



# Made In Earth

-Towards community friendly housing in lesotho



Construction in Lesotho is very heavily influenced by its surrounding neighbour, South Africa, with construction and materials supplies companies and many building materials imports originating in South Africa. . Incremental development is often layer by layer rather than room by room. This tends to underuse land(which is already very scarce due to the topographic nature of lesotho) for many years until construction is complete.

...the solution is introducing a new simple idea..  
Earthbagconstruction

Earthbag construction is an inexpensive method using mostly local soil to create structures which are both strong and can be quickly built.

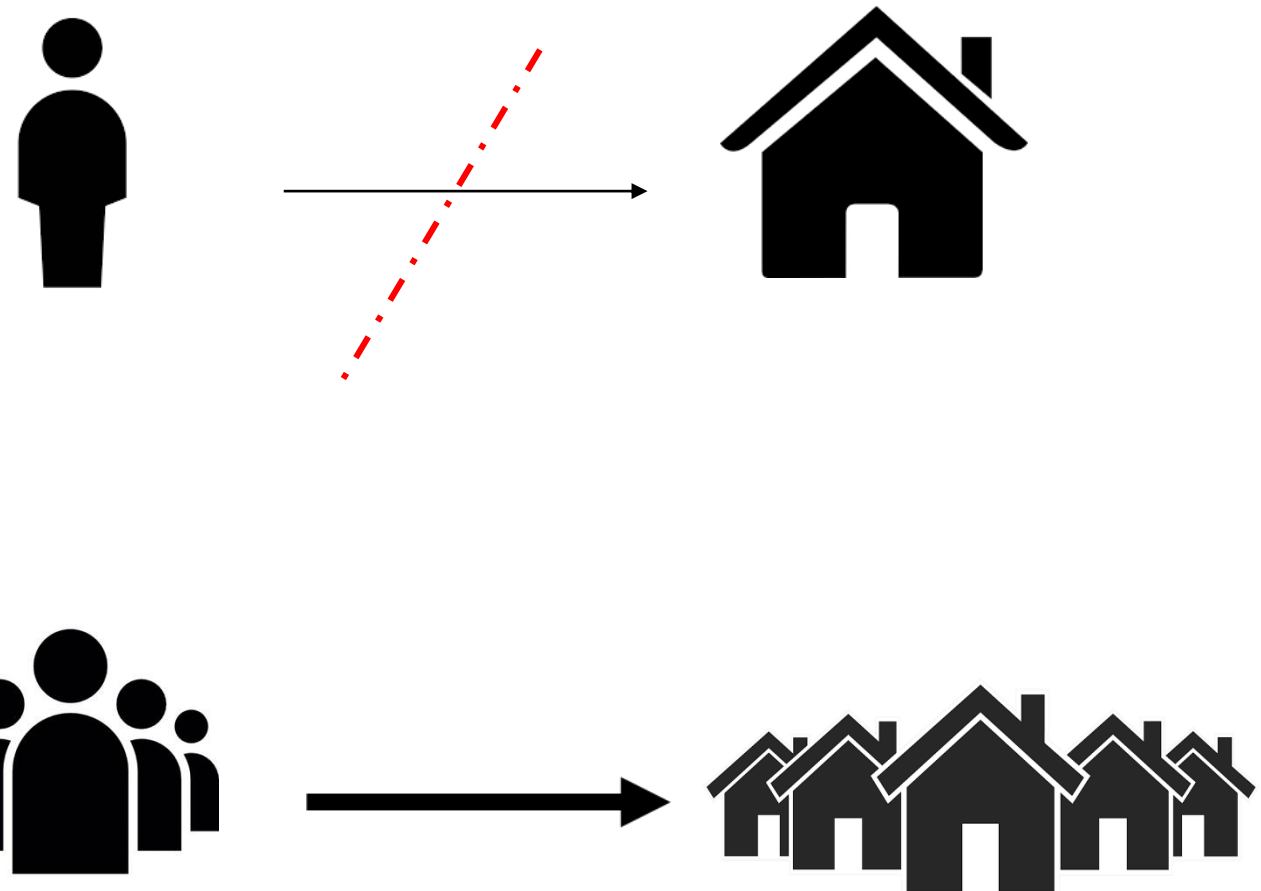
**MADE IN EARTH** focus on the economic empowerment of people by participation in the creation of their own homes and communities to create sustainable developments that integrate traditional building materials with modern materials and technology, providing comfortable living spaces acceptable to modern safety standards.using extremely inexpensive means to provide safe homes

The house is based on three modules, two used for sleeping and one for kitchen and living room, with an opportunity to expand vertically

The access platform is a space for social interaction between family members, and with the families of adjacent houses. It serves both to set a table with chairs and lunch, or to lay a carpet or mat and rest.

OUR GOAL IS to create a project in which one member of each family work on the construction of multiple houses in exchange for receiving one of the houses upon completion. Teaching the locals not only provides them with useful skills but also greatly reduces the cost of labor for the project. The local acceptance and understanding of a new building technique is also more likely because the recipients are involved in every step of the construction process.

. We believe that when a person builds his own house he will give it more importance and a larger sense of identity and preserve it with special care



“A person can not build his house but ten persons can build ten houses for them”

## EARTHBAG CONSTRUCTION..WHY?

### 1. Easy to learn and user friendly

The Earthbag system can be mastered by unskilled people and communities in a very short amount of time, with minimal supervision and cheap tools.

### 2. Reduce, Reuse, Recycle

With Earthbag building, the use of resources is highly reduced. The Earthbags themselves can easily be reused locally or emptied and used elsewhere, and the materials are all recyclable. (They are also pretty good for sack races!)

### 3. Cost

Earthbags can be filled with a variety of materials that can be obtained from the site itself, often available at no cost. This dramatically reduces fossil fuel use and transport costs to the site. It also means environmental damage from quarrying is eliminated.

### 4. Strength

Earthbag structures are extremely strong, owing to their own thickness and weight. Therefore, earthbag structures are unaffected by high winds or other destructive forces, and should stand for decades, if not centuries.

