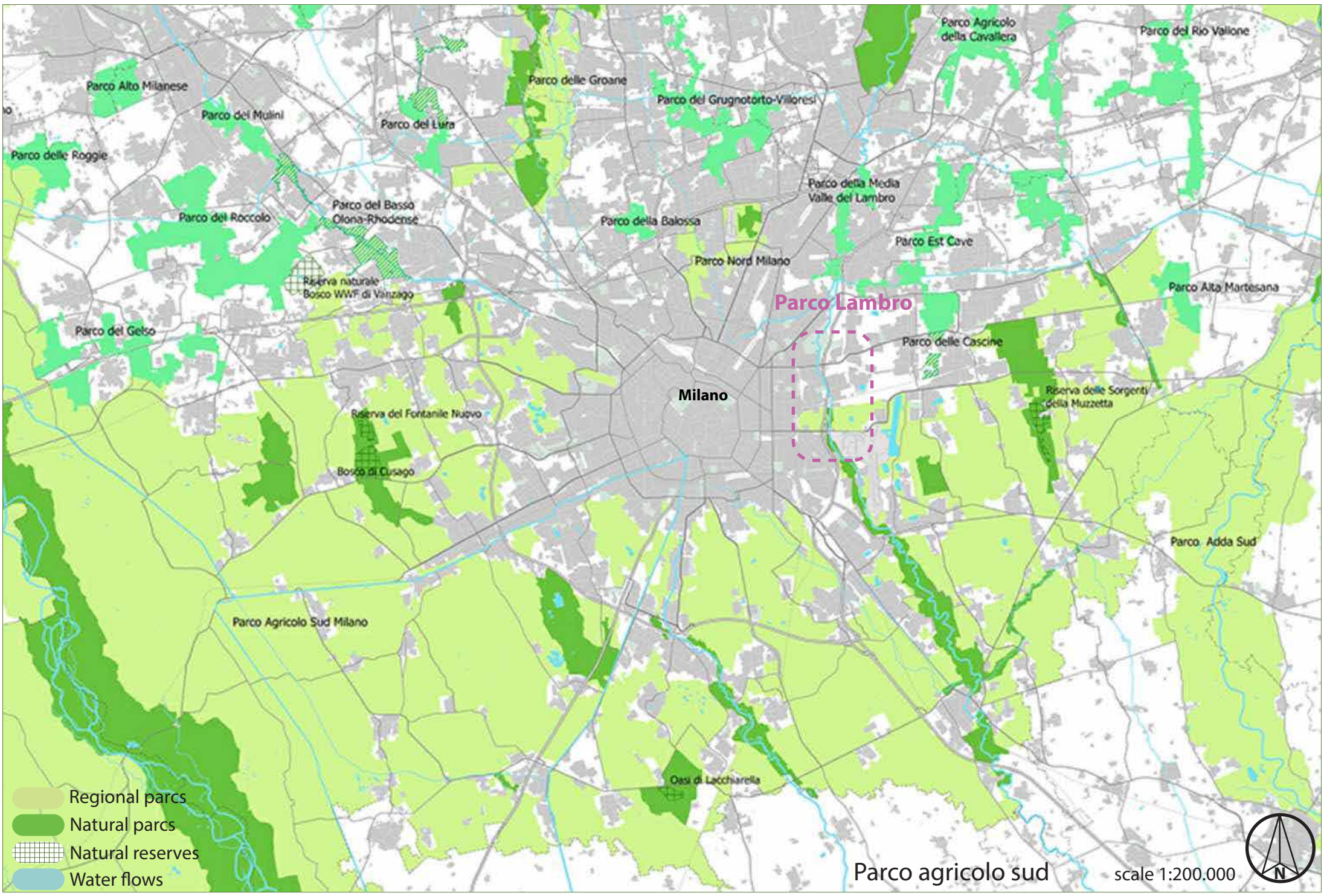
Simone Giostra,
Paolo Camilletti,
David Colaci,

