Practice Workbook

This workbook is designed for use in Live instructor-led training and for OnDemand selfstudy.
The explanations and demonstrations are provided by the instructor in the classroom, or in the OnDemand eLectures of this course available on the Bentley LEARN Server (*learn.bentley.com*).

This practice workbook is formatted for on-screen viewing using a PDF reader.
It is also available as a PDF document in the dataset for this course.

Subsurface Utility Engineering Fundamentals

This training guides you through the fundamental tools in Bentley Subsurface Utility Engineering, including modeling utilities from3D features, using geographic filters to model multiple utility lines, and to model a utility line with a trench.

Lesson 1 - Model a Utility Line from 3D Feature

Course Description

In this lesson, we will create a model of an existing utility line by using elevations on a 3D linear feature. Such utility features might be a pressure conduit such as a water line or represent a generic conduit such ductwork or cabling. Workflows which produce the 3D features include traditional survey methods as well as geophysical methods such as ground penetrating radar.

Skills Taught

- Model a Utility from a 3D Linear Feature

- View & Edit Utility Profiles

Model a Utility Line from 3D Features

In this section, we will show how to use 3D features to create a model of a Utility Line.

1. Open …**\Lesson 1\Surveyed Utilities 3D.dgn** This is a 3D dgn file created using Bentley Survey. It contains some segments of utility lines which are 3D. The elevations were surveyed along the ground with assumed depth recorded in a field book.
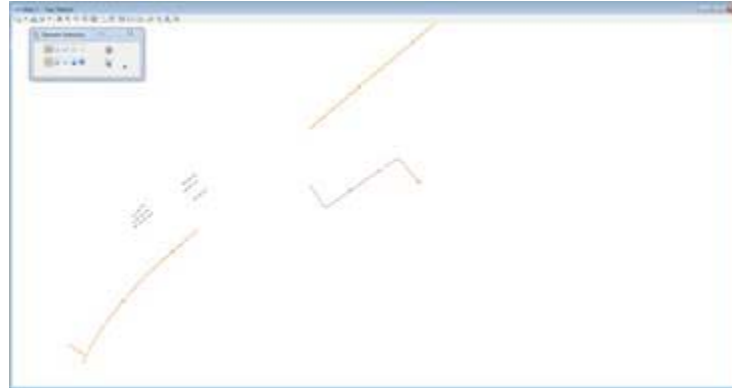
2. Start the **Extract Utilities From Graphics** command.
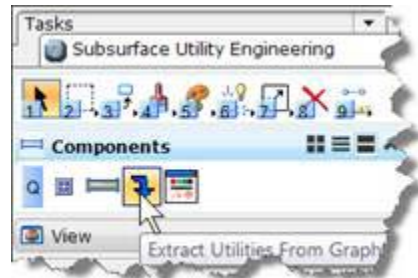
3. If you get a prompt asking to create a hydraulic model then answer **yes**.
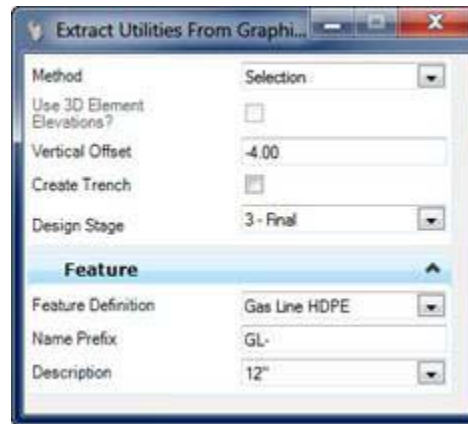
4. We will start with modeling some gas lines. Set Feature Definition to **Gas Line HDPE** and Description to *12" [300 mm]*.
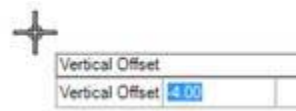
5. First Prompt, use **Selection Method**.

6. Pick the yellow gas lines. Note that these could have been selected before starting the command.

7. **Reset** to stop picking.

