v. 7.6

FHWA HY-8 Culvert Analysis Program

Quick Tutorial

U.S. Department of Transportation
Federal Highway Administration
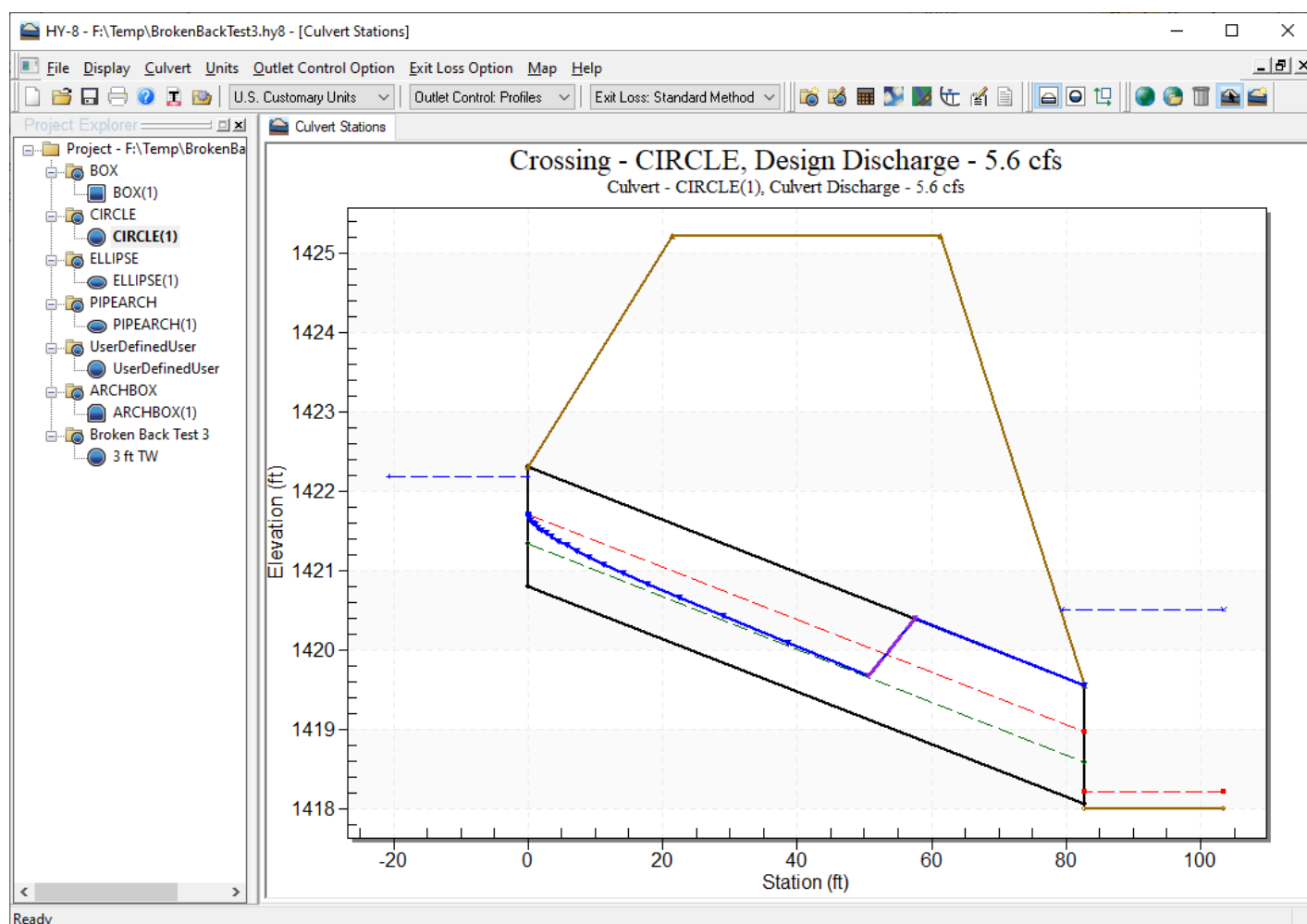
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2   Quick Tutorial

This tutorial shows how to setup a single culvert in HY-8. The tutorial also shows how to view all the results of the culvert analysis. It is meant to be an introduction to using HY-8 for culvert analysis and is by no means a comprehensive reference to all the capabilities of HY-8. A more complete list of HY-8's capabilities is contained in the HY-8 help file.

2.1   Starting a Project
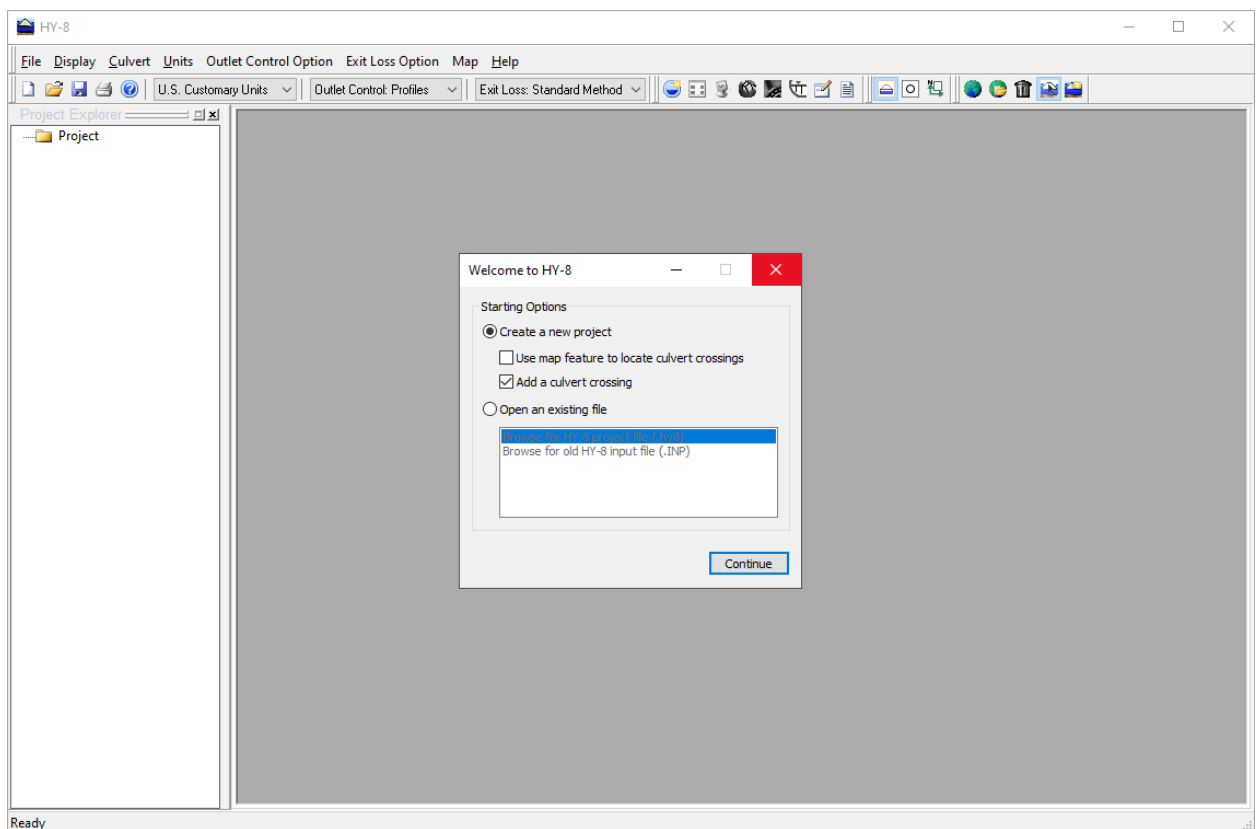
1. Startup HY-8. The following window will appear:

Figure 1: HY-8 on startup

2. Select *Continue* to add a new culvert cross.

Figure 2: Edit Crossing window

2.2   Entering Project Data

3.   Enter the following into the "Discharge Data" section of the *Crossing Data* window:

Table 1: Example discharge data

Minimum Flow	0.0 cfs
Design Flow	200.0 cfs
Maximum Flow	250.0 cfs

4.   Enter the following into the "Tailwater Data" section of the *Crossing Data* window:

Table 2: Example tailwater channel data

Channel Type	Trapezoidal Channel
Bottom Width	8.0 ft
Side Slope (H:V)	2.0 (_:1)
Channel Slope	0.005 ft/ft

