Laying out Pipes and Drainage Design in Connect
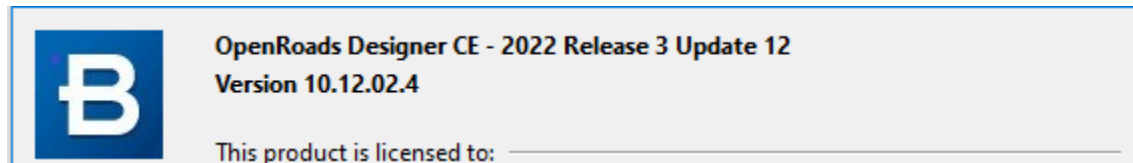
These instructions were created March 2024. These instructions were created with:

OpenRoads Designer CE - 2022 Release 3 Update 12
Version 10.12.02.4

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First, review the project information and determine where a pipe is needed. Once a location is determined, calculate the correct size. Refer to the BDM Chapter 4 https://iowadot.gov/bridge/policy/04-01-00Prelim.pdf. When the correct type, size and location are determined, design the new pipe for that location.

Open the ORD_CCRRRPPP_DOT_PIPE_CULVERTS_SPN.dgn file under the Bridge folder in the project directory for this project in ProjectWise. For this example, use the ORD_8075057_DOT_PIPE_CULVERTS_Z01.dgn file.

Once the file is open, place a pattern line at the location of each pipe needing to be designed. Set the attributes to the correct symbiology. Use the level Draft_DNC that indicates draft lines to <u>not</u> be constructed and is also set to not print on the final plans.
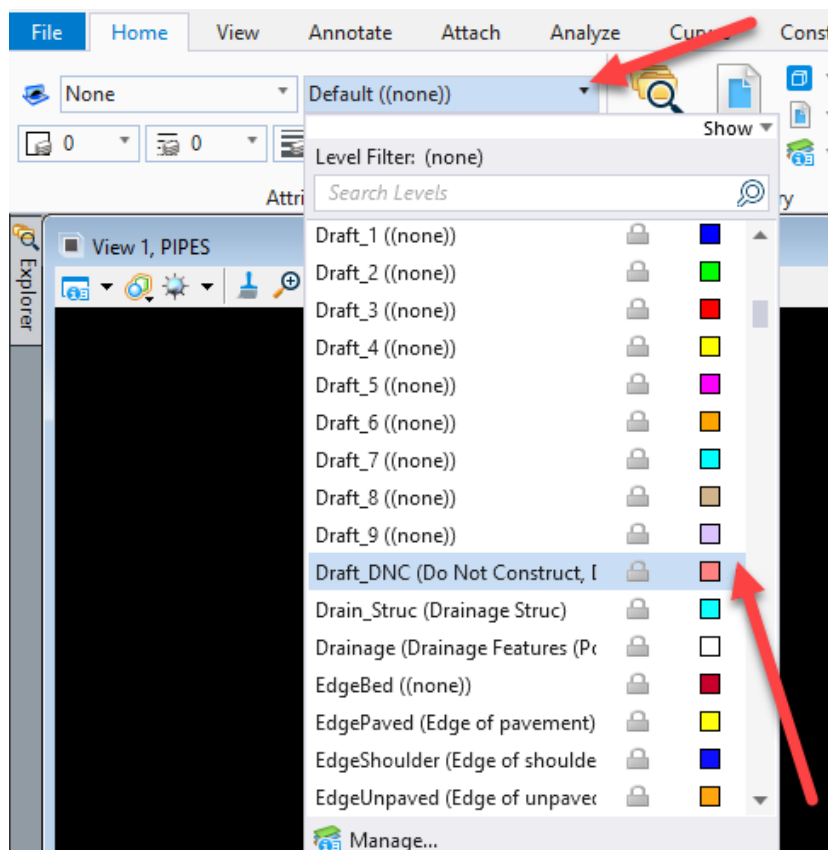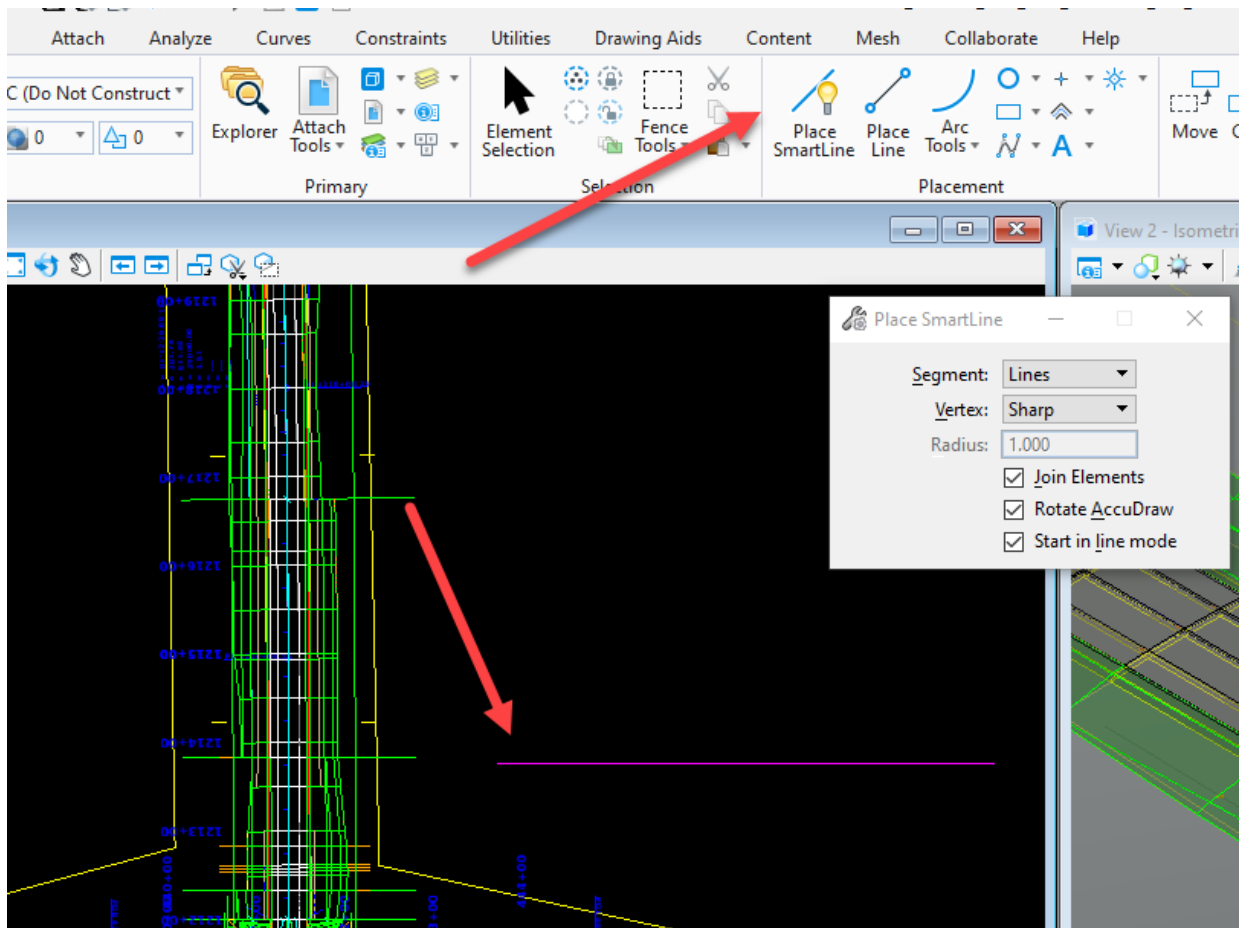
It is preferred to also change the color to something that will stand out and make it easier to find in the file. Color 5 is recommended.
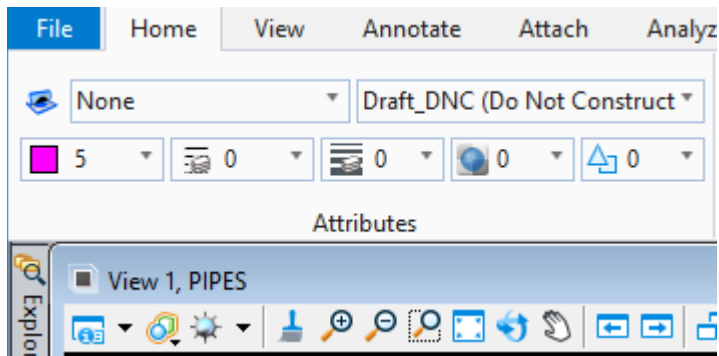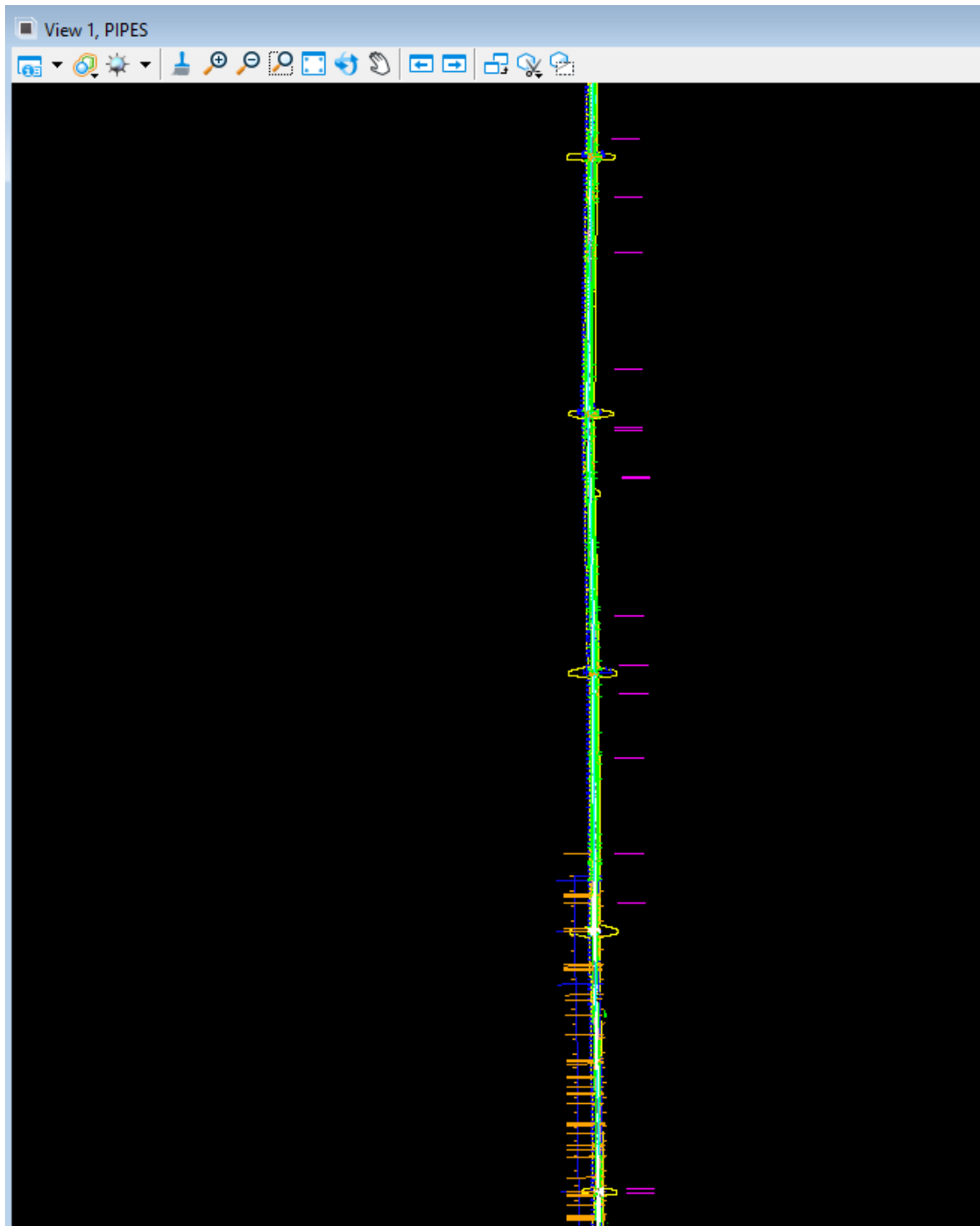

Next, use the Place Smart Line tool and place a line of 560'.

