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# Chapter 4

# Storm Sewers

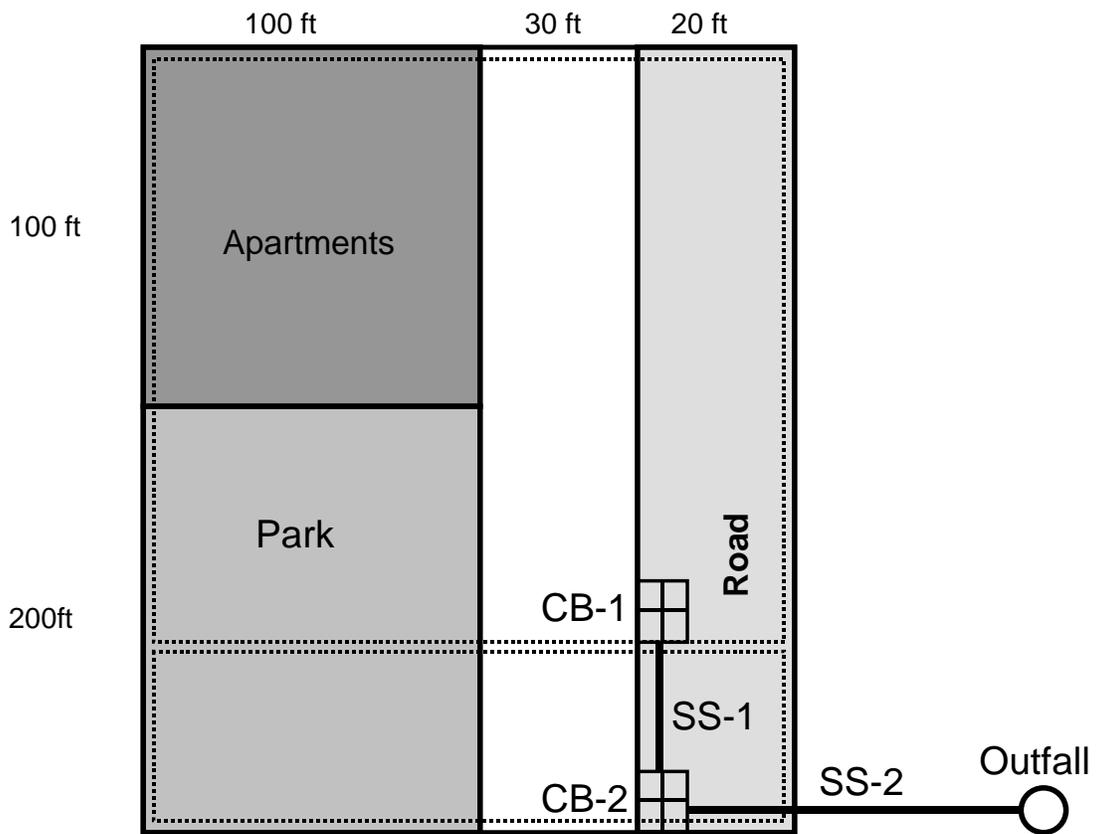
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### 4.1 Objectives

Link established inlets with storm sewer pipes and create a drainage network in GEOPAK  
 Drainage then design the network and view output.

### 4.2 Overview

Place an outfall approximately 100 ft to the left of inlet CB-2. Design pipe SS-1 between inlet CB-1 and CB-2. Design pipe SS-2 between inlet CB-2 and the outlet. Assume the outfall is at an elevation of 99.0 ft and the HGL begins at normal depth in the pipe.