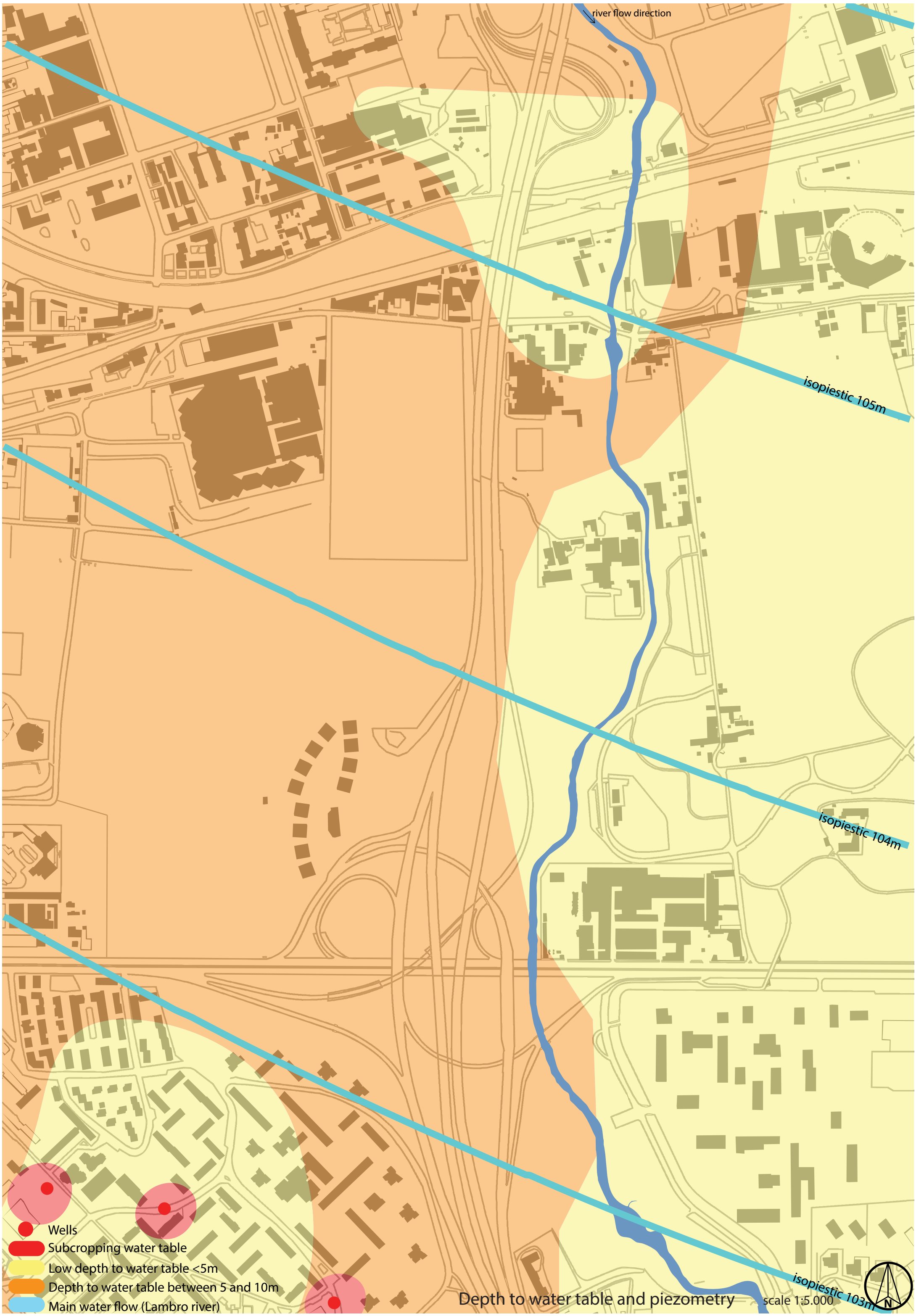
ZEROPLUS + a house as a water source

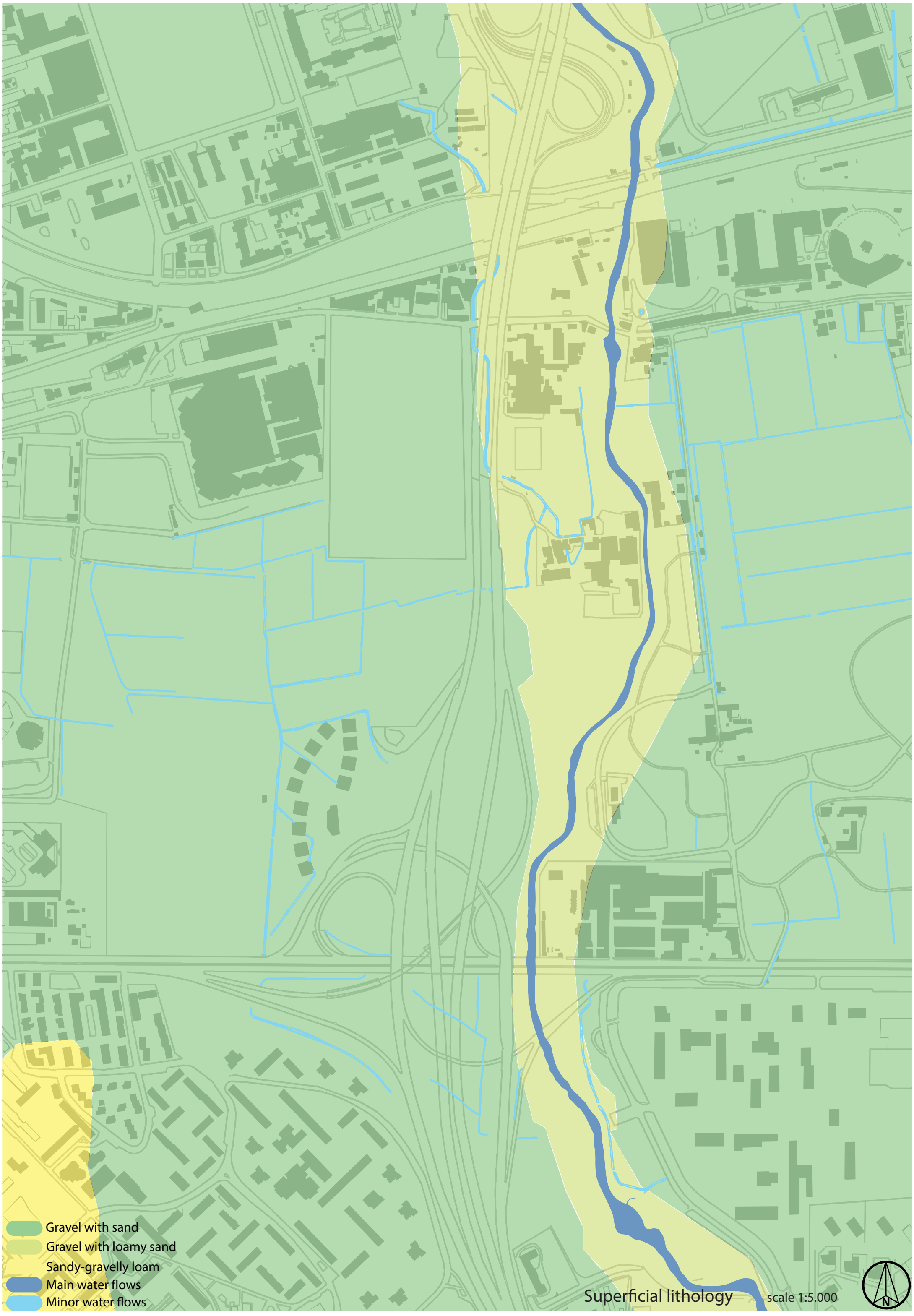
Calamita Ilaria

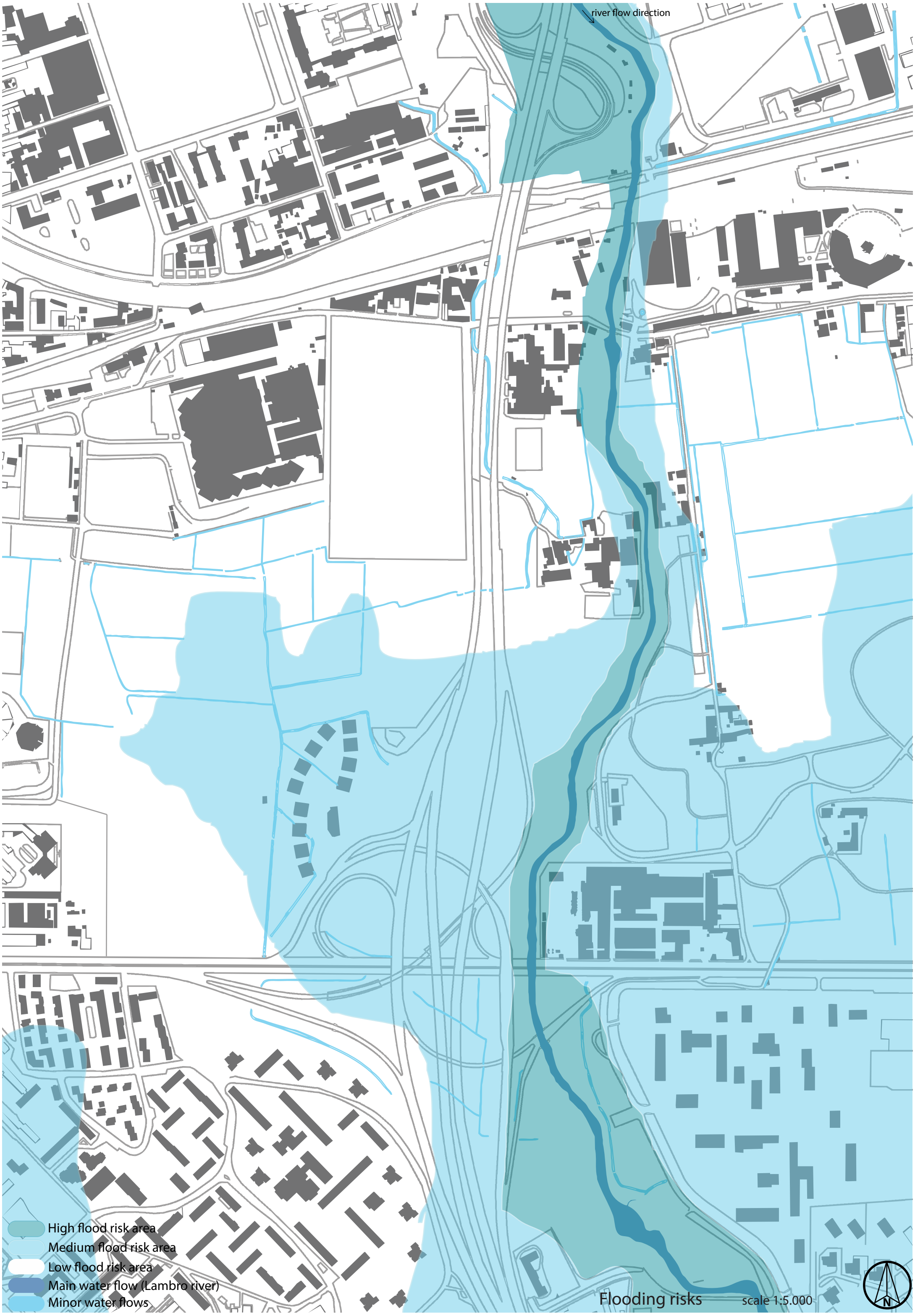
Situation map scale 1:10.000



Parco agricolo sud scale 1:200.000

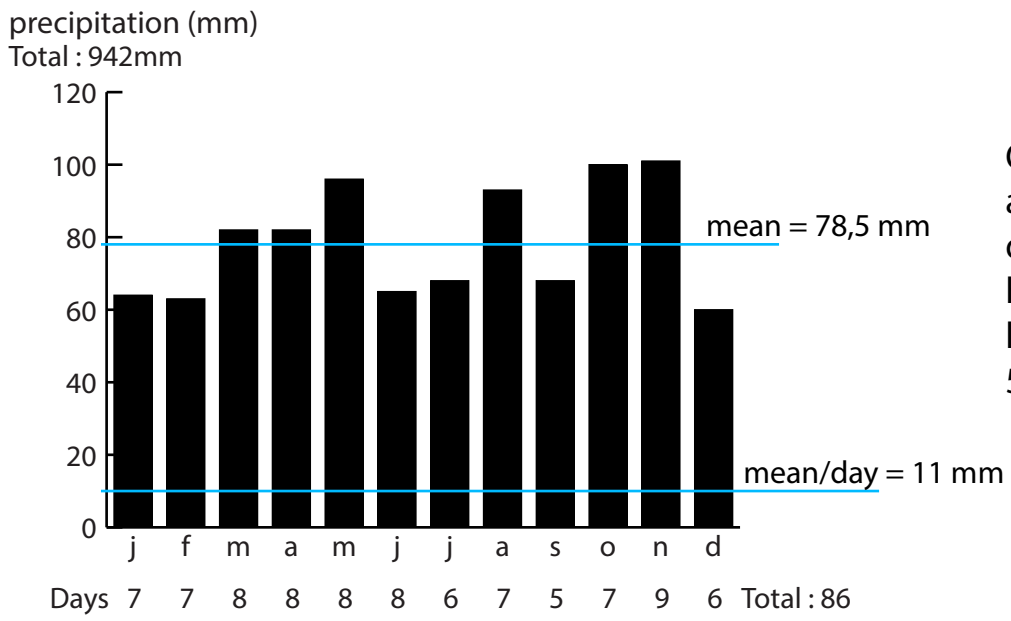

river flow direction
isopiestic 105m
isopiestic 104m
isopiestic 103m
Wells
Subcropping water table
Low depth to water table <5m
Depth to water table between 5 and 10m
Main water flow (Lambro river)
Depth to water table and piezometry
scale 1:5.000
N


Gravel with sand
Gravel with loamy sand
Sandy-gravelly loam
Main water flows
Minor water flows
Superficial lithology
scale 1:5.000
N


river flow direction
High flood risk area
Medium flood risk area
Low flood risk area
Main water flow (Lambro river)
Minor water flows
Flooding risks
scale 1:5.000
N

