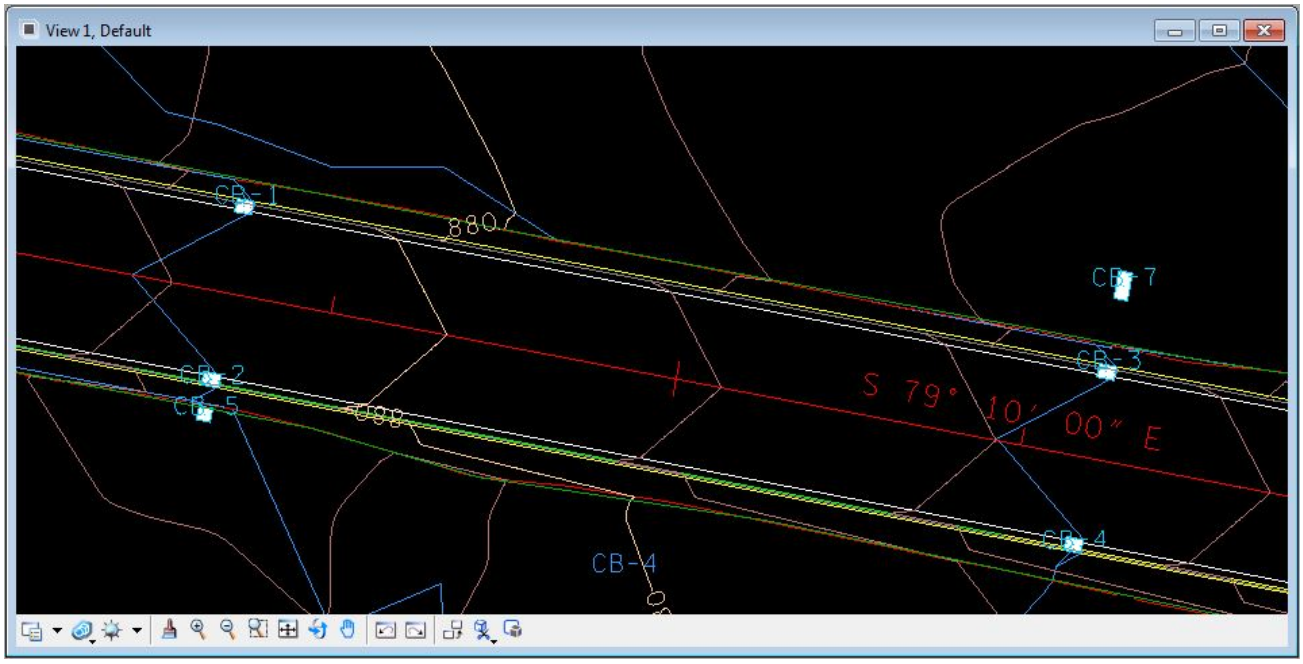
6. Storm Drainage Links

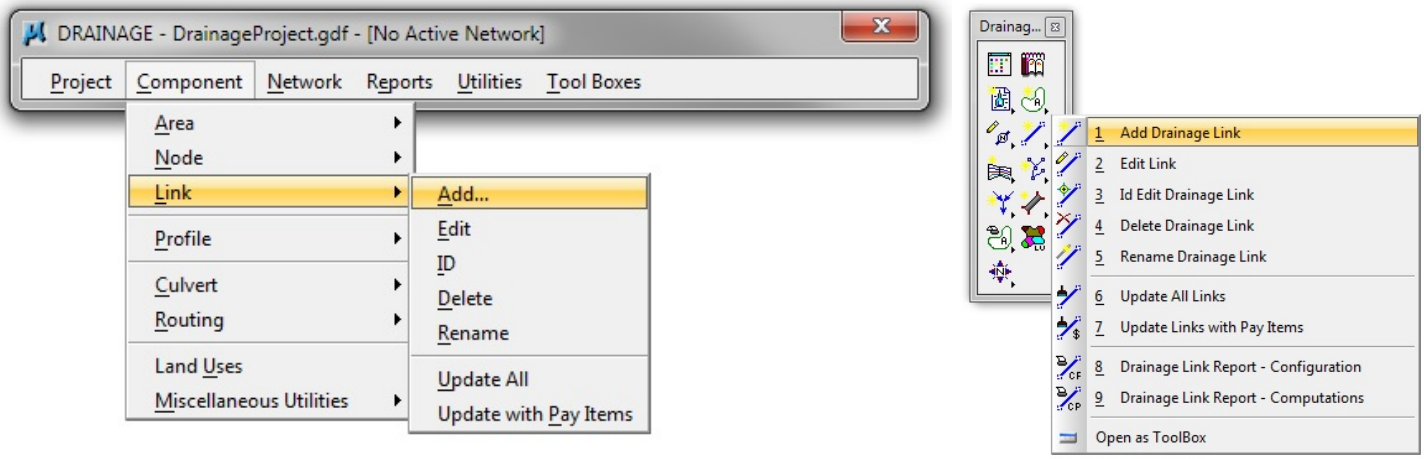
This exercise shows the user how to utilize the tools necessary for connecting the surface drainage (inlets) to the collection system (pipes). The user will design the storm drainage pipes for this project.