## 4.3 General Pipe Design Criteria

The basic design of the pipe is controlled by the parameters set in three locations:

**Preferences >Link Options**

**Link Profile Options** -Minimize Pipe Size or Minimize Depth of Cover

**Link Design Options** -Design for Full Capacity

**Node Configuration >Elevations >Vertical Alignment Preference**

Use **Match Soffit** (Top inside surface of the pipe)

Set the Minimum Depth and Maximum Depth. This determines the design envelope for the pipe design. The preferred minimum depth of cover is 3 ft; the absolute minimum is 1 ft below the pavement. EPG 750.4.2.1

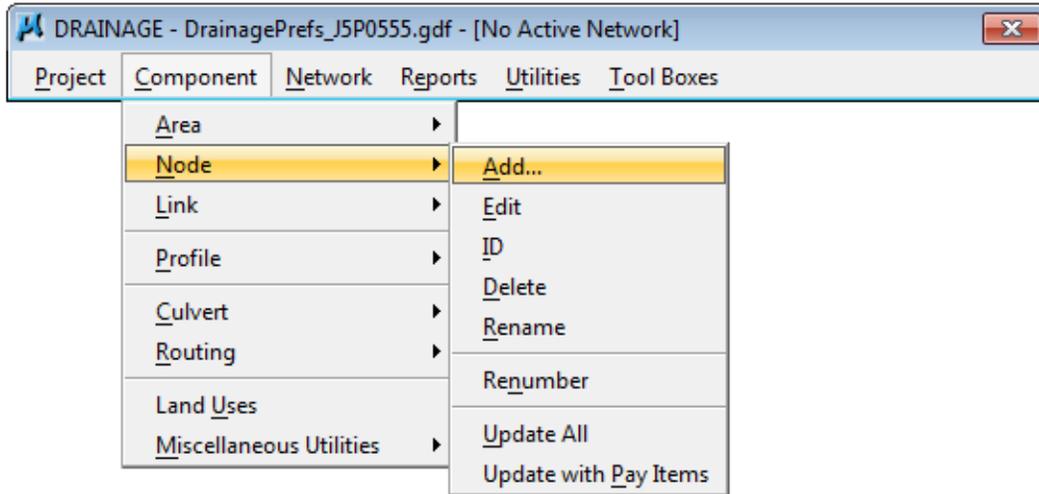
**Link Configuration >Constraints**

As a rule of thumb use a minimum slope of 0.0103 and a minimum velocity of 3.0 ft/s. See EPG 750.4.2.5 for a table of minimum slopes to achieve a self-cleaning velocity when the pipe is flowing a quarter full. The maximum slope and velocity is up to the discretion of the designer.

Use a minimum rise (diameter) = 1'. This is the smallest pipe in the drainage library.

Use a maximum rise (diameter) = 9'. This is the largest pipe in the drainage library

## 4.4 Create an Outfall



### 1. Go to Component >Node >Add

Name the node **OUTLET**

### 2. Configure the Outlet node according to the following specifications:

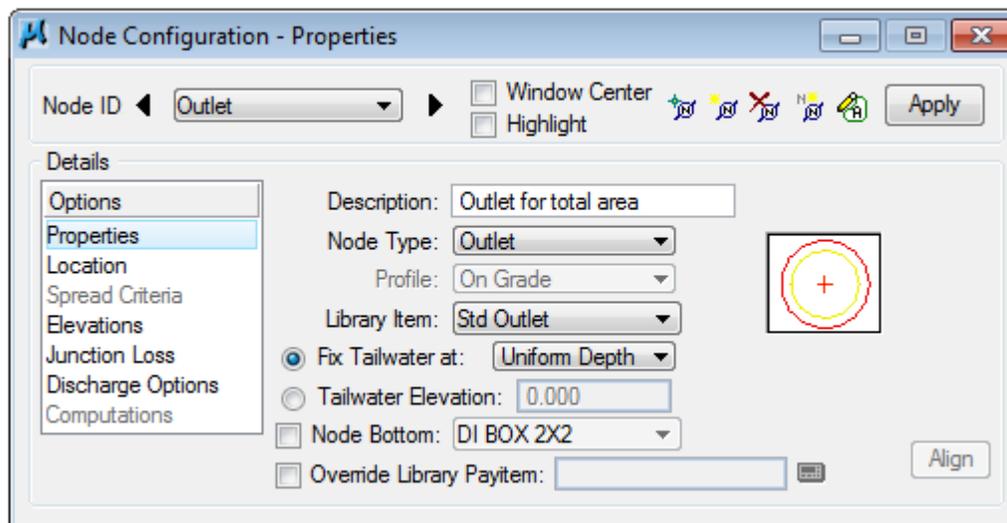
#### Properties Option

Node Type: **Outlet**

Library Item: **Std Outlet**

Fix Tailwater at: **Uniform Depth** for this example.