It should look similar to this:

Use the copy tool to copy the line just created and place a copy at each pipe location needed.
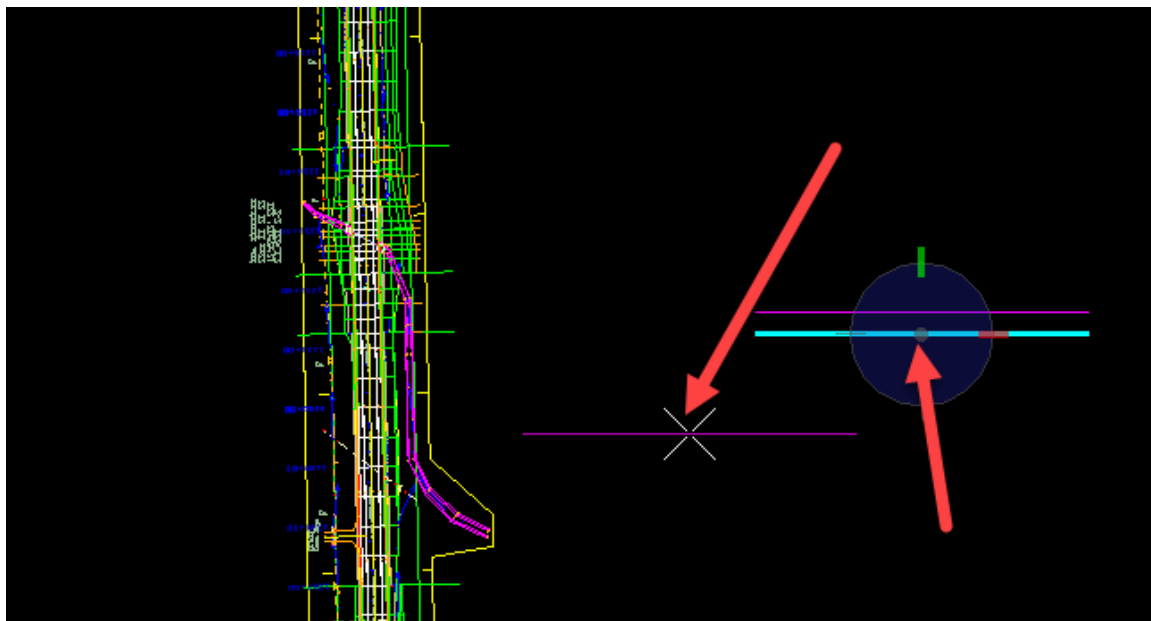
It should look like this:

Next, move the pattern line to the location needed to place the pipe. Rotate the pattern line to the skew of the pipe also. The midpoint of the pattern line should intersect the horizonal design alignment for the project. The purpose of the pattern line is to ensure that all the pipe cross sections are the same width and that the centerline or offset in the cross section is in the center of the cross section.

To do this, use the Element Selection tool to select the pattern line. Then click on the move tool and select the midpoint snap.
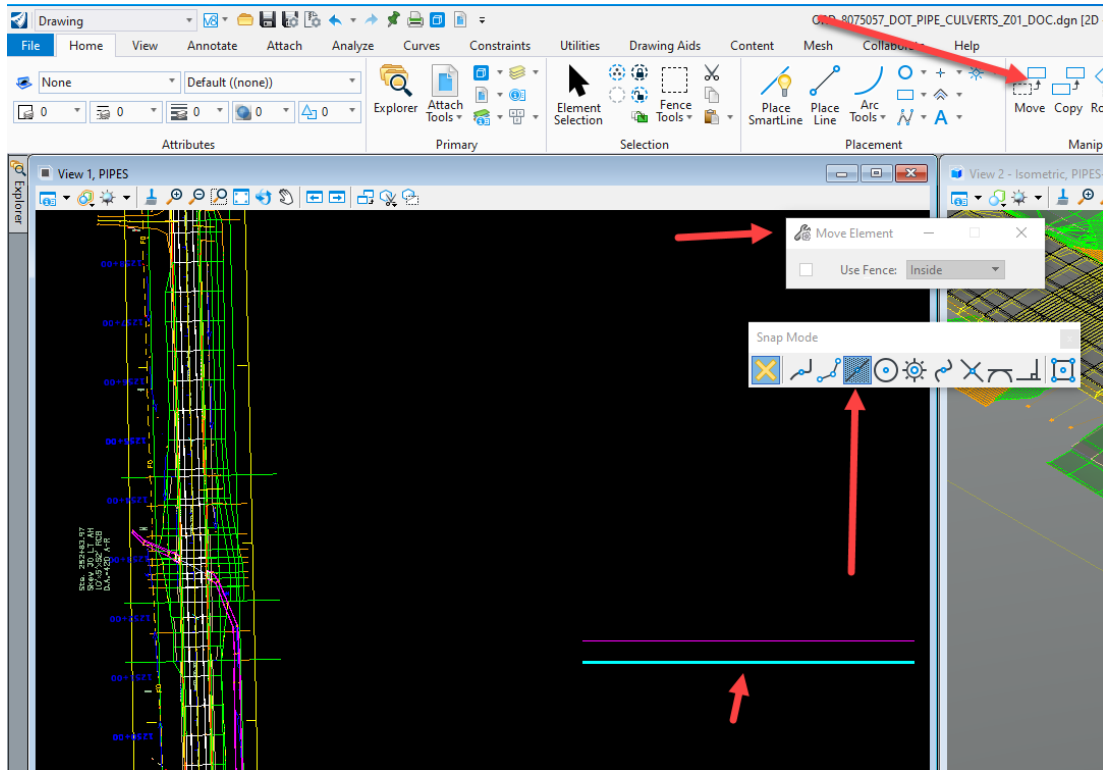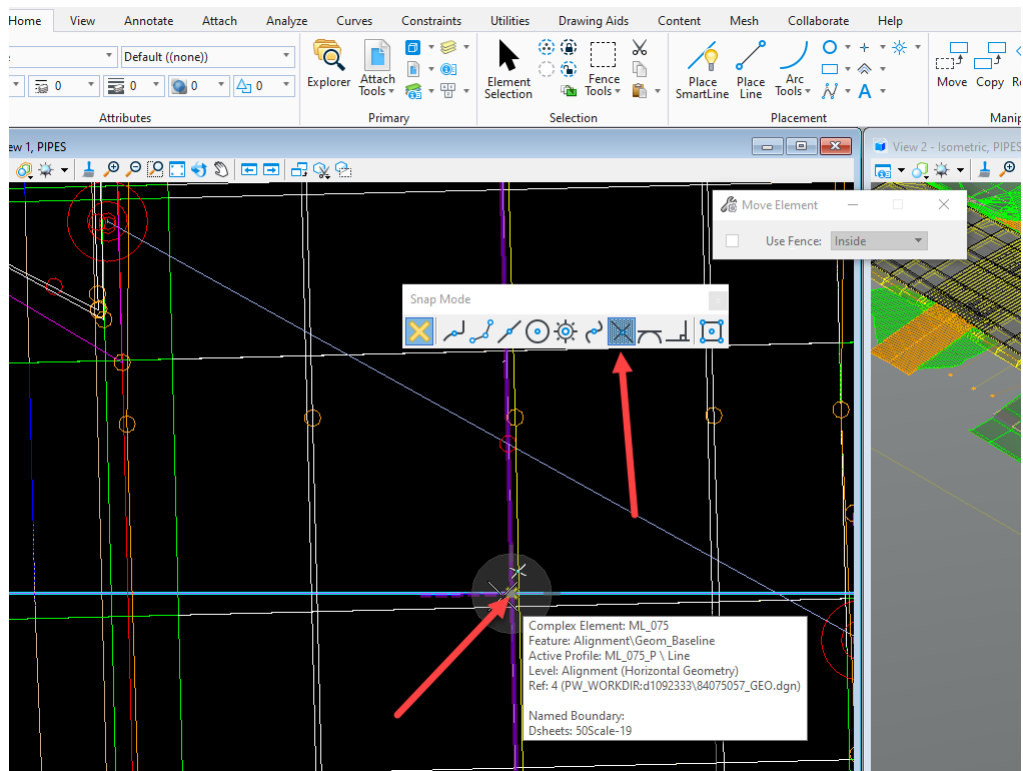

Let the tool find the midpoint on the selected line and datapoint to accept it. Then move the line to the location needed to place the pipe.
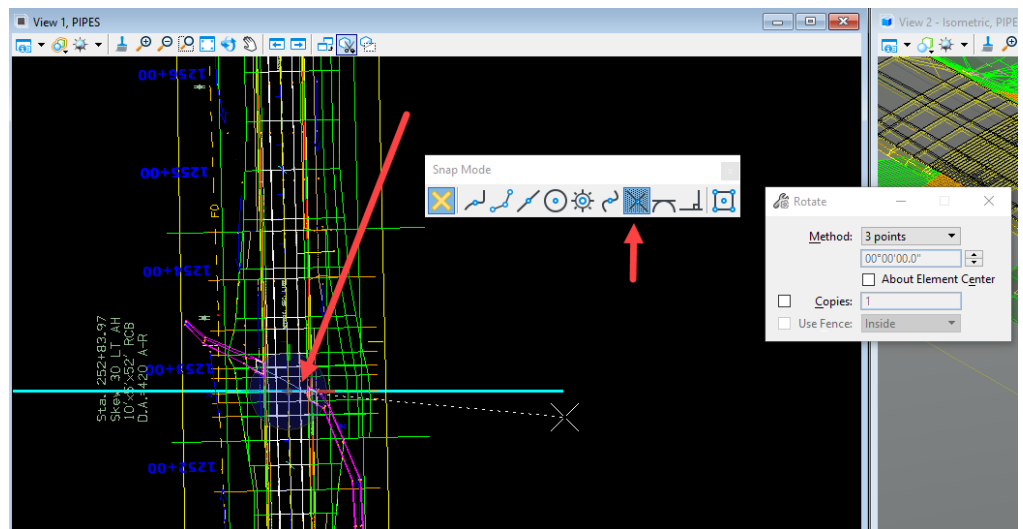
It should look like this:

Select the intersection snap and select the location to place it on the alignment.

It should look like this:

Next click the reset on the mouse once so that the pattern line is still selected with the Element Selection tool and select the rotate tool. Set the method to 3 points and with the intersection snap set, select the point where the pattern line and the alignment intersect for the first point.

For the second point, select the end of the pattern line then select the point to rotate it to.

