Filtering Gardens® for wastewater and rainwater in Rio de Janeiro

by Plínio Oliveira / 2017-06-14 23:10:23 / International / 11677 / EN

Year of commitment : 2017
CO2 Impact : 104,66tCO2/year emissions reduction (The Filtering Gardens® present emission values around 4 times lower than the average of the conventional wastewater treatment)

Water cycle : Collection, Containment, Other, Purification, Capture, Waterways, Other, Phytoremediation, Used water recycling, Other
Biodiversity & Ecosystems : / Ecoystem restauration, Carbon capture, Environment education, Ecosystems preservation /

675 000 €

Builder

Afonso França Engenharia

Manager / Dealer

Phytorestore Brasil

GENERAL INFORMATION

Aiming to be a groundbreaking intervention concerning sustainability and environment preservation since its conception, the building wastewater and rainwater management is provided by the Filtering Gardens®; natural biotechnology features developed by **Phytorestore** based on phytoremediation and wetland ecosystems which promote the removal of pollutants from the water, restore it back to usable conditions and simultaneously recreates natural green landscapes.

The **Filtering Gardens®** are a series of basins filled with specific substrates and plants on top, totalizing around 3000m² of functional and aesthetic landscape features on the outside of the building. The wastewater/rainwater runs through the substrate and the biological interactions occurring at the root zone provide the proper treatment, without any chemical, bacterial, biological or artificial product addition. The process efficiency relies solely on the nature's properties enhanced by the human knowledge applied to the process. The final morphology of the ensemble is nothing but exuberant green areas, with a huge palette of native plant species that create unique patterns, colors and texture mixing.

The whole construction process is Green Building Council's LEED Gold certified and L'Oréal stakeholders are applying for the site's operation certification.

Progress Status

Delivered

Data Reliability

Self-declared

Funding Type

Private

Website Enterprise / Infrastructure

http://www.phytorestore.com.br

Sustainable Development

Attractiveness :

Well Being :

The treatment of sanitary and industrial effluents in Brazil needs innovative approaches aiming towards the concept of smart cities; solutions that contemplate a continuous

sustainable cycle, with the use of natural technologies, without the generation of environmental liabilities and health risks. The Filtering Gardens represent this evolution in the approach to liquid waste by offering a treatment done in a 100% natural way and without generating contaminated outputs. The same happens with rainwater that, when correctly managed, don't cause problems like floods and become an integral part of the system of supply and reuse of an industry, a community or an entire city. The solutions at L'Oréal R & I Center demonstrate how it is possible to harmonize treatment, intelligent resource management and environmental preservation. The island where the project is located is in the Guanabara Bay and has Atlantic Forest remnants. Although the bay's water is filled with pollution and litter, the natural wetland ecosystems scattered around the island's shores still resist and harbor rich biodiversity. Aiming to protect and enhance the natural aspects of the place, the application of the Filtering Gardens adds even more botanical and fauna diversity to the place with the application of native species and creation of ecological habitats within the planted filters.

Social Cohesion : The nearby community is benefited by educational programs developed concerning the ecological and sustainable processes involved in the Filtering Gardens® through universities and schools' researches and technical excursions. The gardens provide a deep and tangible understanding about human living and its effects on nature while it demonstrates the potential to manage human produced residues through nature itself; sparing it from further damage. The nature-based solutions are the basis for smart cities infrastructure and the employment of technologies such as the Filtering Gardens® can play a significant role to construct the sustainable future.

Preservation / Environmental Improvement :

- Nature-based solution aligned with principles for Smart Cities regarding infrastructure and residual management;
- Low operation costs – zero chemical inputs, zero sludge disposal;
- Low energy consumption – natural flow by gravity, few effluent pumps and aerators through the process;
- Low GHG emissions – GHG compounds incorporated by plants are higher than their emissions – carbon credits generation;
- Biodiversity stimulation and enhancement – only native plants used, attractive habitats for amphibians, birds and insects (no disease vectors proliferation);
- Water consumption reduced – vast range of reuses that decreases public system consumption (irrigation, toilet flush, pavement washing, etc.);
- Less/no charge to public sewage system – the Filtering Gardens® consume water volume in the process by evapotranspiration, resulting in savings regarding service bills. L'Oréal's building is completely disconnected from the public sewage net;
- Microclimate improvement through the planted filters/pond bringing temperature's decrease and humidity's increase;
- Improvement of Guanabara Bay's water quality by discharging amounts of treated water in moderate flows;
- Water table replenishing by infiltration (rainwater only);
- Real state valuation – the Filtering Gardens® are open green areas proper for people to contemplate, walk and experience.