Note: For information on establishing tailwater for storm sewers see EPG 750.4.4.1



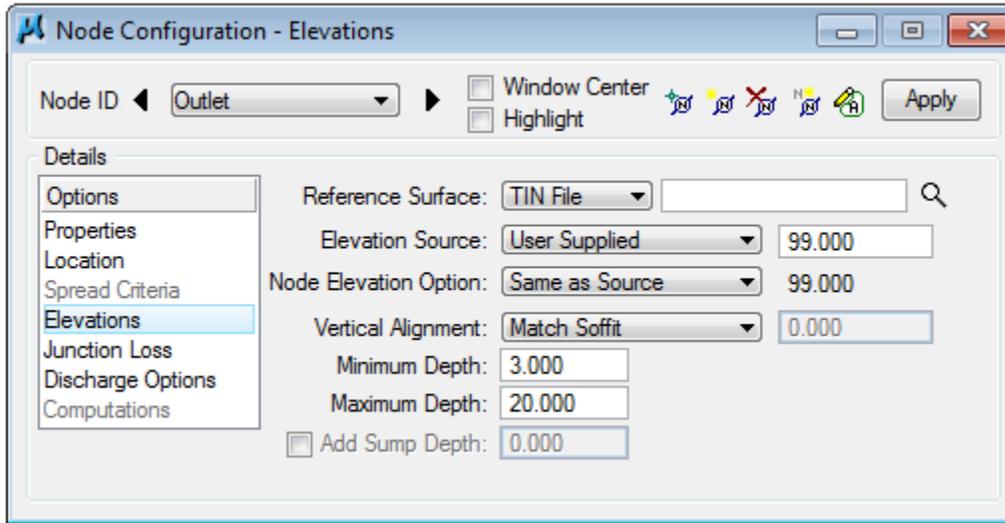
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## Location Option

Place the outfall approximately 100 ft to the right of CB-2, using the same approach used for placing inlets CB-1 and CB-2.

## Elevations Option

Elevation Source: **User Supplied – 99**



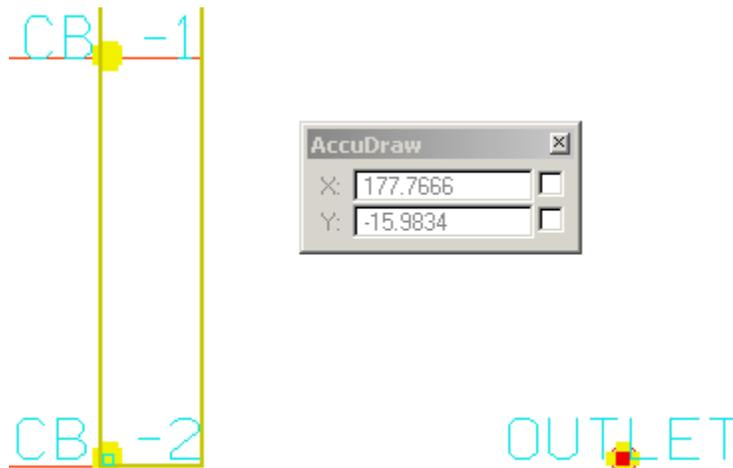
## Junction Loss

No changes required.

