

W A I T I N G P L A C E S

Technical devices abacus

Devices

In this appendix there are the technical data of all the devices used in the strategy.

In the strategy the totality of the devices represent a system of light infrastructure with the triple function to support the human needs, activate the territorial regenerative processes and create spaces of sociality in the settlement.

The system has the aims to mitigate the actual condition of the camp, and to prepare the territory to the possible future scenarios after the camp.

There are three type of device:

- artificial
- hybrid
- vegetal

The entire system it has been thought to face a temporary situation, for this reason the artificial devices are composed by removable materials that doesn't affect directly the soil. After the camp some of them could be removed, some could be converted.

The combined use of artificial technology and natural phytoremediation properties of the plants to purify the soil, create a techno nature system.

For each device it is indicated the typology of void in which it could be placed and the estimated duration in presence and efficiency.

For the vegetal elements, there are indications about their phytoremediation properties, their growing and seasonality

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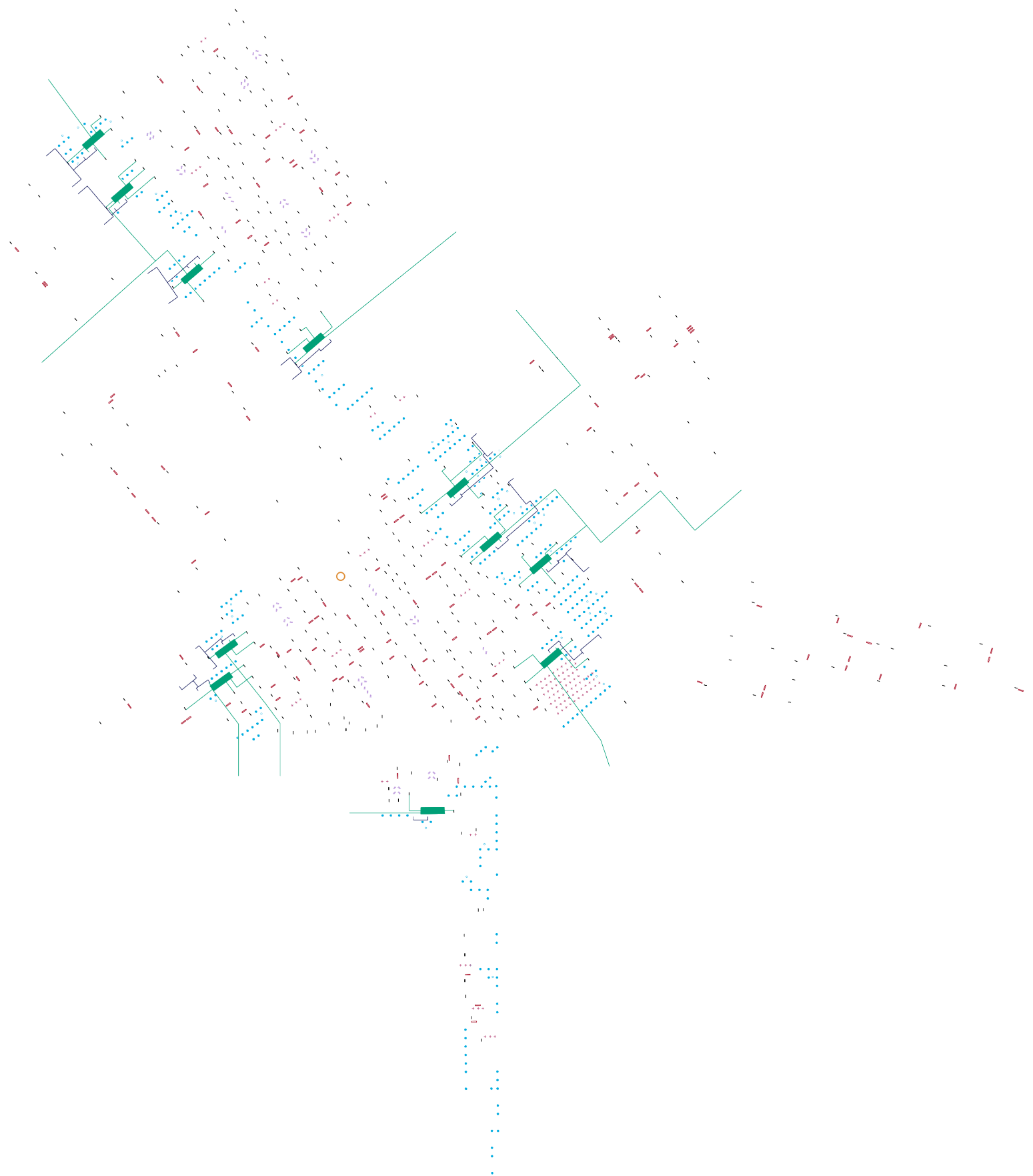
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Devices location and quantity

The amount of each device has been computed in relation with the number of the inhabitants and the available space. The soil of the camp is completely covered with a light layer of drain gravel.

septic tank	1 each 1 hh about 5 person
] rainwater harvesting and storage	1 each 5 hh about 25 person
█ phytopurification tank	1 each 5 hh about 25 person
// micro garden	1 each 5-9 hh 25-45 person
□ evapotranspiration tank	1 each 2 hh about 10 person
○ rain garden	In each part of the camp with an high risk of flooding
● purifying trees	Each large voids in the camp is filled for 2/3 with purifying trees
+ weed grasses	Each 50 interstices there is 1m² of weed grasses

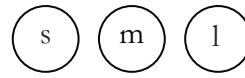
hh: Household, for each household we consider about 5 person





| Septic tank

Baffled Septic Tank (BST)



Description

This technology consists of septic tank followed by one or more filter chambers. The filter reduces the danger of clogging of the soak away. Septic are in plastic material placed close to the Cespit toilet under the ground.

Septic tank technology are placd between toilet and VFCW.

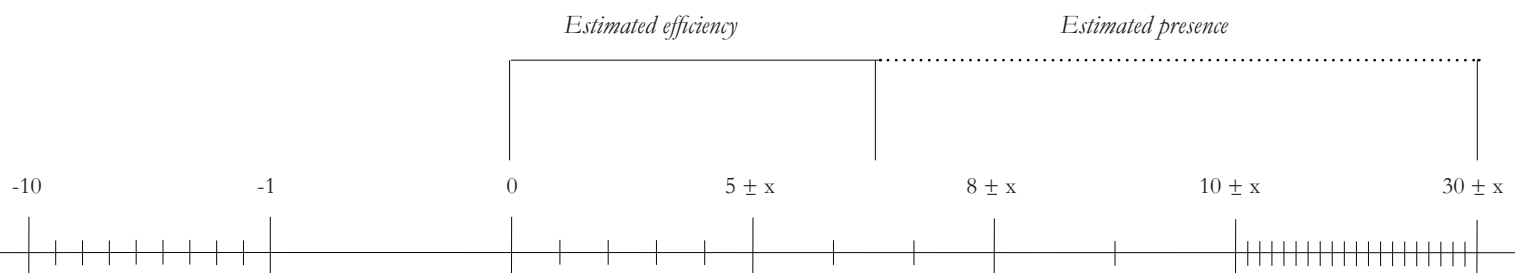
Technical use

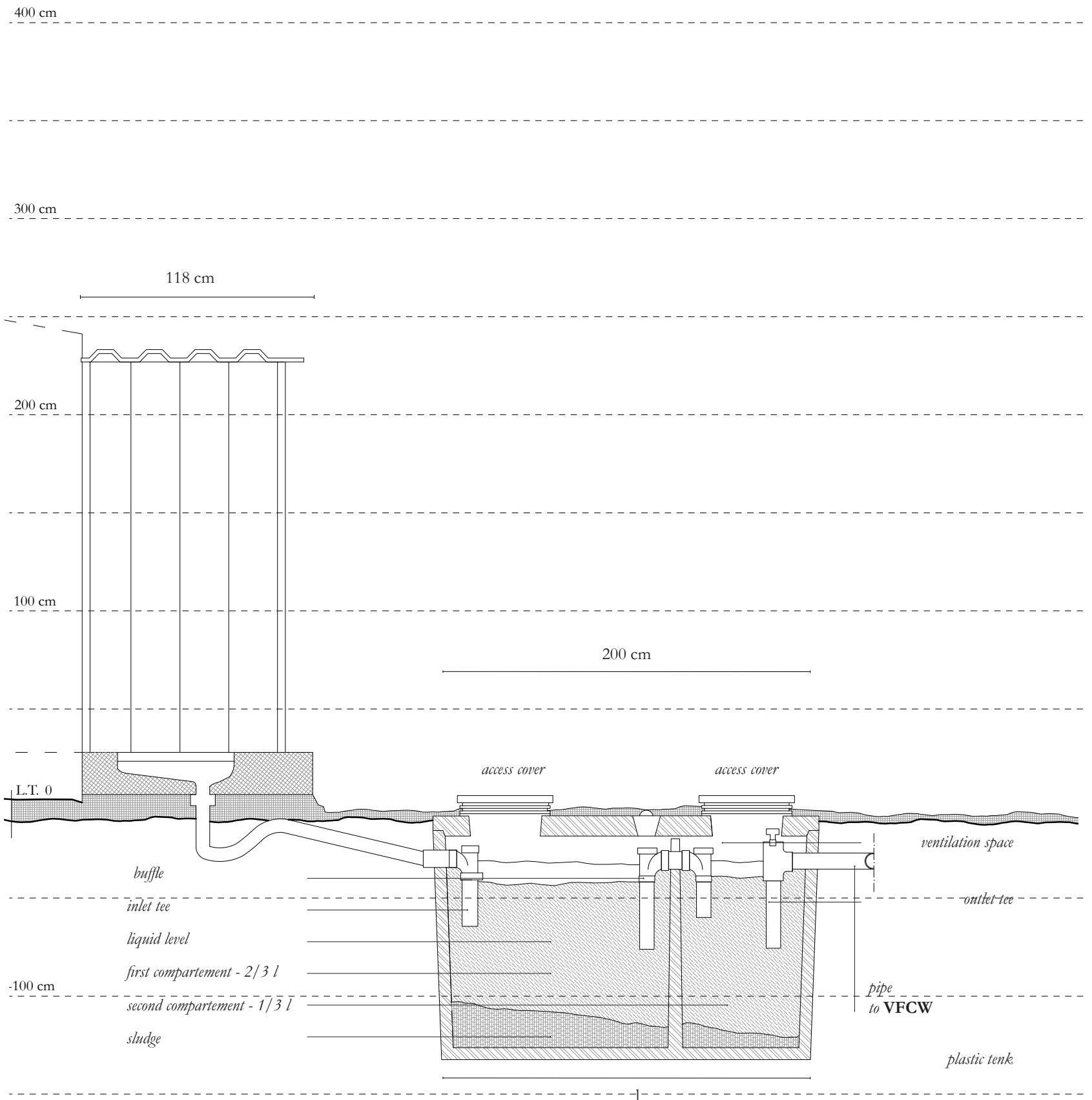
Baffled Septic Tank (BST) is the most appropriate treatment system to treat the effluent of the Solids Free Sewers. When it is followed by a Vertical Flow Constructed Wetland, the effluent is fit for infiltration, reuse in agriculture or disposal in a nearby stream. A BST is an improved septic tank because of the series of baffles under which the wastewater is forced to flow. The increased contact time with the active biomass (sludge) results in improved treatment.

By providing a large surface area for the bacterial mass, there is increased contact between the organic matter and the active biomass that effectively degrades it. The Anaerobic Filter can be operated upflow mode. The upflow mode is recommended because there is less risk that the fixed biomass will be washed out. The water level should cover the filter media by at least 30 cm to guarantee an even flow regime.

The BST are made by plastic material and they are going to be removed during the *Dismantellament Phase* starting at $5 + x$.

Spatial use





Description

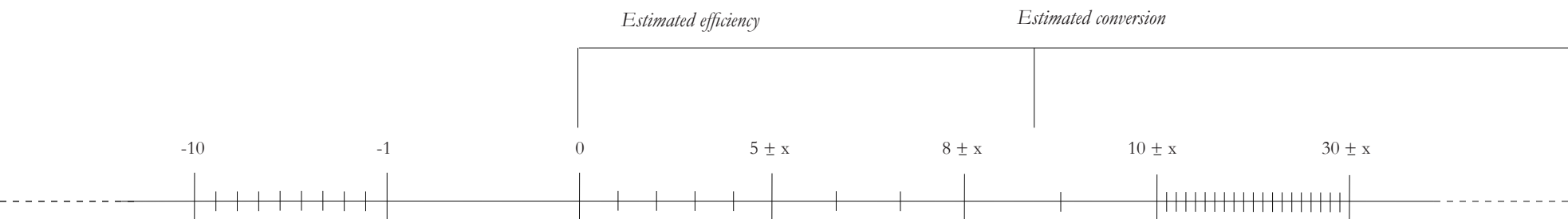
RHS are devices act to store rainwater coming from lebanese roof dwellings. Placed between VFCW and lebanese house are placed under the soil. With the earth keep from the hole of the tank will be realized mud playground. Mud playground are in front of the VFCW.