Resilience : The Filtering Gardens® are also applicable for treatment of rivers, lakes, industrial effluents, landfill leachate, etc. Each solution is unique regarding its morphology, but the process and biotechnology remain substantiated in the same premises, which are Phytorestore's pillars: natural and sustainable treatment. L'Oréal R&I Center's Filtering

Gardens® represent a solution that can be replicated among almost every kind of factory plant or facility. The gardens can substitute the traditional treatment stations completely, reinforcing the pursue of enterprises for innovation and a sustainability based agenda

Responsible use of resources : The Filtering Gardens® promote environmental education and the rational use of natural resources since all effluent is recovered in a natural way, using the properties intrinsic to the plants, generating reuse water that reduces the consumption of drinking water coming from the public network. The consumption of electric power is very low when compared to conventional systems, since practically the system works by the action of gravity, using few pumps and related equipment.

Testimony / Feedback

Fernanda Raimundo, Construction Coordinator Architect – RAF Arquitetura
“It is Impressive to follow the process of building the Filtering Gardens. Hard to imagine how that excavation work with plenty of rules would result at the beautiful set in the end of the construction: colorful gardens that brighten the design of the building of the new L'Oréal Research & Innovation Center. Besides being beautiful, the gardens treat the effluents generating water for reuse and store a large volume of rainwater. Phytorestore gardens link to the architecture in a very harmonious way and reinforce the concepts of sustainability that are so strong in this building.”

Ricardo Guisolphe, Project Manager - L’Óréal
"It was my first experience getting in contact with Filtering Gardens and I have learned enough to conclude now that nature is able treat itself. Having a system that can treat water and feed on residues is fantastic from the environmental and economic points of view. The Filtering Gardens are a magnificent project/installation that brings to L'Oréal a new perspective for the effluent treatment itself. As the costumer spokesperson, we are already very satisfied to have this solution. It represents the innovation that a Research & Innovation Center should support."

Governance

L'Oréal

Holder Type : Private Company

Afonso França Engenharia

Builder Type : Construction Industry

Phytorestore Brasil

Manager / Dealer Type : Private

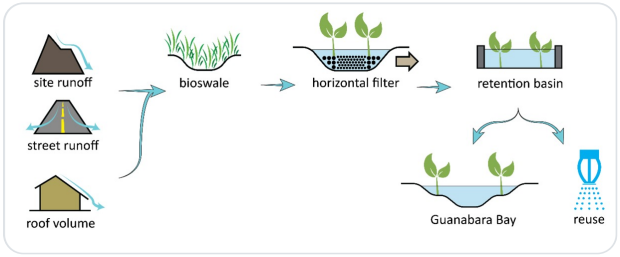
- Filtering Gardens project and operation: Phytorestore Brasil
- Architecture project design: Perkins+Will/RAF Arquitetura/MHA Engenharia

- LEED consultant: CTE – Centro de Tecnologia de Edificações
- Builder: Afonso França Engenharia
- Site's management: Sodexo

Business Model :

Sustainable Solutions

Rainwater management



Description :

Process steps:

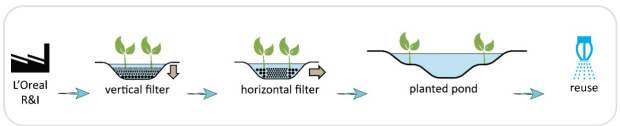
Bioswales – 380m²
Filtering Garden® – horizontal filters – 340m²
Retention basin – 975m²/1500m³ storage capacity
Reuse storage tank – 215m³
Rainwater management happens through bioswales that capture site's runoff and roof contribution. These features are filled with natural materials chosen by their capability of retaining oil and other derivatives originated by cars in fuel consuming. The Rainwater Filtering Garden® receives the liquid to be polished direct from the bioswales, without storage tank. The rain treatment is provided by horizontal filters (the flowing direction is horizontal) which retain and degrade remaining pollutants in the substrate. These filters are lined to provide enough water retention for plants to survive during dry seasons.

In the next step, the rainwater is conducted into the retention basin able to hold up to 1 hour of 10 years rain event (72mm/h). The total volume retention capacity is 1500m³. The basin is not lined, allowing water to infiltrate into the soil; gradually replenishing the underground water table without causing floods.After the natural treatment in rainy days, water goes to a storage tank to be reused or can be discharged into Guanabara Bay in a moderate flow, avoiding floods by excessive volume accumulation in a short time. The improvement of water's quality in the bay is not measurable but this system surely is a punctual contribution.

- Biodiversity :
- Air quality
- Infrastructure
- Water management
- Low-carbon materials/ infrastructure

Company (es) Website :

Wastewater management



Description : **Process steps:**

Oxygenation tank – 29m³
Filtering Garden® – vertical filters – 324m²
Filtering Garden® – horizontal filters – 234m²
Filtering Garden® – planted pond – 204m²/225m³ storage capacity
Reuse storage tank – 200m³
Besides the common sanitary effluent (max. 40m³/day), the research center also produces small amounts of lab waste (max. 17,3m³/day) coming from products development and tests.

