Links

A link is defined as a connection between two nodes. Links cannot exist without nodes at the end points, and the direction is indicated by the arrow line.

This page contains the following topics:

General Information

When the link tool is selected, the cursor changes to a link shape, and the application will allow you to create connections between nodes. The first click on the window defines the node from which the link emanates. The next and subsequent mouse clicks identify the node to which the link joins. A straight line is then drawn between these two nodes with an arrow indicating direction.

If the mouse is not clicked on an existing node, then a default node is created at that point for the new link. Following each mouse click in the drawing area, a dotted line tracks the mouse's movements, indicating how the new link will appear. This is the most effective way of creating a new network.

The successful creation of a link depends on certain network validity checks made by the XP shell, described in Expert System Capabilities.

Two main types of links are available:

Conduit Link. This represents a drainage path between nodes such as a circular pipe, rectangular pipes, or open channels of any cross section.

Multiple Conduit/Diversion Link. Represents either an alternative flow path between nodes, such as a weir, an orifice or a pump, or allows you to have a number of conduits between the same two nodes without the need for dummy nodes.

Bridge Link.This creates two joined nodes representing a bridge crossing. During HEC RAS imports, bridges will be modeled in bridge links by default. This specialized link allows users to specify bridge low and high coordinates. The bridge opening can be represented by a natural channel, with and without piers, or be described as a culvert. This type of application can also be created with a multilink, but the parameters are more clearly shown when created using this tool.

River Link. This tool draws a segmented River Reach comprised of river segments and intermediate river nodes, and is the default object when importing HEC RAS models. This specialized link contains the open channel cross section and limits the input for the typical river reach. It is designed to simplify the modeling process for users with river modeling experience.
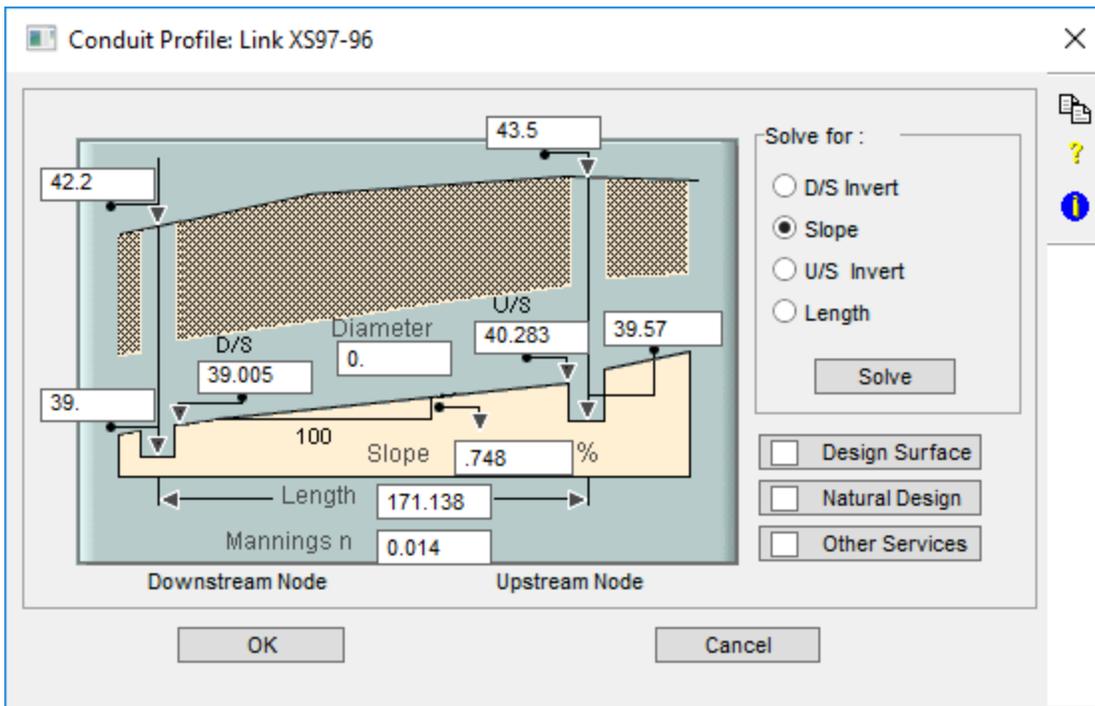
Link Data
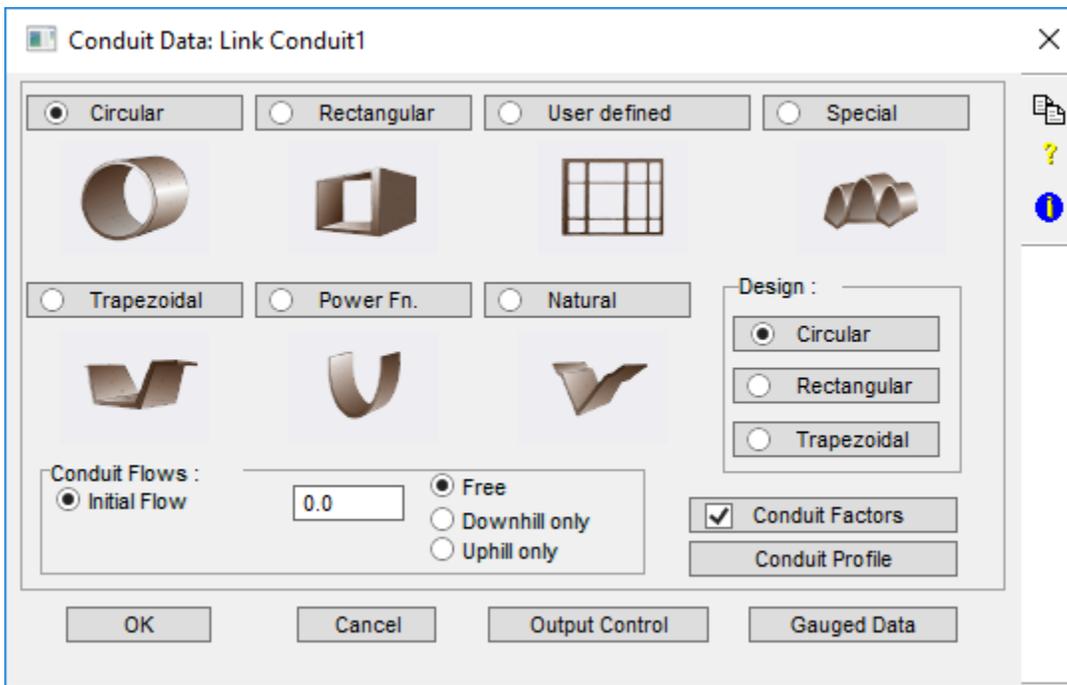
Conduit data is shared amongst all three modes: Runoff, Sanitary, and Hydraulics. Each layer (module) routes flow differently, increasing in complexity in the order above. The Sanitary layer uses a Kinematic Wave approach for conduit routing, in which disturbances are allowed to propagate only in the downstream direction. As a consequence, backwater effects are not modeled beyond the realm of a single conduit, and downstream conditions (eg. tide gates, diversion structures) do not affect upstream computations.

