Solar Pit House

By Owen Geiger

Specifications: 1,127 sq. ft. interior living space, 441 sq. ft. interior greenhouse, total = 1,568 sq. ft. interior, Footprint: 36'x53'
Description: This modern solar pit house is based on the traditional pit house. The construction is much the same. Additional 'modules' have been added to create an elongated rectangular design for added living space and windows added on the south for solar gain. Each module is based on wood posts set in geopolymer or concrete footings. Wood beams approximately 10"-12" diameter are joined at the posts with half lap joints and pinned in place with rebar or logging spikes. Smaller poles around the perimeter lean against the beams. 24" wide earthbag walls with a reinforced geopolymer or concrete bond beam rest on rubble trench foundations.

Evolution of the Pit House
I'll never forget the Native American museum exhibit of a pit house I saw in Anchorage, Alaska. I couldn't stop staring at it. Pit houses are so simple and yet so effective that people lived in structures like this for thousands of years with relatively minimal environmental harm. This building method and lifestyle really captures my imagination and provides many lessons for modern societies.

Earth sheltered housing is the way to go, especially in harsh, cold climates like Canada. I'm surprised more people don't build along these lines. Why not take what's proven to work and update the design to suit our needs today? That's exactly what I did with this design. I was looking at pit houses on the Internet and realized you could just add windows on one side and greatly improve the design. And instead of a square, make it rectangular for additional solar gain.

Email that Sparked the Solar Pit House Design

Dear Owen, I am currently doing research and compiling data in order to draft a proposal here in Canada largely related to solving an epidemic within our First Nations communities in regards to a lack of adequate housing. I could go on for hours and hours about the immense and serious problems in this area, but I'll keep it as brief as possible.

Many of these areas are in arctic or subarctic conditions and I am curious if there is any data available on the viable use of earthbag building in such areas. I am certain that this should be possible especially given that a majority of families in the most remote areas live in temporary housing with little or no insulation, and thin walls.

My first thought when trying to come up with a solution to this problem was earthbags due to their sustainable nature, low cost and widely available materials. Many of these reservations have absolutely no sources of income or employment and survive entirely on government assistance so cost effective solutions are incredibly important while having to be as close to permanent as possible.

Though I am nothing more than a humble artist, recent events in our country have given me a strong passion to work towards this cause.

Thank you very much for your time and consideration,
Hideo Luc Goyer, Cloudgazer Studios http://www.cloudgazerstudios.com/

Owen: The two key issues for you are:
1. Locating a source of affordable insulation. Tamped earth without insulation would be as cold as living in a cave. Maybe you could buy scoria by the truck or train load to get a big discount. Scoria and pumice provide decent insulation and don't mold, rot, burn, etc. It's lightweight and easy to work with. Our Natural Building Blog http://naturalbuildingblog.com/ covers this subject in detail. (Use the search engine on the blog. A later email explained how recycled polystyrene is plentiful in Canada.)

2. You'll definitely want to create a passive solar design with lots of large, south facing windows to maximize free heat from the sun. Thick, high mass walls and floor will absorb the heat, and a thick layer of insulation around all sides (including under the floor and on the roof) will trap the heat inside. You could even grow bananas or other tropical fruit with this sort of design.

Solar Pit House Building Details

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As explained in the previous blog post, this modern solar pit house is based on the traditional pit house. The construction is much the same. Additional 'modules' have been added to create an elongated rectangular design for added living space and windows added on the

south for solar gain. Each module is based on wood posts set in geopolymer or concrete footings. Wood beams approximately 10”-12” diameter are joined at the posts with half lap joints and pinned in place with rebar or logging spikes. Smaller poles around the perimeter lean against the beams. 24” wide earthbag walls with a reinforced geopolymer or concrete bond beam rest on rubble trench foundations.

The entire structure is surrounded by insulation and moisture barriers, both of which can be obtained as recycled materials. The Solar Canadian [their blog is currently unavailable for some reason] reported that farmers use large plastic bags for storing grain for one year and then discard them. They should make a perfect moisture barrier. And, as discussed in a previous blog post, recycled polystyrene is available. In this design, loose polystyrene is used around the perimeter, and home-made rigid board insulation is used on the roof and under the floors. Be sure to test the rigid board insulation so it doesn’t compress and cause cracking in the slab floor.