8. Since the selection set contains 3D features, we get an option to use the elevations from the features. Set this to **Yes**.

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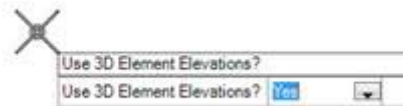
9. Enter *-4.00 ft [-1.2 m]* for the vertical offset.

Vertical Offset
Vertical Offset | -4.00

10. .Since this is an existing utility line then a trench is not needed.

Create Trench
Create Trench | No ▾

11. The gas lines are modeled. Rotate the view in 3D to examine.

12. Note the following:

    a. Since the DGN file is 3D, there is no separate 2D model.

    b. Notice that the 3D conduit is *4 ft [1.2 m]* below the 3D survey line. This is because:

        i.The actual survey points were on the ground surface

        ii.We asked for a *-4 ft [-1.2 m]* offset in the command.

    c. Which probably suggest, that in a situation like this, we would be better served by using the surveyed linear features in reference file rather than in the surveyed file directly.
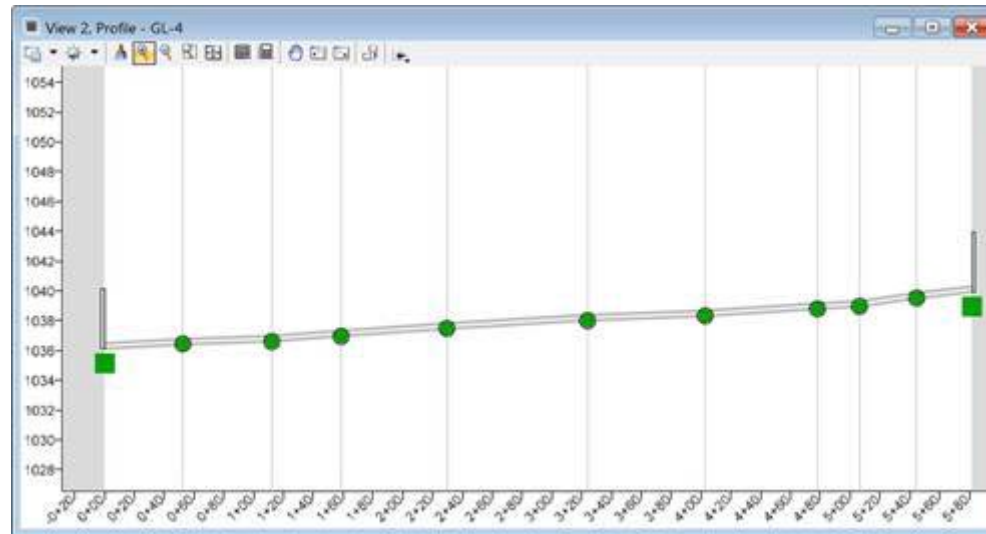
13. Select one of the gas lines and on the context toolbox, select **Open Profile Model**
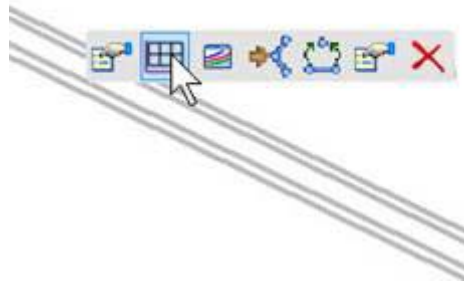
14. **Open/Select** a view to display the profile
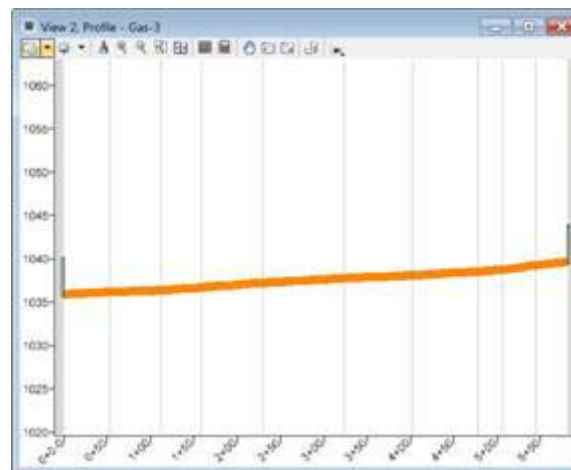
15. You'll notice that in this case, instead of a best fit profile like in the previous lesson, we have a profile derived from the 3D graphic element.