## Discharge Options

Select **Use Computed Discharge**

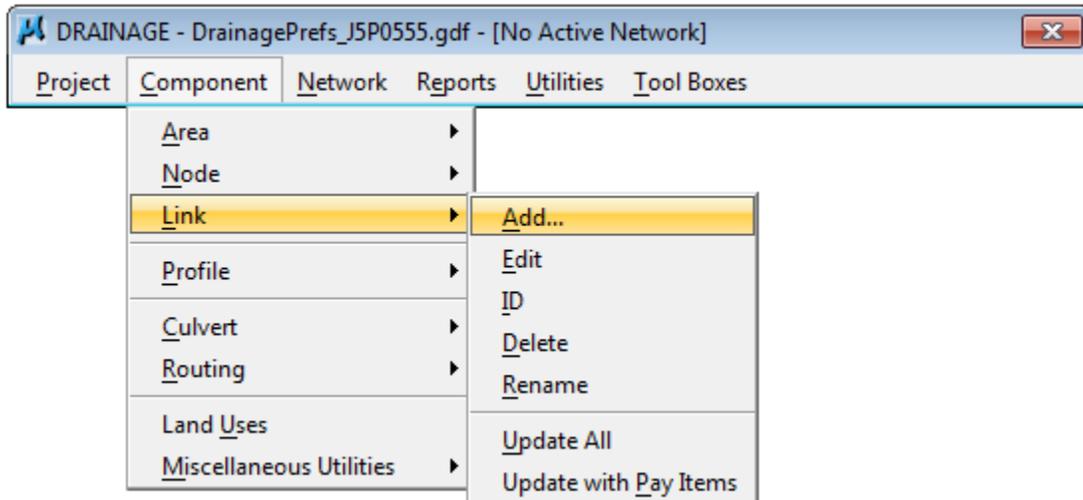
Finally select the **Apply** button



## 4.5 Add Pipes to the Storm Sewer Network

### 1. Go to **Component >Link >Add.**

The link ID should appear as SS-1.



### 2. Configure SS -1 by following the information provided below:

#### Definition Option

Set the From Node and the To Node fields by using the drop-down lists or by using the ID option and selecting the nodes graphically.

Shape: **Circular**

Material: **Concrete**

Toggle on **Design Size** and select any pipe from the drainage library.

With the Design Size toggle enabled GEOPAK will run through the pipes contained in the drainage library starting from the smallest diameter until it finds one that will work for the supplied design parameters.

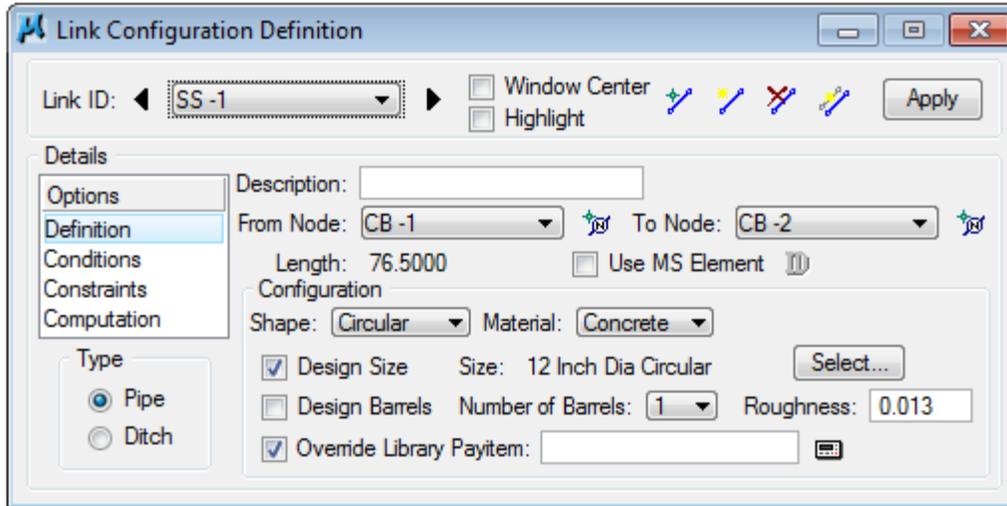
You can force a pipe diameter by un-toggling Design Size and selecting a pipe from the drainage library.