Both effluent types (57,3m³/day total) are entirely directed to the Wastewater Filtering Garden®. The treatment begins with the oxygenation tank that help to dissolve solids and homogenize the effluent. This garden configuration is slightly more complex than the rainwater gardens, due to the heavy pollutant charges. The composition's filters must be waterproofed to avoid the effluent infiltration, but the treatment is still completely natural.Special procedures involving other technologies are unnecessary.
The first element in this composition is the oxygenation tank. Inside the tank are the aerators for oxygen insertion. This process removes any odor coming from the effluent. The discharge from the tank is done by batching, allowing the effluent inside to receive enough aeration before the it happens.

Vertical filters (the flowing direction is vertical) represent the aerobic process which is capable of decreasing charges of suspended material, BOD and enhancing nitrification. Horizontal filters are the second step, representing the anaerobic process capable of degrading phosphorus compounds and promoting denitrification. With this hybrid system, it's possible to degrade all organic matter and neutralize other kinds of pollution. The planted pond is the last step and operates as final water refinement and as landscape embellishment feature. Lastly, the treated water goes to the storage tank to be reused.

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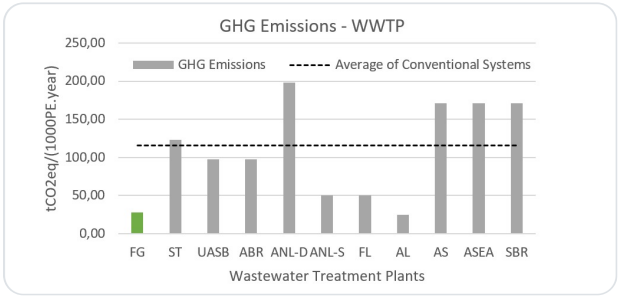
GHG BALANCE & CO2 CREDITS



Description : The procedure used for the estimation of direct GHG (CH4 and N2O) emissions in the L'Oréal Filtering Gardens® was based on The 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands (Wetlands Supplement) and the calculation tool provided by the GHG Protocol Brasil was used to determine the indirect emission from purchased energy and to convert the results into tCO2eq.

In its maximum capacity, the Filtering Gardens® issue 208,7kgCH4/year and 3,64 kgN2O/year, which are equivalent to 6,30 tCO2eq/year. The total energy consumed with aerators and pumps is approximately 4528 kWh/month, equivalent to 4,44 tCO2eq.Therefore, the total GHG emission in the system is 10,74 tCO2eq/year.

Under the IPCC methodologies, CO2 is not counted as an emission from wastewater treatment plants. The reason for this is that any carbon that is present in wastewater is biogenic. Therefore, returning the carbon in liquid to the atmosphere as CO2 represents no net flux to the system.

One of the greatest Filtering Gardens®' advantages – compared to conventional wastewater treatment systems (WWTP) – is the significantly lower levels of GHGs emissions.Table 1 presents a comparison between Filtering Gardens® (FG) and conventional WWTPs such as septic tank (ST), up-flow anaerobic sludge blanket digestion (UASB), anaerobic baffled reactor (ABR), anaerobic lagoon with depth higher than 3 meters (ANL-D), anaerobic lagoon with depth lower than 3 meters (ANL-S), facultative lagoon (FL), aerated lagoon (AL),

conventional activated sludge (AS), activated sludge with extended aeration (ASEA), and sequencing batch reactor (SBR).

The Filtering Gardens® present values around 4 times lower than the average of the conventional wastewater treatment, which is 115,4 tCO2eq/year. It is important to remark that energy indirect emissions were calculated for the Filtering Gardens® but were not accounted in the values of the conventional technologies, what makes the Filtering Gardens® even more advantageous. Therefore, the Filtering Gardens® have potential to generate on average 105 carbon credits/year, helping the technology's investors to shorten the payback time linked to the investment in this solution

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Company (es) Website :

Contest

Reasons for participating in the competition(s)

WATER CYCLE
The Filtering Gardens® treat sanitary/industrial effluents and rainwater through totally natural processes, without addition of products harmful to the environment. The result of the treatment is the generation of volumes of clean water that can be reused in various building activities, such as irrigation, floor washing and toilet flush. This reduces the consumption of water from public system and eliminates the pollution of rivers and lakes through the discharge of sewage.
BIODIVERSITY & ECOSYSTEMS
The Filtering Gardens® recreate natural areas, such as the wetlands, providing for the establishment of communities of amphibian, avian and insect fauna that find refuges and breeding habitats in planted filters. In addition, the Filtering Gardens® for the L'Óreal R&I Center was designed containing only native plant species from Brazil, valuing the local flora and showing the richness of the country's biodiversity.

Building candidate in the category

Users' Choice

Sustainable Infrastructure Grand Prize

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