16. If you select the profile, you will see manipulators for editing.

Lesson 2 - Model Multiple Utility Lines from 2D or 3D Features Using Geographic Filters

Course Description

In this lesson, we will create a model of multiple existing utility lines in batch, using filters to segregate lines into type. The source features are a mix of 2D and 3D. Using this method, the Subsurface Utility modeler can model many utility lines in only a few steps.

Skills Taught

- Use Filters to Extract Utilities

Model Multiple Utilities Using a Utility Filter

In this lesson, we will create a model of multiple existing utility lines in batch, using filters to segregate lines into type.

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1. Open …**\Lesson 2\Surveyed Utilities.dgn** This is a copy of the same file used in the *QuickStart using Subsurface Utility Engineering* course. The difference in this exercise is that we will use graphic filters to simultaneously extract all utilities.

2. Open **Project Explorer > Civil Standards tab > Libraries > Utility Filters** branch. You will note that there are several different filters and filter groups configured in the library. The *Subsurface Utility Engineering Advanced* course teaches how to construct these filters.
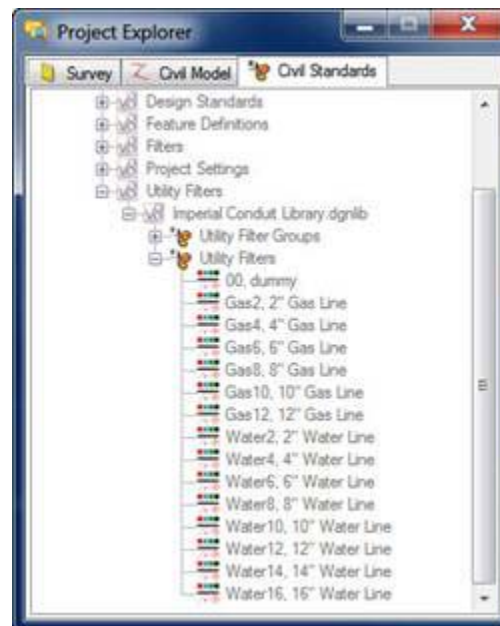
3. Start the **Extract Utilities From Graphics** command.
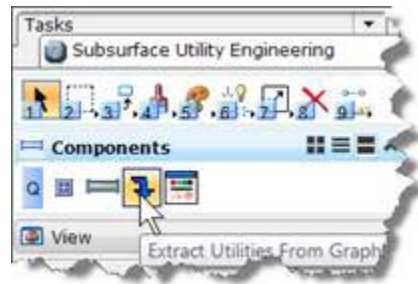
4. Set method to **Utility Filter**

5. Then choose the filter group named "**Gas and Water**" in the dialog.

6. Pick the terrain model or **Reset** to use the active terrain. This dgn is 2D and thus we are using a terrain for elevations. Further, the filter itself defines whether the elevations come from a terrain or from the element itself.

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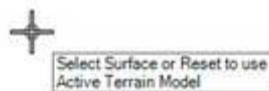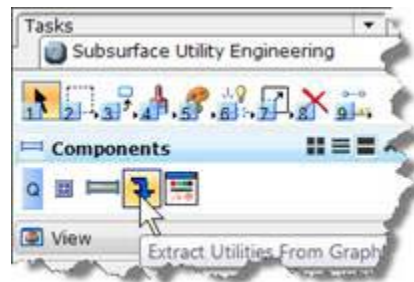
7. Create trench = **No**.

