Culvert Modeling Options

~or~

“Hec! Ras! How HY-8 to get up in the morning.”

James Justin Mercier, P.E.

Hydraulics Engineer

Design Division - Hydraulics

Which One?

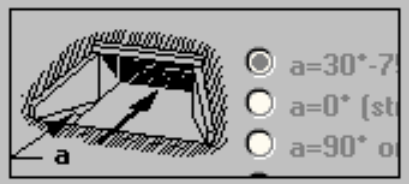
- Culvert?
- HY-8?
- HEC-RAS?

TxDOT Culvert Design - Ver. 1.2 February, 2002

File Edit Print Options Help

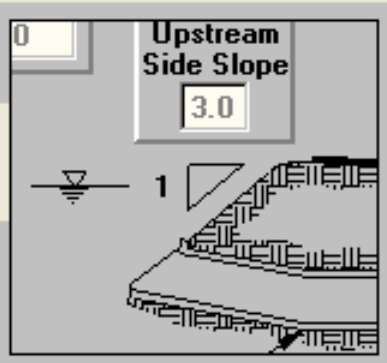
Project File:

Texas Hydraulic System Culvert Design



created by

Steve Jensen
Mihai Stan, P.E.
Jay Vose, P.E.



Description	HW Elev.	TW Elev.	Velocity
2yr	3.61	0.10	9.25
5yr	3.82	0.15	9.47
10yr	4.24	0.18	9.92

The results derived from the Texas Hydraulics System Culvert Design program are intended for the review, interpretation, and approval by a registered professional engineer. The program has been tested; however, the developers assume no responsibility for the validity of the results produced by the Texas Hydraulics System Culvert Design program.

from

Texas Department of Transportation

TxDOT Culvert Design

DES-BRG

Units In: English
Units Out: English

Save | Calculate | Exit

Configuration | Profile | Discharge/TW | Roadway Profile | Results

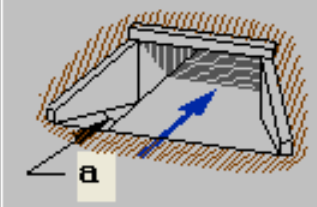
Shape
- Arch
- Pipe Arch
- Box
- Circular
- Elliptical

Material
- Aluminum
- Concrete
- Steel
- Plastic

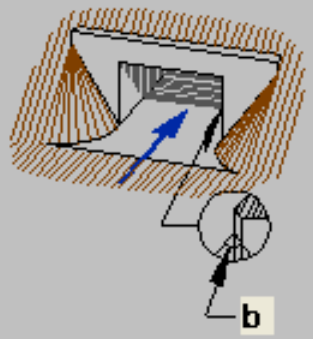
Size Setting/Computation Mode
- Design — Maximum Rise: 4.00
- Analysis — Barrels: 1; Span: 5.000; Rise: 3.000

Entrance Ce: .2

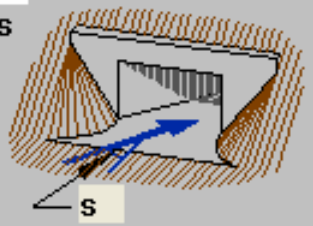
Manning's 'n': .012



- a=30°-75°
- a=0° (straight)
- a=90° or 15°
- a=45° with top bevel
- a=18.4° with skew (s=30°)



