Designing Inlets to Collect Runoff

This course is for the **2021 Release 1** *version of:*

OpenSite Designer CONNECT Edition

OpenRoads Designer CONNECT Edition

OpenRail Designer CONNECT Edition

About this Practice Workbook...

- This workbook is designed for use in Live instructor-led training and for OnDemand self-study. OnDemand videos for this course are available on the *LEARNserver* and through *CONNECT Advisor*.
- This PDF file includes bookmarks providing an overview of the document. Click on the bookmark to quickly jump to any section in the file.
- Both Imperial and Metric files are included in the dataset. Throughout this practice workbook Imperial values are specified first and the metric values second with the metric values enclosed in square brackets. For example: **12.0'** *[3.4m]*.
- This course workbook uses the *Training and Examples* WorkSpace and the *Training-Imperial* or *Training-Metric* WorkSet delivered with the software.
- The terms “Left-click”, “Click”, “Select” and “Data” are used interchangeably to represent pressing the left mouse button. The terms “Right-click” and “Reset” are also used interchangeably to represent pressing the right mouse button. If your mouse buttons are assigned differently, such as for left-handed use, you will need to adjust accordingly.

Have a Question? Need Help?

- If you have questions while taking this course, search in *CONNECT Advisor* for related courses and topics. You can also submit questions to the Civil Design Forum on Bentley Communities where peers and Bentley subject matter experts are available to help

Bentley Institute

Edition: **03-01**

Course Level: **Fundamental**

Designing Inlets to Collect Runoff

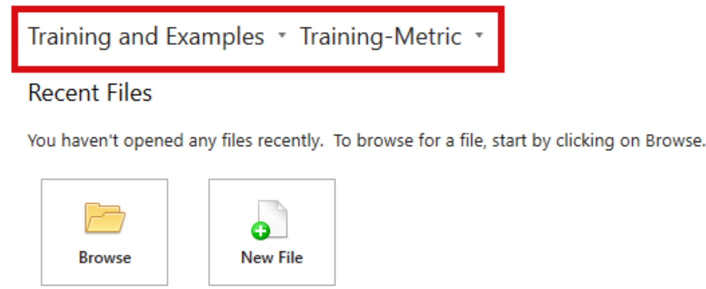
This class will show you how to place inlets with catchment delineation, to collect the runoff from a road surface. You will learn how to check whether the inlet efficiencies, and the spread widths of the flows along the road edge, are acceptable, and adjust the design so that they are.

Note: catch basins can also be called Pits, Gullies, or Inlets. In this class the term catch basin will be used to describe a drainage node that accepts surface runoff.

Getting Started

1. Start the software.
2. Set the *WorkSpace* and *WorkSet*.

   The *WorkSpace* and *WorkSet* define standards that are used by the software. The **Training and Examples** WorkSpace that is used by this class is included in the software install. If you don't use this WorkSpace, you may not have the feature definitions that are used in this class.



3. Click the left-hand down arrow and select **Training and Examples** from the *WorkSpace* menu.
4. Click the left-hand down arrow and select **Training-Imperial** *[Training-Metric]* from the *WorkSet* menu.
5. Open a design file.

   a. Click **Browse**.

   The dialog automatically opens in the path defined in the location for Design files that you specified when you selected the *WorkSet* Path a moment ago. Navigate to the *C:\Bentley Training\Designing Inlets to Collect Runoff* folder.

   b. Select the file name **Intersection-Drainage-Imperial.dgn** *[Intersection-Drainage.dgn]*.

   c. Click **Open.**

   NOTE: If you get a message stating "Incompatible Civil Data", this is because the training files are "aligned" to OpenSite Designer. Clicking *Yes* will align the file to the software you are using (OpenRoads or OpenRail Designer). This will have zero impact for training. Note that in production, upgrading the file will make the file read-only in OpenSite Designer. Full information is available at Bentley Communities - Product Realignment.

6. Change the *workflow* to **Drainage and Utilities.**

Exercise 1: Place Catch Basins with Catchment Delineation

Description

In this exercise, you will place catch basins with catchment delineation using two methods of placement.

Skills Taught

- Use the Place Node tool to place several Catch Basins
- Use Snaps and Civil Accudraw
- Generate catchments
- Review the 2D and 3D graphics, placement position, and orientation
- Review the catch basins and catchment properties

Checking Project Reference Files

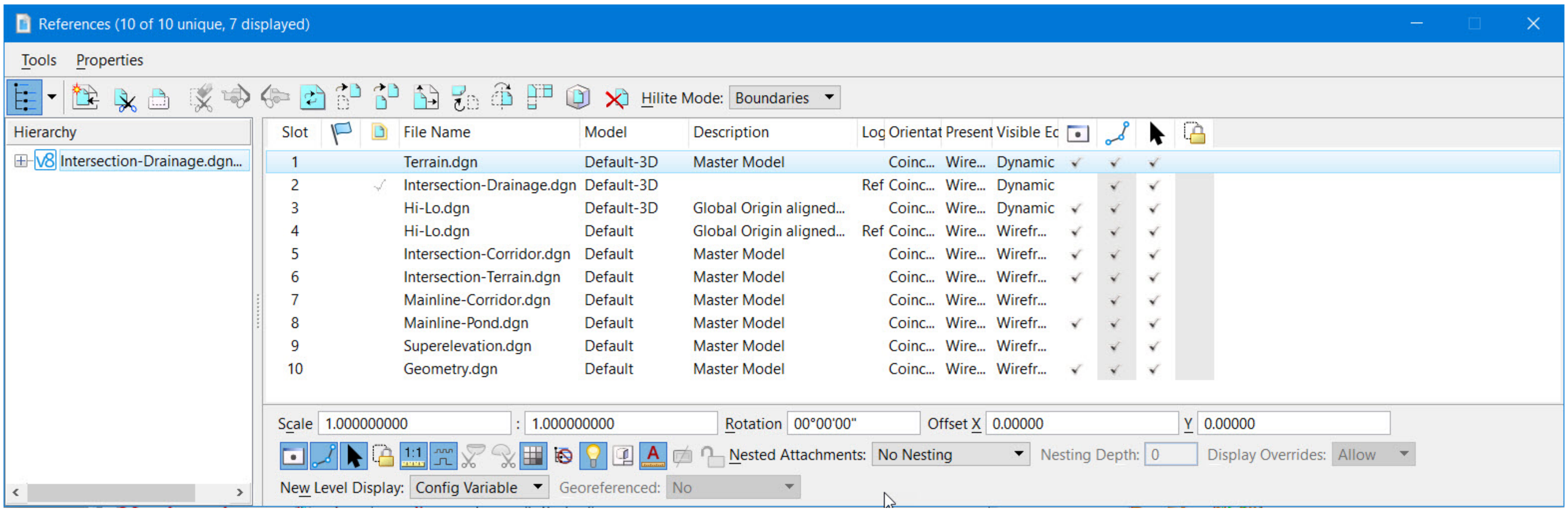
The first thing you need to do is check the references in the active file.

1. On the *Home* ribbon, click *Primary > Attach Tools >* **References**.

Note: References have already been attached and some have the *Display* icon clicked to turn off the display of the model.

2. Put focus on to *View 1*, by clicking on its title bar.

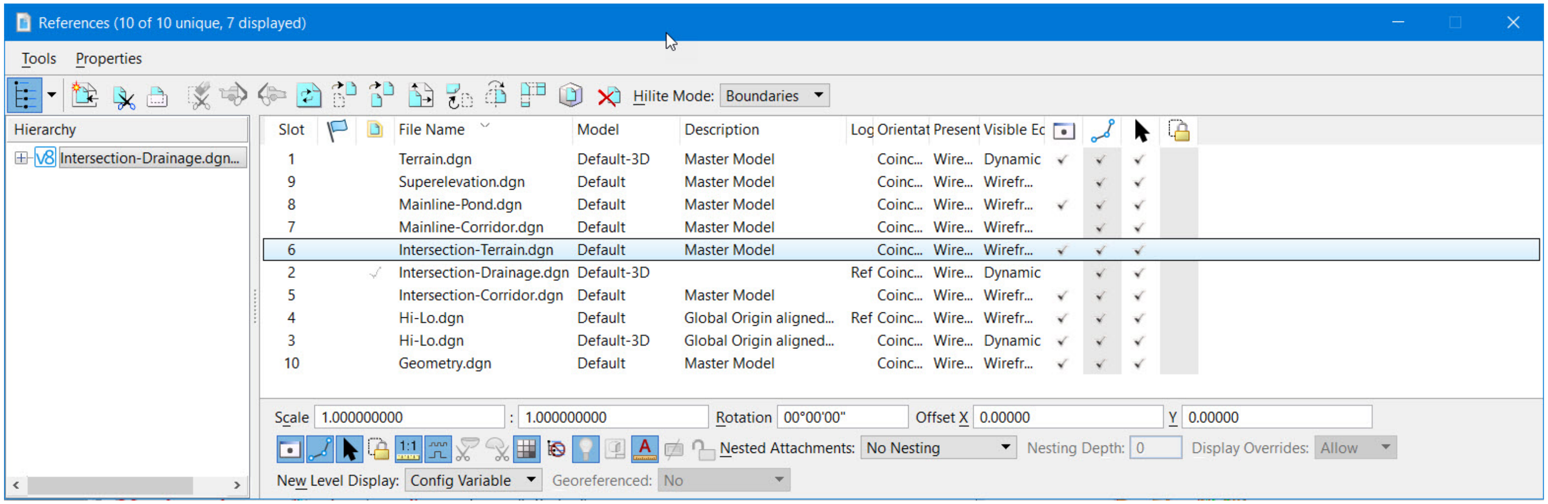
The *Default* model References are shown below.



3. Check the *Default-3D* model References as well.

The *Default-3D* model References are shown below.

A reference that contains a terrain model for the surface of the intersection – *Intersection-Terrain* - is displayed in the *Default-3D* model. This will be used when placing the inlets and catchments.



4. Close the *References* dialog.

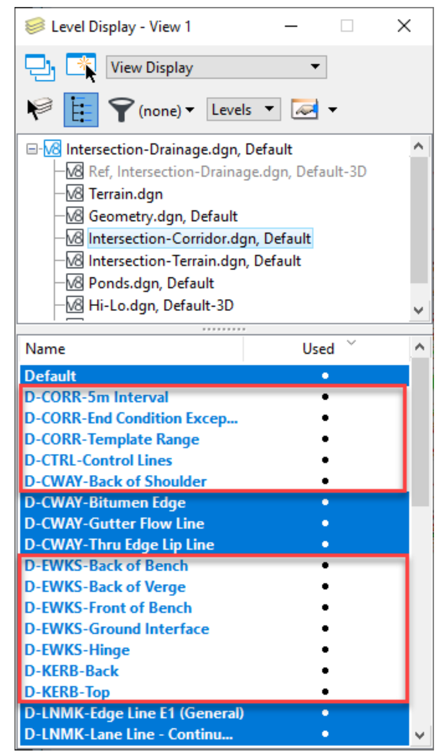
5. Make sure focus is on to *View 1*, by clicking on its title bar.

6. On the *Home* ribbon, click *Primary >* **Level Display.**

7. Select the **Intersection-Corridor.dgn**

   Note that some of the Corridor Levels have already been turned off. This will help when placing the catch basins.

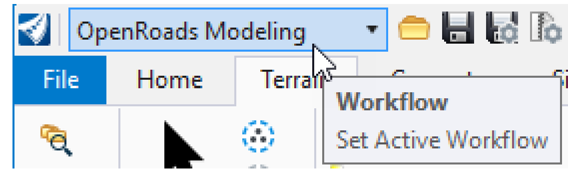
8. Close the *Level Display* dialog.



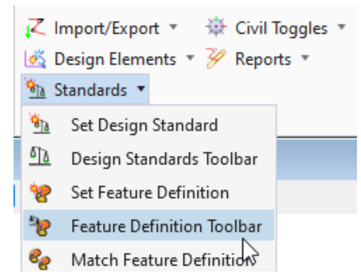
Feature Definition Toolbar and Persist Snaps

The Feature Definition Toolbar needs to be active. This will give access to the *Persist Snaps* Toggle.

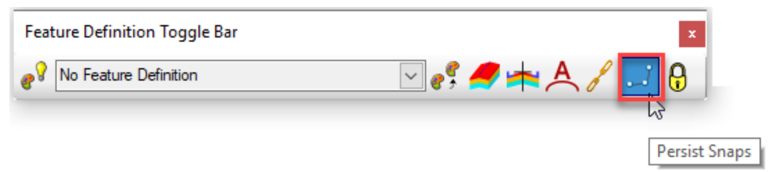
1. Set the **Active Workflow** to *OpenRoads Modeling / OpenSite Modeling / OpenRail Modeling* – as appropriate for the product you are using.



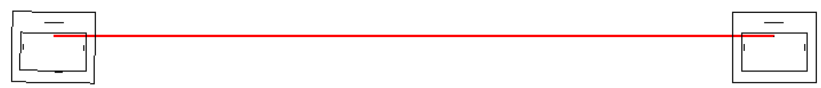
2. On the **Geometry** ribbon, click *General Tools >* **Feature Definition Toolbar**.



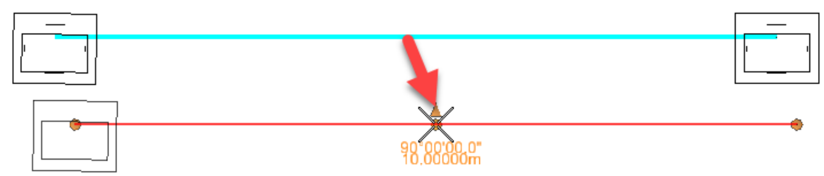
3. Check that *Persist Snaps* is toggled on.



When you place catch basins with *AccuSnap* and *Civil AccuDraw* you are creating rules and relationships. If the parent feature moves - the catch basins will also move.



As an example of this, the catch basin on the left has been placed with *AccuSnap* with *Persist Snaps* **On.** The catch basin on the right has been placed with *AccuSnap* with *Persist Snaps* **Off.**



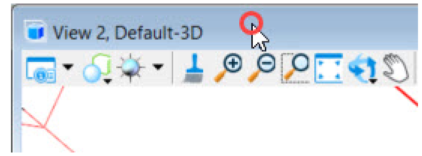
If the parent feature (the red line in the pictures) is moved horizontally, vertically or both, only the catch basin placed with *AccuSnap* and *Persist Snaps* **On** moves, because it was ruled to the parent feature.

The catch basin on the right does not move, because it was not ruled to the parent feature.

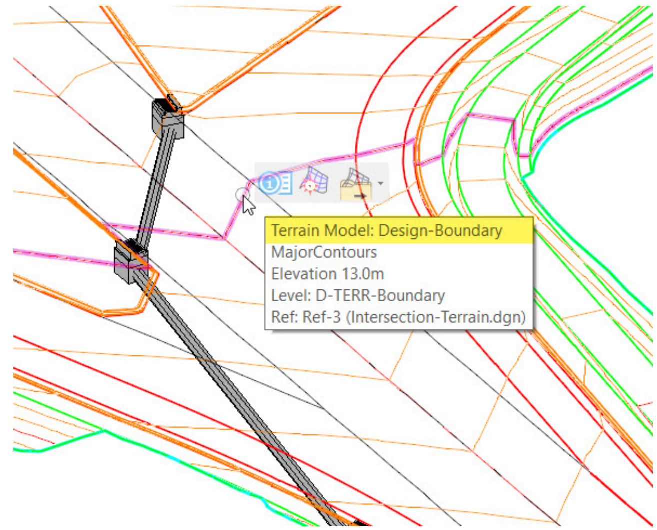
4. Close the *Feature Definition* toolbar.

Set the Active Terrain Model

1. Click on title bar of **View 2, Default-3D** to make it active.

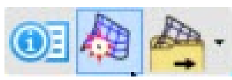


2. Window to the area as you can see in the image.



3. **Left click** on the contour as you can see in the image.

4. **Hover** the cursor at the contour for a few seconds and context sensitive toolbar appears displaying tools commonly used with terrain models.



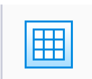
   The tooltip will show *Terrain Model: Design-Boundary.*

5. **Click** the *Set as Active Terrain Model* tool.

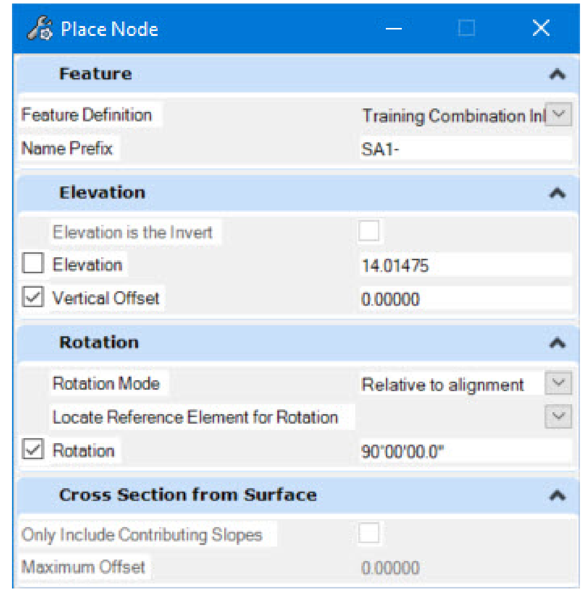
   Setting the terrain model active instructs the software to use the active terrain model as the default terrain model when using other design tools. You can always change or clear the active terrain model at any time.

6. Click on title bar of **View 1, Default** to make it active

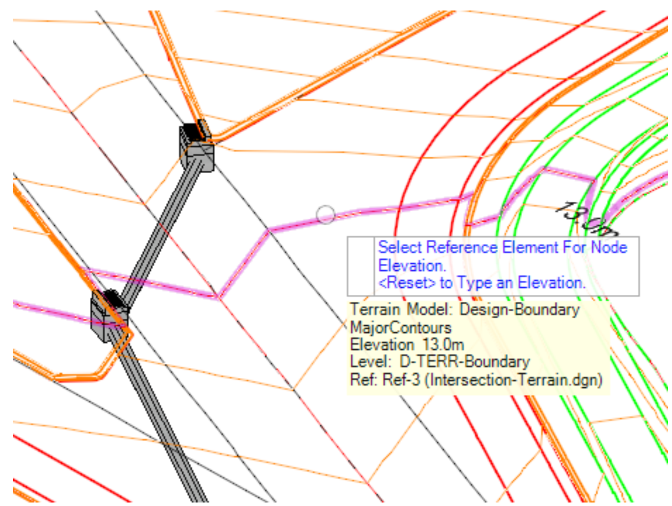
Placing Catch Basins and Catchments using AccuSnap



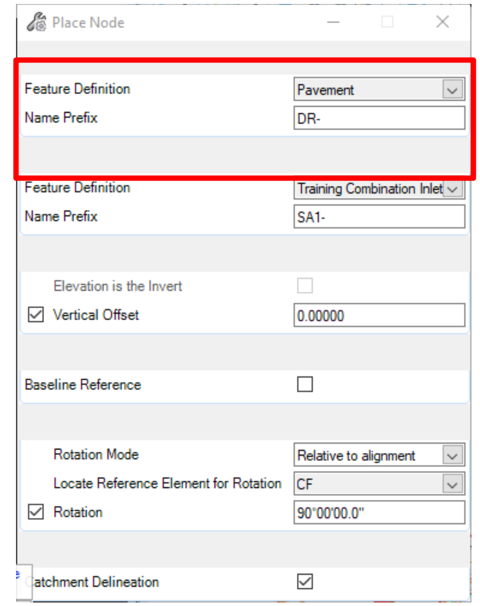
1. Set the **Active Workflow** back to *Drainage and Utilities*.
2. On the **Layout** ribbon, click **Place Node**.
3. On the *Place Node* dialog set the following:
    a. Set the *Feature Definition* to *Node > StormWaterNode > Inlets >* **Training Combination Inlet**
    b. Check **Vertical Offset,** set value to **0.**
    c. Select Rotation Mode to **Relative to alignment**.



4. Following the *Heads-up prompts,* set the following: -
    a. *At the Select Reference Element for Node Elevation. Reset to Type Elevation* prompt, select the **Design-Boundary** Terrain feature from *View 2*. Select the contour as you can see in the image.
    b. The dialog now changes, and *Catchment Delineation* is now available. Check this on.

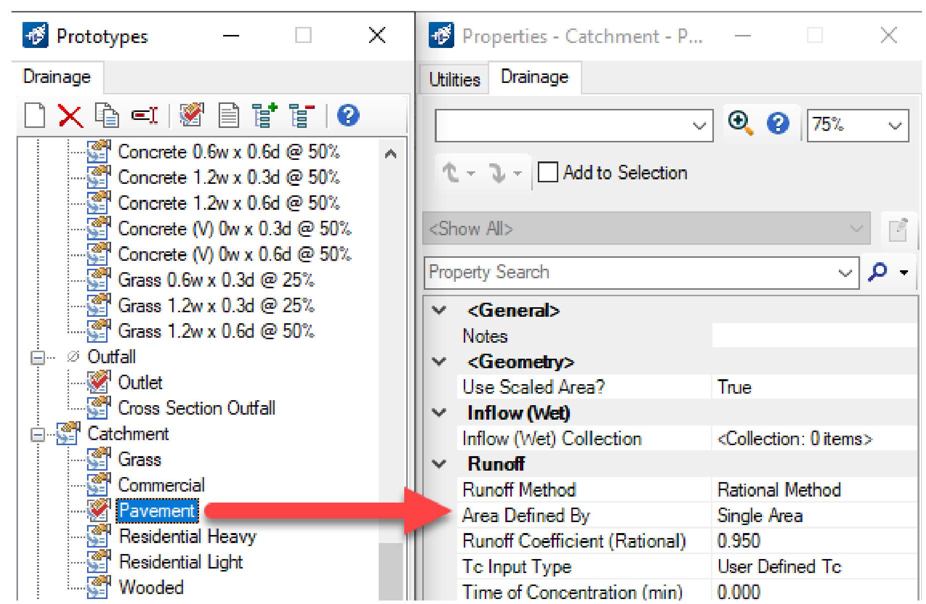


c. Set the *Catchment Feature Definition* to *Drainage Area > Catchment >* **Pavement**.