8. Many various utility lines in the DGN should have been found and modeled.

   a. Many different feature definitions were used

   b. A variety of vertical offsets came from the various filters.

   c. Various conduit diameters were created.

Model Drainage Network From 3d Graphics Using a Utility Filter

1. Open …**\Lesson 2\Drain Network 2D.dgn**. This is a 2D file which has referenced 3D graphics which represent top and invert of the catch basins and flow line of the pipes of a drainage network. Arranging the 3D survey elements as a reference into a 2D file will generally provide for a more efficient workflow.
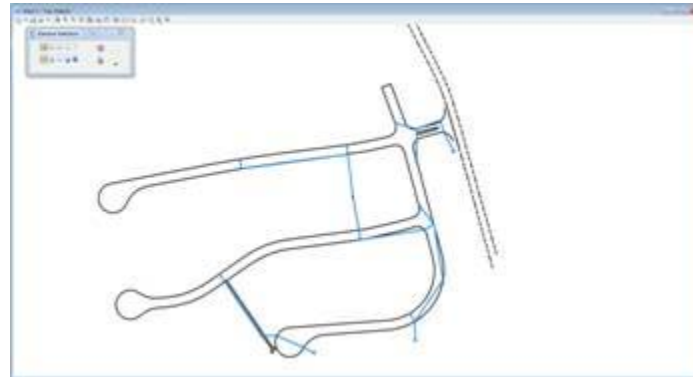
2. All the drainage network components have been surveyed in 3D, including tops of catch basins (rim elevation), Catch basin invert elevation and pipes at the flow line.

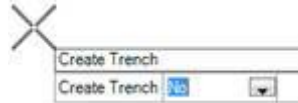3. Start the **Extract Utilities From Graphics** command

4. Set method to **Utility Filter**

5. Then choose the filter group named "**Storm Network**"

6. Create Trench = **No**

7. Open another view window and set it to show the 3D model.

Lesson 3 - Model a Proposed Utility Line With Trench

Course Description

This workbook contains information on creating a proposed model of a Utility Line with a Trench.

Skills Taught

- Extract Utility From Graphics

- View utility in Cross Section

- View Utility in Profile

- View Utility in 3D

Model a Proposed Relocation

In this lesson, we will create a model of a proposed utility line relocation using a geometric layout and design profile.
The situation is that the road is planned for a year or two in future but the utilities need to be relocated now.

1. Open …**\Lesson 3\WaterLine Relocate.dgn**. On left side of main road is an alignment (heavy blue line) for proposed waterline relocation. This is a civil geometry element.
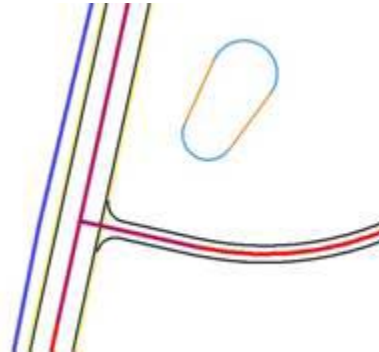
2. Start the **Extract Utilities From Graphics** command.
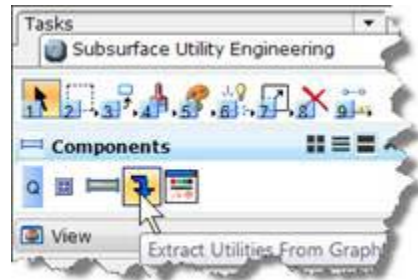
3. If you get a prompt asking to create a hydraulic model then answer **yes**.
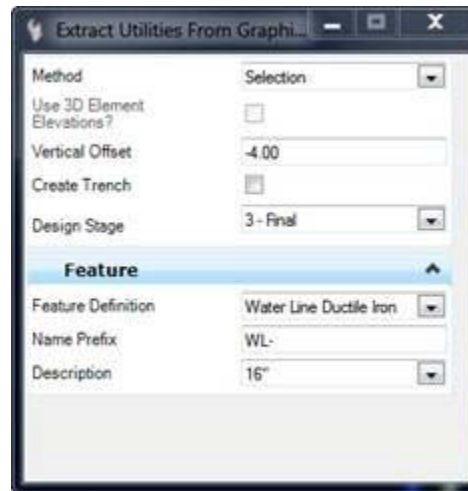
4. The next steps will be identical to what you did in the *QuickStart using Subsurface Utility Engineering* course except:

   - Set Feature Definition to **Water Line Ductile Iron**.

