Connections

Connections are links between two elements of the Site. They allow a Connection Type to be specified, which will impact the Time of Travel along the Connection and therefore impact the analysis.

The flow routing calculations done during the Analysis are described in **Analysis of Connections**.

The connections form allows all of the available connections in the phase to be viewed as a table.The top (Input) spreadsheet then allows the Connection Type and other Physical dimensions to be adjusted as required. The lower (Results) spreadsheet will show the results from an Auto Sizing calculation for the selected flow path if available.

The Columns displayed are effected by the Connection Types shown and can also be filtered using the **Spreadsheet Preferences**.

Change Templates - Provides users the option to change the currently assigned templates for Connections.

Add to Templates - Provides users with the option to add the currently selected Connection to the **Templates** library.

Delete Row - Clears data in the current row and deletes the selected Connection.

Clear all data - Clears all data and deletes all Connections.

Filtering the tables   Filter By: [All Connections ▾]

The Filter By drop down list allows the connections shown to be filtered:

- **All Connections** - Shows all connections.
- **By Flow Path** - Shows the connections that make up the selected **Flow Path,** and its associated **network**, in the order of flow. This view is of particular interest as it also allows the **Auto Sizing** of the pipes & channels in that network.

Auto Sizing

When a **Flow Path** has been selected on the Filter it is then possible to perform an Auto Sizing of the pipe/channels that form the **network** along the flow path. The calculations are completed based on the specified Pipe Sizing Criteria when the 'Auto Size' option is clicked. Full details can be found in the **Pipe Sizing** topic.

Spreadsheet columns

Spreadsheet Preferences

Fields can be turned on or off using the Spreadsheet Preferences form that is accessed from the toolbar at the top of the form. The full set of columns available on both the Input and the Results spreadsheet are shown and can be turned on or off using the check boxes. These settings will be remembered between sessions.

Inputs

Label (Always Shown)

Label of the connection as shown on the plan view.

Workflow - What's next...?

Inflow → Inlet → Stormwater Control → Outlet → Inlet → Junction → Outlet → Inlet → Stormwater Control → Outlet

Connect Inflows to your **Stormwater Control**, specify **Inlets** or **Outlets** or connect to another Stormwater Control or **Junction**.

From

The label of the item at the upstream end of the connection.

To

The label of the item at the downstream end of the connection.

Length (Always Shown)

Length of the connection. If in red - the length was defined by the user, otherwise, it was calculated using the Connections coordinates from the plan view.

Connection Type (Always Shown)

Type of the connection:

- **No Delay** - Imposes no effect of the movement of water.
- **Lagged Flow** - Introduces a time delay on the movement of water based on the Time of Travel value entered. Velocity and Time of Travel columns are shown by default.
- **Attenuated Flow** - Introduces a time delay and adjustment to the flow hydrograph using Muskingum based on the Time of Travel and Retention Coefficient. Velocity, Time of Travel and Retention Coefficient columns are shown by default.
- **Pipe** - Allows a pipe, or series of parallel pipes, to be modeled with a Diameter, Longitudinal Slope and levels. The dimensions can be entered as required or calculated using the **Auto Size** calculation. Slope, Manning's n, Diameter/Base Width, Upstream Cover Level, Upstream Invert Level, Downstream Cover Level and Downstream Invert Level columns are shown by default.
- **Rectangular Channel** - Allows a Rectangular channel, or series of parallel channels, to be modeled with a Base Width, Height, Longitudinal Slope and levels. The dimensions can be entered as required or calculated using the **Auto Size** calculation. Slope, Manning's n, Diameter/Base Width, Height, Upstream Cover Level, Upstream Invert Level, Downstream Cover Level and Downstream Invert Level columns are shown by default.
- **Trapezoidal Channel** - Allows a Trapezoidal channel, or series of parallel channels, to be modeled with a Base Width, Side Slope, Height, Longitudinal Slope and levels. The dimensions can be entered as required or calculated using the **Auto Size** calculation. Slope, Manning's n, Diameter/Base Width, Height, Side Slope, Upstream Cover Level, Upstream Invert Level, Downstream Cover Level and Downstream Invert Level columns are shown by default.
- **Triangular Channel** - Allows a non-symmetrical Triangular channel, or series of parallel channels, to be modeled with a Side Slope, Height, Longitudinal Slope and levels. The dimensions can be entered as required or calculated using the **Auto Size** calculation. Slope, Manning's n, Height, Side Slope, Upstream Cover Level, Upstream Invert Level, Downstream Cover Level and Downstream Invert Level columns are shown by default.