Manning's n (channel)	0.032
Channel Invert Elevation	89.2 ft

5. Select the "View" button to view the rating curve:

Figure 3: Edit Crossing window with the 'view rating curve' button highlighted

6. Plot the rating curve if you wish, but when you are finished, close the plot window and choose "OK" in the Rating Curve Window.
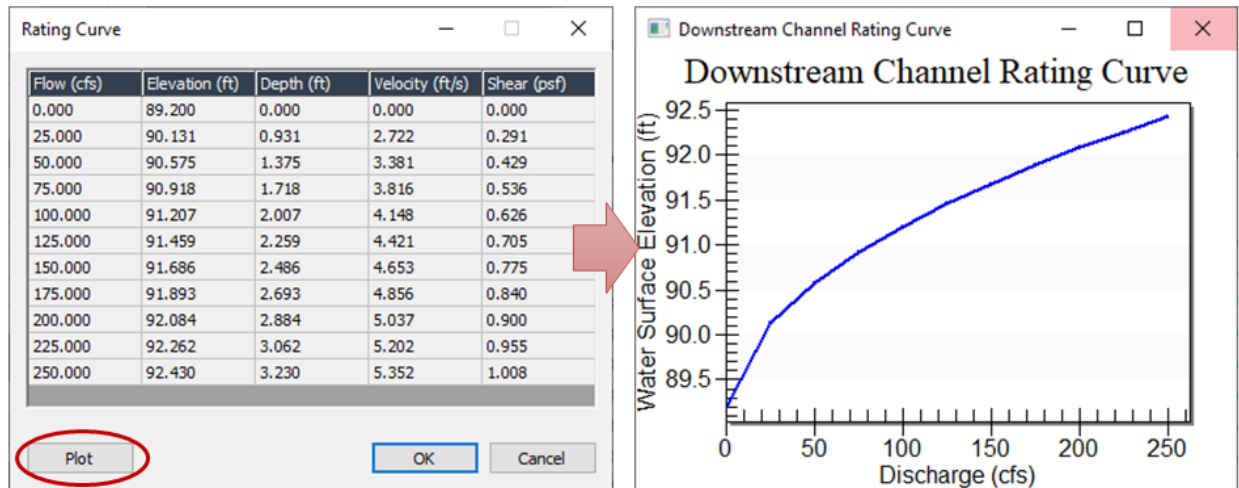
Figure 4: Rating curve table and plot

7. Enter the following into the "Roadway Data" section of the *Crossing Data* window:

Table 3: Example roadway data

Roadway Profile Shape	Constant Roadway Elevation
First Roadway Station	0.0 ft
Crest Length	100.0 ft
Crest Elevation	110.0 ft
Roadway Surface	Paved
Top Width	68.0 ft

8. Enter the following into the "Culvert Data" section of the Crossing Data window:

Table 4: Example culvert data

Name	Example 6
Shape	Concrete Box
Material	Concrete
Span	6.0 ft
Rise	5.0 ft
Embedment depth	0.0 ft
Manning's n	0.012

Culvert Type	Straight
Inlet Edge Condition	1:1 Bevel Headwall
Inlet Depression?	No

9. Enter the following into the "Site Data" section of the *Crossing Data* window:

Table 5: Example site data

Site Data Input Option	Culvert Invert Data
Inlet Station	0.0 ft
Inlet Elevation	90.0 ft
Outlet Station	78.0 ft
Outlet Elevation	89.2 ft
Number of Barrels	1

The dialog should look like the following figure:

Figure 5: Edit Crossing window with example data

2.3   Running an Analysis

10. Select the Analyze Crossing button at the bottom of the Crossing Data window. This runs the analysis, but does not save the information.

Figure 6: Edit Crossing window with Analyze Crossing button highlighted

11. Select the Crossing Rating Curve button.

Figure 7: Analyze Crossing window with Crossing Rating Curve button highlighted

12. A plot of the rating curve (Headwater Elevation vs Discharge) will appear. After viewing this curve, close the plot window.

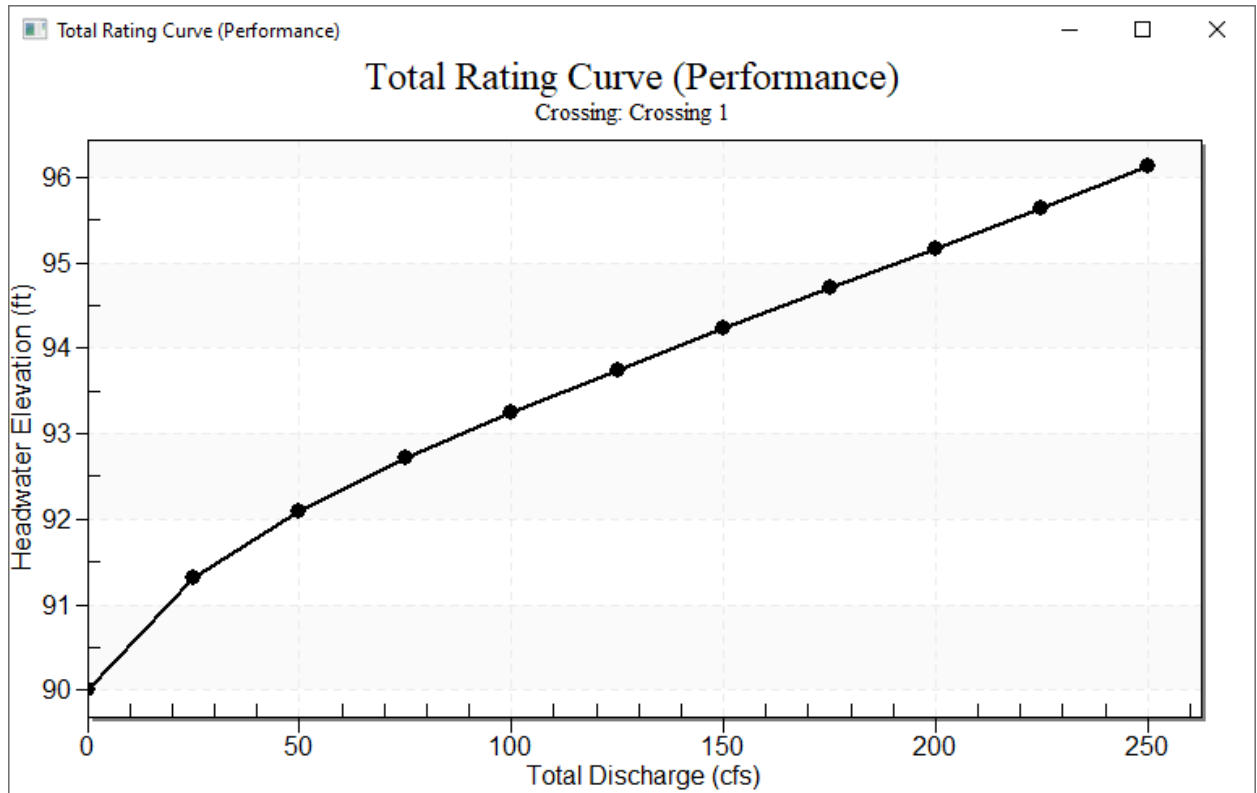*Figure 8: Crossing Rating Curve plot for example data*

13. Select the *Culvert Summary Table* option in the *Display* box. Any of the data displayed in any of the spreadsheets in this window can be selected, copied (using Ctrl+C), and pasted into any spreadsheet program. It can also be exported to a Microsoft Word Document or Microsoft Excel Workbook using the 'Export Report' button and the following combo box.