   - Set Description to *16" [400mm]*

   - Method = Selection

   - Pick the blue alignment. **Reset** to stop picking.

   - Pick existing ground terrain model for elevation reference.

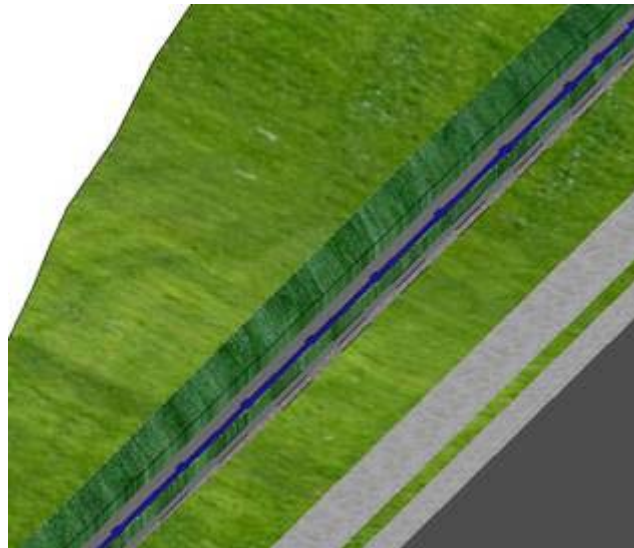   - Vertical Offset to *-4.00ft [-1.2m]*

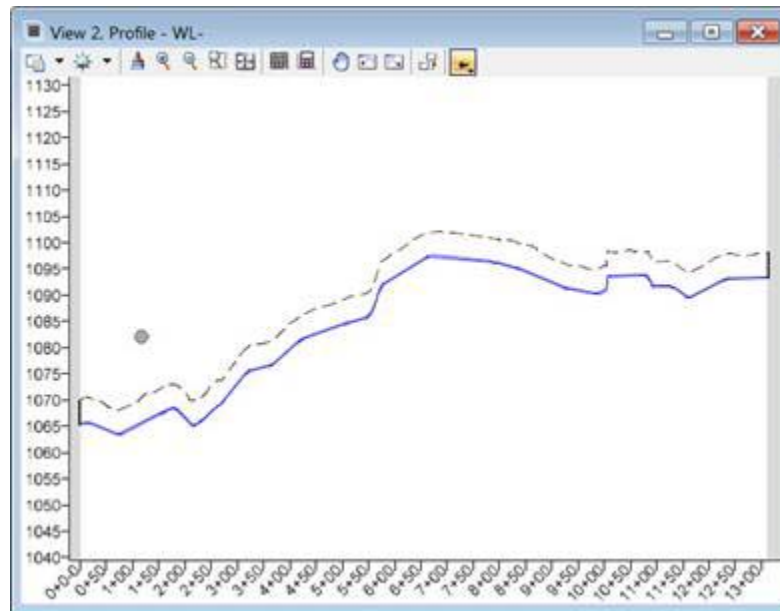5. Set Create Trench to **Yes**

6. Set Design Stage to **3 - Final**

7. Design stages work identically as in OpenRoads corridors. Subsurface Utility Engineering makes a corridor in order to model the trench.