- 3/4" chamfer at edges
- b=45° bevel
- b=33.7° bevel



- s=10°-45° skew w/ bevel
- s=30° skew
- s=15° skew

TxDOT Culvert Design

DES-BRG

Units In	Units Out
English	English

Save | Calculate | Output File | Exit

Configuration | Profile | Discharge/TW | Roadway Profile | Results

Max Headwater Elevation: 0.00

Upstream Side Slope: 3.0

Downstream Side Slope: 3.0

Upstream Toe of Slope

Station: 0.0

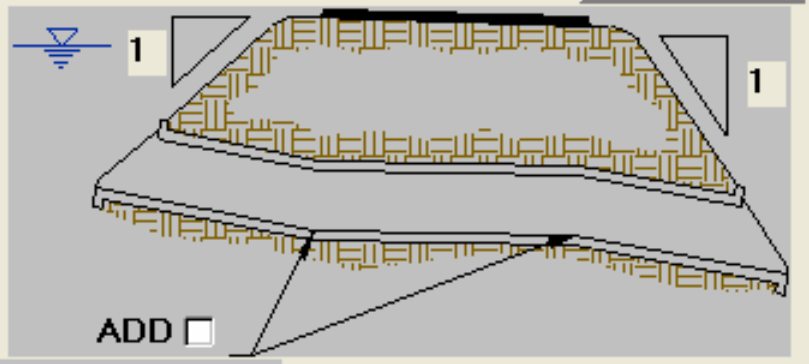
Elevation: 600.00

Length: 82.0

Inlet Opening

Station: 9.0

Elevation: 599.99



Downstream Toe of Slope

Station: 100

Elevation: 599.9

Outlet Opening

Station: 91.0

Elevation: 599.91

- The culvert length is measured as the difference between the INLET and OUTLET stations with adjustment for the side slopes.
- BREAK POINTS determine the location of a change in the slope for a broken back culvert.

TxDOT Culvert Design

DES-BRG

Units In	Units Out
English	English

Save | Calculate | Output File | Exit

Configuration | Profile | Discharge/TW | Roadway Profile | Results

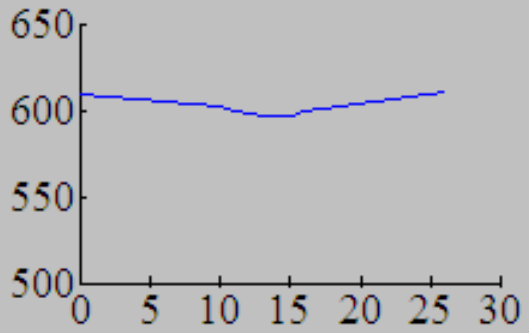
Discharge

Description	Discharge
2 year	100
5 year	175
10 year	325
25 year	550
50 year	700
100 year	1000

Tailwater

Input

Compute from Cross Section



Add | Delete | Insert | Plot

X	Y
11	600
13	598
15	598
16	600
26	612

Manning's "n"	Channel Slope
0.0300	0.0030

TxDOT Culvert Design

DES-BRG

Units In: English | Units Out: English

Save | Calculate | Exit

Configuration | Profile | Discharge/TW | Roadway Profile | Results

Profile Coordinates

Add | Delete | Insert | Plot

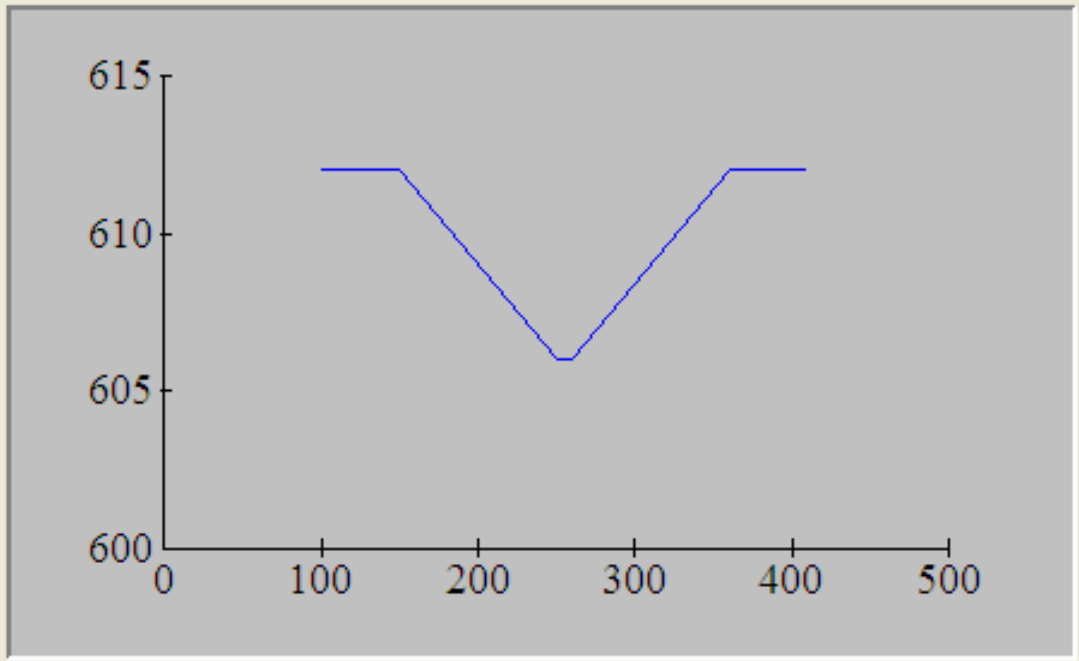
Station	Elevatio
100	6
150	6
250	6
260	6
360	6
410	6

Roadway Data

- (•) Pavement
- ( ) Gravel
- ( ) Specified Weir Coef. ...

