

How to model ACO water quality products in Causeway Flow

1.0 Introduction

Protecting the environment from surface water run-off contaminated with hydrocarbons and particulates is a critical process within modern integrated surface water management. Stormwater surges that dislodge and carry high concentrations of pollutants from exposed areas must be treated prior to its release.

ACO manufacture a range of water quality treatment systems designed to remove pollutants by means of settlement, capture of floatables and multi process filtration. These systems have been tested to the stated performances for each in terms of their removal of Total Suspended Solids (TSS), metals and hydrocarbons to derive mitigation indices that can be used in the Simple Index Approach (SIA) in the Ciria SuDS Manual C753, Chapter 26.

The SIA is a risk-based method for designing water quality treatment within sustainable drainage systems. It begins by assigning a pollution hazard index to a site based on its land use and pollutant types. For each SuDS component, whether they are nature-based solutions or proprietary treatment devices, their mitigation index is used to calculate pollutant removal performance, either as a single component or part of a treatment train, to meet or exceed the site's hazard index.

The SIA process can be modelled for any drainage network in Causeway Flow, along with the wider hydraulic model network analysis.

2.0 Modelling ACO water quality products

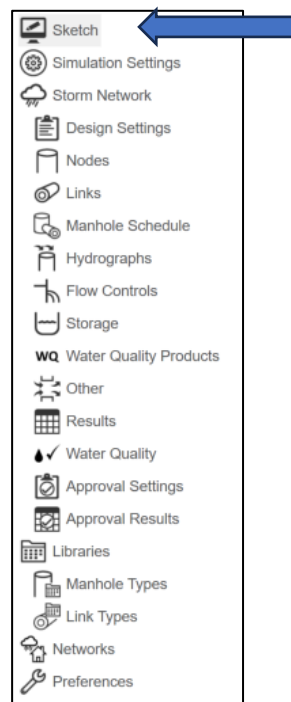
The easiest way to model ACO water quality products in Flow is by using the Sketch module.

Firstly, create your drainage network model in the usual way, but do not allocate catchment areas into your model yet.

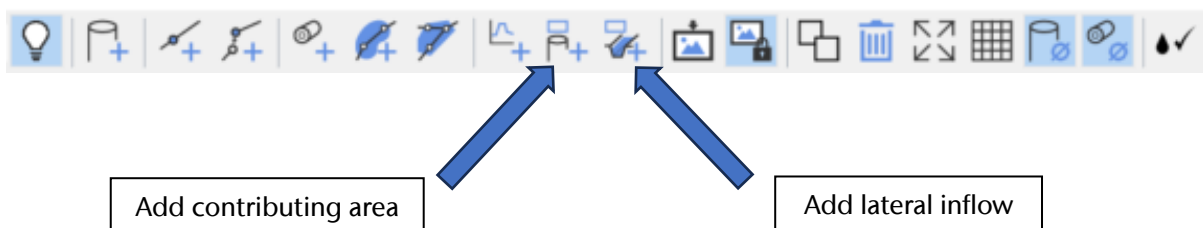
When you are defining your model, ensure you create nodes for all the proposed locations where you plan to insert ACO water quality products. It is important that these nodes are set to junctions rather than manholes so as not to create additional storage within the model, as the ACO units would be charged with water once installed and in use.

You can now allocate the intended land use for the runoff areas that will be entering your drainage network, and this is also where you will assign the catchments areas as well.

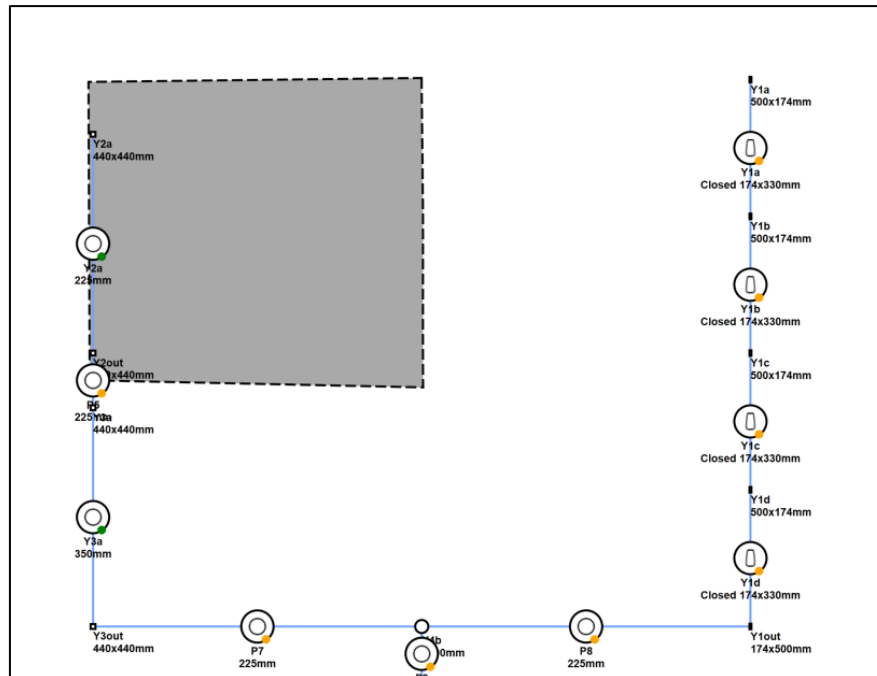
Select the Sketch module by clicking on “Sketch” on the tree menu on the left-hand side of the screen:



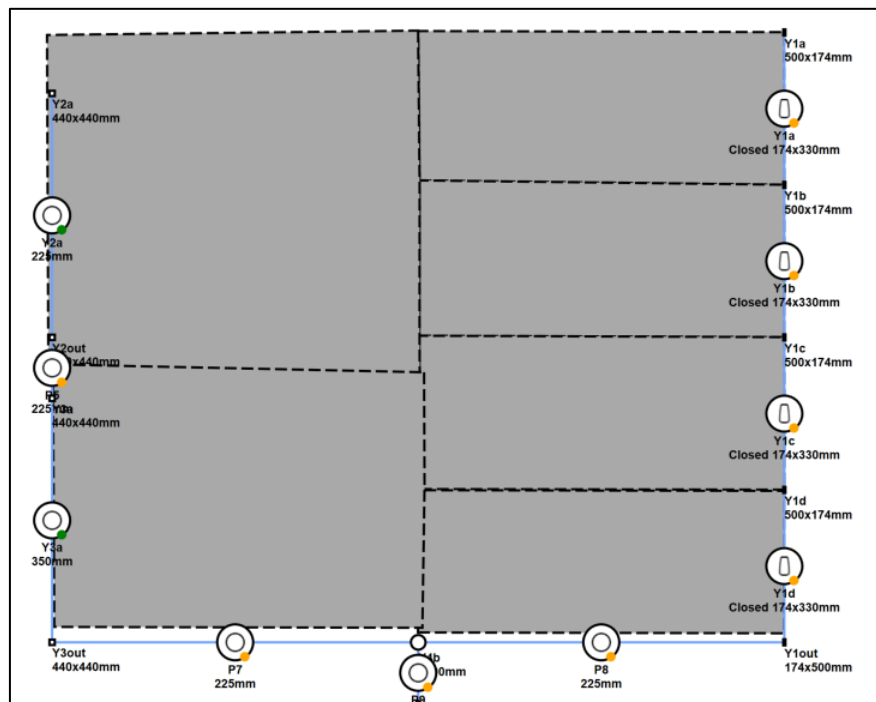
This will now display the network model you have created in sketch mode. You will now see a variety of button options at the top of your model. If you are assigning a catchment area to a node select “**Add contributing area**” or if you are assigning your catchment to a link (e.g. for a linear channel as a lateral inflow) select “**Add lateral area**”:



Dependent on your choice select either the node or the link to apply the catchment area to and then draw the extents of the catchment runoff area. Right click to finish and this will close off the catchment area. See below example of this where a catchment area (grey box) has now been assigned to a Link section of an ACO Linear Drainage channel:

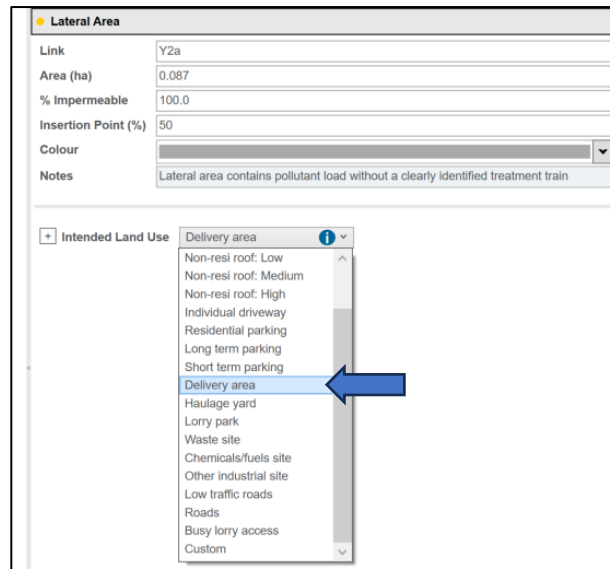


Continue assigning catchment areas in this way to the rest of your network model and right click to finish:



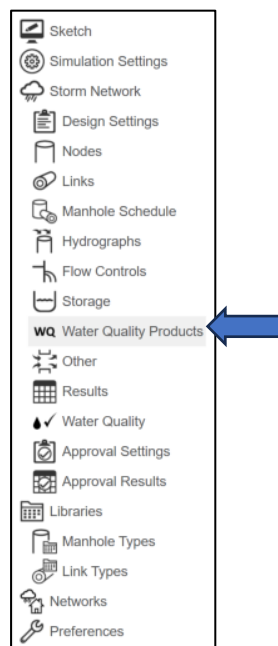
You are now ready to assign the land use pollutant indices to each of your catchment areas.

Select your chosen catchment by left clicking on it, this will now bring up an “area” box on the right of the screen allowing you to select and modify the catchment parameters. You will see the “**Intended Land Use**” box here where you can click to open a drop down of all the different land use types. For this example, we are going to select a delivery area:



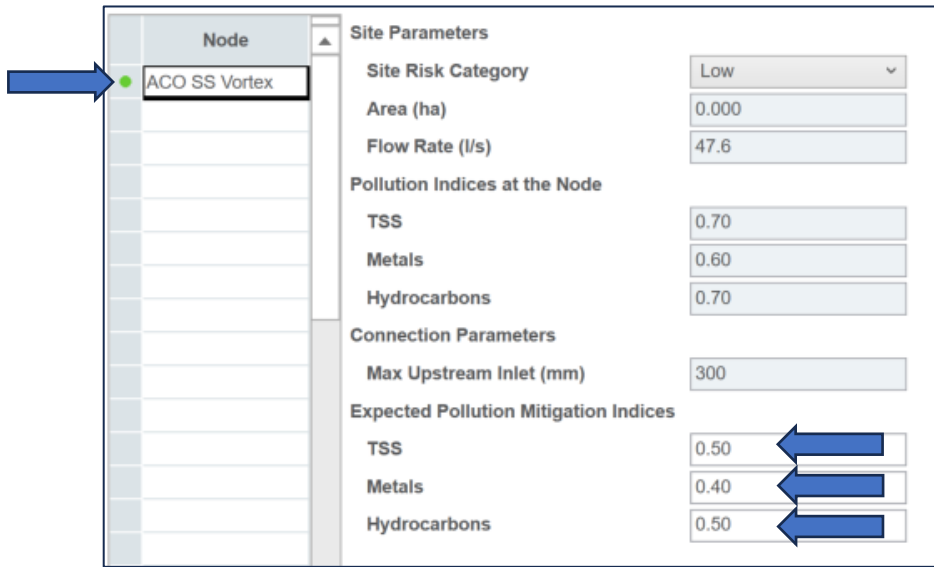
Once selected this will automatically apply the appropriate pollution indices for Total Suspended Solids (TSS), Metals and Hydrocarbons based on the values stipulated in the Ciria C753 SuDS Manual. Repeat this process to assign intended land uses for all catchment areas.

You can now start to add the relevant ACO water quality products into your model for mitigating against the pollutants. Select “**Water Quality Products**” from the tree menu on the left-hand side:



You will now have the option to enter Nodes where you will be introducing ACO water quality products (remember these should be set to junctions).

In this example we have created a Node called “ACO SS Vortex” to add the StormSed Vortex separator product. Type the name of the node here and this will then allow you insert the appropriate mitigation values for TSS, Metals and Hydrocarbons for the chosen product. Please refer to Section 3 of this document where you can find tables of these values for all of the ACO water quality products.



Node	
ACO SS Vortex	

Site Parameters	
Site Risk Category	Low
Area (ha)	0.000
Flow Rate (l/s)	47.6

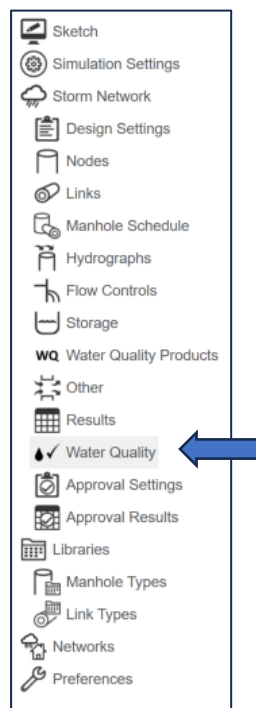
Pollution Indices at the Node	
TSS	0.70
Metals	0.60
Hydrocarbons	0.70

Connection Parameters	
Max Upstream Inlet (mm)	300

Expected Pollution Mitigation Indices	
TSS	0.50
Metals	0.40
Hydrocarbons	0.50

Repeat this process to add all of your proposed ACO water quality products into the network model.

