Section 2 - Placing Sump Grates and Pipes

How to Set Drainage Options
When to Set Structure Settings
Using Preference Sets
Placing Ditch Inlets
Placing a connecting Pipe
Saving the Drainage File

Overview

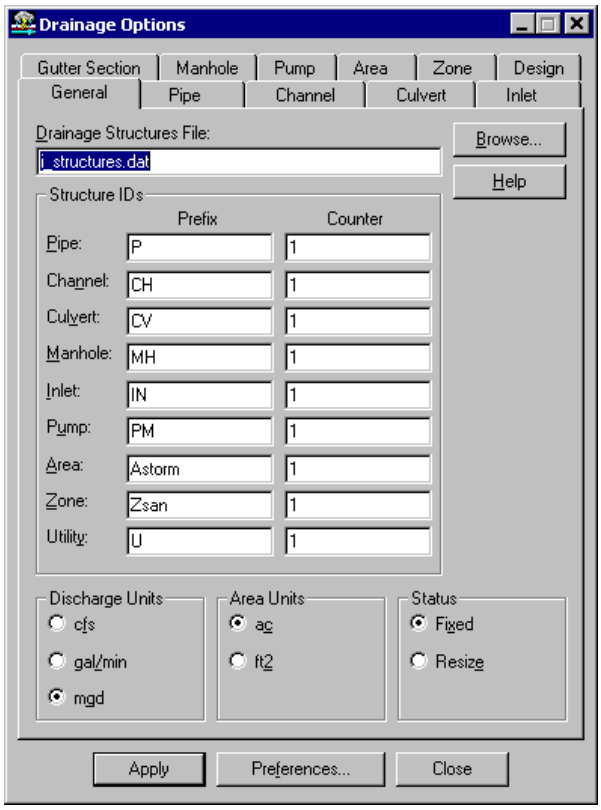
The Drainage database has a data model for each of the drainage structures types it models. Pipes, for example, have over 70 storable attributes, inleets over sixty. Obviously Laying Out structures would be a very slow process if the user had to answer fifty questions per structure. Typically, some attributes of a structure type remain fairly constant in an office or on a project. Other data varies for every instance of a structure. When Laying Out structures, S&S only asks the users for the most volatile information, the rest it takes from pre-defined settings.

Default Settings
In implementing Storm & Sanitary, Intergraph chose to allow saving common static region- or project-wide data in Preference files. This data is easily modified by the user, but it provides a common starting point from which to start, and can be thought of as Default Settings.

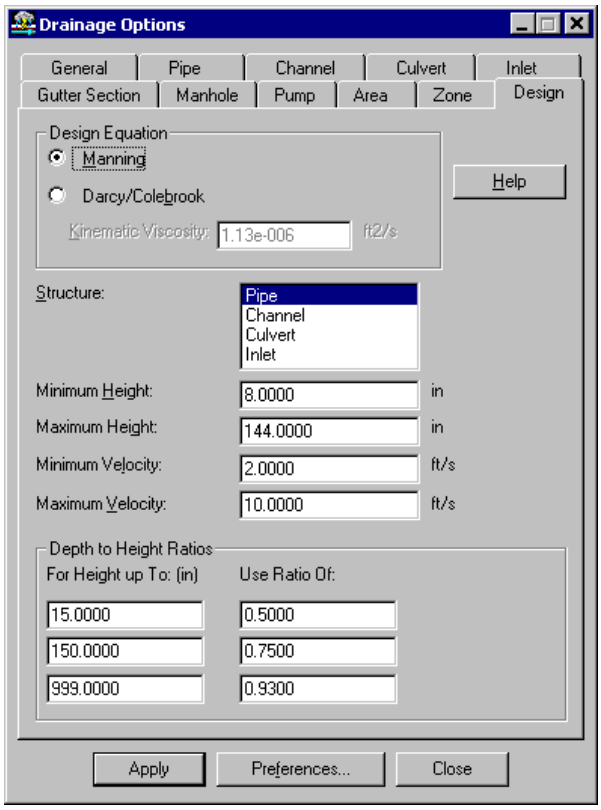
Interactive Settings
Structure-specific information, such as location, cannot be saved ahead of time. This information must be input by the user during Lay Out of the Structure. These can be thought of as the Interactive Settings.

Other fields in the structure model cannot be set until later in the workflow when other information is provided, such as flow information.

The default options are segregated into General, Design, and structure-specific areas.



Drainage Options form, General tab



Drainage Options form, Design tab

The Design tab, "Structure:" listbox, lists the four structure types. Design settings for the structure types are set through this Design tab.

Structure physical characteristics are set under the tab for that structure.

Goal 1 – Setting Default Options

The first step in laying out a structure is to make sure that S&S Design and Structure Defaults Settings are set properly. General settings, such as Discharge Units or Hydraulic Equation, seldom change. Other settings, such as Pipe Sizes and Inlet Types, tend to change many times across a network.

