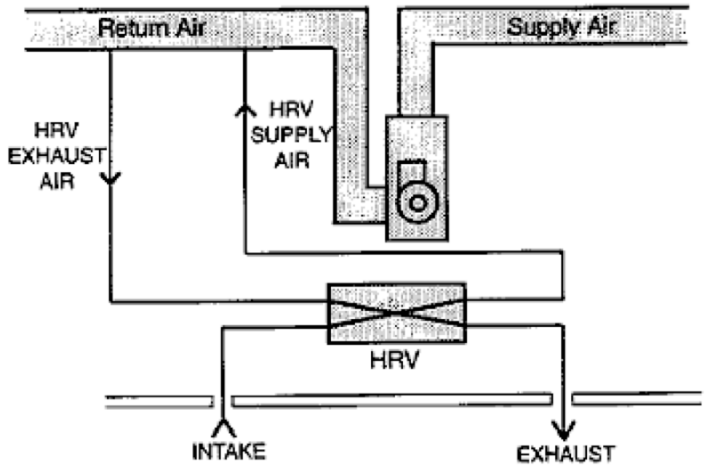

Simplified Standard HRV Installations exhaust air from the furnace return air plenum and supply air to the furnace return air plenum (downstream of where air is exhausted). Ventilation air is circulated by the furnace fan.

In the winter, heat from the outgoing exhaust air is transferred to the incoming air. In the summer, when the outside air is warmer, than the inside air heat is transferred from the incoming air to the outgoing exhaust air. This circulates fresh air through your entire house while saving heat and energy.

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Broan Heat Recovery Fresh Air Ventilator

- Ideal for families and homes where daily activities such as showers, whirlpools and cooking create pervasive excess moisture problems.
- Designed for superior energy efficiency.
- Simple speed control switch on side of unit lets you run the system on an as-needed basis to keep operating costs to a minimum.
- Optional dehumidistat automatically switches system to high speed when humidity level rises above your preselected comfort setting, for perfect control of excess moisture.
- Quality built for dependable, trouble-free operation.
- Foam filters are easily accessible and completely washable for maximum convenience.
- 135 CFM

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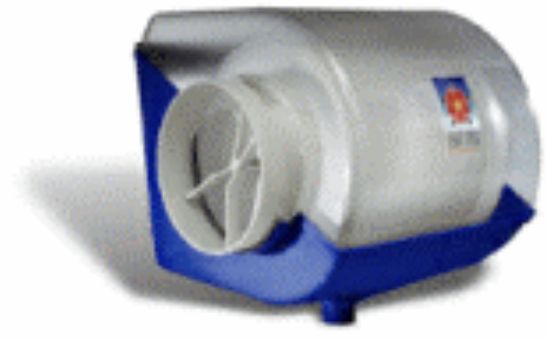
The Desert Spring Power Humidifier™ accessory that we recommend with our geothermal systems has many unique advantages over conventional systems that will save you time and money.



The patented Desert Spring Power Humidifier design is a market leader, due to the innovative cylinder of plastic rings making up the core of the unit. Numerous rings with tiny grooves slowly rotate in the water reservoir, picking up a thin film of water that is instantly evaporated by the furnace air flow. Due to the number of rings in the core, the total evaporation surface of the Desert Spring is an amazing 15 square feet! Hard water deposits cannot coat or clog the plastic rings, and are left behind in the water reservoir. Since the Desert Spring connects to your home water system it never needs refilling, ever. It's truly the last humidifier you'll ever need!

1. The Desert Spring connects to your home water system so it **never needs refilling.**
2. Since the Desert Spring mounts on your furnace, the hot furnace air **prevents the growth of mold and bacteria**.
3. It's 100% efficient, eliminating wasted water and because of its unique patented plastic disc design the desert spring is **unable to pick up or clog with hard water deposits.**
4. The Desert Spring is one of only a few humidifiers with a cleanout drain that allows you to easily clean your unit once a year in the spring.
5. The Auto Flush adapter is an option that when installed will flush out those hard water deposits so you don't have to.
6. With the humidistat, the precise relative humidity can be set just like your thermostat - set it between 30% and 50% and forget it.
7. A complete humidification system that helps to maintain and preserve the beauty of hardwood floors and fine furniture.
8. Balanced design eliminates stress on the high torque motor, providing years of trouble free operation.