Slope

Longitudinal slope of the connection. This is calculated based on the Fall, between the upstream & downstream invert levels, along the Length of the connection. Entering a value for the slope will therefore adjust the downstream invert level.

Manning's n

Manning's coefficient for the connection, which will be used in velocity and flow/capacity calculations.

No. of Barrels

Number of barrels/channels laid in parallel.

Diameter/Base

Diameter of the connection if a Pipe, or base width of a Rectangular or Trapezoidal channel.

Height

Height of a Rectangular, Trapezoidal or Triangular channel.

Side Slope

Slope of the sides of a Trapezoidal or Triangular channel.

Upstream Cover Level

The cover/exceedence level at the upstream end of the connection. Levels may be set automatically if sufficient data exists, see individual connection type pages for more details.

Upstream Invert Level

The invert level at the upstream end of the connection. Levels may be set automatically if sufficient data exists, see individual connection type pages for more details.

Downstream Cover Level

The cover/exceedence, level at the downstream end of the connection. Levels may be set automatically if sufficient data exists, see individual connection type pages for more details.

Downstream Invert Level

The invert level at the downstream end of the connection. Levels may be set automatically if sufficient data exists, see individual connection type pages for more details.

Auto Size

Lock the padlock to exclude the given connection from **Auto Sizing** calculations.

Velocity

Velocity of the flow in the connection. For **Pipes**, **Rectangular Channels**, **Trapezoidal Channels**, **Triangular Channels** the Velocity, Time Of Travel is calculated with **Muskingum-Cunge** methodology.

Time Of Travel

Time of travel of the flow through the connection. This value will be automatically calculated based on the dimensions of the connection, however manually entering a value into the column will overrule this.

Retention Coefficient

The coefficient within the **Muskingum** calculations when using the Attenuated Flow Connection type. This affects the spread of the connections outflow hydrograph with values closer to 0.5 having less effect. The default value is 0.1, if it has been user specified it will be shown in red.

Pipe Sizing Results

The bottom table shows results after **Auto Size** of the connections. The results will only be shown when the Flow Path that they relate to is selected on the filter.

Label (Always Shown)

Label of the connection as on the plan view

Total Travel Time

The Travel Time is calculated as the Min. Time of Concentration from the **Pipe Sizing Criteria** + The Travel Time through the Upstream connections. The time of travel for a given connection is calculated using the Velocity of flow under full bore conditions and the length of the connection.

Rainfall

The Rainfall Intensity is determined from the IDF data, specified on the **Pipe Sizing Criteria**, based on the Travel Time for the given connection. The Rainfall Intensity is then used in the selected Calculation Method to determine the Flow used for Auto Sizing the pipes/channels.

Total Contributing Area

Total contributing area from connected **Inflows**. This is factored by the Runoff Coefficient specified per area before being summed. This includes all the upstream contributing areas.

Total Base Flow

Total base flow including all base flows from the upstream connections.

> (i) **Inflows**
>
> For the purposes of **Auto Size**, the peak flow from a **Hydrograph** is considered as a Base Flow.

Proportional Depth

The Proportional Depth is the actual depth of water in the pipe for the calculated flow.

Proportional Velocity

The Proportional Velocity is the velocity of water in the pipeline (i.e. at the Proportional Depth) corresponding to the calculated flow.

Pipe Full Velocity

The Pipe Full Velocity is calculated using the **Manning equation** and is based on pipe full conditions.

Capacity

The Pipe Capacity is calculated using the Manning's n equation and is based on pipe full conditions.

Flow

The flow is determined based on the calculation method selected in the **Pipe Sizing Criteria**:

Rational Method: Flow = Rainfall Intensity x Total Area + Total Base Flow

(UK) Modified Rational Method: Flow = Rainfall Intensity x Total Area * Cr(1.3) + Total Base Flow