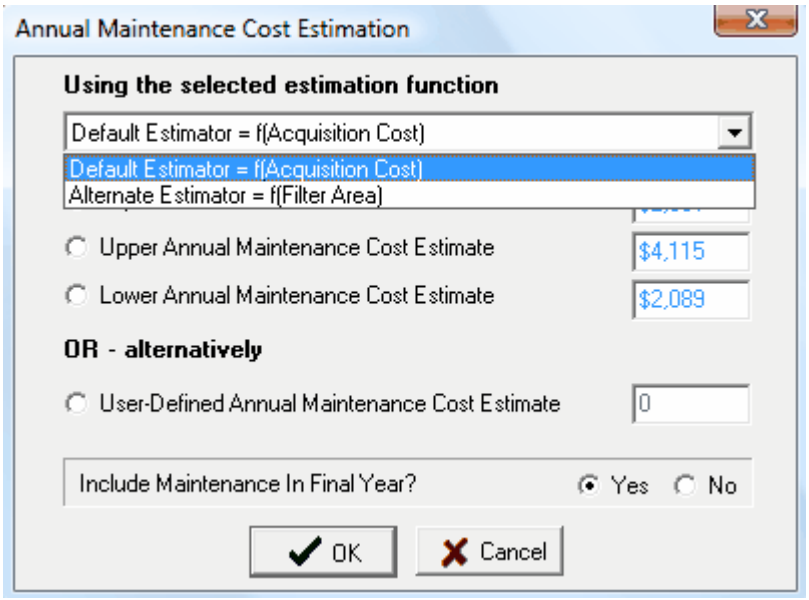
Bioretention Systems Costing (Costing)

The process for undertaking a life cycle costing analysis for bioretention systems is essentially the same as described in Life-Cycle Costing - Constructed Wetlands. The only additional step is that users have a choice of cost / size relationships when estimating a typical annual maintenance cost (i.e. one based on the total acquisition cost and the alternative based on the surface area of the bioretention system). The recommended option is labelled "Default". Users should choose one of these relationships from the drop-down menu at the top of the annual maintenance cost estimation screen as shown below.



The origin of all of the 'expected' values and algorithms in MUSIC's costing module, as well as the statistical operations used to generate 'upper' and 'lower' estimates for bioretention systems are explained in Table 1.

Table 1 Summary of cost-related relationships for bioretention systems.

Element of Life Cycle Costing Model	Default Option for Estimation in music	Alternative(s)	Notes
Life cycle	50 years (Expert judgement)	25 years (From collected survey data, n = 6)	One could convincingly argue the life cycle is infinite for well-maintained and 're-set' bioretention systems, but we need to set the life cycle to a finite number to calculate a life cycle cost. Expected, upper and lower estimates based on expert judgement.
Total acquisition cost (TAC)	TAC ($2004) = 387.4 x $(A)^{0.7673}$ R^2 = 0.59; p = 0.04; n = 7 Where: A = surface area of treatment zone in m^2.	No alternative size / cost relationships in music. For literature values, see Taylor (2004) - Included in Appendix H.* (Note in particular some recently obtained unit rates for three types of bioretention systems from SE Qld that should be carefully considered.)	**Warning:** This algorithm derives from a combined data set involving bioretention systems *and* vegetated swales, as there was insufficient data to analyse bioretention systems on their own. Upper and lower estimates derived using a 68% (or 1 standard deviation) prediction interval for the regression. "Treatment zone" refers to the filter area of the system (not the storage area). Note however that the estimated TAC relates to the *whole* bioretention system, not just the filter area.

Typical annual maintenance (TAM) cost	TAM ($2004) = 48.87 x $(TAC)^{0.4410}$ R^2 = 0.94; p = 0.03; n = 4	TAM ($2004) = 4.610 x (A) + 2500 R^2 = 0.65; p = 0.19; n = 4 Where: A = surface area of treatment zone in m^2. For literature values, see Taylor (2005b).*	**Warning:** Default size / cost relationships for TAC, TAM, and RC derive from a combined data set involving bioretention systems *and* vegetated swales, as there was insufficient data to analyse bioretention systems on their own. Upper and lower estimates derived using a 68% (or 1 standard deviation) prediction interval for the regression. In approximate terms, TAM 4.4% of TAC (for the combined swale / bioretention system data set). **Note**: The high (> 0.05) p value, associated with the *alternative* algorithm. This algorithm is derived from a data set *only* including bioretention systems. This p value indicates there is a ~19% chance that the regression relationship is a product of random variation (i. e. chance).
Annualised renewal / adaptation cost (RC)	RC ($2004) = 2.0% of TAC p.a. n = 3	No alternative size / cost relationships in music. For literature values, see Taylor (2005b).	Upper and lower estimates derived using a 84th and 16th percentile, respectively.
Renewal period	25 years n = 6	No alternative in music.	There is great uncertainty surrounding this period (and the associated RC), given the lack of experience in corrective maintenance associated with bioretention systems in Australia (e.g. replacing the infiltration media and landscaping).
Decommissioning cost (DC)	DC ($2004) = 39% of TAC n = 1	No alternative size / cost relationships in music.	**Warning:** Only one set of data was available.
General caveats / notes for this type of device	* There are several estimates of capital and maintenance costs reported in the literature for bioretention systems in Australia (see Taylor, 2005b or Appendix H for a summary). The typical annual maintenance cost is an average over the bioretention system's life cycle, so MUSIC's life cycle costing model does not simulate elevated maintenance costs in the first few years of the asset's life. It is likely that elevated maintenance costs typically occur in the first few years.		