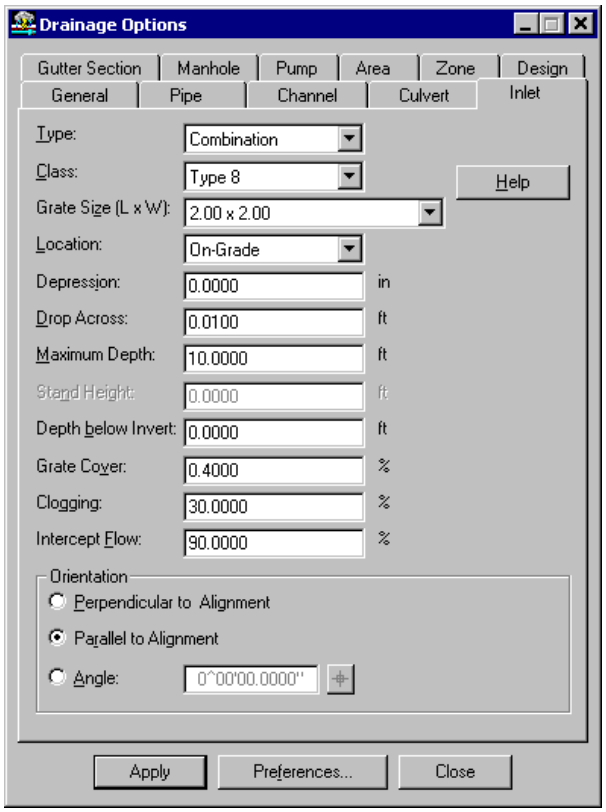
1. Select SC>Tools>Drainage>Options.

The Drainage Options form is invoked. The General and Design tabs tend to contain information that changes infrequently. Nonetheless, a quick check will only enhance quality.

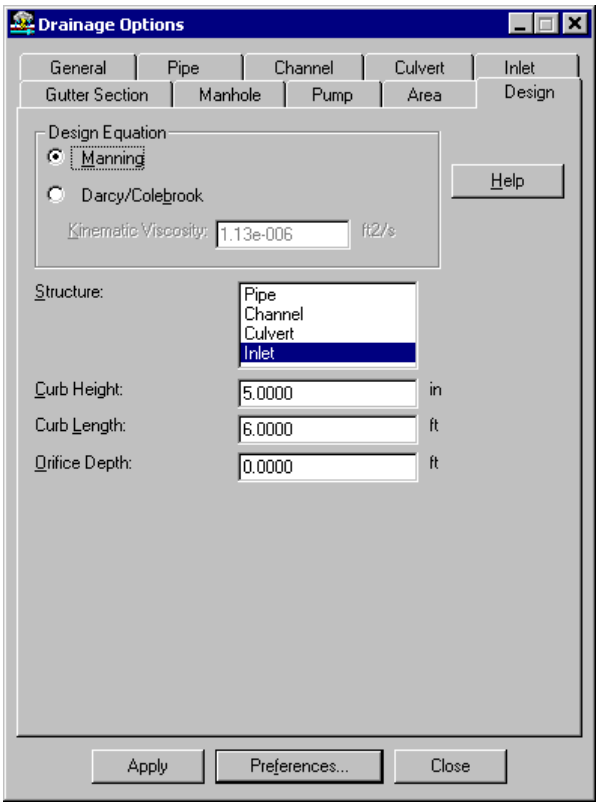
In this lab we will place two Grate Inlets in Sump condition along the centerline of the inverted-crown Balcony Rd. We will also place a pipe between these two Inlets. Before doing so we set the "default" settings of the inlets and the pipes.

2. Select the Inlet tab of the Drainage Options form.

3. The active Inlet Information is displayed, which may or may not be appropriate for the structures we are placing.
4. Click on the Design tab.
5. Click on “Inlet” in the “Structure:” list.