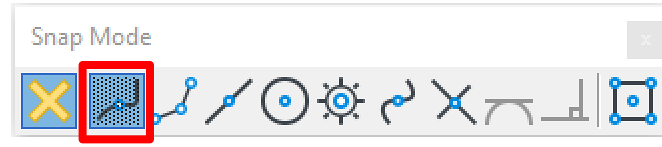


The Hydraulic Properties of the Catchment will be populated from the Hydraulic Prototype. One of these properties is the **Runoff Coefficient** for the catchment. When you pick a Feature Definition, you pick a Hydraulic Prototype. When placing the catchment, the settings defined in the Prototype are copied into the catchment's data record.

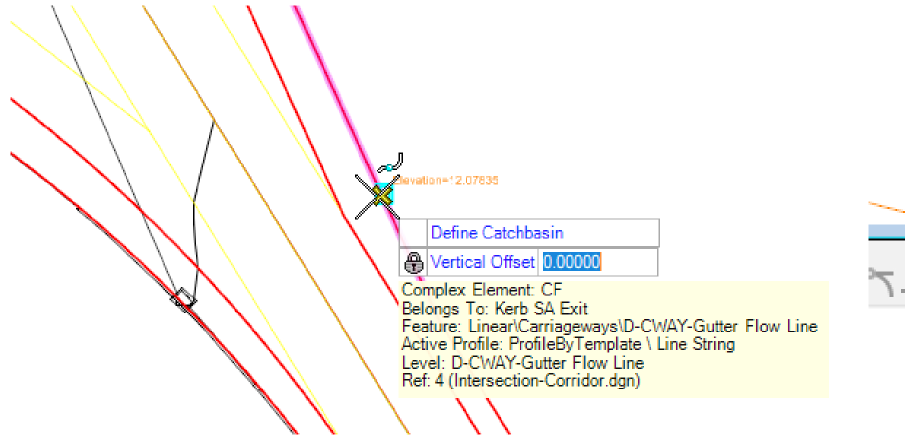
Prototypes can be viewed and edited using the *Components > Catalog >* **Prototypes** tool or viewed and selected through *Home > Explorer > OpenRoads Standards > Active File > Feature Definitions > Drainage Area > Catchment > Pavement > Hydraulic >* **Prototype**.



5. Select Snap Mode *AccuSnap > Near Snap Point.*

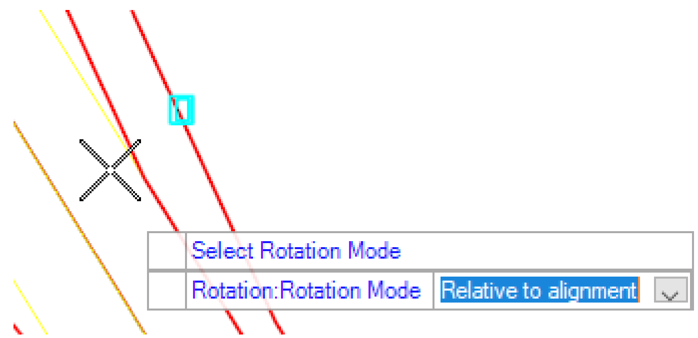


6. At the *Define Catchbasin* prompt, data point on the **D-CWAY-Gutter Flow Line** feature opposite the catch basin on the intersection approach in *View 1.*



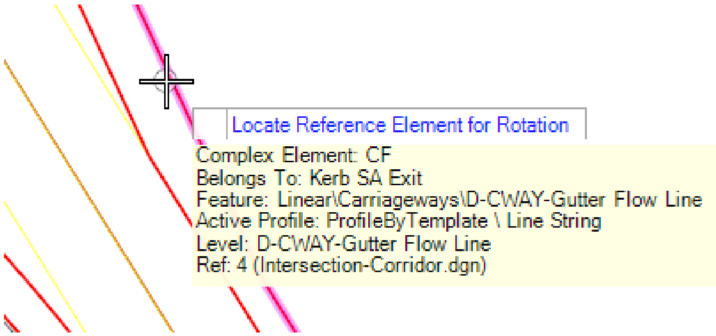
7. Follow the *Heads-up prompt*:

   a. Data point to accept the Rotation Mode > *Relative to alignment*

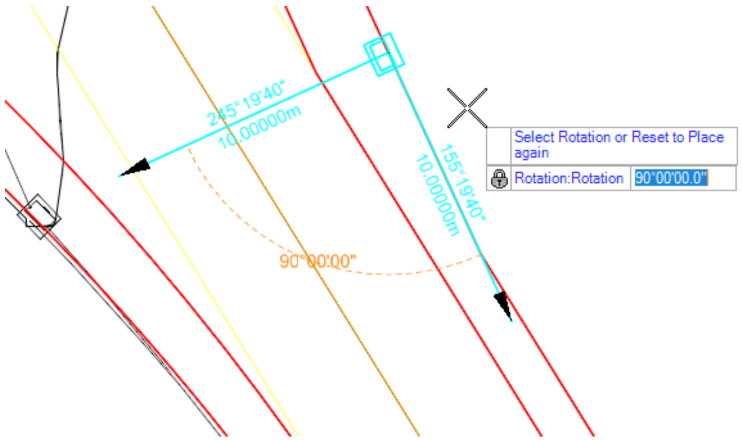


b. At the *Locate Reference Element for Rotation* prompt, data point on the **D-CWAY-Gutter Flow Line**.

At this point the catch basin is placed.

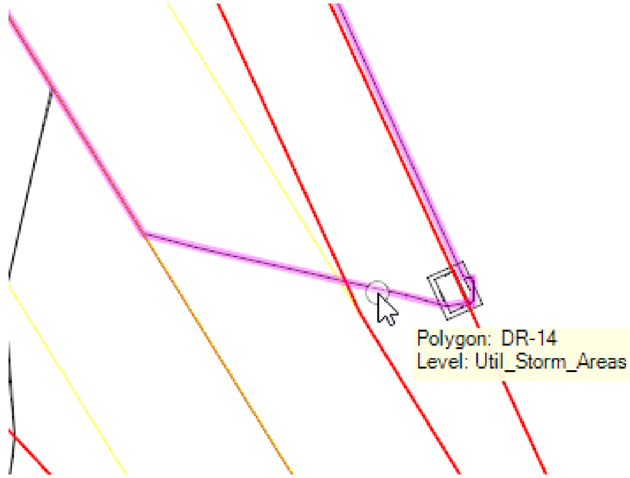


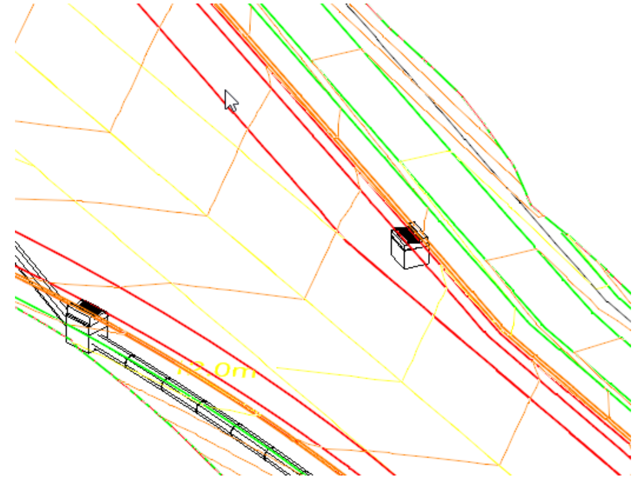
c. Type *90* for the **Rotation** and *Enter,* then data point to accept the rotation.



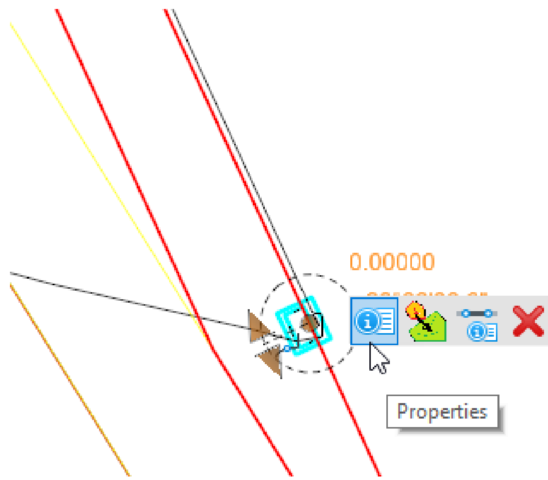
The placed catch basin can now be seen in both the *Default* and *Default-3D* views

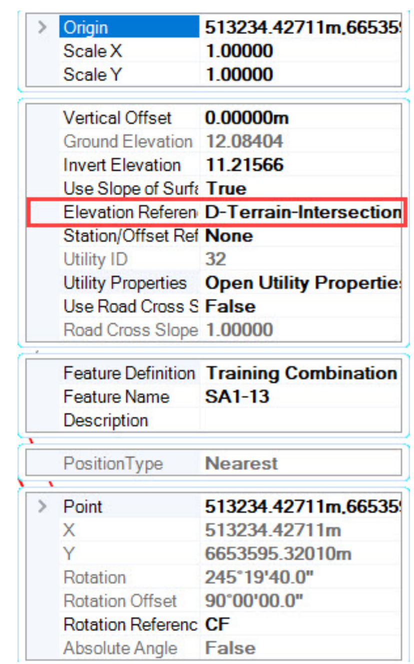
The catchment area has automatically been created and can be seen only in the *Default* view.





8. Select the catch basin and view the **Quick Properties**. Note the design intent – it is ruled to the gutter flow line feature both for position and rotation. The catch basin will be updated if the element is subsequently modified. The Elevation Reference is the terrain.



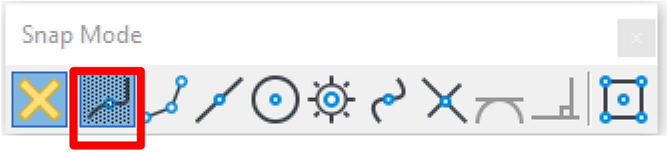


Moving in a southerly (downstream) direction place another catch basin, snapping to the gutter feature.

9. On the *Place Node* dialog set the following:
   a. Check the *Vertical Offset* value is **0**.
   b. Check the *Rotation Mode* is **Relative to alignment.**
   c. Check the *Feature Definition* is *Node > StormWaterNode > Inlets >* **Training Combination Inlet.**
10. From the *Heads-up prompts* set the following: -
   a. *Select Reference Element for Node Elevation. Reset to Type Elevation* prompt, select the **Design-Boundary** Terrain feature from *View 2.*
   b. The dialog now changes, and *Catchment Delineation* is now available, check this on.

      The *Catchment Feature Definition* is now available in the dialog.
   c. Check the *Catchment Feature Definition* is *Drainage Area > Catchment >* **Pavement.**
   d. Check the Snap Mode is *Near Snap Point.*

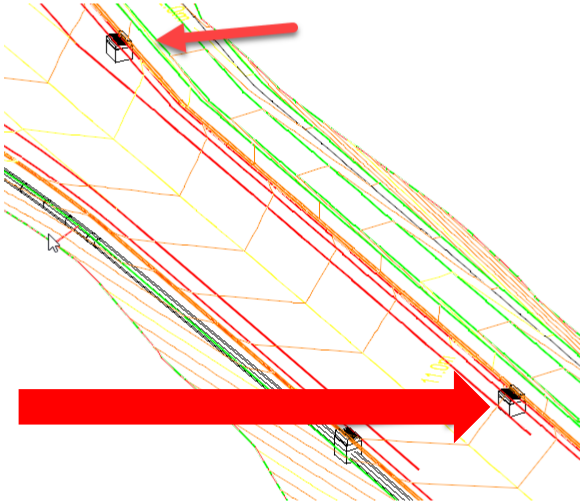
      Note *that double-clicking the icon will set it to the default snap mode, which can be easier than remembering to check it.*



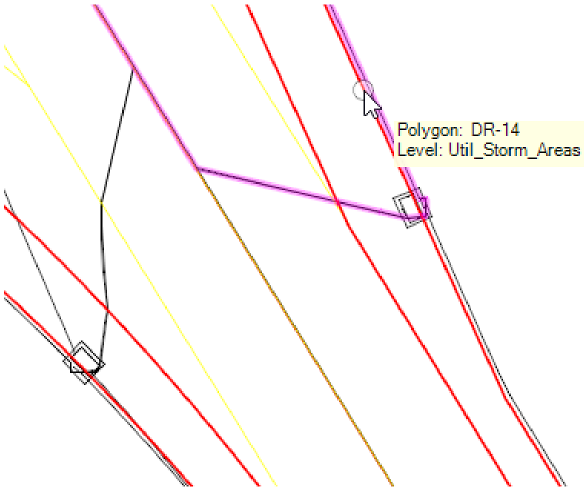
   e. At the *Define Catchbasin* prompt, data point on the **D-CWAY-Gutter Flow Line** feature opposite the catch basin on the intersection approach in *View 1.*
   f. Data point to accept the Rotation Mode > *Relative to alignment*
   g. At the *Locate Reference Element for Rotation* prompt, data point on the **D-CWAY-Gutter Flow Line**.

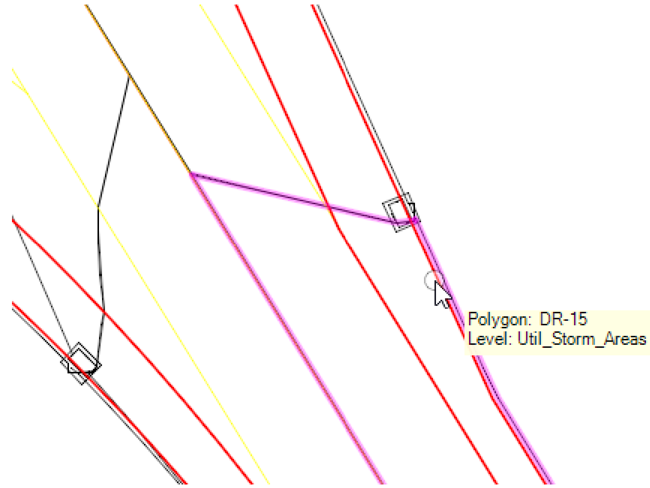
      At this point the catch basin is placed.
   h. Type *90* for the **Rotation** and *Enter,* then data point to accept the rotation.

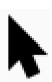
New Catch Basin



Note: how the area for the new catchment has stopped at the edge of the previous area.

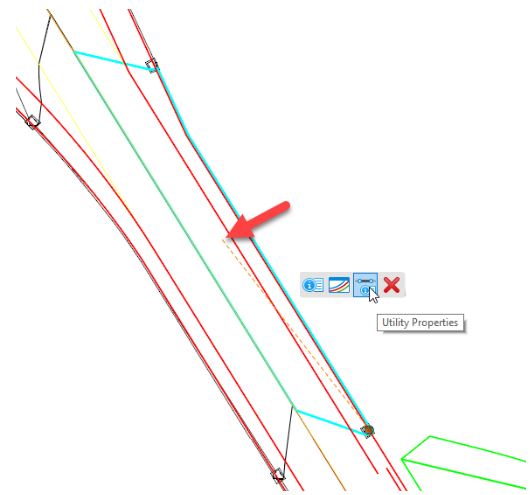






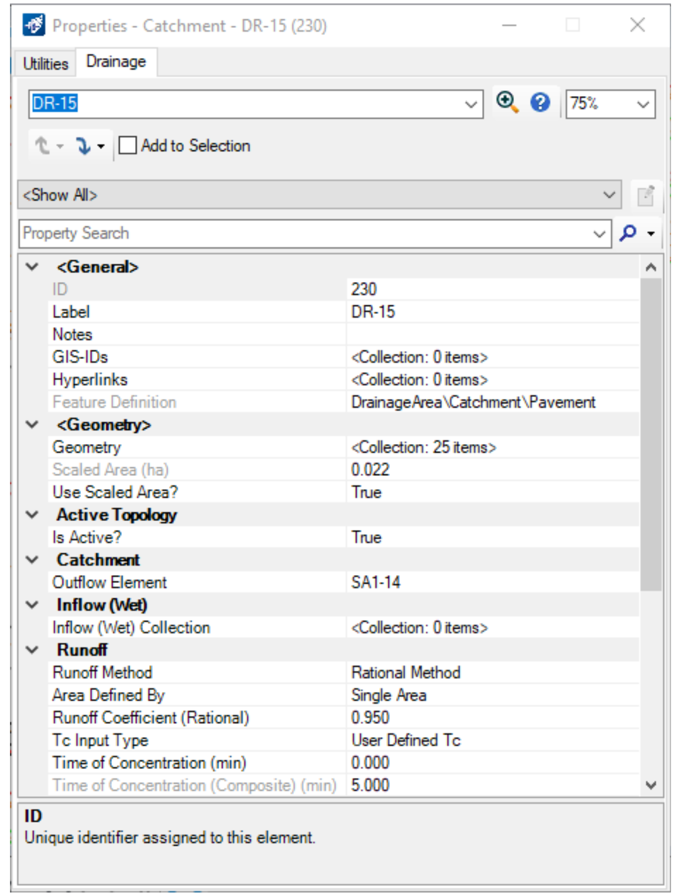
11. On the **Layout** ribbon, click the **Element Selection** icon.
12. Select one of the catchments and view the **Utility Properties**.

    A line is also displayed from the centroid of the catchment to the *Outflow Element*.



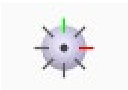
13. The **Utility Properties** show information such as the *Outflow Element* the catchment flows to, and **Runoff** properties such as *Runoff Method* and *Runoff Coefficient.*

There are numerous properties with values of N/A. This is because you have not yet computed the system yet.



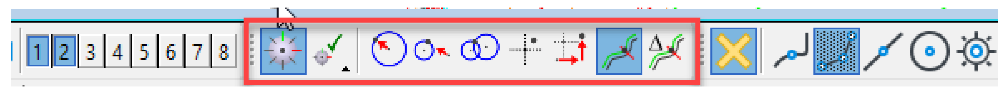
Placing Catch Basins and Catchments using Civil AccuDraw

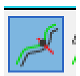
Civil AccuDraw is used for precision input and will be used here to place catch basins that are ruled to civil geometry by station and offset.



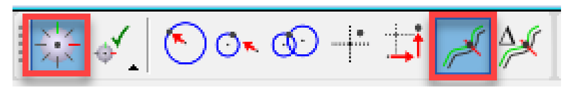
1. Select *Layout > Toggles >* **Civil AccuDraw** to display the *Civil AccuDraw* toggle bar.

2. Dock the toggle bar next to the *AccuSnap* tools at bottom of the screen.





3. Click the **Toggle Civil AccuDraw** icon on the toggle bar.
4. Click the **Station-Offset** icon on the toggle bar.

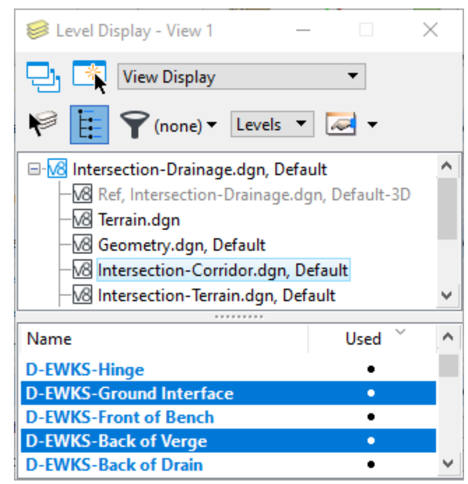


The next catch basin you will place is near the pond. The levels that the pond features are displayed on are turned off in the *Default* view.

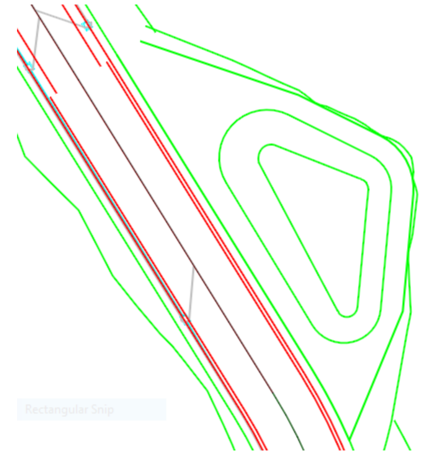
5. Make sure focus is on to *View 1*, by clicking on its title bar.
6. On the *Home* ribbon, click *Primary >* **Level Display.**

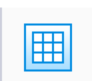
Note that some of the Corridor Levels have already been turned off. This will help when placing the Catch Basins.

7. Click on **Intersection-Corridor.dgn, Default** to select it.
8. Click on **D-EWKS-Ground Interface** and **D-EWKS-Back of Verge**, to turn the display of these levels on.
9. Close the *Level Display* dialog.