6.1 Link Design

a) Visually determine the tentative location of the first storm drainage pipe. This link will connect Nodes CB-1 and CB-3.



b) Select from the Drainage Menu Bar: **Component > Link > Add** or from the main toolbar: **Add Drainage Link***:*

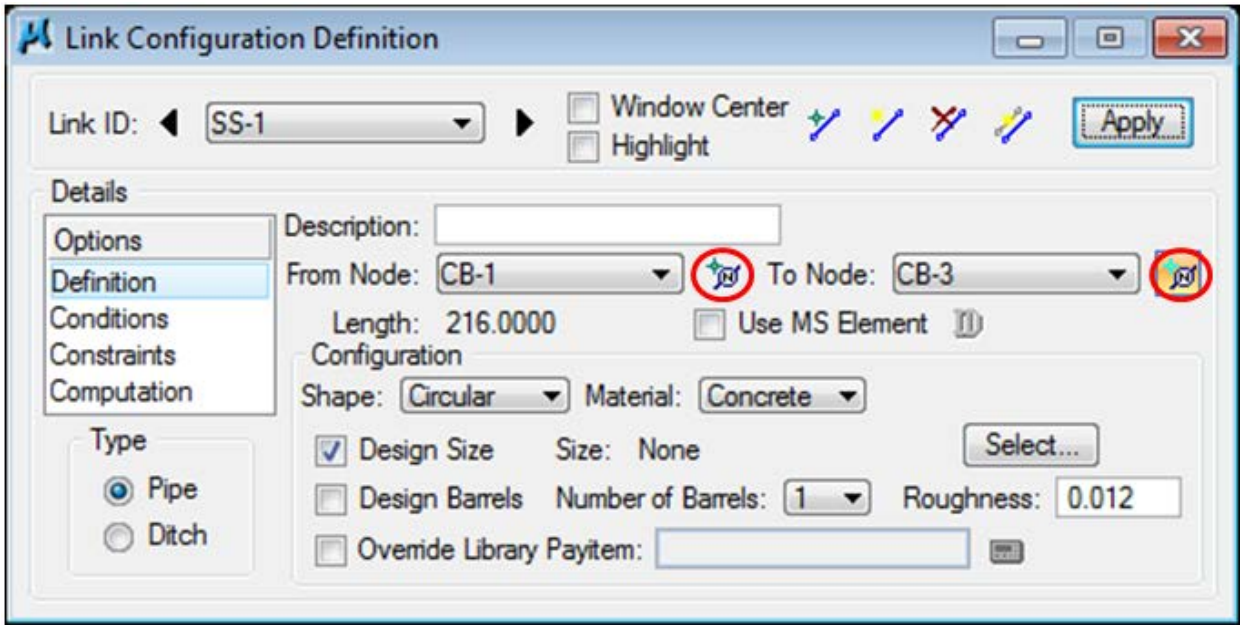


c) In the **New Link** window that appears, click OK to set the name **SS-1**

d) **Definition >** This dialog sets the pipe configuration including: From Node, To Node, Shape, Material, Library Item, etc.

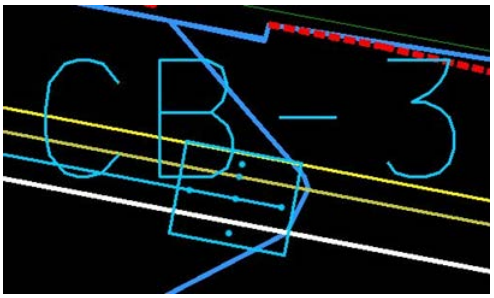
There are two ways to set the Nodes: from the dropdown list or graphically selecting the Nodes. Graphically is recommended to ensure the correct pipe connection points are utilized. See note concerning these below.

To select graphically click the ID button for each and identify the correct Node. SS-1 traverses **From Node** CB-1 **to Node** CB-3:

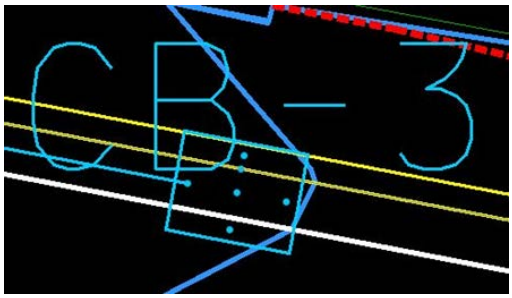


NOTE: All drainage nodes include pipe connection points on the structures (for circular structures there are NOT single points but an entire circle for connection). When a drainage node is identified for connection it will use the nearest face to the identification Data Point. **Therefore it is important to Zoom in close enough to drainage nodes and identify them at the correct connection point of the structure.** Correct and Incorrect examples are shown below.

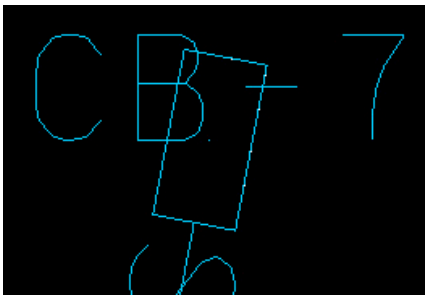
INCORRECT

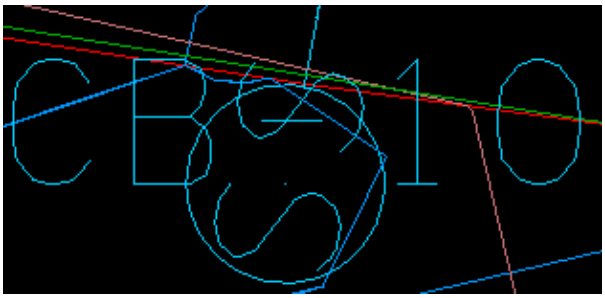


CORRECT



The symbolization for drop inlets display the full extent of the sub-structure as opposed to the normal smaller symbol used for curb and gutter inlets. This is done so that the designer can ensure adequate R.O.W. or easement is provided. For this reason you will **not** see the pipe connection points for these structures since they coincide with the structure wall as shown below.





e) Set the remaining Link Configurations as follows:

Shape: Circular

Material: Concrete

Design Size: Toggle ON

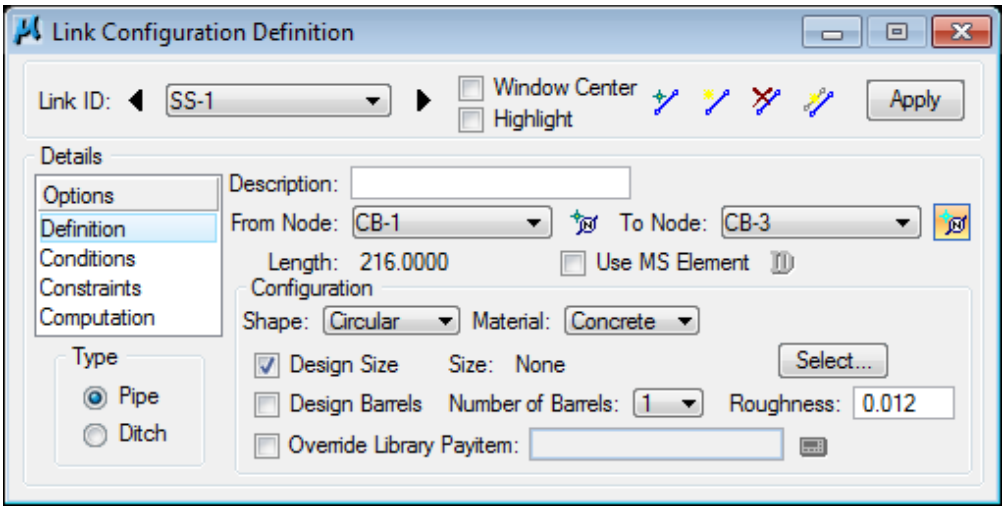
Design Barrels: Toggle OFF

Number of Barrels: 1

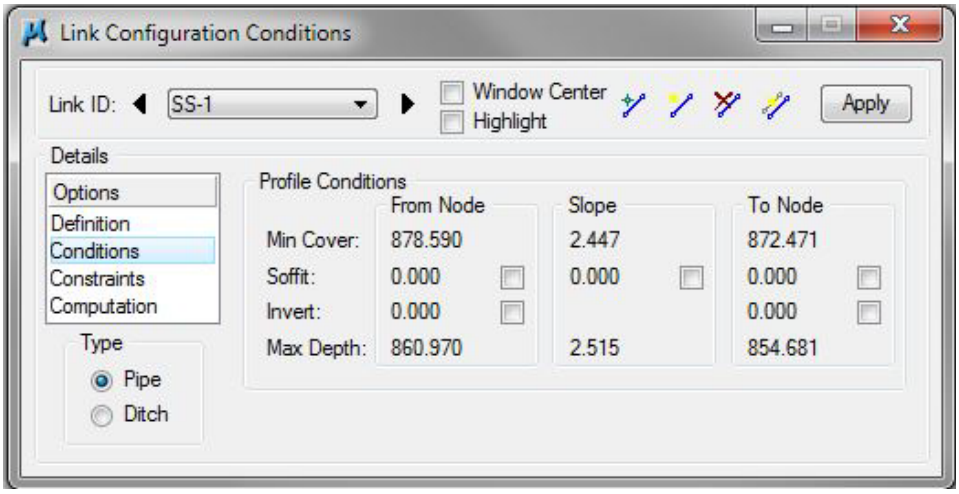
Roughness: Automatically set based on the selected Material

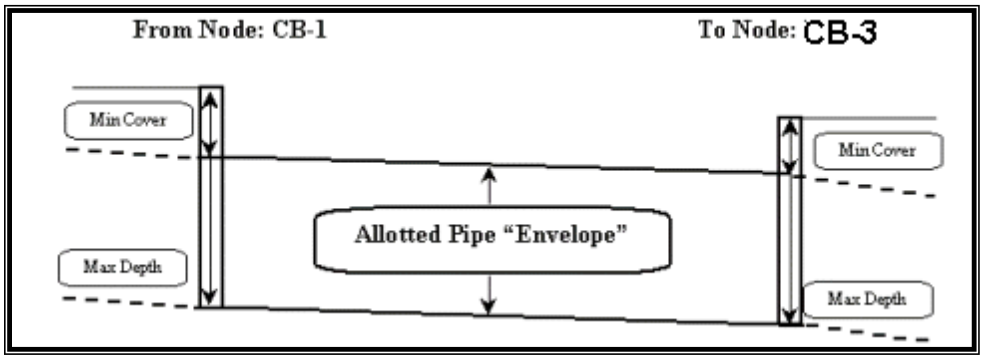
NOTES:
Multiple barrels could be designed, if required, by toggling **Design Barrels** ON or setting **Number of Barrels** to the determined number.

If the link size is known, it may be input by toggling **Design Size** OFF and clicking on the **Select…** button.



f) Conditions > The elevations shown are based on the Node Elevation minus the min/max depth. These depths were specified in the **Node Definition** (See Exercise 5) Dialog Box for Nodes CB-1 (From Node) and CB-3 (To Node) respectively. In this case, no entries are necessary and GEOPAK Drainage will design all the profiles for this project.





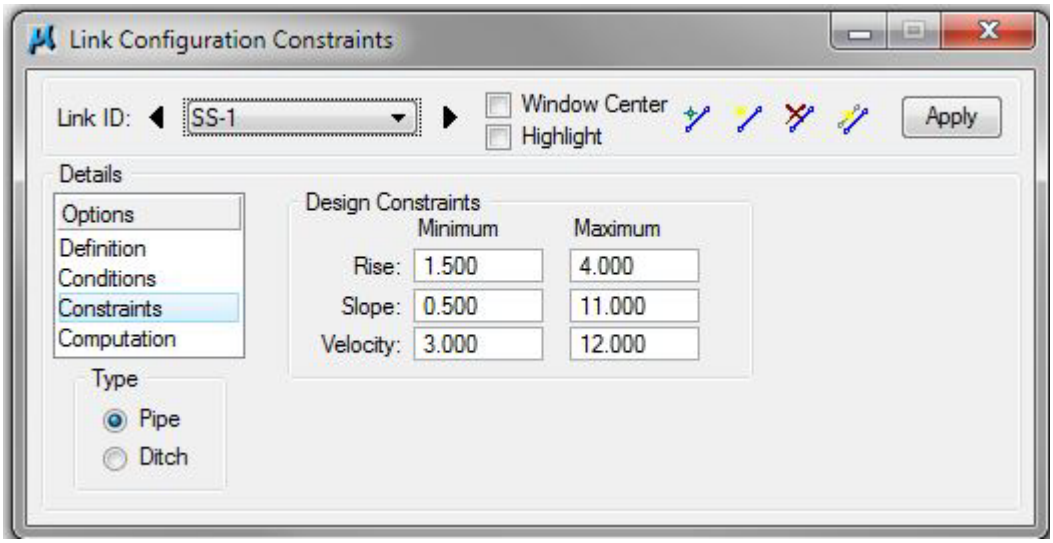
NOTE: When **manually** defining Invert elevations for links, make sure the drop across a structure is accounted for. In other words, if you were to define the Invert elevations for Links SS-1 and SS-3 at CB-3, then make sure the **From Node Invert e**levation for Link SS-3 is at least the minimum drop lower than the **To Node Invert** elevation for Link SS-1.