Default Inlet settings under the Inlet tab

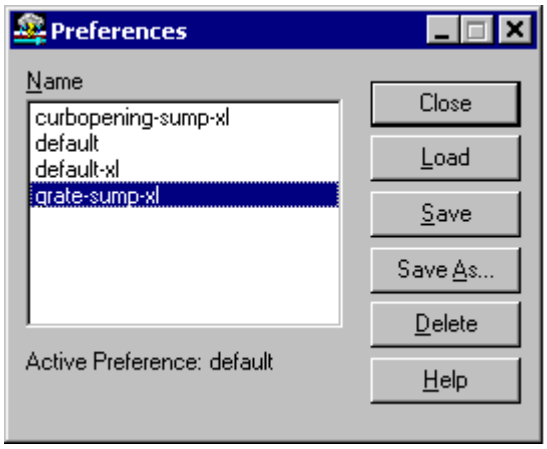


Default Inlet settings under the Design tab

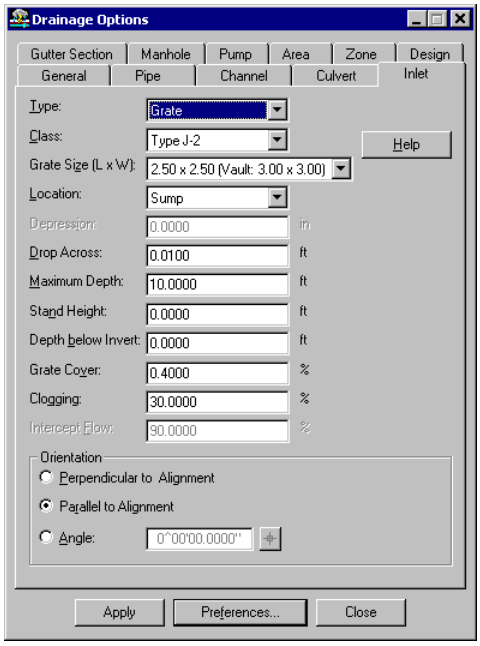
Rather than change each individual setting individually, which requires attention to detail, many steps, and is subject to error after many changes to structures, let us see if an appropriate Preference Set is set up:

6. Select the Preference… button.

The Preference form is invoked, displaying the previously-defined Preference Sets for the Drainage Options Dialog box.



7. Select the Preference Named "Grate-Sump".
8. Click "Load".
9. "Close" the Preference form.



Note: ALL the settable options in the form (not just the those visible under the active tab) are reset as per the Preference Set values.

Management Hint: For relatively static settings, individually changing settings every time leads to greater rework and chances for random errors. Appropriate Preference Sets minimize rework and changes for random errors. Changes to incorrect or non-existent Preference Sets should be saved as a new Preference Set and sent to the "Standards Manager" for review and inclusion into the software standards.

10. Verify the information in the form matches that shown here.

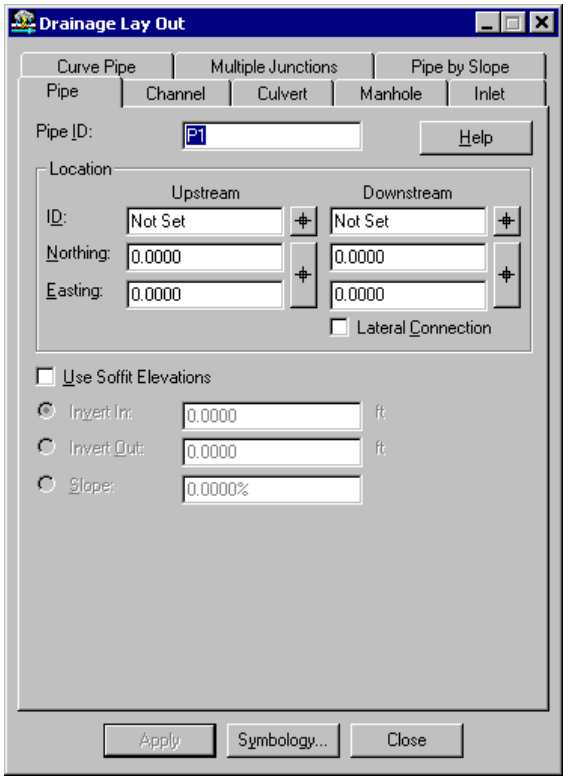
11. If you make any necessary changes, hit Apply.
12. "Close" the form.

Goal 2 – Place Sump Grates

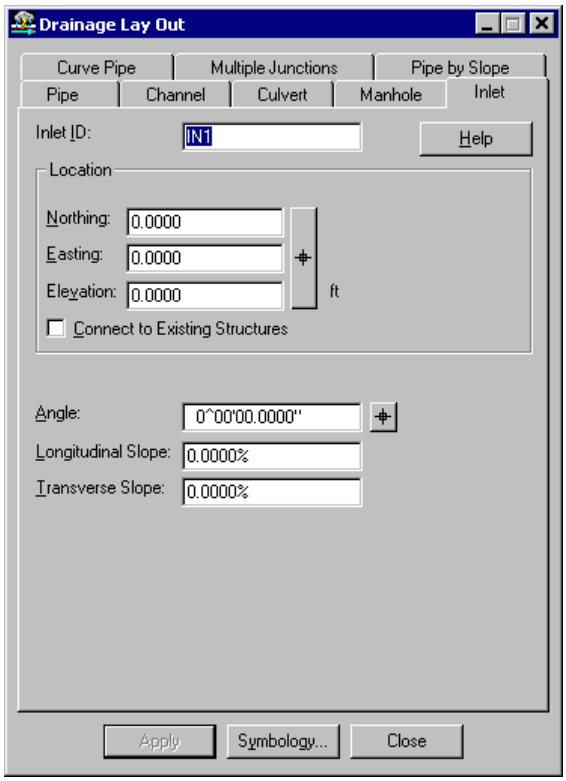
Now that we have set up our Grate Inlet defaults, let's place them.
In our dataset we will place two Grate inlets at sump locations along the centerline of the inverted-crown Balcony Rd. The leaders are linestrings which can be snapped to for "exact" placement.

