

ABSTRACT

Shallow-bed constructed wetland (SCW) has been used as a secondary wastewater treatment technology with low cost, less maintaining and operational requirements and environmental friendliness. Green roof has been considered an effective solution in saving energy, enhancing green space, providing landscape aesthetics, limiting stormwater runoff causing flooding, and purifying air pollutants. Recently, a wetland roof (WR) has been interested as a good integration of these two technologies. To gain an insight understanding of this combination, this review aimed to provide the potential applications of SCW on the roof as a WR. Factors affecting performance, benefits and challenges of SCW were also presented. The literature data showed WR was a promising green technology that needed to be investigated and scaled-up in the future.

POTENTIAL BENEFITS OF WETLAND ROOF



STRUCTURES OF WETLAND ROOF

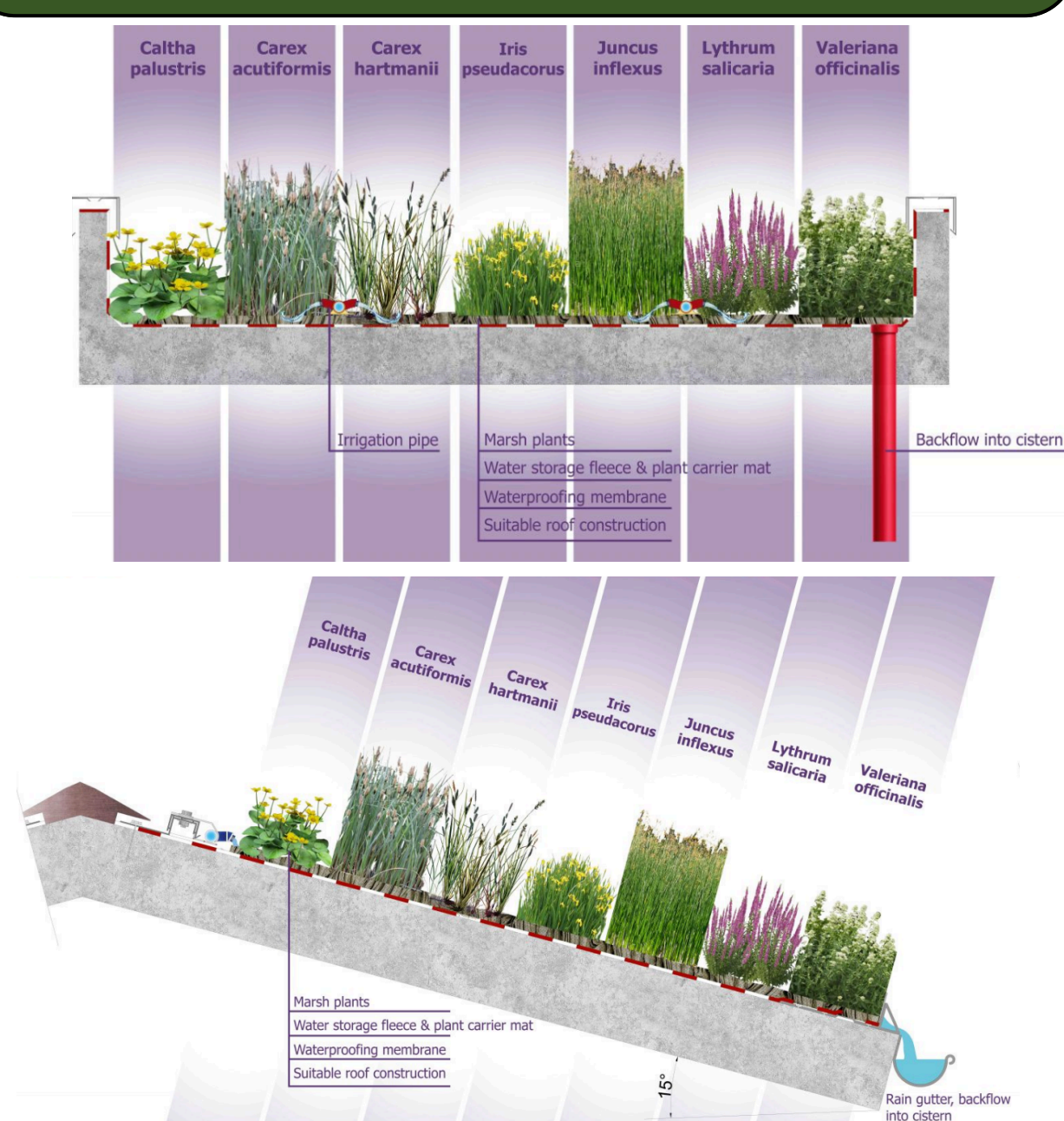


Fig. 2. Diagrams of typical wetland roofs with roof slope 0° and 15° (<https://rhizotech.de/en/131/wetland-roof>)

CHALLENGES OF SCW

While WR systems offer environmental advantages, certain limitations persist. The gravity load, typically around 163 kg/m², can affect roof capacity, making lighter bed materials crucial. Odor nuisances, arising from wastewater and decomposing organic matter, can be minimized by using closed tanks and subsurface water flow systems, which also reduce the risk of infectious organisms like mosquitoes.

Cost Concerns:

Cost for WR systems is another key consideration. Although no comprehensive cost-benefit analysis for WR exists, studies on Green Roofs (GR) indicate benefit-cost ratios vary widely based on factors like materials and location. In Helsinki, GR projects had ratios from 0.5 to 2.2.

FACTORS AFFECTING PERFORMANCE

Effects of plant

Plants – macrophytes stabilize the surface of the material layer and provide a green area. The plant root system could facilitate physical filtration, prevent clogging, uptake nutrients and metals, and work as a media for attached bacteria [21]. Nutrient uptake capacity of plants is different and depends on the characteristic of species.

CONCLUSIONS

Shallow-bed constructed wetland (SCW) is successfully used for wastewater treatment in many parts of the world but their other potential benefits seem to be ignored. From the results of the review, SCW in the form of wetland roof (WR) can be an economical and environmental option, especially for developing countries where low-cost wastewater treatment strategies are critical. Once it overcomes barriers including gravity loads, bed materials, odors, infectious organisms, and biomass harvest, WR becomes a promising secondary treatment technology, which is able to adapt to climate changes and in accordance with the development strategy of green cities.

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