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	90.00	0.00	0.0	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
25.00	25.00	91.31	1.31	0.15	1-S2n	0.55	0.81	0.57	0.93	7.36	2.72
50.00	50.00	92.09	2.09	0.64	1-S2n	0.86	1.29	0.92	1.38	9.08	3.38
75.00	75.00	92.71	2.71	1.06	1-S2n	1.13	1.69	1.23	1.72	10.14	3.82
100.00	100.00	93.24	3.24	1.50	1-S2n	1.38	2.05	1.52	2.01	10.95	4.15
125.00	125.00	93.74	3.74	1.96	1-S2n	1.61	2.38	1.80	2.26	11.60	4.42
150.00	150.00	94.22	4.22	2.44	1-S2n	1.83	2.69	2.06	2.49	12.16	4.65
175.00	175.00	94.69	4.69	2.93	1-S2n	2.04	2.98	2.31	2.69	12.64	4.86
200.00	200.00	95.15	5.15	3.43	5-S2n	2.24	3.26	2.55	2.88	13.08	5.04
225.00	225.00	95.63	5.63	3.96	5-S2n	2.45	3.52	2.78	3.06	13.47	5.20
250.00	250.00	96.12	6.12	5.12	5-S2n	2.64	3.78	3.01	3.23	13.83	5.35

Figure 9: Analyze Crossing window with Culvert Summary Table option highlighted

14. Select the *Culvert Performance Curve* button.

Figure 10: Analyze Crossing window with Culvert Performance Curve

15. A plot of the performance curve (Inlet/Outlet Control Headwater Elevation vs Discharge) will appear. After viewing this curve, close the plot window.

Figure 11: Performance Curve for example culvert barrel

16. Select the *Water Surface Profiles* option in the *Display* box.

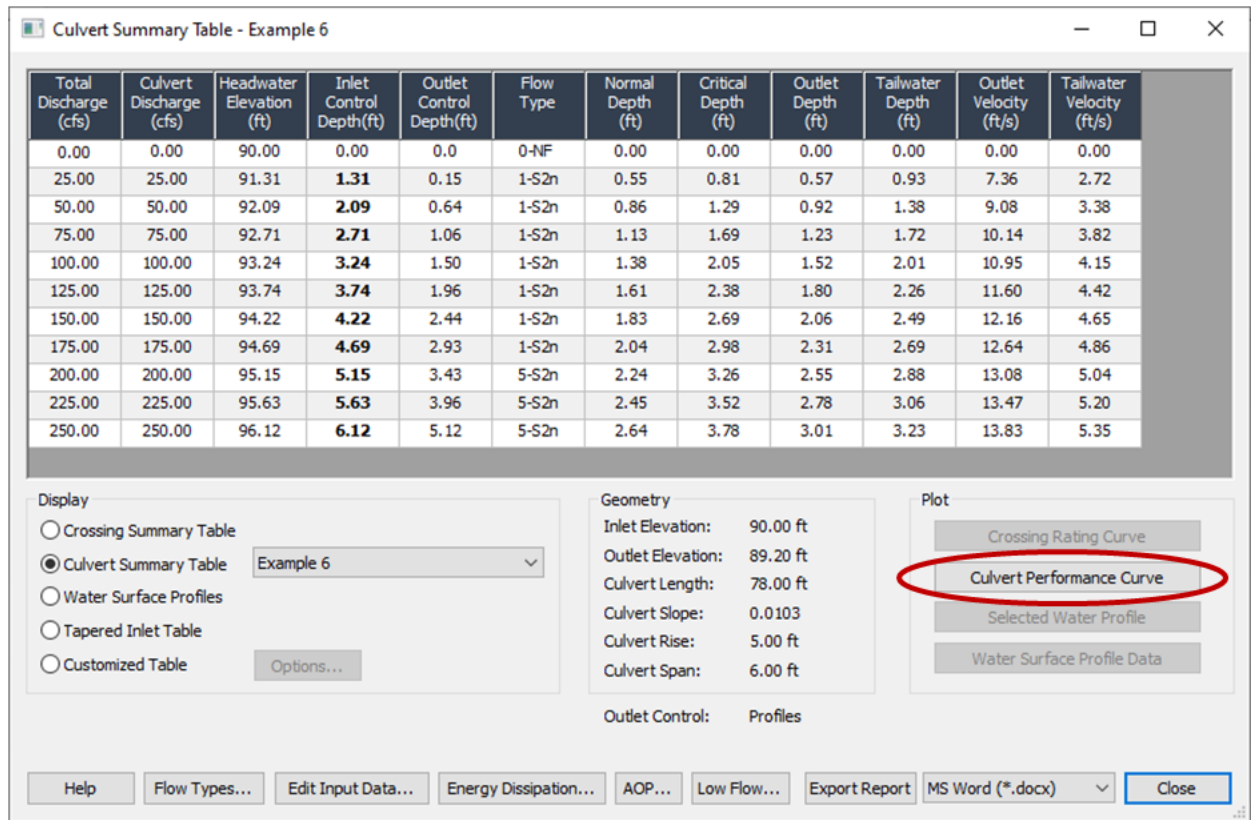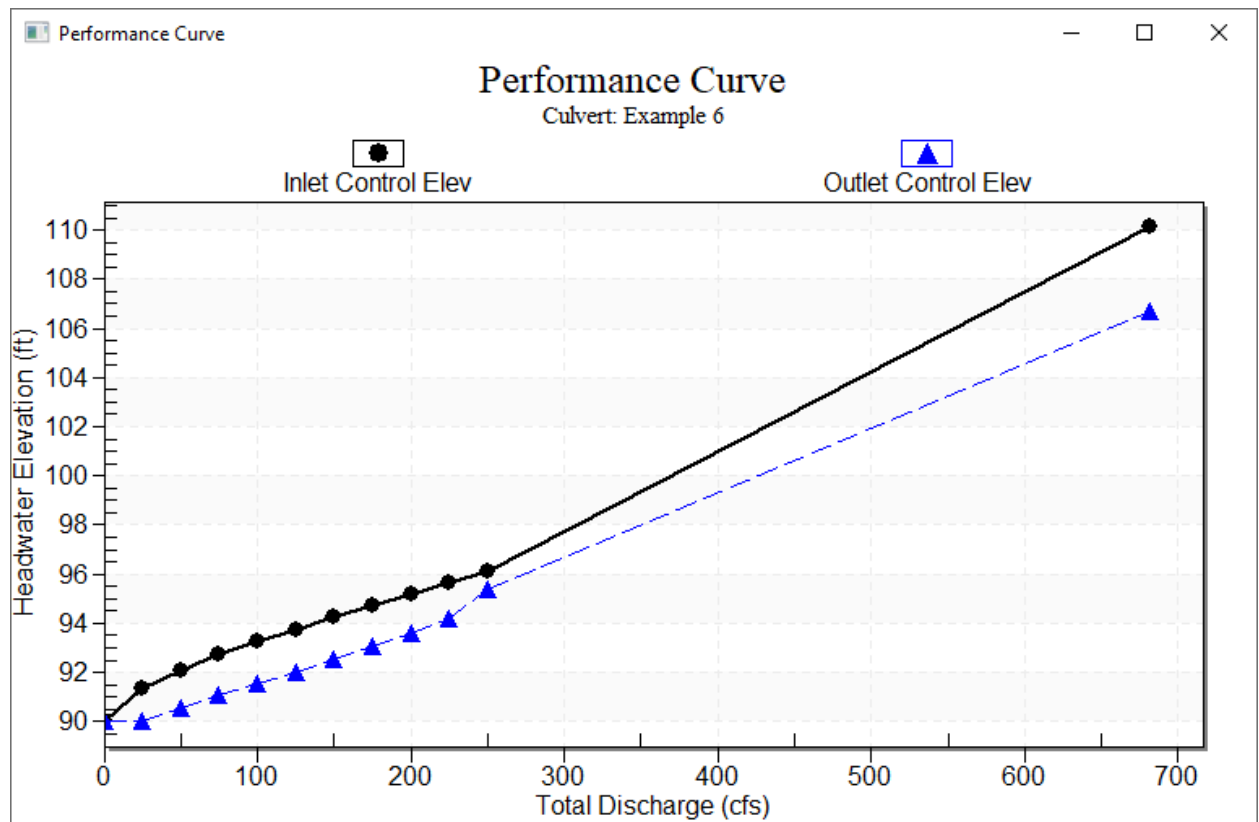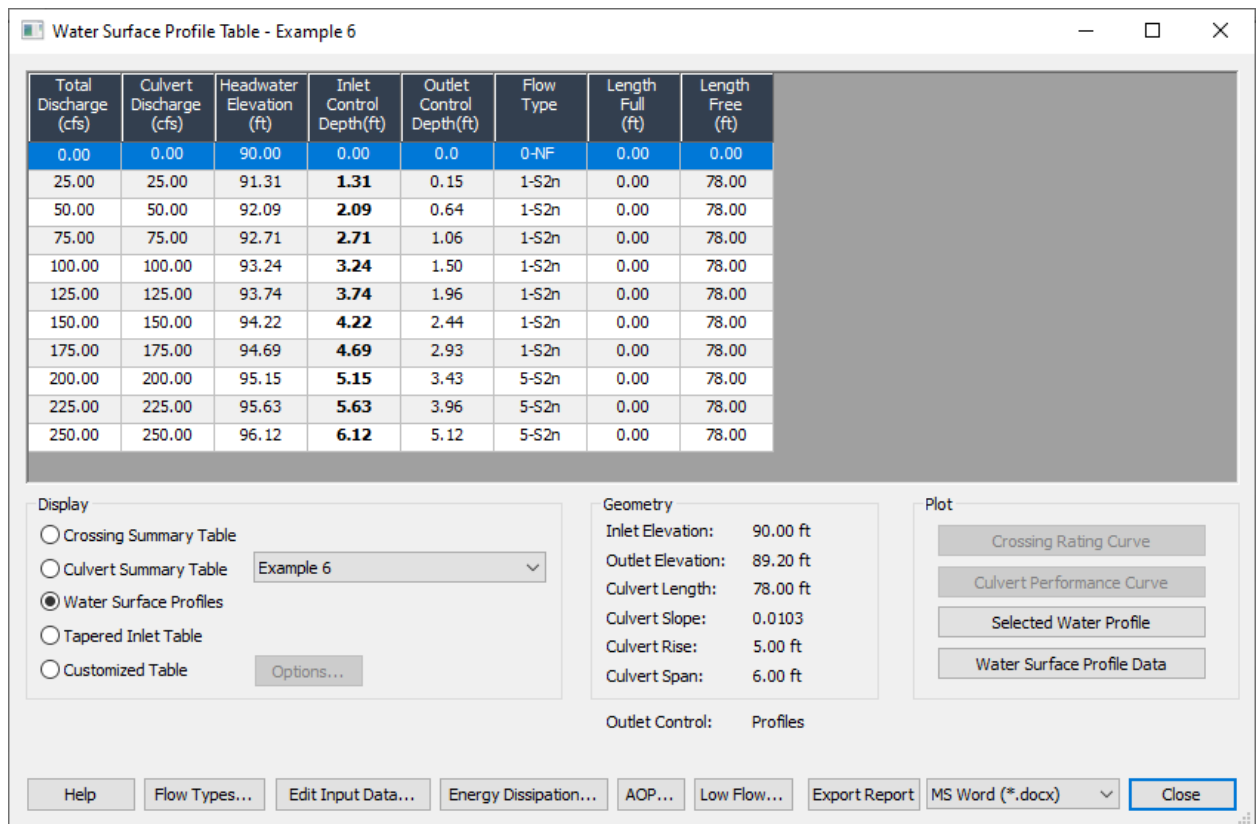*Figure 12: Analyze Crossing window with Water Surface Profiles option highlighted*