WATER

Rain in Milano (average from 1971 to 2010)

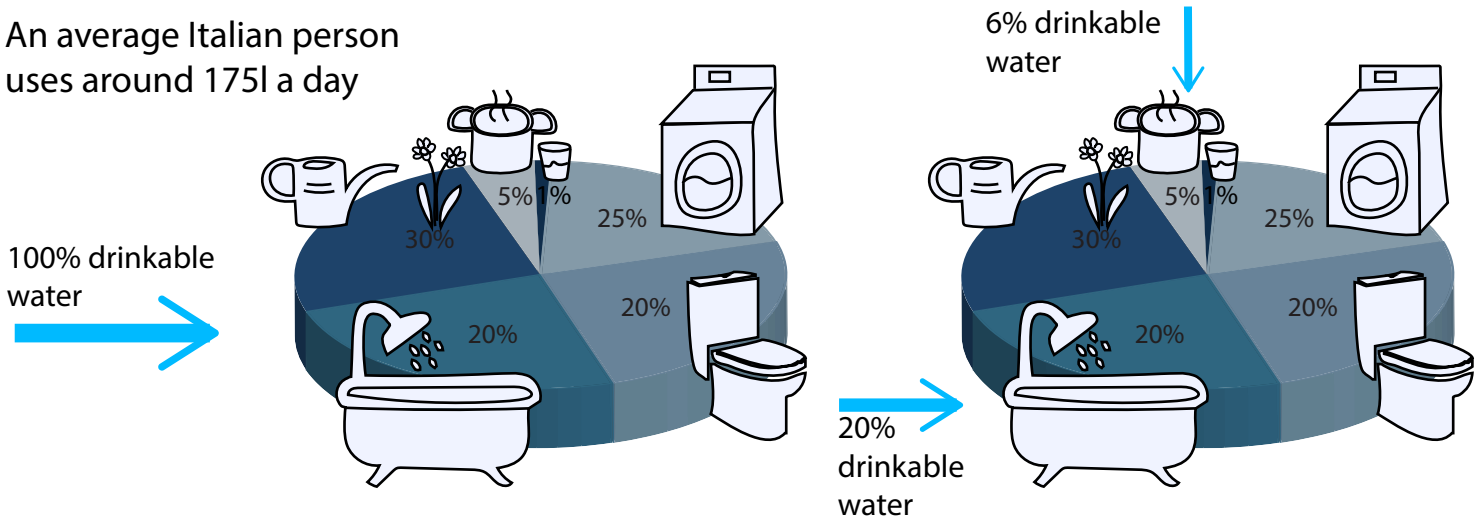


On 1ha of land, it rains approximately 26m³ of water a day. Supposing we can only harvest water on a fifth of the land we could collect an average 5m³ of rain water every day.

Considering that a person uses in average 0,2 m³ of water a day, a 1ha site could only supply 25 people. But while a 3rd of it will not go back to the water pipes (evaporation and garden watering), 4m3 of grey waterwater could be filtered on site and be reused by the same people, and more.

Water consumption per capita/day

An average Italian person uses around 175l a day

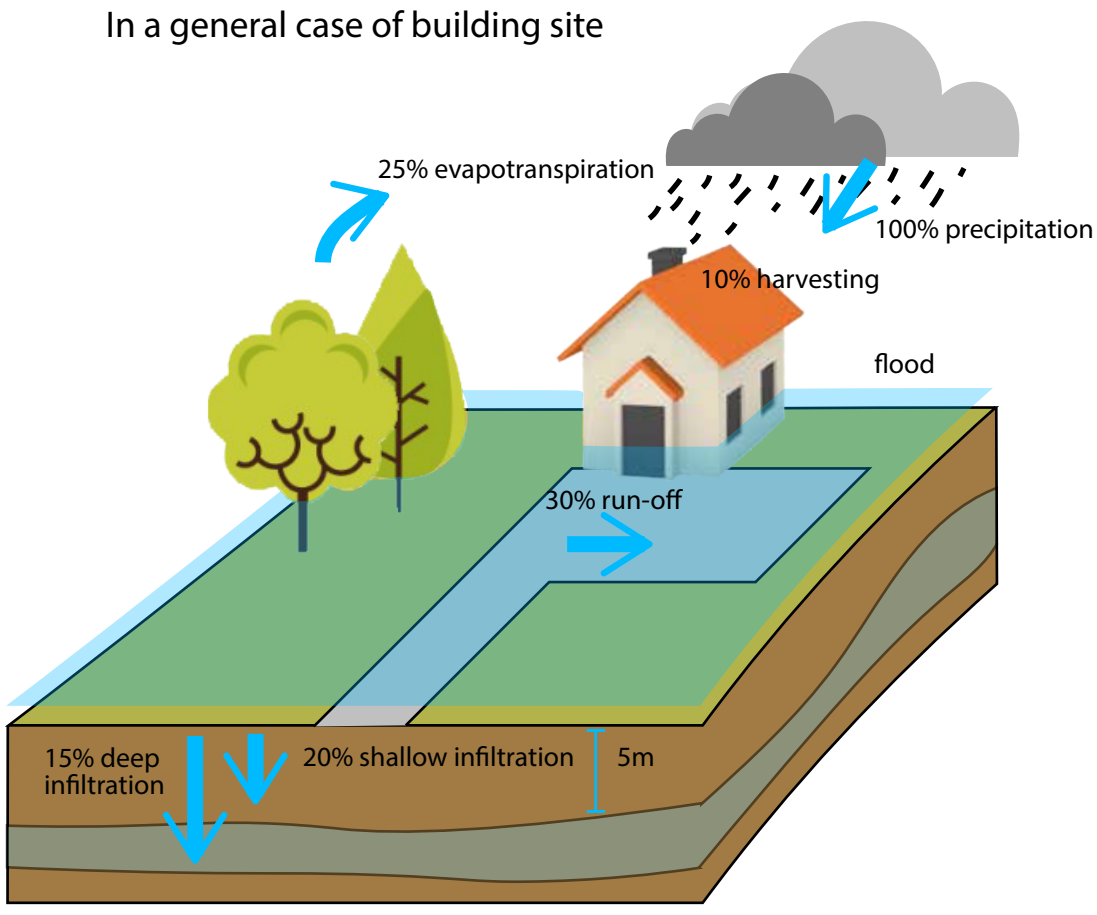


74% of the water we use doesn't need to be drinkable. This 129l could thus directly come from the rain water harvested and quickly filtered.

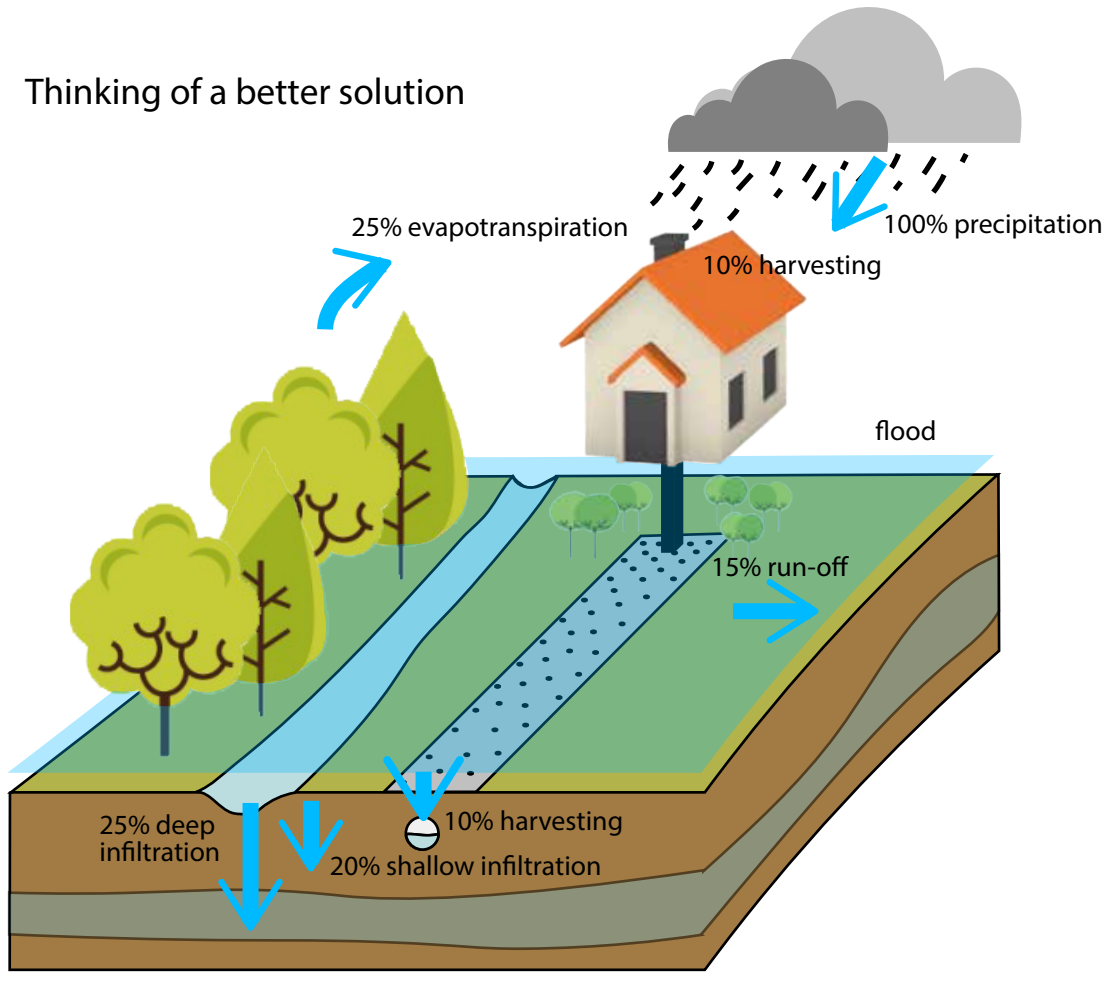
On site options

WHAT IF WE COULD BUILD AND LIVE ON THE FLOODABLE AREA ?

