enviss™

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Enviss Media Systems

MUSIC Modelling Guide

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Copyright Notice

Legal Information

The tear drop device and Enviss are trademarks of Envirostream Solutions Pty Ltd.

The following patent applications protect aspects of the Enviss solution:

- » Australian provisional patent application 2009903796
- » International patent application PCT/AU2010/001036
- » US provisional patent applications 61/315134, 61/377677

1 Introduction

Modelling of stormwater treatment systems is an important design stage to determine the required system size and level of performance. Enviss treatment filters can be modelled using the industry standard MUSIC software or envissDT, a custom built software tool designed for use with Enviss filters.

This document outlines the method used to model treatment systems that use Enviss media filters. This includes the Enviss Sentinel range of pits and Enviss High Flow media.

2 MUSIC Modelling

Enviss media filters are modelled in MUSIC using generic treatment nodes to reduce nutrient levels in stormwater flows to match results from the extensive tests run at Monash University. Generic nodes are available in MUSIC version 3, 4 and 5 so this method is compatible with all commonly used versions of the software.

2.1 Method

Insert a generic treatment node into your model by selecting 'Generic' under the treatment nodes menu (Figure 1).
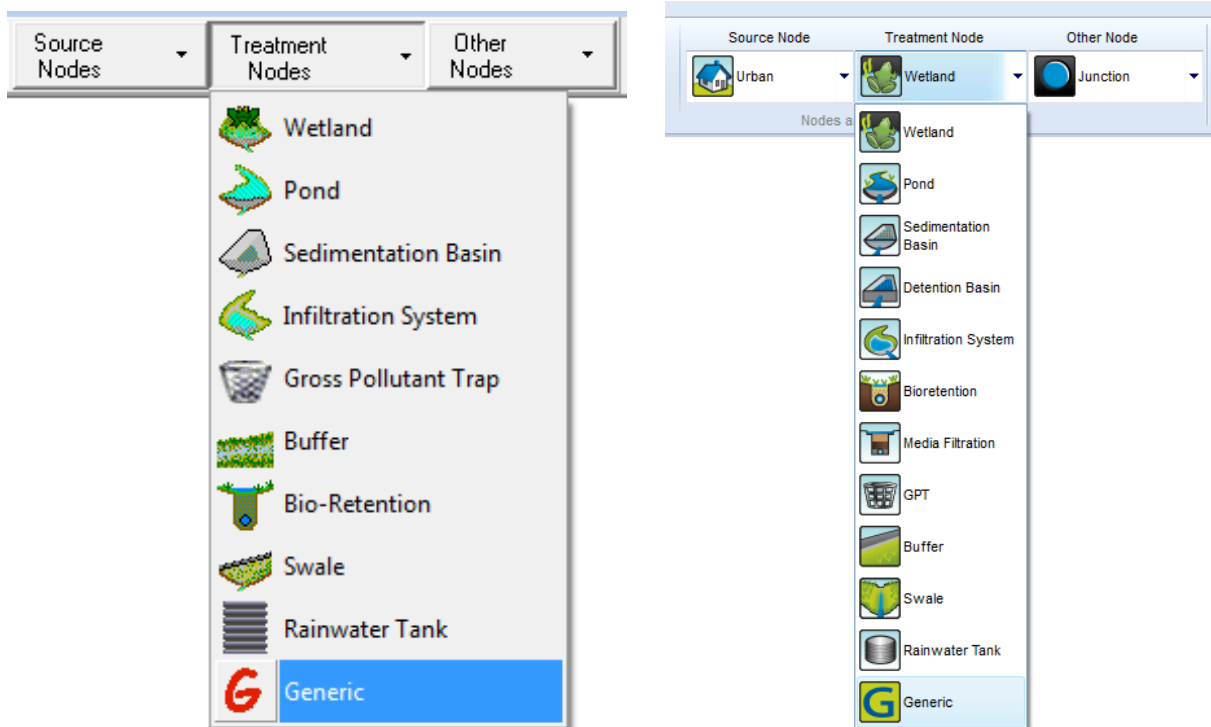

Figure 1 - Treatment nodes menu in MUSIC v3 (left) and v5 (right)