g) Constraints > Establish the min/max design criteria for Links as follows:

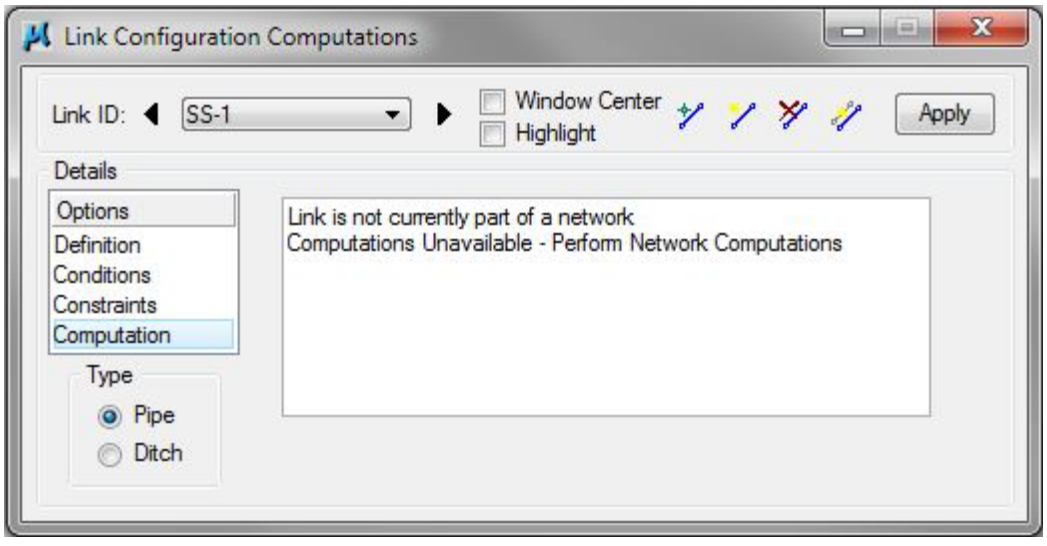
Rise Min/Max: 1.5 / 4.0 (feet)

Slope Min/Max: 0.50 / 11.00 (%)

Velocity Min/Max: 3.00 / 12.00 (fps)



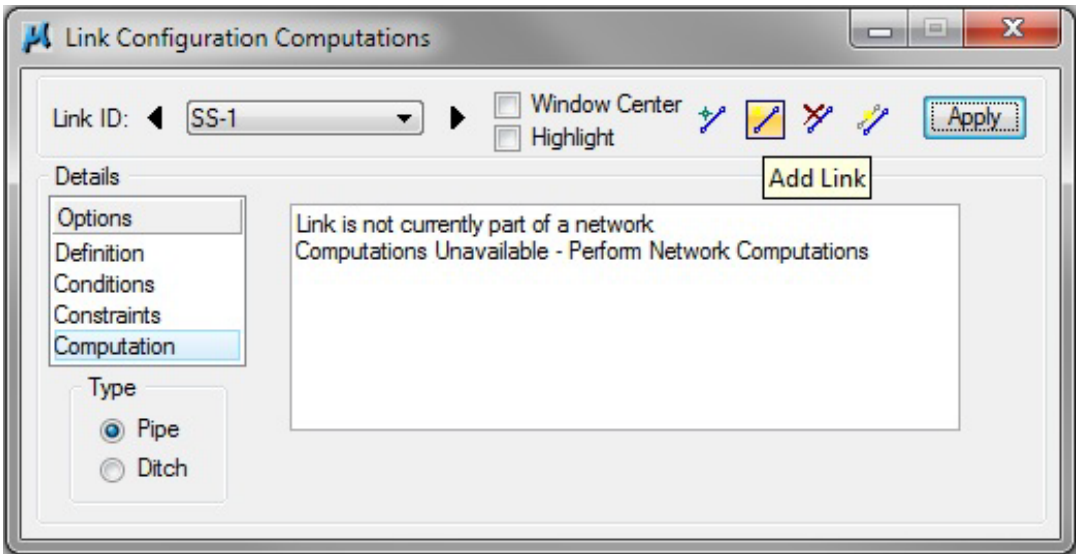
h) Computations > Displays the computed hydraulic properties of the Link.



NOTE: Link hydraulics are not available for review until a Network has been established and designed or analyzed successfully (See Exercise 8). Check back here for computations after the Network has been added and designed or analyzed.

i) Click the **Apply** button to include this Link in the drainage project.

j) **Add** the remainder of the link conveyance system using **Component > Link > Add** from the Drainage Menu Bar or by clicking the **Add Link** button as shown below.