Surcharging is modeled by storing excess flows, above the full flow conduit capacity at the upstream node until capacity exists to accept the stored volume. Pressure flow conditions are not explicitly modeled and no attempt is made to determine if ground surface flooding exists. If the network has extensive interconnections or loops, flow reversals, significant backwater effects, or pressure flows, then the Hydraulics layer (module) should be used for flow routing.

Clicking the Conduit Profile button in the above dialog or hitting the **F3** key will load the Conduit Profile dialog for a selected link in XP since version 2013.
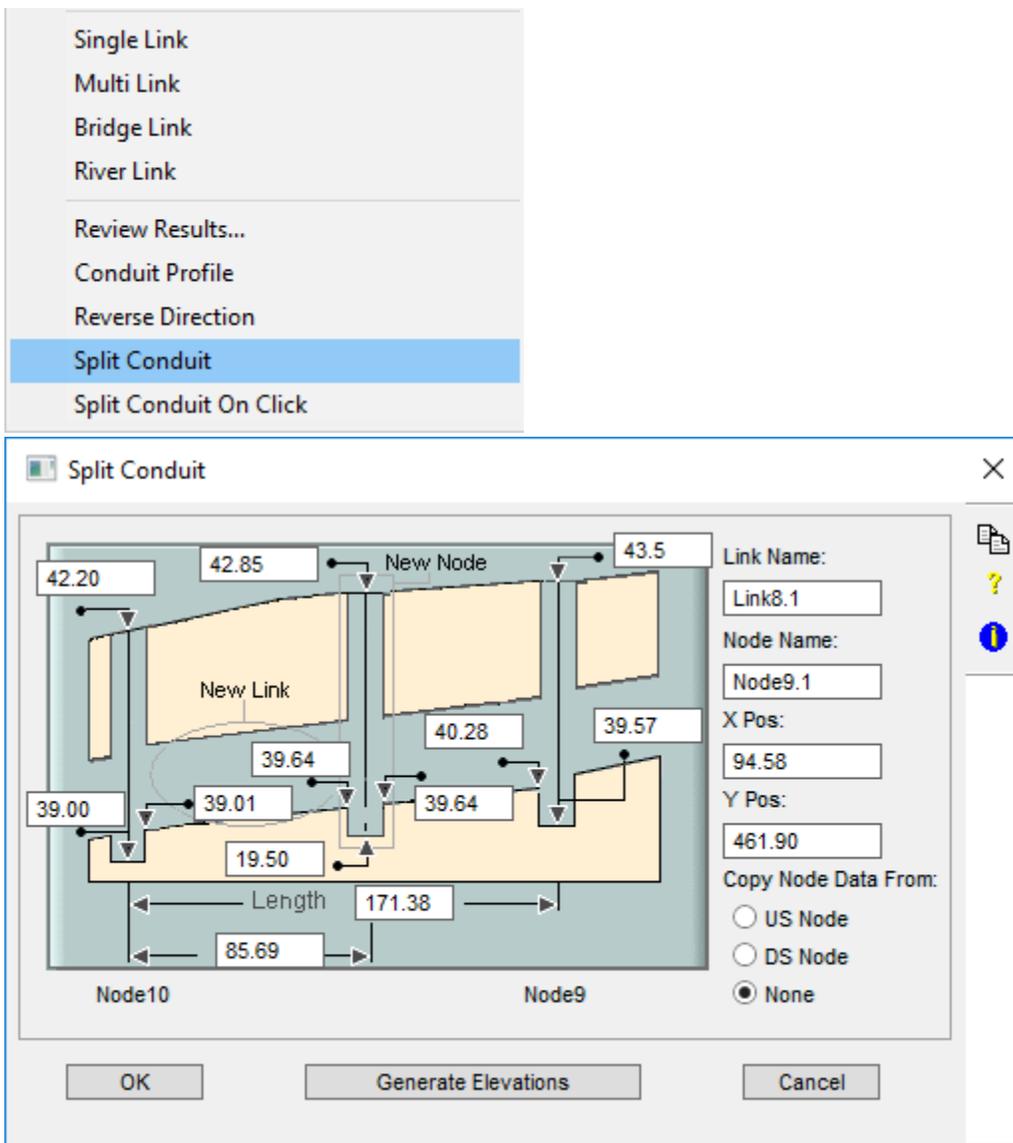

There are four common types of Links available:

- **Single Conduit Link Data**
- **Hydraulics Layer Multiple Conduit/Diversion Link Data**

- **Runoff Layer Multiple Conduit/Diversion Link Data**
- **Sanitary Layer Multiple Conduit/Diversion Link Data**

Split Conduit

This tool is accessed via the link pop-up menu (select a link and right-click).

Generate Elevations computes new values for slope and invert based on existing values. Use this feature whenever a new length is entered overriding the default split in the middle.
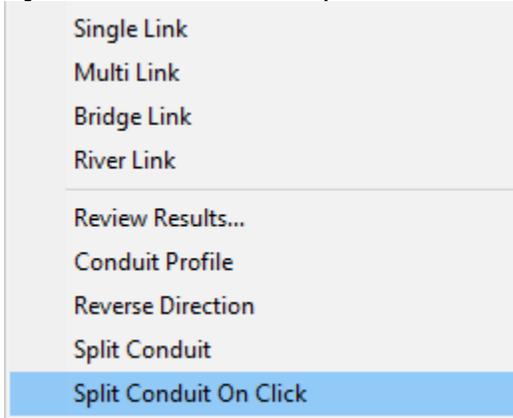
Split Conduit on Click

This tool allows you to split the link in the network view by clicking on a point along the link.

⚠ Note: This tool is not applicable for River Links and will only duplicate conduit data for Bridge Links and Multi Links.