Window to the area where the pond is located in order to place the next node.





10. On the **Layout** ribbon, click **Place Node**.

11. In the *Place Node* dialog set the following: -

  a. Check the *Vertical Offset* is **0.**

  b. Check the *Rotation Mode* is **Relative to alignment.**

  c. Check the *Feature Definition* is *Node > StormWaterNode > Inlets >* **Training Combination Inlet.**

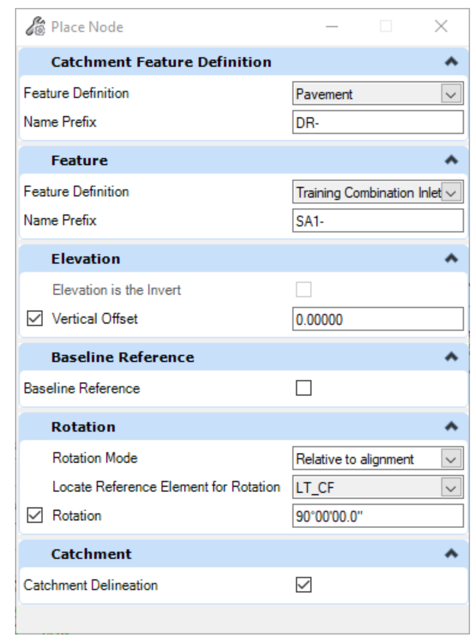
12. From the *Heads-up prompts* set the following: -

  a. *Select Reference Element for Node Elevation. Reset to Type Elevation* prompt, select the **Design-Boundary** Terrain feature from *View 2.*

  b. The dialog now changes, and *Catchment Delineation* is now available, check this on.

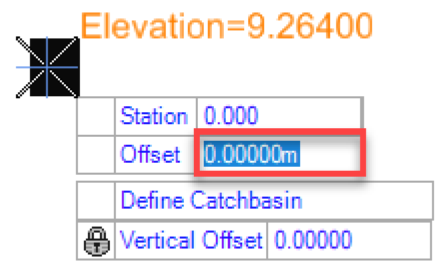
  The *Catchment Feature Definition* is now available in the dialog.

  c. Check the *Catchment Feature Definition* is *Drainage Area > Catchment >* **Pavement.**



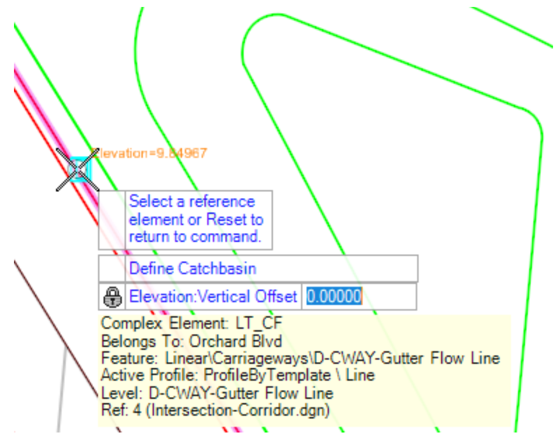
13. At the *Define Catchbasin* prompt **Civil AccuDraw** input fields *Station* and *Offset* are now added to the prompt.

14. **Tab** to highlight the *Offset* input and type the letter **'o'.**



Note: that **'o'** is the shortcut key for setting the reference element and stands for *'Offset'*.

15. At the *Select a reference element or Reset to return to command* prompt, click the **D-CWAY-Gutter Flow Line** feature.



16. **Civil AccuDraw** is now locked on the feature and by using the **Tab** key to highlight *Station,* set value to **49.2'** *[15m],* press **Enter** on keyboard to accept and lock the value.

17. *Offset* will now be active, set value to **0**, press **Enter** on keyboard keyboard to accept and lock the value.

    a. Data Point to accept the location.

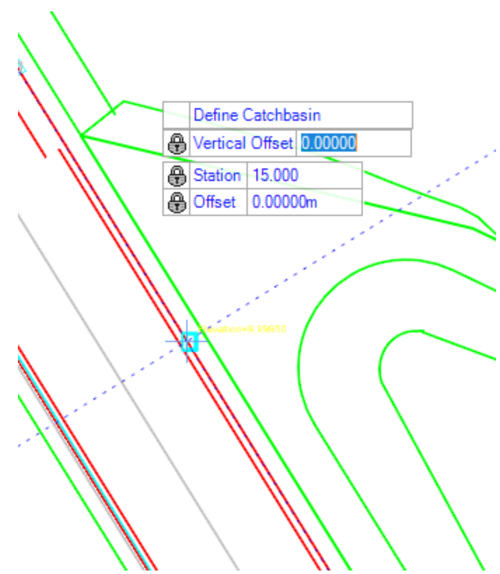
    b. Data point to accept the Rotation Mode > *Relative to alignment*

    c. At the *Locate Reference Element for Rotation* prompt, data point on the **D-CWAY-Gutter Flow Line**.

    At this point the catch basin is placed.

    d. Type *90* for the **Rotation** and *Enter,* then data point to accept the rotation.

You need to place two more catch basins.



18. Window to the area where there is text saying, ‘Low Point’.

19. At the *Define Catchbasin* prompt **Civil AccuDraw** input fields *Station* and *Offset* are now visible.

20. **Tab** to highlight the *Offset* input and type the letter **‘o’.**

21. At the *Select a reference element or Reset to return to command* prompt, click the **D-CWAY-Gutter Flow Line** feature.

22. **Civil AccuDraw** is now locked on the feature and by using the **Tab** key to highlight *Station* set value to **227.2’** *[84.5],* press *Enter* on the keyboard to accept and lock the value.

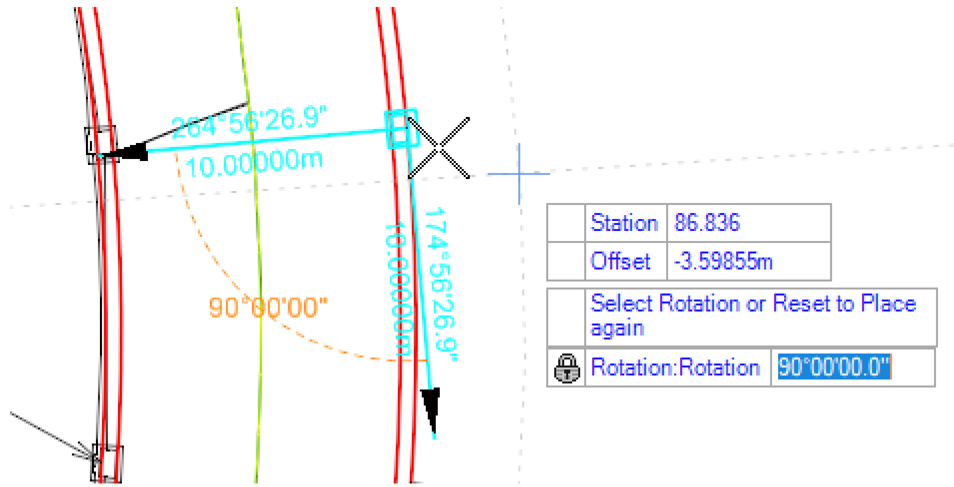
23. *Offset* will now be active, set value to **0**, press *Enter* on the keyboard keyboard to accept and lock the value.

    a. Data Point to accept the location.

    b. Data point to accept the Rotation Mode > *Relative to alignment*

    c. At the *Locate Reference Element for Rotation* prompt, data point on the **D-CWAY-Gutter Flow Line**.

       At this point the catch basin is placed.



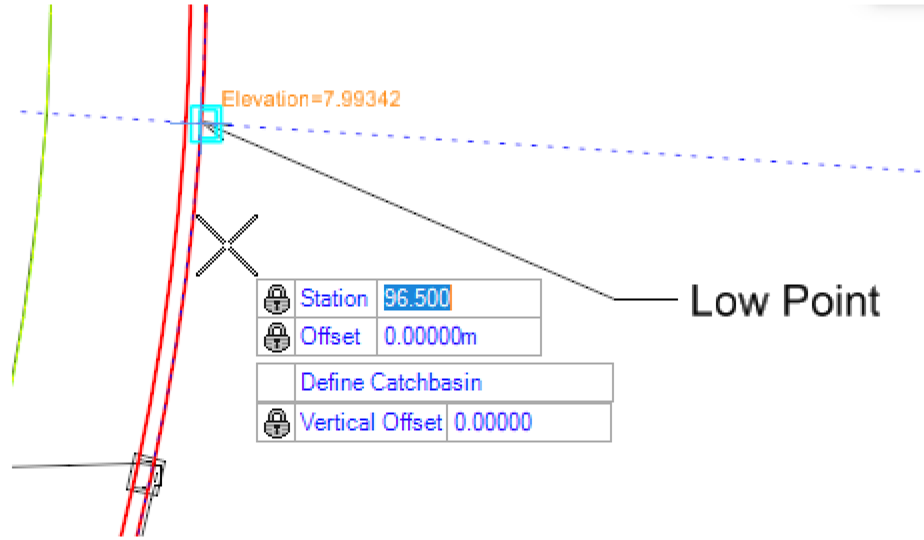
    d. Type *90* for the **Rotation** and *Enter,* then data point to accept the rotation.

24. Repeat steps **20 to 23** above to place the last catch basin at the location below.

25. *For the Station*, set the value to **316.6'** *[96.5].* For the *Offset*, set value to **0.**

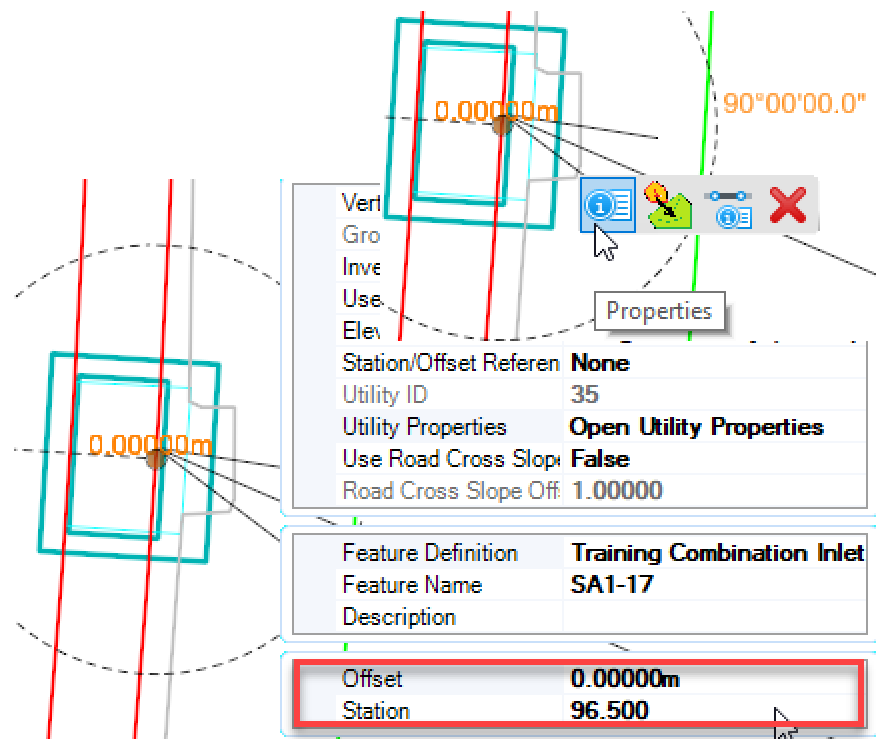
26. Click the **Element Selection** icon, or press **Esc** on the keyboard, to exit the command.

27. Click the **Toggle Civil AccuDraw** icon on the toggle bar, to deactivate it.



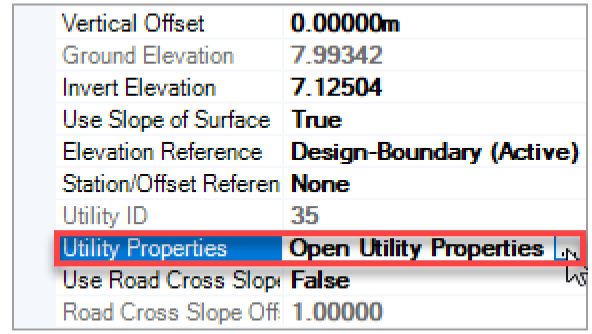
28. Check the **Properties** of the last catch basin you placed.

29. **Note** the Station and Offset values that you just entered are shown. These values can be changed if required, to move the catch basin.



30. From the **Properties**, click **Open Utility Properties**.

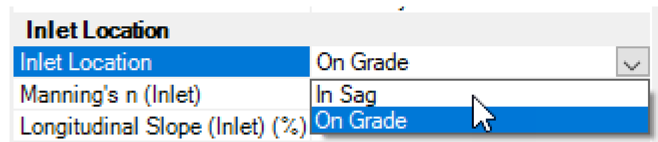
31. Click the **Browse** icon.



The **Utility Properties** show information such as the *Inlet Type* and *Longitudinal Slope*.

Inlet Location properties show as *On Grade*, but this catch basin is at the low point of the gutter flow line.

32. Select the **Inlet Location** property and change it to *In Sag.*



Note: *A grate inlet in a sag operates as a weir up to a depth of about 150mm and as an orifice for depths greater than 450mm. Between these depths, a transition from weir to orifice flow occurs.*

33. **Close** the dialog box

Exercise 2: Checking Spread Widths

Description

In this exercise, you will set up the data needed for a gradually varied flow scenario using a backwater analysis, compute it to calculate the hydrology and hydraulics, and review the messages for potential issues.

The exercise will start with an overview of scenarios, to give you an appreciation of what they are. In this class, you will be placing catch basins and checking whether they are in the correct position to drain the road surface effectively. You will be analysing the hydrology of the catchment areas, and the hydraulics of the catch basins, to see how well they perform. You can do this using a single scenario, but it is still important that you know what a scenario is, and what it does.

Skills Taught

- Understanding Scenarios
- Review the Base Rainfall Runoff rainfall event for the Analysis Scenario
- Review the Calculation options
- Compute an Analysis Scenario to see how well the catch basins cope with a rainfall event
- Review the spread widths at the catch basins

Understanding Scenarios

Given that …

- there are hundreds of properties involved in hydraulic design and calculations
- regulatory agencies often require analysis on multiple variations of constraints (such as multiple storm events)
- the engineering design process itself often requires evaluation of alternative solutions

having a logical and manageable system to manage and compare the variations in the hundreds of properties is essential to ensure optimum design. This is what the effective use of Scenarios offers you.

Drainage and Utilities groups similar properties into function-based groups called Alternatives. Calculations are then performed on a bundle of Alternatives, which are grouped together in Scenarios. A Scenario also controls how the calculations are performed, in the Calculation Options.

- *Property* – a property is any stored characteristic of a model element. Examples include:
  - a single numeric quantity such as a pipe's Diameter, Length, or Roughness.
  - a Yes/No toggle such as *Design Conduit?*
  - A value from a list such as *Design* or *Analysis* for Calculation Type
- *Alternative* – an Alternative is a logically organized set of properties. Examples include:
  - *Physical* Alternative – groups physical data for the network's elements, such as elevations, sizes, and roughness coefficients.
  - *Design* Alternative – groups engineering criteria that will be applied during calculations such as velocity limits and other settings that may or may not be applied during calculations such as adjusting pipe diameters and inverts.
  - *Rainfall Runoff* Alternative – allows different storm events to be used in calculations.
- *Calculation Options* – a Calculation Option contains properties that control how to 'solve' the hydraulics and hydrology of the drainage system. Examples include:
  - *Calculation Type* – whether the system is to be analysed (doesn't change elevations or sizes) or designed (hydraulic optimisation of elevations or sizes)
  - *Active Numerical Solver* – the methods used for the calculations, such as 'Rational Method' and the settings that the method needs.

- *Scenario* – a Scenario contains a set of Alternatives, and the settings that control how the hydraulics and hydrology are calculated. This "bundling" of Alternatives lets you easily generate system conditions that mix and match groups of data that have been previously defined. Note that Scenarios do not actually hold any attribute data – the referenced alternatives hold the data.

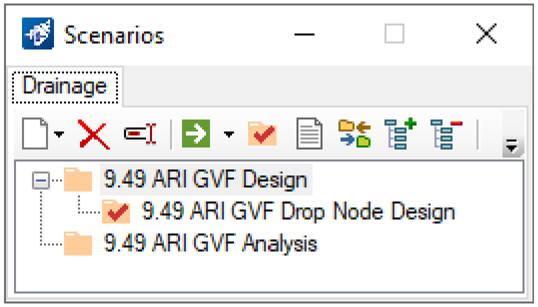
There is always a current scenario. It specifies the current alternatives. The current alternatives are where your data is stored.

You can use multiple Scenarios to calculate multiple "What If?" situations, in a single project file. You can try several designs and compare the results, or analyze an existing system using several different input alternatives, and compare the results.

Scenarios and Alternatives can "inherit" properties from other Scenarios and Alternatives. These Parent-Child relationships are a critical tool in easily managing variations from otherwise global properties.

When creating a new project, Scenarios and Alternatives are copied from the Hydraulic Seed File. This is a DGN Library, which is specified in the WorkSpace or WorkSet configuration.

Scenario Manager



The Scenario Manager is the primary interface for creating, editing and managing an unlimited number of Scenarios.

There must be at least one Scenario. Additional Alternatives and Scenarios are easily created to handle any design requirements.

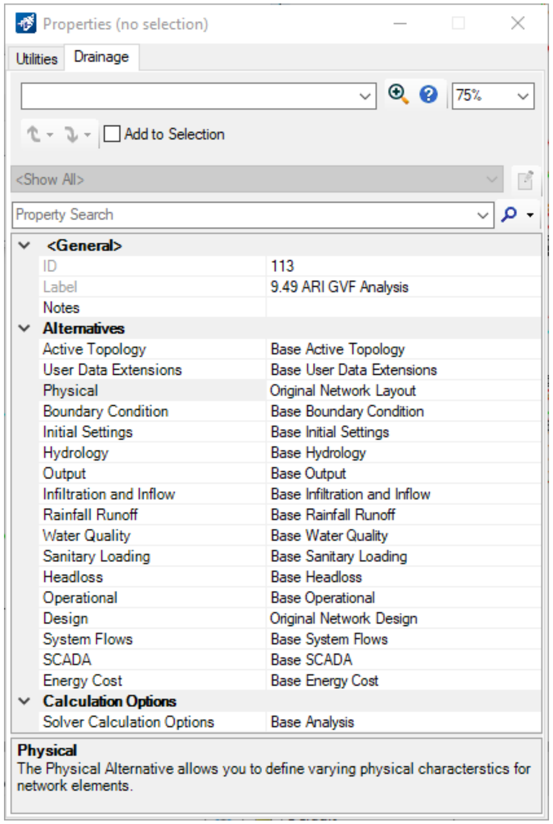
Examples include:

- Competing physical layouts may be managed by different Physical Alternatives.
- Different Storm Frequencies may be managed by different Rainfall Runoff Alternatives.

There are two types of Scenarios: Base Scenarios and Child Scenarios.

- Base Scenarios contain all of your working data. When you start a new project, you begin with a default Base Scenario. As you enter data and calculate your model, you are working with this default Base Scenario and the alternatives it references.
- When a Child Scenario is created, it inherits its data from its Parent. More precisely, its Alternatives and Calculation Options are links to the Alternatives and Calculations Options of its parent.

Scenario Properties



As stated above, Scenarios are simply a list of Alternatives and a Calculation Options definition. Viewing, changing, and managing the different alternatives associated with a scenario is done through the Properties dialog. To view the scenario properties, double-click on the scenario, or right-click on the scenario and choose Properties.

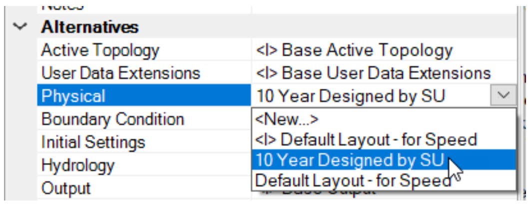
A list of the alternatives associated with the scenario will be displayed in the Properties dialog.

If you have created a new Base Scenario, all the Alternatives will be the same as in the "copied" Scenario. They will be copied, but they will not maintain any further relationship to the original Scenario's Alternatives. Changes to the original Scenario do NOT propagate to the new Base Scenario.

If you created a Child Scenario, the scenario will initially inherit all of the alternatives from the parent scenario. In this case, you will see the "I" next to the name of the alternative. Changes to any of the settings in the original scenario – a change in the Rainfall Runoff Alternative, for example, automatically gets propagated to the new Childe Scenario. They're linked.

If you manually pick an alternative without the "I," then the Child Scenario will no longer inherit any changes in alternatives made in the parent scenario.

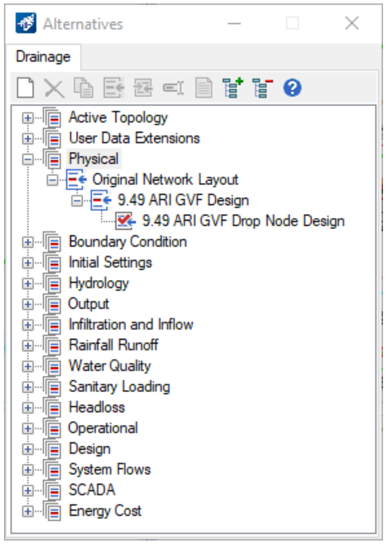
To change any alternative for a scenario, click the pulldown beside the scenario name and select the alternative.