Roadway (Crown) Width: 50

Weir Coef.: 3.00



```
       CULVERT  OUTPUT      RUN NO =>  3
-------------------------------------------------------------------------------

TAILWATER ELEVATION:    605.94 ft (computed).

ANALYSIS for discharge frequency of :   10 year

Barls. Qpb  Rise  Span  Length  Max.HW  Calc.HW  HW  Control  Veloc. Out.depth
                                 elev    elev
       cfs   ft    ft     ft      ft      ft     ft            ft/s     ft
-------------------------------------------------------------------------------
  1 180.27  3.00  5.00   82.00    0.00  607.05  7.06 Inlet    12.02    3.00

Inlet control depth  =      7.06 ft
Outlet control depth =      9.48 ft

Normal depth   =     3.00 ft    Culvert slope  =     0.00100
Critical depth =     3.00 ft    Critical slope =     0.01027
Road top width  => 50.00 ft.  Road pavement type => asphalt
Computed Weir Coefficient => 3.04.

Toal Discharge                  =>   325.00 cfs
Discharge per barrel            =>   180.27 cfs
Discharge over the road         =>   144.73 cfs
Average velocity over the road  =>     2.35 ft/sec
-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
       CULVERT  OUTPUT      RUN NO =>  4
-------------------------------------------------------------------------------

TAILWATER ELEVATION:    607.71 ft (computed).

ANALYSIS for discharge frequency of :   25 year

Barls. Qpb  Rise  Span  Length  Max.HW  Calc.HW  HW  Control  Veloc. Out.depth
                                 elev    elev
       cfs   ft    ft     ft      ft      ft     ft            ft/s     ft
-------------------------------------------------------------------------------
  1  73.05  3.00  5.00   82.00    0.00  608.29  8.30 Outlet    4.87    3.00

Inlet control depth  =      2.94 ft
Outlet control depth =      8.30 ft

Normal depth   =     3.00 ft    Culvert slope  =     0.00100
Critical depth =     1.88 ft    Critical slope =     0.00359
Road top width  => 50.00 ft.  Road pavement type => asphalt
Computed Weir Coefficient => 3.05.

Toal Discharge                  =>   550.00 cfs
Discharge per barrel            =>    73.05 cfs
Discharge over the road         =>   476.95 cfs
Average velocity over the road  =>     3.48 ft/sec
-------------------------------------------------------------------------------
```

```
-----------------------------------------------------------------------------
       CULVERT  OUTPUT      RUN NO =>  5
-----------------------------------------------------------------------------

TAILWATER ELEVATION:    608.63 ft (computed).

ANALYSIS for discharge frequency of :   50 year

Barls. Qpb  Rise  Span  Length  Max.HW  Calc.HW  HW  Control  Veloc. Out.depth
                                elev    elev
       cfs   ft    ft     ft      ft      ft     ft            ft/s     ft
-----------------------------------------------------------------------------
  1 211.23  3.00  5.00   82.00    0.00  608.76  8.77 Inlet    14.08    3.00

Inlet control depth  =      8.77 ft
Outlet control depth =     13.49 ft

Normal depth   =     3.00 ft    Culvert slope  =     0.00100
Critical depth =     3.00 ft    Critical slope =     0.01409
Road top width  => 50.00 ft.  Road pavement type => asphalt
Computed Weir Coefficient => 3.05.

Toal Discharge                 =>   700.00 cfs
Discharge per barrel           =>   211.23 cfs
Discharge over the road        =>   488.77 cfs
Average velocity over the road  =>     2.92 ft/sec
-----------------------------------------------------------------------------
-----------------------------------------------------------------------------
       CULVERT  OUTPUT      RUN NO =>  6
-----------------------------------------------------------------------------

TAILWATER ELEVATION:    610.11 ft (computed).

ANALYSIS for discharge frequency of :   100 year

Barls. Qpb  Rise  Span  Length  Max.HW  Calc.HW  HW  Control  Veloc. Out.depth
                                elev    elev
       cfs   ft    ft     ft      ft      ft     ft            ft/s     ft
-----------------------------------------------------------------------------
  1  42.97  3.00  5.00   82.00    0.00  610.31 10.32 Outlet    2.86    3.00

Inlet control depth  =      2.00 ft
Outlet control depth =     10.32 ft

Normal depth   =     2.03 ft    Culvert slope  =     0.00100
Critical depth =     1.32 ft    Critical slope =     0.00337
Road top width  => 50.00 ft.  Road pavement type => asphalt
Computed Weir Coefficient => 3.09.

Toal Discharge                 =>  1000.00 cfs
Discharge per barrel           =>    42.97 cfs
Discharge over the road        =>   957.03 cfs
Average velocity over the road  =>     3.71 ft/sec
```