When the node is created the node properties dialog is displayed (Figure 2). There are several changes that need to be made in this dialog.
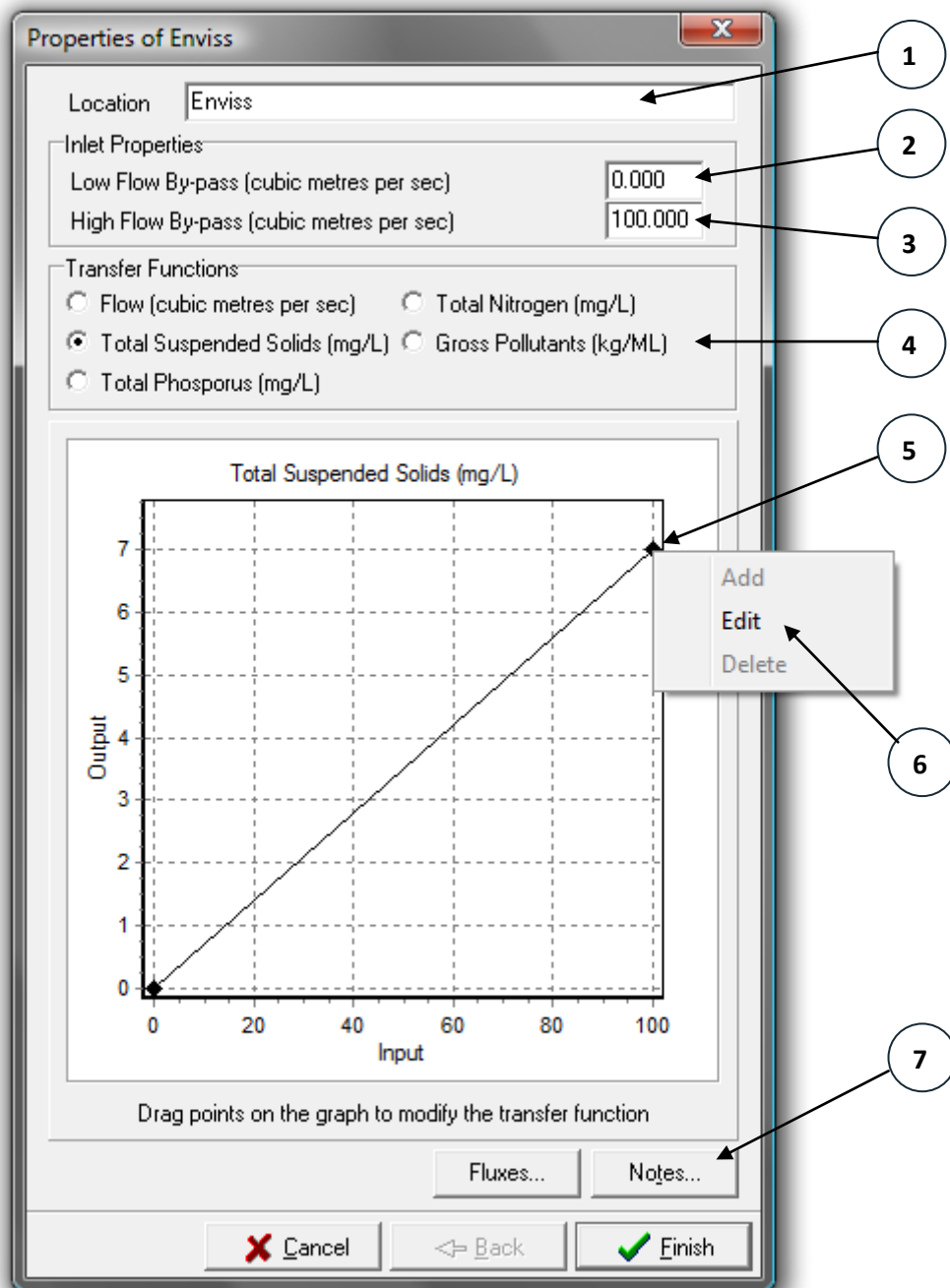

Figure 2– MUSIC generic treatment node properties dialog

The first is to add a location name (1) to the node so that it can be recognised later as an Enviss treatment node.

The next step is to change the high flow bypass (3) to the maximum flow rate through the filter. This will divert above-design flows around the node without treatment. The low flow bypass (2) should be left at $0m^3/s$. The value for the high flow bypass is calculated using the equation

$$Q_p = AP$$

Where Q_p = maximum flow rate through the filter (m^3/s)

 A = area of the Enviss filter (m^2)

 P = infiltration rate of the filter (m/s)

For standard filter media the design infiltration rate is 2000mm/hr which is equal to 5.56×10^{-4} m/s. The area of the filter can be found in a number of ways:

» using the envissDT modelling tool (contact Enviss for more details)
» selected to meet a target flow rate through the media
» trial and error modelling in MUSIC

Once the flows have been entered the transfer functions (4) need to be defined for each of the pollutants. The flow transfer function does not need to be modified as flows have been limited by the high flow bypass.

The pollutant functions are defined by first selecting the pollutant in the transfer functions section (4) and then right clicking the right most data point on the graph (5) to display the data point menu. Clicking edit will display the edit point dialog (Figure 3) which allows the coordinates to be entered.
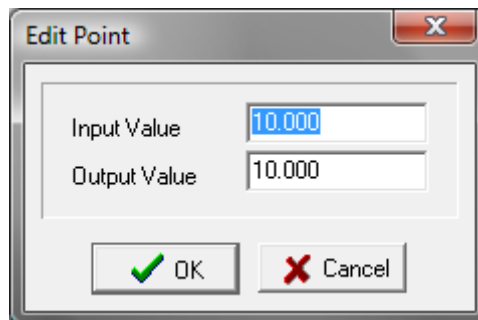

Figure 3 - Edit point dialog

The output value for each pollutant will depend on the type of filter media being modelled as each removes a different amount. The removal statistics are available from the filter media datasheets provided on our website. Table 1 demonstrates how to enter the removal rates into the edit point dialog for each type of pollutant. Defining one point for each pollutant is sufficient to create the transfer function.