If you have not yet created an alternative for the scenario, you can create a new alternative here as well, by selecting the "<New…>" item. You will be prompted to enter the name for the new alternative – after which the new alternative will be selected for the scenario and listed in the Alternatives Manager.

Alternatives Manager

The Alternative Manager lets you create, view, and edit the alternatives that make up the project scenarios. The dialog box consists of a pane that displays folders for each of the alternative types which can be expanded to display all of the alternatives for that type and a toolbar.



As with Scenarios, there are two kinds of Alternatives: Base Alternatives and Child Alternatives. Base Alternatives contain local data for all elements in your system. Child Alternatives inherit data from Base Alternatives or even other Child Alternatives. The data within a Child Alternative consists of data inherited from its parent and the data altered specifically by you (local data).

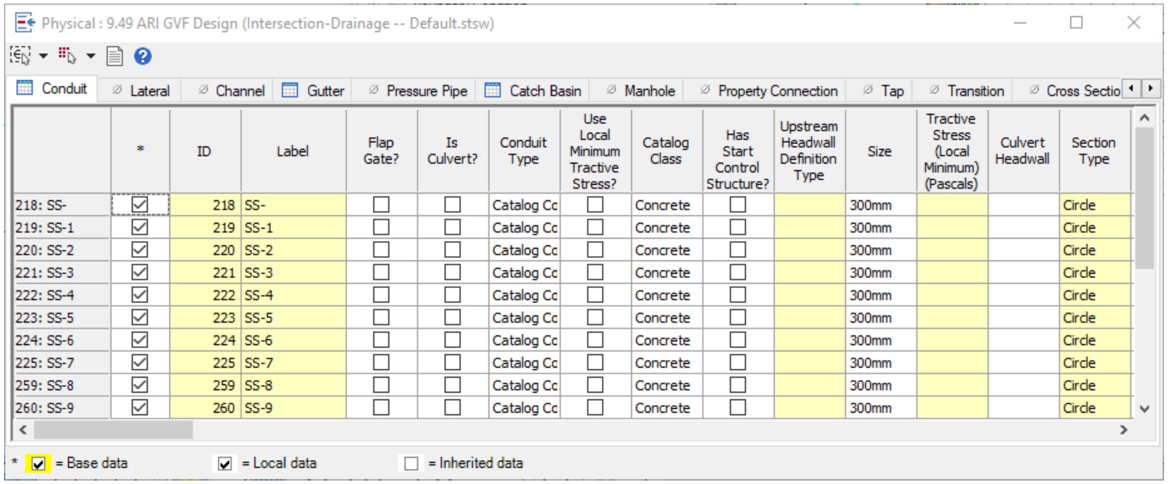
Remember that all data inherited from the Base Alternative is changed when the Base Alternative changes. Only local data specific to a Child Alternative remains unchanged.

Editing Alternatives

To edit an alternative, expand the tree so that all of the alternatives for a given type are listed.

There are a number of ways to open an alternative:

- You can double-click on the alternative.
- You can also highlight the alternative and select the Open icon.
- Finally, you can right-click the alternative and select Open. This will open a new dialog.



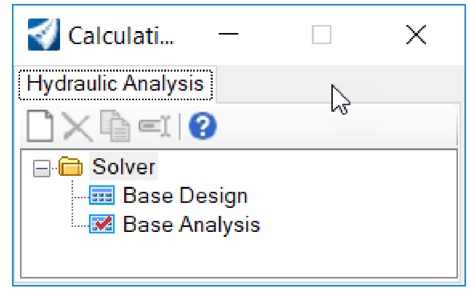
Each alternative will have different properties. Any column that is shown as white is a field that can be edited. Columns in yellow cannot be edited from the alternative, but in some cases, may be editable from other places in the model, such as the FlexTables or Properties.

The first column in any alternative editor contains a check box indicating the records that have been changed in this alternative. If the box is checked, the record on that line has been modified and the data is local, or specific, to this alternative. If the box is not checked, it means that the record on that line is inherited from its higher-level parent alternative. Inherited records are dynamic. If the record is changed in the parent, the change is reflected in the child. The records on these rows reflect the corresponding values in the alternative's parent.

Changes made in the graphics, Properties, and FlexTables will automatically make changes to the values in the appropriate active Alternatives.

Calculation Options

The Calculation Options Manager lets you create, view, and edit the calculation options available for your scenarios. The dialog box consists of a pane that displays the calculation options created.



To edit the calculation options, double-click on the one you want to edit. This will display the properties of the calculation options in the Properties dialog.

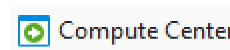
The parent/child function is not available for calculation options. New calculation options can be created by clicking the New icon.

Computing Scenarios

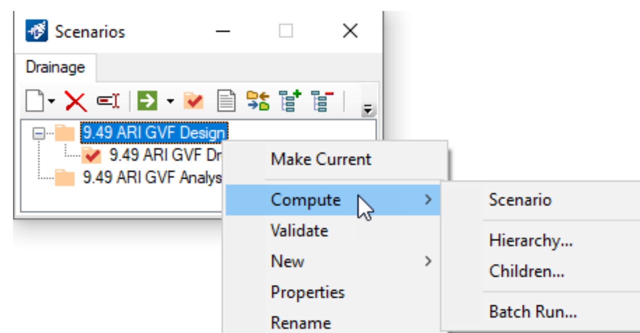
There are several places where you can compute a scenario:

- The Compute icon in Analysis > Calculation - this computes the current scenario. Use this if you’re confident that you know which scenario this is

- The Compute Centre – this lets you choose the scenario to compute and shows you the most important settings that it contains. Use this when you are getting familiar with scenarios, as an easy way to check their settings



- The Scenarios Manager – this lets you choose the scenario to compute, and compute multiple scenarios, in a hierarchy or by selecting a batch. You will use this more when you are more proficient with the software and are using more scenarios.



Checking the Storm Data

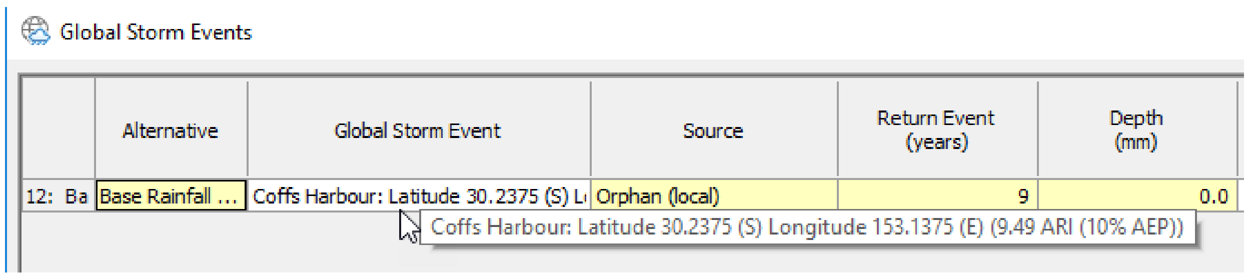
1. On the **Components** ribbon, click the arrow below *Common > Storm Data >* **Global Storm Events.**

2. Click *Global Storm Events.*

Here you are choosing the storm event that you want to use. It is stored in a *Rainfall Runoff* alternative, and this one is called **"Base Rainfall Runoff".** This storm event is therefore specific to this rainfall runoff alternative. The **"Base Rainfall Runoff"** alternative has been selected in the scenario which you will compute in a moment.

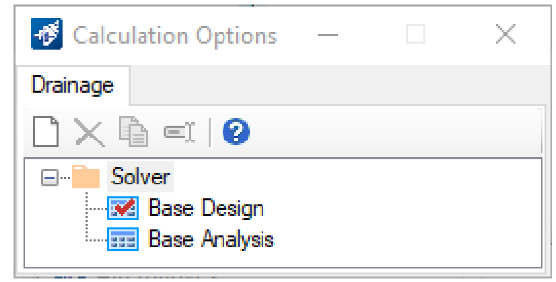
3. Check that *Coffs Harbour: Latitude30.237 (S) Longitude 153.1375 (E) (9.49 ARI (10% AEP))* is selected.

4. Close the *Global Storm Events* dialog.



Checking the Calculation Options

By default, the Gradually Varied Flow (GVF) calculations will be used to 'solve' the hydraulics of a storm drainage network.



1. On the **Analysis** ribbon, select *Calculation > **Options***.

Note: The calculation options that you see here have been copied in from the DGN library.

Note: The red tick in the icon for the *Base Analysis* solver icon tells you that this is the active calculation option.

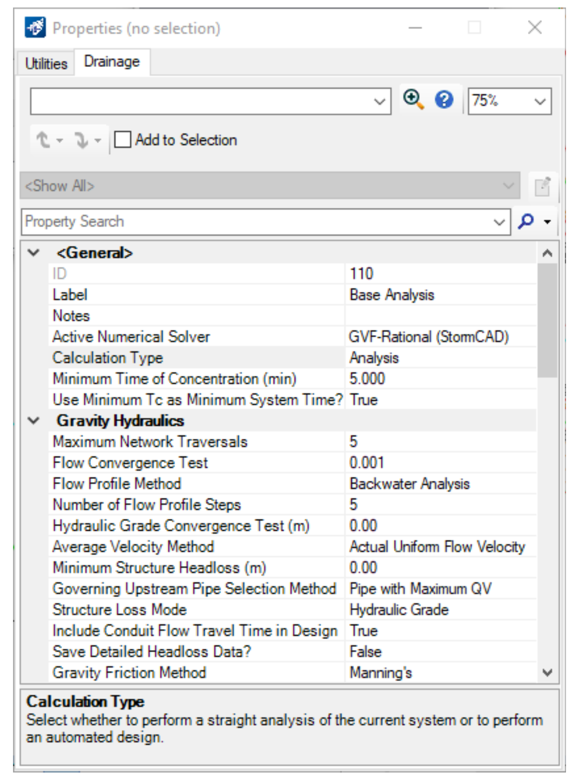
Perhaps the most important property of a Scenario is the *Calculation Option:*

- An *Analysis* performs calculations but does NOT change pipe sizes and levels
- A *Design* performs calculations and MAY change pipe sizes and elevations

2. Double-click **Base Analysis** in the *Calculation Options* dialog.

Note that because you are editing the active Calculation Options they will automatically be used by the active Scenario.

3. The settings for *Base Analysis* are displayed in the *Properties* dialog.



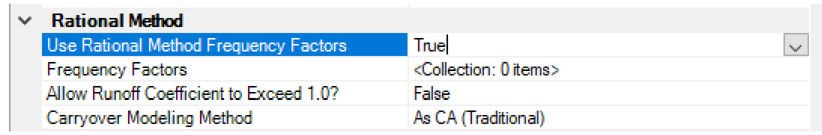
Your Calculation Options should be the same as the picture on the right.

Notes:

- The *Active Numerical Solver* is set to *GVF-Rational (StormCAD),* for Gradually Varied Flow using the Rational method.
- The *Calculation Type* is set to *Analysis.* This will not change the pipe sizes, levels etc. – i.e. none of the physical data.
- The *Flow Profile Model* is set to *Backwater Analysis*. This is the preferred option for computing a system because the gradually varied flow algorithms it uses are more rigorous and generate solutions that more closely reflect reality.
- The *Minimum Time of Concentration* is set to *5* minutes. Any catchment with no Time of Concentration set, or one that is less than this, will be adjusted by the calculations to use this value.
- *Use Minimum Tc as Minimum System Time* applies when a pipe at the top of a branch has no flow.

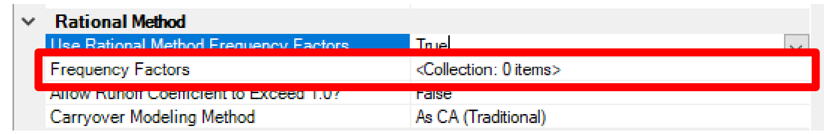
4. Scroll further down the *Calculation Options.*

5. Locate the *Use Rational Method Frequency Factors* property in the *Rational Method* category.



6. Set *Use Rational Method Frequency Factors* to *True.*

7. Locate the *Frequency Factors* property in the *Rational Method* category.



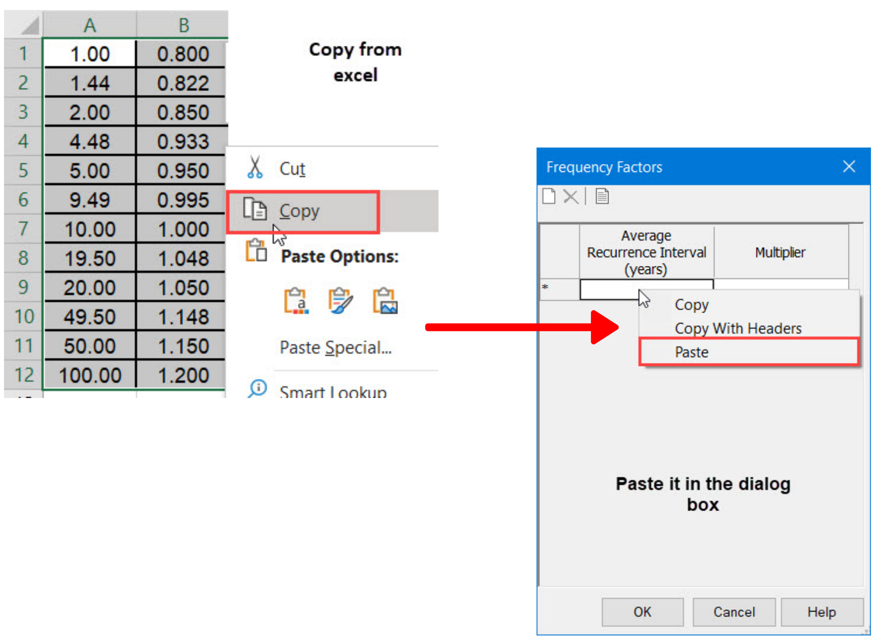
8. Click the **Browse** button and *Key-in* the ARIs and Multiplier shown in the screen shot below, **or**

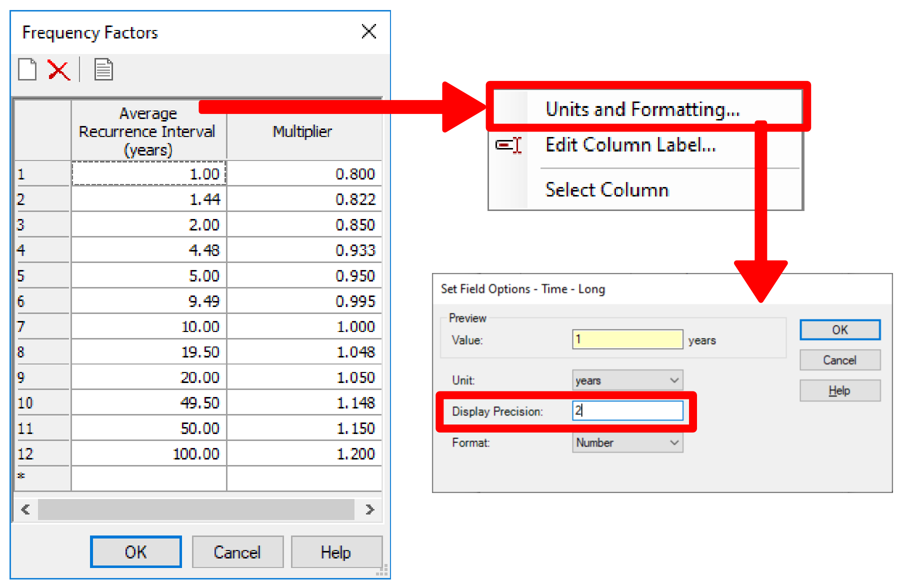
   go to the dataset folder and open **Frequency Factor.xlsx** file, copy the data columns, and paste it in the *Frequency Factors* dialog box.

9. To change the number of decimal places, *Right Click* on the title heading ‘Average Recurrence Interval’ and select *Units and Formatting*.

Note if your design standards require the use of Frequency Factors, then these values should be set up your WorkSpace dgn library.

10. Click **OK** to close the *Frequency Factors* dialog.





11. Locate the *Allow Runoff Coefficient to Exceed 1.0* property in the *Rational Method* category.

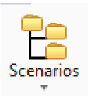
12. Check that this is set to *False*.

    This setting does not allow the product of the *Runoff Coefficient* and the *Frequency Factor* to exceed *1.0.*

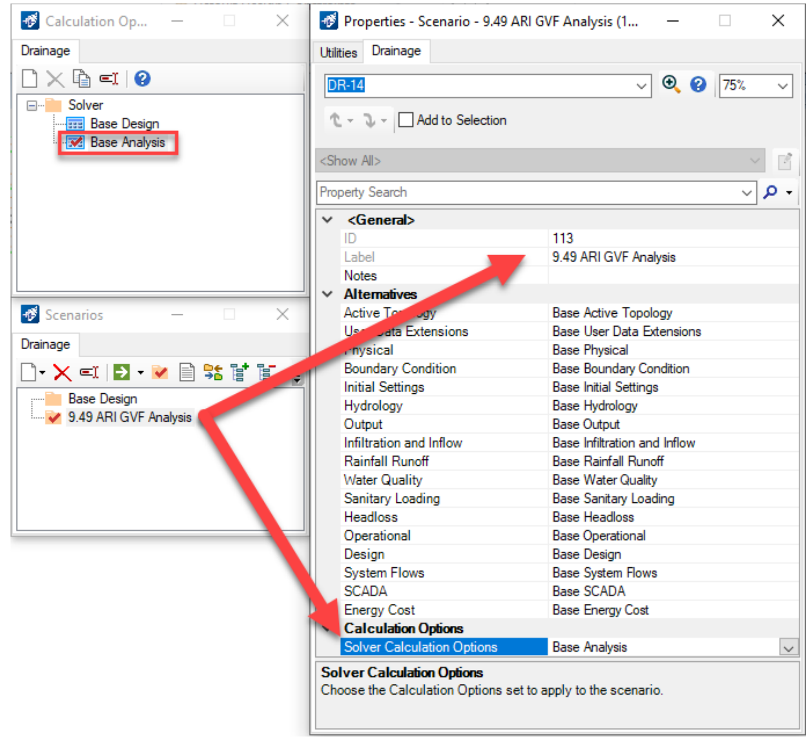
13. Repeat the process in Steps **4 - 12** above for *Base Design* in the *Calculation Options* dialog.

14. Close the *Calculation Options* dialog.

Checking the Active Scenario

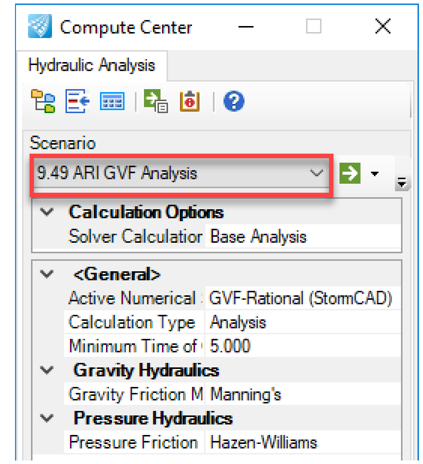


1. From the **Analysis** ribbon, select *Calculations >* **Scenario Manager.**
2. Rename the *Base Analysis Scenario* to **9.49 ARI GVF Analysis.**
3. Double click the *Scenario* and check that the *Calculation Options* are set to **Base Analysis.**
4. Close the **Properties** panel.



Computing the Scenario

1. From the **Analysis** ribbon, select *Analysis Tools >* **Compute Center.**



The toolstrip at the top of the Compute Center lets you access a number of Managers and tools, to help you use scenarios. It always displays the current scenario when you open the dialog, but you can change the scenario to compute if you need to.

2. Confirm that the *Scenario* is set to **9.49 ARI GVF Analysis.**

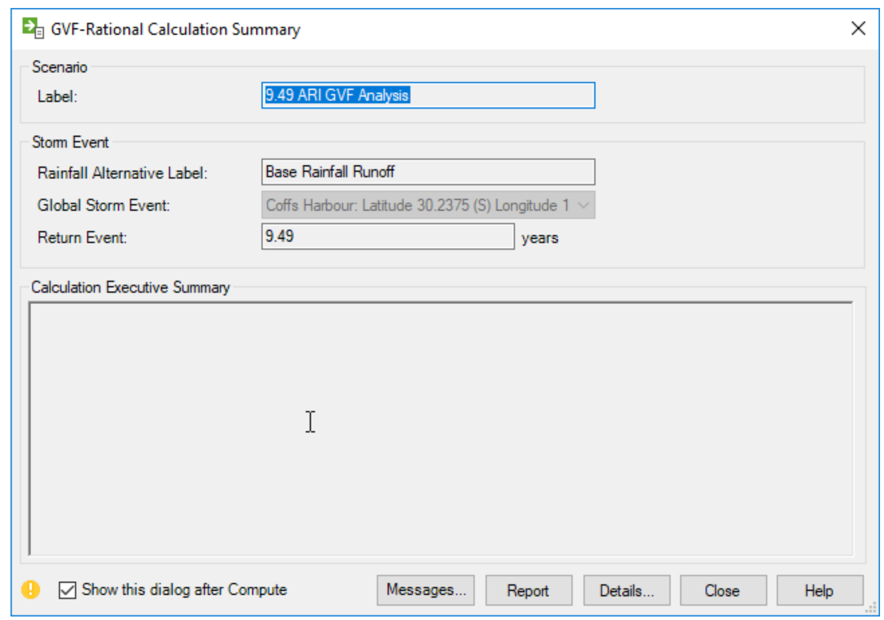
Review the other settings in the *Compute Center* dialog.