13. Select SC>Drainage>Layout 

The "Pipe" tab is displayed by default.



14. Select the "Inlet" tab.



The “Inlet ID” value is derived from the settings defined in the Drainage Options form, General tab. Duplicate ID's are not allowed. The number is incremented to the next available number.

The Location frame contains Northing, Easting, and [Inlet] Elevation key-in fields. A locator button  to the right of these fields allows the user to use select the location via a MicroStation Data Point <D> or Tentative Snap <T>.

If the point lies within the active surface the Elevation is read from the surface. If the point does not lie within the surface it reads the elevation from the active Z (which can be arbitrary) or from the elevation of the tentative point <T>.

Note: any default offered by the SelectCAD products is editable if it is in a text (or keyin) field.

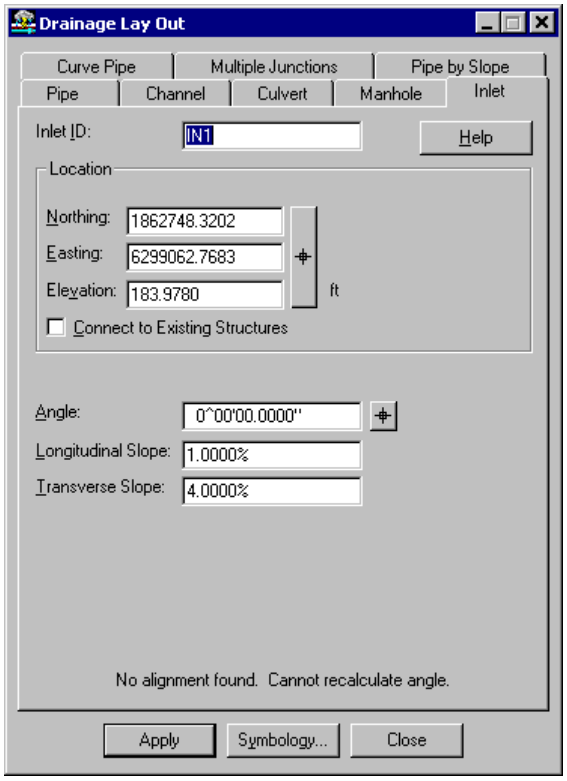
“ Angle:” refers to the placement angle of the structure (subject to defaults in Drainage Options>>Inlets: Absolute Angle; Parallel to Alignment, Perpendicular Alignment).

“Longitudinal Slope:” and “Transverse Slope:” are used for gutter flow depth and spread calculations (subject to defaults in Drainage Options>>Inlets) and are more important for on-grade inlets.

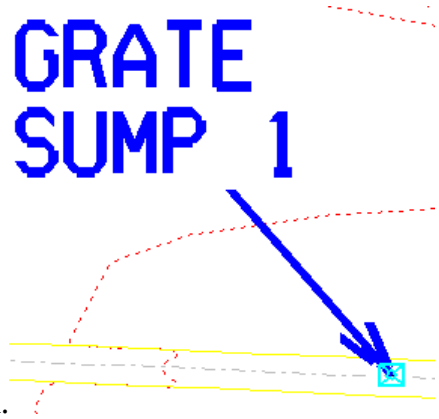
The "Symbology" button invokes the View Drainage Symbology form from which the Inlet symbology can be set (discussed later in Chapter 3).

15. Click the Locator button  to the right of the Northing, Easting, and Elevation fields.
16. Snap to the end of the "Grate Sump 1" leader.

The form should return looking similar to the screenshot below:



17. Hit Apply.

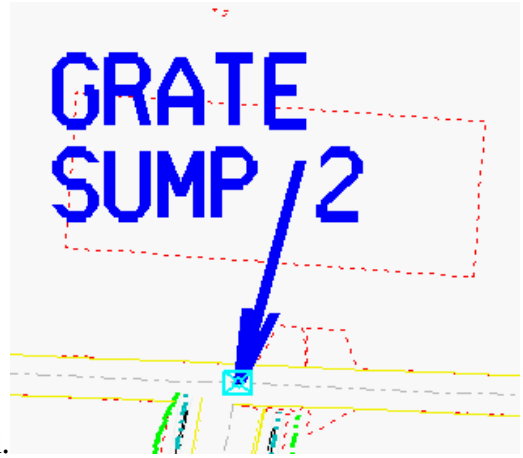


The inlet is placed.