17. Select the 200 cfs profile (third from the bottom) and select the *Selected Water Profile* button.
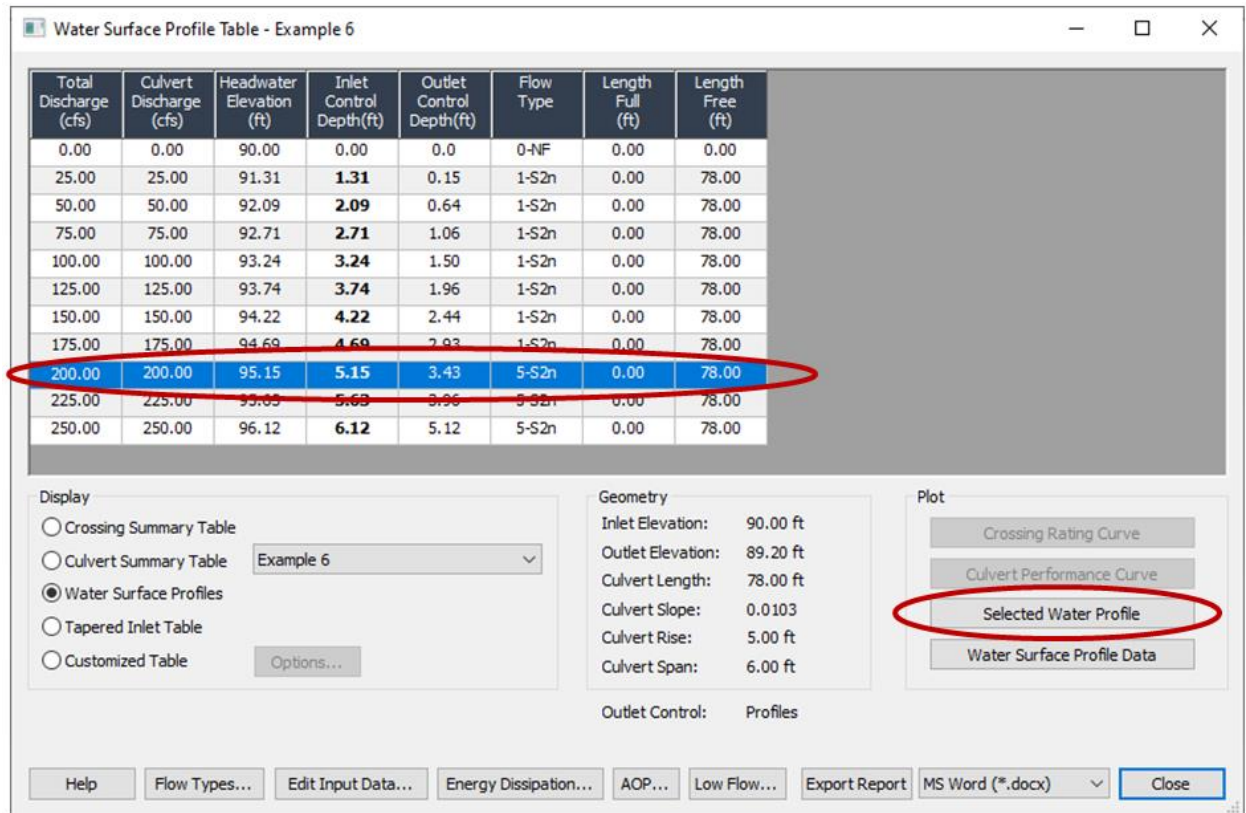
Figure 13: Analyze Crossing window with 200 cfs row selected and the Selected Water Profile button highlighted

18. A plot of the culvert profile (for the selected discharge of 200 cfs) will appear. After viewing this curve, close the plot window.