Note: Settings for the *Calculation Type*, is set to **Analysis.** Remember - this means that the physical properties of the drainage network will not be changed. A *Calculation Type* that is set to **Design** may well cause the physical properties, such as invert levels and pipe diameters, to change.

4. Click **Compute.** This computes the current scenario.

After a few moments, the *GVF-Rational Calculation Summary* dialog is displayed.

Due to the system only consisting of catch basins and catchments, and no conduits or outfall, no details are displayed in the *Calculation Executive Summary* area of the dialog.



5. On the *GVF-Rational Calculation Summary* panel, Click **Details.**

   This dialog is a good way to get an overview of a conveyance system, without selecting individual objects. Because we don't have any gutters or pipes yet, some of the tabs don't show any useful information, but the *Inlet Summary* tab does.

6. Click the *Inlet Summary* tab and review the data.

   You can see the *Capture Efficiency* of each catch basin, and the *Spread / Top Width*, so you can easily find any big issues.

   The *Catchment Summary* tab is also a useful one to check at this stage, as it could reveal an issue with the storm data.

7. Close the *Details* dialog.

Calculation Detailed Summary

Calculation Options | Catchment Summary | Link Summary | Node Summary | Inlet Summary | Pond Summary

Label	Inlet Type	Catalog Inlet Type	Catalog Inlet	Flow (Captured) (L/s)	Flow (Total Bypassed) (L/s)	Bypass Target	Capture Efficiency (Calculated) (%)	Depth (Gutter) (cm)	Spread / Top Width (m)
SA1-	Catalog Inlet	Combination	Training Combin:	13.05	0.00	(N/A)	100.0	3.936	0.492
SA1-1	Catalog Inlet	Combination	Training Combin:	21.39	0.34	(N/A)	98.4	4.761	0.754
SA1-2	Catalog Inlet	Combination	Training Combin:	7.27	0.00	(N/A)	100.0	3.176	0.397
SA1-3	Catalog Inlet	Combination	Training Combin:	5.59	0.00	(N/A)	100.0	3.036	0.380
SA1-4	Catalog Inlet	Combination	Training Combin:	22.93	1.34	(N/A)	94.5	5.399	0.966
SA1-5	Catalog Inlet	Combination	Training Combin:	15.05	0.01	(N/A)	100.0	4.207	0.569
SA1-6	Catalog Inlet	Combination	Training Combin:	12.63	0.00	(N/A)	100.0	3.905	0.488
SA1-7	Catalog Inlet	Combination	Training Combin:	14.42	0.69	(N/A)	95.4	5.436	0.979
SA1-8	Catalog Inlet	Combination	Training Combin:	23.09	3.54	(N/A)	86.7	9.699	2.400
SA1-9	Catalog Inlet	Combination	Training Combin:	6.16	0.00	(N/A)	100.0	2.952	0.369
SA1-10	Catalog Inlet	Combination	Training Combin:	13.33	0.52	(N/A)	96.2	5.321	0.940
SA1-11	Catalog Inlet	Combination	Training Combin:	7.08	0.00	(N/A)	100.0	3.222	0.403
SA1-12	Catalog Inlet	Combination	Training Combin:	13.54	0.66	(N/A)	95.4	5.495	0.998
SA1-13	Catalog Inlet	Combination	Training Combin:	43.95	9.56	(N/A)	82.1	6.686	1.395
SA1-14	Catalog Inlet	Combination	Training Combin:	13.56	0.00	(N/A)	100.0	4.063	0.521
SA1-15	Catalog Inlet	Combination	Training Combin:	6.17	0.00	(N/A)	100.0	2.986	0.373
SA1-16	Catalog Inlet	Combination	Training Combin:	19.71	2.35	(N/A)	89.4	6.290	1.263
SA1-17	Catalog Inlet	Combination	Training Combin:	7.26	0.00	(N/A)	100.0	6.217	0.311

Report | Close | Help

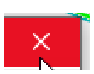
8. On the *GVF-Rational Calculation Summary* panel, click **Messages.**

Review the messages.

Note: The messages about time of concentration, no gutters, no outfall, and no valid network can be ignored as this is to be expected.

User Notification Details

Message Id	Scenario	Element Type	Element Id	Label	Time (min)	Message
44045	9.49 ARI GVF Analysis	Catchment	217	DR-13	(N/A)	Time of concentration for catchment is less than the minimum Tc value
44045	9.49 ARI GVF Analysis	Catchment	215	DR-12	(N/A)	Time of concentration for catchment is less than the minimum Tc value
44045	9.49 ARI GVF Analysis	Catchment	213	DR-11	(N/A)	Time of concentration for catchment is less than the minimum Tc value
44045	9.49 ARI GVF Analysis	Catchment	211	DR-10	(N/A)	Time of concentration for catchment is less than the minimum Tc value
44045	9.49 ARI GVF Analysis	Catchment	247	DR-18	(N/A)	Time of concentration for catchment is less than the minimum Tc value
44045	9.49 ARI GVF Analysis	Catchment	209	DR-9	(N/A)	Time of concentration for catchment is less than the minimum Tc value
44045	9.49 ARI GVF Analysis	Catchment	245	DR-17	(N/A)	Time of concentration for catchment is less than the minimum Tc value
44045	9.49 ARI GVF Analysis	Catchment	207	DR-8	(N/A)	Time of concentration for catchment is less than the minimum Tc value
44045	9.49 ARI GVF Analysis	Catchment	205	DR-7	(N/A)	Time of concentration for catchment is less than the minimum Tc value
44045	9.49 ARI GVF Analysis	Catchment	203	DR-6	(N/A)	Time of concentration for catchment is less than the minimum Tc value
44045	9.49 ARI GVF Analysis	Catchment	201	DR-5	(N/A)	Time of concentration for catchment is less than the minimum Tc value
44045	9.49 ARI GVF Analysis	Catchment	199	DR-4	(N/A)	Time of concentration for catchment is less than the minimum Tc value
44045	9.49 ARI GVF Analysis	Catchment	238	DR-16	(N/A)	Time of concentration for catchment is less than the minimum Tc value
44045	9.49 ARI GVF Analysis	Catchment	197	DR-3	(N/A)	Time of concentration for catchment is less than the minimum Tc value
44045	9.49 ARI GVF Analysis	Catchment	233	DR-15	(N/A)	Time of concentration for catchment is less than the minimum Tc value
44045	9.49 ARI GVF Analysis	Catchment	195	DR-2	(N/A)	Time of concentration for catchment is less than the minimum Tc value
44045	9.49 ARI GVF Analysis	Catchment	231	DR-14	(N/A)	Time of concentration for catchment is less than the minimum Tc value
44045	9.49 ARI GVF Analysis	Catchment	193	DR-1	(N/A)	Time of concentration for catchment is less than the minimum Tc value
44025	9.49 ARI GVF Analysis	Catch Basin	192	SA1-	(N/A)	There is no gutter leaving this 'On Grade' catch basin. Bypassed flow i
44025	9.49 ARI GVF Analysis	Catch Basin	194	SA1-1	(N/A)	There is no gutter leaving this 'On Grade' catch basin. Bypassed flow i
44025	9.49 ARI GVF Analysis	Catch Basin	196	SA1-2	(N/A)	There is no gutter leaving this 'On Grade' catch basin. Bypassed flow i
44025	9.49 ARI GVF Analysis	Catch Basin	198	SA1-3	(N/A)	There is no gutter leaving this 'On Grade' catch basin. Bypassed flow i

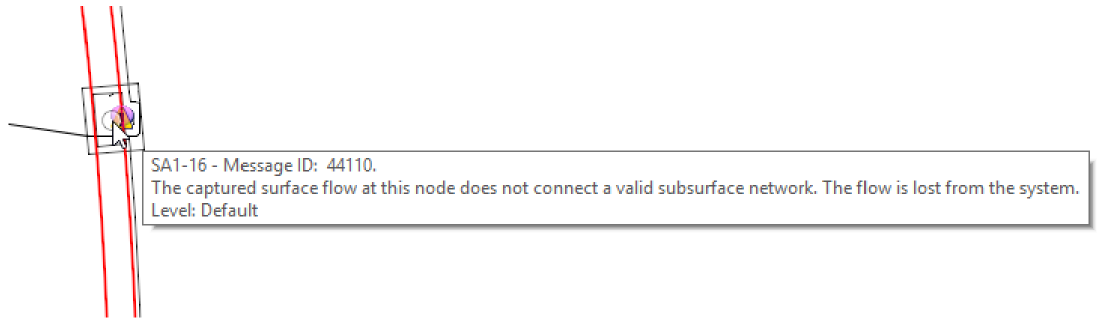


9. Close the *User Notifications* dialog.

If this is the first time that you've used the User Notifications dialog, then the *Civil Message Center* dialog will now be displayed. The content of this will be very similar to what you've just seen in the User Notifications, but this dialog also displays MicroStation and other OpenRoads Designer messages.

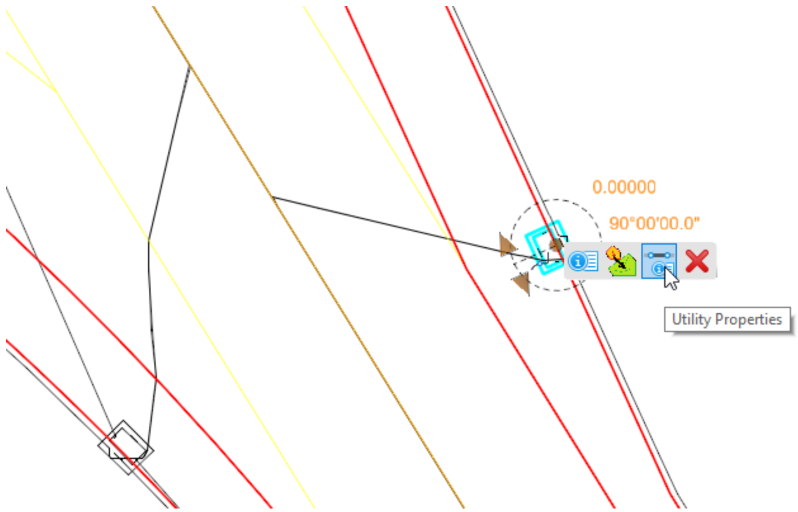
The buttons across the top of the dialog act as toggles, so you can click them to toggle the display of the errors, warnings, and information messages on and off. This also toggles on and off the glyphs in the graphics.

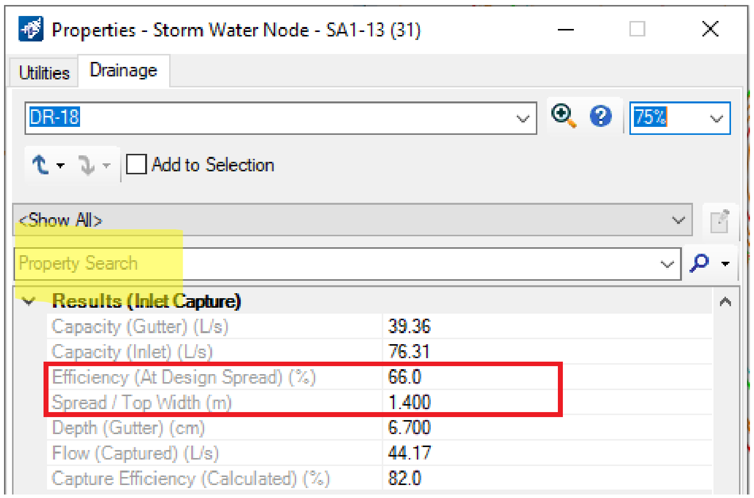
10. Close the *Civil Message Center* dialog – if it is open.
11. Close the *GVF-Rational Calculation Summary* and the *Compute Center* dialogs.
12. *User Notifications* are now also shown as warning glyphs in the **Default** view.



Checking Hydraulic Properties

1. Select the catch basin south of the intersection fillet (this was the first catch basin we placed) and view the **Utility Properties.**
2. There are quite a lot of result fields so if you want to look at the spread width in the gutter just type in the word *'spread'* in the *Property Search*.





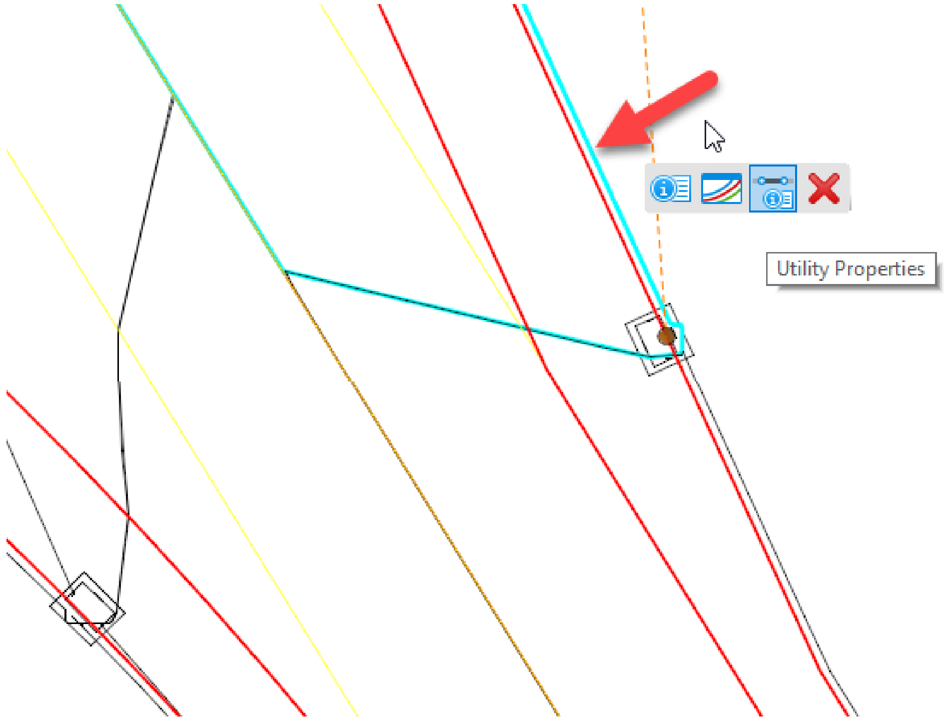
3. You can see that the inlet is operating at *66%* of its efficiency.
4. You can also see the width of flow in the gutter is approximately **4.778'** *[1.4m].*

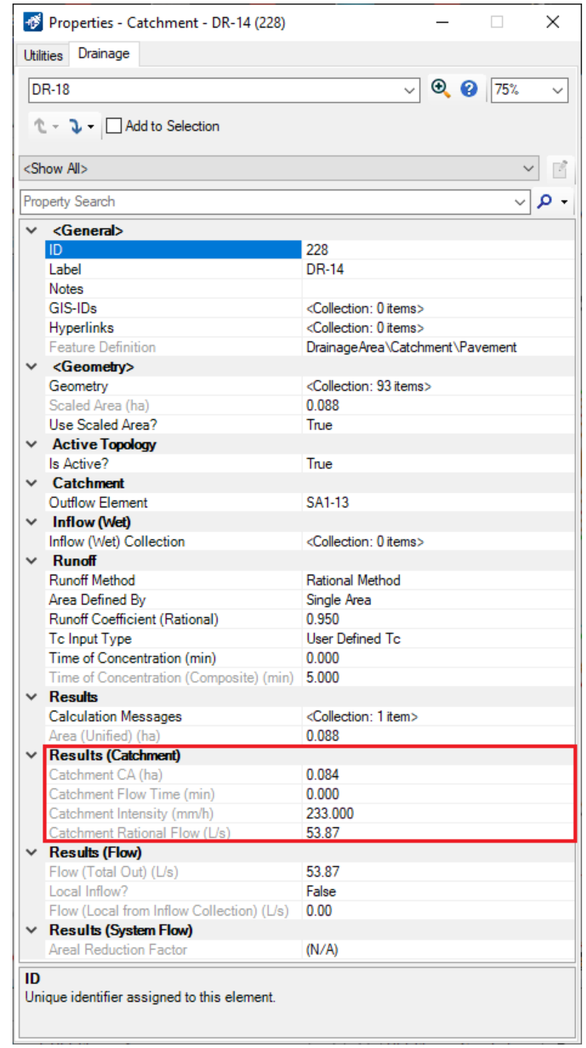
Note that your values may differ slightly, as they depend on exactly where you placed the catch basin.

5. Select one of the catchments
6. Remove the *'spread'* text from the **Property Search** if you typed it in.

You can see the results for the catchment, including how much flow is coming off it.

7. Keep the **Properties - Storm Water Node – SA-13** open and click on the Catchment boundary. (Image shown on the next page)


Utility Properties


Properties - Catchment - DR-14 (228)
Utilities
Drainage
DR-18
75%
Add to Selection
<Show All>
Property Search
<General>
ID 228
Label DR-14
Notes
GIS-IDs <Collection: 0 items>
Hyperlinks <Collection: 0 items>
Feature Definition DrainageArea\Catchment\Pavement
<Geometry>
Geometry <Collection: 93 items>
Scaled Area (ha) 0.088
Use Scaled Area? True
Active Topology
Is Active? True
Catchment
Outflow Element SA1-13
Inflow (Wet)
Inflow (Wet) Collection <Collection: 0 items>
Runoff
Runoff Method Rational Method
Area Defined By Single Area
Runoff Coefficient (Rational) 0.950
Tc Input Type User Defined Tc
Time of Concentration (min) 0.000
Time of Concentration (Composite) (min) 5.000
Results
Calculation Messages <Collection: 1 item>
Area (Unified) (ha) 0.088
Results (Catchment)
Catchment CA (ha) 0.084
Catchment Flow Time (min) 0.000
Catchment Intensity (mm/h) 233.000
Catchment Rational Flow (L/s) 53.87
Results (Flow)
Flow (Total Out) (L/s) 53.87
Local Inflow? False
Flow (Local from Inflow Collection) (L/s) 0.00
Results (System Flow)
Areal Reduction Factor (N/A)
ID
Unique identifier assigned to this element.

Exercise 3: Moving Catch Basins

Description

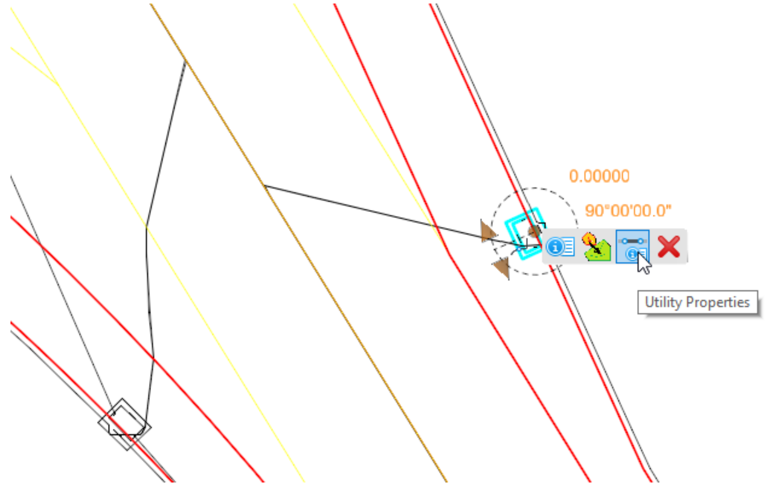
This exercise will look at moving catch basins to optimize their locations. This will also show the power of using catchment delineation, because the catchments are linked to the catch basins and will update automatically.

Skills Taught

- Moving a catch basin using Accusnap
- Automatically calculate the Road Cross Slope
- Measuring the Road Cross Slope
- Finding the route of a bypass flow path
- Moving a catch basin to collect bypass flow

Moving a Catch Basin using AccuSnap

You are going to move a catch basin in a moment. First though, check its hydraulic properties.

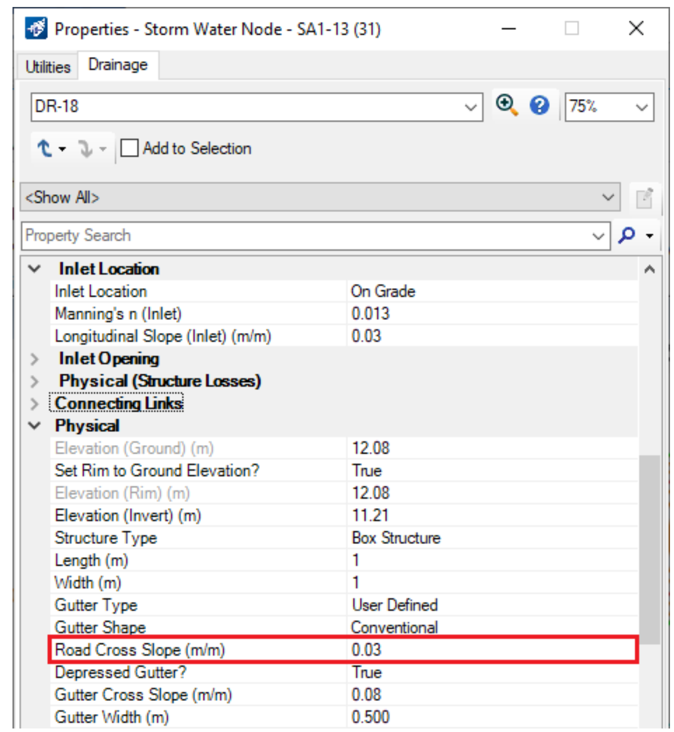


1. Select the catch basin **SA1-13**, south of the intersection fillet (which was the first catch basin that you placed)
2. View the **Utility Properties.**
3. Find the *Road Cross Slope* property.
4. There are quite a lot of result fields so if you want to look at the spread width in the gutter just type in the word *'slope'* in the *Property Search*.
5. **Note** the value – *0.03 m/m*.

