Water sensitive design

at the Auckland Botanic Gardens

Introduction

The Auckland Botanic Gardens (the Gardens) are committed to a sustainable water approach to land management. This approach started after an unfavourable environmental audit of the Gardens' lakes in 2008 which highlighted poor water quality with algal blooms, high water temperatures and high nutrient levels. Cleaning up the lakes required treatment of all 16 hectares of land, including waterways, around the lakes catchment. This included large volumes of stormwater piped into the Gardens' waterways from the surrounding neighbourhood and the nutrient-laden irrigation water flowing into the lakes from the nursery. Large amounts of nutrient had also built up in the lake waters from duck defecation and bread fed to the ducks by visitors. Bringing our visitors on board was critical.

Working with the (then) Auckland Regional Council's stormwater and community education teams and consultants MWH and Aqua Terra Ltd, a sustainable water plan was created for the lakes catchment, covering stormwater treatment devices, and water-use minimisation procedures. The treatments chosen were as naturally and environmentally based as possible, using the minimum amount of hard infrastructure. This approach and its implementation was technically peer reviewed by Stormwater Technical Services to ensure it would meet the expected treatment outcomes. The Gardens' visitor centre staff also led a campaign to reduce the amount of duck feeding around the lakes and promote the use of grains as duck food, rather than bread.

The stormwater treatment devices are now all in place and have resulted in improved water quality, increased ecological value, increased native fish habitats and increased visual appeal.

The opportunity to engage the wider community within the project was taken, and a joint project with the stormwater team and the Gardens saw the creation of an educational Sustainable Water Trail. The trail was launched in March 2012, showcasing the culmination of five years of environmental improvements at the Gardens. The 1km walking trail through the Gardens inspires visitors and raises the awareness of stormwater issues and their solutions.

What is sustainable water management?

Stormwater generation is concentrated within built-up areas such as cities, where rain water cannot be absorbed into the ground due to the amount of hard surfaces (like roads and roofs). Typically this water is collected and piped underground to streams, where it flows on to sea. Stormwater is a major source of pollutants like sediment and petrochemicals and its velocity causes stream and beach damage.

Typically there is low public awareness of the negative impact of stormwater on the environment, and ways to decrease its effects.

Sustainable water management (also sometimes call Low Impact Design or Water Sensitive Design) is a design approach to manage the effects of stormwater and its contaminants. It focuses on ‘at source’ management of stormwater, decreasing stormwater generation, slowing its flow, and removing contaminants. In other words sustainable water management is about keeping storm water on land and using plants to slow the flow of stormwater to natural water bodies such as streams and the sea, and use plants to help remove contaminants. A range of devices can do this, usually designed to suit the site. The devices commonly use natural materials such as plants, ground contours, rocks, sand, gravel and growing mediums to slow the flow of stormwater and clean it up.

Innovation

Stormwater treatments at the Gardens also have a positive effect downstream, with better quality water flowing out of the Gardens, into the Puhinui Stream and on to the Manukau Harbour.

The Auckland Botanic Gardens now represents the best site in Auckland for viewing a range of stormwater treatments, offering a ‘pick and mix’ selection of devices for stormwater technicians and industry professionals to view. Purposely, a wide variety of devices were installed. For example the Gardens has four different types of swale – a wetland swale, a grassed swale, a vegetated swale and a gravel swale. All are used to convey stormwater for further treatment, but all are planted to suit their sites and to showcase their differences.

In order to assist the progress of these approaches in New Zealand, the Gardens has used technology that is new to the country, such as a buried ‘tree pit’, which treats stormwater with plants and soil and underground chambers. The tree pit is a design prototype and how it functions onsite allows industry to determine its value and potential application.

Growing conditions within stormwater devices can be challenging for plants, due to large fluctuations between wet and dry. Trials of plant species such as edible native plants and a variety of exotic succulent species on our living roofs is providing valuable information to Landcare Research, Auckland University, and the stormwater industry.

Trials of soil depth on the retro-fitted living roof within the Gardens’ Edible Gardens provide feedback to industry suppliers for design and functioning improvement.