In a general case of building site



Thinking of a better solution

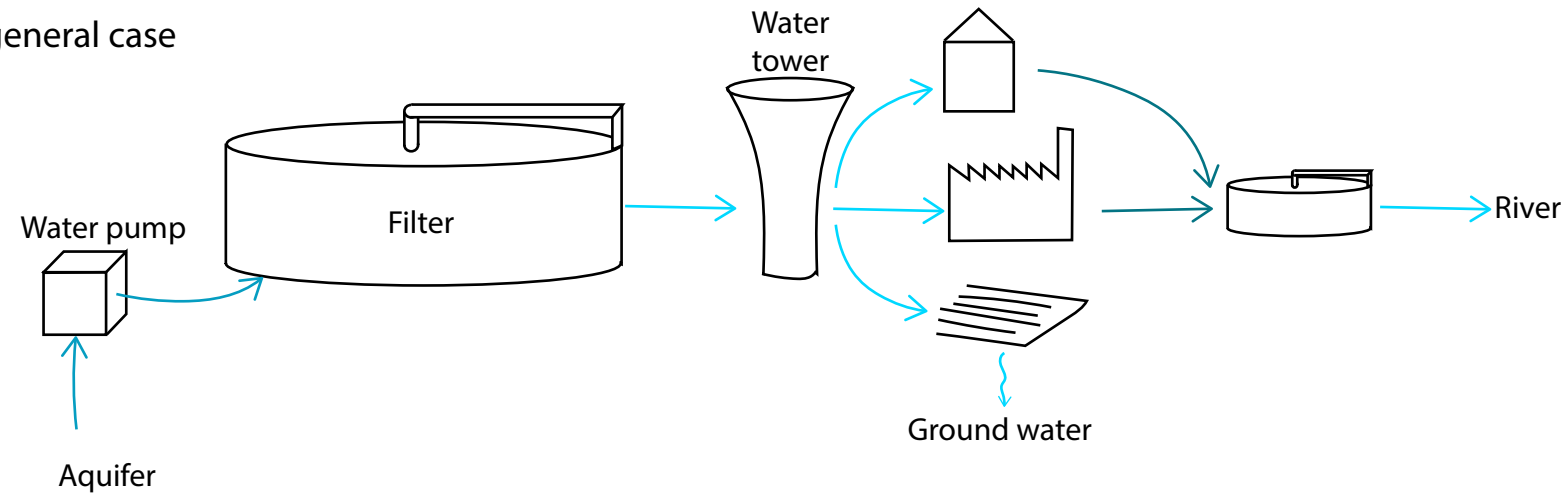


Turning the impermeable surface in a more permeable one by raising up the building reducing the built surface by more than 90%.
Leaving more space for vegetation.
Creating swales for rain water retention and infiltration.