As Links are added, most dialog values default from the previous Link with the exception of **From Node** and **To Node**. Add Links between all of the following Nodes:

Link SS-2 Traverses From Node CB-2 To Node CB-4
Link SS-3 Traverses From Node CB-3 To Node CB-6
Link SS-4 Traverses From Node CB-4 To Node CB-9
Link SS-5 Traverses From Node CB-5 To Node CB-2
Link SS-6 Traverses From Node CB-6 To Node CB-12
Link SS-7 Traverses From Node CB-7 To Node CB-3
Link SS-8 Traverses From Node CB-8 To Node CB-6
Link SS-9 Traverses From Node CB-9 To Node CB-11
Link SS-10 Traverses From Node CB-10 To Node CB-9
Link SS-11 Traverses From Node CB-11 To Node CB-13
Link SS-12 Traverses From Node CB-12 To Node CB-14
Link SS-13 Traverses From Node CB-13 To Node MH-1
Link SS-14 Traverses From Node CB-14 To Node MH-1
Link SS-MH1 Traverses From Node MH-1 To Node EW-1

**** See notes on next page ****

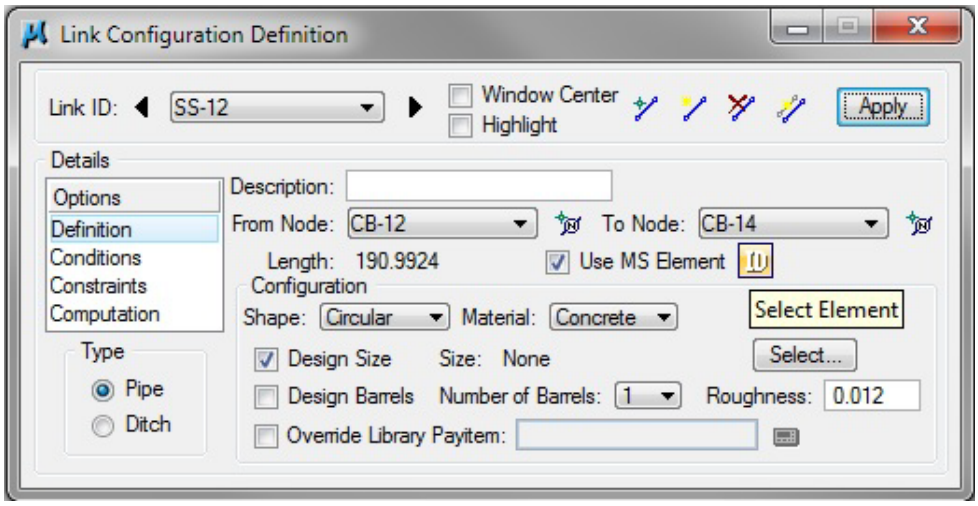
6.2 Curved Links

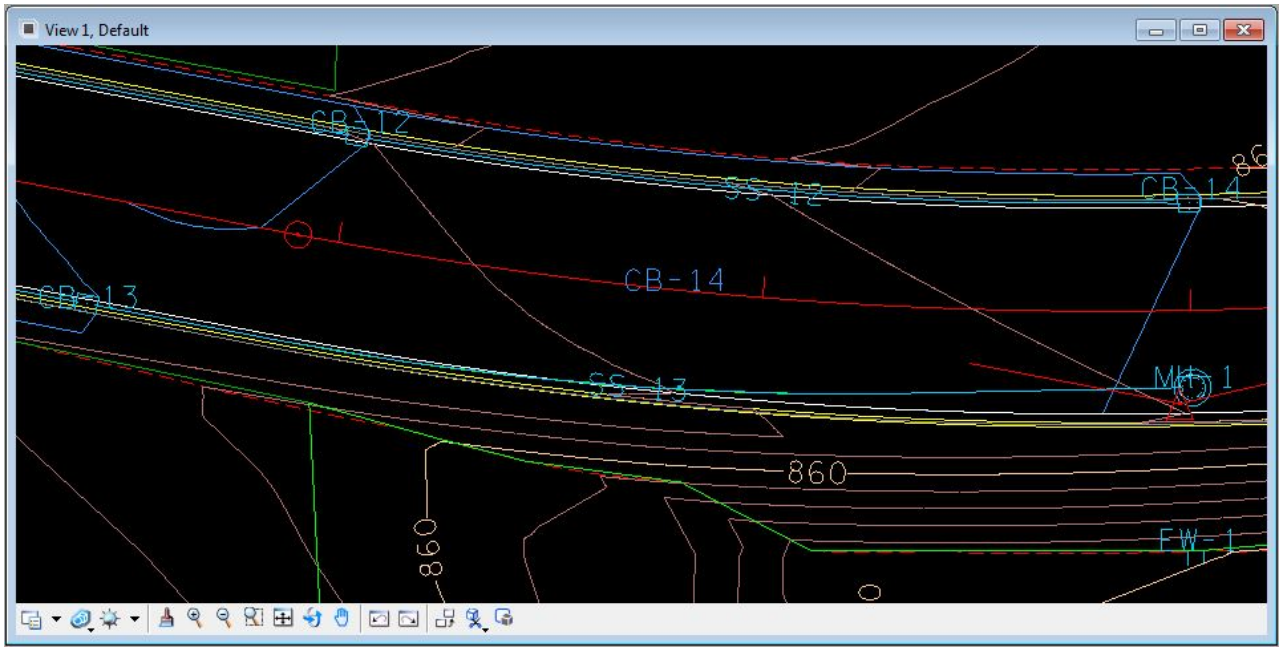
a) Use MicroStation's Place Arc Tool and use the settings 'Method: Start, Mid, End' to draw a curved element (must be a continuous line string) between the nodes and following the middle of the gutter to the extent possible.

NOTE: Make sure the ends of the MicroStation Element terminate at the correct attachment point on the catch basin.

b) In the **Link Configuration Definition** dialog **toggle ON Use MS Element.**

c) Click the Select Element button then Data Point on the element created in **Step 1.** Then click **Apply**.