TxDOT Culvert Design

DES-BRG

Units In: English | Units Out: English

Save | Calculate | Output File | Exit

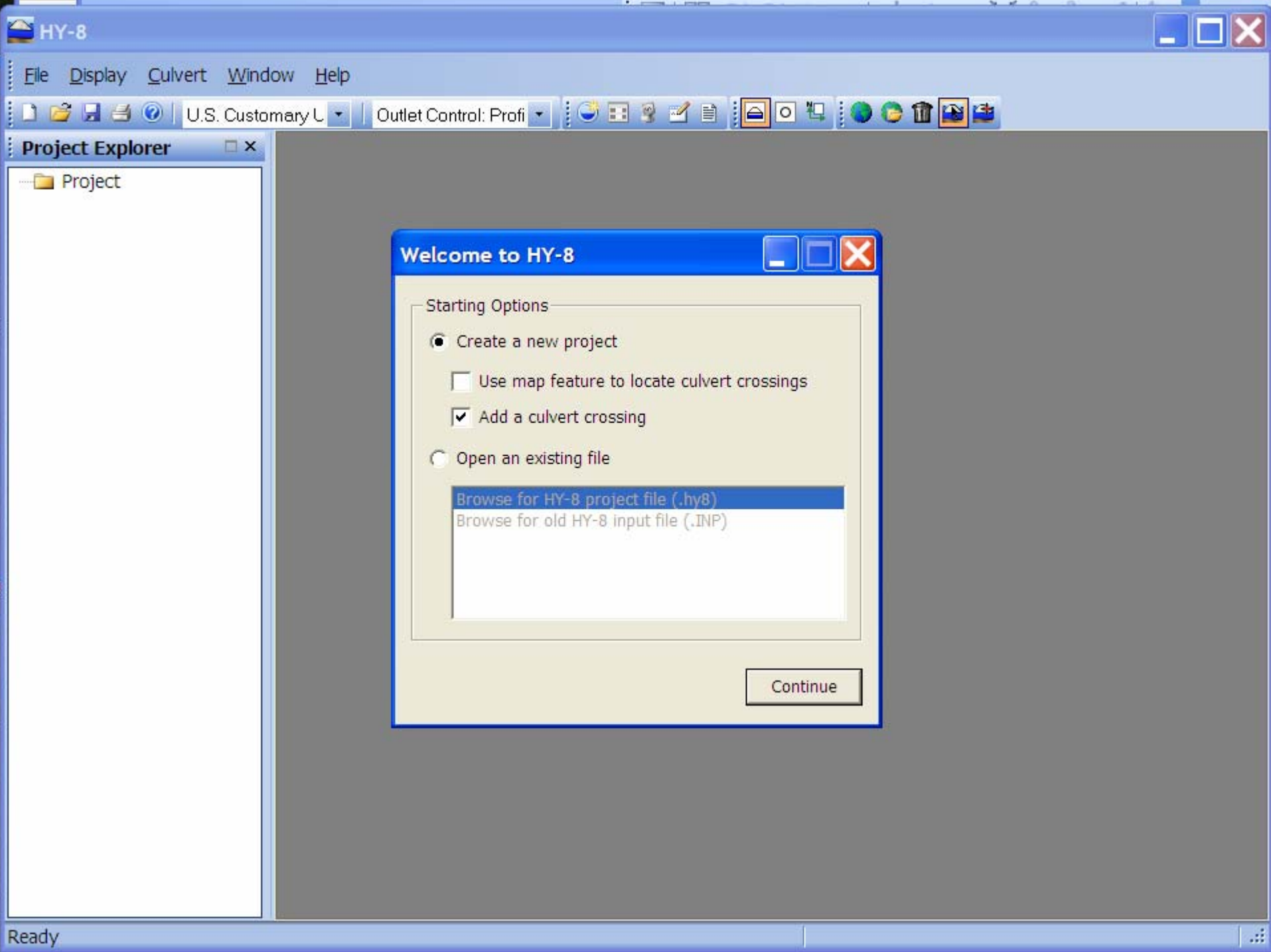
Configuration | Profile | Discharge/TW | Roadway Profile | Results