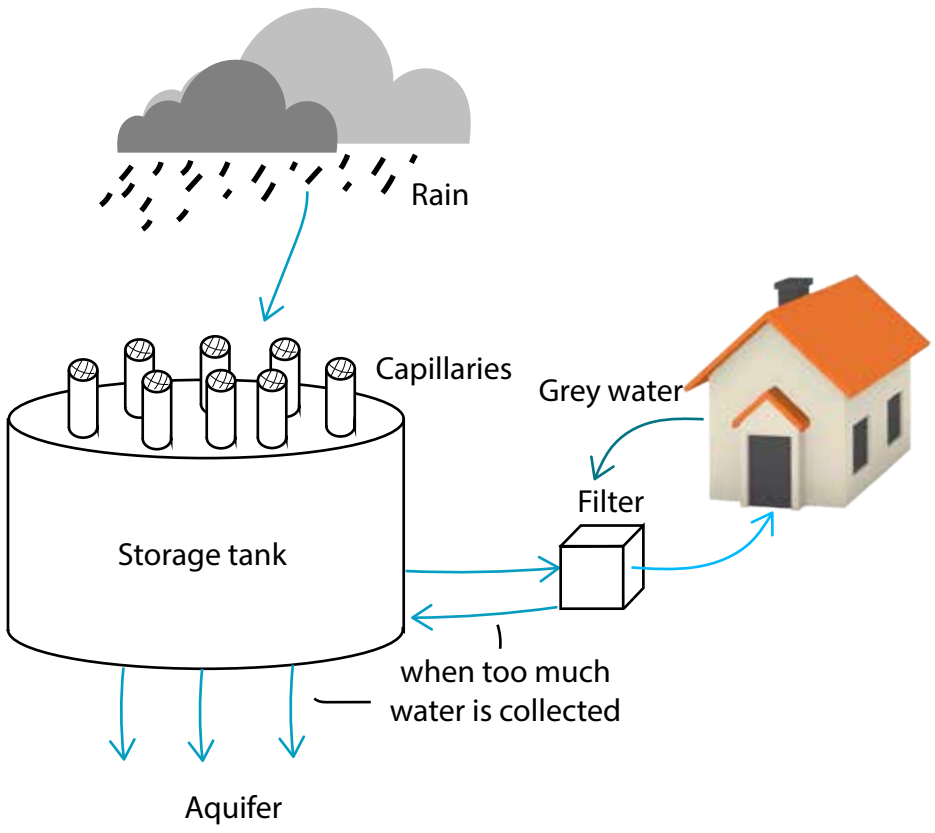
WATER

Water cycles

In a general case

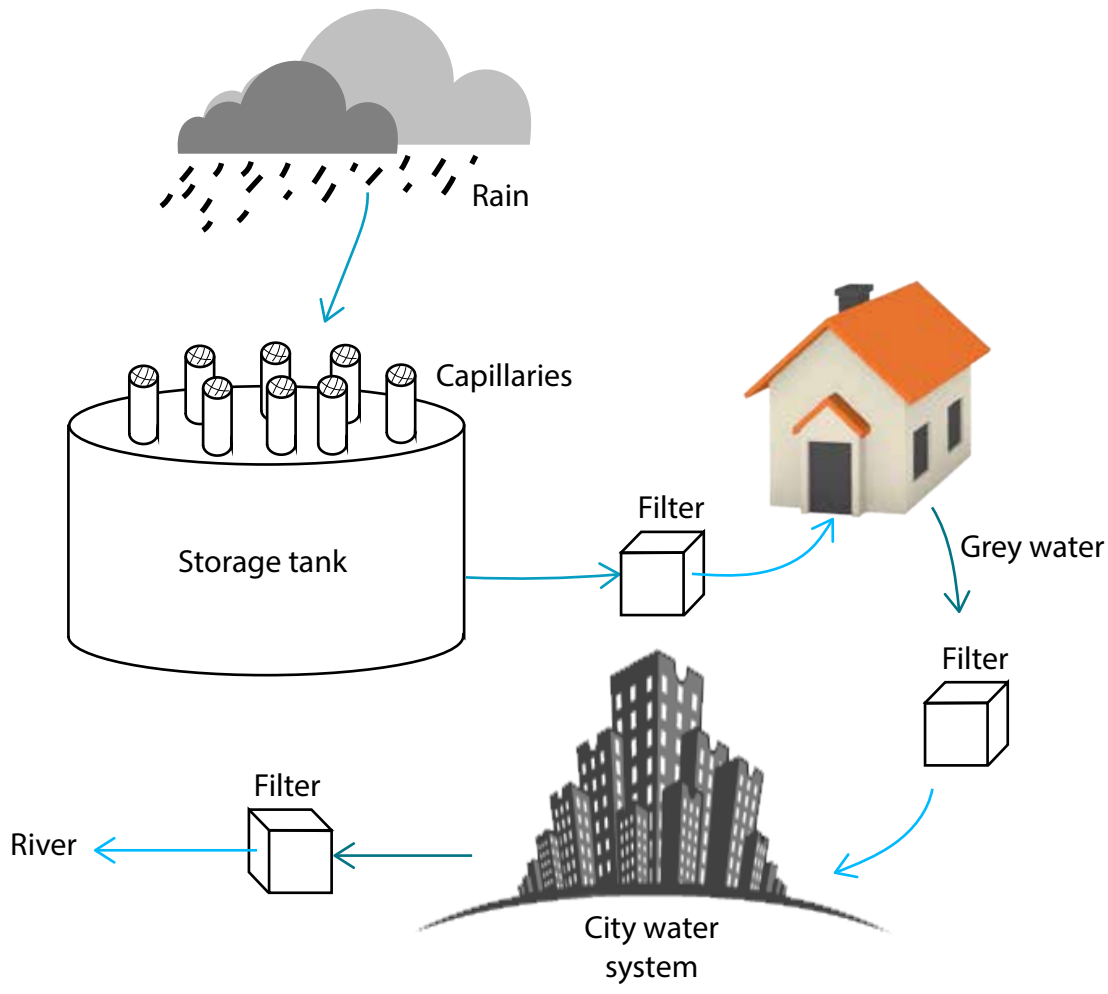


Self-sufficient



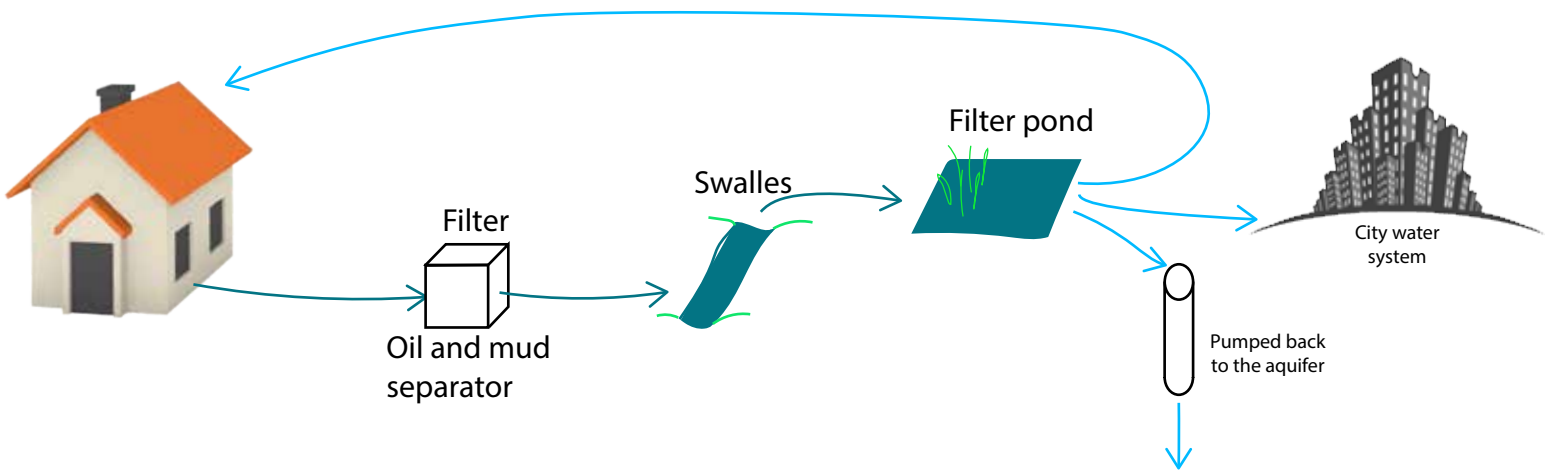
This way they will probably have too much water in the system, and they will then release some of it gradually to recharge ground water.

Self-suffient but sharing



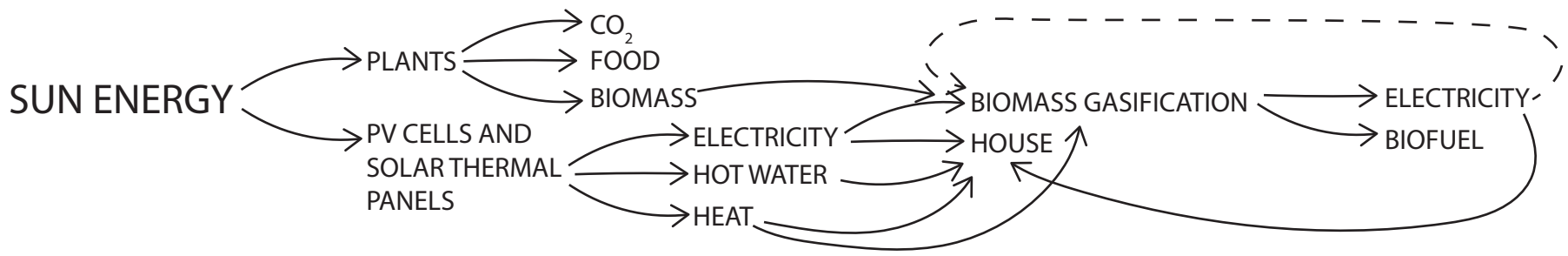
The house will act as a water harvester, collecting water not from the acquifer but from rainfall. Rain becomes a new water source, and the collected water enters the city water system.