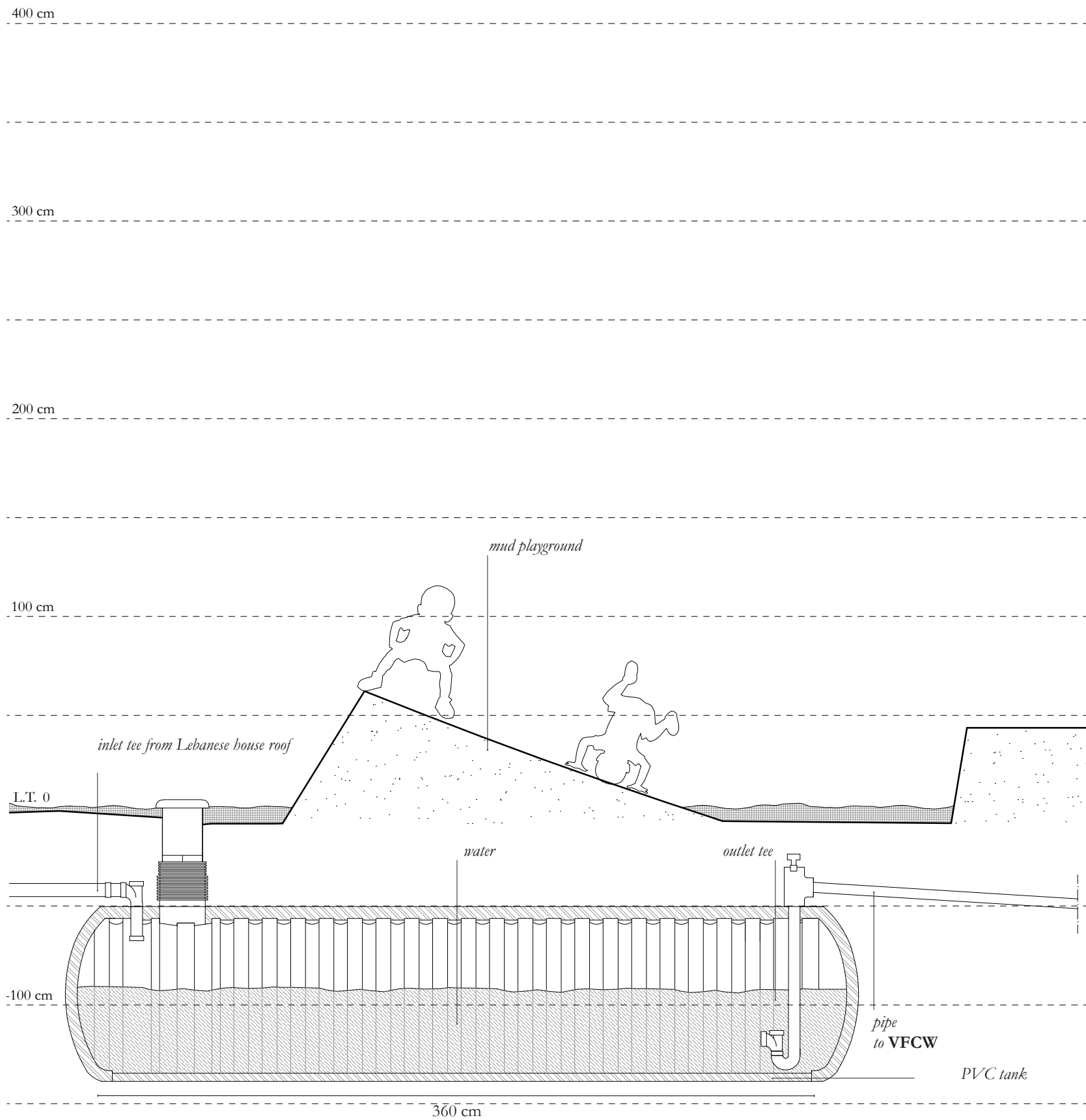
Technical use

These devices are used for underground storage of rainwater. The water storage will be use to aid the corrects working of the VFCW. Each tanks is associated with VFCW and the two systems are linked by a control-flux-pipe to guarantee non re-turning back of purified water. Water cistern have also the function to provide enough water to VFCW after Syrian will start the dismantlement of tents and thus of septic tank who are connect to them.

Spatial use

On top of the water tank will be built a mud play ground. All the different palyground are in front of the VFCW therefore to create a social dinamic into the open-air waiting room sour-randed by project trees.





Phytodepurification Tank

Vertical Flow Constructed Wetland (VFCW)



Description

VFCW is secondary treatment facilities for a filter grey and black water. Wastewater arrives into tanks after had been purified by the BST. Is a filter bed planted with aquatic plants. The water is treated by a combination of biological and physical processes. The filtered water can be reused for irrigation,

aquaculture or other agricultural uses.

Technical use

In the vertical system the wastewater is poured into the wetland surface from above using a siphon. The water vertically flows down through the filter matrix. The tank is filled by a layer of gravel for drainage followed by layers of either sand or fine gravel. The filter media acts as a filter for removing solids, a fixed surface upon which bacteria can attach and a base for the vegetation.

Specific vegetation is planted inside the tanks in order to maintain permeability in the filter and provide habitat for microorganisms, in addition it transfers a small amount of oxygen to the root zone so that aerobic bacteria can colonize the area and degrade organics.

During the flush phase, the wastewater percolates down through the unsaturated bed and is filtered by the sand/gravel ma-

trix. Nutrients and organic material are absorbed and degraded by the dense microbial populations attached to the surface of the filter media and the roots.

A drainage network at the base collects the effluent. Pathogen removal is accomplished by natural decay, predation by higher organisms, and sedimentation.

The Phytodepuration tanks play a key role in the eco-system of the settlement because by purifying the wastewater they allow its re-use, a cleaner water that can irrigate the soil supporting its regeneration.

To dimensionate VFCW we can use the parameter of 5 m² for person.

Spatial use

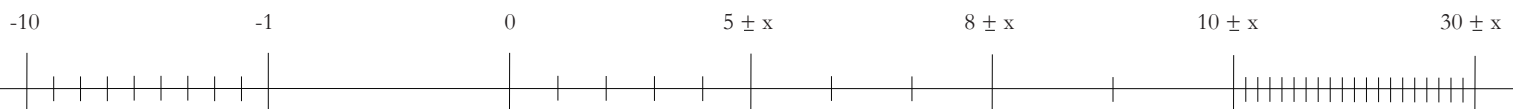
VFCW are located just in *Large* voids and have a double specific function. Purification of water but thanks to their design are thought to be our main aggregation and integration devices.

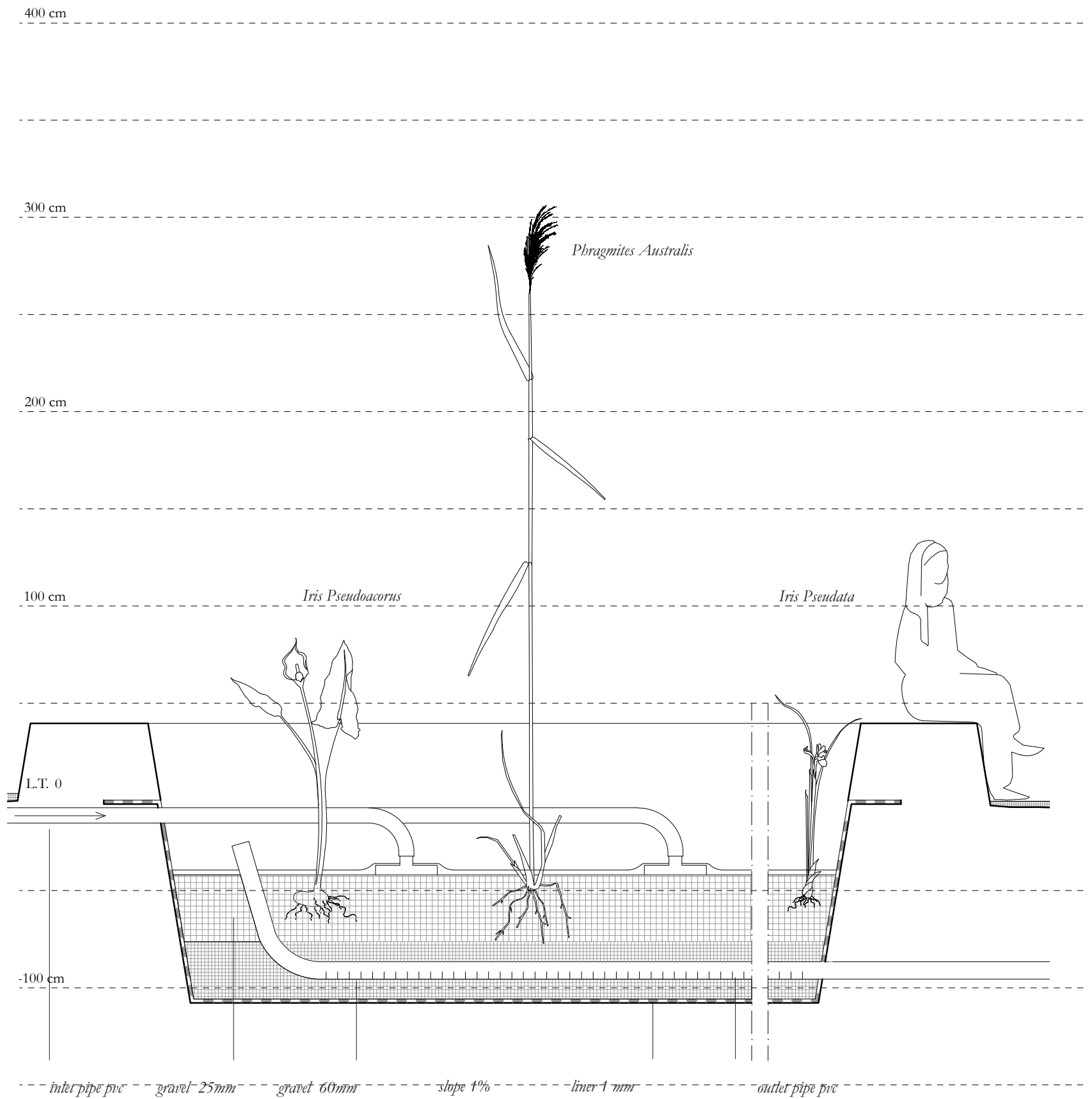
Placed on border of the informal camp, surrounded by trees, are the centre of aggregation of rooms. Each VFCW is sur-

rounded by a mud-clay bench high 40 cm. The shape of tanks are perpendicular at the wall thanks to their big dimension are as obstacle between trees creating forced break.

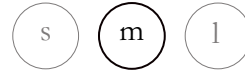
Estimated efficiency

Estimated conversion





// **Micro Garden**
Vertical Wall



Description

Vertical wall technology are modular structure ideated to work with plants for cooking such as rocca parsley, tomato, eggplant, parsly.

Technical use

A light structure made by steel pole (\varnothing 3x3), vegetable boxes and irrigation barrel are the elements composing this devices. Each structure cuold keep 4 boxes for line and each box cuold keep 18 liter of soil.