Figure 14: Side view plot of example culvert barrel

19. Select the *Close* button on the Analysis window.

Figure 15: Analyze Crossing window with Close button highlighted

20. Select the "Example 6" culvert in the project explorer to show the culvert profile for the design discharge in the main window. Notice that the side View is active.
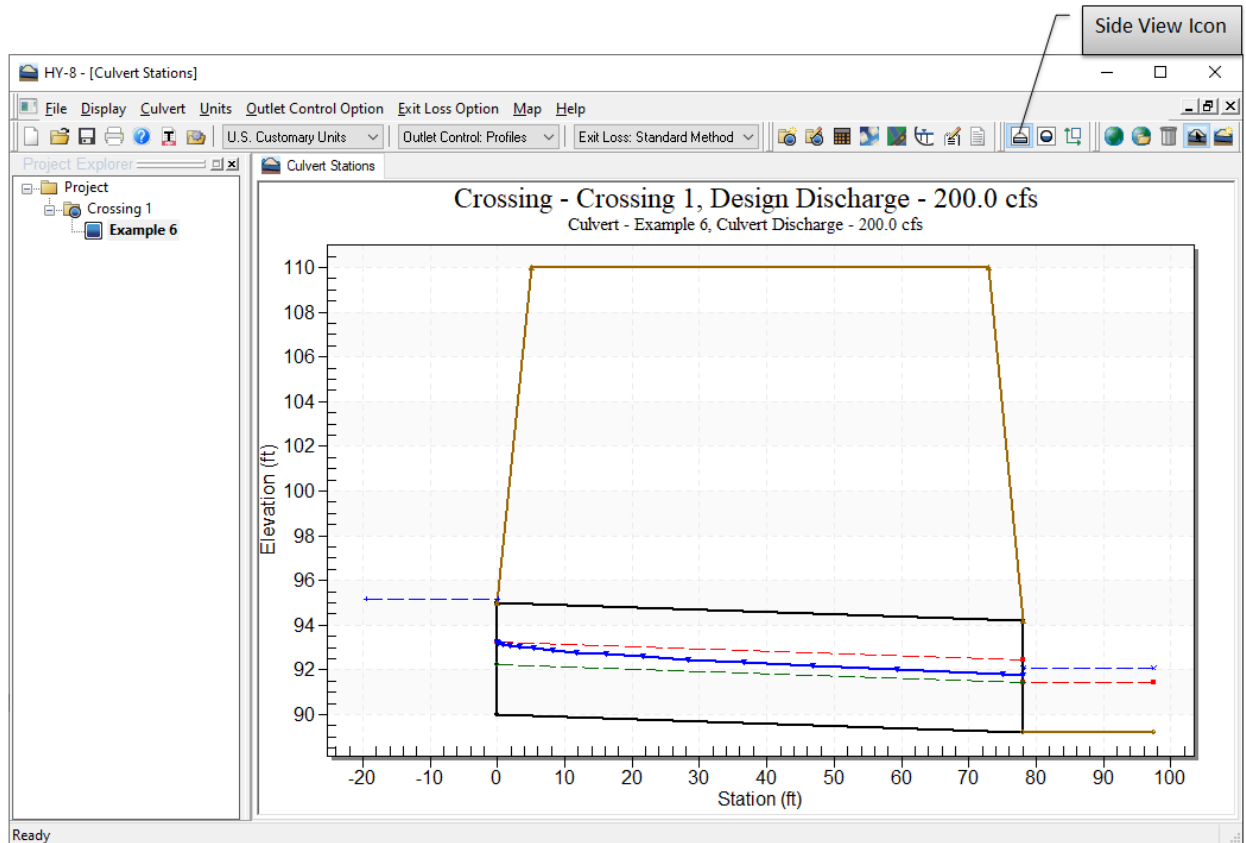
Figure 16: HY-8 main window with the side view icon highlighted
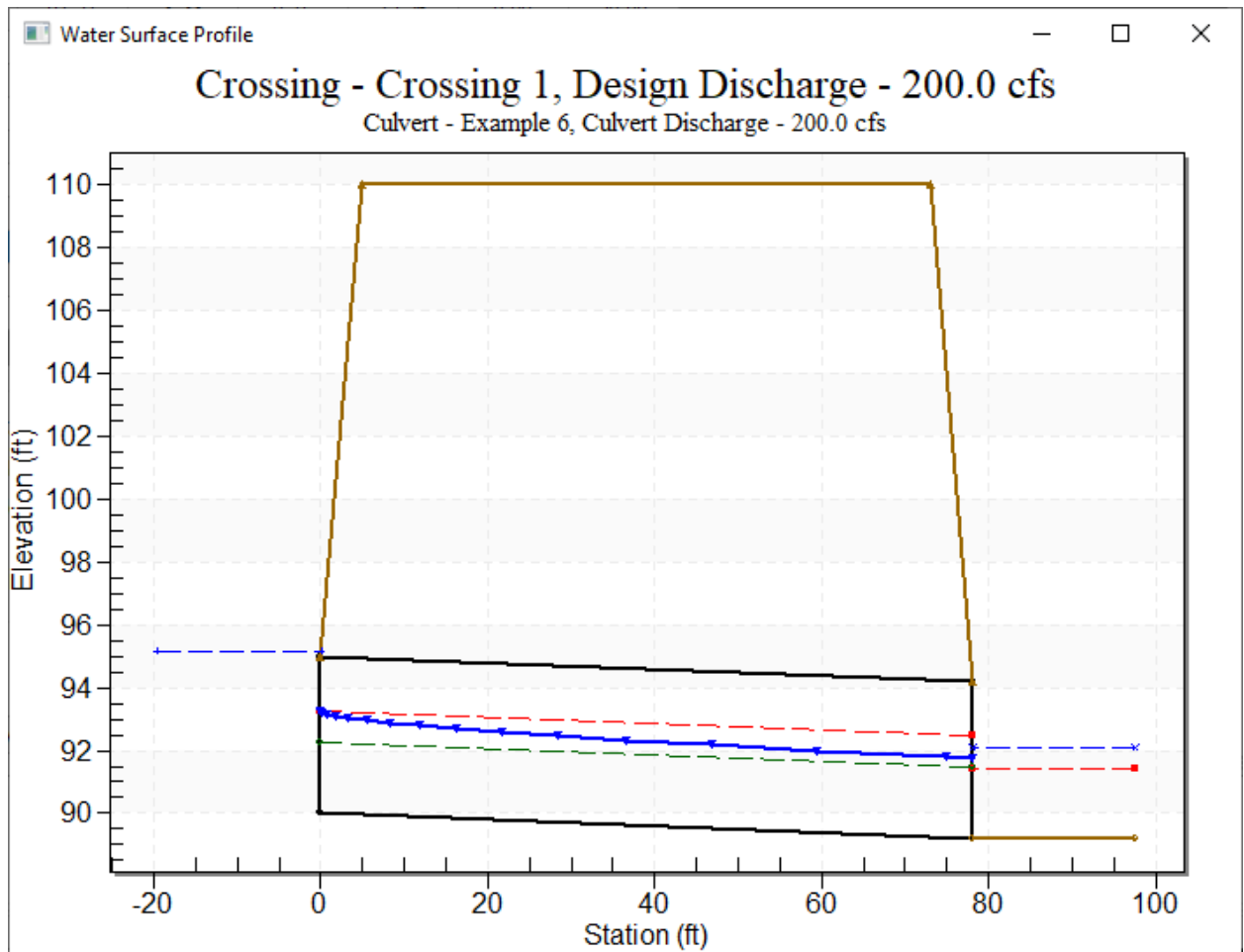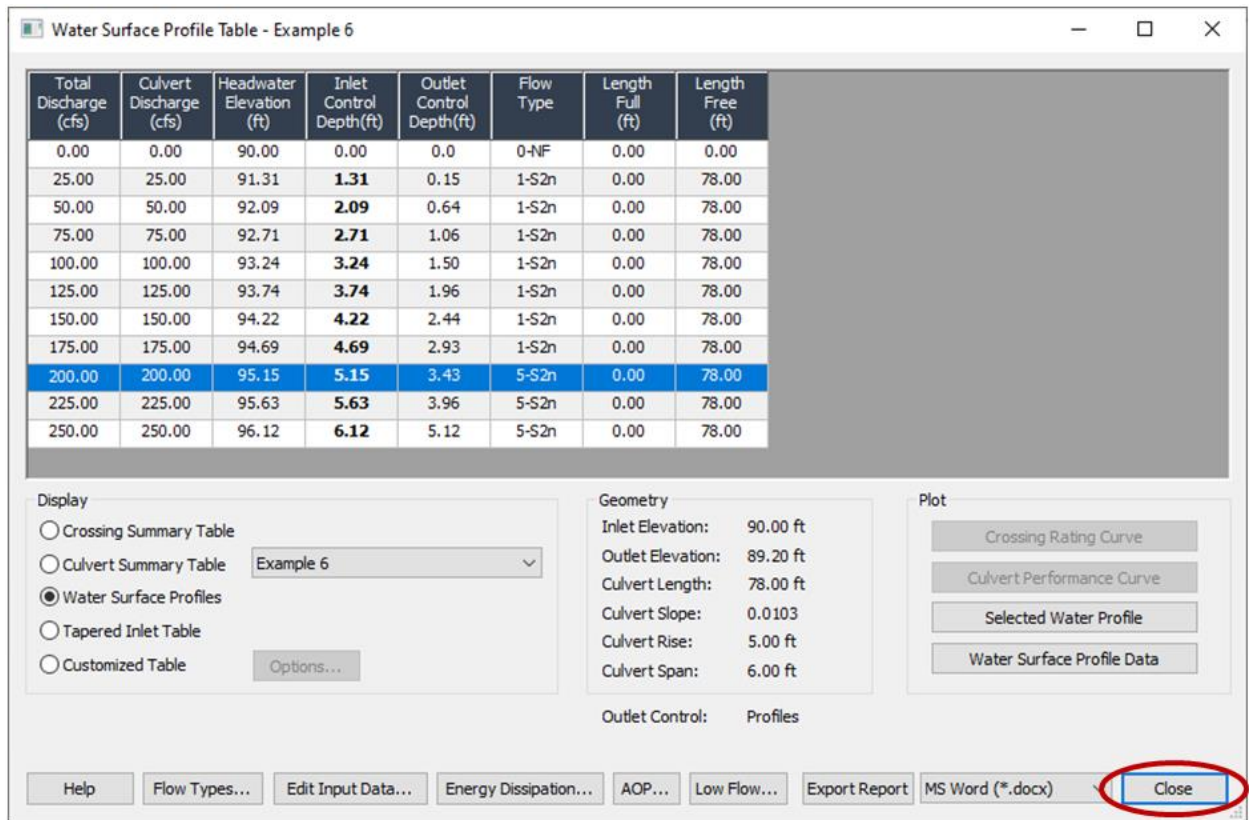
2.4   Optional: Defining Front View

Should the user wish to define the front view, they can do so at this (or any other time after entering crossing and culvert information). Recall that details regarding this option were discussed earlier in this document. If you wish to skip to the next session, pick up at step #26.