It should look like this:

Unselect the line with the Element Selection tool. Repeat the process for all the locations of the pipes.

When finished, the file content should look like this:

Once identifying the pipe locations is completed, switch to the pipe cross section file SHT_CCRRRPPP_DOT_PIPE_CULVERTS_SPN.dgn under the (Paren)_Work Description folder. For this example, use the SHT_8075057_DOT_PIPE_CULVERTS_Z01.dgn file.

Now that the pattern lines are in place and are in the SHT file, the files are ready to cut the cross sections.

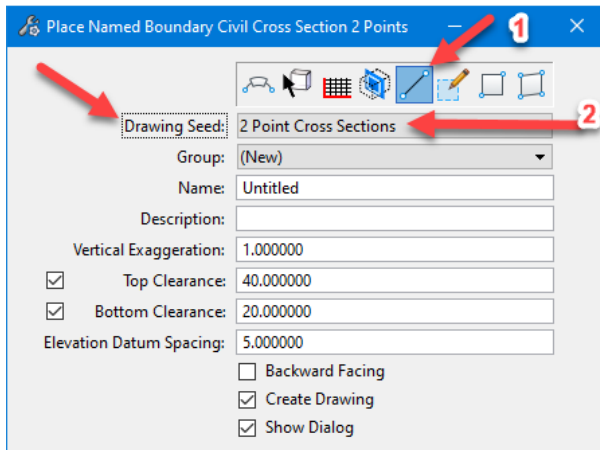To do this, set the workflow to Drainage and Utilities.
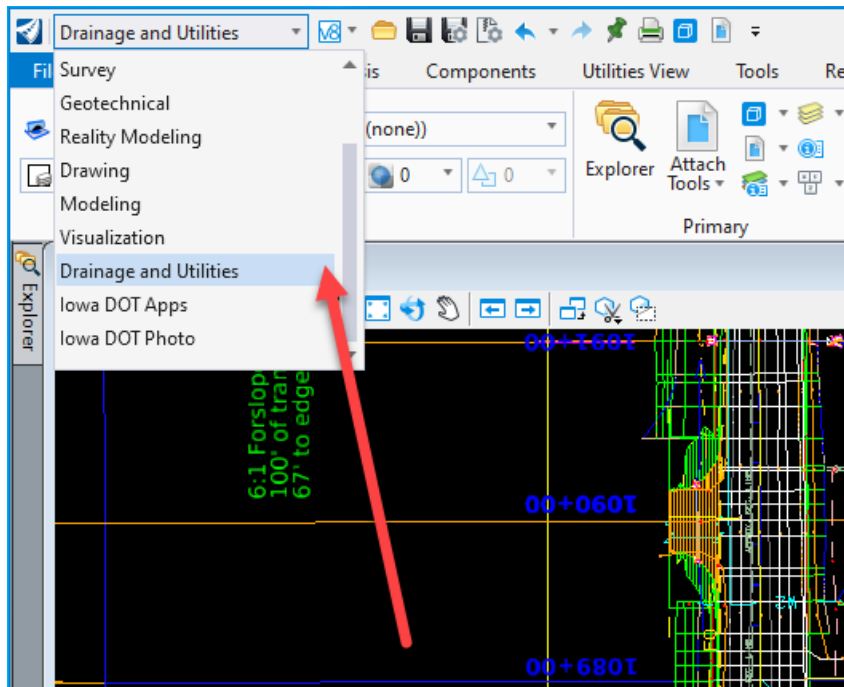
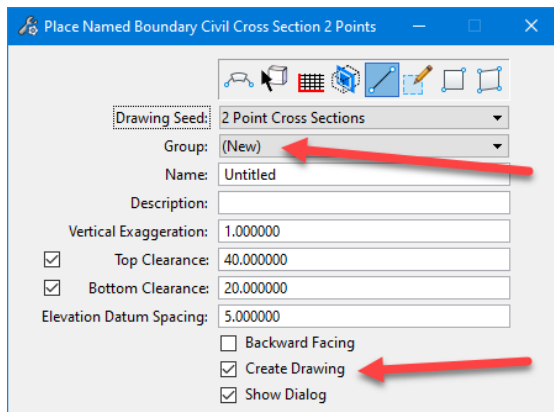Next, use the place Named Boundary tool on the Drawing Production ribbon tab.
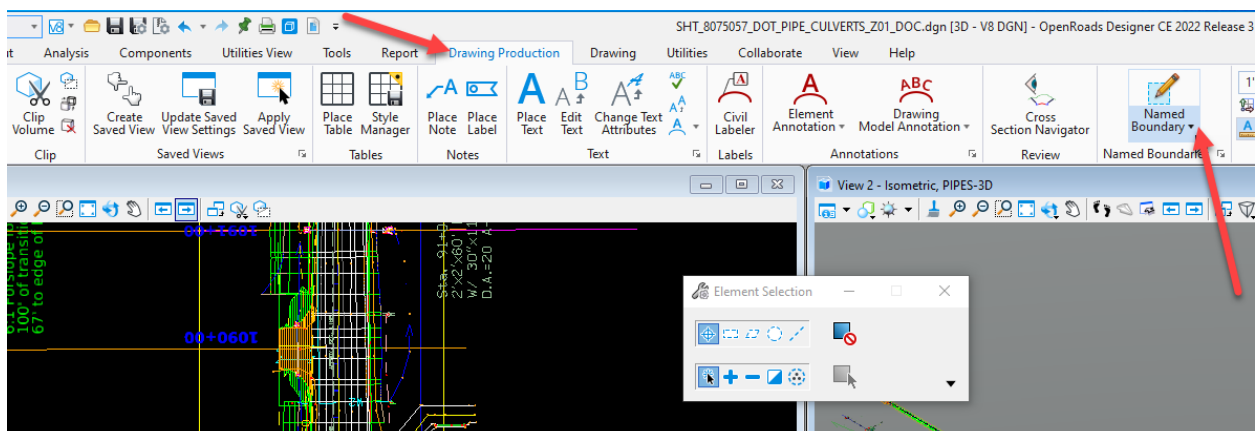
Complete the following steps for the Place Named Boundary dialog box.

1. Select the Place Named Boundary Civil Cross Section 2 Points tool.
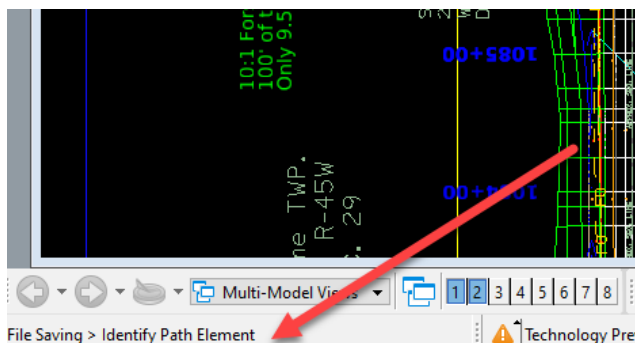2. Select the 2 Point Cross Section Drawing Seed:

Note: For the first section cut from an alignment set the Group to (New).
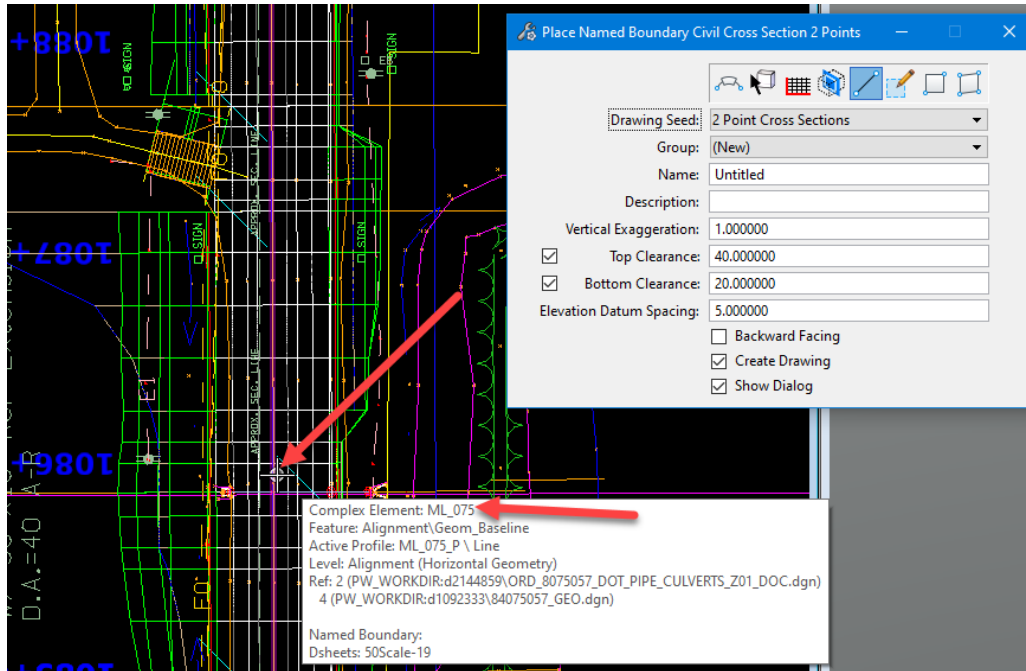
Toggle on Create Drawing.

Follow the prompts in the lower left corner of the application window.
The first prompt is Identify Path Element.

Select the design alignment that the pattern line intersects. For this example, it will be ML_075.


Complex Element: ML_075
Feature: Alignment\Geom_Baseline
Active Profile: ML_075_P \ Line
Level: Alignment (Horizontal Geometry)
Ref: 2 (PW_WORKDIR:d2144859\ORD_8075057_DOT_PIPE_CULVERTS_Z01_DOC.dgn)
  4 (PW_WORKDIR:d1092333\84075057_GEO.dgn)

Named Boundary:
Dsheets: 50Scale-19

Once the alignment is selected, the name of the Group will populate with the alignment name.
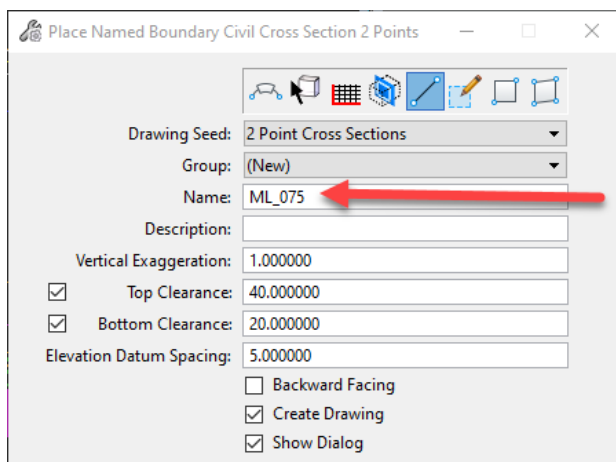
The next prompt is Enter first point.

