



Introduction

Filtterra® is a biofiltration stormwater treatment device. It treats stormwater runoff using a similar mechanism to traditional Rain Gardens, which utilise plants and media to remove pollutants from stormwater runoff. The media used in Filtterra® is specifically engineered to have an infiltration rate approximately ten times higher than a traditional rain garden. Therefore, for treatment of a specific catchment area, the footprint of Filtterra® biofiltration media is approximately one-tenth of a traditional rain garden.

Achieving greater than 75% TSS removal, the Filtterra® system has been approved by multiple regional, district, and city councils around New Zealand. There are more than 200 units installed and operational in New Zealand at the time of writing this report.

Understanding Life Cycle Costing

The life cycle cost of a system is the sum of the acquisition and ongoing ownership costs of an asset. This includes design, construction, usage, maintenance and disposal, as illustrated in Figure 1.

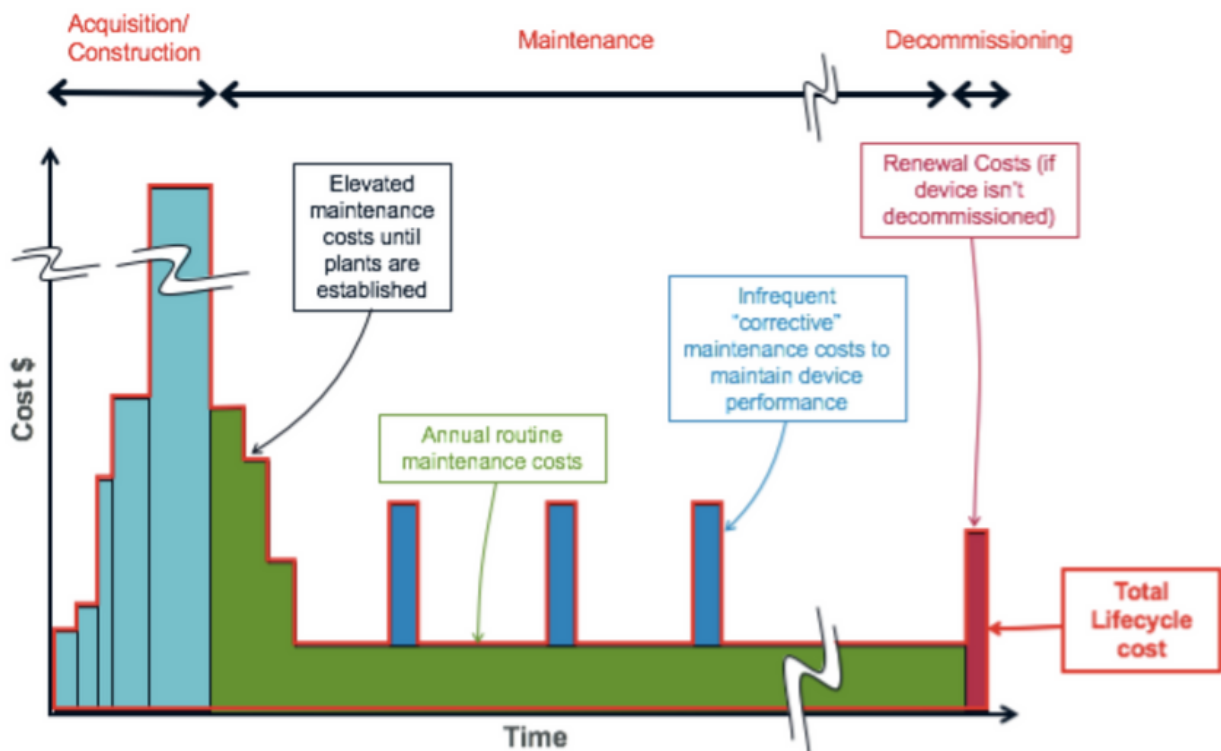


Figure 1 Illustration of an assets Life Cycle Cost showing in time versus costs.

Stormwater 360 approached an independent life cycle expert, Koru Environmental Consultants Ltd, to develop a Life Cycle Cost (LCC) analysis for the Filterra® system.