21. Select the Front View icon. A message will appear in the Main Window describing the requirement to define lateral culvert stations.

Figure 17: HY-8 main window with Front View Icon highlighted

22. Right click and select "*Define Roadway Culvert Stations…*" option.

Figure 18: HY-8 main window with right-click menu options shown
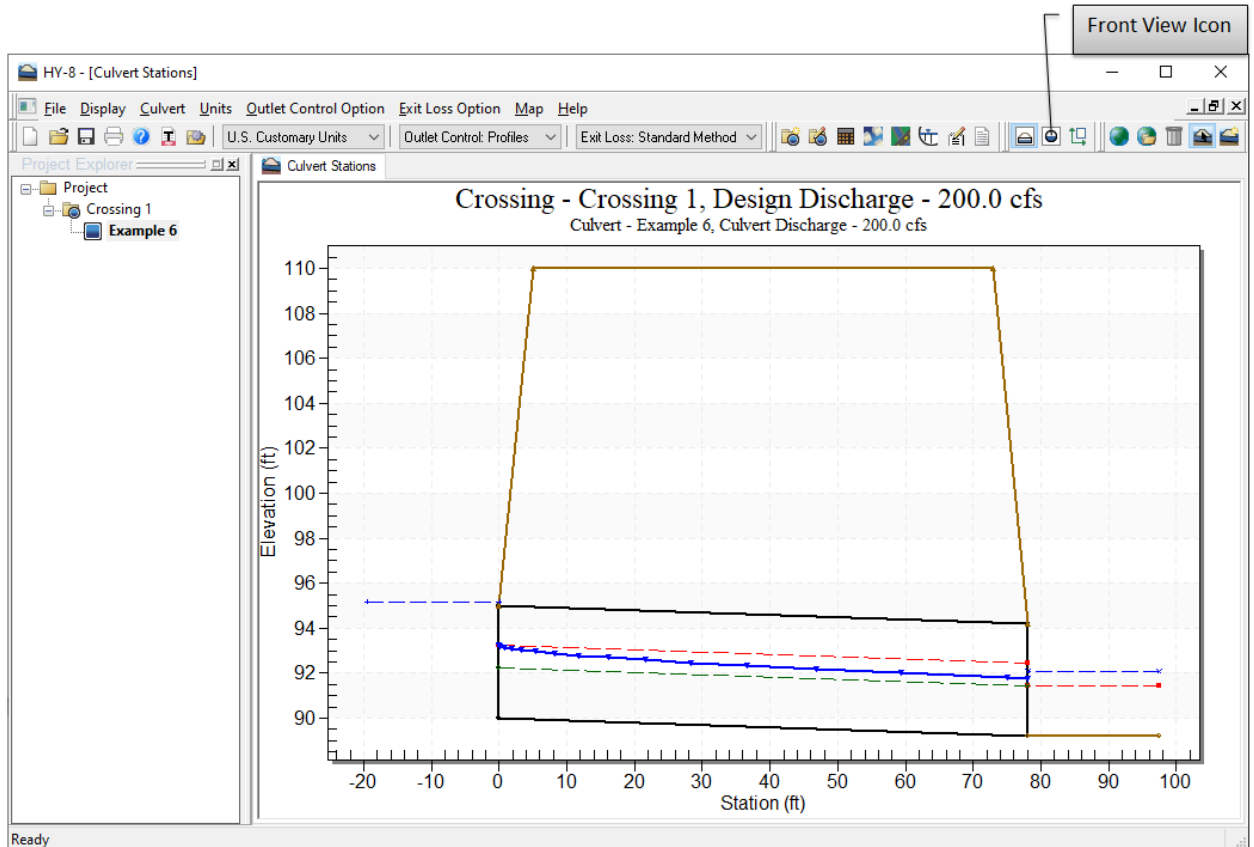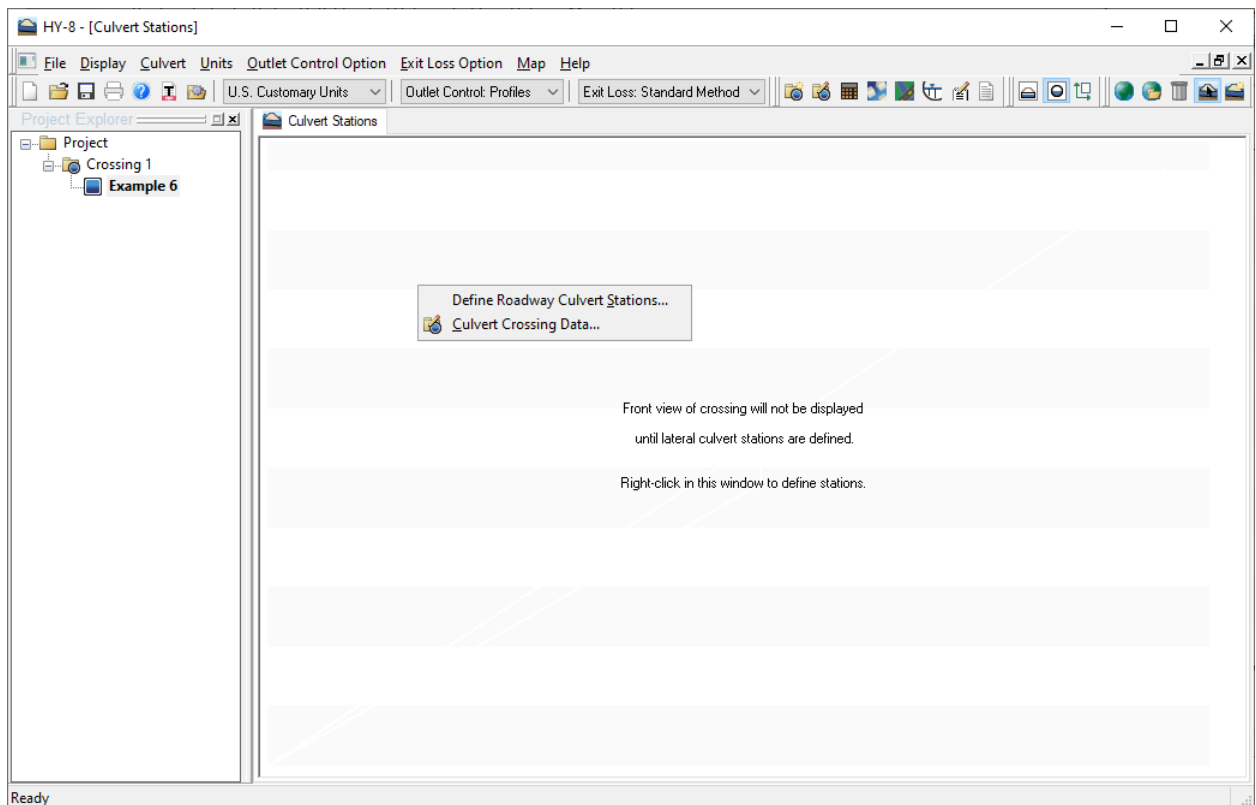
23. The Roadway Profile window appears. Notice that the roadway station data (0.00 ft and 100.00 ft) entered back in step 7 is in the window. Click on the "Example 6" station field (currently set to the default of 0.0).
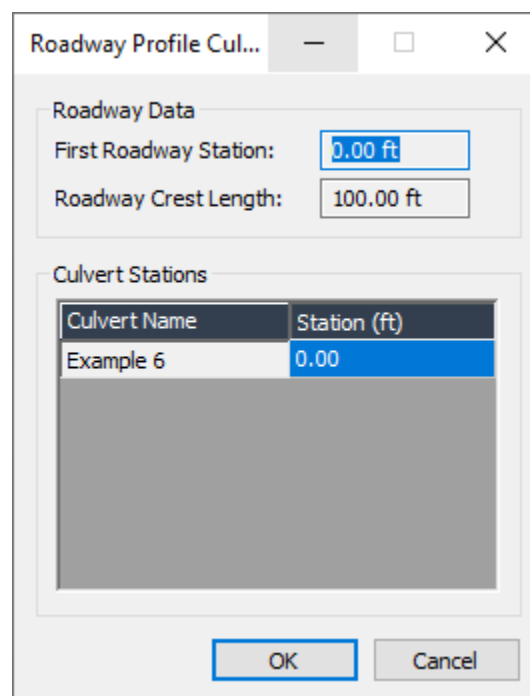
Figure 19: Roadway Profile Culvert Stations window