Number of Barrels: **1**

Check the **Override Library Payitem**

This will allow for a deviation from the standard pay item number.

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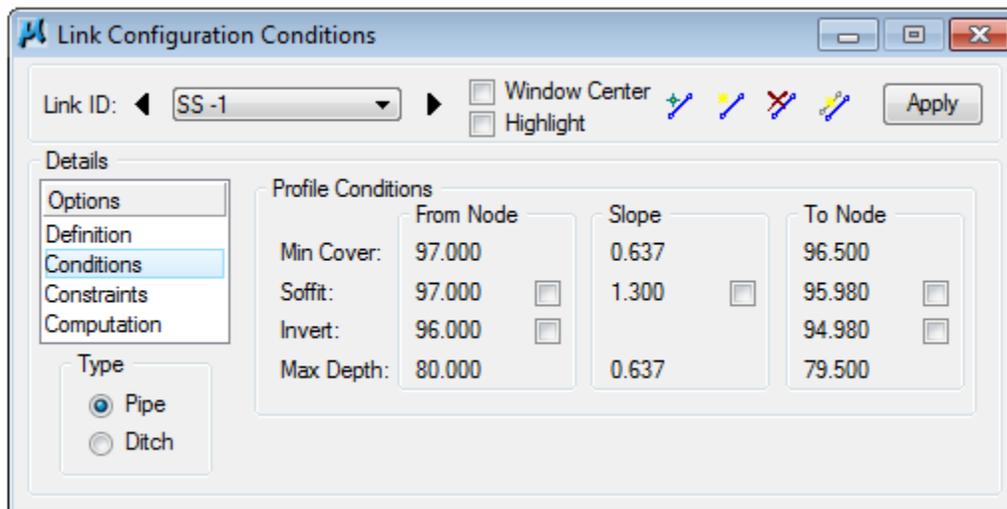


## Conditions Options

The elevations corresponding to minimum cover and maximum depth are taken from the node configurations.

Note the soffit (top inside surface of pipe) and invert (bottom inside surface of pipe) are initially zero. After the pipe has been designed (or if a pipe diameter had been selected under the definitions option) these values will be populated.

**Any two parameters** can be fixed in this dialog, by selecting the toggle next to the field. For example you could force the soffit at node CB-1 to an elevation of 97 and a slope of 1.5%.

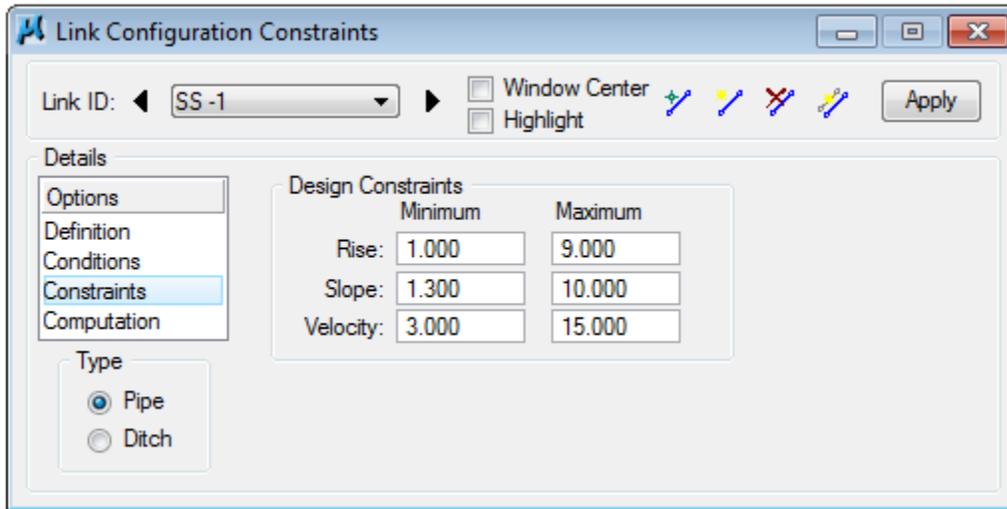


## Constraints Option

Set the **minimum and maximum rise** (pipe diameter) the program should use. The program will design a pipe by choosing from the drainage library between these two extremes.