Sustainable Water Trail sign

Living roof letterboxes made by visiting school groups

Community engagement

The Auckland Botanic Gardens gets over one million visitors annually, representing a wide cross section of Aucklanders, and local and international tourists. Aside from environmental benefits, improving the Gardens' lakes water quality was essential for maintaining the high visual appearance of the Gardens and therefore contributing to high visitor satisfaction.

To create innovative and best-practice stormwater devices, the Gardens and Auckland Regional Council stormwater team worked with the stormwater industry, including private consultants and Landcare Research and Auckland University staff, and sought leading expert advice and peer review opportunities.

Interpretation of the stormwater treatments on the Sustainable Water Trail provides visitors with an educational opportunity and appeals to a range of visitors including home owners, students and engineering and design professionals.

For the Sustainable Water Trail to capture visitor attention the signs are positioned at easy reading height (for those standing or seated) and are located, where possible, within reading distance of paths. Signs and associated brochure and web pages are simply written and free from technical jargon with detailed illustrations provide back-up technical information. All of the interpretive material was technically peer reviewed. The signs are written to make sense even if only one sign is read, so the whole trail does not have to be walked to take some useful information away.

To create knowledgeable ambassadors on site, all Gardens staff and 30 of the Friends of the Auckland Botanic Gardens volunteers were guided around the trail by a stormwater educator, advising them of the key benefits of each device. Visitors can book free guided walks of the trail, and also ask any staff member that they come across about the topic.

Environmental educators from Auckland Council's Environmental Services department deliver educational programmes to thousands of school children at the Gardens every year. They have created new programmes that include stormwater messages, like making living roof letter boxes. The topics are proving popular with our younger visitors.

Annual stormwater industry educational seminars for consultants and contractors have been held at the Gardens. The site offers a unique opportunity to discuss current technology, new findings and best practice in the presence of working examples. Attendance at these events has grown over the years with approximately 400 people attending the last industry field day. Working in partnership with the stormwater industry has resulted in a stronger relationship between the council and the sector.

Clearing lake sediment prior to water improvements

Fantail attracted by insects on living roof

School group exploring the lakes

Excellence

The Auckland Botanic Gardens is now a nationally recognised ‘one stop shop’ where people can see a range of stormwater devices in one location and set up within a catchment context.

Staff at the Gardens have extended their operational knowledge and become familiar with technical devices such as green roofs, swales, a tree pit and an infiltration trench, adding another facet to the Auckland Botanic Gardens horticultural, scientific and amenity value. In doing this, the Gardens has successfully raised awareness of stormwater issues and sustainable water treatment solutions and continues to share its learnings with the industry and the public.

The Gardens is interested in what grows well, self sustains its own population and looks good in a garden setting. For example a variety of succulents, bulbs and native plants are being trialed on the Gardens three living roofs. This is carried out in partnership with Landcare Research and the University of Auckland.

Now that the catchment around the lakes has been thoroughly dealt with, further stormwater treatments are being put in place in other areas of the Gardens. The most recently installed is a rain-garden, treating surface run-off from the Gardens’ main car park. Once interpreted, this device will help raise awareness of the contaminants created by commuting.

The rain-garden has been built to meet the Auckland Council’s new stormwater guidelines (GD 01). This treatment will help prevent vehicle contaminants reaching the spring-fed stream beyond the Gardens library. It is a well-timed development as a recent survey has shown that the native fish, banded kokopu, is now present in the stream.

Living roof toilet block and vegetated swale form a small ‘treatment train’ of connected treatment devices.

Achievement

The main objective of installing a series of stormwater devices in the lakes catchment, which was to capture the bulk source of contaminated water (from the nursery and inflowing stormwater) and reduce pollution from ducks, has been achieved, with nutrient and sediment loads decreased in the lakes and the lakes remaining free of algal blooms.

All of the stormwater treatment devices were designed and constructed in accordance with Auckland Council’s TP10 Design Guideline Manual for Stormwater Treatment Devices, and hence have known minimum treatment efficiency when installed correctly and maintained. The riparian plantings were undertaken within the Auckland Council’s Riparian Management Guidelines TP148. The Gardens is

committed to making further water quality improvements and more stormwater treatment options are being investigated.