### 5. Climate control

Earthbag structures control humidity well since moisture will be absorbed and released from the walls, meaning the interior humidity is maintained at a steady and healthy level. This eliminates the condensation and mould that can occur with concrete and brick walls, reducing the dangers from respiratory conditions such as asthma, pneumonia and TB

### 6-transport

The walls for one hundred 200 sq foot domes or other structures can be easily be built from a single container-load of earthbags. Also, local site-sourced fill material is used in the earthbags and this dramatically reduces fossil fuel use and transport costs to the site. It also means environmental damage from quarrying is eliminated

### 7-remote control

: As only the bags (and concrete if desired) need to be transported to the site to build with earthbag construction, it allows for easier construction in remote locations. Bales or rolls of bags can even be carried on foot

### 8-timber-free

Earthbag walls use little or no timber

### 9-minimal waste:

Earthbag construction produces almost no on-site waste generation, a huge difference when compared to the volume of material that usually ends up in a landfill after a traditional home build

## LESOTHO..WHY?

### 1- Ineffective land use planning and management frameworks

land is very limited. It constitutes about 10 percent of the total land area in the country owing to the predominantly mountainous topography. This has led to increasing competition between agriculture and housing in the use of land, particularly in the peri-urban areas. Any encroachment by housing development reduces the limited arable land. In the absence of effective land use planning and management frameworks, availability of land for housing development is becoming a major challenge.

### 2- Development and expansion of underserviced and unplanned settlements

### 3- Limited access to housing finance

The main source of housing finance in Lesotho is a small mortgage lending sector which grants about 400 long term mortgage loans a year to Basotho earning more than \$900 a month. Qualification criteria limit mortgage loans—of a minimum of M300,000 (US\$27,000) and maximum repayment period of 20 years—to salaried workers who can prove a household monthly income of 2.5 to three times their proposed loan repayments. However, most households are in need of short-term housing loans of around US\$2-5,000.

**4- Climate change:** Lesotho is already feeling the impact of climate change, with high exposure to climate variability and extremes, which are expected to intensity in the future. Climate change and variability, together with soil erosion, human induced degradation through poor farming practices and overgrazing, have led to a loss of nearly 800 km<sup>2</sup> of arable land in the past decade—leaving only about 9.6 per cent of the total land arable. And there is increasing competition for the limited arable land remaining.

## Earthbag construction guide

### Tools needed:



cutter



tamper



soil



Recycled pipes



sliders



Window and door wooden frames



shovels



Propylene empty bags



buckets



Barbed wire



gloves



Recycled plastics



Anchoring pins to close the filled bags

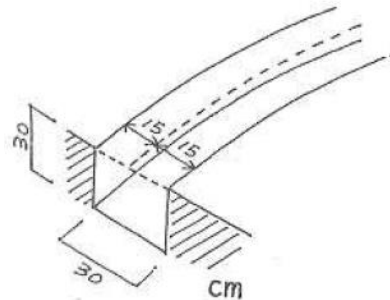
1-prepare the insitu soil to be filled in the propylene empty bags

Please refer to the soil test for better result:

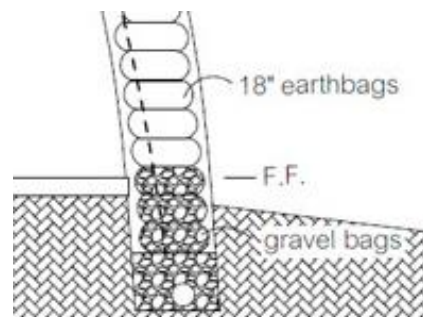
<https://buildsimple.org/wp-content/uploads/2018/01/soil-test-research-2017.pdf>

<https://buildsimple.org/wp-content/uploads/2018/01/how-strong-is-my-soil.pdf>

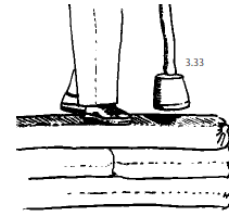
2-dig the foundation trench



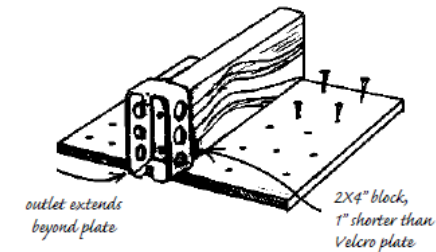
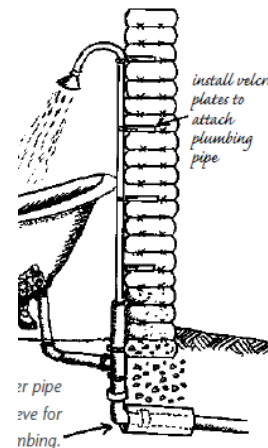
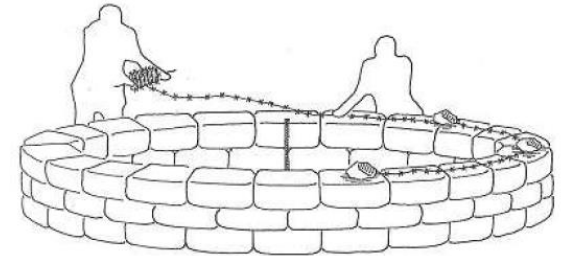
3-fill the first 3 rows of bags of gravel to support the structure



4-every bag is filled by 2/3 buckets of soil then tamped

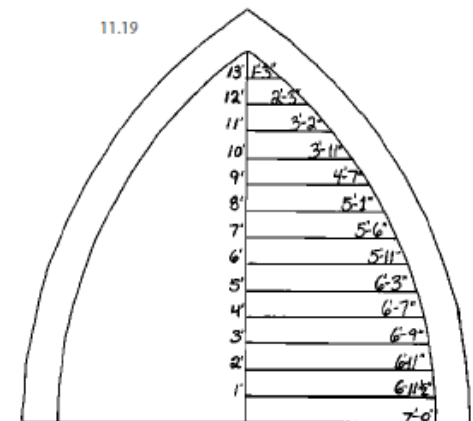


5-bags are put row by row and stuck together with the barbed wire -barbed wire acts as mortar in traditional construction method



6-electricity-pumping-vent pipes and door-window frames are added between bag layers

7-rows of bags is completed layer by layer till the dome in finished



8-the external structure may be plastered by lime or insitu mixture of clay and sand and covered by traditional woven textures