Table 1 - Transfer function input and output values

Pollutant	Example Removal Rate	Entered Input Value	Entered Output Value
Total Suspended Solids	96%	100	4
Total Phosphorus	64%	100	36
Total Nitrogen	79%	100	21
Gross Pollutants	100%	15	0

Once the transfer functions have been defined for each of the pollutants the node has been fully defined. It is recommended that notes (7) should be added outlining the basis for the node and any assumptions made. When complete the properties window can be closed by clicking the finish button.

2.2 Flow Splitting

One use of Enviss Sentinel pits is in stormwater harvesting, where the pits are used to filter stormwater runoff prior to storage in tanks. This reduces the volume of sediment and other pollutants entering the tank, providing higher quality water. Usually in these systems only the filtered water is connected to the tanks, with high flows directed to stormwater discharge. In MUSIC v5.1 and above this situation can be modelled using the flow splitting feature.
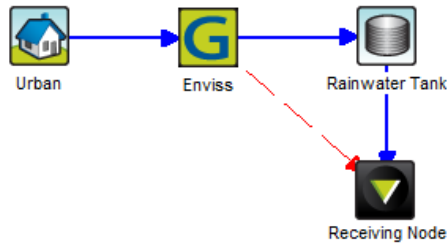

Figure 4 - Simple modelling showing flow splitting

Figure 4 shows a very simple model that uses flow splitting to divert the high flows directly the discharge while all filtered flows go to the storage tank. All that is required is a secondary drainage link from the Enviss generic node to the downstream receiving node. In the properties for the secondary link (Figure 5), check the box marked High Flow Bypass in the Outflow Components section.
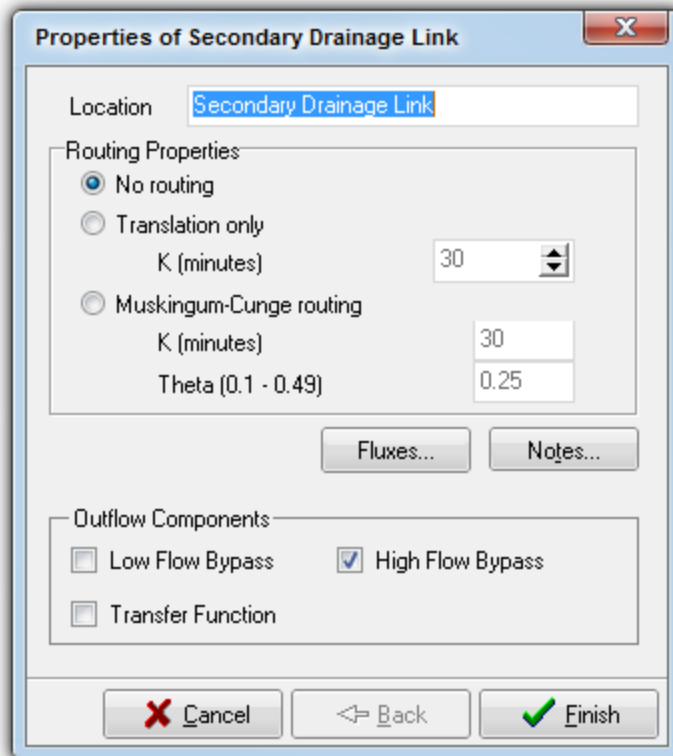

Figure 5 - Secondary drainage link properties dialog

2.3 Limitations

The method used to model Enviss systems has some known limitations which are listed below.

» Due to the minimum high flow bypass rate being 0.001 m^3/s or 1 L/s, and the maximum flow through a standard 600x600 pit of 0.2 L/s using 2000 mm/hr media, only multiples of 5 pits may be modelled. In small projects this will overstate the number of pits required. To overcome this, the catchment area and high flow bypass can be scaled up by a factor of 10 or more. The pollutant loads and flows should also scale by a similar factor.

» No extended detention above the pits is modelled, which can have a significant effect on the performance for small catchments and systems. This should cause performance to be underestimated if ponding is designed.

» Changes in media flow rate due to clogging are also not modelled. This will cause the model to overestimate performance, however, this is generally cancelled out by the limitation above.

» In MUSIC versions prior to 5.1 there was no ability to split treated and untreated flows if required, such as in a stormwater harvesting system where Enviss pits are used to filter the stormwater prior to storage.

» There is a known bug in version 3 of MUSIC where very small high flow bypass rates may cause an increase in total annual flows from the treatment node. If this occurs the system needs to be scaled up (both catchment and treatment area) by a constant factor, usually around 10 or 100 times.