1. Select the link that you want to split.

2. Right-click the link and then select **Split Conduit On Click**.

Single Link
Multi Link
Bridge Link
River Link

Review Results...
Conduit Profile
Reverse Direction
Split Conduit
Split Conduit On Click

3. Click on a point along that link where you want it to split. This creates a new node and link and interpolates the elevations using the original slope and duplicates the conduit geometry.
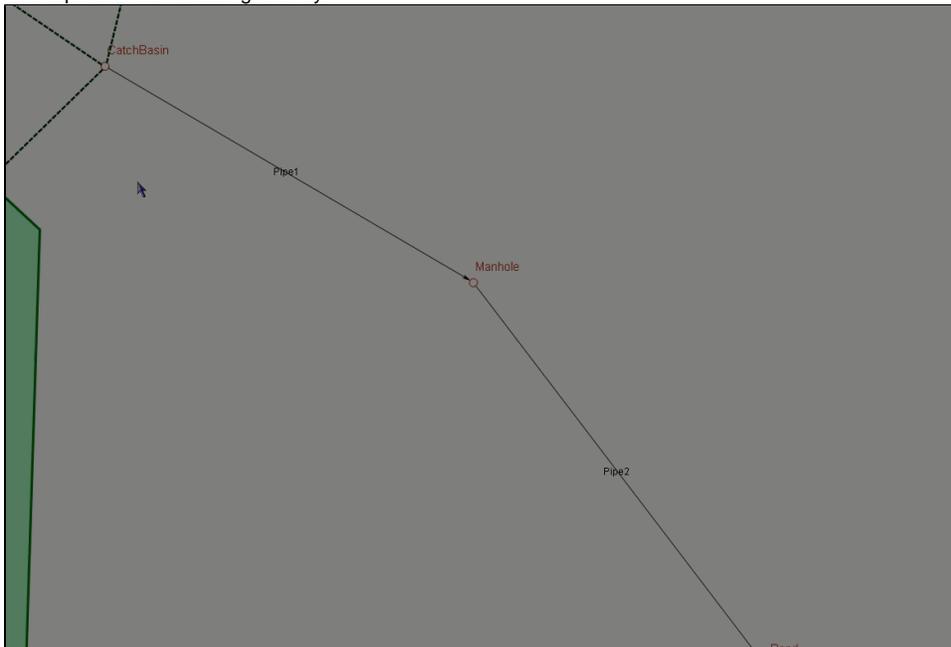
Polylink

A polylink is a special type of link that has vertices between the two end-nodes. It may be used to define the path of a river, or to indicate a curved pipe, or in any situation where the end-nodes are not connected in a straight path. To create a polylink, select the link tool as normal and hold the <Ctrl> key down while clicking at the location at which you want a vertex.

An existing straight single link or multi-link may be converted to a polylink and a polylink can be reshaped by right mouse click on the link and select Edit Vertices from the pop-up menu. Then the following options are possible:

1. Move a vertex: Drag the vertex of the highlighted link to the new location and release the mouse button.
2. To delete a vertex: Right mouse click on the vertex and select delete vertex from the pop-up menu.
3. To insert a vertex: Click on the link in the location where you want the vertex to be created then drag the vertex to a new location.

Note that the network may be re-scaled or panned without the need of re-selecting the pointer tool. See Panning Around the Network and Re-scaling the Network Window for more details.