Some of the key benefits of the Life Cycle Costings are:

- Improved understanding of long-term investment requirements.
- An ability to make more cost-effective choices at the project scoping phase.
- An ability to better understand long-term financial risks.
- An understanding of relative costs between two or more management options without requiring costly detailed engineering assessments.

Filterra® Life Cycle Costing Model

The Filterra® system LCC model is based on the following assumptions:

- A 50-year life cycle.
- Total Acquisition Cost (TAC)
 - The TAC is defined as the design, planning, consenting and construction costs for a device.
 - The TAC for the Filterra® system comprises the supply cost plus 45% of the supply cost to account for installation, overhead and indirect costs.
- Land use development factor (LUDF)
 - The LUDF is a cost adjustment factor applied to the TAC based on the site land use (i.e., greenfield, brownfield or retrofit). As an example, the LUDF assumes construction costs for a retrofit would be the costliest.
 - A greenfield LUDF has been applied to the Filterra® LCC model.

- Filterra® maintenance includes six monthly mulch replacement. Media replacement should not be required if the mulch maintenance is carried out, however, a provision for media replacement and corrective maintenance has been included to account for unforeseen circumstances, such as extreme weather events or vandalism.
 - The first year of maintenance costs are not included because the first year of maintenance is carried out by Stormwater360 and is included as a part supply of the Filterra® system.
- Renewal and decommissioning costs
 - The LCC of a system typically includes a decommissioning cost, however green infrastructure is unlikely to be decommissioned. Therefore, it is assumed the system will be renewed and upgraded to allow the device to function for a second 50-year life term.
- Base date for all costs is 2021.
- A discount rate of 4% was applied to the LCC
 - The discount rate (DR) is used to bring future costs back to today's dollar values. By discounting the costs, we are able to determine the total sum that would need to be invested now in order to meet the required costs over the total life cycle.
- The LCC model does not include an inflationary component.
- All costs are in \$NZ and are excluding goods and services tax (GST).



Filterra® Life Cycle Costing Results

The LCC for a Filterra® system with a media footprint of 8.4m² to treat 2000m² was modelled at a greenfield development over the 50-year design life. The results gave a Net Present Value (NPV) of \$50,850.

An analytical comparison between the Filterra® system and a conventional Rain Garden was performed by Koru Environmental as part of the LCC analysis. The conventional Rain Garden was sized as 2% of the catchment area in accordance with GD01 design guide for water quality treatment. Therefore, for the same catchment area of 2,000m² the Rain Garden media footprint was 40m². Assumptions used in the LCC for the conventional Rain Garden were consistent with those used for Filterra® and Auckland Council's Freshwater Management Tool. Results are shown in Table 1.

The comparison showed the Filterra® system to be more cost effective than the conventional Rain Garden. For treatment of an impervious 2,000m² catchment at a greenfield development, the 50-year NPV LCC for a conventional rain garden was \$109,589. When compared to the Filterra® system in the same model, which gave an NPV LCC of \$50,850, the LCC for a Filterra® system is less than half of that for a conventional Rain Garden.

Table 1 Comparison of average indicative estimate LCCs for Filterra® and Rain Gardens (2% surface area) for a range of catchment areas over a 50-year life cycle with a 4% discount rate.

LCC Trends- Catchment area (excludes land costs; 2% RG surface area)	Average LCC\$/m ² catchment area treated per year	
	Filterra®	Rain Garden
2000m ² Catchment area	\$0.51	\$0.80
1444 m ² Catchment area	\$0.55	\$0.87
1155m ² Catchment area	\$0.65	\$0.94
578 m ² Catchment area	\$1.01	\$1.28

Table 2 Comparison of average indicative estimate LCCs for Filterra® and Rain Gardens (3% surface area) over a 50-year life cycle and a 4% discount rate, excluding land costs.