Set the **minimum and maximum pipe slopes**. Select a minimum slope steep enough to establish a self-cleaning velocity.

Set the **minimum and maximum velocity**. Select a self-cleaning velocity for the minimum.



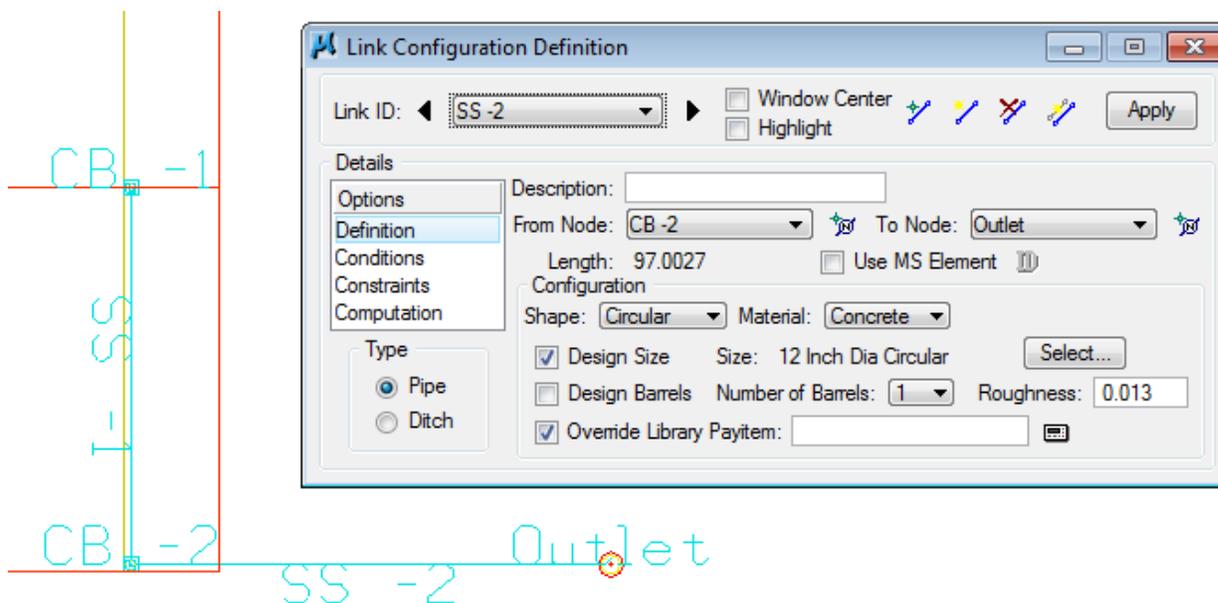
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## Computation Option

Note there will not be any computations available until after a network has been created.

**3. Select the Apply button to store the pipe in the gdf file.**

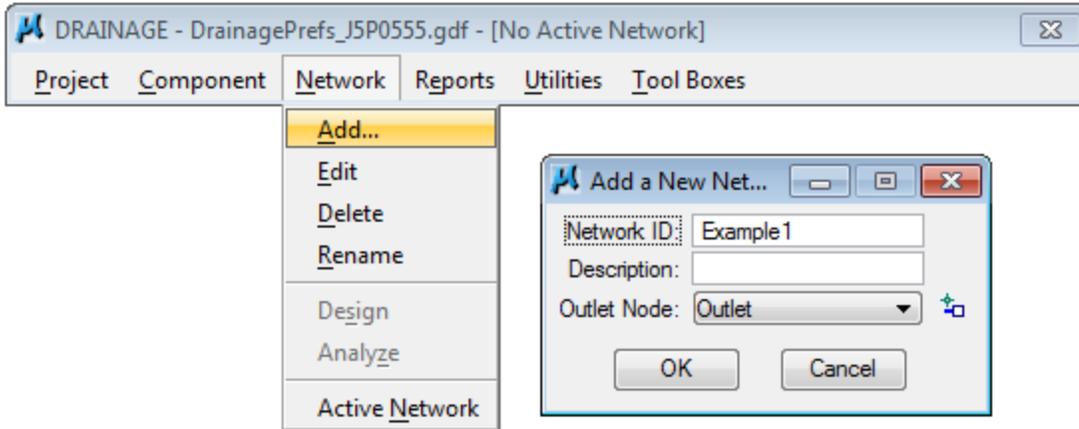
**4. Add pipe SS-2 in a similar fashion.**