Soil composition is made by :

1/3 Perlite

1/3 Pottig soil

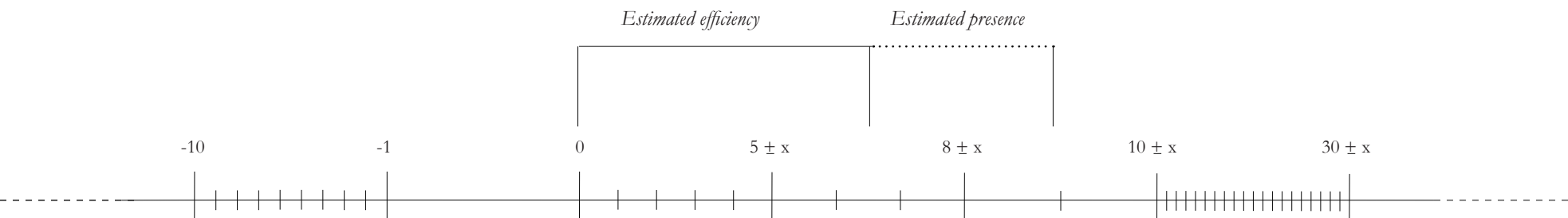
1/3 Peat moss

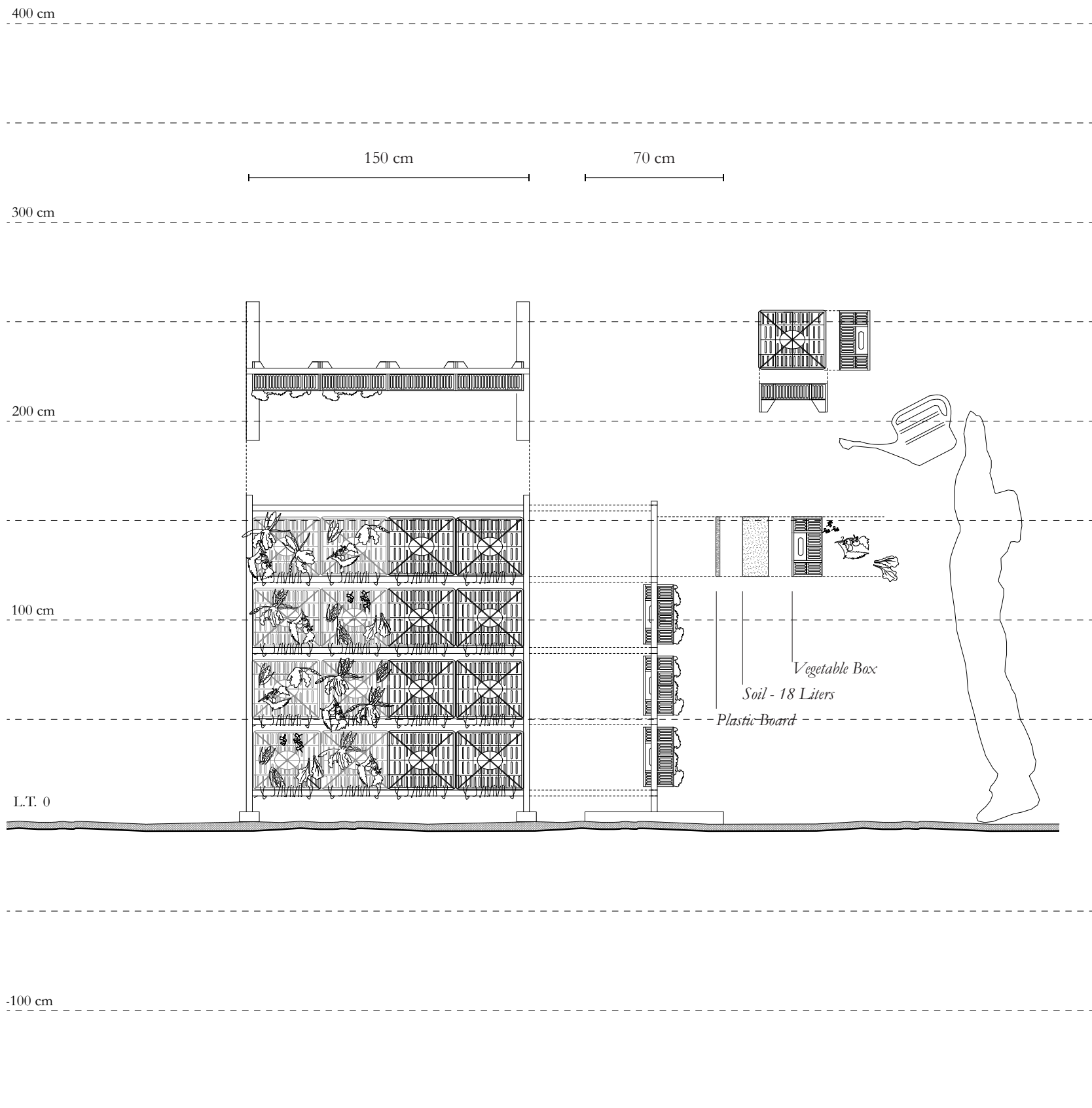
The boxes are tie to horizontal steel plank.

Spatial use

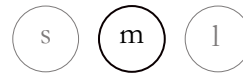
Vertical Wall, together with standing wall, are placed in *Medium* void with the aim of creating the spatiality of small/semiprivate courtyard. They have been thought to be related to people who lives adjacent to them and to cope with the stressful situation through gardening, improving social relations between pe-

ople sharing green units and to innovate and adapt the production units to camp conditions. Last but not least to partially subsidize the diet of the refugees.





// **Micro Garden**
Standing Wall



Description

Standing wall are medium high structure ideated to create spatiality configuration and possibile cultivate surface added to the Vertical Wall divices. This divices are like and Hortus

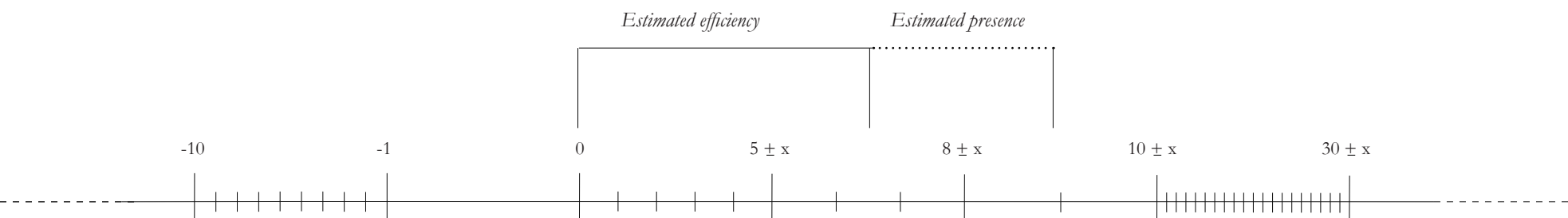
Technical use

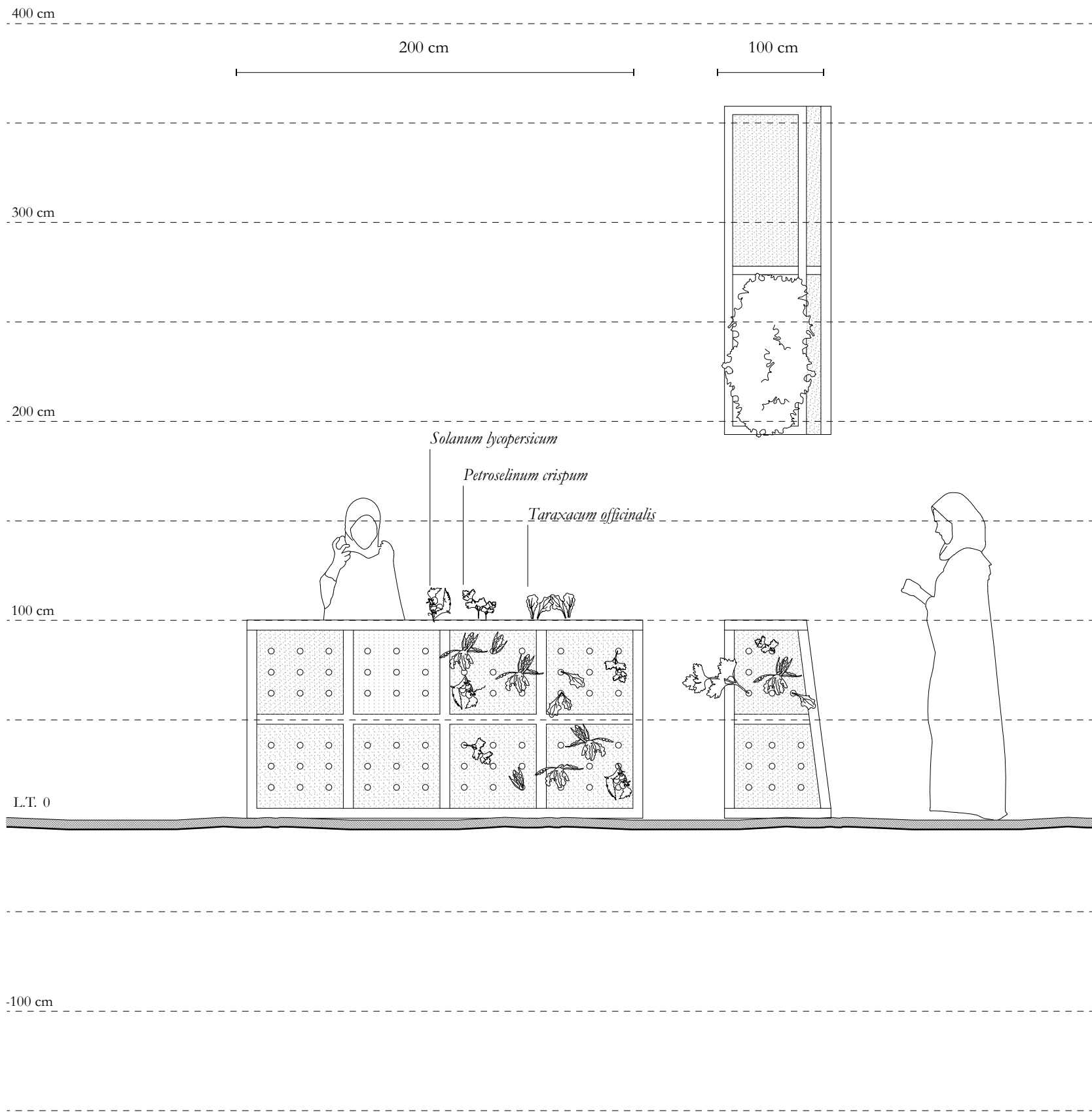
A light structure made by steel and soil.
Have a dimension of 1 meters width and 2 meter of lenght .
Each structure is filled of soil .

Spatial use

Standing Wall, together with Vertical wall, are placed in *Medium* void with the aim of creating the spatiality of small/semi-private courtyard. They have been thought to be related to people who lives adjacent to them and to cope with the stressful situation through gardening, improving social relations

between people sharing green units and to innovate and adapt the production units to camp conditions. Last but not least to partially subsidize the diet of the refugees and the hosting communities.





▮ **Evapotraspitaion tank I**
between tents, semishadow



Description

Evapotraspiration are devices use for treatment of grey water produced by each tents. This tank is located in the space between tents where there is a distance of at least 2 meters in order to pledge enough sunlight reaching plants.