Site strategy



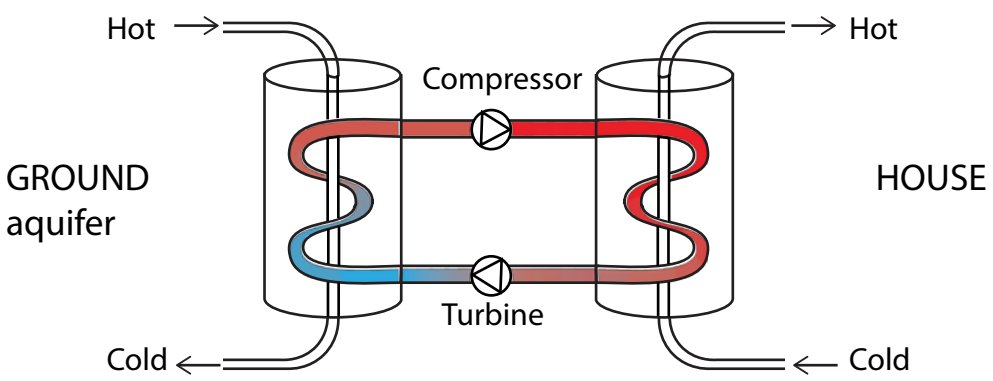
ENERGY

Sun energy harnessing

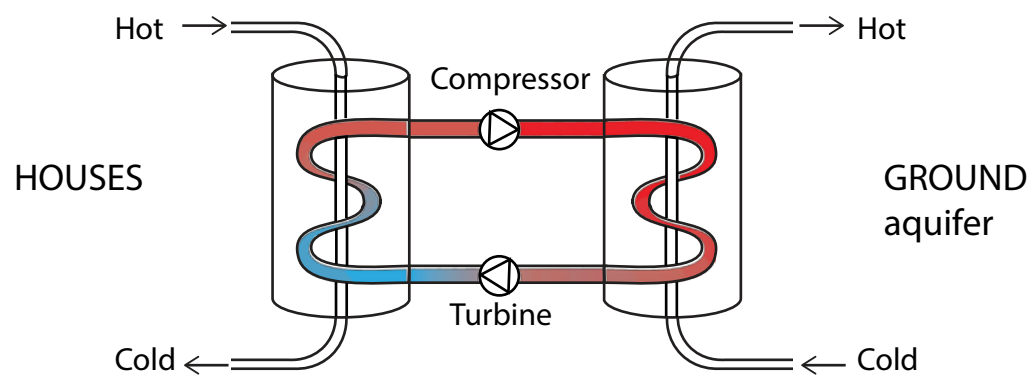


Geothermal energy - Heat pump

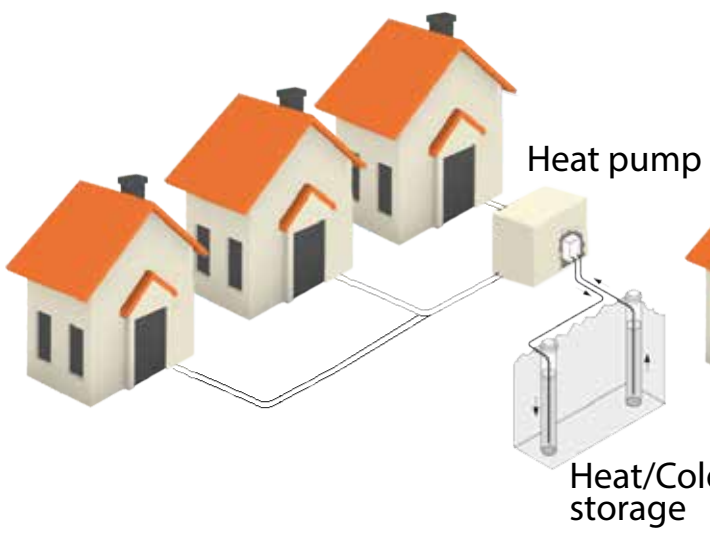
Winter situation



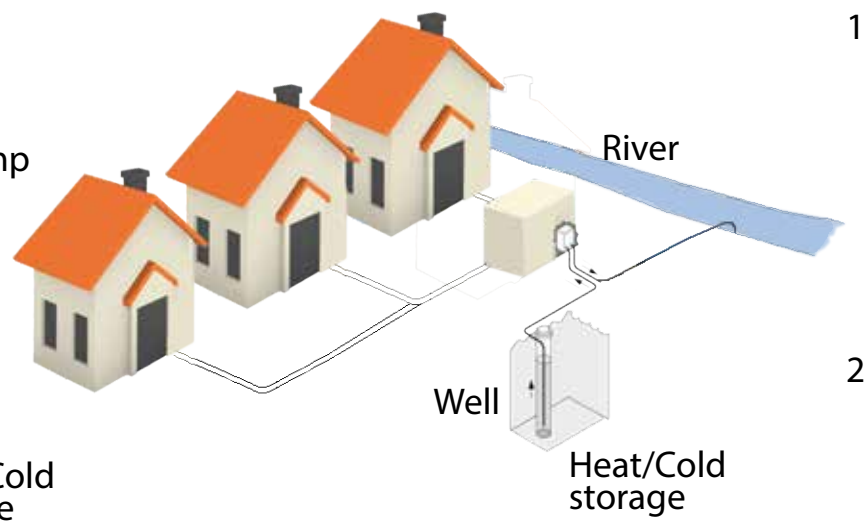
Summer situation



1 Open loop system



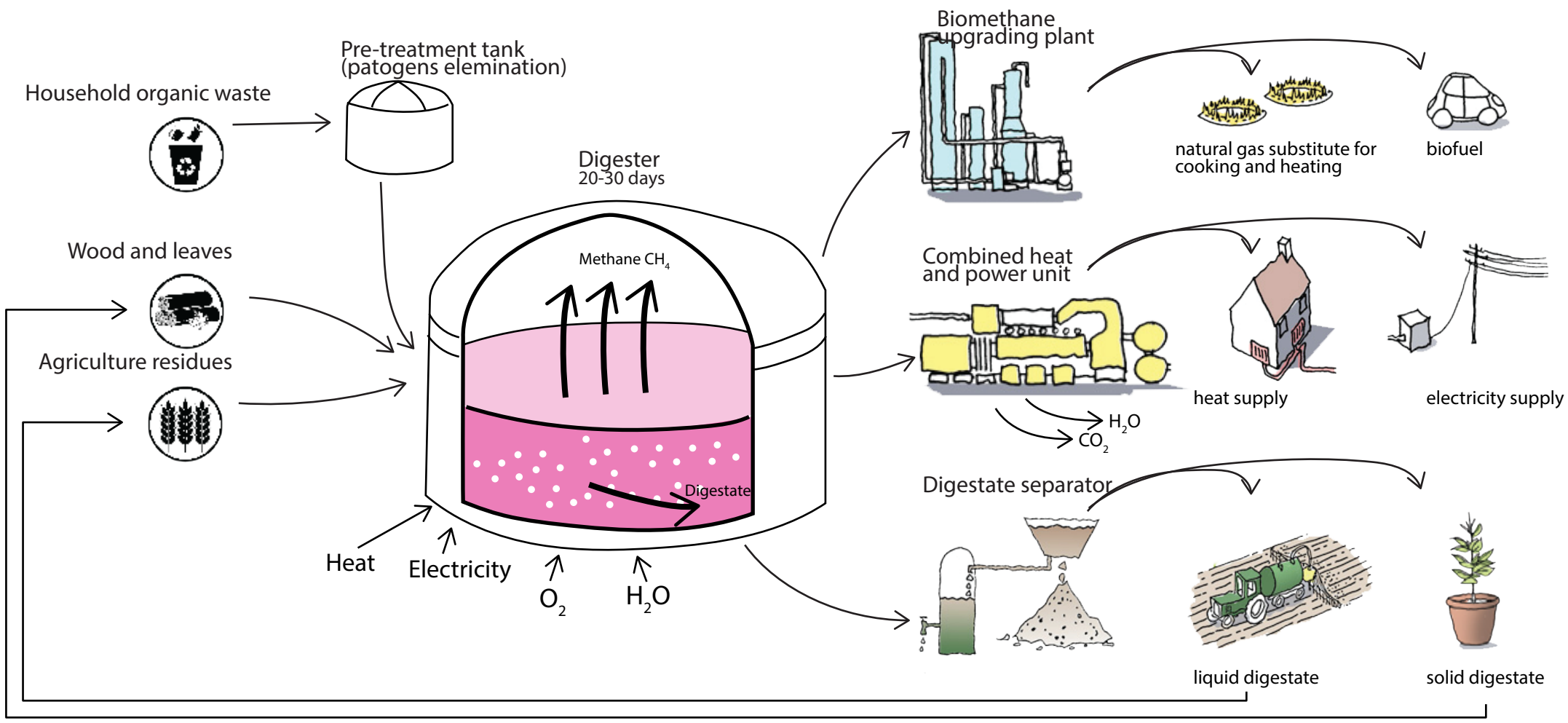
2 Well water system



1 The ground is always about 10-13°C. We can use this constant temperature for heating up the house in winter time, while we can use the oposite system in summer time for cooling (higher efficiency)

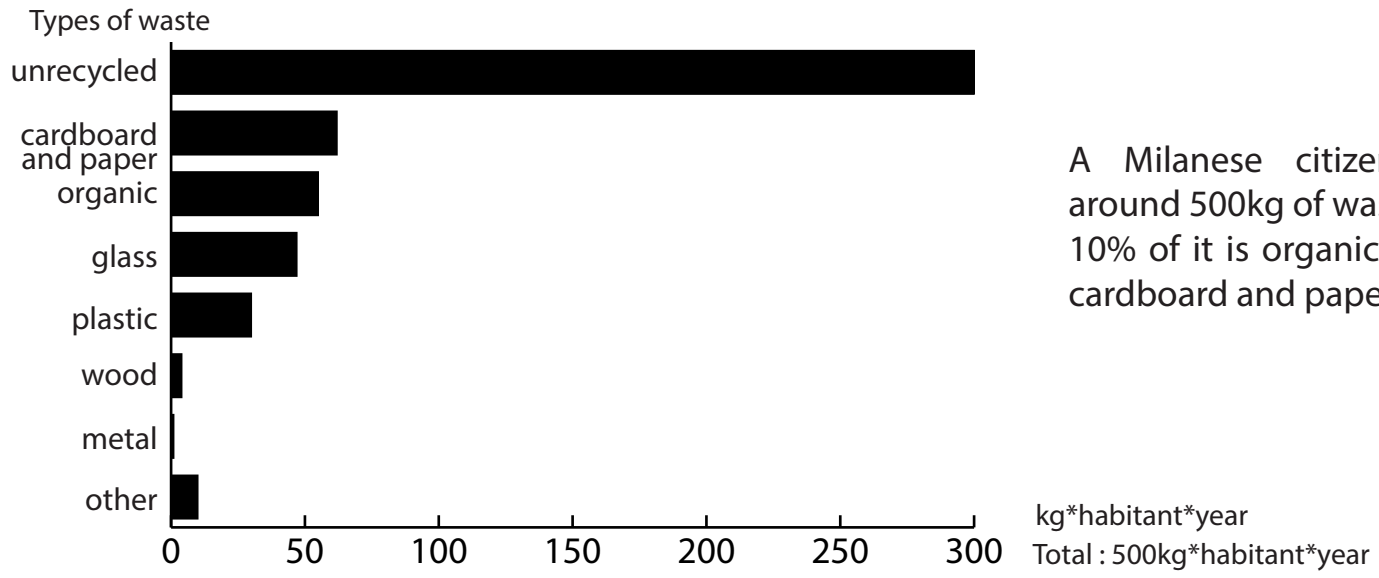
2 Where a well is available we can direclty pump up the groundwater for cooling or heating the house. Then the water returns to the river.

Biomass digester - Combined heat and power (CHP)