24. Enter the station of the centerline of the culvert barrel. For this example, let's assume that this is at roadway station 50.0 feet (or halfway between the roadway section that is acting as a weir).

Figure 20: Roadway Profile Culvert Stations window with example data

25. Choose "OK" and the main window presents the Front View of the crossing with the selected culvert barrel plotted with a red line. If there was another culvert barrel in our plot, it would be displayed with a black line.
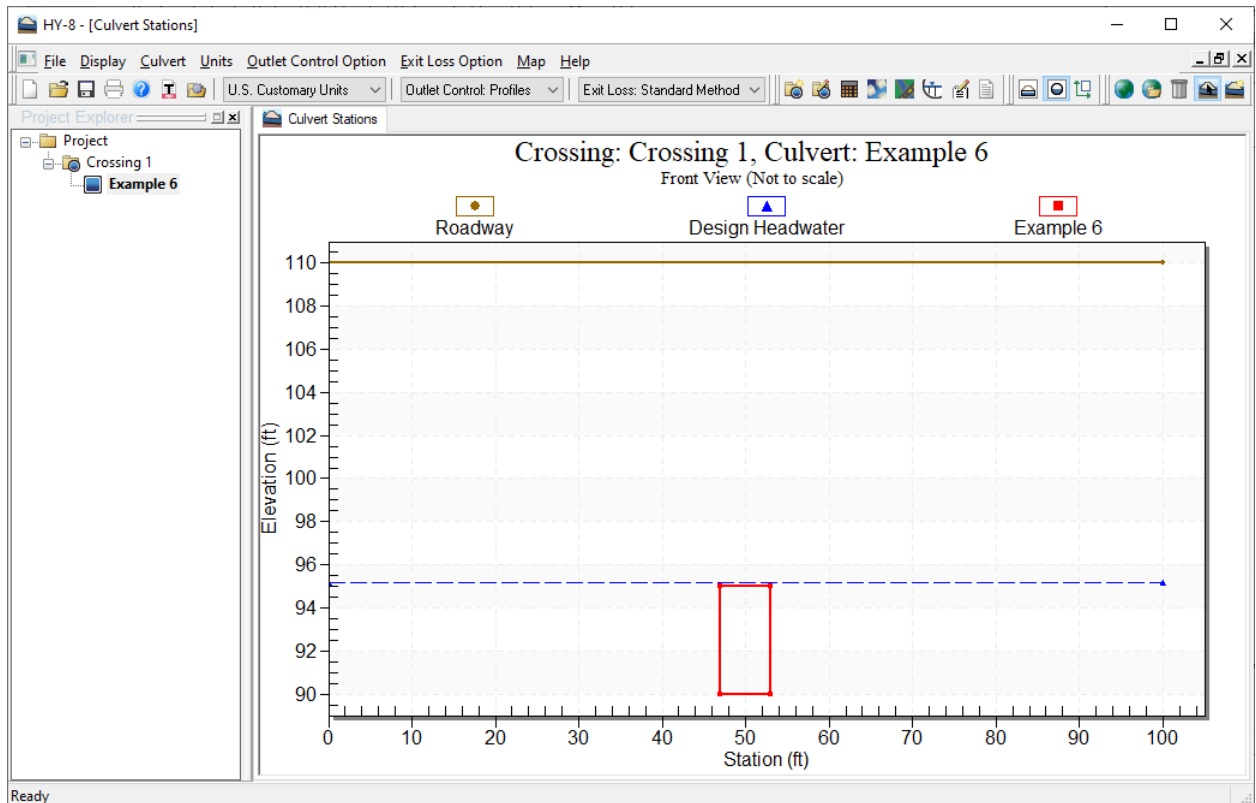
Figure 21: HY-8 main window with front view displayed

You can switch between the Front View and Side View by selecting the appropriate toolbar icon or menu item. Note when the cursor hovers over a toolbar icon, a short help message in the lower left of the program window appears.

2.5   Saving the Project File

26. A best practice when using any computer program is to save your work often. Select the *Save As* option from the File Menu.

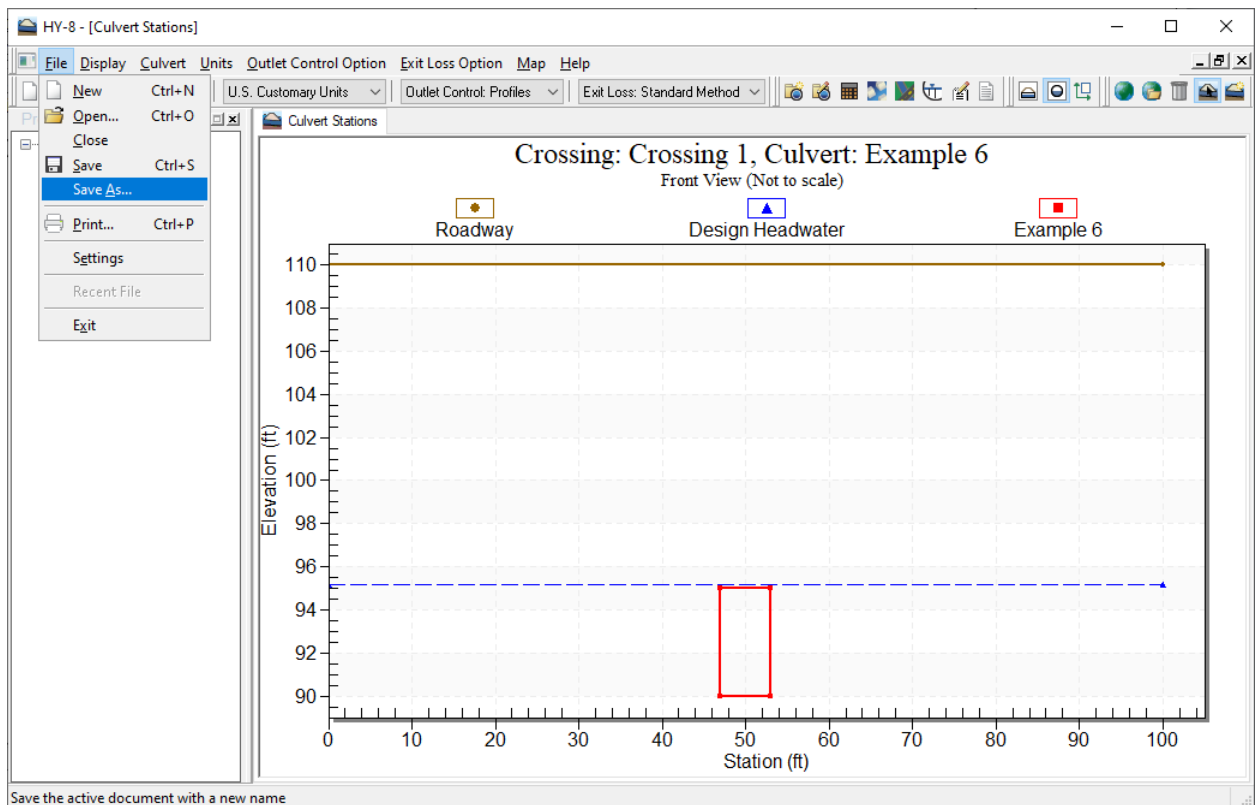*Figure 22: HY-8 main window with File | Save as menu option selected*

27. When prompted, name the project file *QuickTutorial*. The program will automatically add the .HY8 extension to the file.