18. Click on the Locator button again.

The Inlet ID is automatically incremented and the form disappears so that you can select the end of the leader at "Grate Sump 2".

19. Snap to the end of the leader at "Grate Sump 2".
20. Hit Apply.



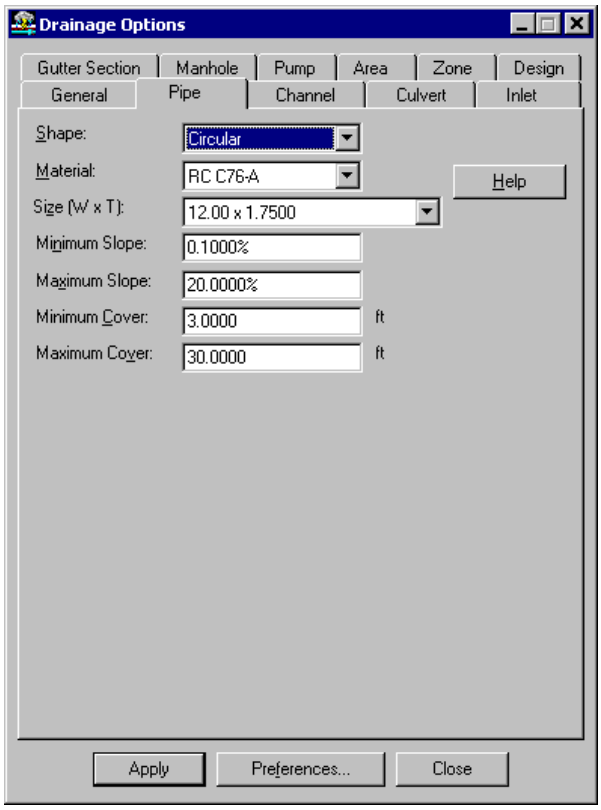
Inlet #2 (IN2) is placed.

21. "Close" the Form.

Goal 3 – Laying Out Pipe

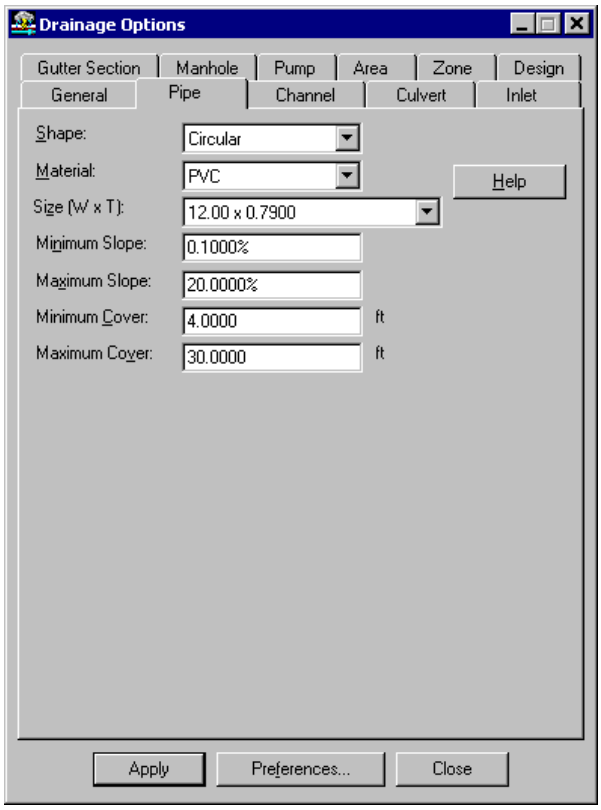
Before Laying Out a different type of structure it is always a good idea to check the structure defaults.

22. Select SC>Tools>Drainage>Options>>Pipe.



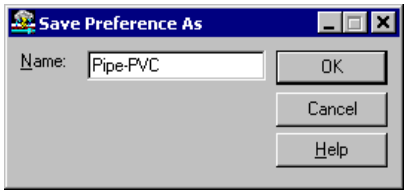
We want to place 12” diameter PVC pipe with 4 feet of cover.

23. Change pipe “Material:” to PVC.
24. Change pipe “Size (W x T):” to 12.00 x 0.7900
25. Change “Minimum Cover:” to 4.00



Although the Pipe Size will be subject to frequent changes, let us nonetheless save a Preference Set for PVC pipes.