Once complete the model can be analysed and the results can be reviewed by selecting “Water Quality” from the tree menu on the left-hand side:



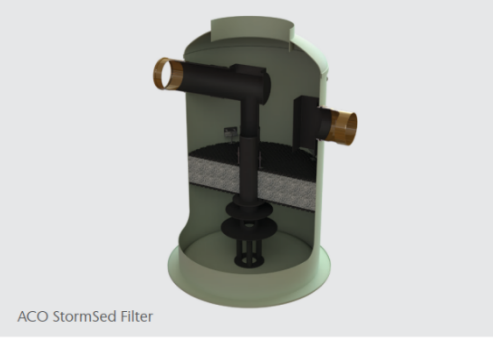
Water quality components are effective at mitigating the pollution when their combined score is higher than the pollution risk from the land use. When this happens, the chosen treatment train is sufficient to manage the pollution and the result **“Sufficient”** is shown in green for each pollutant type:

Area (ha)	Intended Land Use	Entering via Node or Link	Name	SuDS Component	Pollution hazard indices			Pollution mitigation indices			Cumulative pollution hazard indices		
					TSS	Metals	Hydrocarbons	TSS	Metals	Hydrocarbons	TSS	Metals	Hydrocarbons
0.044	Delivery area	Link	Y1a		0.7	0.6	0.7				0.7	0.6	0.7
0.044	Delivery area	Link	Y1b		0.7	0.6	0.7				0.7	0.6	0.7
0.044	Delivery area	Link	Y1c		0.7	0.6	0.7				0.7	0.6	0.7
0.044	Delivery area	Link	Y1d		0.7	0.6	0.7				0.7	0.6	0.7
0.087	Delivery area	Link	Y2a		0.7	0.6	0.7				0.7	0.6	0.7
0.088	Delivery area	Link	Y3a		0.7	0.6	0.7				0.7	0.6	0.7
		Node	ACO SS Vt: Water quality product					0.5	0.4	0.5	0.2	0.2	0.2
		Link	Swale 2	Swale				0.25	0.3	0.3	0	0	0
0.050	Long term parking	Link	Ch 1a		0.5	0.4	0.4				0.5	0.4	0.4
0.050	Long term parking	Link	Ch 1b		0.5	0.4	0.4				0.5	0.4	0.4
0.050	Long term parking	Link	Ch 2a		0.5	0.4	0.4				0.5	0.4	0.4
0.050	Long term parking	Link	Ch 2b		0.5	0.4	0.4				0.5	0.4	0.4
		Link	Swale 1	Swale				0.5	0.6	0.6	0	0	0
		Node	M8								0	0	0
											Sufficient		

If the proposed treatments are insufficient for any of the pollutant types, the result will show in red, stating additional mitigation is required and the water quality design will need to be reviewed:

Area (ha)	Intended Land Use	Entering via Node or Link	Name	SuDS Component	Pollution hazard indices			Pollution mitigation indices			Cumulative pollution hazard indices		
					TSS	Metals	Hydrocarbons	TSS	Metals	Hydrocarbons	TSS	Metals	Hydrocarbons
0.044	Delivery area	Link	Y1a		0.7	0.6	0.7				0.7	0.6	0.7
0.044	Delivery area	Link	Y1b		0.7	0.6	0.7				0.7	0.6	0.7
0.044	Delivery area	Link	Y1c		0.7	0.6	0.7				0.7	0.6	0.7
0.044	Delivery area	Link	Y1d		0.7	0.6	0.7				0.7	0.6	0.7
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0.050	Long term parking	Link	Ch 2a		0.5	0.4	0.4				0.5	0.4	0.4
0.050	Long term parking	Link	Ch 2b		0.5	0.4	0.4				0.5	0.4	0.4
		Node	M8								0.5	0.4	0.4
											Additional TSS Mitigation Required Additional Metals Mitigation Required Additional Hydrocarbon Mitigation Required		

3.0 ACO Water quality products – pollution mitigation indices



ACO StormSed Filter

SuDS Mitigation Indices

Total Suspended Solids	Metals	Hydrocarbons
0.9	0.85	0.9

ACO StormSed Filter




ACO StormSed Vortex

SuDS Mitigation Indices

Total Suspended Solids	Metals	Hydrocarbons
0.5	0.4	0.5

ACO StormSed Vortex



Hydrocarbons	Total suspended solids	Metals
0.45	0.5	0.375

ACO Combipoint SSA