Other features:
- Sloping, earth-sheltered design has no vertical walls exposed to the harsh wind. This greatly reduces heating cost.
- Radiant floor heating is the recommended heating system. At least one back-up heating system is called for due to the extreme climate – either a wood stove or propane heater.
- A window wall separates the greenhouse from the main living space. Solar powered, heat activated fans blow heat from the greenhouse into the home, and cold air return vents draw cool air back into the greenhouse.
- Double door airlock reduces heat loss.
- The entry or mud room has space for coats, boots, shovels, snowshoes and greenhouse window insulation (possibly more polystyrene panels).
- The entry vault helps block westerly winds and prevent drifting snow from accumulating on the greenhouse roof.
- Pantry provides long-term food storage to reduce trips to the store.
- Storage room for greenhouse supplies and potting bench.
- Buried cisterns (not shown) with gravity flow design or back-up water hand pumps in case of blackouts.
- Joseph Jenkins sawdust composting toilets greatly reduce water use. Water conservation is important since water deliveries are expensive and unreliable in remote areas.
- Enhanced livability over current low income housing: traditional design for cultural acceptance; warmer (huge psychological boost when the floor and air temperature are always comfortable); more pleasant living environment with abundance of plants and much greater daylighting (combats cabin fever); fresh food production and higher oxygen level; superinsulated design with far lower energy costs (money stays in the community); adequate space for extended families and storage; greater self sufficiency.

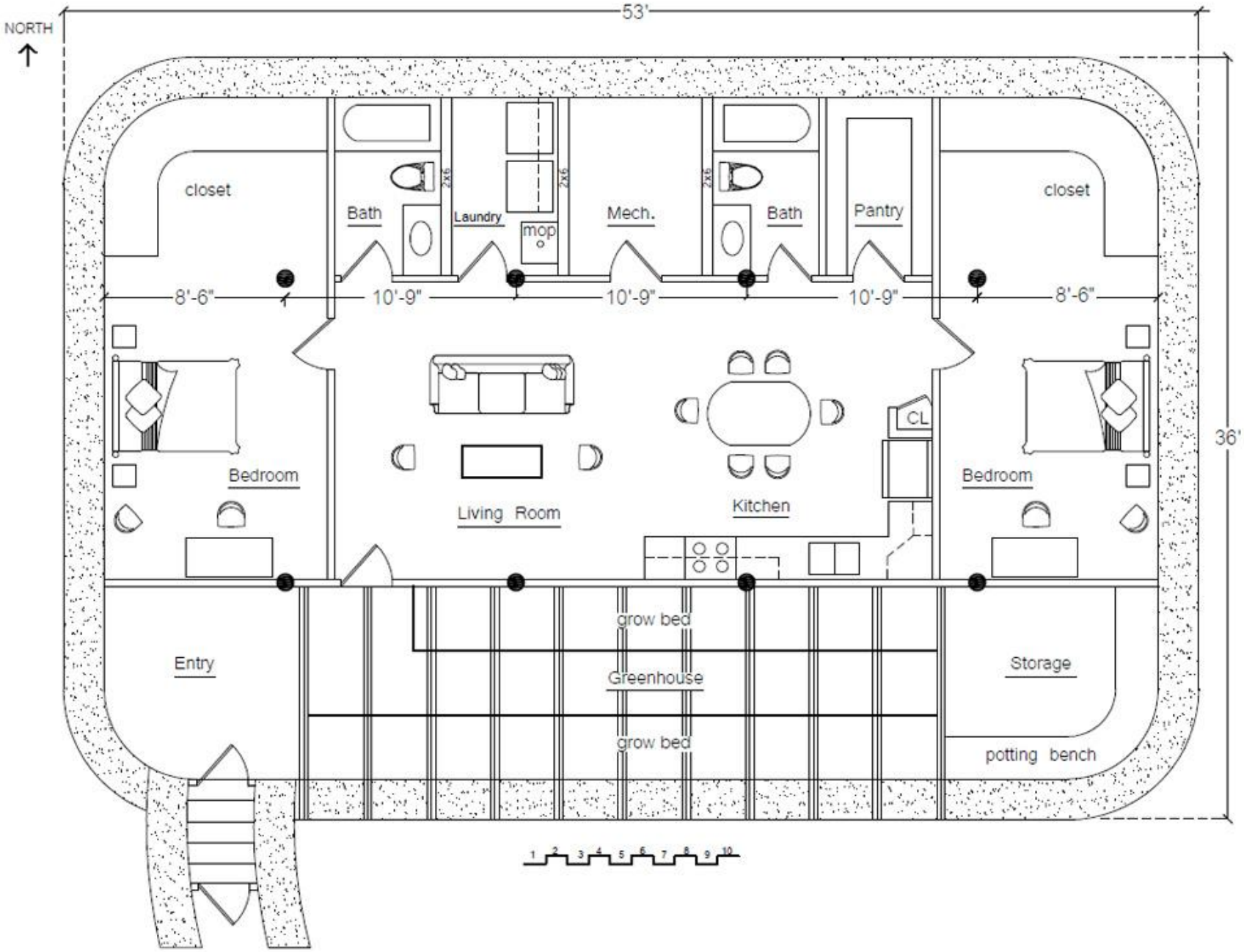
Additional Notes:
Note to other designers: I’d like to refine this design with input from other design professionals and make all drawings freely available on the Internet. Please email me at