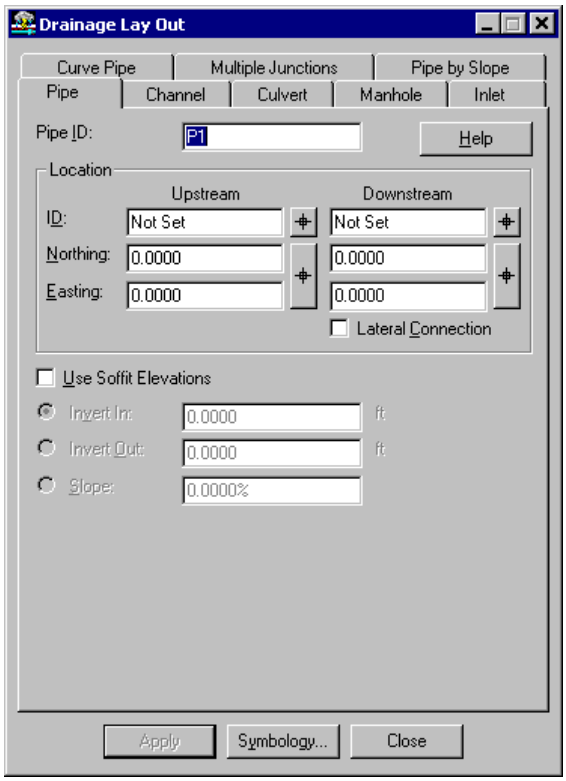
26. Click the "Preferences…" button.
27. In the Preferences dialog box, click the "Save As" button.
28. Key in "Pipe-PVC" in the preference "Name field.



29. Click "OK".
30. Close the Preference form.
31. Close the Drainage Options form.

We are now ready to Lay Out Pipes. We will connect a pipe from Inlet 1 (IN1) to the Inlet 2 (IN2) and a pipe from IN2 to a free-exit position (similar to an outfall pipe).

32. Select SC>Drainage>Lay Out>>Pipe



Drainage Lay Out form, Pipe Information

The "Pipe ID" value is derived from the settings defined in the Drainage Options>>General form. Duplicate ID's are not allowed. The number is incremented to the next available number.

Pipe Connections
The Location frame behaves like the location frame under inlets. The Locator buttons function the same but there are two per pipe end. Pipe ends can be either attached to a structure or be "free." Use the Locator button adjacent to the ID fields if you want to select a structure and the Locator button adjacent to the Northing and Easting fields if you want to define the location of a free end.

Free-entrance and Free-exit Pipe ends (or "nodes") can later be attached to other structures, including pipes. The free end has Northing, Easting and Elevation data stored in the database.

Locator buttons adjacent to Structure (ID) or Northing/Easting fields make selecting either a structure or a free-entrance/exit a click of a button.

Upstream and Downstream

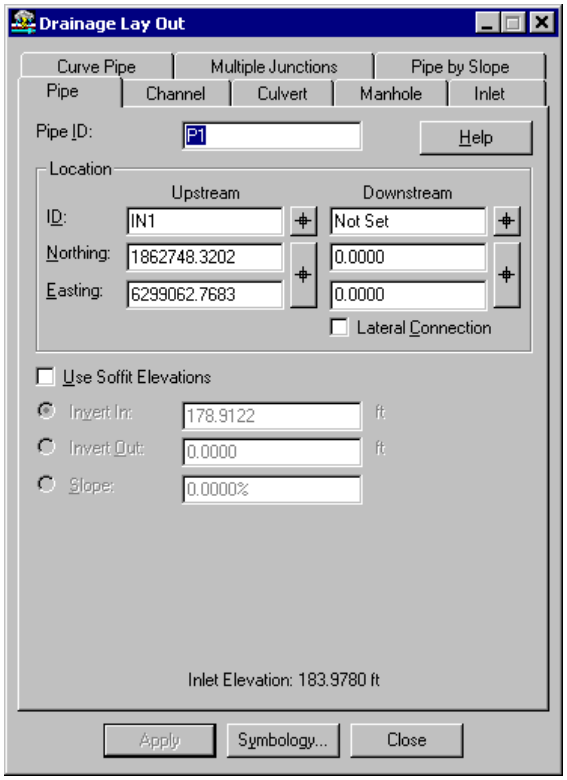
Storm&Sanitary pipe layout is relatively flexible, but has one strict definition: Upstream and Downstream are defined from flow direction. You can define the Upstream and

Downstream in either order and you can have Upstream inverts lower than the Downstream (adverse slope), but if you accidentally define the Upstream structure as the Downstream structure, S&S assumes that you know what your doing and lets you. The flow will ALWAYS be from UP to Down. The error may not show up until you Design your system.

Inverts
The remaining three fields are used to give the pipe invert/soffit elevations and slope. One field is derived from the other two. Clicking a radio button locks the corresponding value. Keying in a value in one of the remaining fields causes a recalculation in the other.

By default, invert elevations are used for pipe elevation input. With the "Use Soffit Elevations" checkbox Checked (ON), soffit elevations can be used.