LCC Trends- Scenarios for a 2000m ² area; 3% RG surface area (excludes land costs)	Total NPV LCC		Average LCC\$/m ² catchment area treated per year	
	Filterra®	Rain Garden	Filterra®	Rain Garden
2000m ² Catchment area Greenfield	\$50,850	\$109,589	\$0.51	\$1.10
2000m ² Catchment area brownfield	\$66,981	\$123,689	\$0.67	\$1.24
2000m ² Catchment area retrofit	\$83,112	\$137,789	\$0.83	\$1.38



Commercial, Westgate

Multiple scenarios with different site conditions were run through the LCC model. Scenarios included greenfield, brownfield and retrofitted land use development factors. As shown in Table 2, the LCC model repeatedly found the Filterra® system to be more cost-effective than the traditional Rain Garden. It is worth noting that there are additional costs avoided with the Filterra® in terms of the supply methodology, construction protection, and compact size. Unfortunately, these costs could not be quantified within the LCC model but will most likely result in further cost saving than is shown by the study when comparing a Filterra® project to a conventional Rain Garden project.

The LCC scenarios in Table 1 and Table 2 do not consider the land cost for the installation of the bioretention systems. The Filterra® system has the advantage of needing one-fifth of the land area required for the GD01 conventional rain garden system. Therefore, in dense urban areas where land comes at a premium price and space is limited, the Filterra® system can be retrofitted into smaller spaces. Scenarios where the land cost was included in the LCC are presented in Table 3. Results show the 50-year NPV LCC for the Filterra® system and conventional Rain Garden as \$56,310 and \$148,589, respectively.

Table 3 Comparison of average indicative estimate LCCs for Filterra® and Rain Gardens (3% surface area) over a 50-year life cycle and a 4% discount rate, including land costs.

LCC Trends- Scenarios for a 2000m ² area; 3% RG surface area (includes land costs)	Total NPV LCC		Average LCC\$/m ² catchment area treated per year	
	Filterra®	Rain Garden	Filterra®	Rain Garden
2000m ² Catchment area Greenfield	\$56,310	\$145,589	\$0.56	\$1.49
2000m ² Catchment area brownfield	\$82,941	\$237,689	\$0.83	\$2.38
2000m ² Catchment area retrofit	\$99,072	\$251,789	\$0.99	\$2.52

Table 4 NPV LCC for the smallest and largest Filterra® systems, with cost per square meter of catchment area treated.

Cost Type and Unit Size	NPV LCC for FT1212 (366m ² catchment)	Cost/m ² catchment area treated	NPV LCC for FT4021 (2,246m ² catchment)	Cost/m ² catchment area treated
Total Acquisition Cost	\$16,187	\$44.23 /m ²	\$32,262	\$14.36 /m ²
Discounted Routine Maintenance Cost	\$6,629	\$18.11 /m ²	\$9,723	\$4.33 /m ²
Discounted Corrective Maintenance Cost	\$3,337	\$9.12 /m ²	\$5,930	\$2.64 /m ²
Total Discounted Maintenance Cost	\$9,966	\$27.23 /m ²	\$15,652	\$6.97 /m ²
Total Discounted (NPV) life cycle cost Over 50 years life	\$26,153	\$71.46/m ²	\$47,914	\$21.33 /m ²

Table 4 shows LCC costing for the smallest Filterra® system and the largest Filterra® system. The smallest model Filterra® system (FT1212) was calculated as treating 366m² of impervious area, and the largest model of Filterra® system (FT4021) as treating 2,246m² of impervious area. The LCC as NPV cost per square meter of catchment is also presented.

Results show the NPV LCC cost is directly proportional to the Filterra® system size and catchment area, hence the larger system and catchment area have a greater cost overall. However, the economy of scale significantly reduces the treatment cost per square meter, from \$71.46/m² to \$21.33 /m², when employing a larger system for a larger treatment area for 50 years. This is consistent throughout the LCC model scenarios and demonstrates larger systems are more cost-effective than multiple smaller systems for the treatment of larger catchment areas for the 50-year design life of the asset.

Disclaimer

Please bear in mind that LCC is a site-specific assessment. Taking the number from this document may not reflect the true LCC of the Filterra® system for your site. Stormwater360 will provide assistance with Filterra® LCC for your site free of charge.

Please contact us at 0800 STORMWATER or email us at sales@stormwater360.co.nz if you would like the full Filterra® LCC report or would like an LCC analysis for your Filterra® site.



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