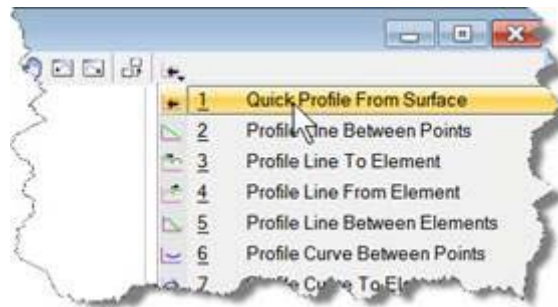DO NOT DISTRIBUTE - Printing for student use is permitted

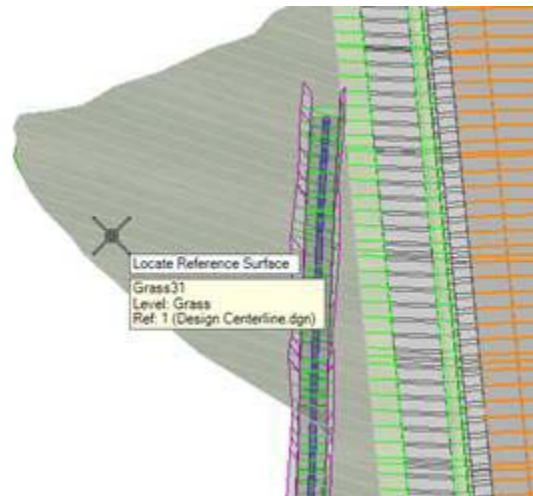8. Open the profile for this waterline so we can investigate further.

9. In this profile we see the water line profile and the existing ground profile. But we need to see what the future roadway cut looks like.

10. In the profile window title bar choose the command **Quick Profile From Surface**.
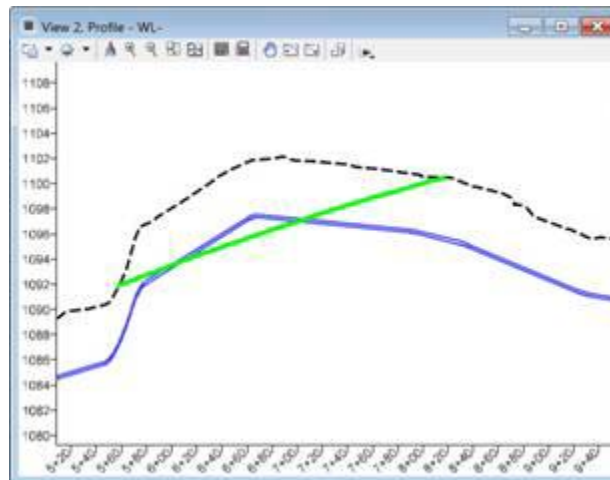
11. Then in 3D model pick the **cut slope** component.

12. **Reset** to stop picking and finish the command.

13. Now we see the profile of the cut slope in our profile view.

14. We need to modify the profile to get under this slope. Using your knowledge of the civil vertical geometry commands, make a new profile that stays approximately *4 feet (1.2m)* under the existing ground and the cut slope. Remember: You must name your profile for the trench corridor to update correctly
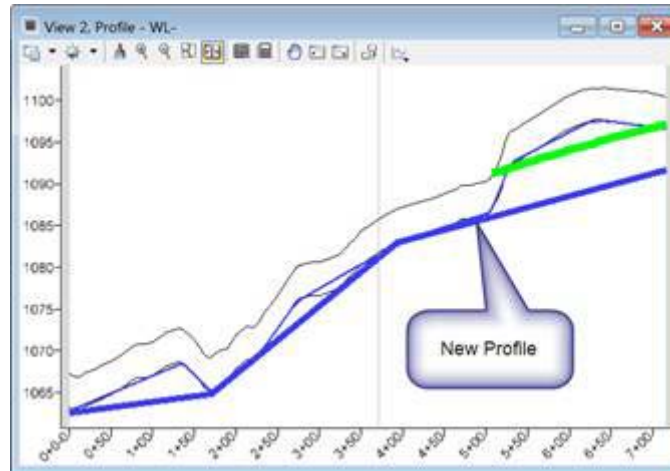

15. Select this new profile and make it active. The pipe and trench models will update.

16. We can further check our design by reviewing cross-sections.

17. Click **Open Cross Section** View in tasks.

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18. Follow the prompts:

   - Locate Corridor or Alignment - pick the red main road centerline

   - Left and Right offset - enter *100ft [30m]* or dynamically locate a width wide enough to show the road slopes and water relocation.