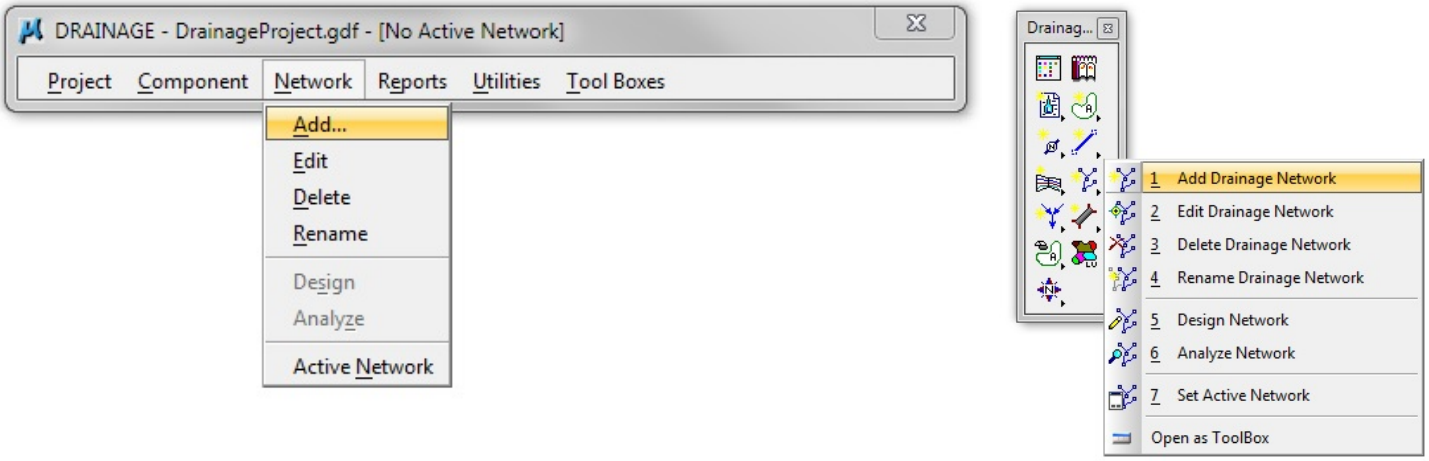




NOTE: Be sure to toggle **Use MS Element** OFF for subsequent Links that are not curved. When used, the Link position and length are defined by the MS Element. **Caution must be used** in order to properly define the Link.

6.3 Storm Drainage Network Design

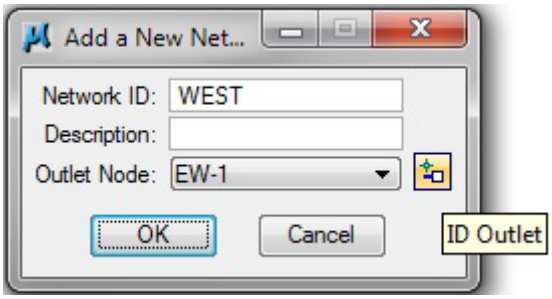
a) Select the **Add Drainage Network** tool or select **Network > Add** from the main drainage menu bar.



b) In the **Add a New Network** dialog, enter the following information:

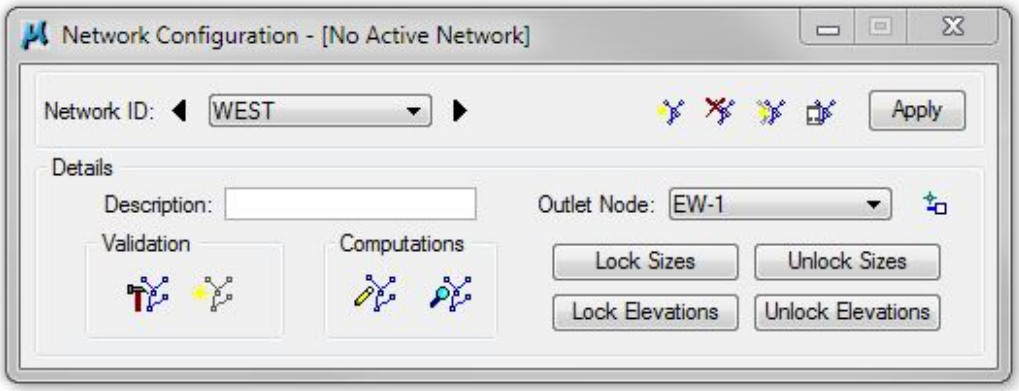
Network ID: WEST

Outlet Node: EW-1

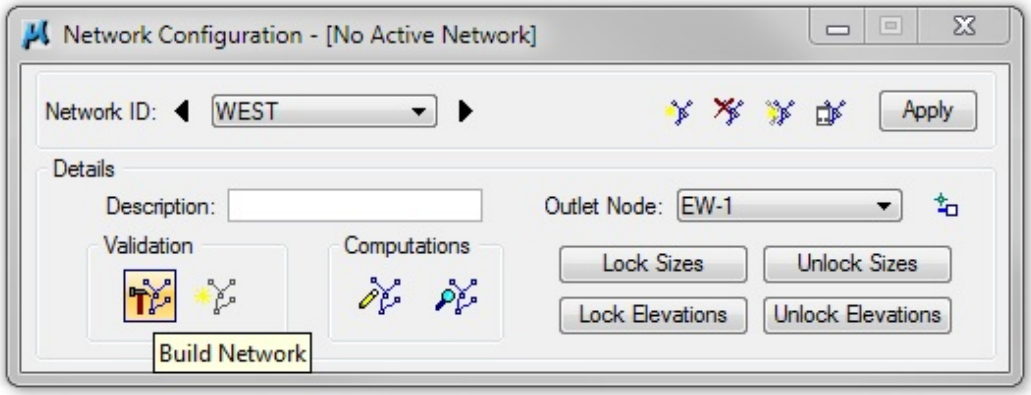


NOTE: The **Outlet Node** may be selected via the dropdown or by clicking **ID Outlet** and selecting the Node in the plan view.

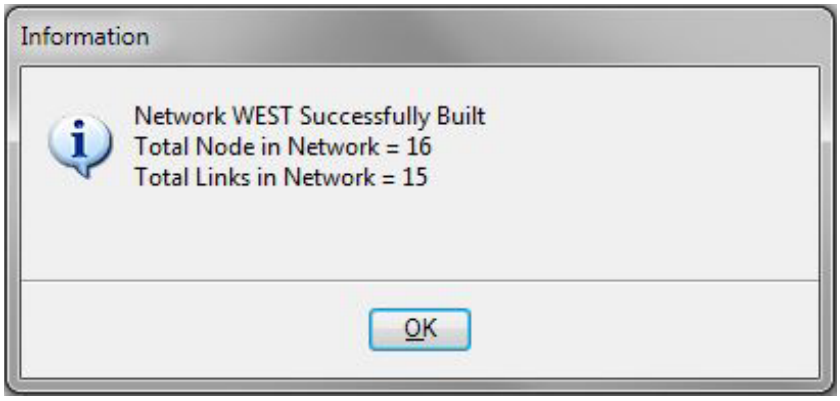
c) Click **OK** in the Add a New Network dialog box.