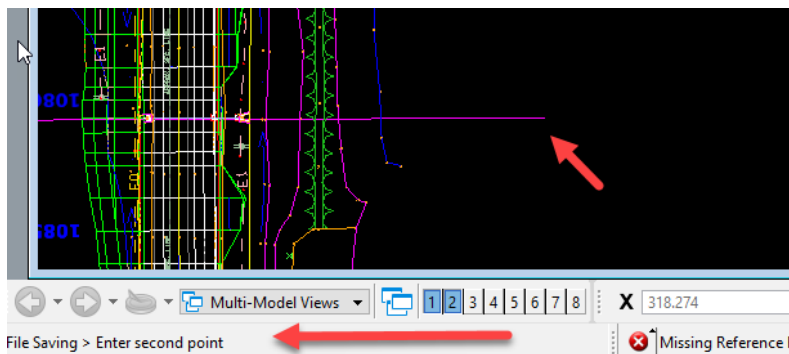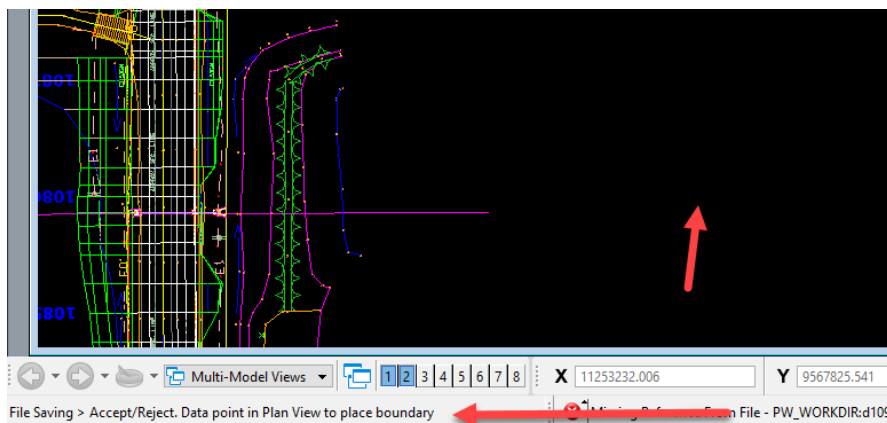File Saving > Enter first point
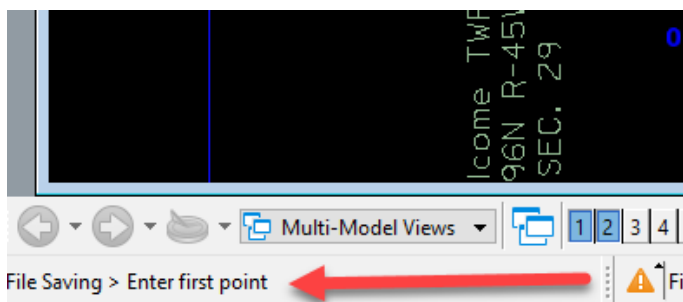
Find the pattern line and select one end of the pattern line.
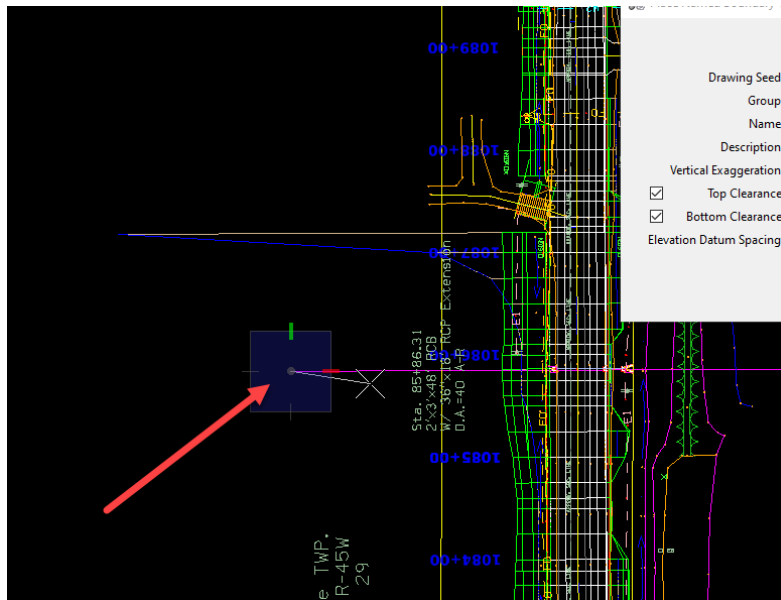
The next prompt is Enter second point. Select the other end of the pattern line.

The next prompt is Accept/Reject. Data point in Plan View to place boundary.
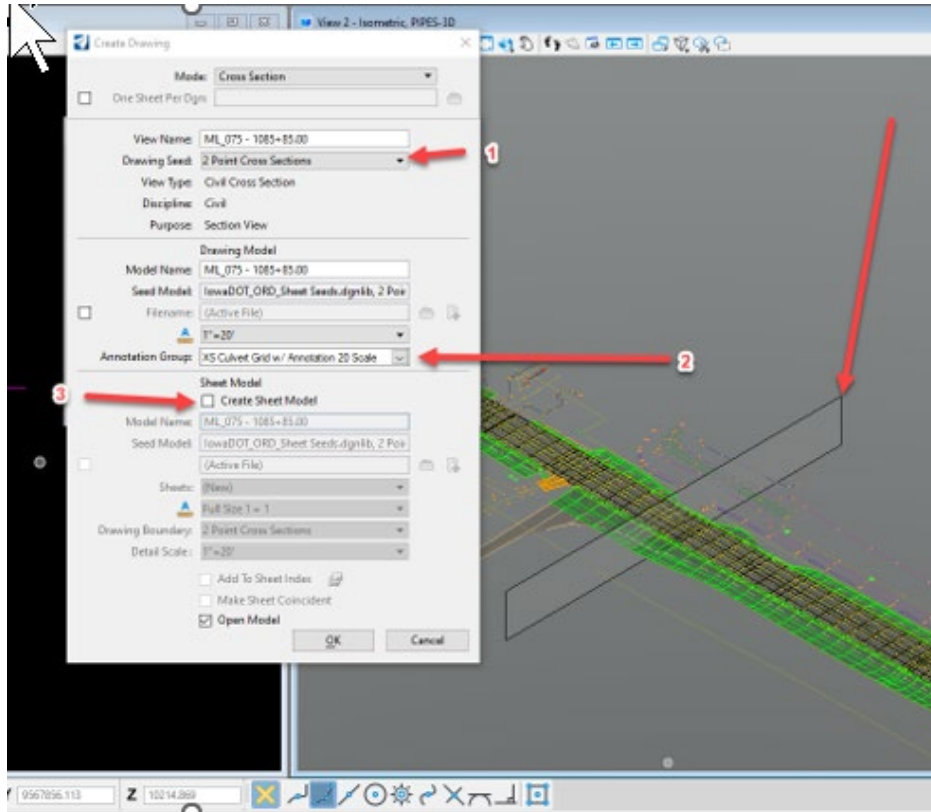

Then the boundary will be placed. Move the cursor to black space and datapoint to accept.

The Create Drawing dialog box opens.
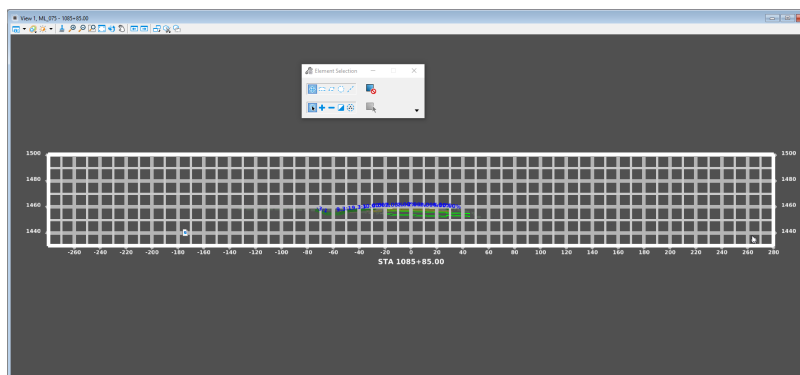
Set the following settings.

1. Drawing Seed to 2 Point Cross Section
2. Annotation Group to XS Culvert Grid w/Annotation 20 Scale
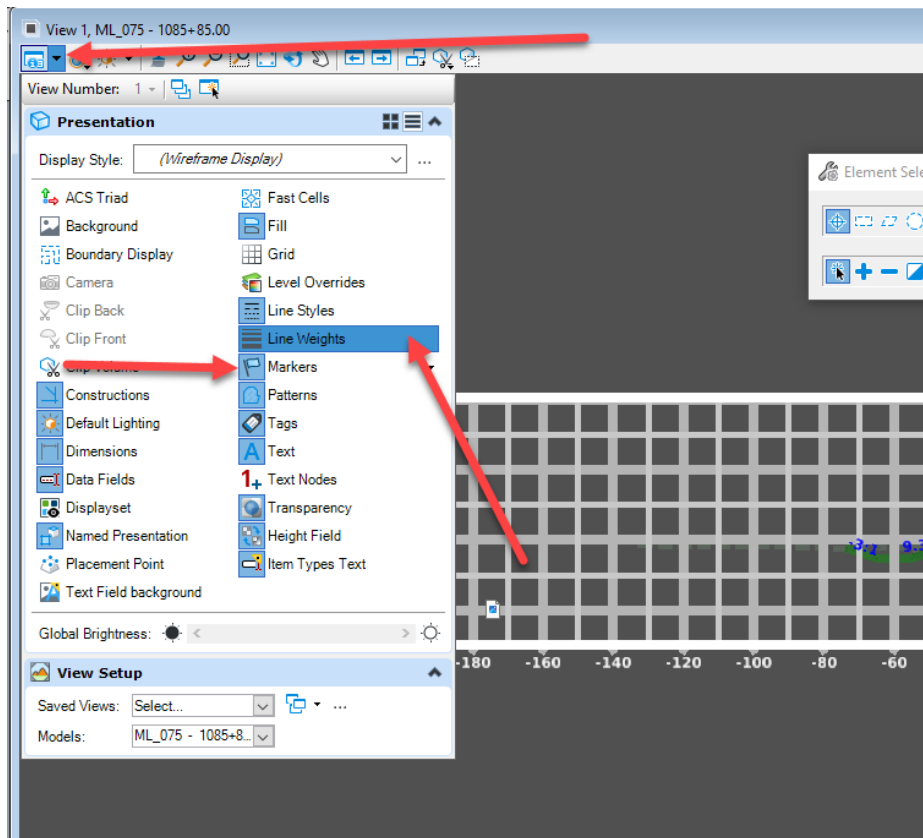3. Uncheck the Create Sheet Model.

Also, notice that the boundary has been placed in the 3D model.

Once everything is set correctly, click OK. This will create and open the drawing model.
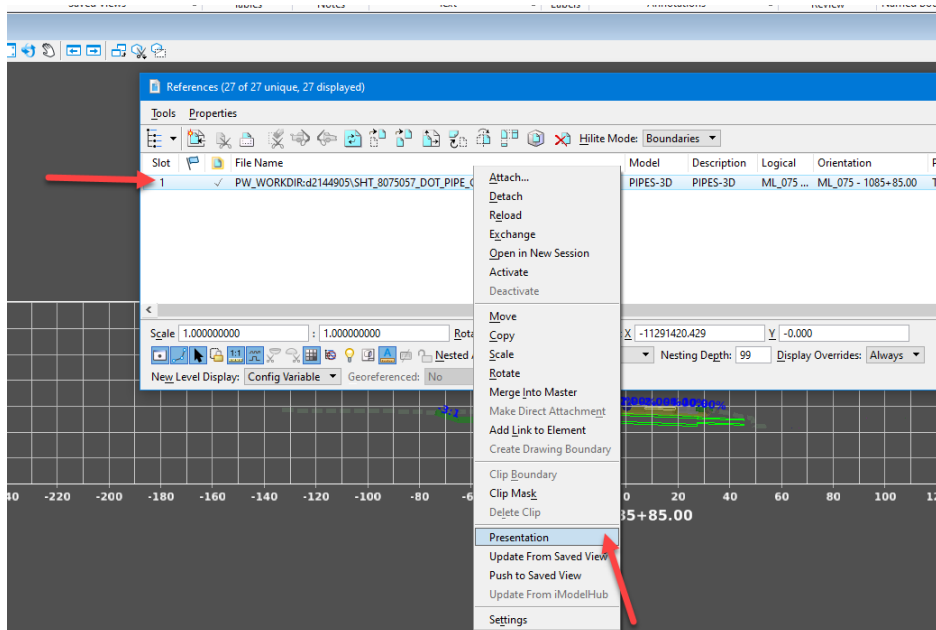
It should look like this:

It is recommended to work in the drawing model with the line weights turned off. Open the View Attributes dialog box and turn off the Line Weights and Markers.