   This value came from the prototype that is assigned to the Training Combination Inlet feature definition. The prototype defines the default value – so any catch basin placed will have this value by default. This value can be edited – you can type a new value in the Utility Properties for example, but you would need to measure the road cross slope first, then type it in.

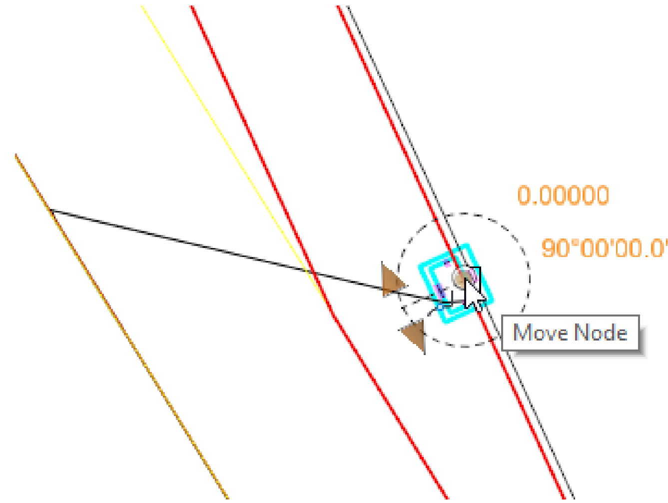
   While you are reviewing the **Utility Properties**, note the value for the *Longitudinal Slope (Inlet)*, which also happens to be **0.03ft/ft** *[0.03 m/m].* This value is set automatically when the catch basin is placed or moved.

6. **Close** the properties dialog.

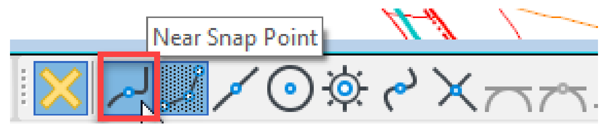


The next step is to relocate this catch basin to the corner fillet of the intersection.

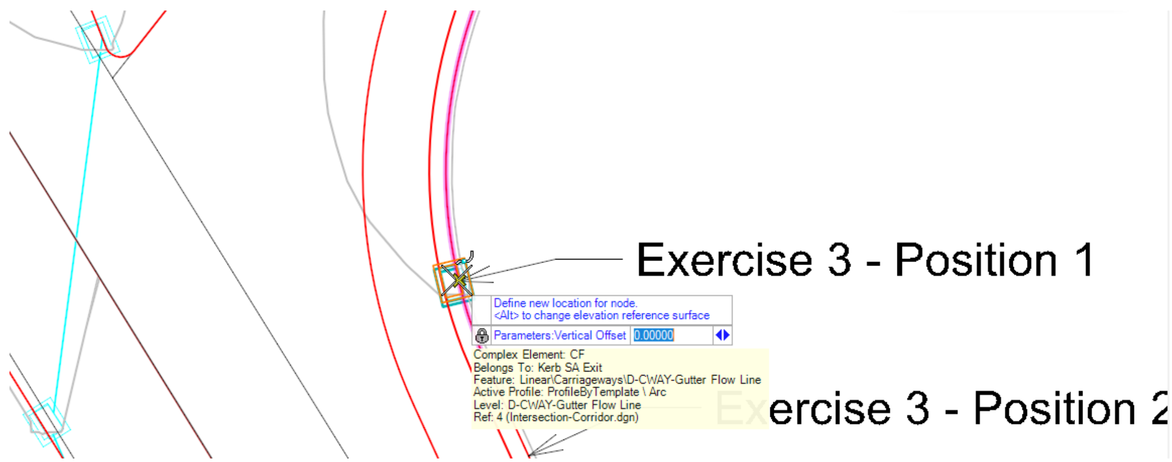
7. Select the catch basin, then select the **Move Node** manipulator.



8. Select Snap Mode *AccuSnap > Near Snap Point.*



9. Locate the catch basin and data point on the **D-CWAY-Gutter Flow Line** feature as shown below. Use the arrow for the *"Exercise 3 – Position 1"* text to guide you, but make sure that you snap to the **D-CWAY-Gutter Flow Line** feature – not the arrow.

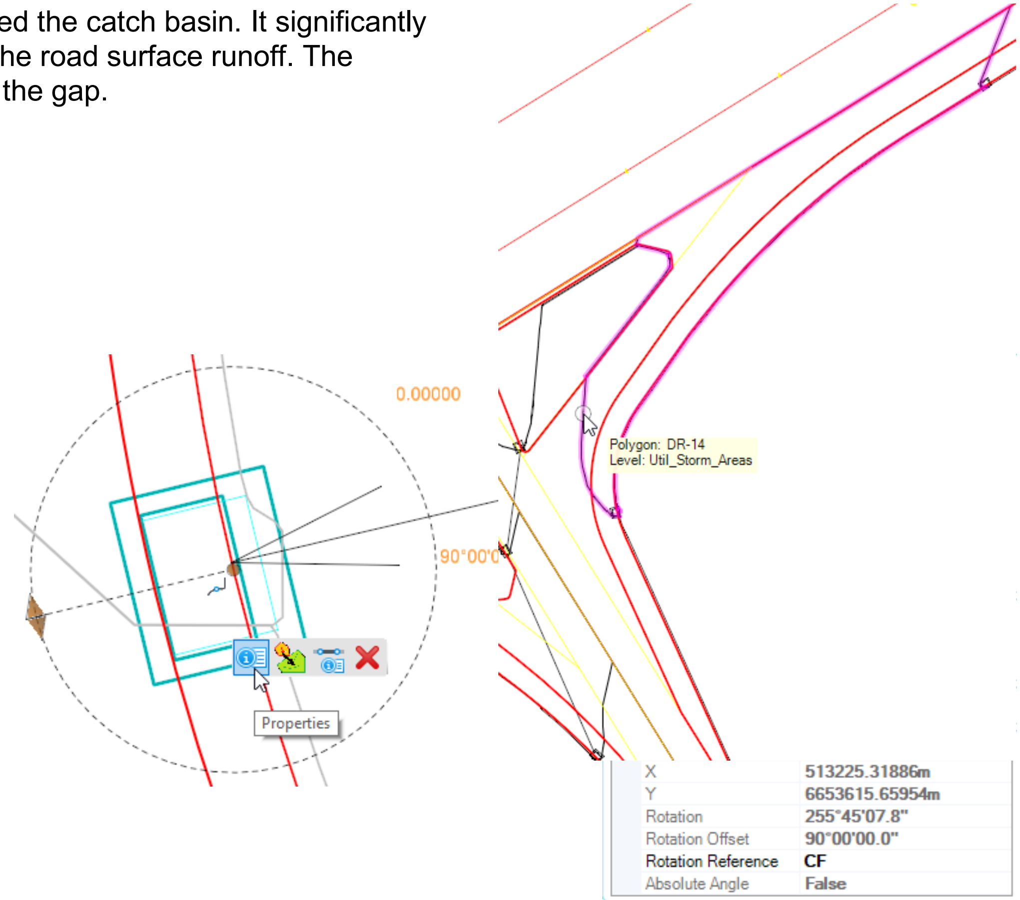


Note that the catchment area was updated when you moved the catch basin. It significantly reduced in size, because it is now not picking up some of the road surface runoff. The catchment area downstream has increased in size to fill in the gap.

10. Check the **Properties** of the repositioned catch basin.

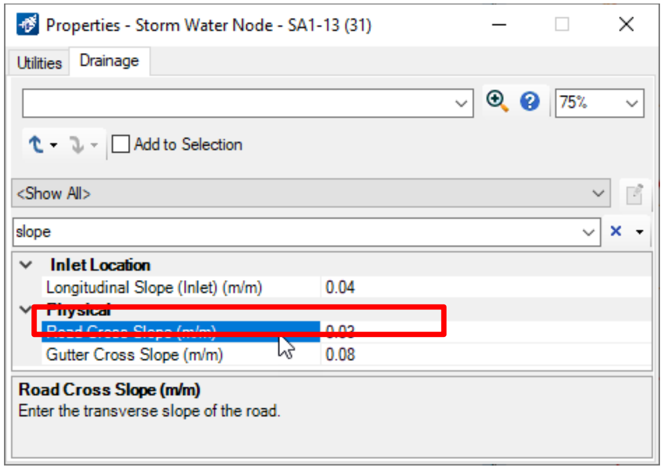
    a. First, note that the **Rotation Reference** has been retained, and the **Rotation Offset**, so the catch basin stays at 90 degrees to the gutter flow line.

    b. Next, click **Open Utility Properties**, then click the **Browse** icon.

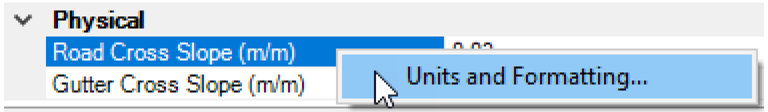


c. Check that the text *slope* is still in the *Property Search* (if not, type it in again)

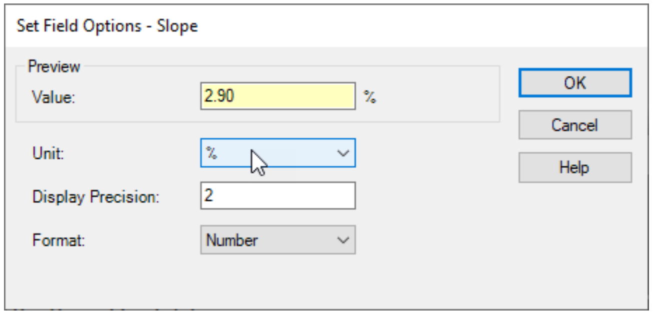
d. Note that the *Longitudinal Slope (Inlet)* has changed and is now **0.04ft/ft** *[0.04m/m].*



11. Right-click on the *Road Cross Slope* property, then select **Units and Formatting**.



12. Change the **Unit** to %, then click **OK.**



The *Road Cross Slope* value is now in percent, which is a more accurate result to two decimal places.

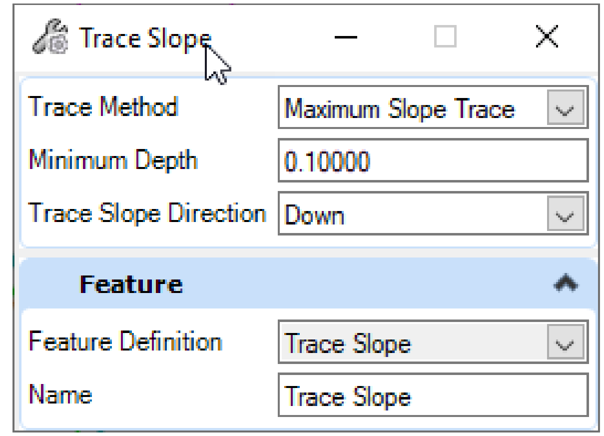
Note: changing the units for the *Road Cross Slope affects the Longitudinal Slope (Inlet)* property as well, because they both use the same **Slope** formatter. The formatter is shown in the title of the *Units and Formatting* dialog.

Finding the Route of a Bypass Flow Path

1. For checking the modified position of the catch basin use *Home > Model Analysis > Civil Analysis >* **Analyze Trace Slope.**

   This tool traces along a surface either following a user-specified slope value or the steepest slope. You can trace upstream or downstream.

2. Set the *settings* as shown on the right.

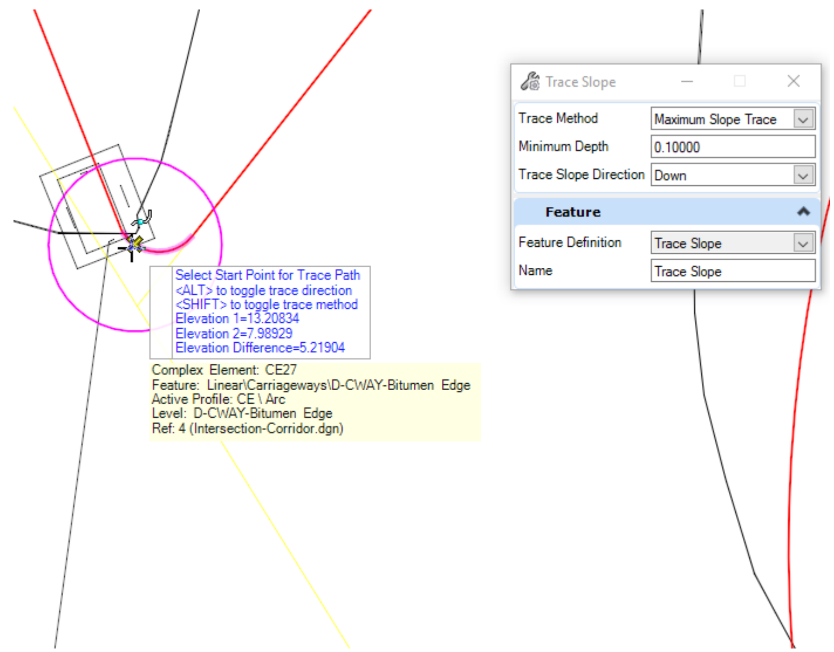


3. Select Snap Mode *AccuSnap >* **Near Snap Point**.

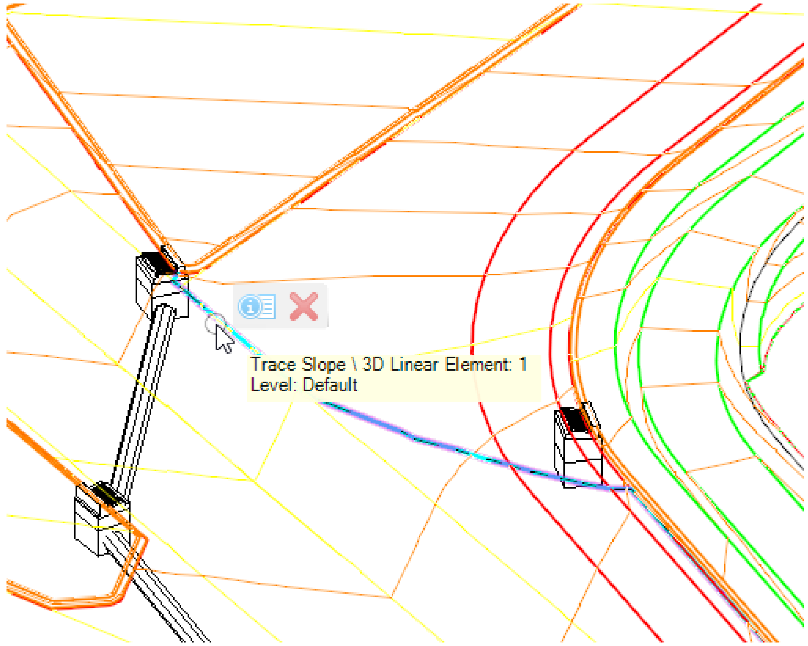
4. Select the Terrain in the *Default-3D View*.

   Data point on the corner of the deflection island in the 2D *Default View.*

   The trace slope is displayed in the *Default-3D View.*

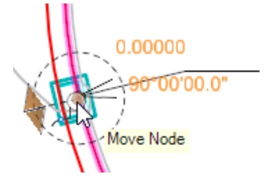


If there is any bypass flow from the catch basin on the corner of the deflection island you can see in the picture below that it will not be captured by the catch basin that you have just moved.



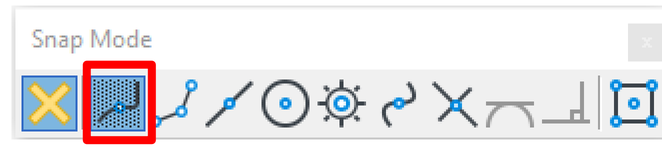
Moving a Catch Basin to Collect Bypass Flow

1. Select the catch basin that you previously repositioned.



Exercise 3 - Position 1

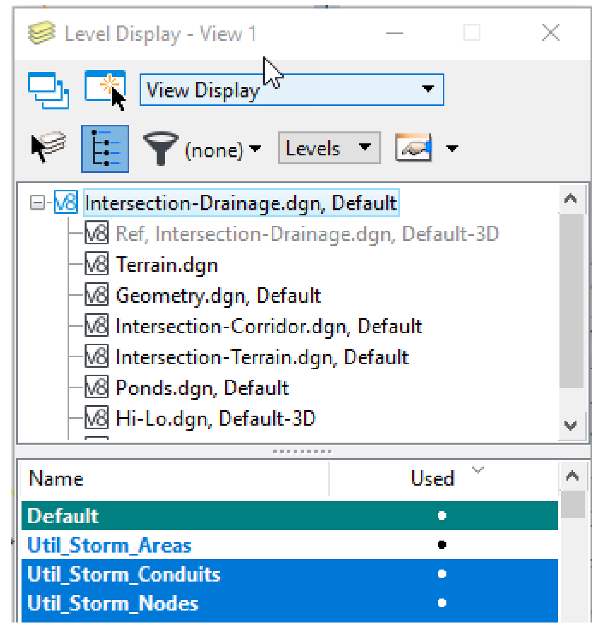
2. Select Snap Mode *AccuSnap > Near Snap Point.*



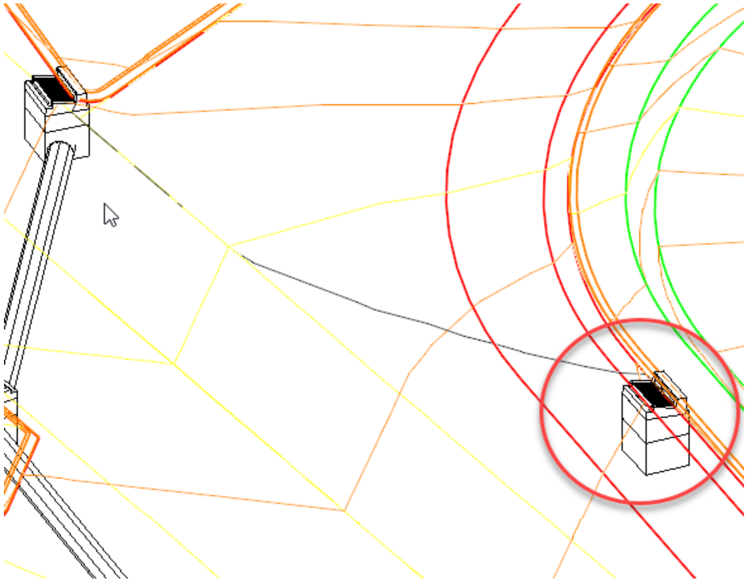
3. You may find it helpful to temporarily turn off the display of the **Util_Storm_Areas,** to make the location pick easier.

   If **Util_Storm_Areas** is the default level, you will need to make another level the default first, because you cannot switch off the default level.

4. Click the **Move Node** manipulator.



5. *Move the catch basin so that any bypass flow will be captured.* Use the arrow for the *"Exercise 3 – Position 2"* text to guide you, but make sure that you snap to the **D-CWAY-Gutter Flow Line** feature – not the arrow.



Exercise 4: Checking Catch Basin hydraulics

Description

This exercise will look at checking the catch basins to ensure that they are hydraulically efficient.

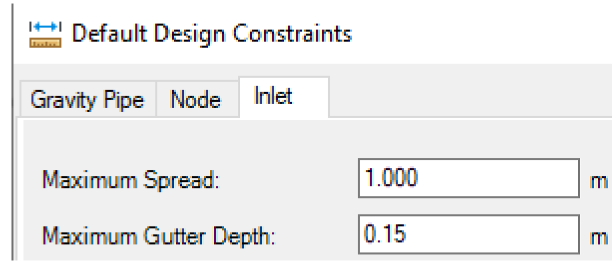
Skills Taught

- Checking the Default Design Constraints
- Computing the active scenario
- Checking the hydraulic properties

Checking the Default Design Constraints

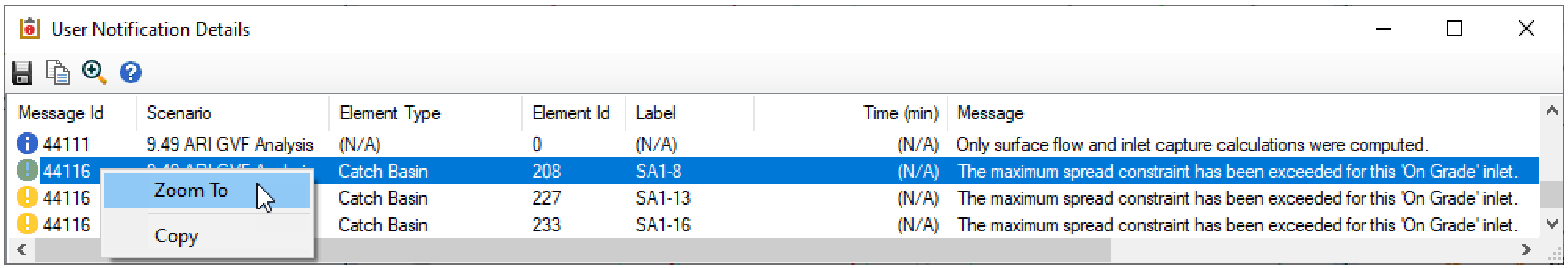
When you have computed the system previously, you have used the default settings for the spread width and depth. At an intersection, where there may be pedestrians, you may want to reduce these values.