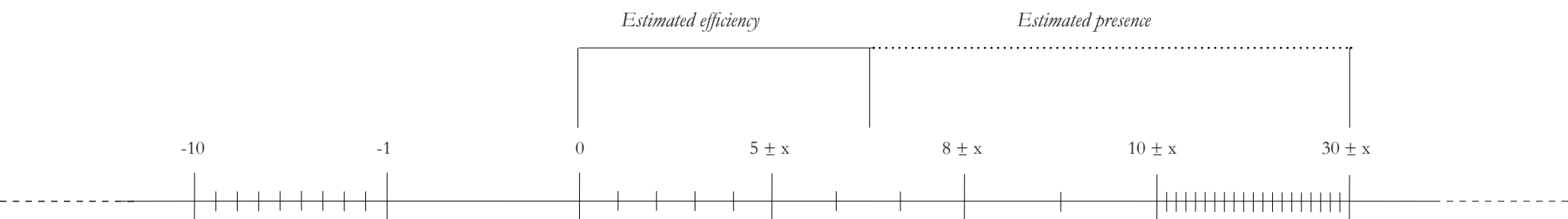
Technical use

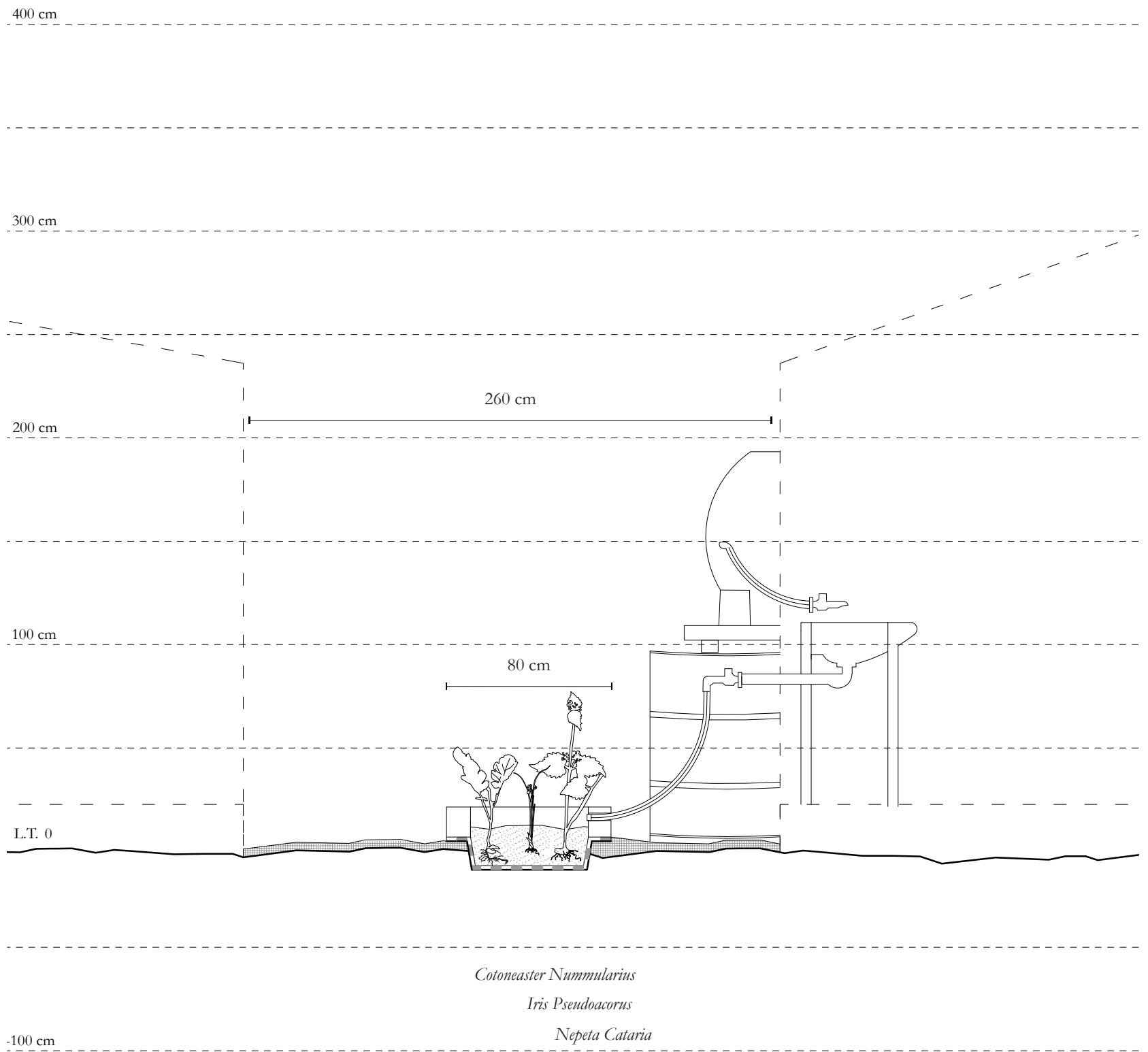
The waste water of the washing taps will be discharge into a Evapotraspiration tank placed close to them. The wastewater effluent is discharged into sealed up receptacles where the water evaporates from the soil or transpires from the plants growing there. Bacteria remove the dissolved organic matter and plants take up the remaining nutrients.

Tanks are borderd by clay and inside arrived pipe from the whasing taps of the tents.

Spatial use

Evaporation tank are located in *small* voids. They are placed mostly in the interstice space of camps and between tents. Aim of divices are purifycation of grey water and beautification of camp's space with flowers and plants.





▮ **Evapotraspitaion tank II**
along streets



Description

Evapotraspiration are devices use for treatment of grey water produced by each tents. This tank is located along the streets of informal camps. Are bigger then Evapotraspiration tank I and plants inside need sunlight.

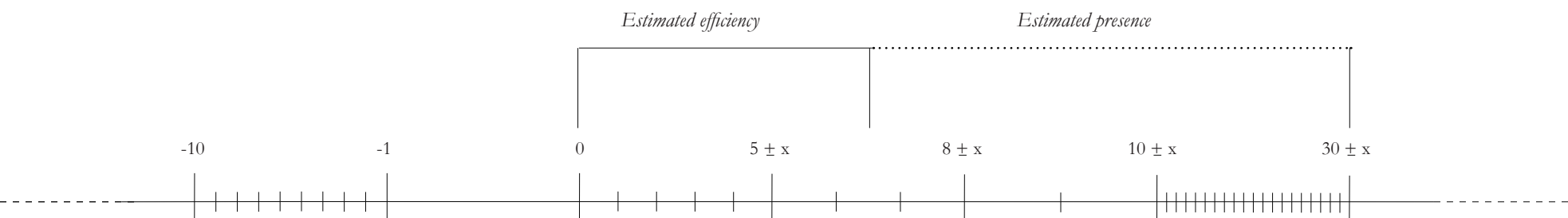
Technical use

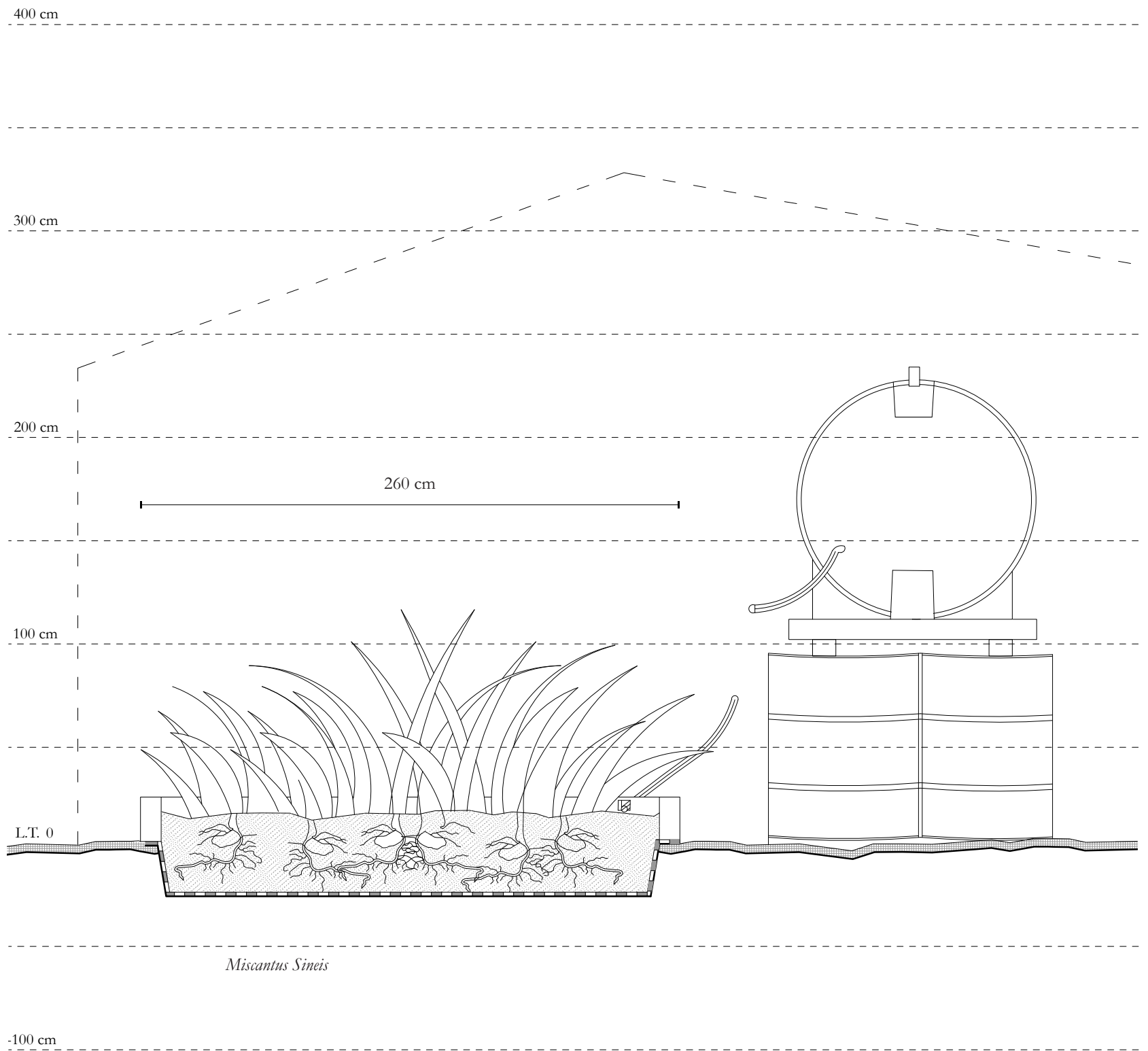
The waste water of the washing taps will be discharge into a Evapotraspiration tank placed close to them. The wastewater effluent is discharged into sealed up receptacles where the water evaporates from the soil or transpires from the plants growing there. Bacteria remove the dissolved organic matter and plants take up the remaining nutrients.

Tanks are borderd by clay and inside arrived pipe from the whasing taps of the tents.

Spatial use

Evaporation tank are located in *small* voids. They are placed mostly along streets of the informl camps or in wider paths where is guarantee enough sunlight for plants. Aim of devices are purifycation of grey water and beautification of camp's space with flowers and plants.





Miscanthus Sineis

Botanical characteristics

The rain garden is a depression of the soil planted with different species of wildflowers and native vegetation that temporarily collect storm water runoff from impervious surfaces.

Technical use

The rain garden allows the water to slowly percolate into the soil preventing the flooding during the heavy rain events. The used plants have long roots that can break up the earth around them and trap the rain water forcing it to drain through several layers of dirt. To increase water filtration the soil is removed (typically 15-30 cm) and altered with tillage, compost and sand. Additionally the water that accumulates pollutants during the run off, is filtered and cleaned by the vegetation and can recharge the groundwater aquifers.

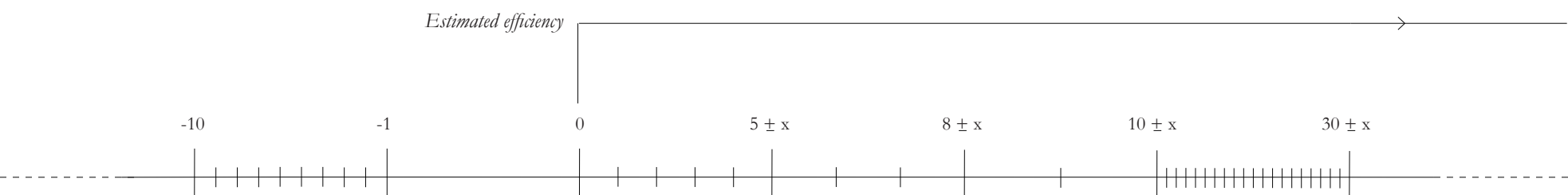
This vegetated depression is dry most of the time and typically

holds water only during and following a rainfall event, the infiltration may take up to 48 hours after a major rainfall, preventing the breeding of mosquitoes. It incorporates native vegetation and the maintenance is minimal.

This natural device represents an exception that is the result of a punctual observation. It is located in a natural depression on the downside of a slope helping to prevent the flooding phenomena that usually affect the informal camp during wintertime.

Spatial use

The rain garden is composed by different species of plants and flowers, a garden that beautify the current space of the informal camp. It is placed in the outer area of one of the informal camps and represents a pleasant vision at the end of a long path. Additionally it is located in a medium void and contributes to improve the environment that surrounds a place of social activities and relation inside one of the camp.