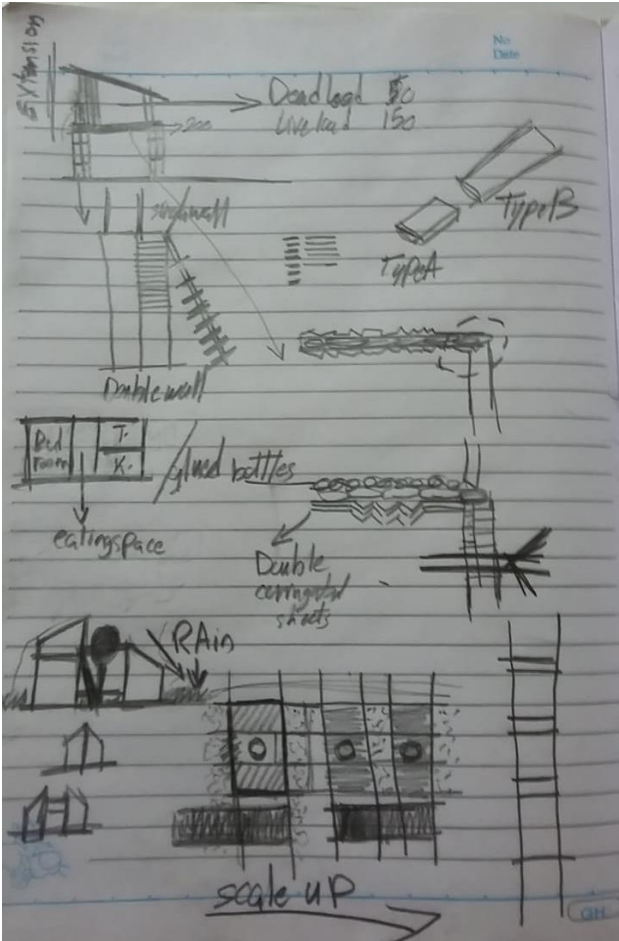
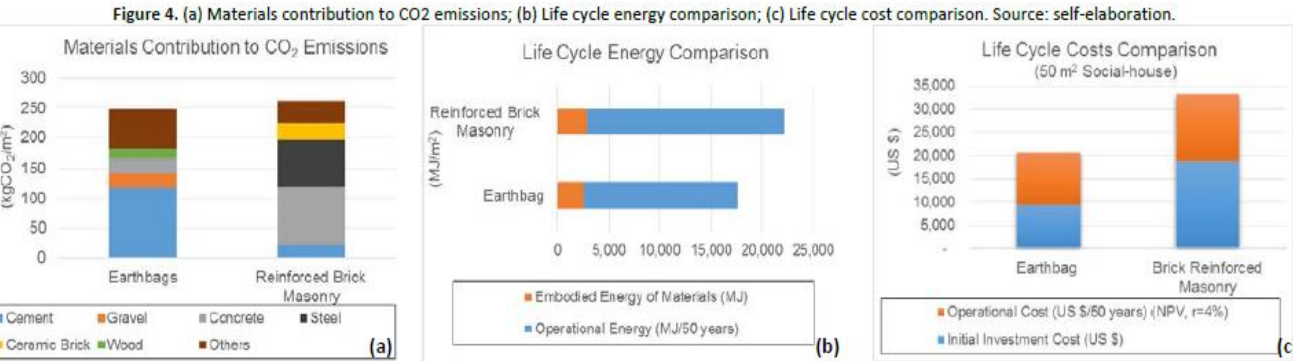
9- you can finish your home in **10-14** days!  
WITH THE HELP OF YOUR FAMILY AND FRIENDS



Further information

	Earthbag	Adobe	Rammed Earth	Cob	CEB
Special curing process? (= delays)	No	Yes	Yes	Yes	Yes
Special soil mix?	No*	Yes	Yes	Yes	Yes
Relatively fast?	Yes	No	No	No	No
Expensive forms?	No	No	Yes	No	No
Expensive tools and equipment?	No	No	Yes	No	Depends on hand vs. power machines
Water required?	No	Yes	Yes	Yes	Usually (minimal)
Work in the rain?	Yes	No	No	Yes	No
Excessive handling of materials?	No	Yes	Yes	Yes	Yes
Owner-builder friendly?	Yes	Yes	No	Yes	Yes
Easy to make curved walls?	Yes	Yes	No	Yes	Yes
Domes?	Yes	Yes	No	Yes	Yes
High R-value?	Yes**	No	No	No	No
Foundation required?	No	Yes	Yes	Yes	Yes
Earthquake/flood resistance?	Excellent	Poor	Fair	Poor	Poor
Plaster required?	Yes	No	No	No	No

Green = Favorable Red = Not Favorable  
\* Assumes a suitable soil is used (= most soil types)  
\*\* Assumes bags are filled with scoria, pumice, etc. (= porous volcanic rock)



Initial sketches



The moodboard of interior and exterior is inspired by the traditional woven texture

Further reforms

Un lesotho urban profile

	Land	Housing Finance	Infrastructure	Building Materials & Construction Sector
Implementation arrangements & instruments	Improve local authorities' capacity to manage land. Implement existing strategies for land. All local authorities should introduce and maintain property tax procedures commensurate with the built cost of housing and the area of plots. As public land allocations should be transparent and traceable, so should customary land transactions. Subsidised land should only be used for households below the median income or the full value of subsidies should be paid by those above median income.	Consider a dedicated institution for housing micro-finance. Improve information on loans available.	Labour-based infrastructure installation has been found to be particularly viable in Lesotho. Focus should be put on installing and managing infrastructure for housing through labour-based technologies and activities. Water and sanitation on or near plots should be the way forward rather than public standpipes and toilets. Encourage continuity and commitment in infrastructure organisations and local councils. There is great potential in improving labour-based collection and management of solid waste and introducing more recycling. The markets of South Africa provide some potential for recycling.	Reducing the exposure of the construction industry to South Africa might be a good idea. Encourage labour-based construction. Improve knowledge dissemination in construction.
Institutional capacity	Increase local authority capacity to cope with land issues as called for in the Decentralisation Policy.	Improve consumer knowledge of credit and its implications.	There is a brain-drain of skilled construction workers out of Lesotho. Promote and encourage teamwork.	Improve co-ordination between WASCO, LEC, local authorities, etc. Provide a way of sharing skills with the informal sector and the public. Recast the curricula of TVET institutions to meet construction-sector needs. Encourage career opportunities in construction and housing-related professions within Lesotho.
Affordability & price-to-income issues	Land should be available in small enough plots to be available without subsidies or market revisions.	Examine consolidated or shared loans.	Empower LEWA as a regulator across infrastructure provision and a consumer protection unit.	New initiatives should focus on using local materials and technologies in labour-intensive construction. Build to the median price of M90,000 (\$8,200) rather than to an artificially-set standard

## References:

NATIONAL HOUSING POLICY April 2018

*Earthbag Architecture: Building Your Dream with Bags*  
by Kelly Hart, 2015, Hartworks LLC.