Paramount to remaining focused on lake water quality and seeking continuous improvement is that visitors enjoy using a garden that has good quality lakes. The lakes are a popular location for picnics, walks, and as a backdrop for wedding photography.

The sale of duck food from the visitor centre has been maintained and regular visitors are familiar with the rules around duck feeding. Some regular visitors even advise other visitors of the rules, and have been observed sharing their bags of duck food with visitors they come across using bread. This secondary sharing of our messages shows that the reasons for our rules are being respected and understood.

Although not all the stormwater devices are applicable for everyday situations for home owners (some are examples of civil sized treatments rather than domestic), they familiarise visitors with large scale treatments that they may come across in their everyday lives alongside motorways or in large car parks, for example. This is aligned with the council stormwater team's aim of raising awareness of stormwater issues and solutions in the Auckland region.

The Auckland Botanic Gardens' byline is 'Where ideas grow'. This is clearly underpinned by the innovation shown by this series of initiatives; the recognition from the environmental sector and the public at large as a respected leader and champion of sustainable water management and the ideas and inspiration offered to visitors.

The primary objective of the Gardens is to promote plants that grow well in the Auckland region and every opportunity has been taken to highlight these plants in the treatment devices. Lastly, the devices look good too! Not only are they excellent working examples that demonstrate a range of natural habitats, these treatments are visually appealing and have high amenity value – which is important to any botanic gardens.

Creation of the wetland swale, below the nursery

A vegetated swale conveys treated stormwater to the lake

Recycled nursery irrigation water

Efficiency and effectiveness

Some of the installed devices decrease the Gardens' water consumption, such as the recycling of nursery irrigation water, the visitor centre use of rainwater for toilet flushing and the running the nikau water feature.

There has been a considerable reduction in the Gardens' water usage since the nursery began to reuse water. This is continuously measured by the council's Environmental Services field team.

Many structures improve with passing of time, as plantings mature and the root systems develop. For plant replenishments the Gardens on-site nursery can supply replacements.

As a result of improving the water quality of the lakes, sediment no longer builds up quickly within them, avoiding potentially costly lake dredging projects.

Those structures that will need to be dredged for sediment have had that need factored into their design. For example, the sediment forebay, which is a large pond-like area for collecting sediment from stormwater, was designed to be easily maintained (with a gentle slope created around it so diggers can access the waters edge easily to remove sediment that builds up over time).

The Sustainable Water Trail has a relatively low yearly expense for brochure printing.

The Gardens' is developing an on-line strategy for visitor engagement, including QR code downloads, social media and website development. Should budget restrictions prohibit the printing of the Sustainable Water Trail brochure, and the use of smart phones continue to increase significantly, this supporting information could be based online.

Visitor Centre water feature is fed by rain collected off the roof

A beautiful display of bulbs and succulents trialled on the Potter Children's Garden living roof

Sustainability

Achieving environmental sustainability is a key aim of this project. The Gardens has achieved significant improvements in its water quality, increased habitat for native birds, fish and insects, and achieved a reduction in water use. As for the long-term effectiveness of the stormwater treatment devices, they require little or no maintenance. Maintenance schedules have been developed and implemented for each device to ensure they continue to work efficiently. In fact many of the devices will improve with the passing of time, as the plantings form self-sustaining ecosystems. Other structures will simply need growing medium replacing, or sediment removed. The structures were also 'over-designed' to cope with an increase in stormwater volume flowing into the Gardens should development in neighbouring areas cause this.

The Sustainable Water Trail inspires visitors, including home-owners, students and professionals, and allows them to gather information to help make their own lifestyles more sustainable.

The Gardens has taken into account the long-term viability of the Sustainable Water Trail. The sign bases are recyclable aluminium and steel, with sign-faces able to be recovered should the signs deteriorate or need updating.

Supporting information (in the brochure and website) can be easily updated; allowing for information to always be current, correct and relevant.