400 cm

300 cm

200 cm

100 cm

L.T. 0

-100 cm

Phragmites Australis

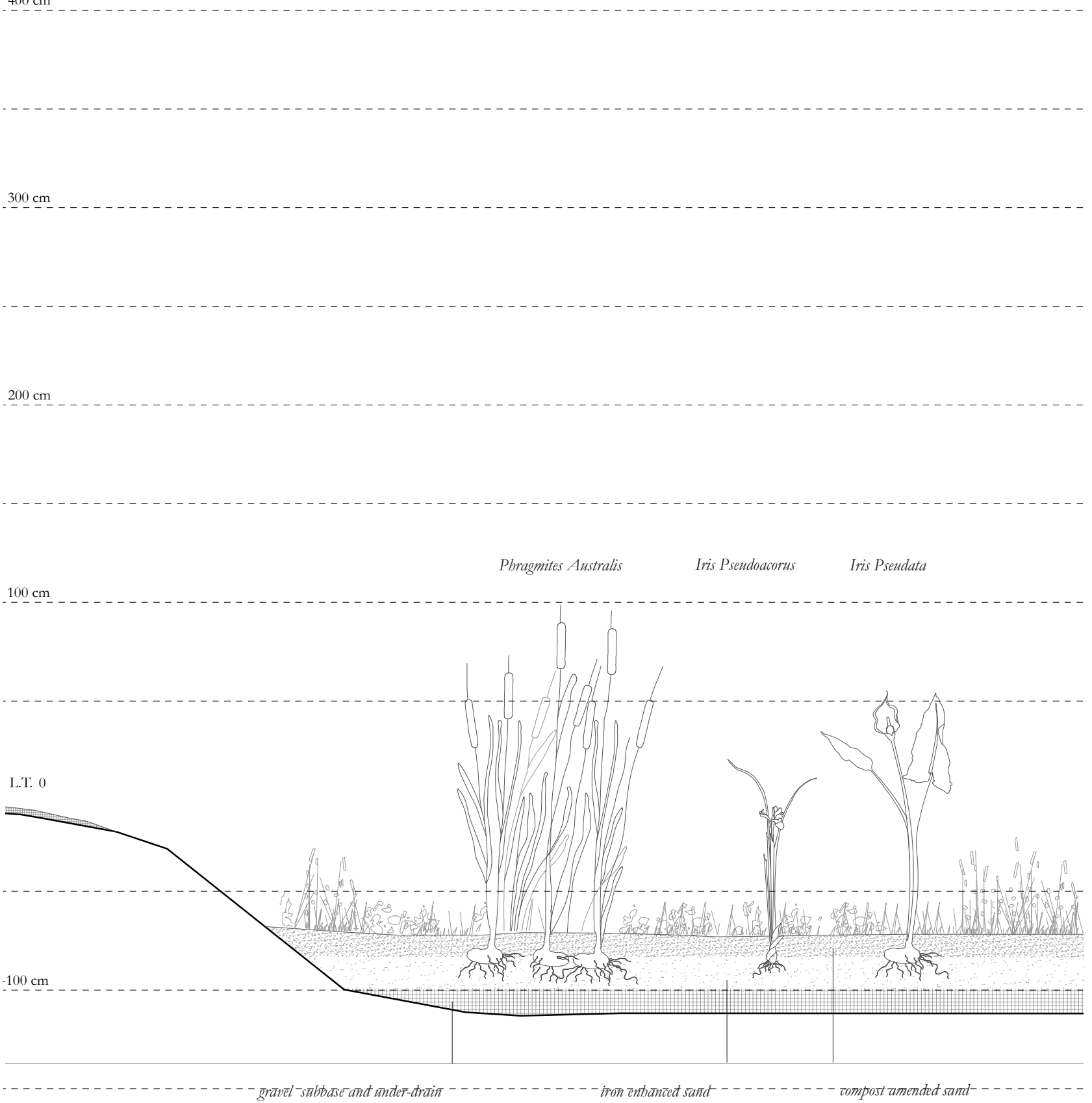
Iris Pseudoacorus

Iris Pseudata

gravel subbase and under-drain

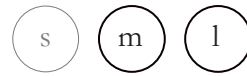
iron enhanced sand

compost amended sand



● **Downy black poplar**

Populus nigra



Botanical characteristics

The Downy black poplar is a large deciduous tree of the family of the Salicaceae, original from the central southern Europe and western Asiatic regions. The growing is relatively fast, it could reach 30m tall and its trunks achieves up to 1.5 m in diameter. The foliage is variable, usually ovoid or elongated. It

is particularly resistant and adaptable to clay, chalk and loam soils, it just need that the aquifer is reachable from its roots.

Technical use

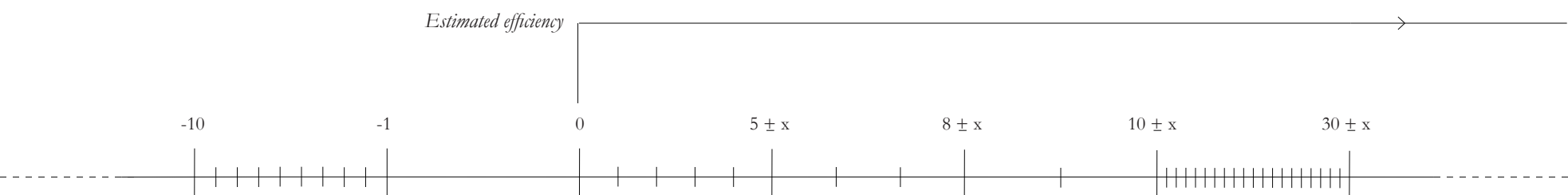
The Downy black poplar is particularly indicated for the processes of phytoremediation, through the enzymes emitted by its roots it have an active role in the deterioration of the polluting particles present in the soil. It has been always used in the agricultural field for its compatibility with several cultivations. In the strategy together with the Golden ness represent the device that could deperate the soil in deep.

Spatial use

The Downy Black Poplar trees play a key role in the design proposal. They are mainly located along the border between the informal camp and the Lebanese dwellings representing a new filter that tries to encourage the interaction between the two. They are placed in rows, with a spacing of 4m x 6m, that contradict the main direction of the weft in order to create a

visual and physical link between the two areas blurring the confine and trying to create a continuous and porous space of relation. On a larger scale the poplar rows are incorporated in a bigger linear system that links the three informal camps.

The trees generate a sequence of different open-air waiting rooms.



20 m

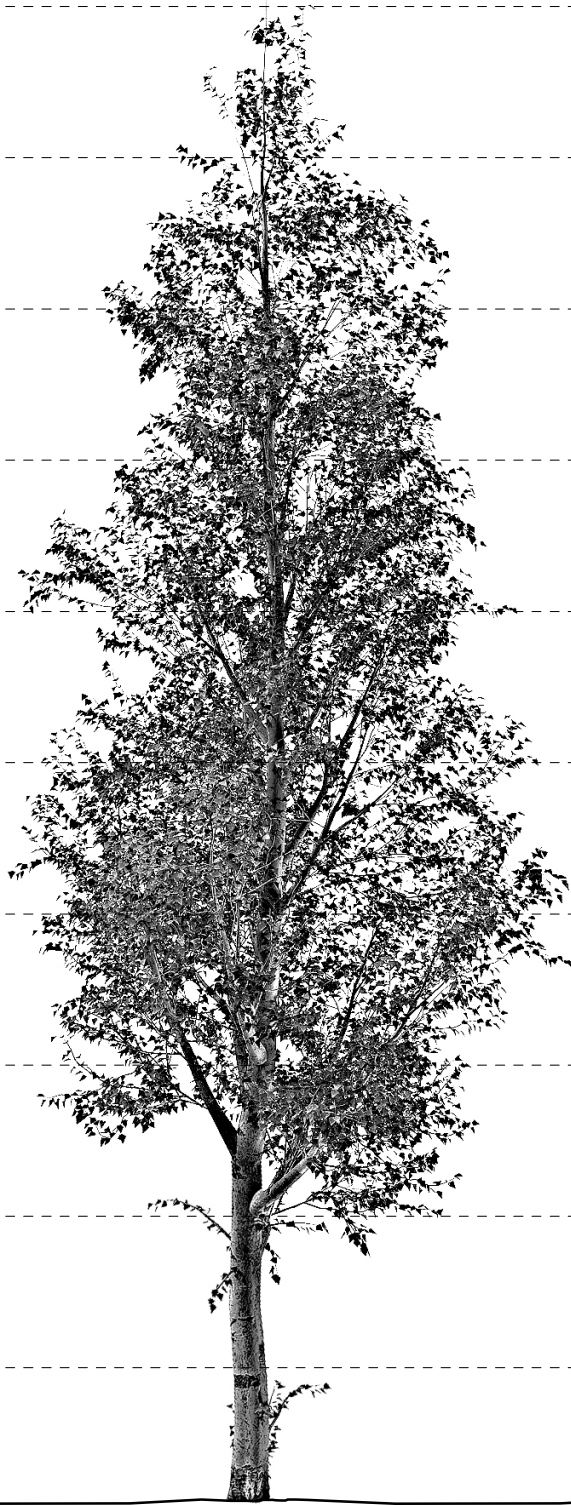
16 m

12 m

8 m

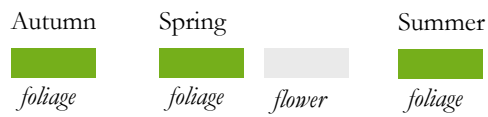
4 m

L.T. 0



○ **White Willow**

Salix Alba



Botanical characteristics

The White Willow is a medium-sized deciduous tree of the family of the Salicaceae, original from Europe and western and central Asia. The grow is fast, it could reach 20 m tall and its trunk achieve rarely 1m diameter. The foliage is expanded with a spread until 10m. It is adaptable to clay and loam soil.

Technical use

The tree is able to grow in adverse conditions and it easily adapts to contaminated sites.

This species is an effective accumulator of both organic and inorganic compounds and can regenerate the soil through a phytoextraction process. The tree absorbs soil contaminants through the root system and transport them up to the leaves. In the strategy together with the poplars represent the device that could depurate the soil in deep.

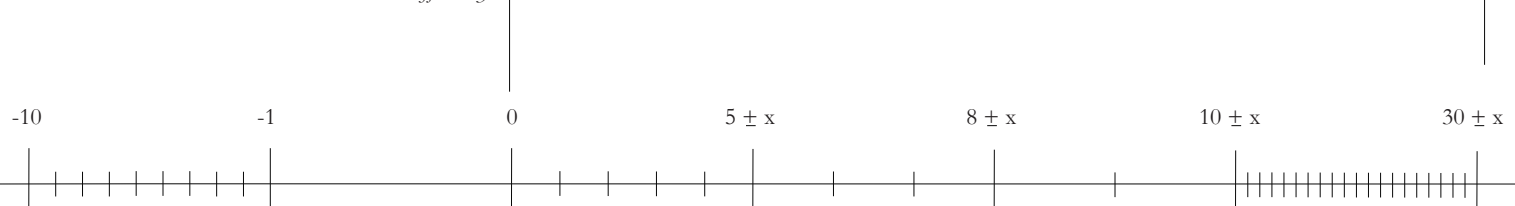
The salix species rapidly begins to product high biomass in early life and the quick harvest cycle allows a remediation of the soil to tolerable levels in a shorter period of time.

It is also a good producer of biomass representing also a good option for renewable energy source useful for both the local community and the informal camp inhabitants

Spatial use

In the project there are punctual presence of the tree that interact with the linear system of the Black Poplar, creating discontinuity and diversity in the arboreal mass. Furthermore the masses compact and low foliage generates under it a shaded and protected space.