*Earthbag Building Guide*  
by Owen Geiger, 2011

*Emergency Sandbag Shelter* by Nader Khalili,  
2008, Cal Earth Press.

*Earthbag Building: The Tools, Tricks and  
Techniques* by Kaki Hunter and Donald Kiffmeyer, 2004, New Society Publishers.

*Building with Earth: A Guide to Flexible-Form Earthbag Construction*  
by Paulina Wojciechowska, 2001, Chelsea Green Publishing.

earthbagbuilding.com  
greenhomebuilding.com  
dreamgreenhomes.com  
naturalbuildingblog.com  
earthbagstructures.com

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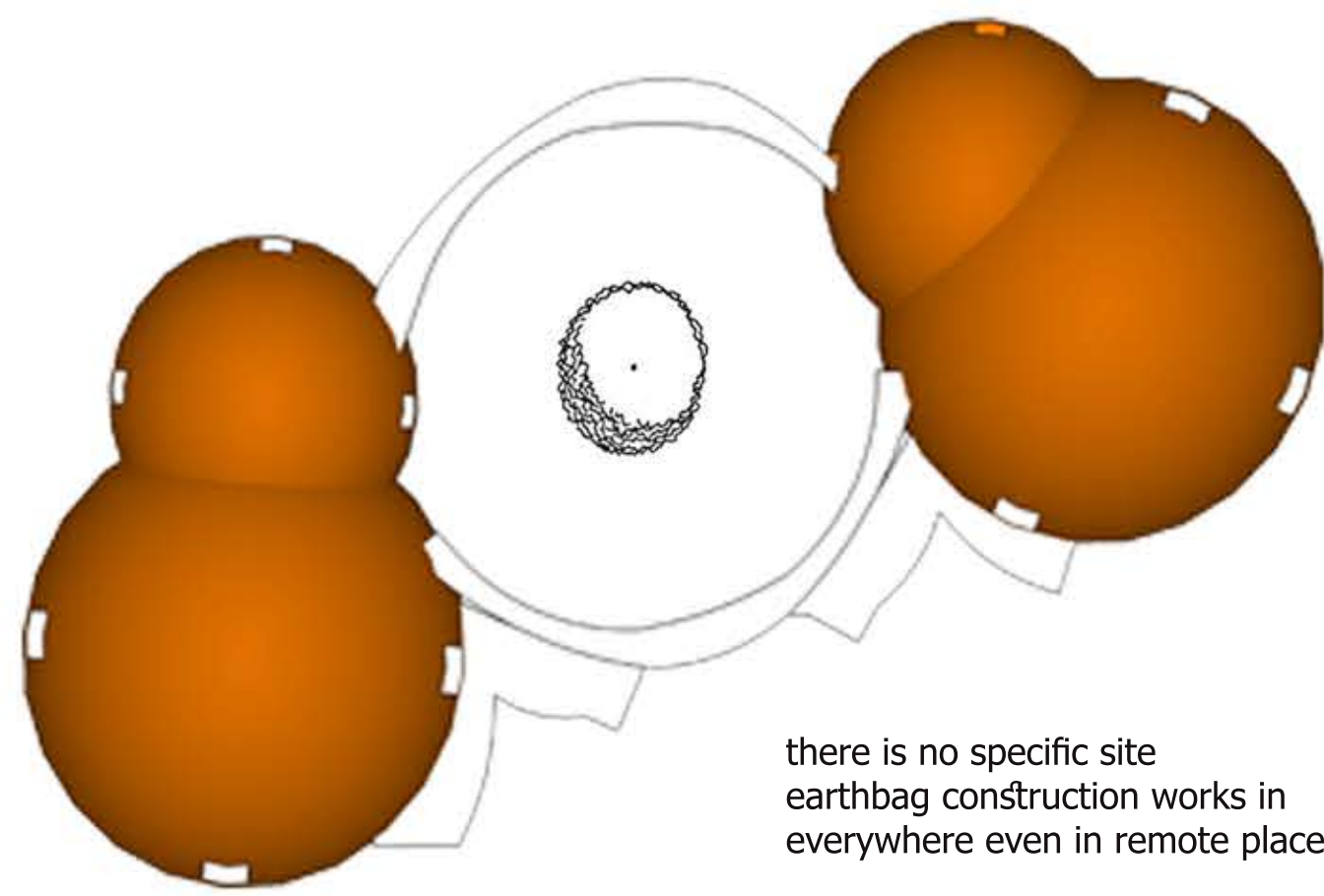
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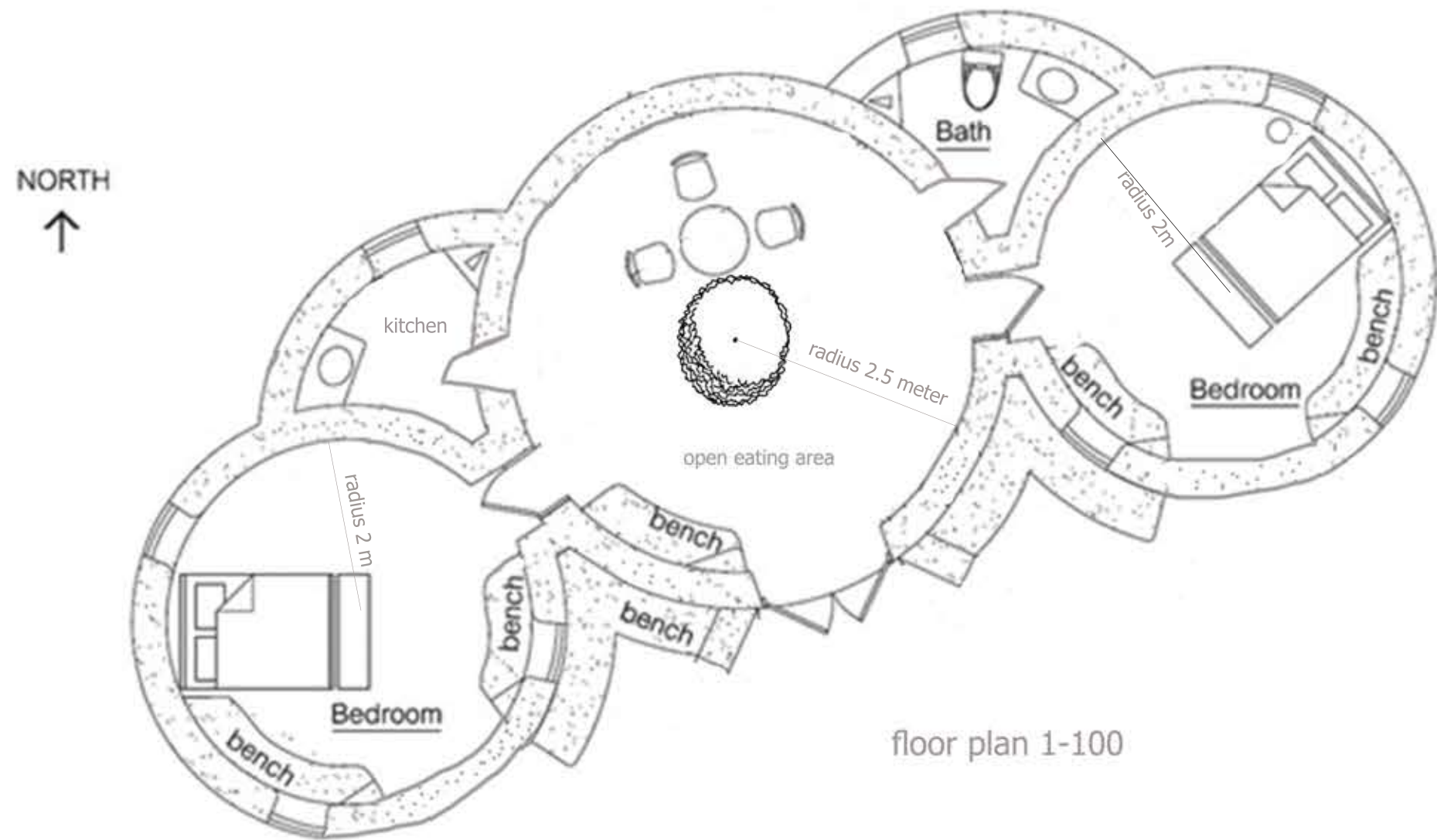
## Project cost estimation