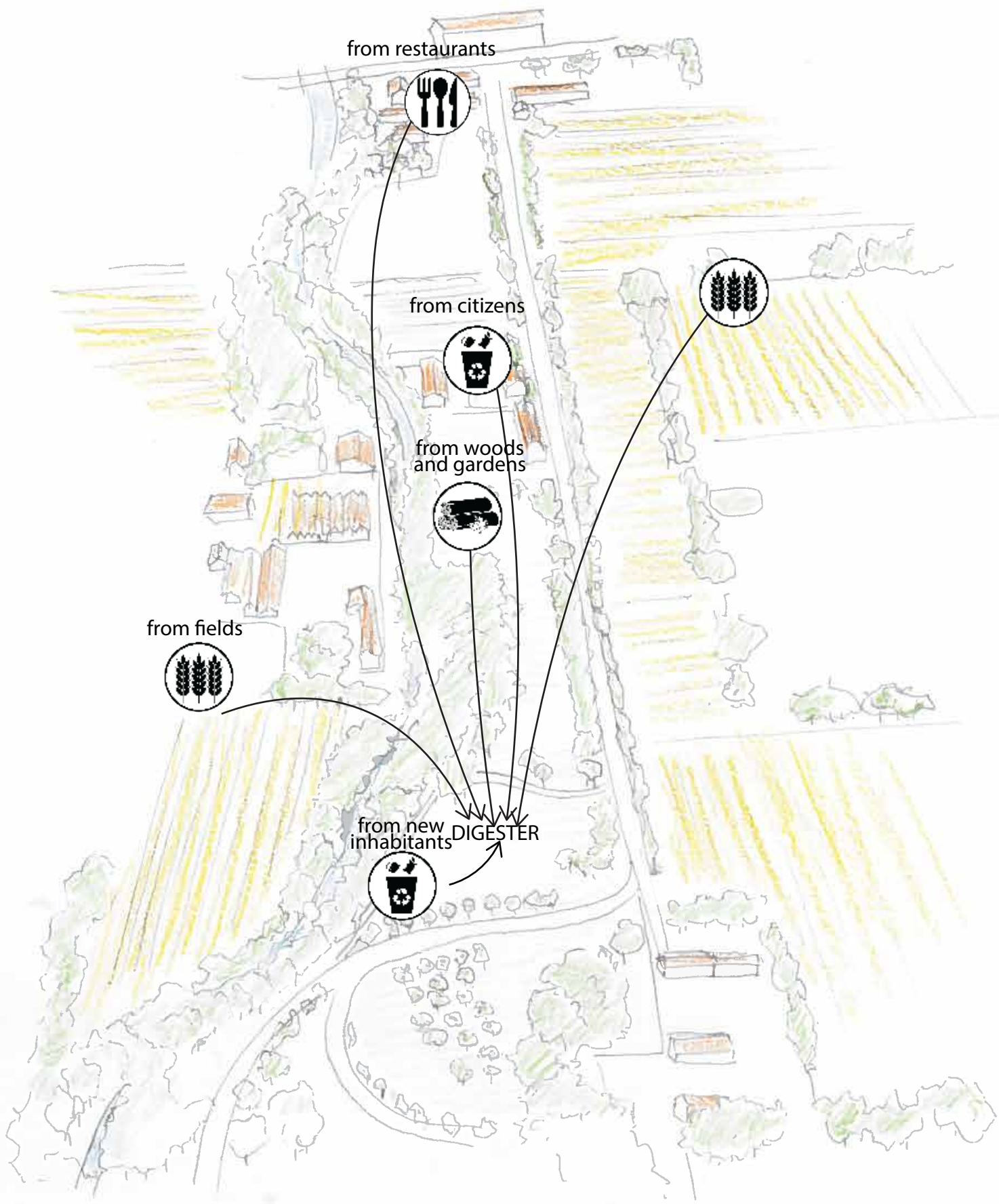
WASTE = ENERGY

Waste production by Milanese citizens



A Milanese citizen produces around 500kg of waste per year. 10% of it is organic, and 12% is cardboard and paper

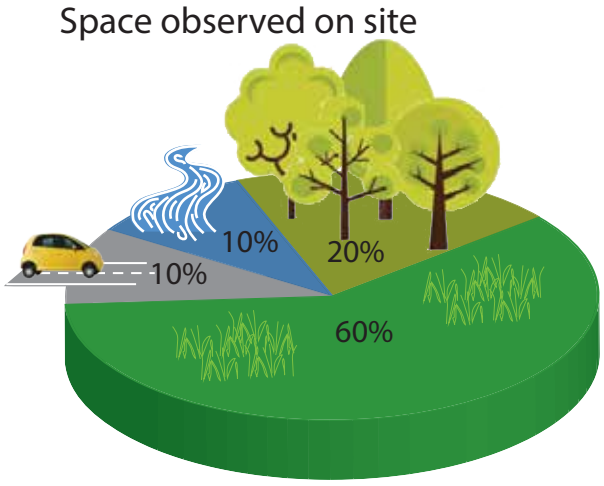
Organic waste and biomass harvesting at local scale



PROJECT IDEA

Site observations

Space observed on site



Space need for a sustainable project, in general

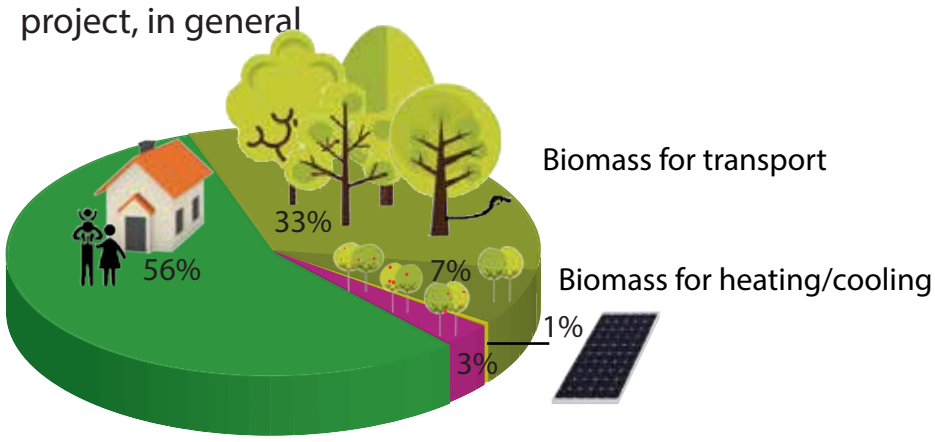
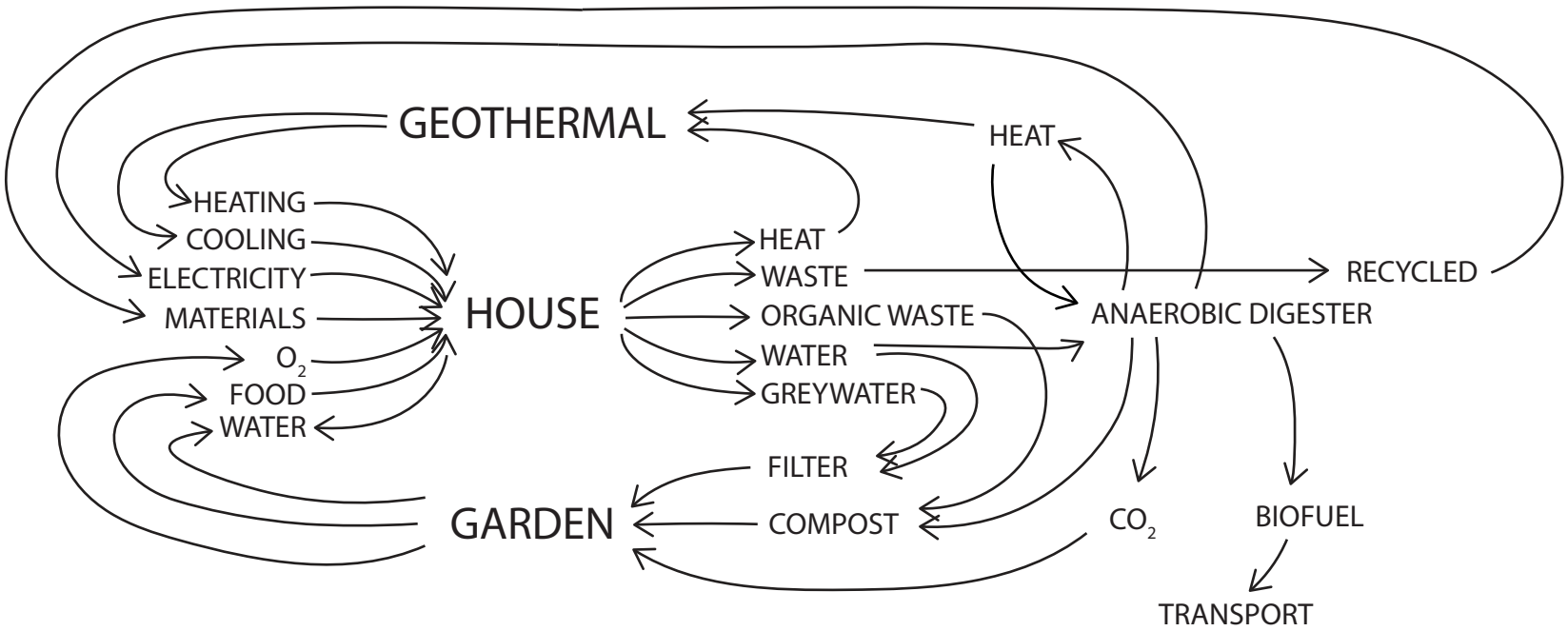