Estimated efficiency



20 m

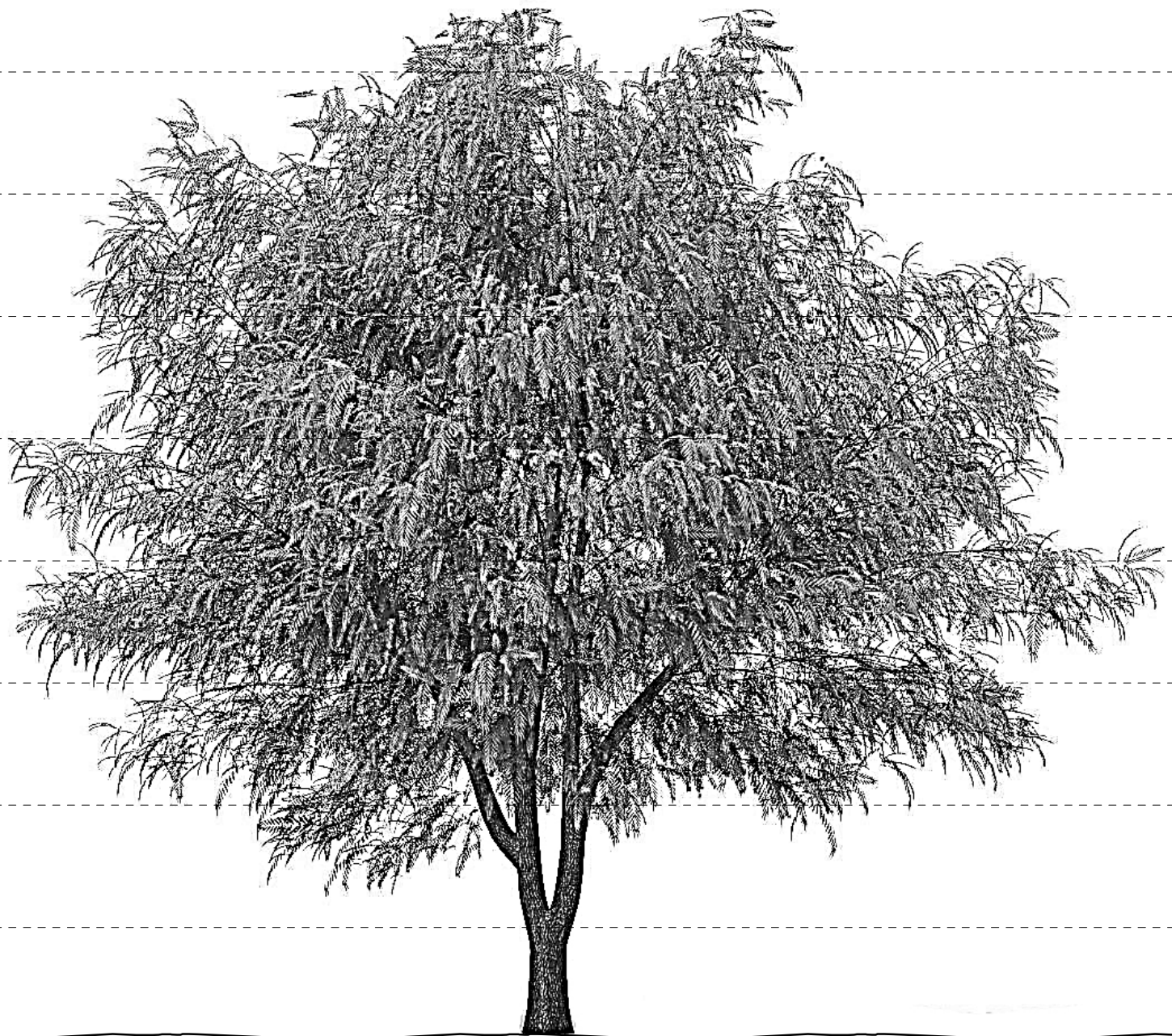
16 m

12 m

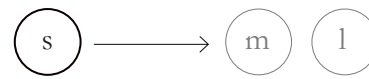
8 m

4 m

L.T. 0



+ **Green mustard** - *Brassica Junacea*



Botanical characteristics

The Green mustard is an herbaceous plant of the family of *Brassicaceae*, original from Asia. The growing is fast and it propagates spontaneously by seeds, in some countries it considered as infestant plant. It has ascendant and sturdy stem that could reach 70cm, with alternate ranches. The lower leaves are expanded and picciuolate, the upper ones are smaller.

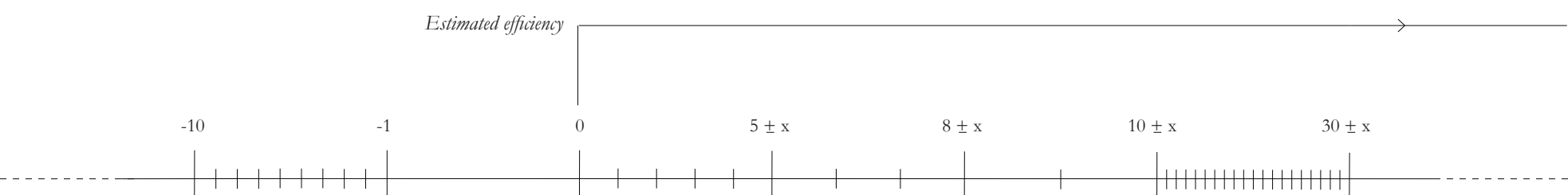
Technical use

Brassica juneca is particularly effective at removing from soil polluting particles, also heavy metal scores. It has a higher tolerance for contaminating substances, for this characteristic, for its fast and spontaneous spreading and for its capacity to survive without maintenance it is the most used plant in project of phytoremediation. It is able to absorb and hyperaccumulate in its cells contaminant substances and consequentially to remove them from soil. The limit of the plant is the shorts roots that do not go in the deep of the soil. In the project it is associated with the trees which have a slower growth but going deeper in the soil.

Spatial use

In the strategy the *Brassica juneca* represent the only element which hypothetically should expand itself in the space. At the phase 0 of the project it is planted in the interstices, and in a particular place of one settlement in which there is an empty space of some burned tents. During the permanence of refugees, it starts its process of phytoremediation but its spread

is controlled by people. When the human desertion and the dismantlement of the concrete bases begin, the brassica could start expand itself in the camps. It represent the lowest trace of the strategy in the territory, a grass camp that become the field of opportunities.



400 cm

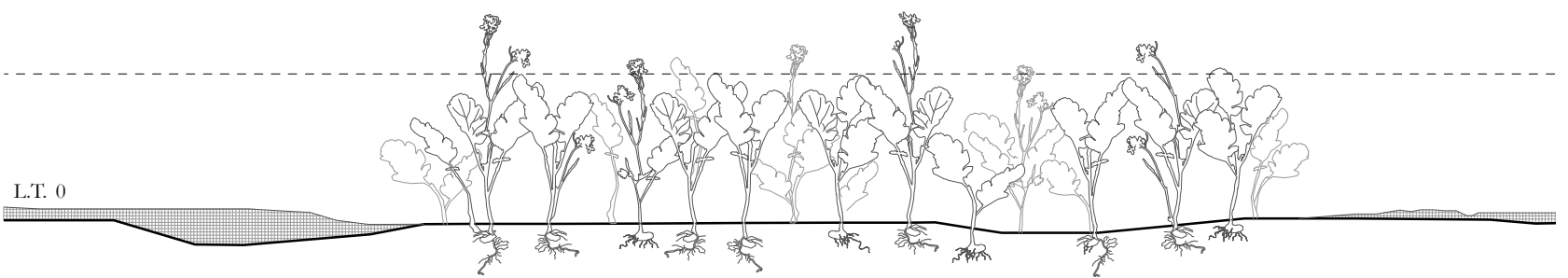
300 cm

200 cm

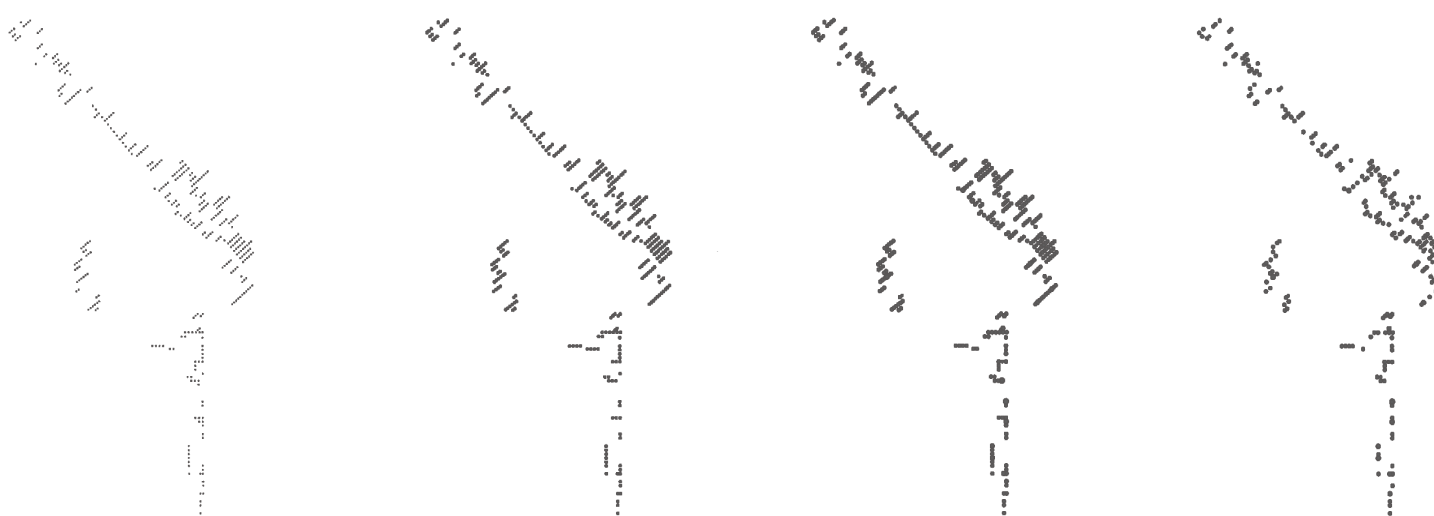
100 cm

L.T. 0

-100 cm



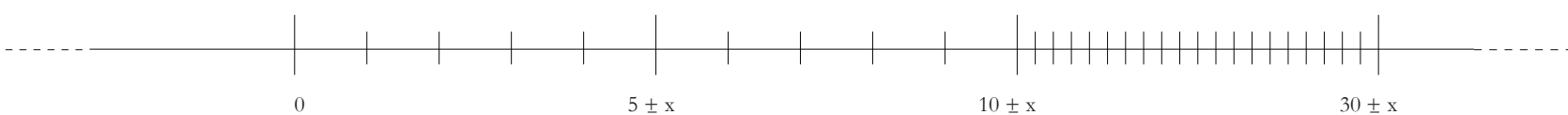
Downy black poplar - *Populus nigra*
evolution of the distribution in the strategy



Golden Ness - *Salix Alba*
evolution of the distribution in the strategy



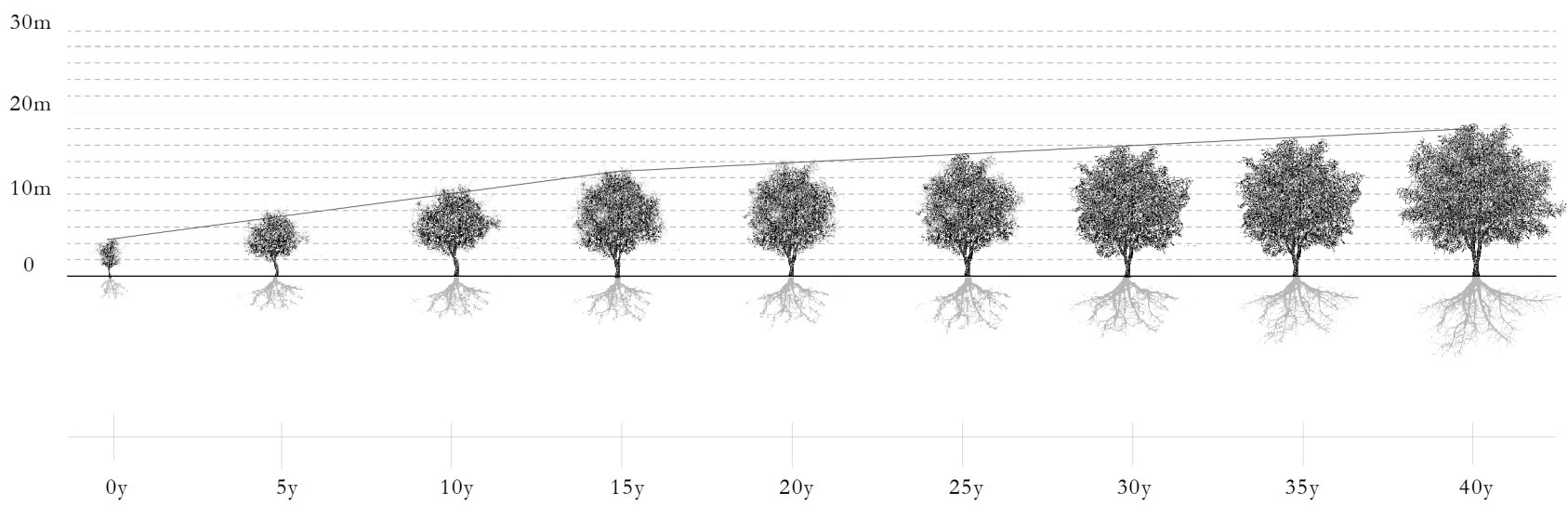
Green mustard - *Brassica Junacea*
evolution of the distribution in the strategy