What we need	amount	cost	notes
1-tools -cutter -tamper -recycled pipes -steel sliders -shovel -bucket -gloves -Anchoring pins	2 2 5 1 2 2 2 1500	4.43 usd -125 lsl 40 usd-560 lsl 0 35usd-500 lsl 80usd-1,136.05LSL 50usd-710.070LSL 20usd-284.068LSL 160usd-2,273.92LSL	*pipes are recycled from surrounding then reused as vents *floors are made entirely of earthbags for better insulation *rainwater harvesting system can be added later through long pipes fixed between the small and big dome as shown in <a href="#">section 1</a>
2-materials -barbed wire -recycled bottles -insitu soil (for filling and plaster) -Window frames -door frames -Polypropylene bags - traditional tarps	600m -- -- 8 4 1500 --	350usd-4,973.41LSL 0 0 180usd-2,555.95LSL 80usd-1,136.54LSL 400usd-5,682.27LSL 0	*recycled bottles and traditional tarps will be made by friends for nearly zero cost
3-sanitation -composting toilet	1	75usd-1,064.90LSL	
4-electricity boxes	5	125usd-1,775.83LSL	
5-Labour 6-transport 7-interior(beds-wardrobe..)-others	--- Shipping prices is included per every item	--  200usd-2,842.59LSL	*this construction method is easy and available for everyone-no need for skilled labour
Total cost		1800usd-25,587.94LSL	

