



Landscaping project produces a sustainable rain garden

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The construction of the new Mining Industry Study Centre, immediately west of the Engineering 1 Building, revealed the opportunity for a unique landscaping project, which is one of only a few in the world. This centre is utilised by students who live far from the campus and do not have adequate facilities for study purposes or for groupwork.

With the planning of the study centre facilities for study purposes or for groupwork, the professional team decided to integrate a rain garden into the design of the new building that would use stormwater to create a habitat for a number of fauna and flora species.

Design considerations

The site consisted of a severely degraded space and roads older than 60 years with impervious surfaces. These surfaces resulted in very poor soil conditions. The area is used extensively by blind students and with the new entrances from the drop-off-and-go facility to the campus and the study centre itself, pedestrian traffic in the area would also increase.

The new building has a large roof of 1700 m², which placed considerable pressure on the existing overloaded stormwater infrastructure. The space also needed to address the requirements of the increasing

number of students at the University. The engineering lecture facilities under the study centre were not waterproofed and a cost-effective solution was required to resolve this. From a design perspective, the symmetry of the buildings was to be retained.

Opportunities

The site had a number of existing trees that are protected by South African legislation, which were all incorporated into the design. The landform and geology of the site allows for the collection, storage, cleaning and re-use of stormwater. As a result, habitats have been created and the microclimate manipulated to establish various species of fauna and flora. The landscape design showcases the progression of the various professions involved and is an example of a functional, cultural and aesthetic landscape, as well as a living laboratory for research purposes.



Constraints

The natural water cycle was short-circuited because the evaporation, transpiration and infiltration of water were limited due to impermeable surfaces. Natural infiltration was not possible due to the lack of waterproofing of the lecture halls. Level changes and narrow walkways, which presented challenges for disabled users, also had to be considered. The implementation of symmetry, while retaining existing elements and the character of the building, was an important consideration for the final design. The poor soil conditions due to the impervious surfaces of the roads and the acidification of the soil due to the pine trees that had been planted over the years also posed a challenge to the final design of the project.

Theory

The landscape design followed the principles of the Sustainable Sites Initiative (SITES), especially with regard to stormwater management and recycling. SITES is an interdisciplinary effort in America that aims to create voluntary national guidelines and performance benchmarks for sustainable land design, construction and maintenance practices.

The design team comprised Neal Dunstan (the University's resident landscape architect) and Jason Sampson (Curator of the Manie van der Schijff Botanical Garden on the Hatfield Campus). They studied the theories of Prof Nigel Dunnet, who specialises

in planting design and vegetation technology at the University of Sheffield in the United Kingdom, as well as those of Andy Clayden, a senior lecturer in landscape architecture at the same university. The design revolves around the concept of a rain garden, which can be defined as an engineered combination of specially selected plants, soil and mulch, designed to collect, retain and clean rainwater that runs off impenetrable surfaces, such as parking lots and rooftops. The benefits of rain gardens include habitat creation, reduced energy usage, pollution control, microclimate manipulation, establishing a sense of place and distinctiveness, developing visually stimulating and dynamically built surroundings, and establishing environmental stewardship.

Project description

To resolve the issues of the waterproofing and the inadequate

stormwater infrastructure, estimated to cost R8 million if resolved by conventional means, an ultra-violet stable ethylene propylene diene monomer (EPDM) rubber liner, manufactured by Firestone Building Products, was selected to contain the water and prevent water seepage to the lecture halls. EPDM is a synthetic elastomer produced as a co-polymer of ethylene and propylene, with small amounts of a pendant diene (double bonds) in order to cross-link the material. The liner, installed by Belgro Landscaping, was a technical challenge due to the variety of geometric and organic shapes to which it needed to be applied. As a result, the technical director of Firestone EPDM visited the site to render advice and draw up application specifications. This resulted in a variety of changes to the design, the majority of which led to a more viable and cost-effective solution.

A total of 145 aquatic and terrestrial plant species were used in the spaces in and around the system. The foliage is meant to complement and facilitate the bioremediation potential of the system and keep the water clean, as well as soften the hard lines of the building and create a habitat for wildlife.

This is the University's first project that truly merges landscape and building, and is one of a few buildings in the world where a rain garden system has been integrated in a building.

A layer of clay-rich soil-growing medium, which was sourced from the University's Health Sciences Campus, was put on top of the liner. All compost supplied for the project was obtained from the University's waste recycling and composting project. The cost for this phase of the project amounted to around R1,6 million.

The stormwater system

The system revolves around the collection of stormwater from the roof of the Mining Industry Study Centre and surrounding hard surfaces into vegetated swales. From there, the cleaned water flows into a permanent pond and from there into "tidal ponds". The latter are designed to flood in the rainy season and to be partially dry during the dry season. All excess water from these ponds flows into a 130 m³ tank positioned under the staircase and ramps on the western side of the study centre.

This water is used for the irrigation of the University's Manie van der Schijff Botanical Garden. Water from the tank is also circulated through the entire system so that the water is never static. The total capacity of the pond system (excluding the tank) is approximately 550 m³.

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The surrounding areas will also house the University's collection of tropical African cycad species (*Encephalartos*). A suitable microclimate has been created to support the plants. At last count, 56 specimens of 22 species have been planted.

The soft landscaping installation was done by Origin Landscapes. Soft landscaping is the process of designing the elements of a landscape that do not involve construction. The range of soft landscape materials includes each layer of the ecological sequence: aquatic plants, semi-aquatic plants, field layer plants (including grasses and herbaceous plants), shrubs and trees.

Existing building materials were re-used as permeable paving, cladding for walls in the ponds, and energy breakers for the stormwater entering the system. New paving blocks from Bosun were sourced from waste material from platinum mining operations. These paving blocks were selected to assist visually impaired users by means of textural changes in the paving, which produce sounds as they tap their canes. All of the rock used in the project was sourced from project excavations on site and from a construction project in Groenkloof.

The customised grooved clay bricks that had previously clad the walls were also retained and used for the funneling of stormwater into the landscape, and to retain the site's heritage value. In order to contain and also prevent access to the deepest water bodies, seating walls

were constructed in organic forms to assist the visually impaired with unobstructed movement. Subtle, low-level LED lighting was added to these walls, also to assist with unobstructed movement.

The lighting in the landscape was reduced to a minimum so that it does not interfere with the natural day-night cycles of the plants, frogs and Tilapia fish, which were introduced into the system for ecological and research purposes by the Curator of the Manie van der Schijff Botanical Garden and the Department of Zoology and Entomology in the Faculty of Natural and Agricultural Sciences.

Significance

This is the University's first project that truly merges landscape and building, and is one of the very few buildings in the world where a rain garden system has been integrated with a building. The project team has received invitations to present papers from the Ruth Bancroft Botanical Garden and the International Sustainable Campus Network (ISCN) in the USA. The project will also be published in at least three local journals within the next few months, and will be entered into the ISCN and Institute for Landscape Architecture in South Africa (ILASA) awards of excellence.

Landscaping is no longer beautification, but an essential functional and value-adding instrument in solving the many challenges that not only the University, but the urban environments face, working towards the principles of a "resilient city". 🌱