River Link

The River Link is designed for use when modeling natural channel systems. Nodes are automatically generated at vertices (mouse clicks) along the River Reach. The dialogs are similar to those found in HEC RAS and other river modeling software. The feature is intended to simplify the modeling process for river modelers. A River Link can be created by selecting the River Link drawing icon located in the drawing toolbar.
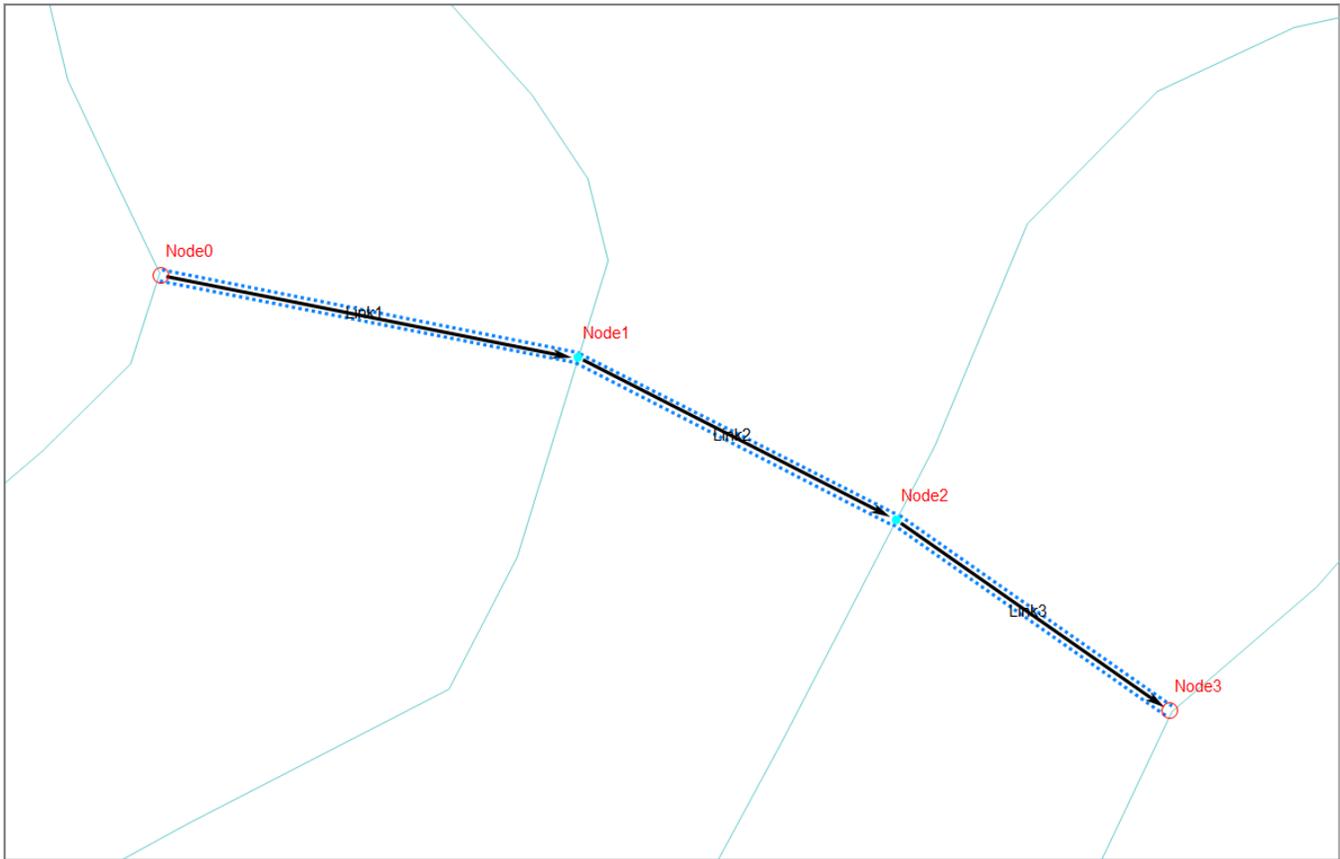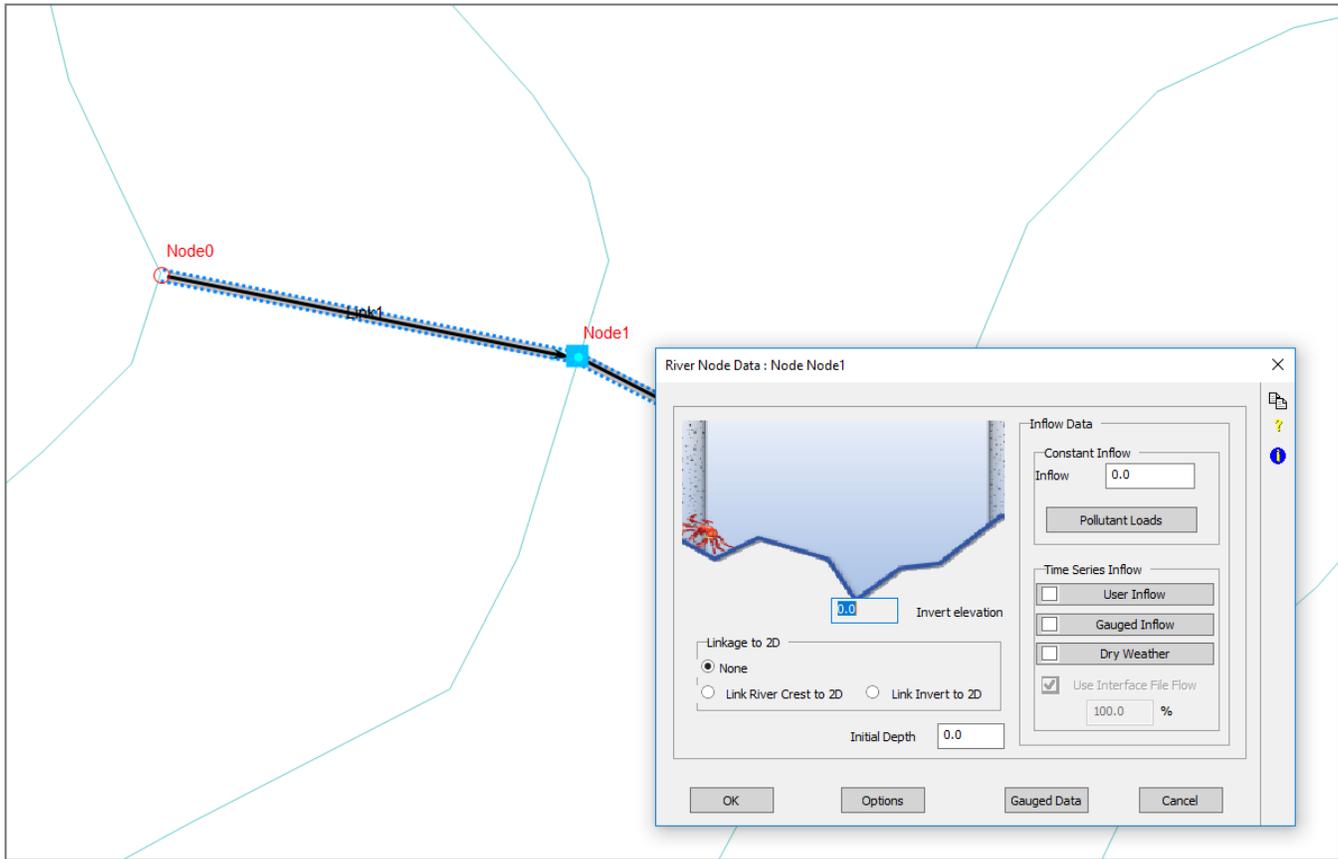
The River Link can be used when:

- There are 5 or more conduits in series containing cross sections.
- There are NO lateral connections
- There is NO Dual Drainage (i.e. Closed conduit and overland gutter flow).

⚠ When an HEC RAS model is imported into xp, the model will default to the River Link (representing the reach). All data will be imported to the link and node dialogs displayed below.
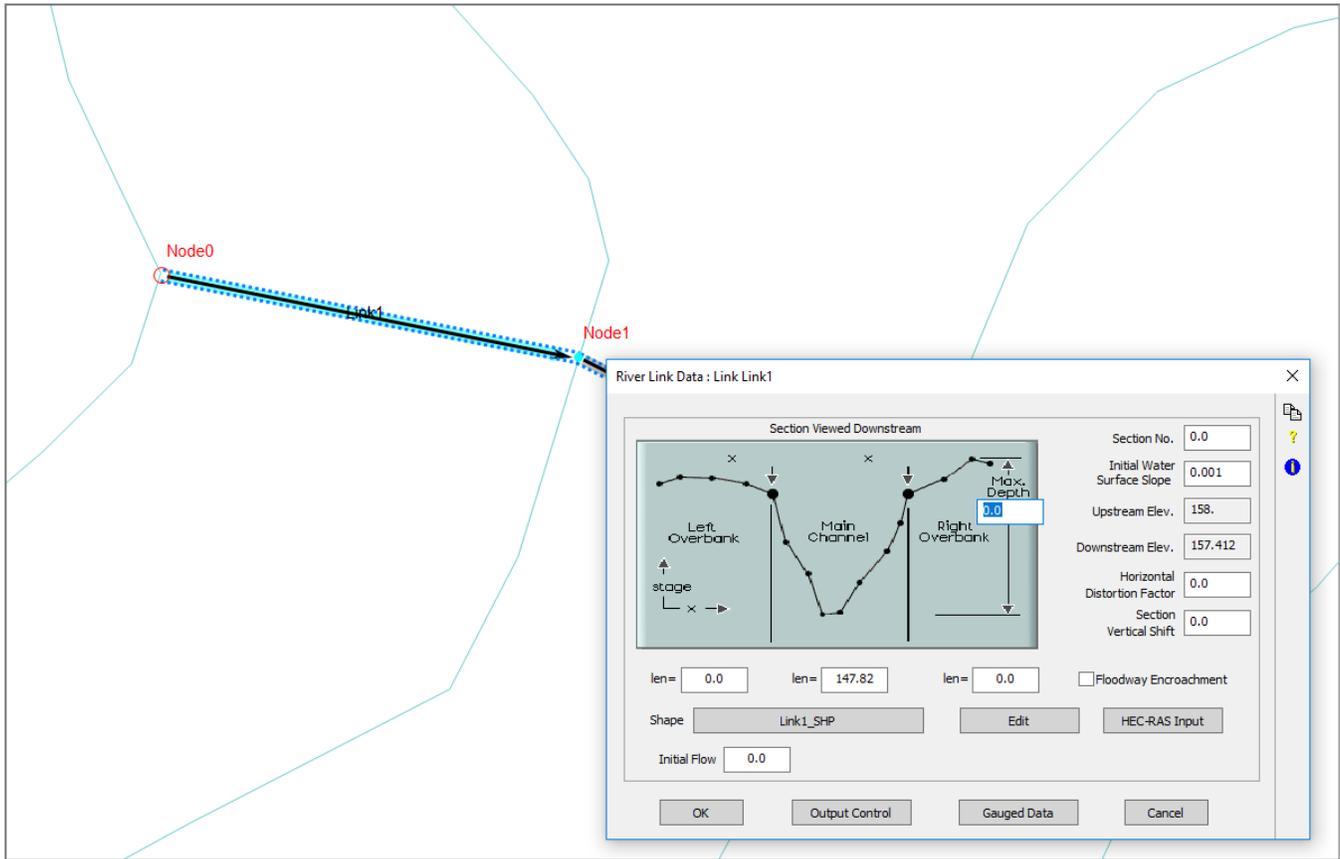
The link dialog is similar to a standard link, or multilink dialog, yet familiar to HEC RAS users as well. The section data is automatically imported to the Global Database (and therefore as the section shape in the link dialog).