Next, turn off the Line Weights in the Saved View. Open the Reference dialog box and select the saved view in the list. Right click and select Presentation.

Next, turn off the Line Weights then click on the blue arow icon to Accept Changes and then Push to Saved View:
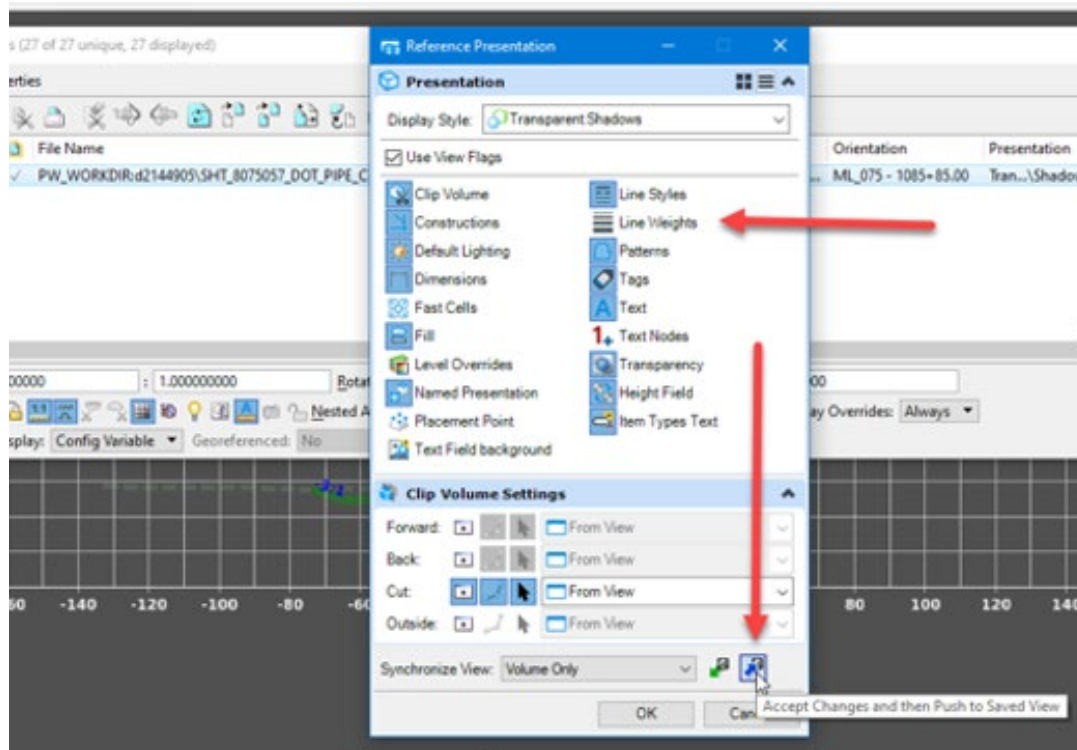
Now cut the next section. Go back to the Multi Model View by selecting the Multi Model View from the View Group at the lower left of the application window.
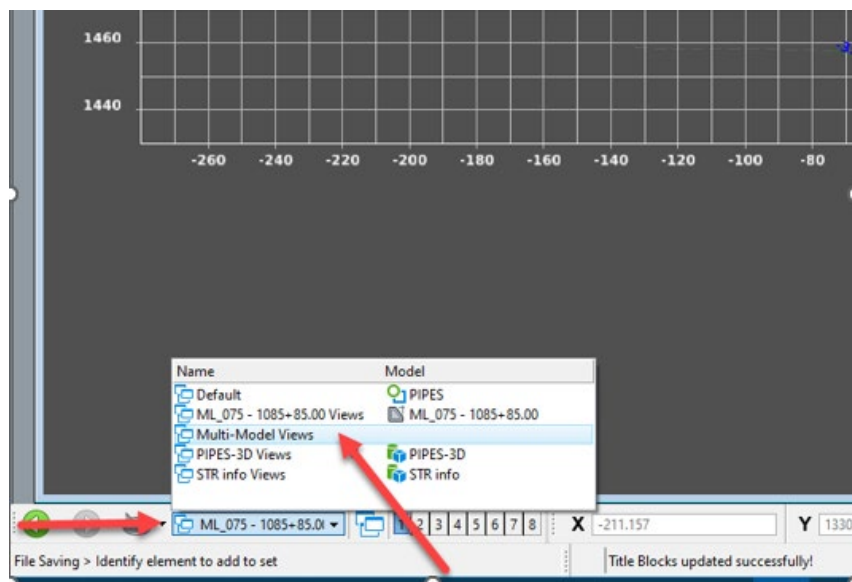
Cutting the next section on this alignment is done with the same steps as before except for one change. When a section is cut from an alignment, it will create a group. The group is used to help organize and orient the sections to each alignment. When cutting another section from the same alignment, choose the correct group for the correct alignment. In this example, the group was ML_075. Change the group from New to ML_075 by selecting from the drop-down list.
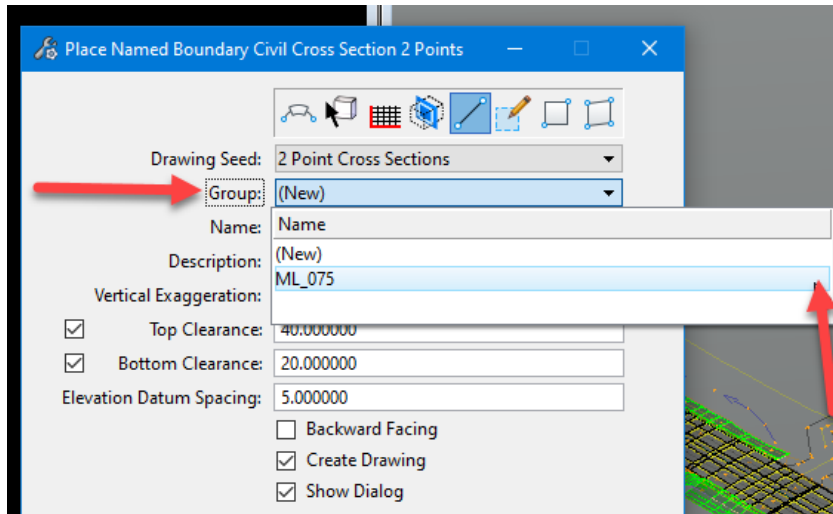

This may seem like a small detail but setting this correctly here avoids major issues later. Remember only use the New group the first time a section is cut from an alignment, then always select the correct group from then on.

Note: It is suggested to cut all the sections on a project at the same time. Change the locations of the pattern lines whenever needed throughout the design. However, removing the cross section boundary if it has been cut and recutting the section at the new location will be necessary. Make sure the correct cross section group is chosen. This helps when making the plan sheets.

Now move onto the designing of the pipe. Start in the Multi-Model View and use the Element Selection tool to select the pipe apron template that is appropriate for the design.

For this example, use a 24" DR-201. It should look like this:
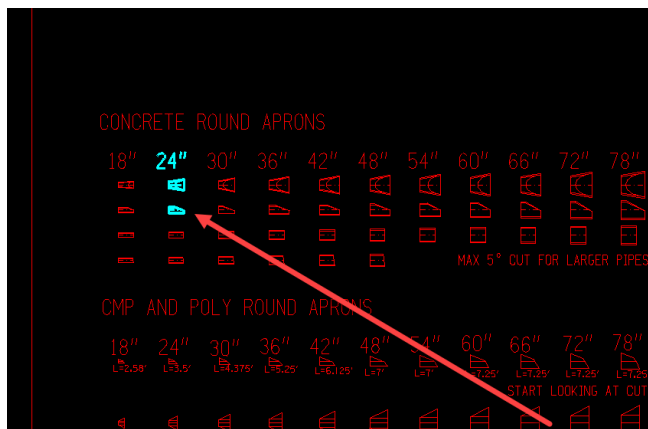
Once it is selected, press Ctrl + C on the keyboard at the same time copying the selection to the clipboard. Then open the drawing model of the cross section for the pipe design. Once in that model, right click and hold. The right click context menu displays. Select the Paste from Clipboard option.
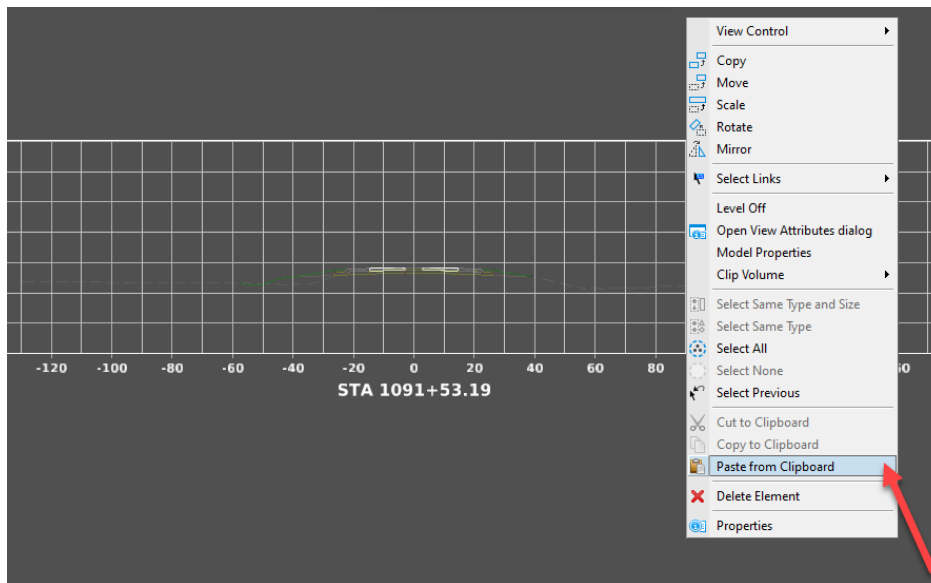

The pipe apron template placed in the clipboard will appear on the end of the cursor.
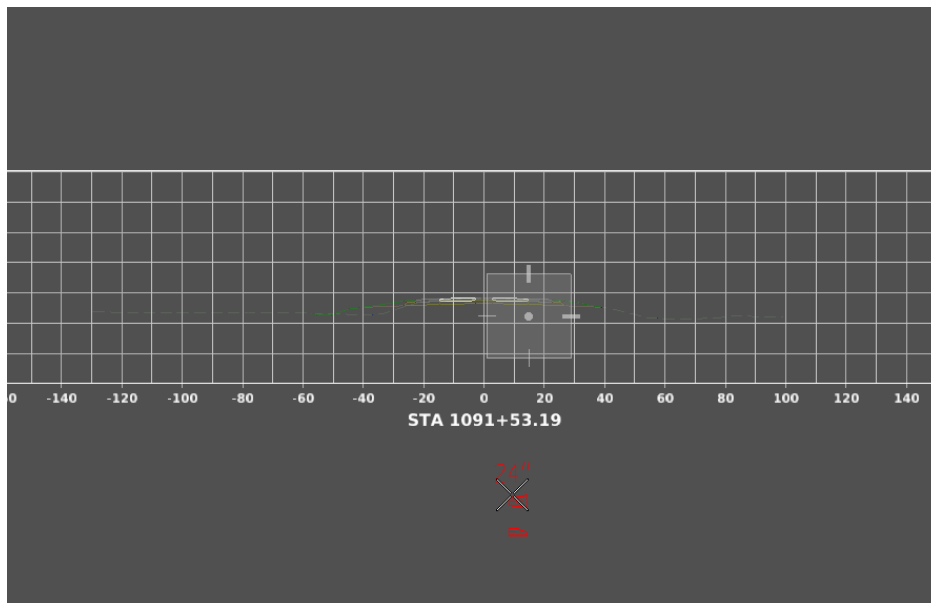

Once confident of the correct location of the new pipe and the hydraulic calculations determined the correct size, determine the clear zone at this location to meet compliance. Use AccuDraw to draw a line from the edge of travel way in the cross section to clear zone distance which marks the clear zone used to help determine the minimum length of the pipe.

