

### 1.5.2 Hydroponic system

Hydroponic systems take advantage of the fact that plants do not actually require soil to grow: soil simply provides mechanical root support for plants [2]. Hydroponic systems often use a dense mat of felt-like material, such as coir, as a growing medium. Plant roots grow on and in-between two layers of felted substrate, which is continuously wetted with nutrient-enriched water. There are also some hydroponic systems (eg. Biotope Biowall) which use a modular, cell-based typology, but with rock wool as a growing medium rather than soil.

Both systems face the possibility of plant stress, not least because the plants' growing surface is vertical rather than horizontal. The growth potential of plants in living walls is correlated with the ability of the roots to utilize resources in all parts of the growing medium. For systems composed of small individual containers, the limited rooting room can restrict species choice. The small size of soil-cells can confine root development and hence compromise anchorage. Hydroponic living walls made of coir tend to have stronger root growth in all parts of the medium than those systems using rockwool.

The weight of the substrate is a critical concern where load-bearing capacity of the ground is limited, and it may need to be specially constituted to include expensive light-weight minerals and other constituents. Specialized lightweight growing media used in living walls, such as rockwool, peat, coir, or polymers, tend to have a very high porosity (up to 95% pore space), and, as a consequence, limited water retention capacity, and significant local variations in water and air content. There can be vertical differences in water content within the growing medium in living walls, ranging from waterlogging in the bottom to the top part being dry and without available water, which affects both root growth and aboveground plant growth. Soil in small individual pockets or thin substrate follows ambient temperature closely, heats up quickly, and loses moisture by evaporation quite readily.

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