33. Select the Locator button  to the right of the Upstream ID field.
34. Select the first upstream inlet, IN1, with a data button <D> (a snap/tentative point<T> to the structure is not necessary).



The Lay Out form returns with "IN1" in the Upstream ID field and the "Invert In:" field containing a default elevation derived from:

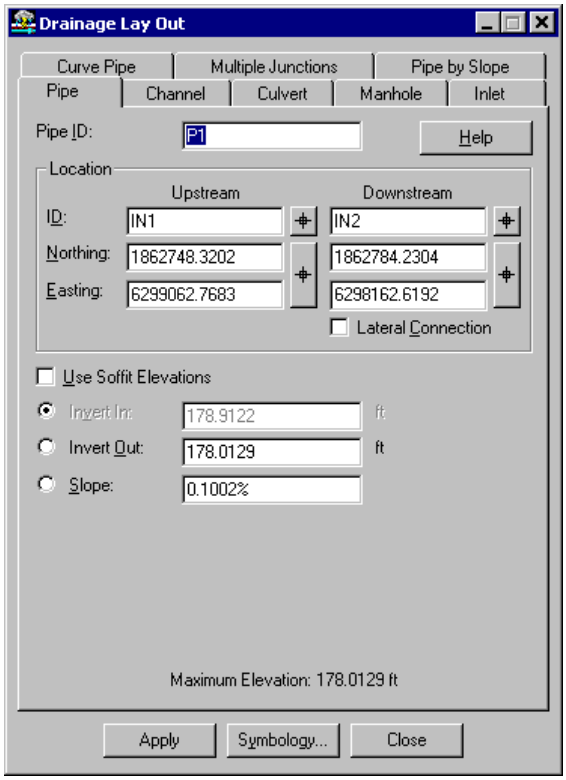
the surface elevation - the minimum cover - the pipe diameter.

The Northing and Easting fields display the structure's Northing and Easting values. Free Entrance/Exit pipes will display “FREE_EXT” in the “ID” Field..

35. Select the Locator button to the right of the Downstream ID field.
36. Select the first Downstream inlet, IN2, with a data button <D>

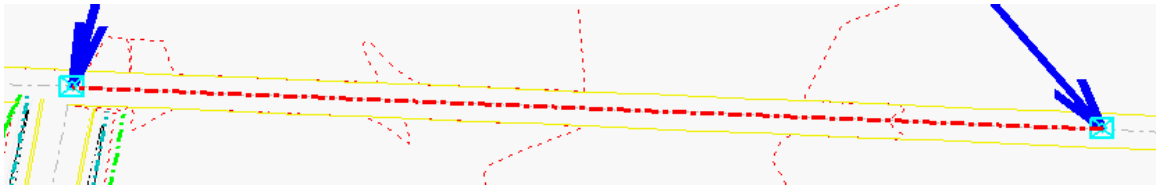
The form returns with the “IN2” in the Downstream ID field, a default value for “Invert Out:”, and a value for slope.

The “Invert Out:” default value = the lower value of the
surface elevation - the minimum cover - the pipe diameter
– -OR-
– (the upstream invert – (the minimum slope * the pipe length)).

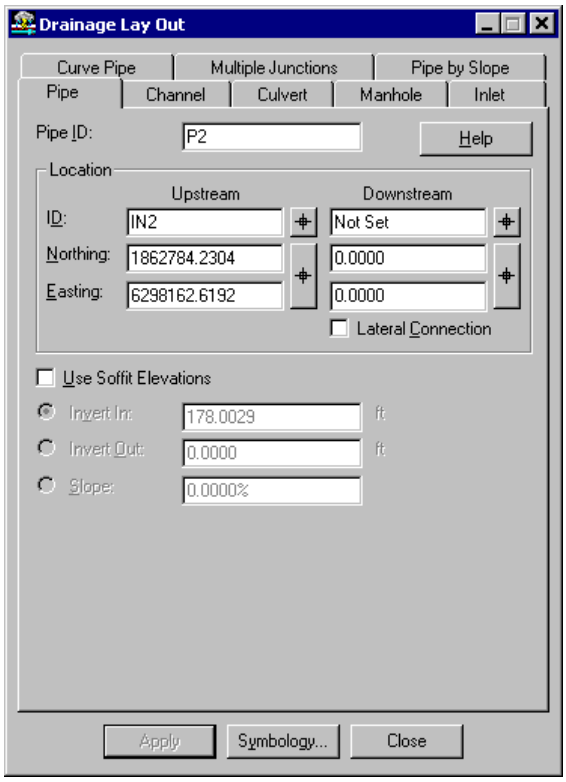


37. Click “Apply” to Place the pipe.

The Pipe graphic is placed and a Pipe record is added to the drainage “database.”