1. On the **Analysis** ribbon, click **Analysis Tools > Default Design Constraints.**
2. Click *Inlet* and for the *Maximum Spread,* set the value to **3.0’** *[1.000m].*
3. *Close the dialog.*



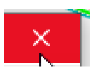
Compute the Active Scenario

1. From the **Analysis** ribbon, select *Calculation > Compute >* **Compute Scenario**
2. Click **Messages** on the *GVF-Rational Calculation Summary* dialog.
3. Review the messages. Because you have changed the default design constraint for the spread width, a new warning is now being shown - **The maximum spread constraint has been exceeded for this 'On Grade' inlet**.
4. Right click, Zoom To and check the positions and properties for the catch basin that have this warning.

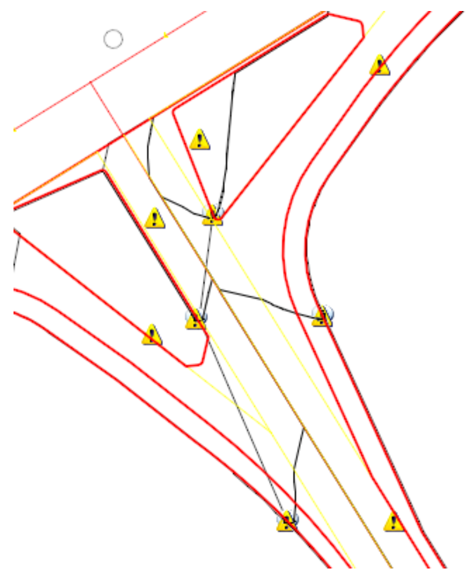


Note: the messages about time of concentration, no gutters, no outfall and no valid network can be ignored as this is to be expected.

You can also click **Details** and review the *Inlet Summary* tab.

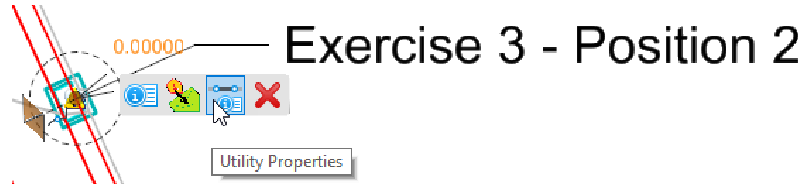


5. Close the *User Notifications* dialog.
6. Close the *GVF-Rational Calculation Summary* dialog.
7. *User Notifications* are again highlighted by glyphs in the *Default* view.



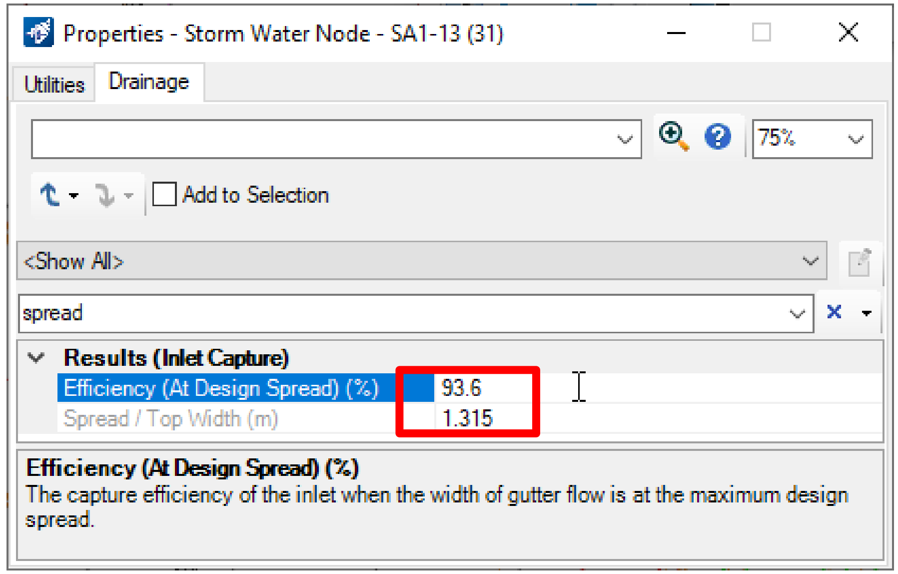
Checking the Hydraulic Properties

1. Select catch basin **SA1-13**, south of the intersection fillet, and view the **Utility Properties.**



2. There are quite a lot of result fields so if you want to look at the spread width in the gutter just type in the word *'spread'* in the *Property Search*.

Note that your values may be slightly different to those shown in the picture on the right, because they depend on the exact position of the catch basin.



You can see that the inlet is now operating at over *90%* of its efficiency.

You can also see the width of flow at the upstream face of the catch basin is over **3.0'** *[1.0m].*

This catch basin can't be moved, because it was placed to accept bypass flow from the catch basin on the corner of the deflection island. A new catch basin is required.

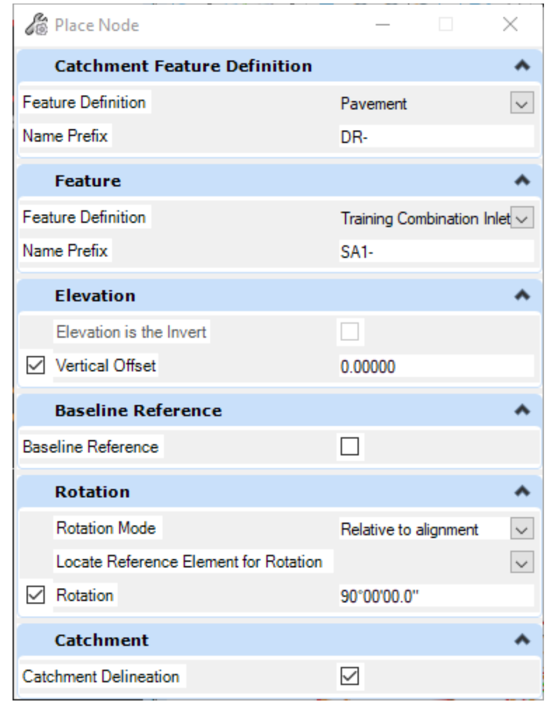
3. On the **Layout** ribbon, click **Place Node**.

4. In the *Place Node* dialog, set the following:

   a. Check the *Feature Definition* is **Node > StormWaterNode > Inlets > Training Combination Inlet.**

   b. Check the **Vertical Offset** is **0.**

   c. Check the Rotation Mode is **Relative to alignment.**



5. Following the Heads-up prompts set the following:

   a. At the *Select Reference Element for Node Elevation. Reset to Type Elevation* prompt, select the **Design-Boundary** terrain feature from *View 2.*

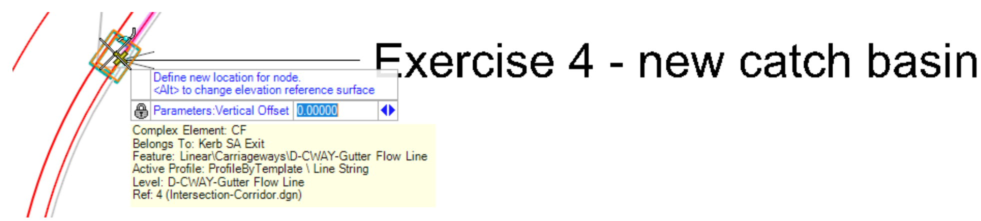
   b. The dialog now changes, and *Catchment Delineation* is now available, check this on.

   c. The *Catchment Feature Definition* is now available in the dialog.

   Set the *Catchment Feature Definition* to **Drainage Area > Catchment > Pavement.**

6. Select Snap Mode *AccuSnap > Near Snap Point.*

   a. At the *Define Catchbasin* prompt, data point on the **D-CWAY-Gutter Flow Line** feature opposite the deflection island. Use the arrow for the *"Exercise 4 – new catch basin"* text to guide you, but make sure that you snap to the **D-CWAY-Gutter Flow Line** feature – not the arrow.



   b. Data point to accept the Rotation Mode > *Relative to alignment*

   c. At the *Locate Reference Element for Rotation* prompt, data point on the **D-CWAY-Gutter Flow Line**.

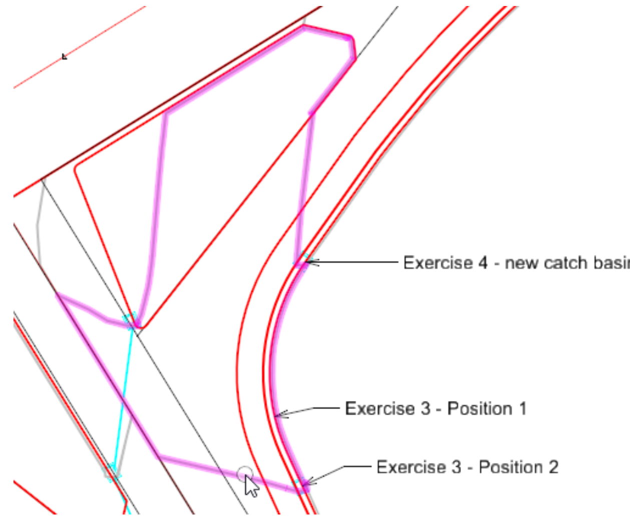
   d. Type *90* for the **Rotation** and *Enter,* then data point to accept the rotation.

Because you have placed a new catch basin upstream of an existing catch basin, you need to update the catchment area for the existing catch basin.

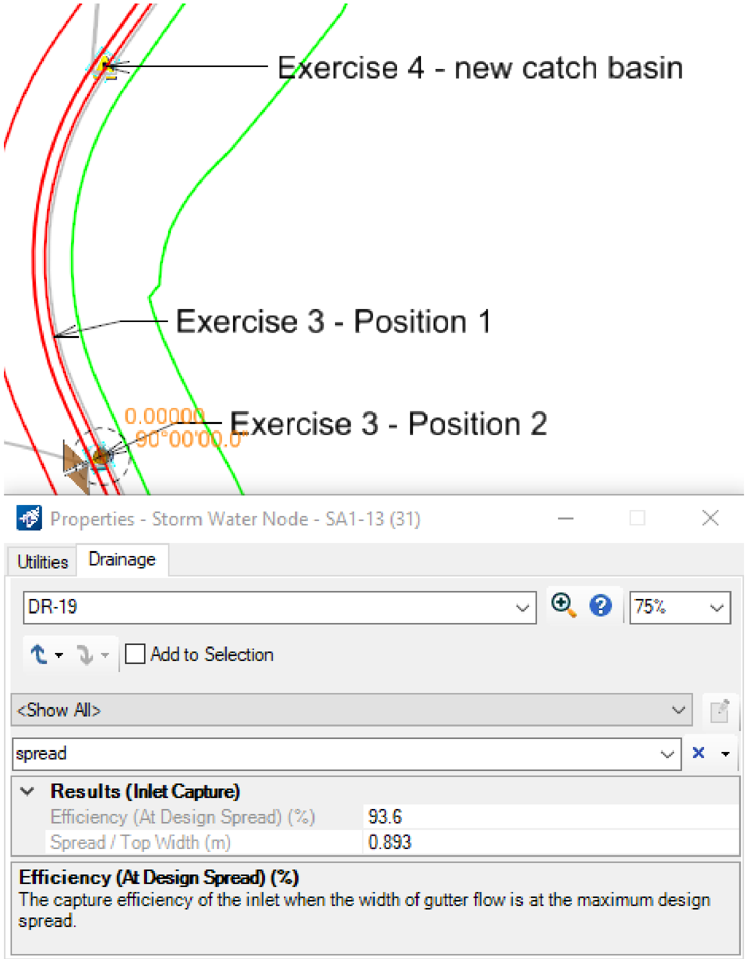
7. Select the catch basin **SA1-13**, shown on the right.
8. Click *Update Catchment for Inlets.*

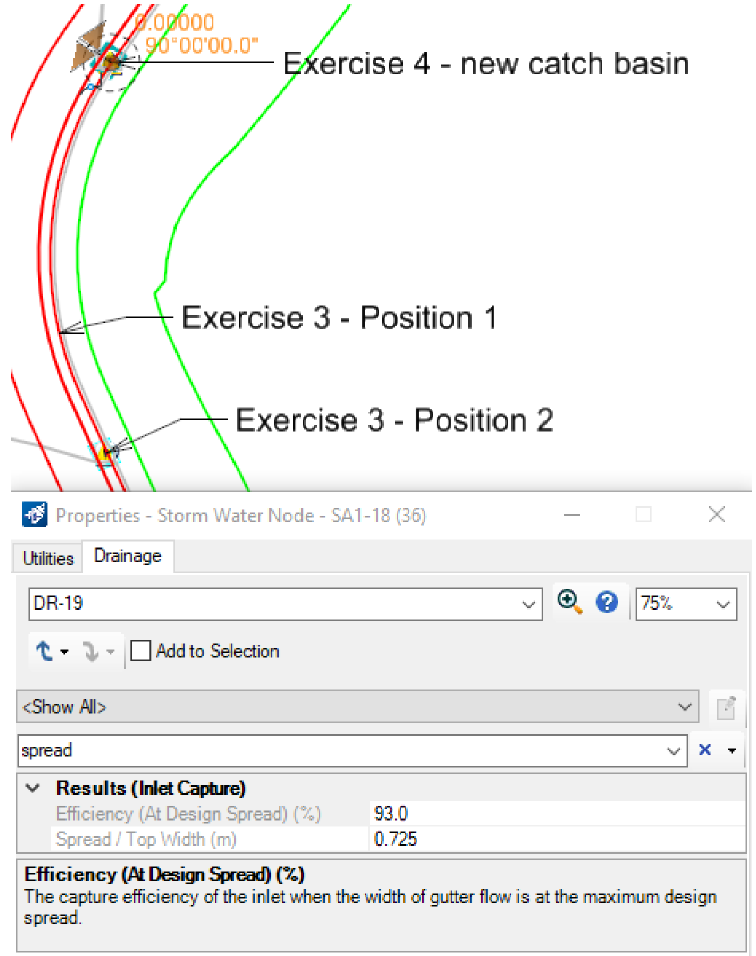
The area of the catchment is updated, and this can be confirmed using a tooltip.

Note that you may need to right-click to cycle through the catchment areas, to select the one that you want.



9. From the **Analysis** ribbon, select *Calculation > Compute >* **Compute Scenario**
10. Select each of the two catch basins **SA1-13** and **SA1-18** and check the results.





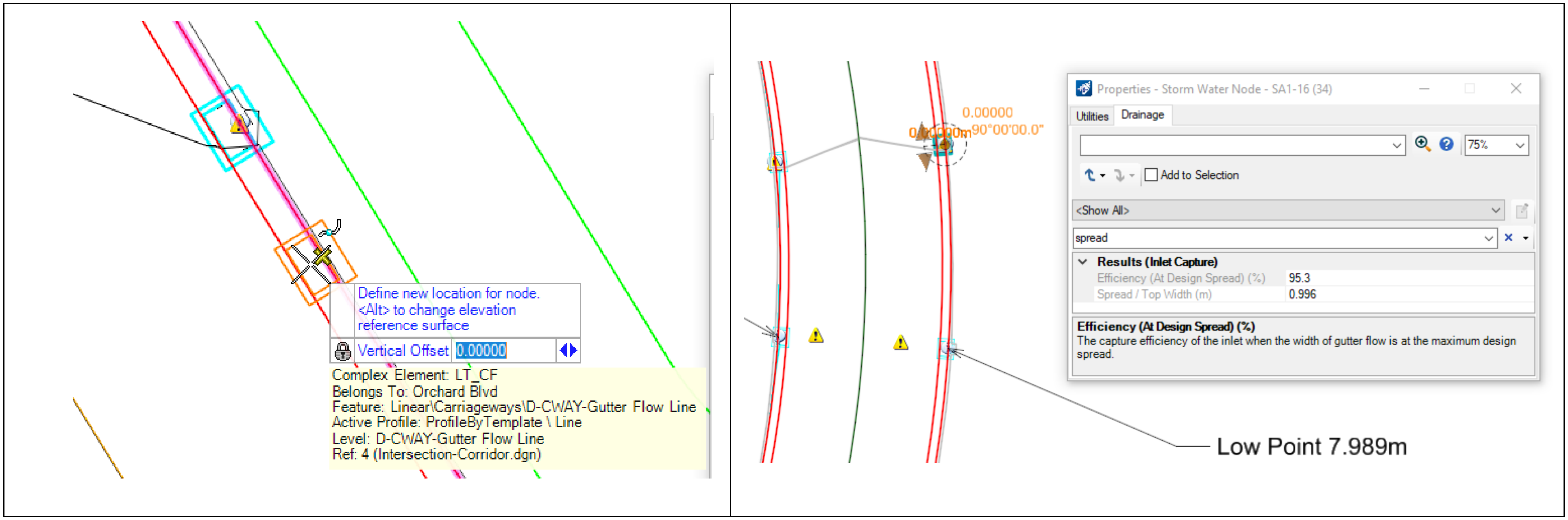
Both catch basins are now operating at a high efficiency, and the spread width is not being exceeded.

11. Catch basin **SA1-16** has a spread width above **3.0’** *[1.0m].*

12. Move catch basin **SA1-15** downstream, towards **SA1-16**, until the spread width of **SA1-16** is reduced to **3.0’** *[1.0m]* or less.

Notes:

- Remember to compute after you have moved catch basin **SA1-15,** to recalculate the spread width
- Use the Near Point snap to position the catch basin, and double-click the icon to set it as the default
- The correct position for catch basin **SA1-15** is a little way south of catch basin **SA1-6**, which is on the opposite side of the road



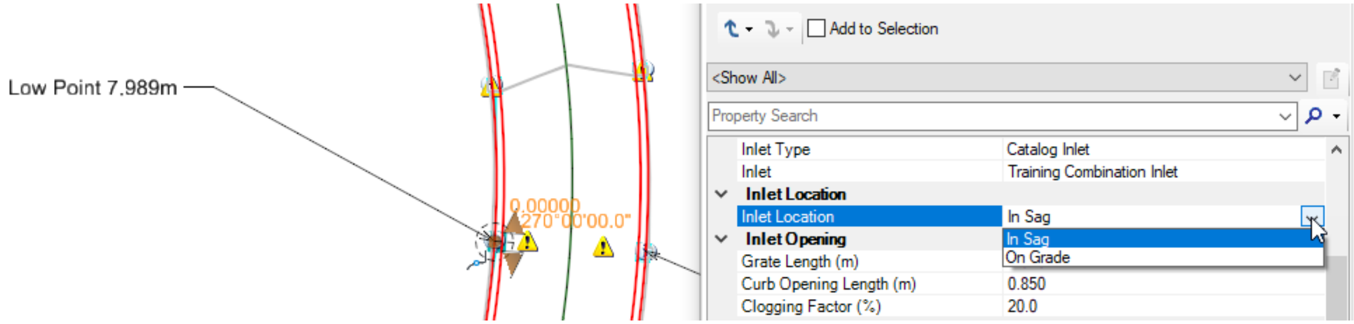
13. Turn back on the display of the **Util_Storm_Areas** level – if you previously turned this level off.

The remaining **maximum spread constraint has been exceeded for this ‘On Grade’ inlet** warning is for catch basin **SA1-8.** This catch basin is at the low point of the road surface.

14. Select catch basin **SA1-8** and view the **Utility Properties.**

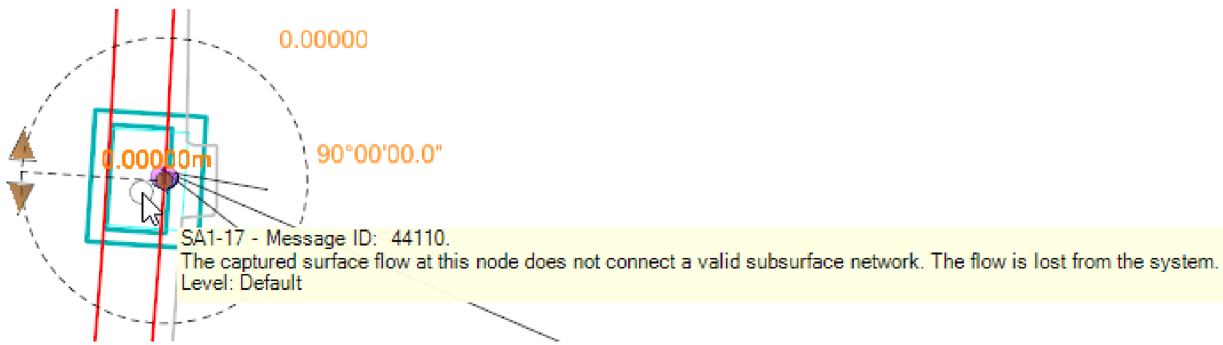
15. Clear the *'spread'* text from the *Property Search* field

16. Change the **Inlet Location** to **In Sag.**



17. From the **Analysis** ribbon, select *Calculation > Compute >* **Compute Scenario**

18. You might notice that there is a glyph at each catch basin. Glyphs show messages that were calculated when you computed the scenario.