28. Select the *Create Report* option from the *Culvert* menu or from the toolbar.
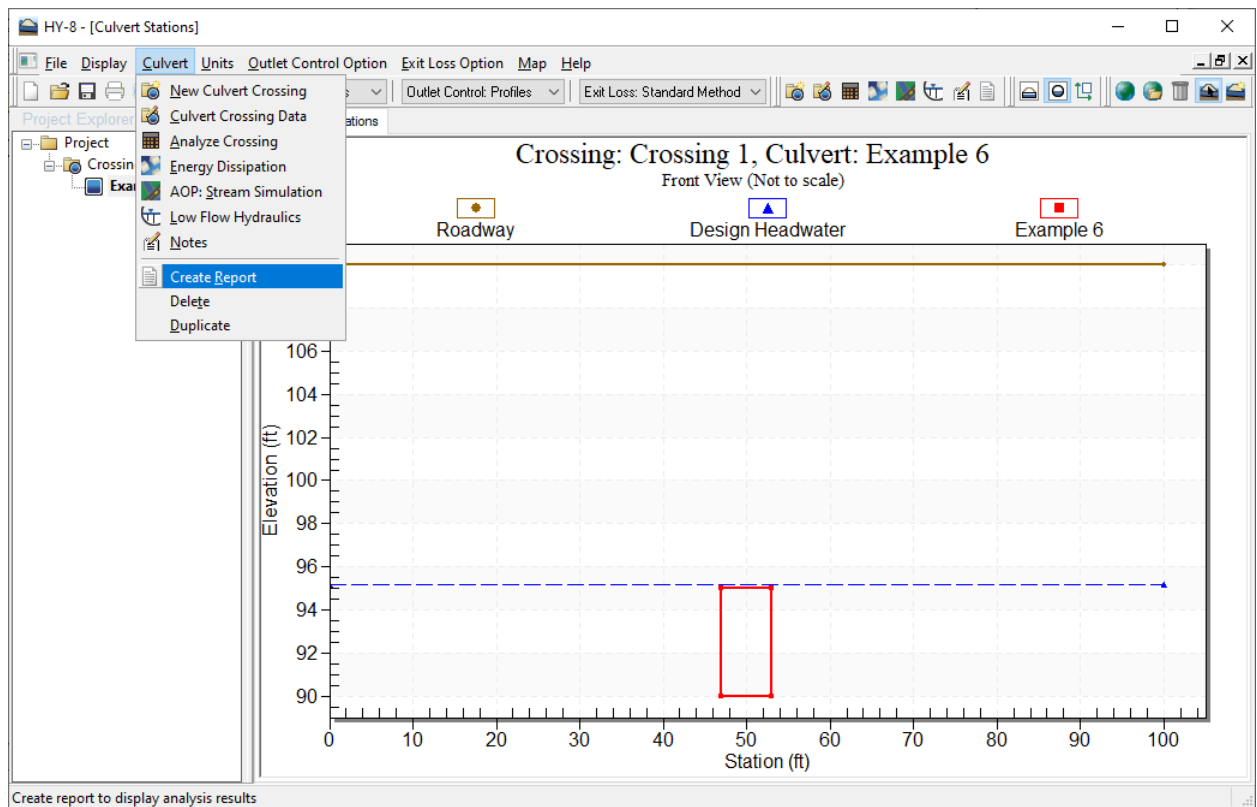
Figure 23: HY-8 main window with Culvert | Create Report menu selected

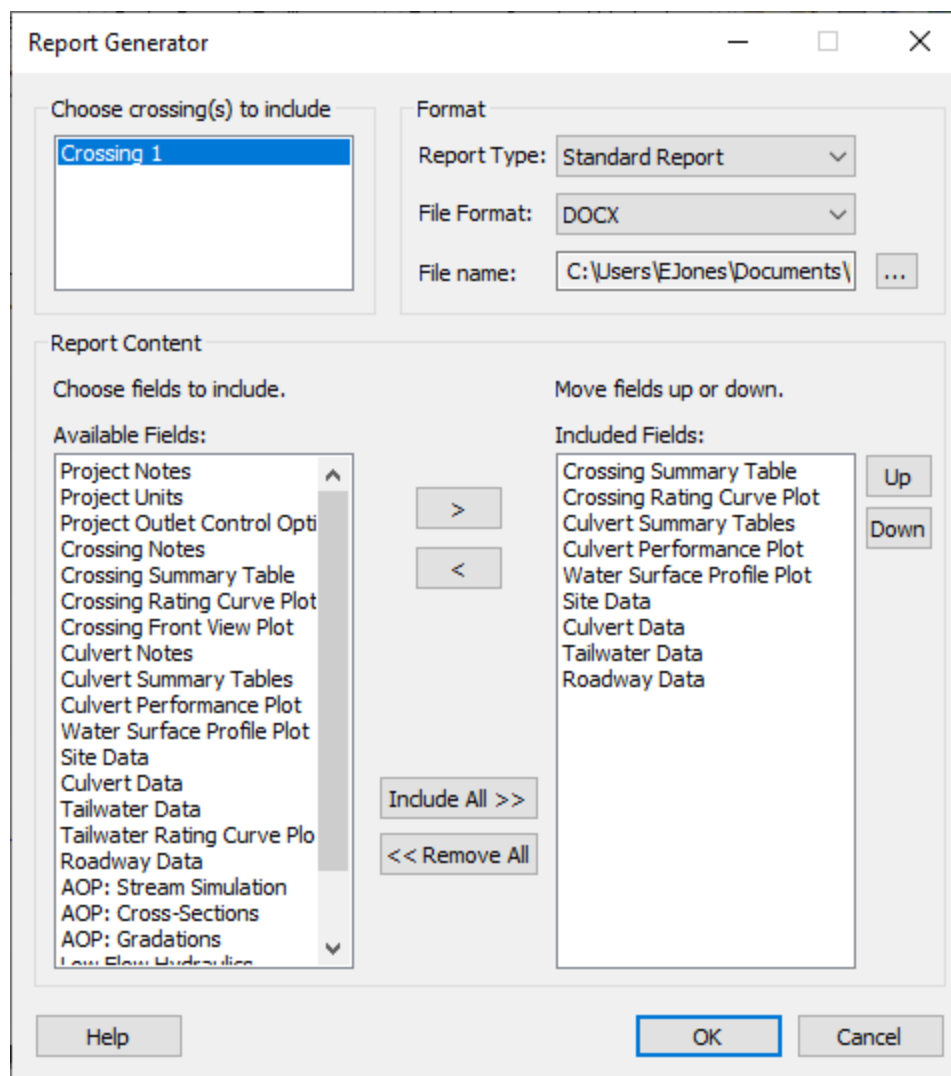29. The *Report Generator* window will appear:

Figure 24: Report Generator window

30. Select the "…" button, navigate to a folder where you have write permissions, and name the file "QuickTutorial". HY-8 will add the appropriate file extension. If the file exists, you will be asked if you want to replace it. If the file is locked, you will be notified and advised to close any program that is accessing the file. Alternatively, you could specify a different filename.

31. Additional data can be added to the report by selecting some or all items in the *Available fields* window and using the right arrow (>) to copy the fields from the available fields to the included fields window.

32. Select OK to export the data in the Included Fields to a report file. After selecting OK, a Microsoft word document (DOCX) file is exported and opened by the system's default DOCX reader.

2.6   Getting Help

Beyond this and the HDS-5 document, the majority of the HY-8 documentation is self-contained within the program. The functional use of the program is documented in the hyper-

linked user manual file available from the Help menu or by selecting help buttons or icons (⊙) from the graphical user interface. The User Manual goes into more depth about the variables used in HY-8, the interface, information on the more advanced options, and the computations being used in HY-8. While the help file is organized to provide context-sensitive help, it can be printed out and organized into a hard copy manual.

Additionally, the National Highway Institute provides courses on application of the HY-8 software (135094 – Culvert Hydraulic Analysis and Design Program (HY-8) Web-Based" and other courses).

While FHWA does not offer any user support (as described in the Terms and Conditions for downloading and using the program), comments and bug reports may be sent to:

 CommentsOnHY8@dot.gov