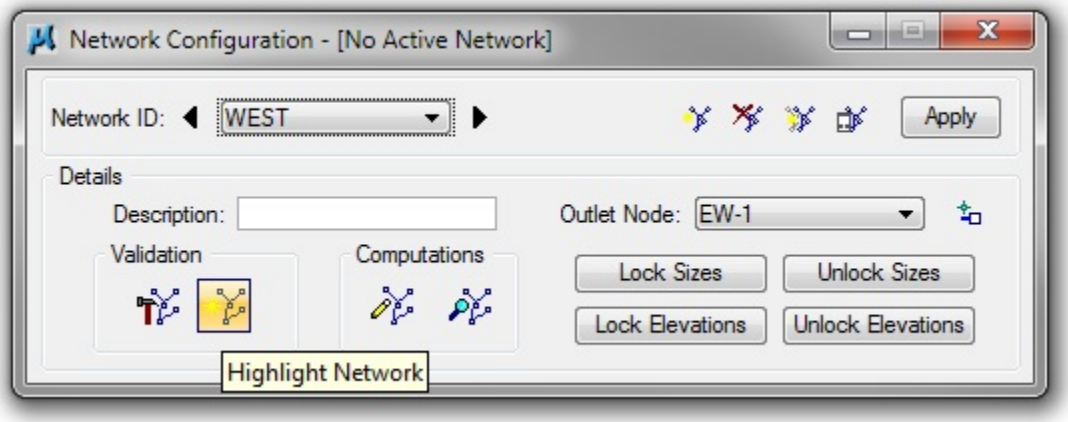
d) Click the **Build Network** button. This feature verifies the nodes and link connectivity.



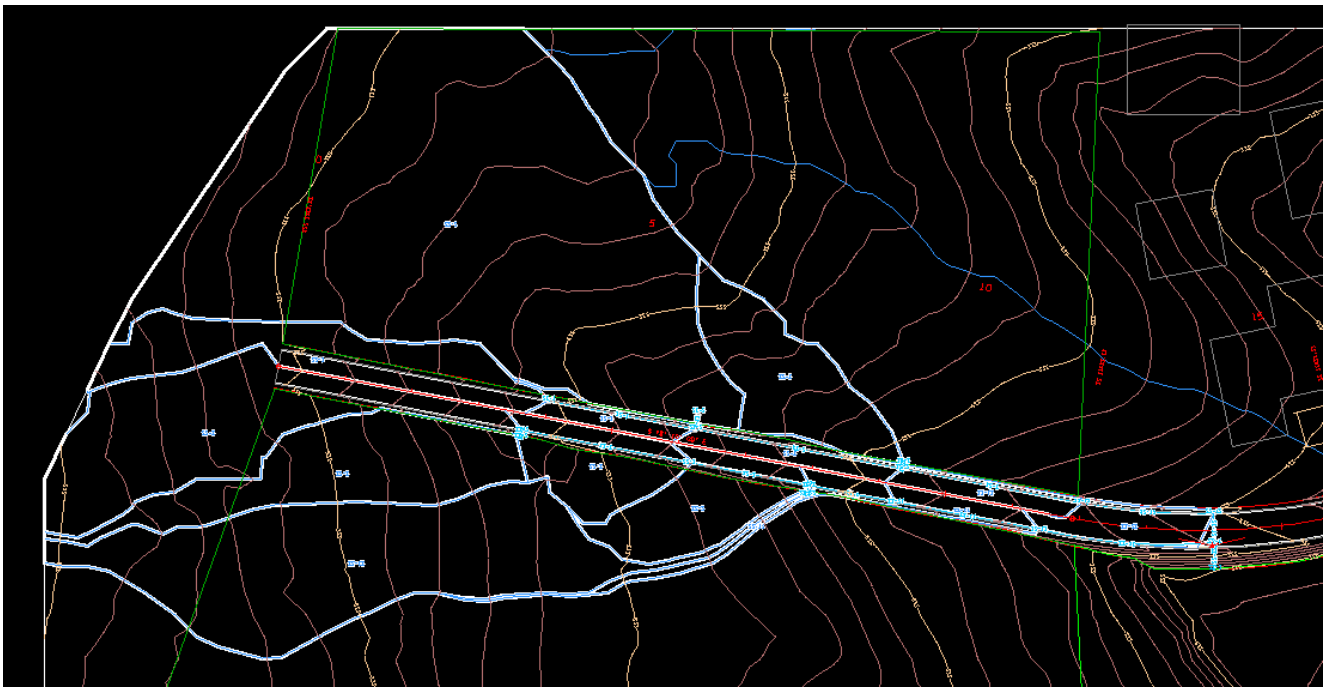
Click **OK.**



e) Click the **Highlight Network** feature. This Feature highlights all components (areas, inlets, pipes, etc.) connected to the active Network.