Diagram of energies management

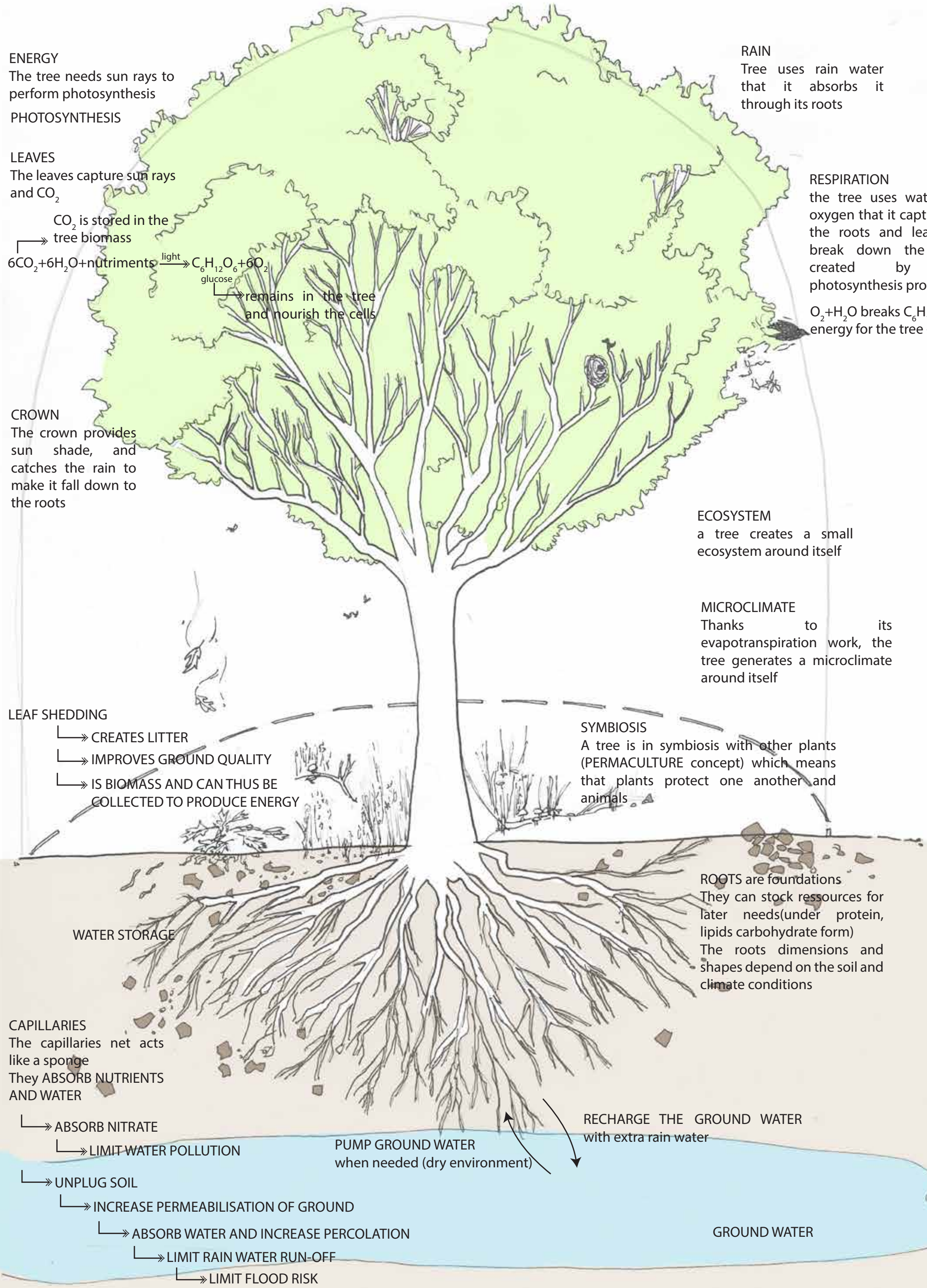


Other alies: sun energy --> PV

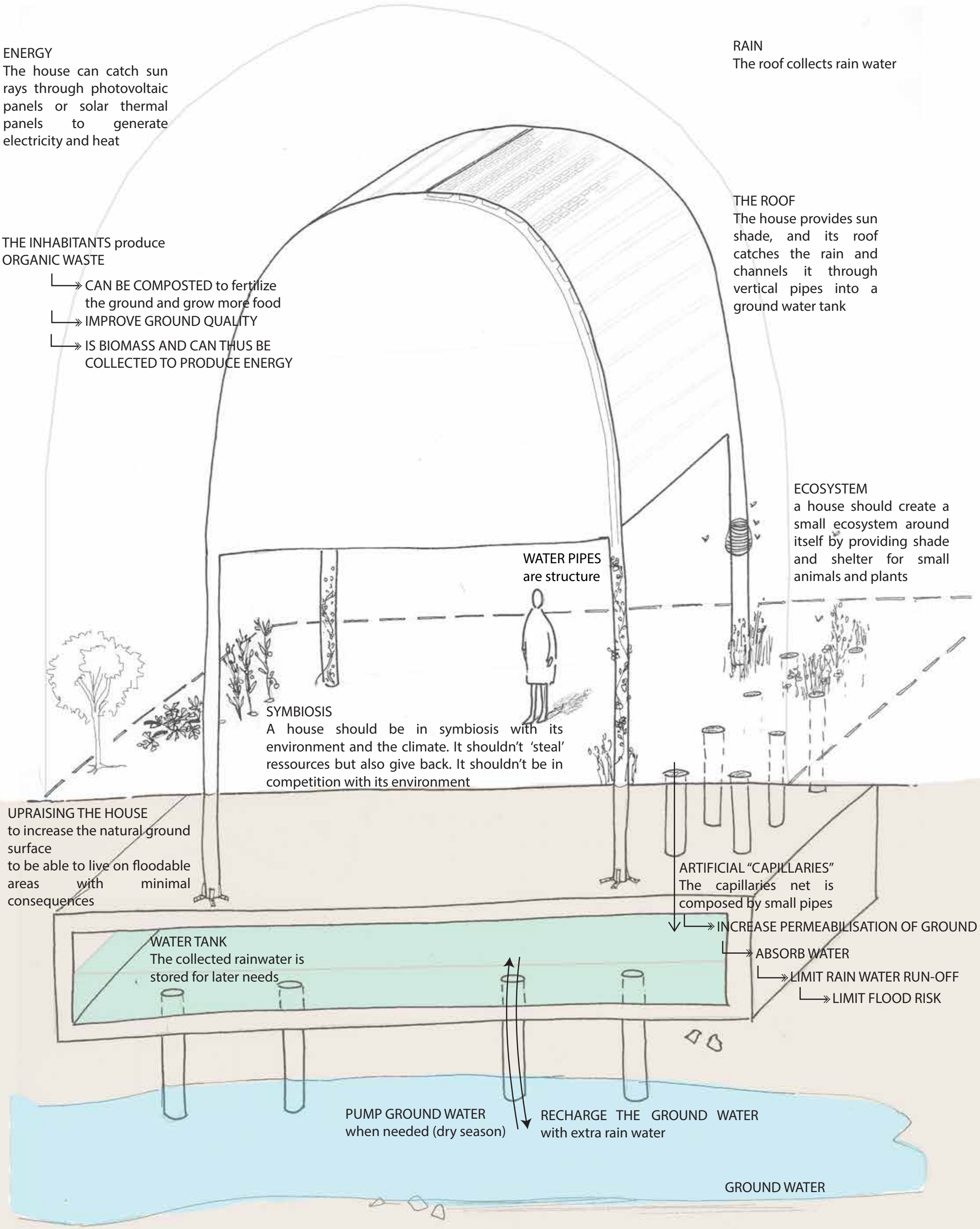
acquifer --> acts as a storage natural tank. If we recharge it well throughout the year we can pump out some water when needed.

Plants can create a micro climate by their shadows and evapotranspiration, which will reduce the temperature fluctuation and the need for extra cooling and heating of the buildings.

TREE


ENERGY
The tree needs sun rays to perform photosynthesis
PHOTOSYNTHESIS
LEAVES
The leaves capture sun rays and CO_2
CO_2 is stored in the tree biomass
$6CO_2+6H_2O+nutriments \xrightarrow{light} C_6H_{12}O_6+6O_2$
glucose
remains in the tree and nourish the cells
RAIN
Tree uses rain water that it absorbs it through its roots
RESPIRATION
the tree uses water and oxygen that it captures by the roots and leaves to break down the sugar created by the photosynthesis process
O_2+H_2O breaks $C_6H_{12}O_2$ into energy for the tree $+CO_2$
CROWN
The crown provides sun shade, and catches the rain to make it fall down to the roots
ECOSYSTEM
a tree creates a small ecosystem around itself
MICROCLIMATE
Thanks to its evapotranspiration work, the tree generates a microclimate around itself
LEAF SHEDDING
CREATES LITTER
IMPROVES GROUND QUALITY
IS BIOMASS AND CAN THUS BE COLLECTED TO PRODUCE ENERGY
SYMBIOSIS
A tree is in symbiosis with other plants (PERMACULTURE concept) which means that plants protect one another and animals
ROOTS are foundations
They can stock ressources for later needs(under protein, lipids carbohydrate form)
The roots dimensions and shapes depend on the soil and climate conditions
WATER STORAGE
CAPILLARIES
The capillaries net acts like a sponge
They ABSORB NUTRIENTS AND WATER
ABSORB NITRATE
LIMIT WATER POLLUTION
UNPLUG SOIL
INCREASE PERMEABILISATION OF GROUND
ABSORB WATER AND INCREASE PERCOLATION
LIMIT RAIN WATER RUN-OFF
LIMIT FLOOD RISK
PUMP GROUND WATER when needed (dry environment)
RECHARGE THE GROUND WATER with extra rain water
GROUND WATER

TREE MIMICKING HOUSE



PROJECT IDEA

grow food/garden on the less flood threatened area
build housing on floodable area

RESILIENCE --> multi sources of energy