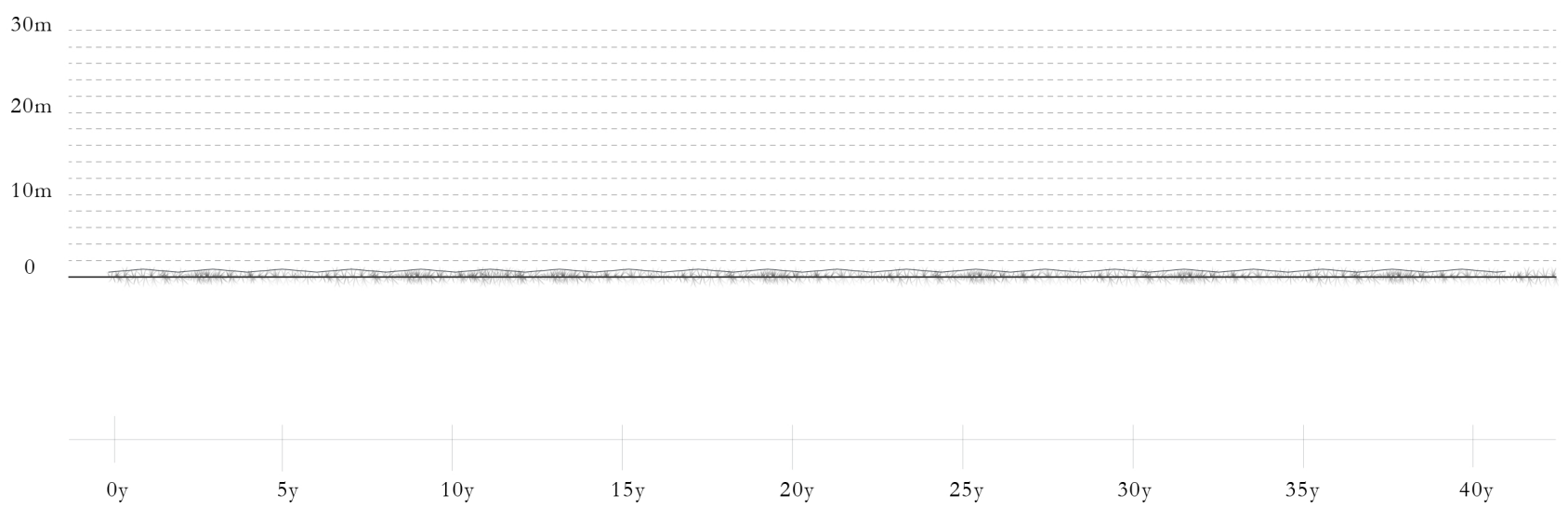
tree growing



tree growing



plant growing



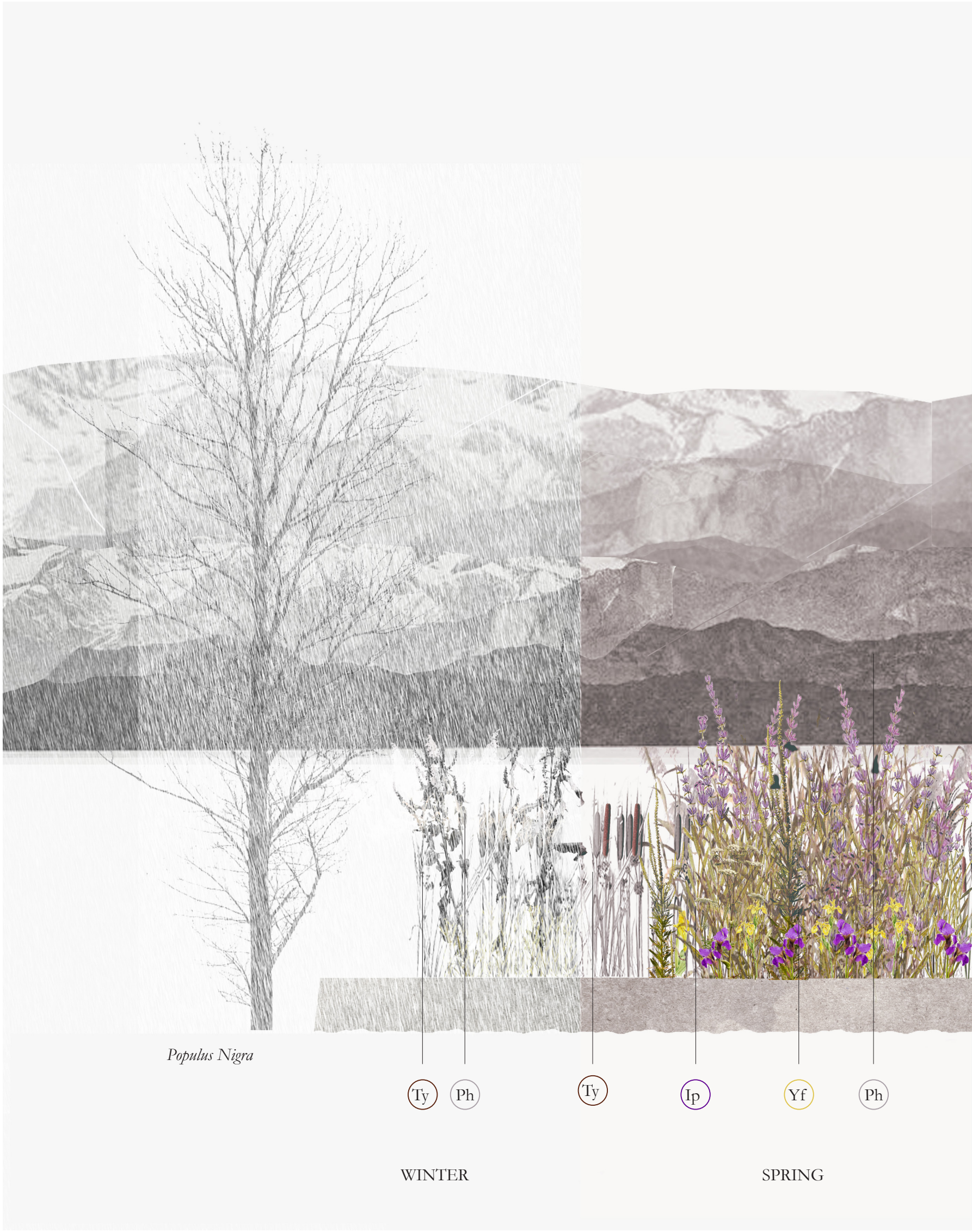
Herbal

For the project have been used 36 different species of plants.
All of them are compatible to the Lebanese ecosystem and appropriate for the
Bekaa Valley region.

Each species has been chosen for its specific function.