The ground elevation (or Spillcrest) is taken from the Natural Section coordinates input by the user, or adopted during import.

> ⚠️ **Note**
>
> The River Link can be used in 1D and 1D/2D modeling scenarios. For 1D/2D models, the ground elevation (Spillcrest) will be automatically raised (by a default value of 20%) in order to account for flooding which occurs in the 2D Inactive Area located within the 1D Channel overbanks.

The Rivers Layer

When a River Link is created, a Rivers Layer will appear in the Layers window. The properties of a River Link can be edited by right clicking on the River Link layer and selecting properties. Additionally, conversions can be made by right clicking on the Rivers layer. See below:
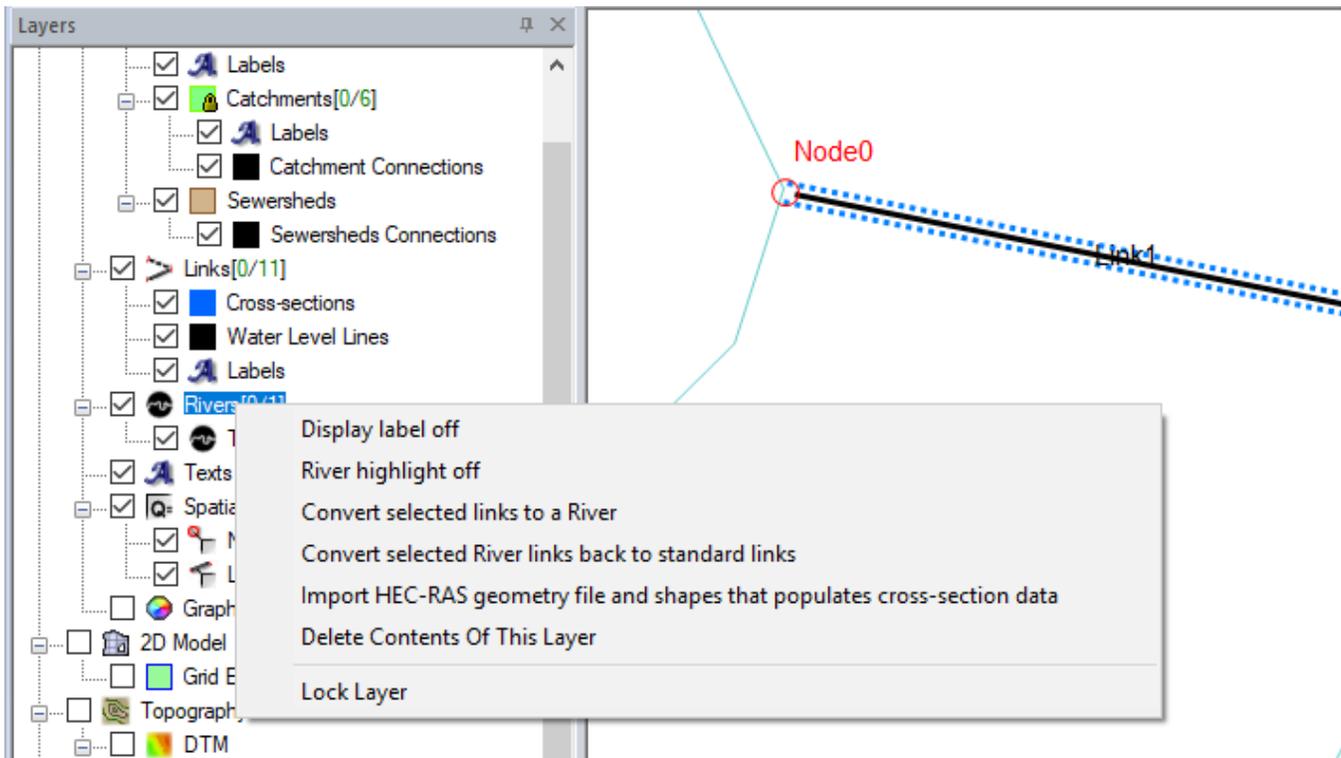
The main points to remember about River Links are:

- River Links are essentially a string of consecutive links, or a group of links containing individual cross sections, but of the same river type without branches/lateral connections.
- They can be converted to a non-river link and single links can be converted to River Links.
- River Links are bound by bank lines on either side.
- Control of River Link Properties is found under right-clicking the layer in the Layers window.
- Multilinks cannot be used in River Links.
- Dual Drainage cannot be used in River Links.

Bridge Link

Bridges and crossings can be represented in one dimension (1D) by using the **Bridge Link** option discussed in this section. A two-dimensional (2D) approach to bridge or structure modeling may be represented using the 2D Flow Constriction option.

You can create a Bridge Link by either right-clicking an existing Link and selecting Bridge Link, or by selecting the **Bridge Link drawing icon** in the

drawing toolbar to create a completely new link.

User Specified Length (ft or m): By default the bridge length (i.e. the length of the bridge span perpendicular to the river reach) is taken from the total cross sectional width of the **Bridge Shape** cross section. This default length can be overwritten by selecting the **User Specified Length** check box and entering the new length value.

Max WSEL (ft or m): This sets the maximum water surface level allowed for weir flow over the bridge deck. This is similar in concept to the Weir Crown elevation. For HEC-RAS data, the default value for the **Max WSEL** field is automatically computed using the formula:

Max WSEL = High chord elevation (ft or m) + 32.8084 (ft) or 10 (m)

The value should be raised if needed to be higher than the maximum water elevation to ensure no orifice flow calculations and always weir flow calculations.

High/Low Chord Elevation (ft or m): These levels represent the top and bottom elevations of the given bridge/structure platform. Setting these levels will block the area between these two elevations from the available channel flow area – basically setting a horizontal ineffective flow area.

⚠ The **High Chord Elevation** must be higher than or equal to the **Low Chord Elevation**. When available, the **Low Chord Elevations** (optional) should be included as a Y elevation(s) in the Hydraulic Opening.

Weir Data: The Bridge Link overtopping flow is simulated either as a Transverse or Broad-crested weir.

Skew Angle: This value is used to derive the effective width of any in-line piers.

⚠ This item is global to the bridge, i.e. if more than one bridge section is defined, the skew for one section will also apply for all other sections.

The Transverse weir equation will be used during the simulation if the constant Weir Coefficient is used and the Broad-crested weir option is not checked.

If the Broad-crested weir option is checked, the discharge coefficients will vary throughout the simulation based on the FHWA Design Manual classifications of Broad-crested weir embankment overtopping with paved or graveled surfaces. See details of Broad-crested weir coefficients information.

⚠ The weir flow over the bridge deck will begin at the High Chord Elevation.

The Hydraulic Opening is a Global Database item similar to the Natural Section Shape. It defines the shape of the reach under the bridge including pier (obstructions) and bridge skewness. The Low Chord Elevation should be noted within the Hydraulic Openings coordinate pairs.

Los Angeles County Link and Diversion Data

LA Link Data

○ Physical Conveyance

	A
LACH Link ID	
LA Channel Type	Circular Pipe
Length	10.0
Conduit Slope	0.0
Channel Side Slope	0
Diameter (Height)	0.05
Bottom Width	0.0001
Hydrograph Output Type	None
LA Area Reduction	No Recomputation
Roughness	0.014
Channel Side Wall Roughness	0.014
Rect/Trap Max Depth	0
LA Max Design Velocity	0

⦿ Dummy Link

☐ Confluence Printout | ID Generation Settings

OK | Cancel

LA Location ID

LA Id Generation Type

⦿ Addional Id Offset `0`

○ Set Minimum Id as `0`

☐ Warn if Id Value Exceeds Minimum

OK | Cancel