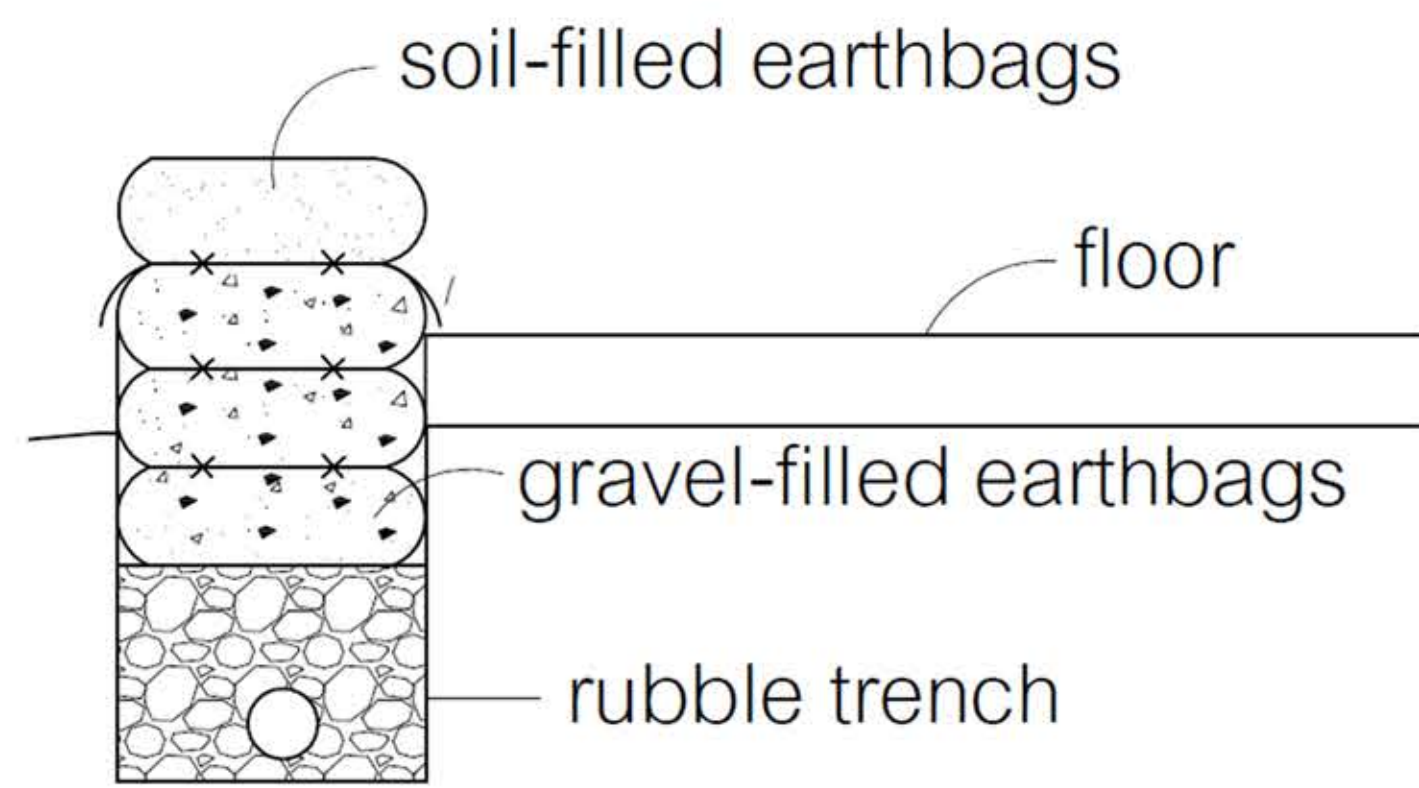




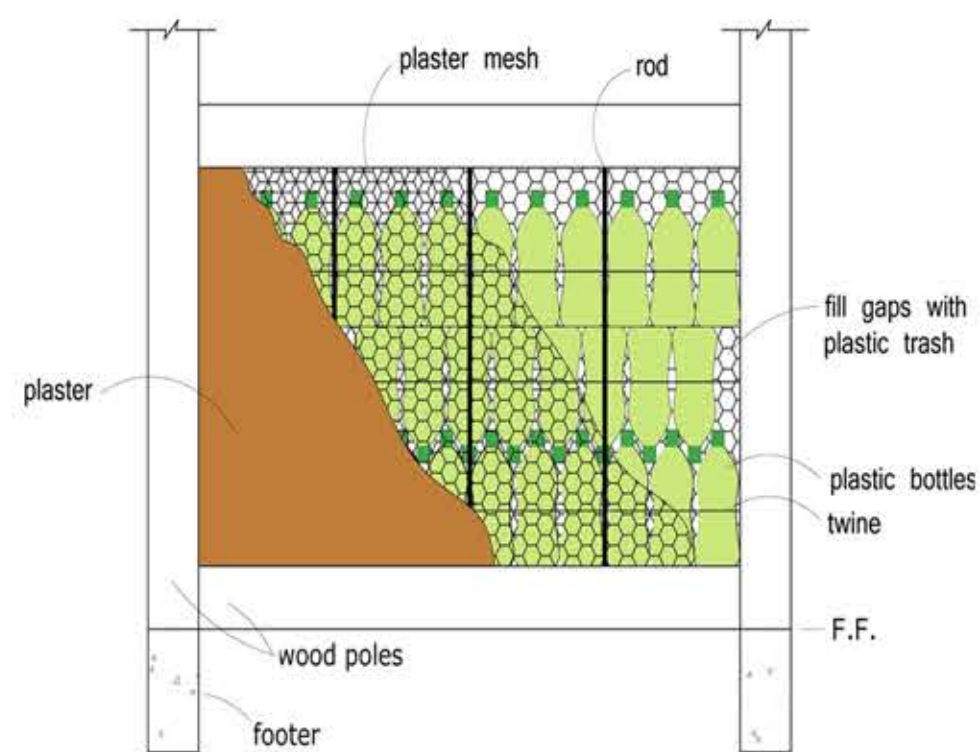
there is no specific site  
earthbag construction works in  
everywhere even in remote places!