Plants are classified in: *Trees, bushes, wetplants, flowers, aromatic*





Populus Nigra

Ty

Ph

Ty

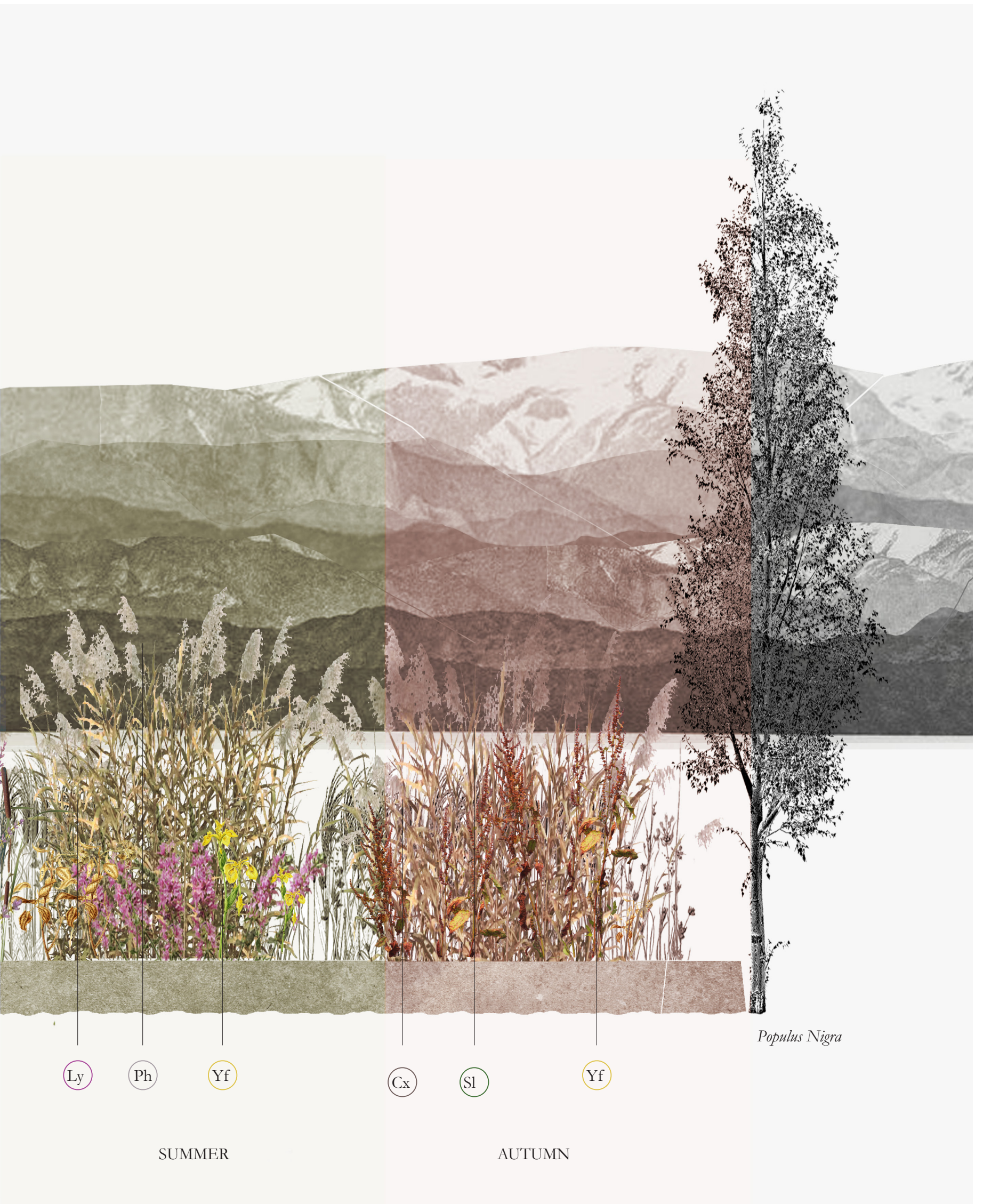
Ip

Yf

Ph

WINTER

SPRING



Ly

Ph

Yf

Cx

Sl

Yf

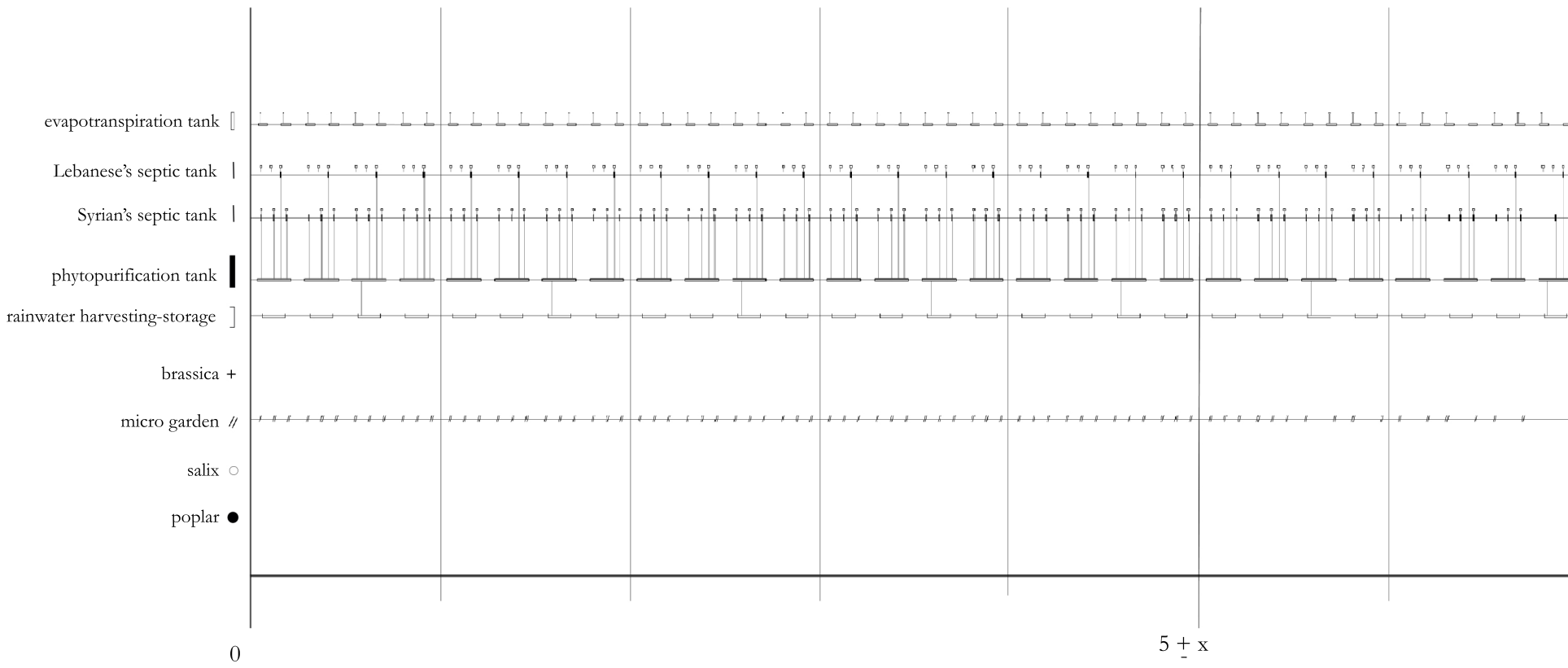
Populus Nigra

SUMMER

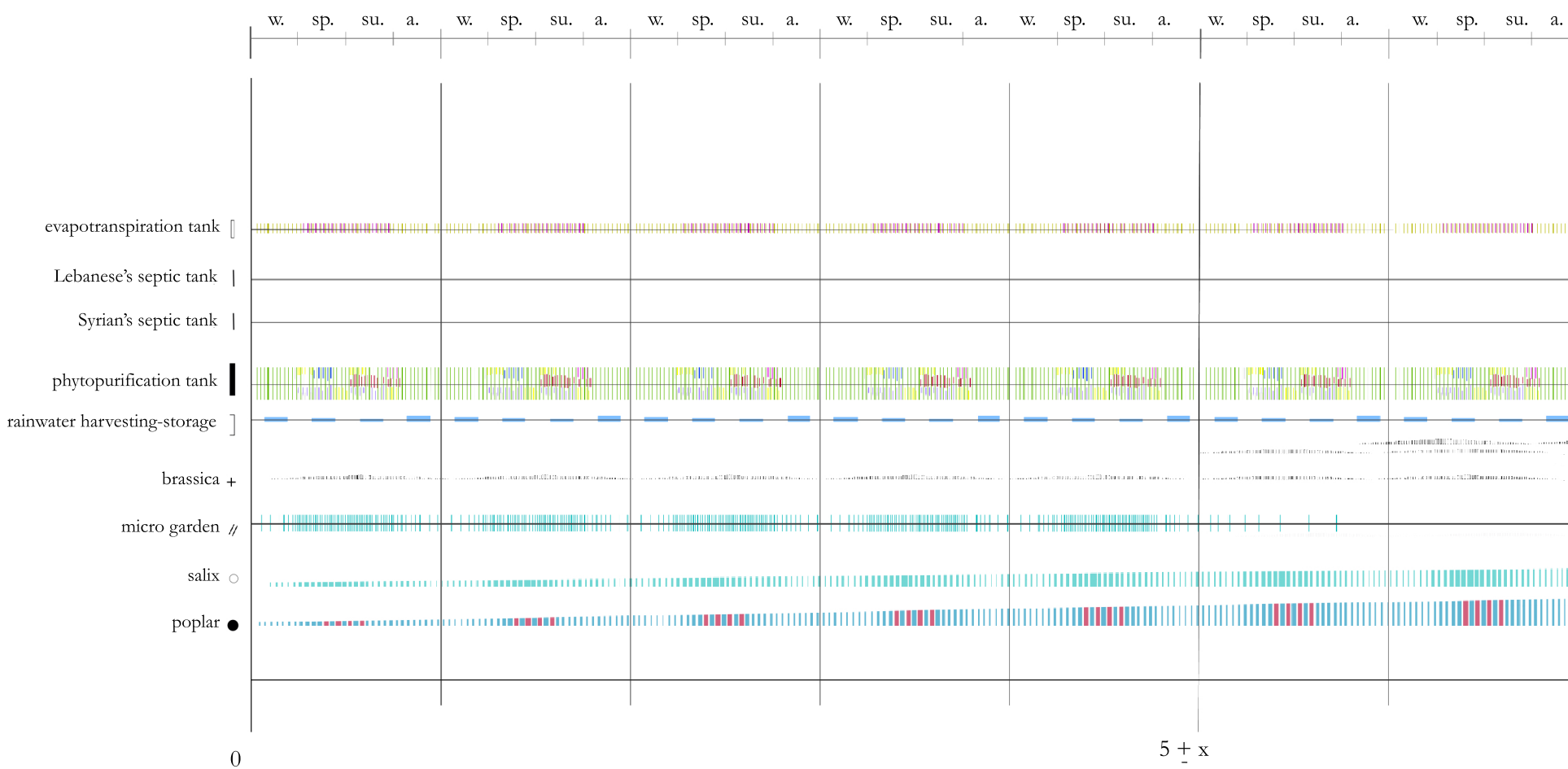
AUTUMN

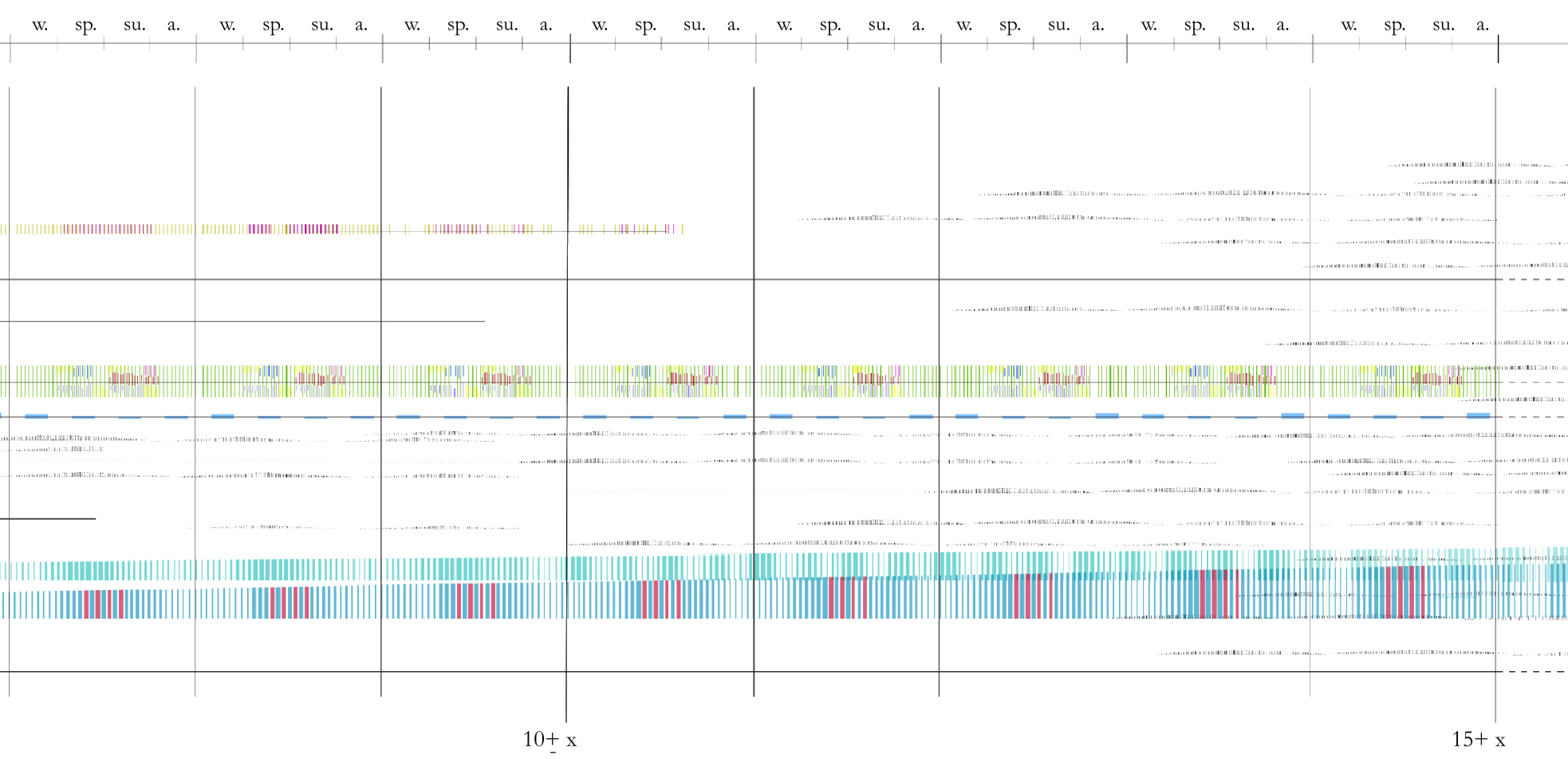
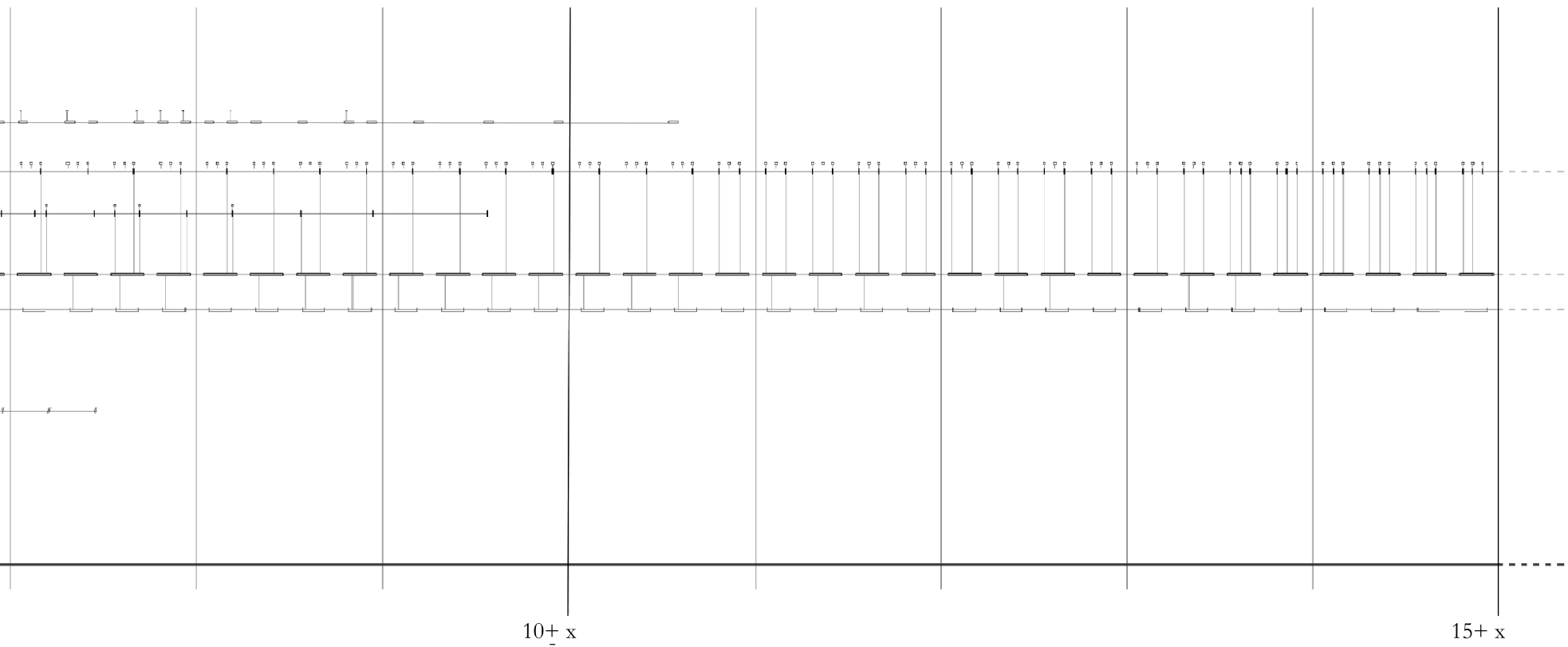
Diagram of presence and interrelation of devices

Artificial components



Natural components





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