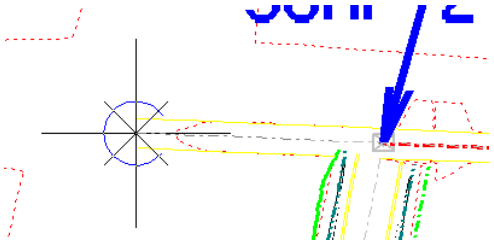


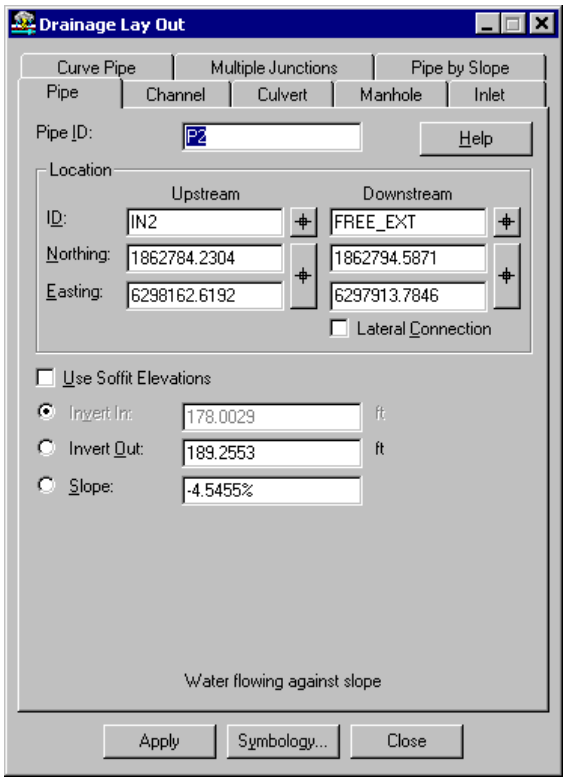
The Layout form is updated so that the "Pipe ID:" is incremented and the Upstream structure is set to the Downstream structure of the previous pipe. The default "Invert In:" is the lowest invert of the upstream structure minus the "Drop Across:" field in the structure Drainage Option tab.



For the pipe P2 we will give it a free-exit.

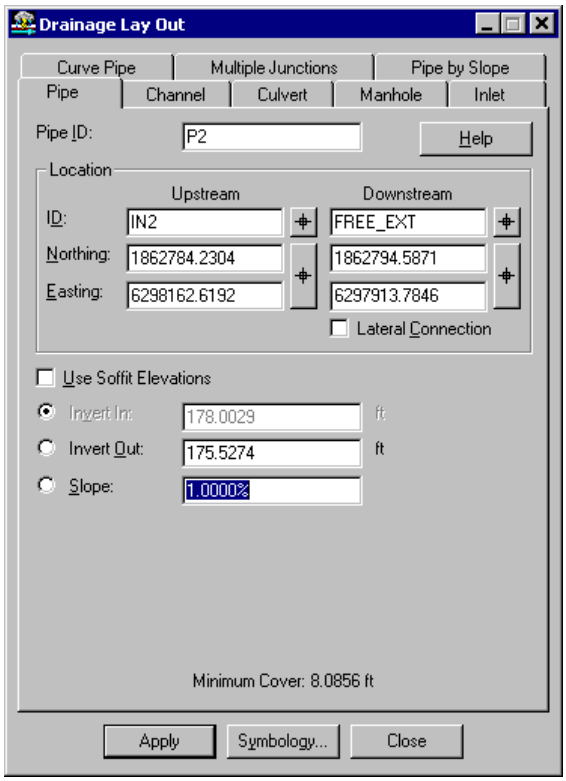
38. Click on the Locator button to the right of the Downstream Northing and Easting.
39. Snap to the left end of the centerline for Balcony Road.



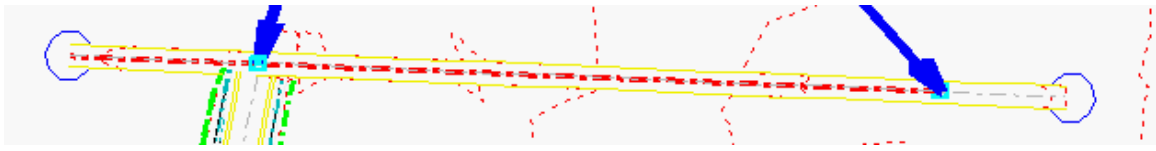


The "Invert Out:" default is from the elevation of the tentative point, which is at-grade. Rather that accept this default, we will define the pipe slope.

40. Key in "1%" or "0.01" in the slope field. The "Invert Out:" will be recalculated.
41. Hit Apply.



42. The pipe is placed.



Now that some work has been done, it is a good idea to save the Drainage file.

43. Select SC>File>Save>Drainage Data.