floor plan 1-100



foundation detail 1-20



door details



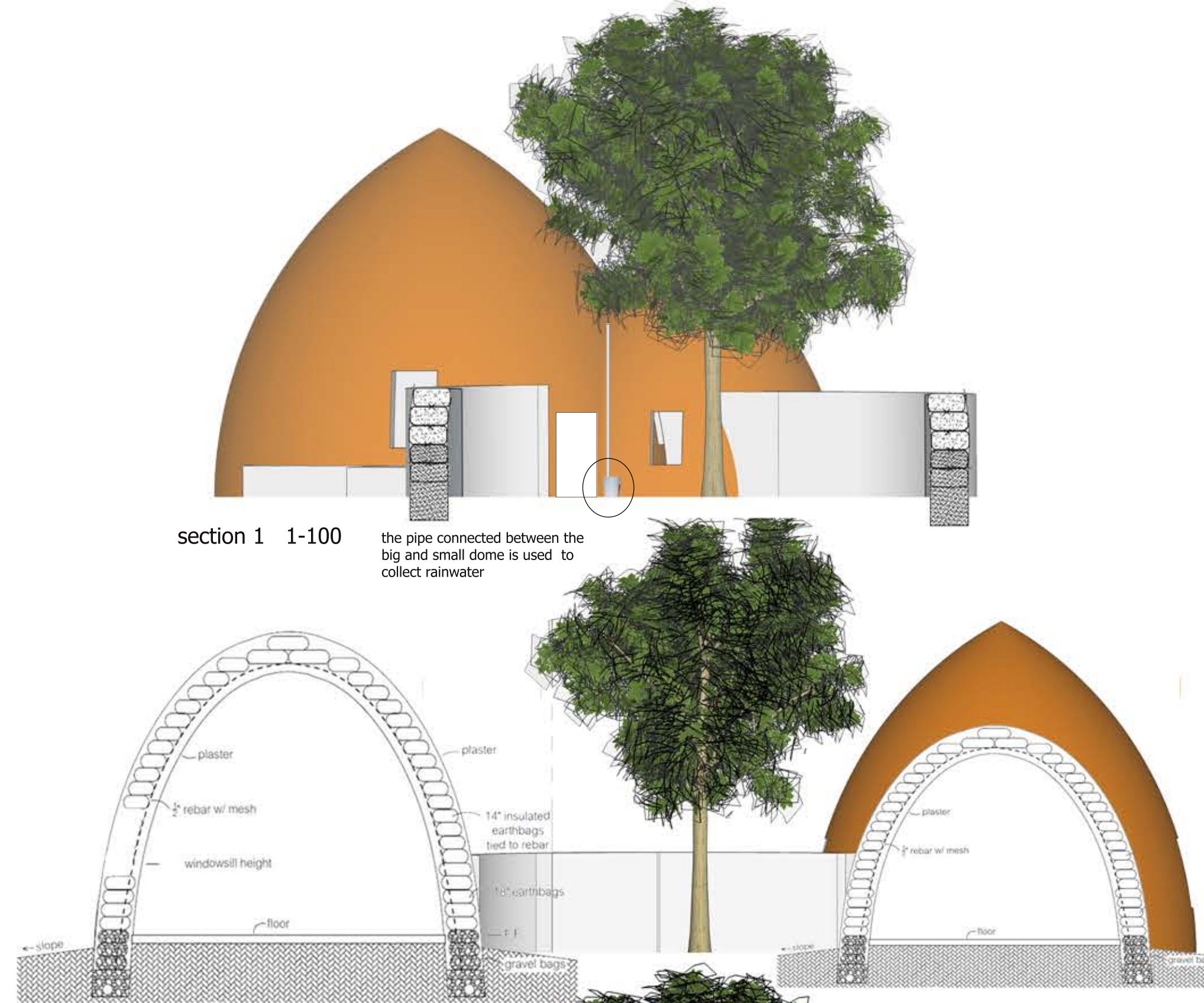
air ventilation



flexible walls ..everyone can  
add his art to it

section 1 1-100

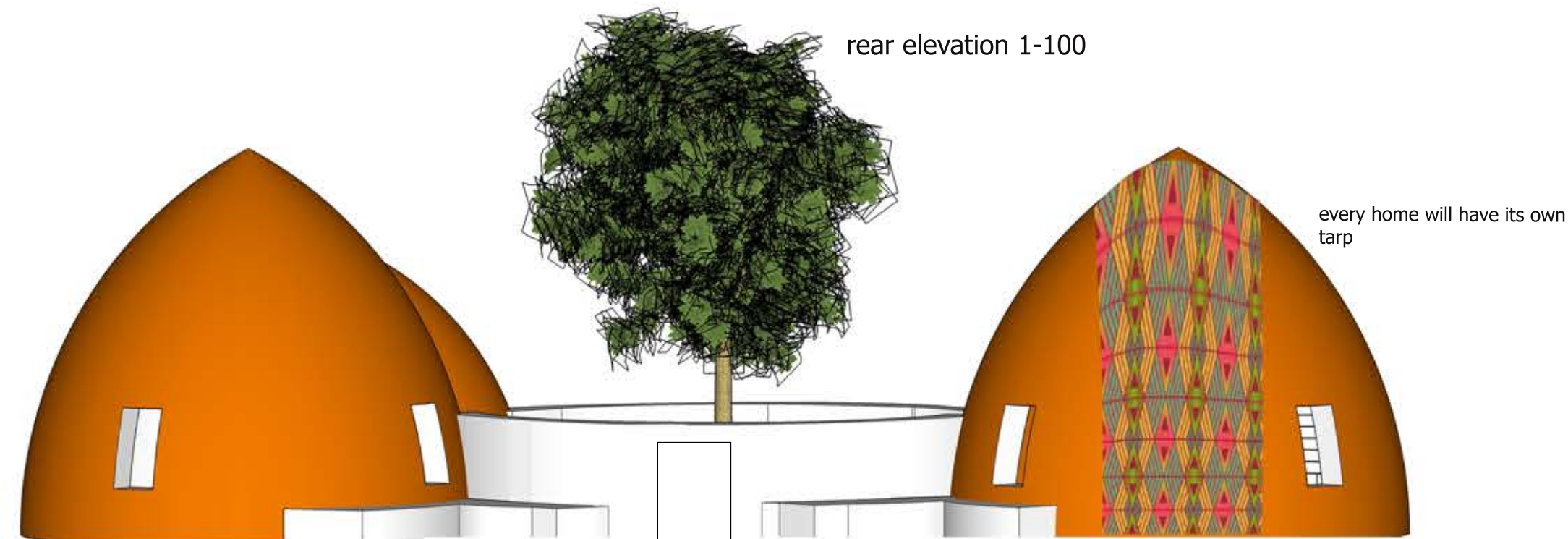
the pipe connected between the  
big and small dome is used to  
collect rainwater