   - Start Station - about *146+00 [45+50]*

   - Interval - *25ft [10m]*

   - Then open the cross-section in view 8

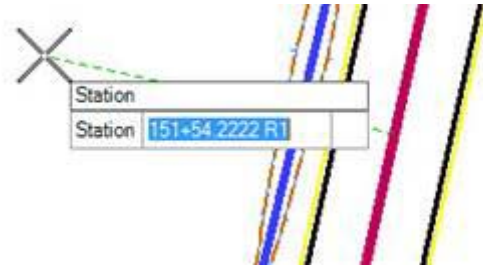19. At the beginning, you will note the water line and trench on the left
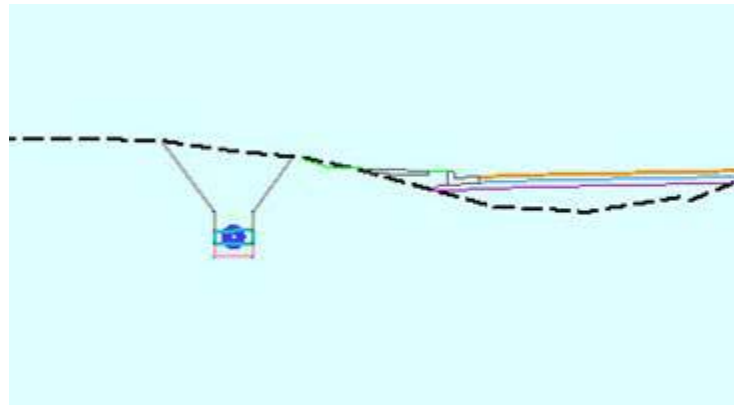
20. Right click in the cross-section view and choose **Locate Station Via DataPoint**
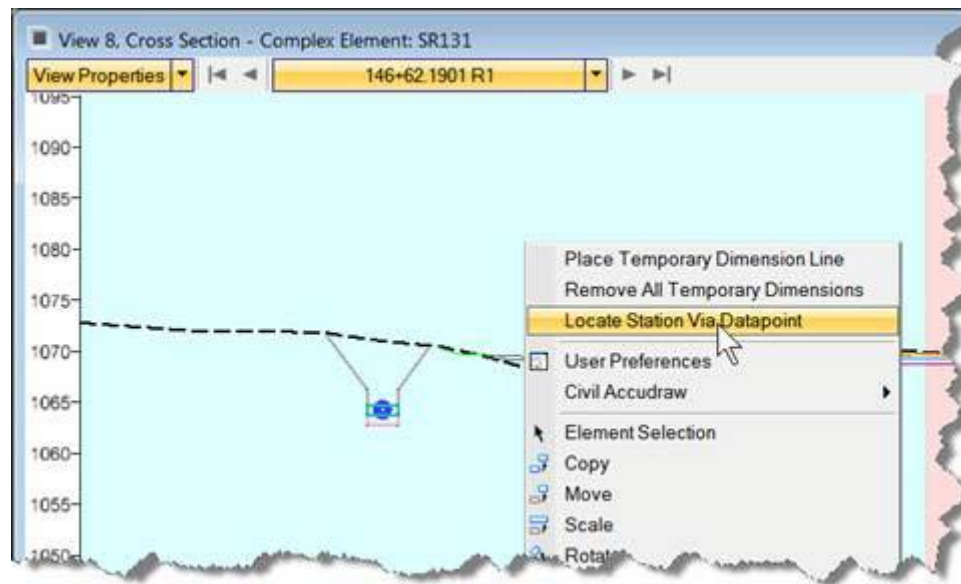
21. Then pick the plan view

22. Choose station near *151+50 [46+50)*]

23. Here we see how our new profile has placed the water line safely under the future roadway cut.