The average humidifier comes in two distinct types: 1) ***Atomizing or cool mist humidifiers*** release a fine mist of water that will reduce the damaging effects of dry air. 2) ***Drum or sponge humidifiers*** have a sponge-like drum that dips into a reservoir of water while a fan blows air through the sponge releasing moisture rich air. Each of these types of humidifiers may solve your dry air problems but unfortunately at a cost most of us don't want to deal with. Both of these humidifiers have water reservoirs that contain a certain volume of water. Once this water supply has been used up, the humidifier needs to be refilled, often every few days. Oh, and don't

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forget to fill up the humidifier when it runs out of water because some units will burn up their motor. Standing water in these

types of humidifiers also provides a great environment for the growth of mold and fungus, so suppliers often recommend changing the water and cleaning the unit every 2 or 3 days. People that live in areas with hard water will probably have to deal with a buildup of mineral deposits. Hard water sediments can slowly begin to clog up the tiny spaces in the sponge drums resulting in little or no air passing through the unit. To fix this problem the home owner will need to spend even more time to regularly clean the hard water deposits from the humidifier.

NEW! DS AutoFlush Self-Cleaning System - The DS AutoFlush is an accessory designed specifically for Desert Spring furnace humidifiers. The AutoFlush will drain and wash the basin of your Desert Spring Furnace Humidifier at regular intervals (every 12, 24, or 48 hours), making your Desert Spring a worry free, ultra-low maintenance system. The AutoFlush is **recommended** for homes with hard water as well as those who want to further minimize maintenance. A special pump is available for homes without a floor drain - please call us for details.

Dynamic Electronic Air Cleaner

Improves Indoor Air Quality

According to the U.S. Environmental Protection Agency, “Indoor levels of air pollutants may be two to five times, and in some cases, more than 100 times higher than outdoor levels...” The patented technology used in the Dynamic Air Cleaner will provide your home with clean, healthy air. In fact, the Dynamic Air Cleaner is so effective it is used in thousands of hospital, commercial and institutional buildings around the world.

Provides Unequaled Performance

The average cubic foot of indoor air contains 20 million particles. And more than 95% of these particles are smaller than 1 micron (a micron is 1/25,000th of an inch.) Most filters, including many so-called “high efficiency” filters, simply can’t catch them. To effectively clean the air, the submicron particles must be removed. The Dynamic Air Cleaner provides unparalleled 97% capture efficiency of these particles down to .3 microns. The superior efficiency of Dynamic Air Cleaner is a result of electronic polarization and activated carbon. The filter works by assigning polarity to all the particles in the air as well as the fiberglass media in the air cleaners. These particles are

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polarized, becoming like small magnets inside the air cleaner, where they will cling to each other and to the media in the air cleaner. And unlike typical electronic air cleaners, the environmentally friendly Dynamic Air Cleaner creates no ozone or nuisance noises.

Easily Installed for Immediate Results
The Dynamic Air Cleaner easily can be installed in your new or existing system, cleaning the air in your entire home. Your home will be cleaner, fresher and healthier with less dust and fewer germs and odors. Allergy and asthma sufferers will experience immediate and dramatic breathing improvements.

Particle Size	Typical Contaminant	Capture Efficiency	
		4-6" pleated	Dynamic Air Cleaner
3 to 10 microns	Pollen, mold, dust, hairspray	98%	99%
1 to 3 microns	Auto emissions, lead dust, large bacteria	Not effective	98.6%
.3 to 1 microns	Smoke (tobacco, cooking), small bacteria, fine dust, paint pigments	Not effective	97%
	VOCs (odor, off-gases including formaldehyde from carpets, furniture and cleaning products)	Not effective	40%

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