## 4.6 Create a Network

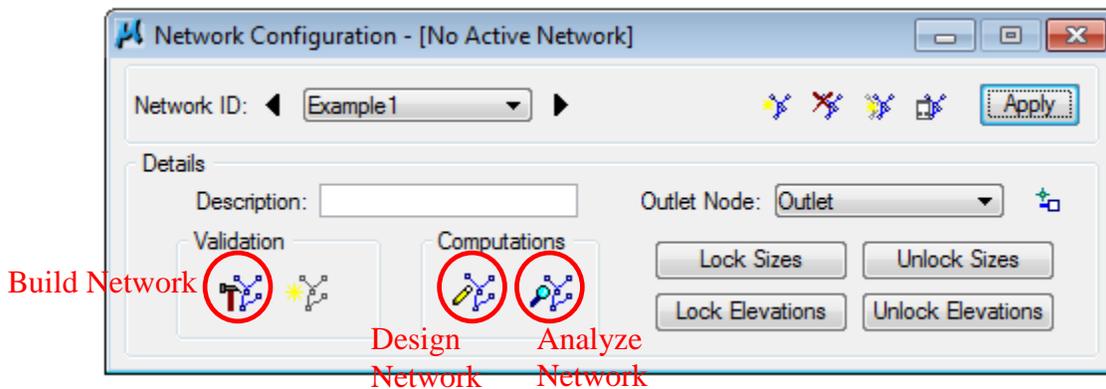
**1. Go to Drainage >Network >Add menu**

2. Enter **Example 1** for the network id
3. Specify the **Outlet Node** as **Outlet**
4. Select **OK**



5. Select the **Build Network** button  
The Build Network function checks for connectivity and establishes the flow direction through all of the links. This function also validates all components for errors and unresolvable issues such as loops, duplicate links, no outlet, or multiple outlets.
6. Select the **Apply** button to place the network in the GDF file.
7. Select the **Design** button to design the network based on any design toggles that have been selected. (Do not click the **Apply** button after choosing **Design**)

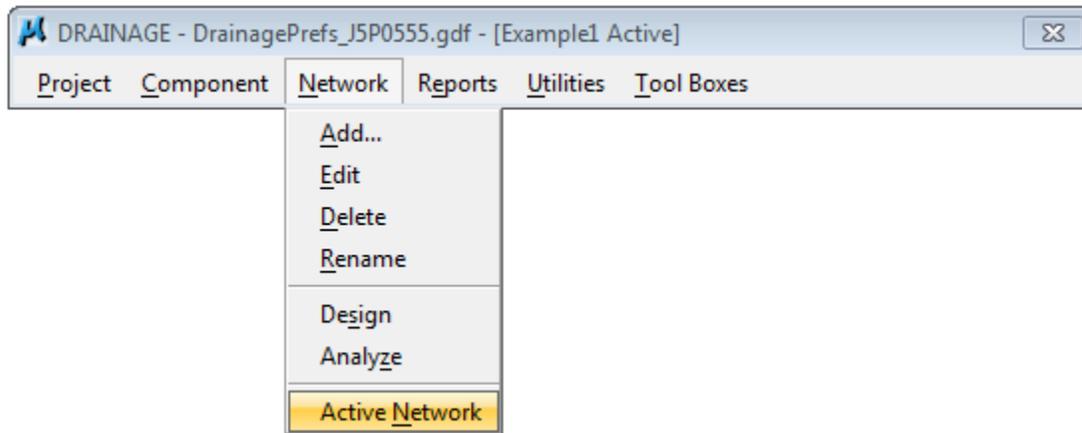
The **Analyze** button will ignore any design toggles that have been selected and simply performs a hydraulic analysis of the network.