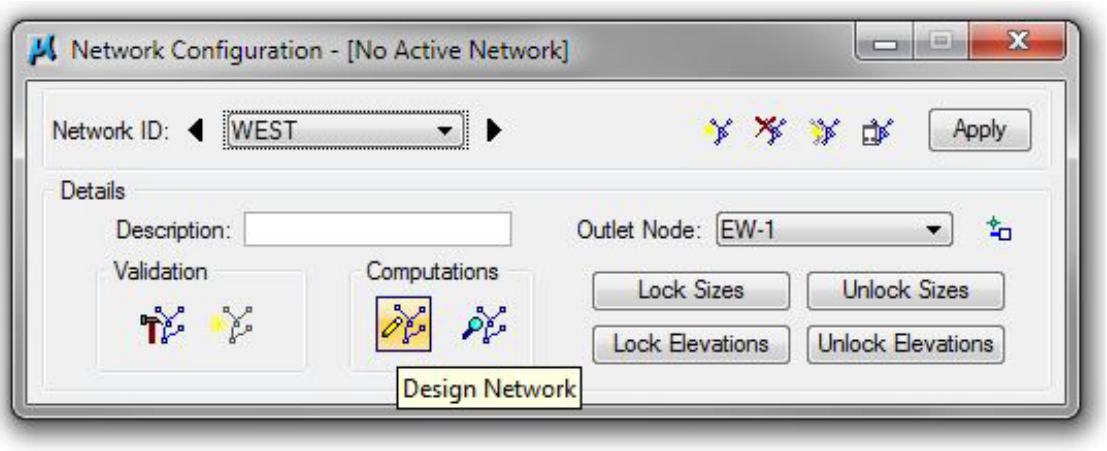


f) Verify that all network components are highlighted.

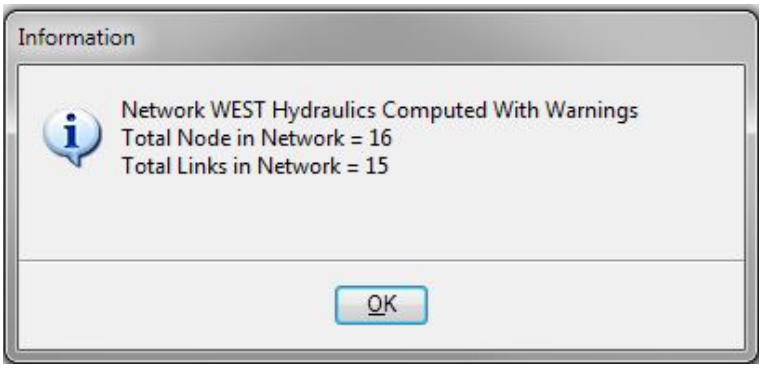


g) Click the **Apply** button. Network "WEST" has been added to the project.

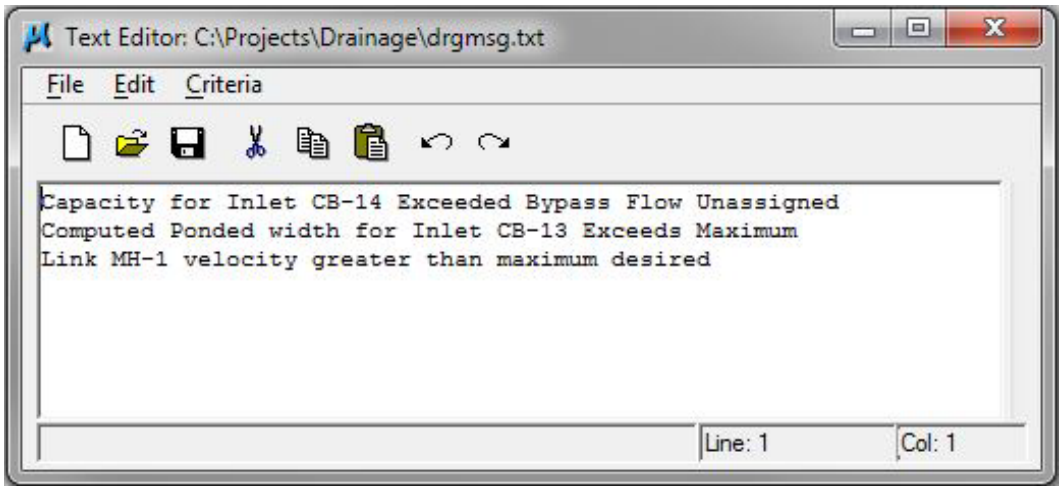
h) Click the **Design** button. This command initiates the hydraulic design of the components contained in the Network.

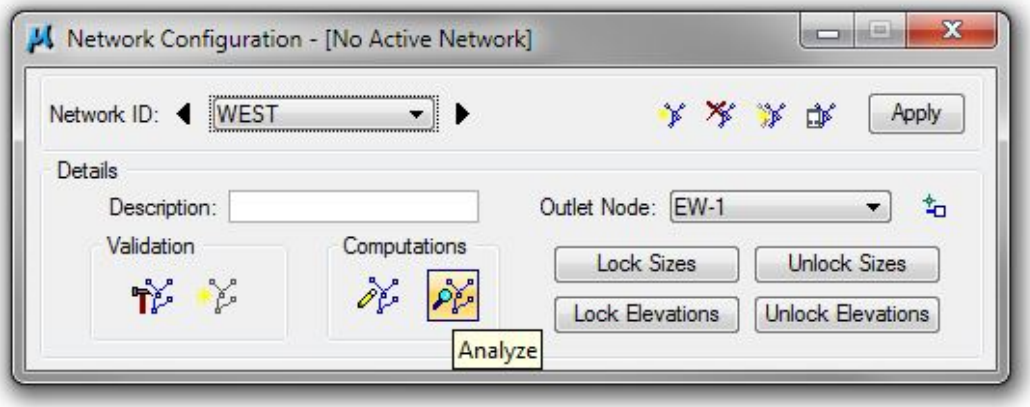


Click **OK**.



i) Review errors to determine steps needed to correct and close the text editor. (See **Appendix C** for common errors and fixes)





NOTES:
Pressing Design or Analyze should be the last step in Designing or Analyzing the Network.

Design performs hydraulic design of the network and designs components of the network as indicated by the 'design toggles'. **Analyze** performs hydraulic analysis of the network as is and ignores all 'design toggles'.

Lock and **Unlock buttons** allow the user to lock or unlock all components in a network at the given **Size** or **Elevation. Caution** must be used when selecting **Unlock** as this action will unlock ALL **Sizes or Elevations,** including ones that should not have been unlocked.

After **Design** or **Analyze** has been utilized, computation values are shown in each link configuration of the network which can be reviewed in the Link Configuration edit dialog. Other methods of reviewing this data will be discussed in Exercise 10, Drainage Navigator.