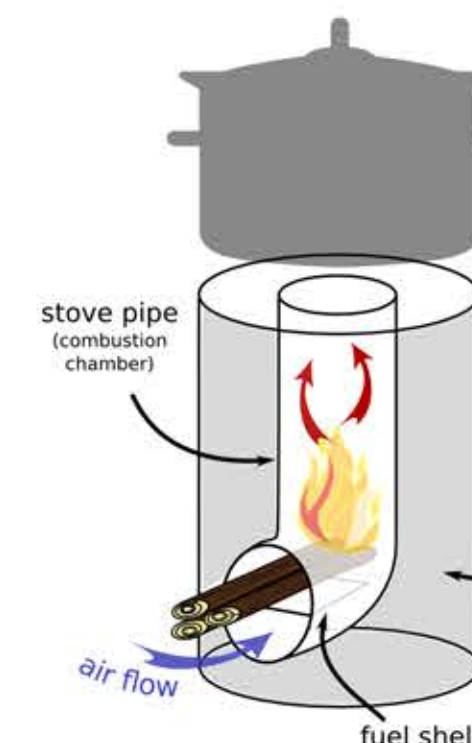
section 2 1-100



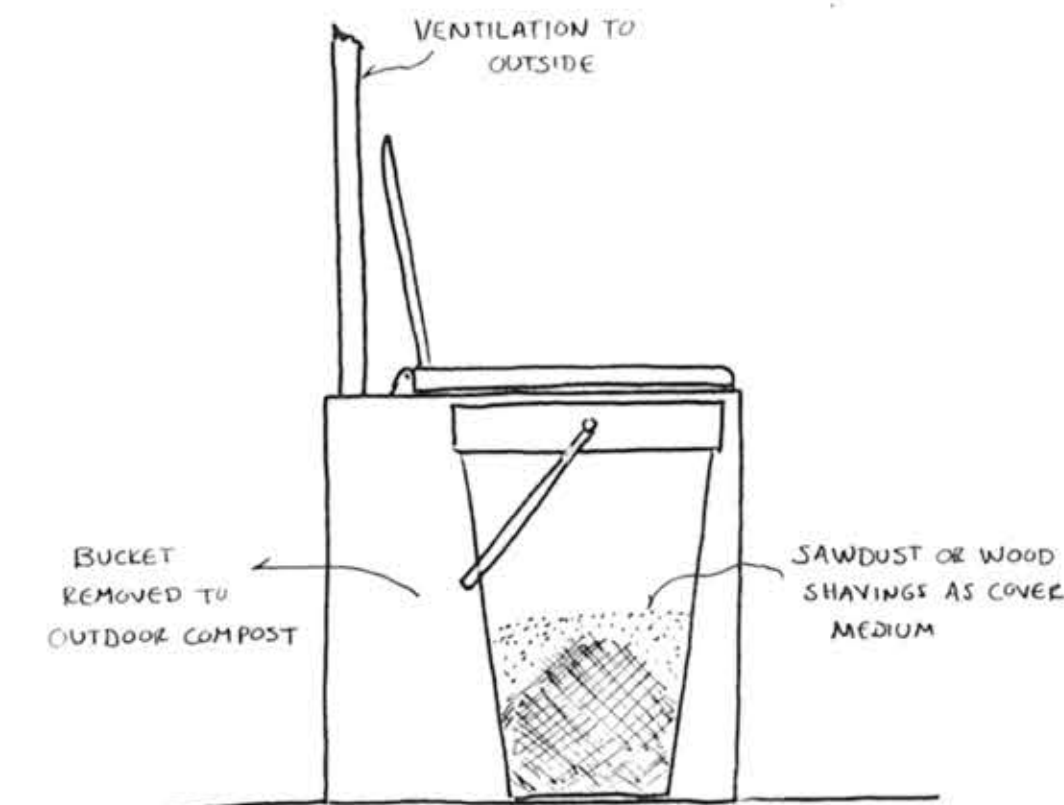
rear elevation 1-100



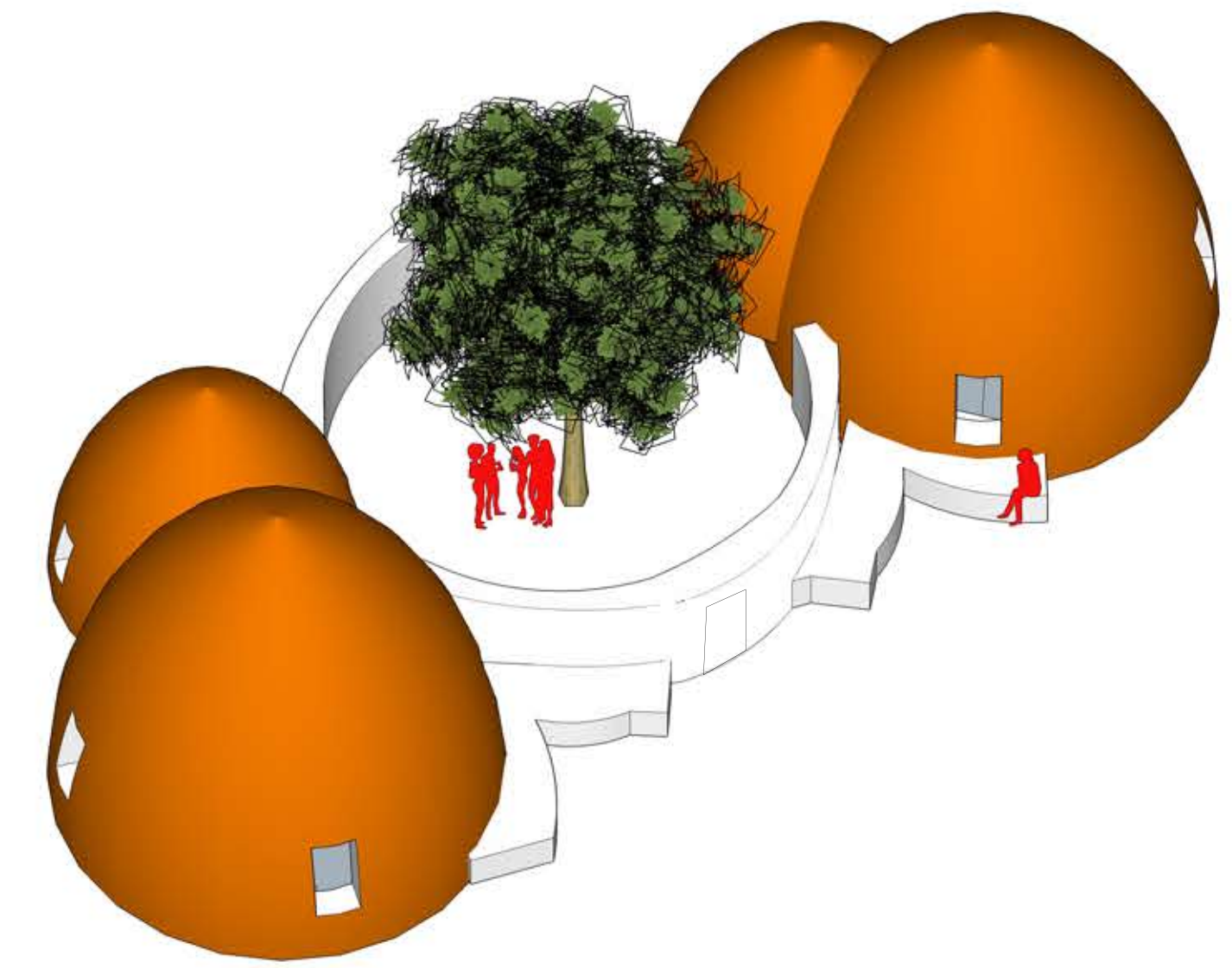
main elevation 1-100



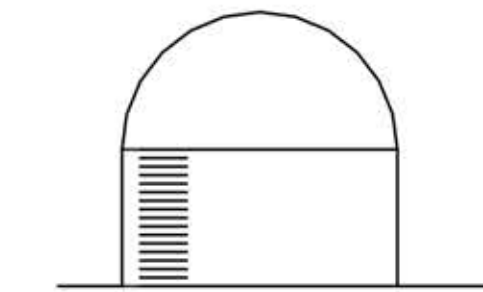
stove pipe



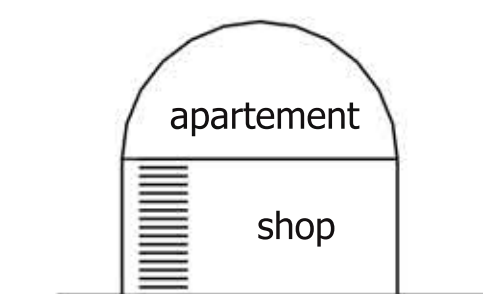
composting toilet



### FUTURE EXPANSION



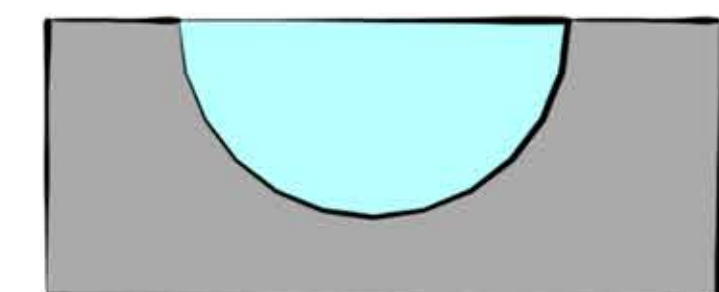
2 floor dome  
(4-6)persons



mixed use dome



using the domes as a  
module to produce large  
buildings:schools..



the soil holes produced  
from filling the bags is  
reused to store water



future city of earthbag domes