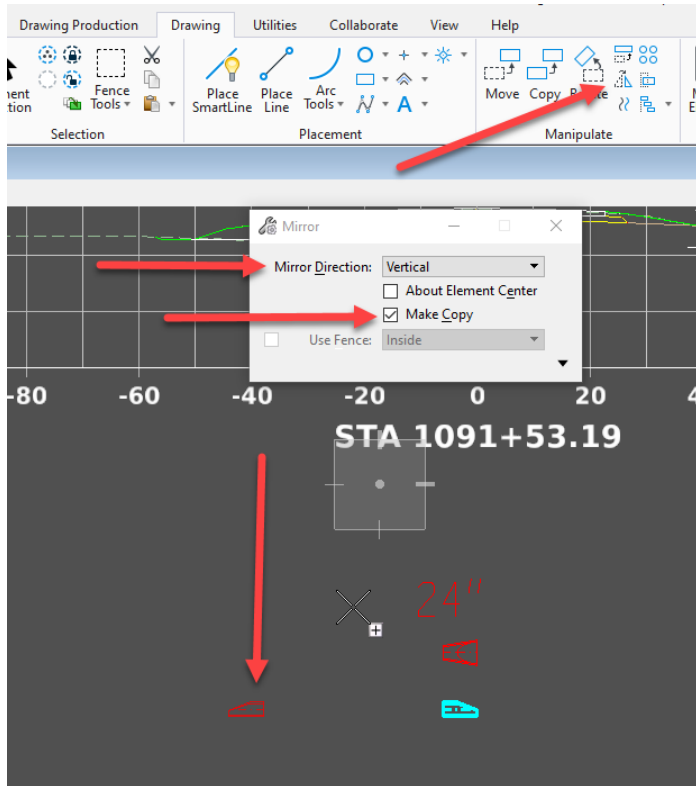It should look something like this:

STA 1091+53.19
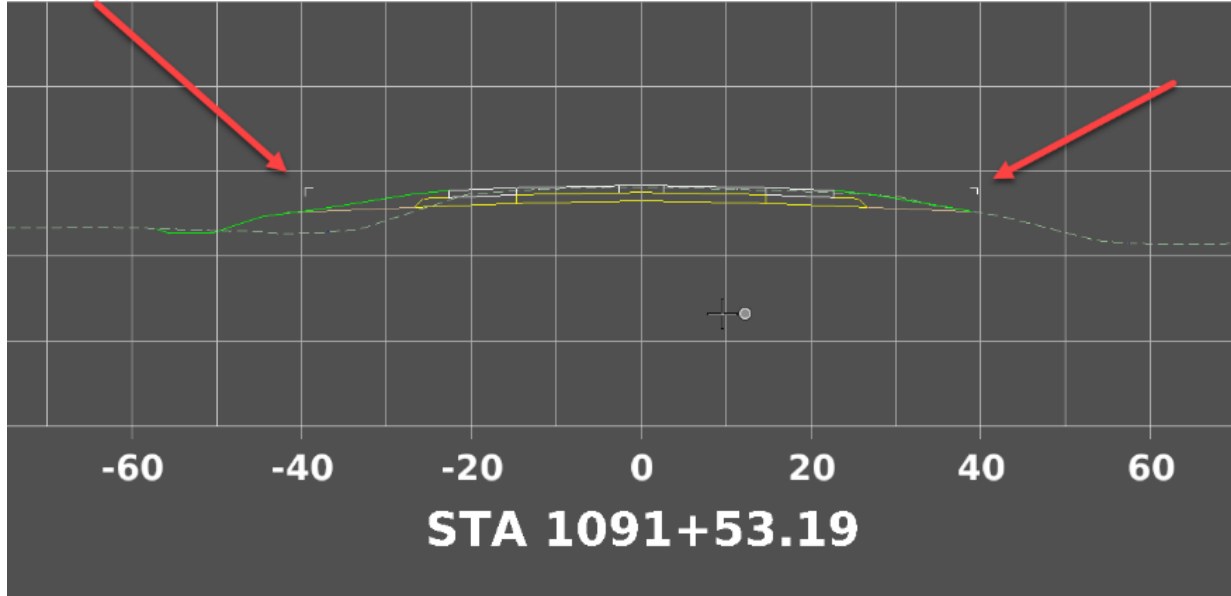
Next, set the flow lines of the pipe. This can be done in many ways depending on the location and design. For a typical crossroad pipe, it would be from one ditch grade to the other ditch grade. Use this approach for this example. Use the place line tool with the aid of AccuDraw and select the low point in each ditch to place the line.

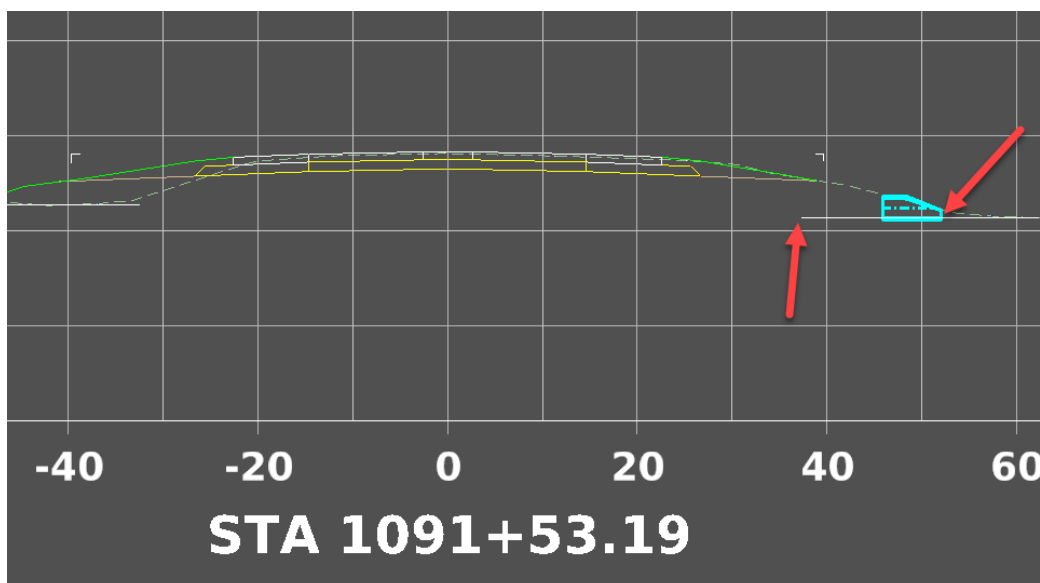It should look something like this:

STA 1091+53.19
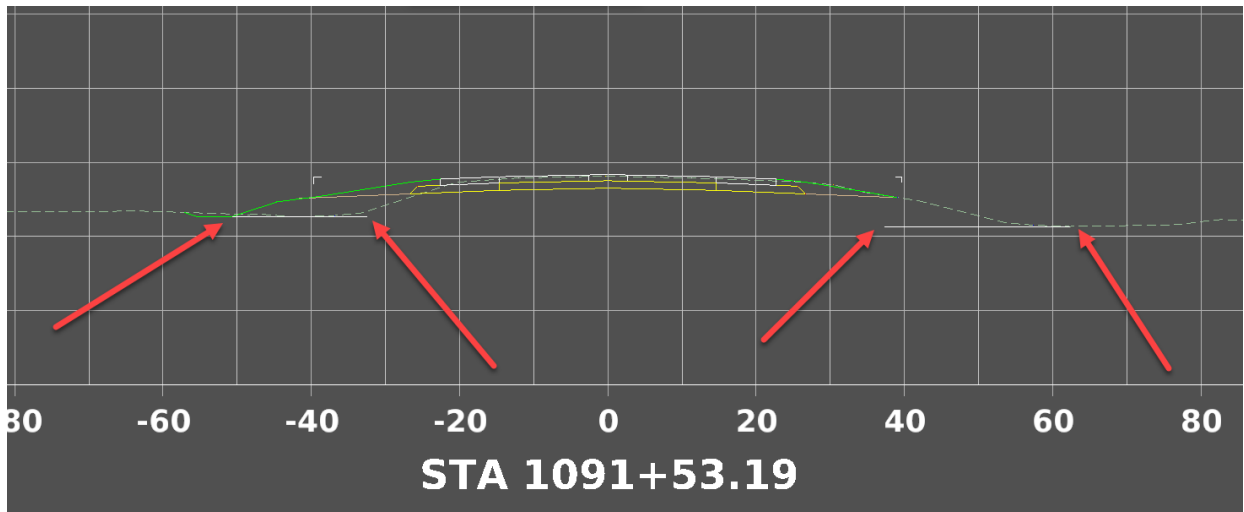
Next, select the apron template copied to this section and make a Mirror copy to use on the other end. Select the Mirror tool, set the Mirror Direction to Vertical and toggle on the Make Copy option.
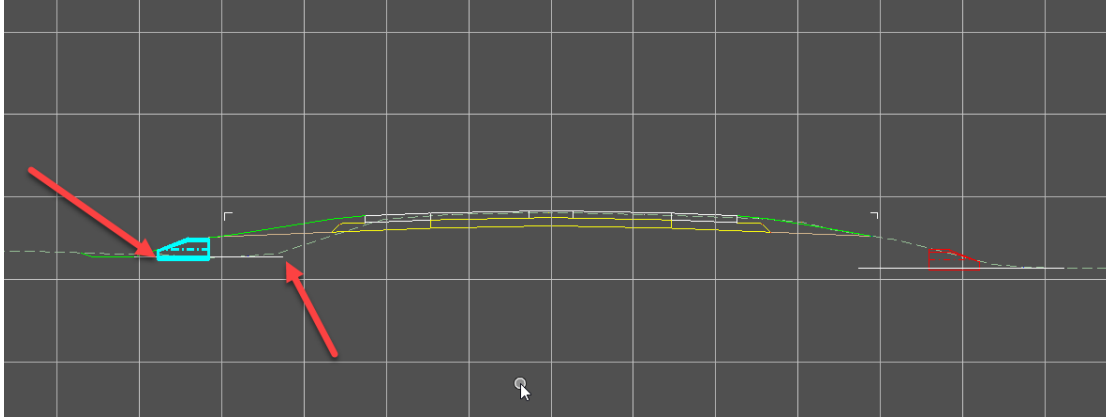
It should look something like this:

Next, select the apron template for the end of the apron and place it on the line representing the low point in the ditch grade. Make sure it is placed at the intersection of the fore slope or the clear zone marker.