strawhouses [at] yahoo.com if you would like to contribute. Or just leave a comment here if you're short on time.

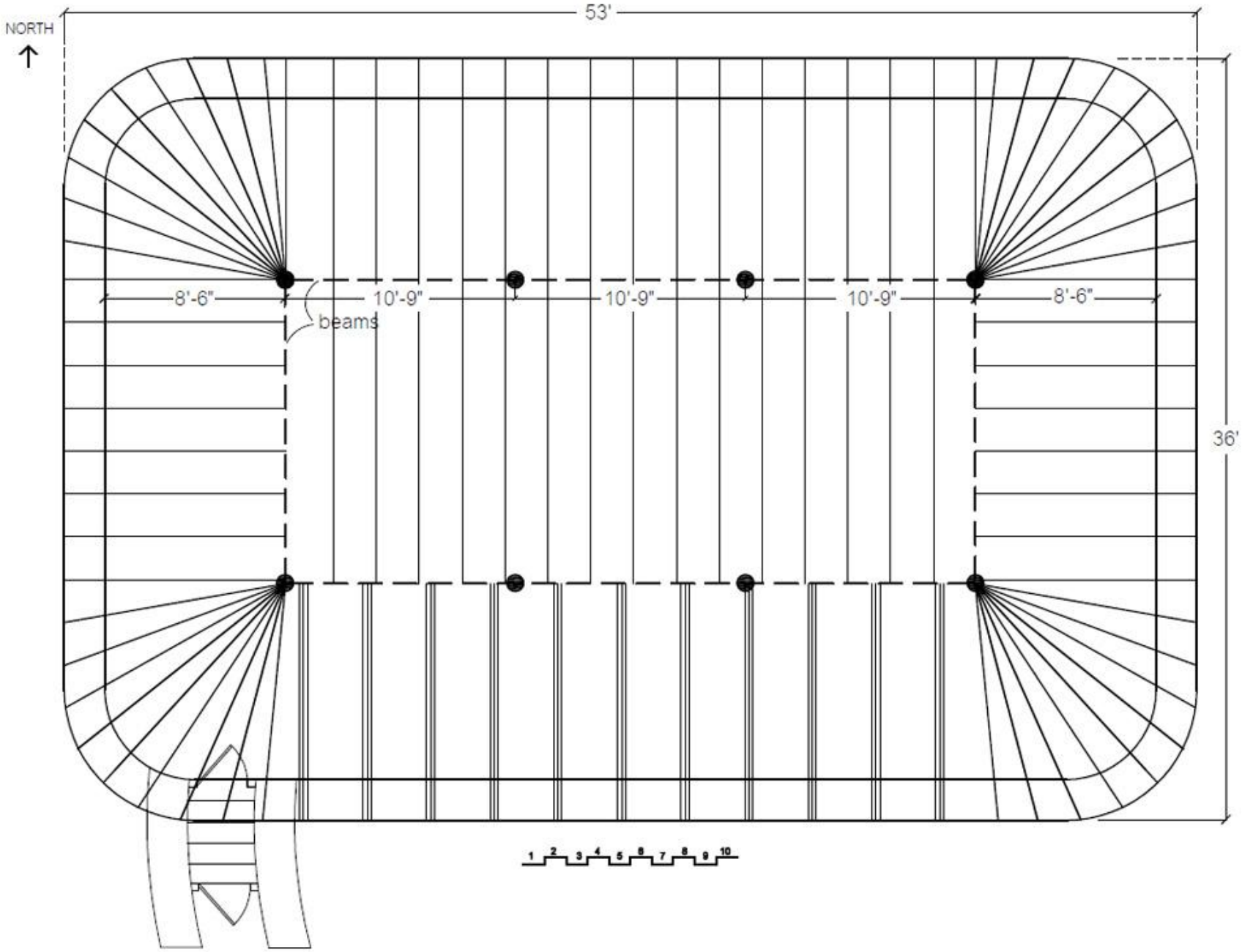
Please document your project with lots of photos and notes so we can share with others.