**Lock Sizes** will lock all sizes in the network before designing  
**Lock Elevations** will lock all elevations in the network before designing

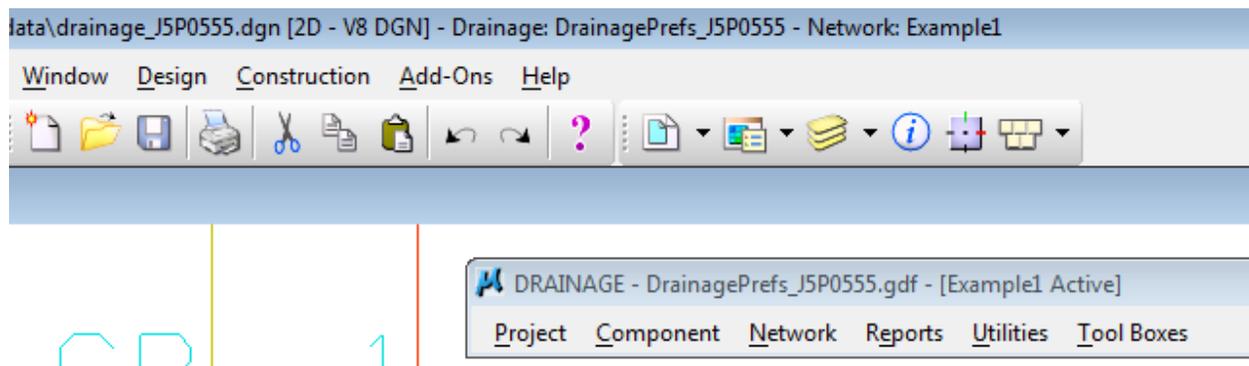
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8. Now go to the **Network** drop-down menu on the **Drainage** menu bar and select **Active Network**



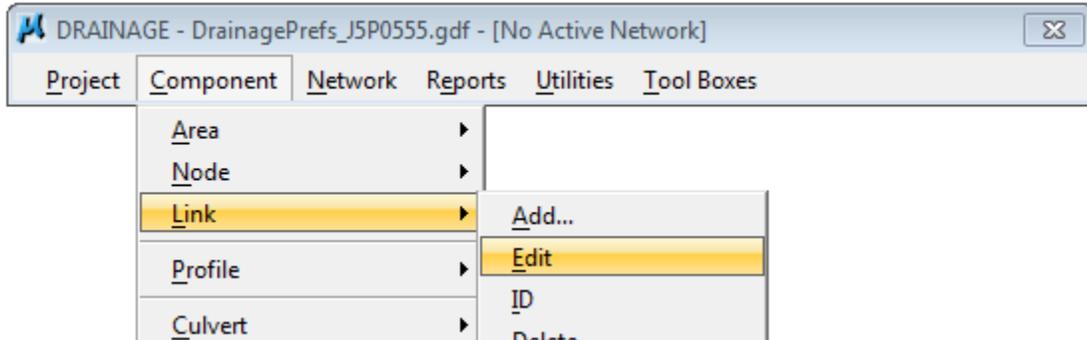
A drainage project can contain multiple networks and GEOPAK Drainage uses the Active Network feature to limit the amount of information processed by the application. This speeds up performance by focusing reporting, querying, and navigation tools on the current active network. It is a good practice to assign the network you are working on as the active network.

Note that **Example1** is now displayed in the banner as the active network.



The computations for the pipes can now be viewed.

## 1. Go to Component >Link >Edit



## 2. Data point on either the link or text for pipe SS-1

Both the conditions and computations now have values.