19. In this particular case this glyph is telling you that, as you would expect, there is no subsurface network. This is because there are no pipes, and no outfall, so the water that arrives at the inlet is lost from the system. In effect it flows through the inlet and falls out of the bottom.

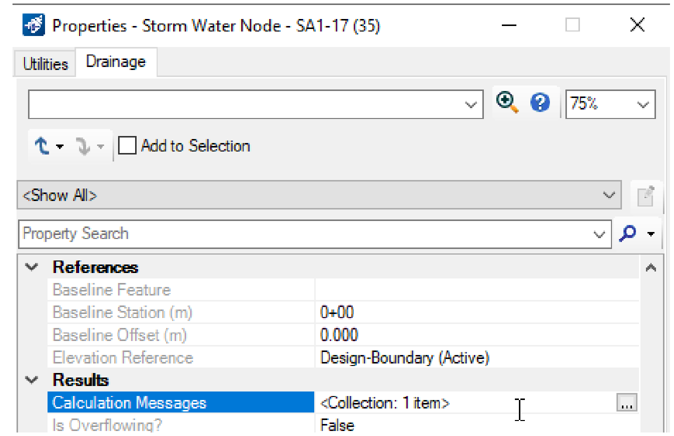
20. Select catch basin **SA1-17** and view the **Utility Properties**.

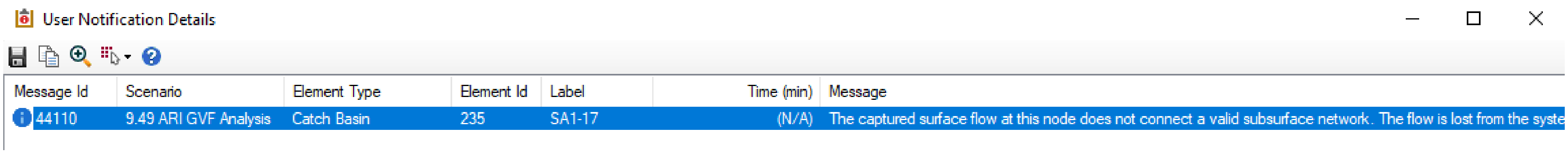
21. Scroll down to *Results*

    You can see a field called *Calculation Messages*, which tells you that there is 1 message for this object.

22. Select the **browse** button and view the message.

    You can see that it shows the same text as the tooltip for the glyph.





Exercise 5: Setting the Time of Concentration

Description

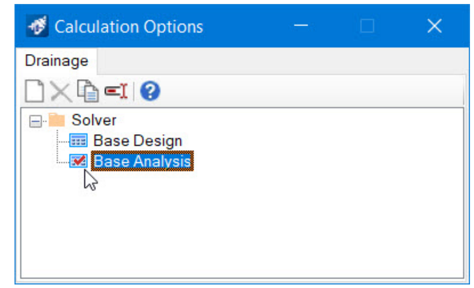
Warnings about the Time of Concentration are being shown in the Notifications. This warning occurs because the catchment areas do not have a Time of Concentration set, so the default time is used. This issue will be addressed in this exercise.

Skills Taught

- Setting the Minimum Time of Concentration
- Setting the Time of Concentration for the Catchment Areas
- Reviewing the Time of Concentration in a FlexTable
- Computing the Design Scenario

Setting the Minimum Time of Concentration

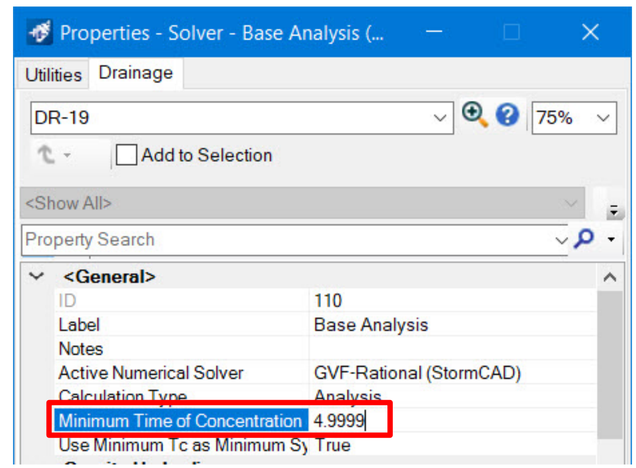
1. Click **Analysis > Calculations > Options.**
2. Double click the **Base Design** and check the *Properties.*



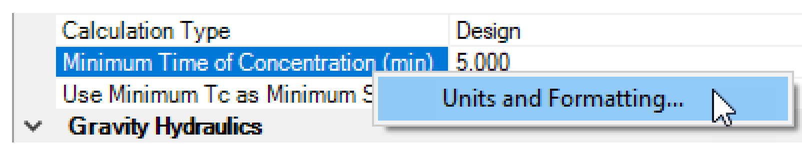
This is where the default value is set for the **Minimum Time of Concentration** for your catchments. This value is used if it has not been set on the individual catchment areas.

3. Change **Minimum Time of Concentration** from *5.000* to *4.9999* as this value is just less than **5.000.**

   Why are you using four decimal places – not two or three? Because the precision of this property is set to three decimal places, so by using four, the result will be displayed to three, and so appear as *5.000.*



   You can check the precision by right clicking on the property, then clicking Units and Formatting.

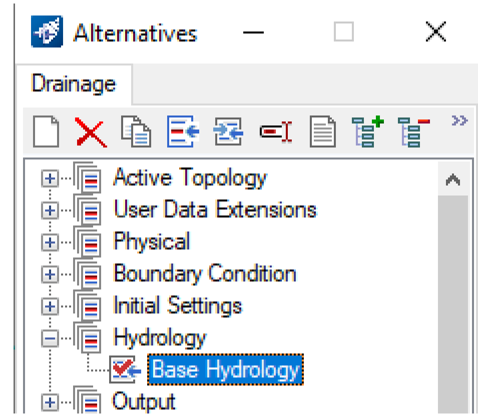


4. Close the **Properties** dialog.
5. Close the **Calculation Options**.

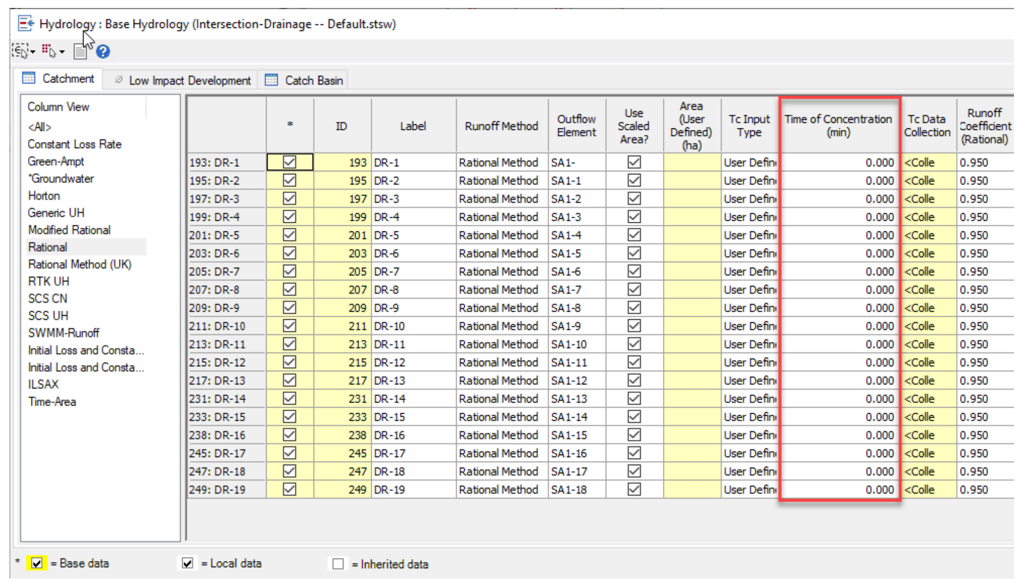
Setting the Time of Concentration for the Catchment Areas

1. On the **Analysis > Calculations** ribbon, click **Alternatives**.

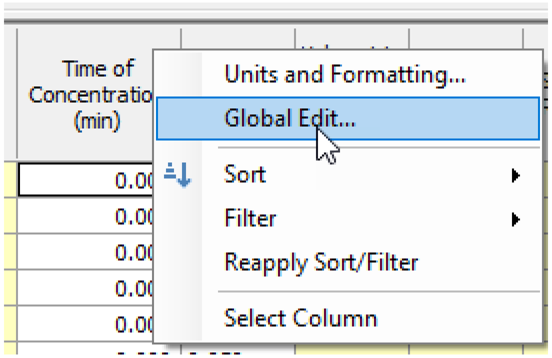
   In the *Alternatives* dialog, locate the **Hydrology > Base Hydrology** Alternative.



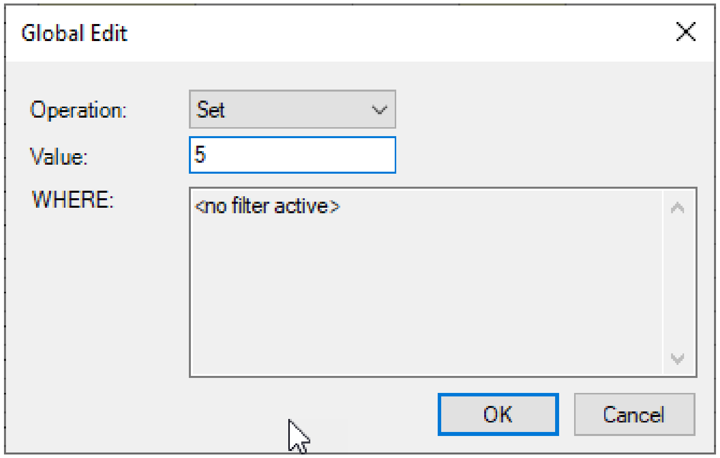
2. Double Click on **Base Hydrology** to view the Hydrology.
3. Select the **Catchment** tab.
4. The **Time of Concentration** values can be set here for individual or all catchments.



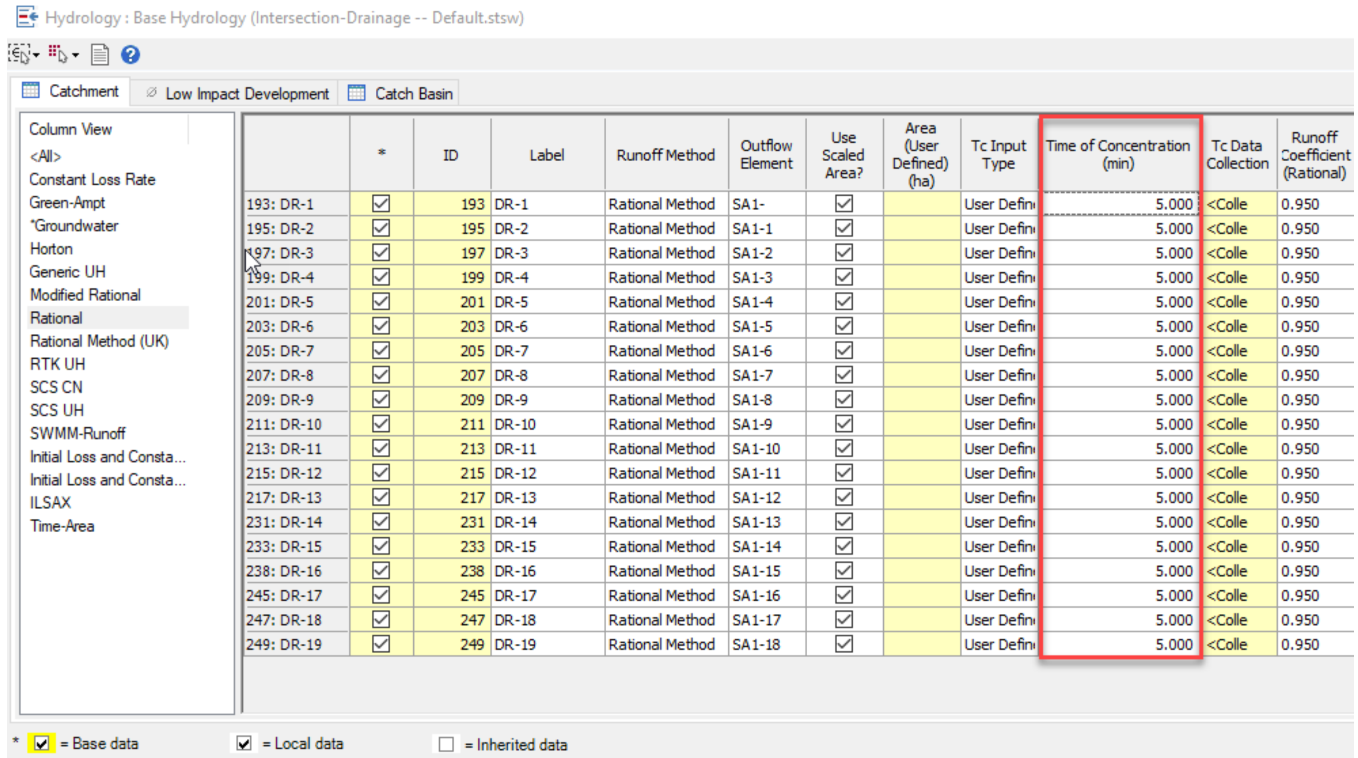
5. Right click on the **Time of Concentration (min)** column heading and select *Global Edit.*



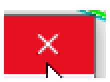
6. Set the value to *5* and click **OK.**



The values are now updated. Remember that individual modifications can be made if required.



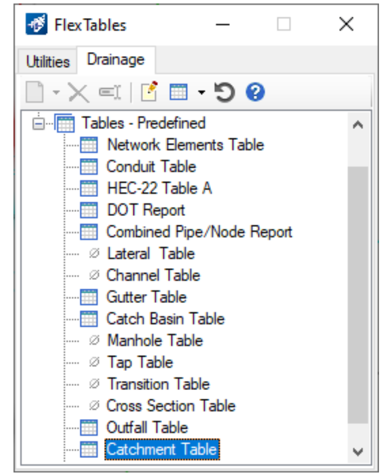
	*	ID	Label	Runoff Method	Outflow Element	Use Scaled Area?	Area (User Defined) (ha)	Tc Input Type	Time of Concentration (min)	Tc Data Collection	Runoff Coefficient (Rational)
193: DR-1	☑	193	DR-1	Rational Method	SA1-	☑		User Defin	5.000	<Colle	0.950
195: DR-2	☑	195	DR-2	Rational Method	SA1-1	☑		User Defin	5.000	<Colle	0.950
197: DR-3	☑	197	DR-3	Rational Method	SA1-2	☑		User Defin	5.000	<Colle	0.950
199: DR-4	☑	199	DR-4	Rational Method	SA1-3	☑		User Defin	5.000	<Colle	0.950
201: DR-5	☑	201	DR-5	Rational Method	SA1-4	☑		User Defin	5.000	<Colle	0.950
203: DR-6	☑	203	DR-6	Rational Method	SA1-5	☑		User Defin	5.000	<Colle	0.950
205: DR-7	☑	205	DR-7	Rational Method	SA1-6	☑		User Defin	5.000	<Colle	0.950
207: DR-8	☑	207	DR-8	Rational Method	SA1-7	☑		User Defin	5.000	<Colle	0.950
209: DR-9	☑	209	DR-9	Rational Method	SA1-8	☑		User Defin	5.000	<Colle	0.950
211: DR-10	☑	211	DR-10	Rational Method	SA1-9	☑		User Defin	5.000	<Colle	0.950
213: DR-11	☑	213	DR-11	Rational Method	SA1-10	☑		User Defin	5.000	<Colle	0.950
215: DR-12	☑	215	DR-12	Rational Method	SA1-11	☑		User Defin	5.000	<Colle	0.950
217: DR-13	☑	217	DR-13	Rational Method	SA1-12	☑		User Defin	5.000	<Colle	0.950
231: DR-14	☑	231	DR-14	Rational Method	SA1-13	☑		User Defin	5.000	<Colle	0.950
233: DR-15	☑	233	DR-15	Rational Method	SA1-14	☑		User Defin	5.000	<Colle	0.950
238: DR-16	☑	238	DR-16	Rational Method	SA1-15	☑		User Defin	5.000	<Colle	0.950
245: DR-17	☑	245	DR-17	Rational Method	SA1-16	☑		User Defin	5.000	<Colle	0.950
247: DR-18	☑	247	DR-18	Rational Method	SA1-17	☑		User Defin	5.000	<Colle	0.950
249: DR-19	☑	249	DR-19	Rational Method	SA1-18	☑		User Defin	5.000	<Colle	0.950



7. Close the dialog.

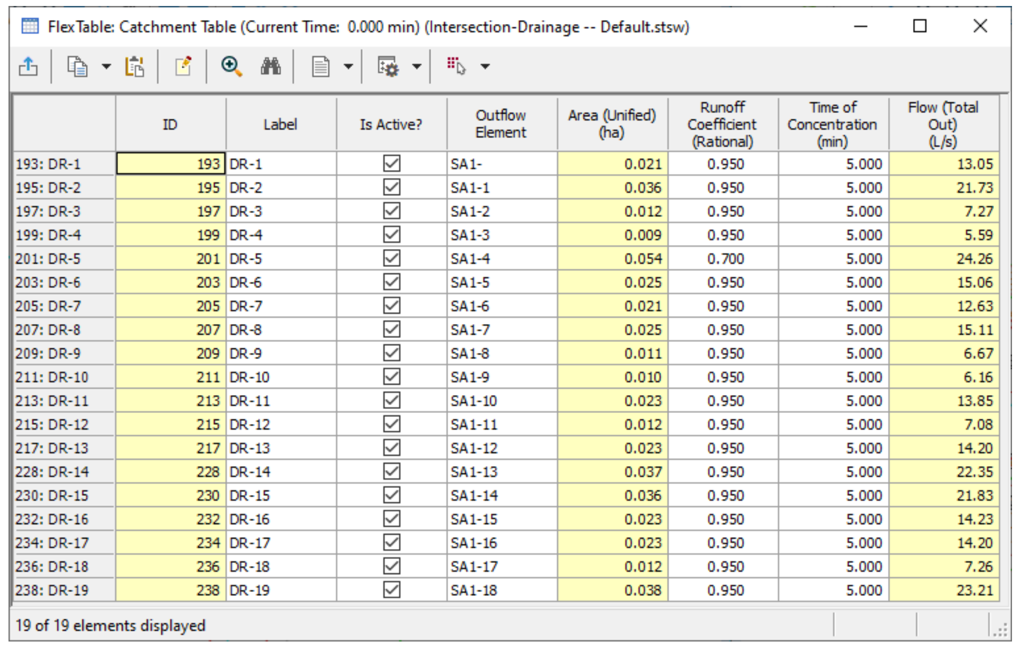
Reviewing the Time of Concentration in a FlexTable

1. Select **Analysis > Analysis Views > FlexTables.**
2. From the **Drainage** tab double click **Tables Predefined > Catchment Table.**



The modified **Base Hydrology** for the *Catchments* can be confirmed here.

Note that the modification could also have been made in this dialog. Why have two dialogs – *Alternatives* and *FlexTables* – that both allow modifications? FlexTables always show values from the current scenario, so it's important that you check this before you start making changes. By using the *Alternatives* dialog, you are specifically choosing the Alternative to edit. Both workflows will achieve the same result.



	ID	Label	Is Active?	Outflow Element	Area (Unified) (ha)	Runoff Coefficient (Rational)	Time of Concentration (min)	Flow (Total Out) (L/s)
193: DR-1	193	DR-1	☑	SA1-	0.021	0.950	5.000	13.05
195: DR-2	195	DR-2	☑	SA1-1	0.036	0.950	5.000	21.73
197: DR-3	197	DR-3	☑	SA1-2	0.012	0.950	5.000	7.27
199: DR-4	199	DR-4	☑	SA1-3	0.009	0.950	5.000	5.59
201: DR-5	201	DR-5	☑	SA1-4	0.054	0.700	5.000	24.26
203: DR-6	203	DR-6	☑	SA1-5	0.025	0.950	5.000	15.06
205: DR-7	205	DR-7	☑	SA1-6	0.021	0.950	5.000	12.63
207: DR-8	207	DR-8	☑	SA1-7	0.025	0.950	5.000	15.11
209: DR-9	209	DR-9	☑	SA1-8	0.011	0.950	5.000	6.67
211: DR-10	211	DR-10	☑	SA1-9	0.010	0.950	5.000	6.16
213: DR-11	213	DR-11	☑	SA1-10	0.023	0.950	5.000	13.85
215: DR-12	215	DR-12	☑	SA1-11	0.012	0.950	5.000	7.08
217: DR-13	217	DR-13	☑	SA1-12	0.023	0.950	5.000	14.20
228: DR-14	228	DR-14	☑	SA1-13	0.037	0.950	5.000	22.35
230: DR-15	230	DR-15	☑	SA1-14	0.036	0.950	5.000	21.83
232: DR-16	232	DR-16	☑	SA1-15	0.023	0.950	5.000	14.23
234: DR-17	234	DR-17	☑	SA1-16	0.023	0.950	5.000	14.20
236: DR-18	236	DR-18	☑	SA1-17	0.012	0.950	5.000	7.26
238: DR-19	238	DR-19	☑	SA1-18	0.038	0.950	5.000	23.21

3. Close the *FlexTables* dialog.
4. Close the **Notifications** dialog.
5. **Save Settings** and **Exit** the software.