Also, please search our websites for building details. We have hundreds of pages of free information. Use the built-in search engine to find blog posts on each topic. (I'm trying to keep emails to a manageable number.) Here's one example: http://www.instructables.com/id/Step-by-Step-Earthbag-Building/ And my YouTube channel has step-by-step videos: http://www.youtube.com/user/naturalhouses

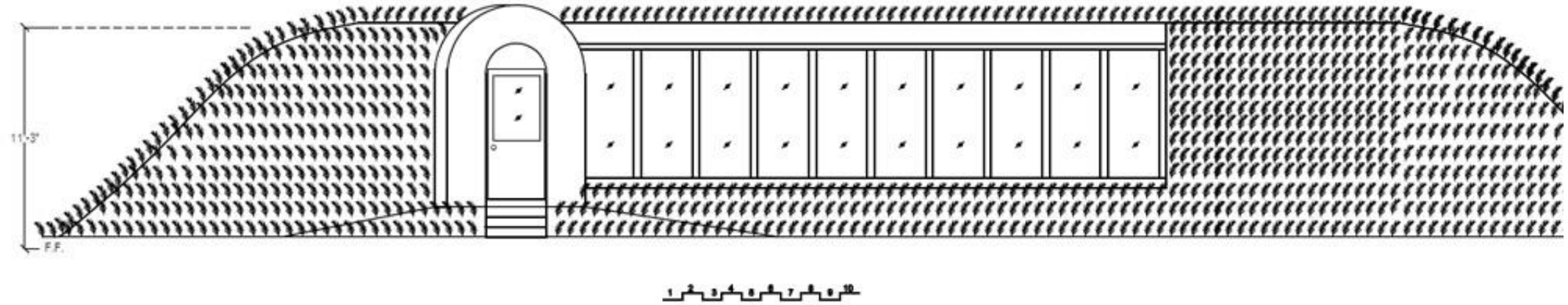
Sincerely,
Owen Geiger



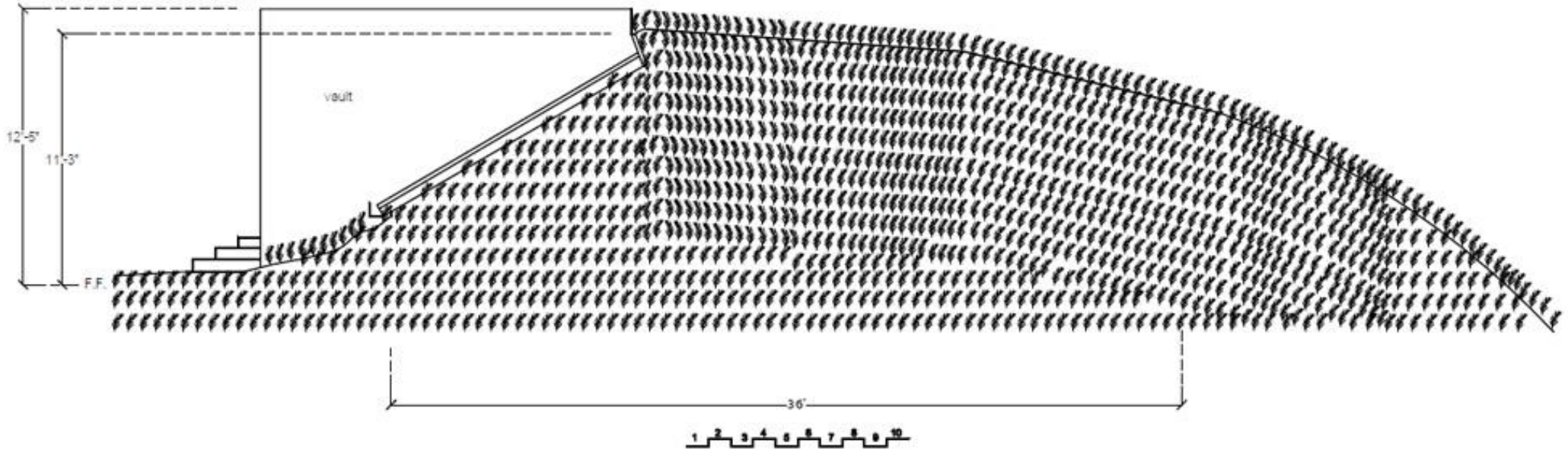
Solar Pit House Plan



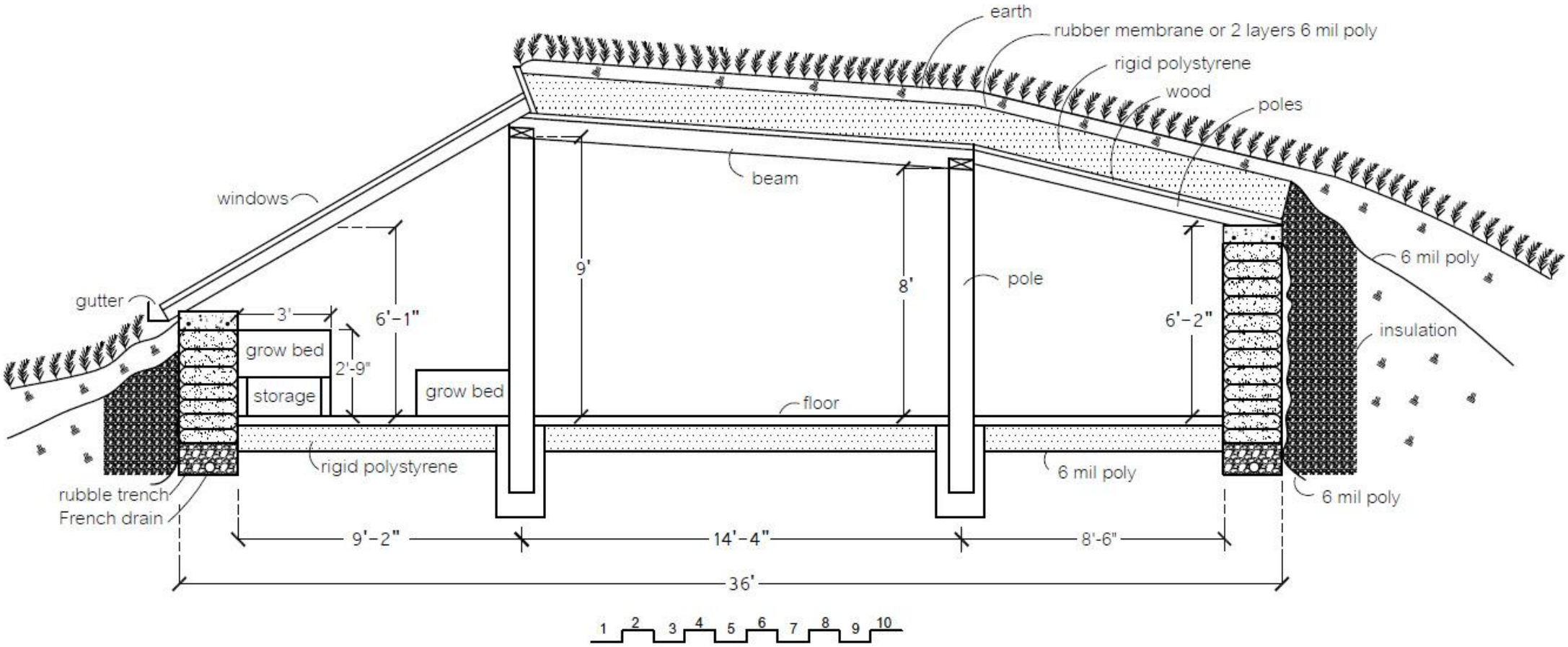
Roof Plan



South



East



East Section