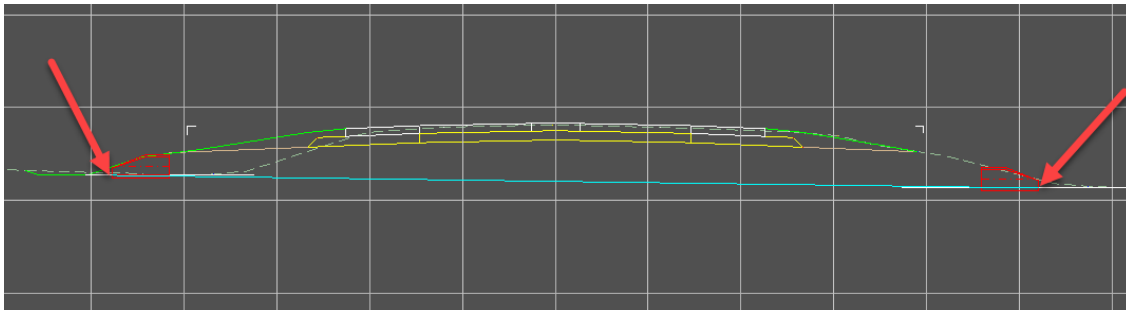It should look something like this:

Next place the other apron the same way on the other end.

Next, place a line from the end of each apron that will represent the flow line of the proposed pipe. Change the color to blue to make it show up better.
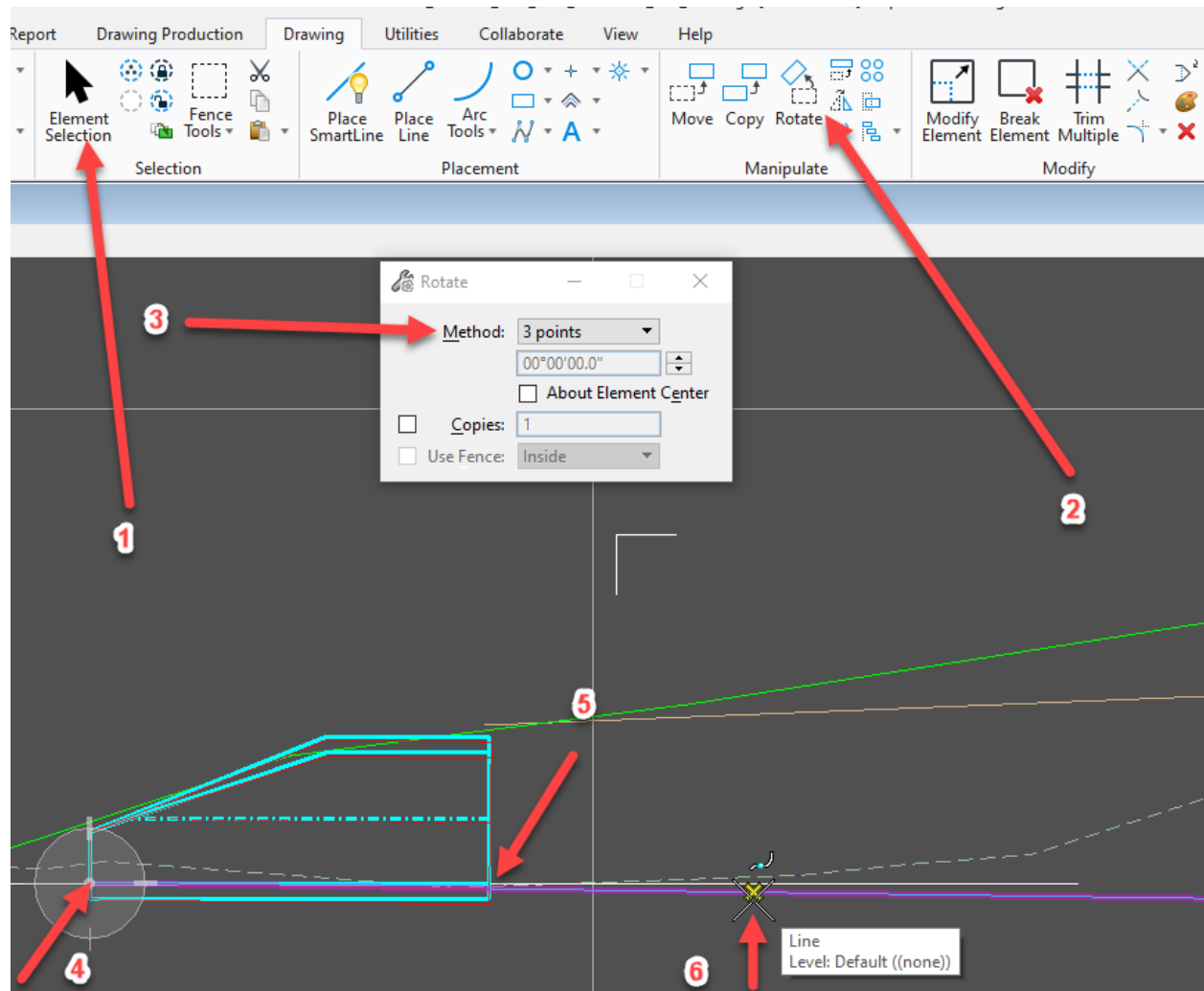
It should look something like this:

Next select the apron template at one end. Rotate the template to match the blue line that was just placed.

Follow these steps to complete.

1. Use the Element Selection tool to select the apron template.
2. Select the Rotate tool.
3. Select the rotate Method as 3 points.
4. Using an intersection snap, select the flow line of the end of the apron from the template.
5. Using an intersection snap, select the point of the flow line on the template that would join with the pipe.
6. Using a near snap, select the blue line that represents the proposed flow line of the pipe.
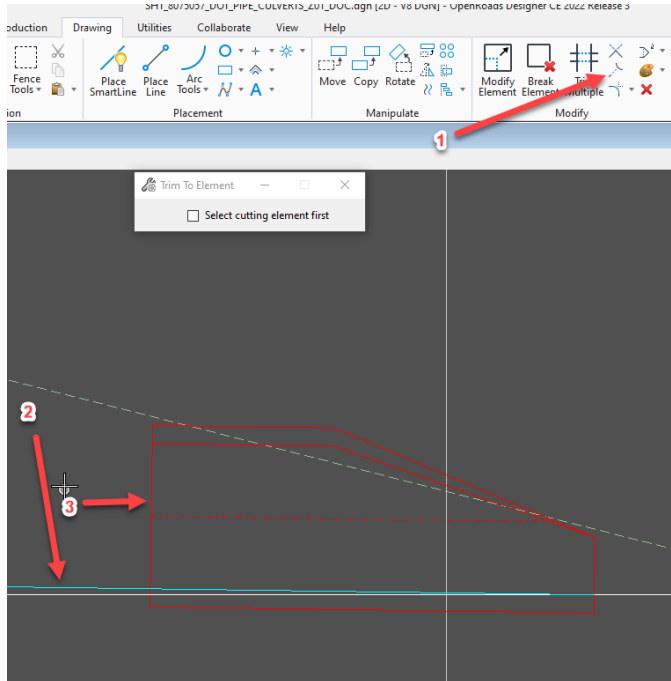
It should look something like this:
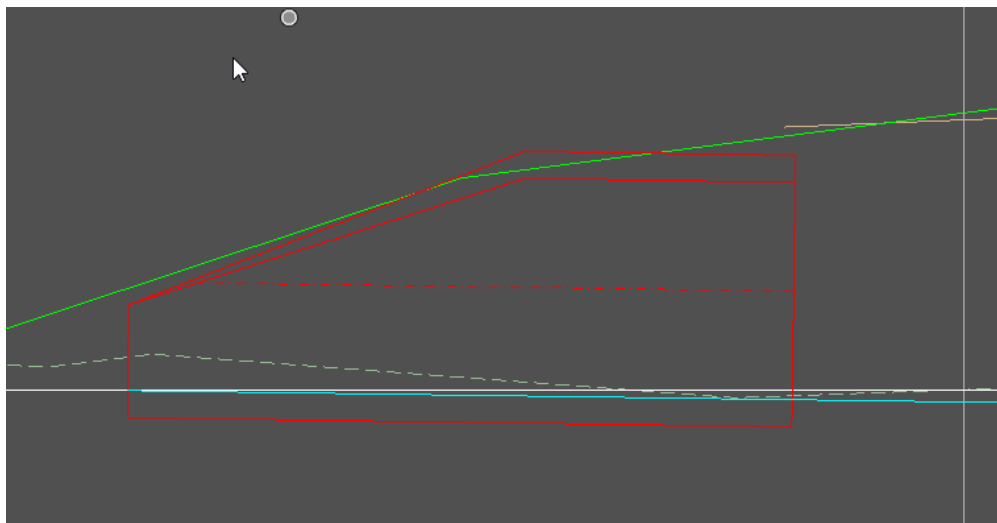
Repeat the same process on the other end of the pipe.

Then, use the Trim To Element tool to trim the blue line representing the proposed flow line of the pipe.

1. Select the Trim To Element tool.
2. Select the blue line.
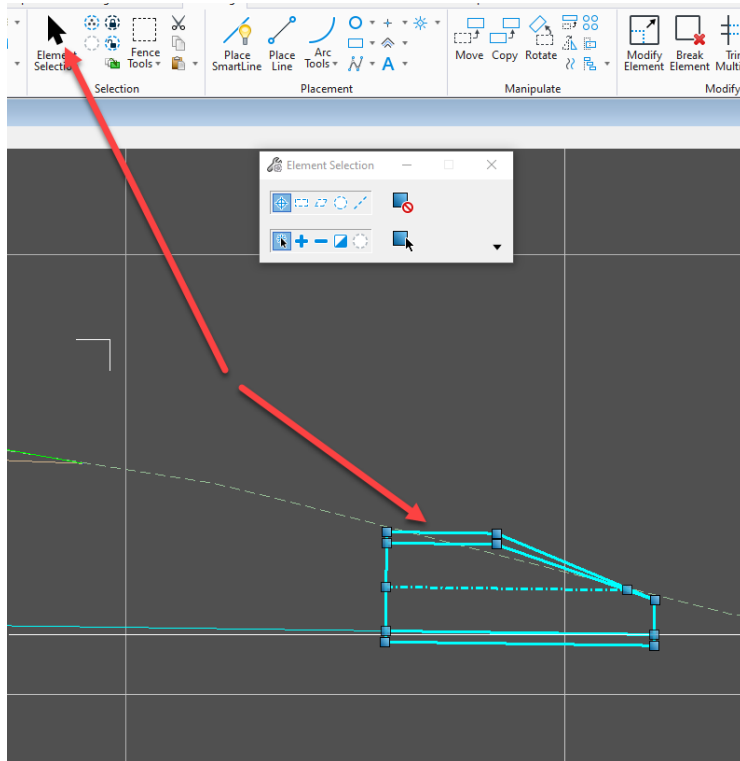3. Select the pipe apron template.

Repeat this at the other end of the pipe.

Next, use the measure distance tool to measure the blue line representing the proposed flow line of the pipe.
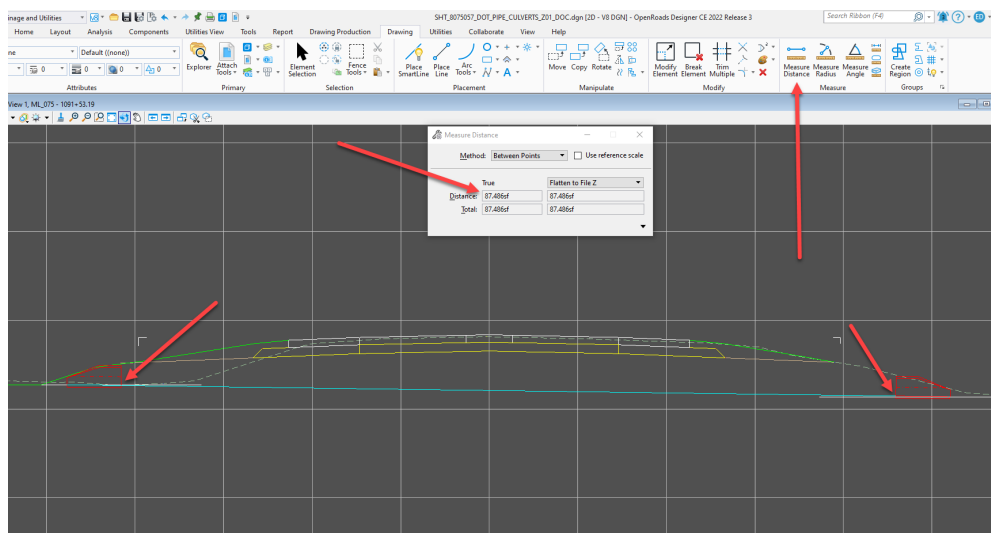
Notice the distance of the line after trimming, it is 87.486' Add 0.514' to the outlet end of the blue line representing the proposed flow line of the pipe to make it an even 88.00'. Pipe design length is constrained to even 2' intervals due to how the pipes are bid and manufactured.

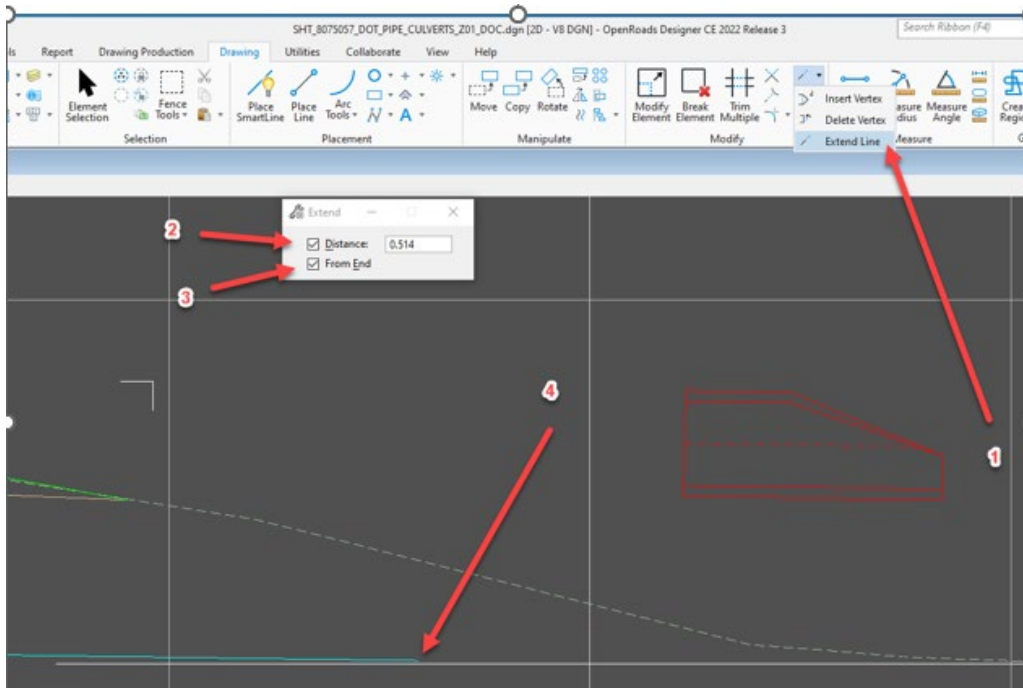Use the Element Selection tool and select the outlet apron template.

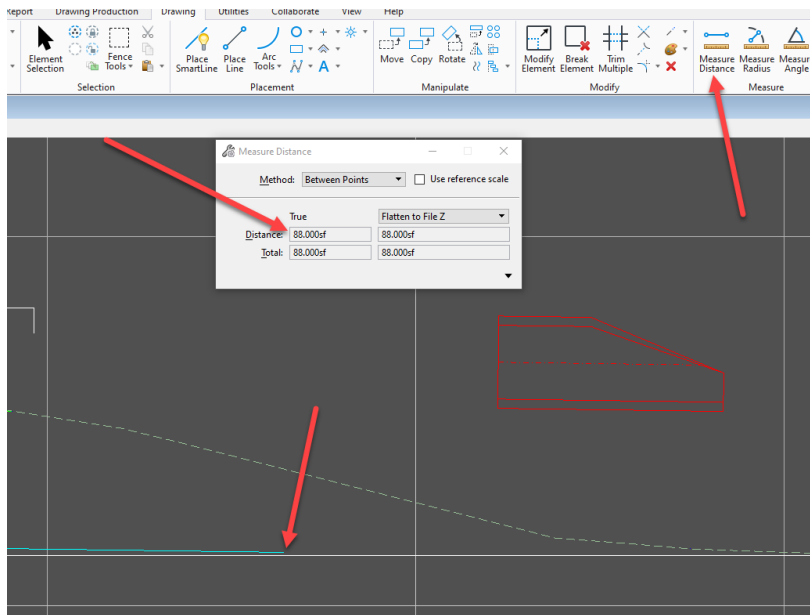Select the move tool and move it out of the way.
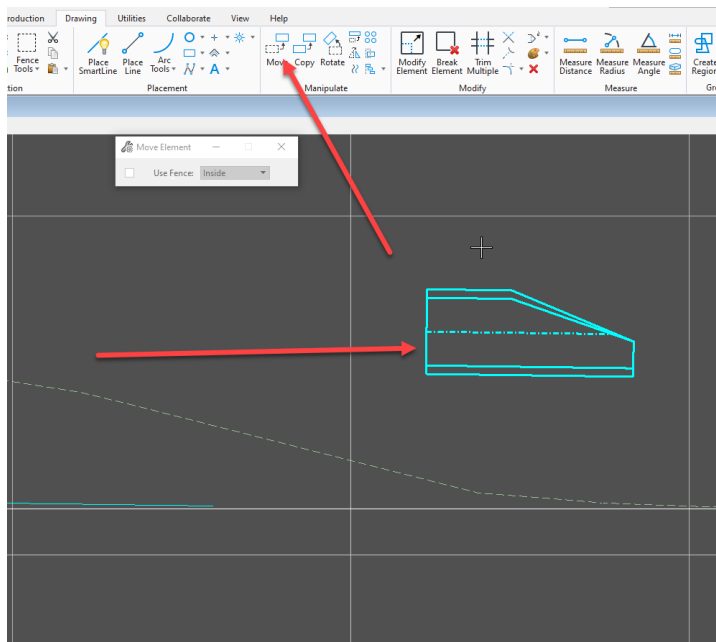
Next follow these steps to achieve the correct length.

1. Select the Extend line tool.
2. Toggle on the distance
3. Toggle on the From End.
4. Select the outlet end of the blue line representing the proposed flow line of the pipe.
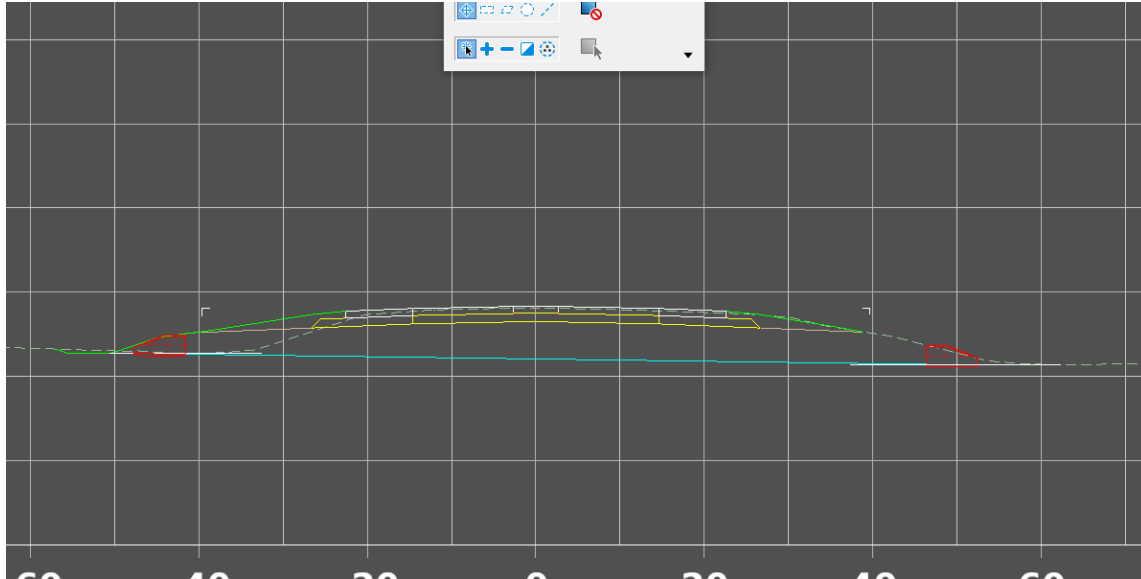

This will make the line exactly 88'. Use the measure distance tool to confirm.
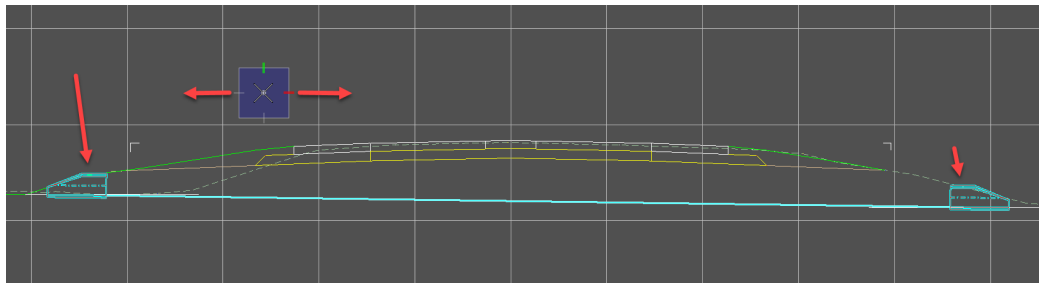
Then use the Element Selection tool to select the outlet pipe apron template and replace it to the end of the outlet end of the blue line.

It should look like this:

Next, use the Element Selection tool and select the blue line and both pipe apron templates. Then, use the move command to move it left or right to best fit the fore slopes.

Now the invert information needed to model the 3D pipes is completed. Continue to the modeling of the pipes.
PW03_Modeling Pipes in Connect