Analysis

Set Columns

Description	HW Elev.	TW Elev.	Velocity	Q total	Q per barrel	Q over road	Normal Depth	Critical Depth	Inlet Ctl. HW	Outlet Ctl. HW
2 year	603.801	602.676	6.667	100.000	100.000	0.000	3.000	2.317	3.781	3.810
5 year	606.195	604.136	10.846	175.000	162.695	12.305	3.000	3.000	6.204	7.024
10 year	607.049	605.941	12.018	325.000	180.273	144.727	3.000	3.000	7.058	9.485
25 year	608.293	607.713	4.870	550.000	73.047	476.953	3.000	1.879	2.943	8.302
50 year	608.761	608.631	14.082	700.000	211.230	488.770	3.000	3.000	8.770	13.494
100 year	610.313	610.108	2.865	1000.000	42.969	957.031	2.030	1.319	2.004	10.322

Design Alternatives


HY-8
File
Display
Culvert
Window
Help
U.S. Customary U
Outlet Control: Profi
Project Explorer
Project
Welcome to HY-8
Starting Options
Create a new project
Use map feature to locate culvert crossings
Add a culvert crossing
Open an existing file
Browse for HY-8 project file (.hy8)
Browse for old HY-8 input file (.INP)
Continue
Ready

Crossing Data - Crossing 1

Crossing Properties

Name: Crossing 1

Parameter	Value	Uni
DISCHARGE DATA		
Minimum Flow	0.00	cfs
Design Flow	0.00	cfs
Maximum Flow	0.00	cfs
TAILWATER DATA		
Channel Type	Rectangular Channel	
Bottom Width	0.00	ft
Channel Slope	0.0000	ft/ft
Manning's n (channel)	0.0000	
Channel Invert Elevation	0.00	ft
Rating Curve	View...	
ROADWAY DATA		
Roadway Profile Shape	Constant Roadway Elevation	
First Roadway Station	0.00	ft
Crest Length	0.00	ft
Crest Elevation	0.00	ft
Roadway Surface	Paved	
Top Width	0.00	ft

Culvert Properties

Culvert 1

Add Culvert

Duplicate Culvert

Delete Culvert

Parameter	Value	Un
CULVERT DATA		
Name	Culvert 1	
Shape	Circular	
Material	Concrete	
Diameter	0.00	ft
Manning's n	0.0120	
Inlet Type	Conventional	
Inlet Edge Condition	Square Edge with Headwall	
Inlet Depression?	No	
SITE DATA		
Site Data Input Option	Culvert Invert Data	
Inlet Station	0.00	ft
Inlet Elevation	0.00	ft
Outlet Station	0.00	ft
Outlet Elevation	0.00	ft

Help

Click on any icon for help on a specific

Analyze Crossing

OK

Cancel

Crossing Data - Desbrg Creek

Crossing Properties

Name: Desbrg Creek

Parameter	Value	Units
DISCHARGE DATA		
Minimum Flow	100.00	cfs
Design Flow	100.00	cfs
Maximum Flow	1000.00	cfs
TAILWATER DATA		
Channel Type	Trapezoidal Channel	
Bottom Width	2.00	ft
Side Slope (H:V)	1.00	_:1
Channel Slope	0.0164	ft/ft
Manning's n (channel)	0.0300	
Channel Invert Elevation	599.90	ft
Rating Curve	View...	
ROADWAY DATA		
Roadway Profile Shape	Irregular	
Irregular Shape	Define...	
Roadway Surface	Paved	
Top Width	50.00	ft

Culvert Properties

Culvert 1

Add Culvert

Duplicate Culvert

Delete Culvert

Parameter	Value	Units
CULVERT DATA		
Name	Culvert 1	
Shape	Concrete Box	
Material	Concrete	
Span	5.00	ft
Rise	3.00	ft
Manning's n	0.0120	
Inlet Type	Conventional	
Inlet Edge Condition	1:1 Bevel Headwall	
Inlet Depression?	No	
SITE DATA		
Site Data Input Option	Culvert Invert Data	
Inlet Station	0.00	ft
Inlet Elevation	600.00	ft
Outlet Station	82.00	ft
Outlet Elevation	599.90	ft

Help

Click on any icon for help on a specific

Analyze Crossing

OK

Cancel

HY-8 - [Culvert Stations]

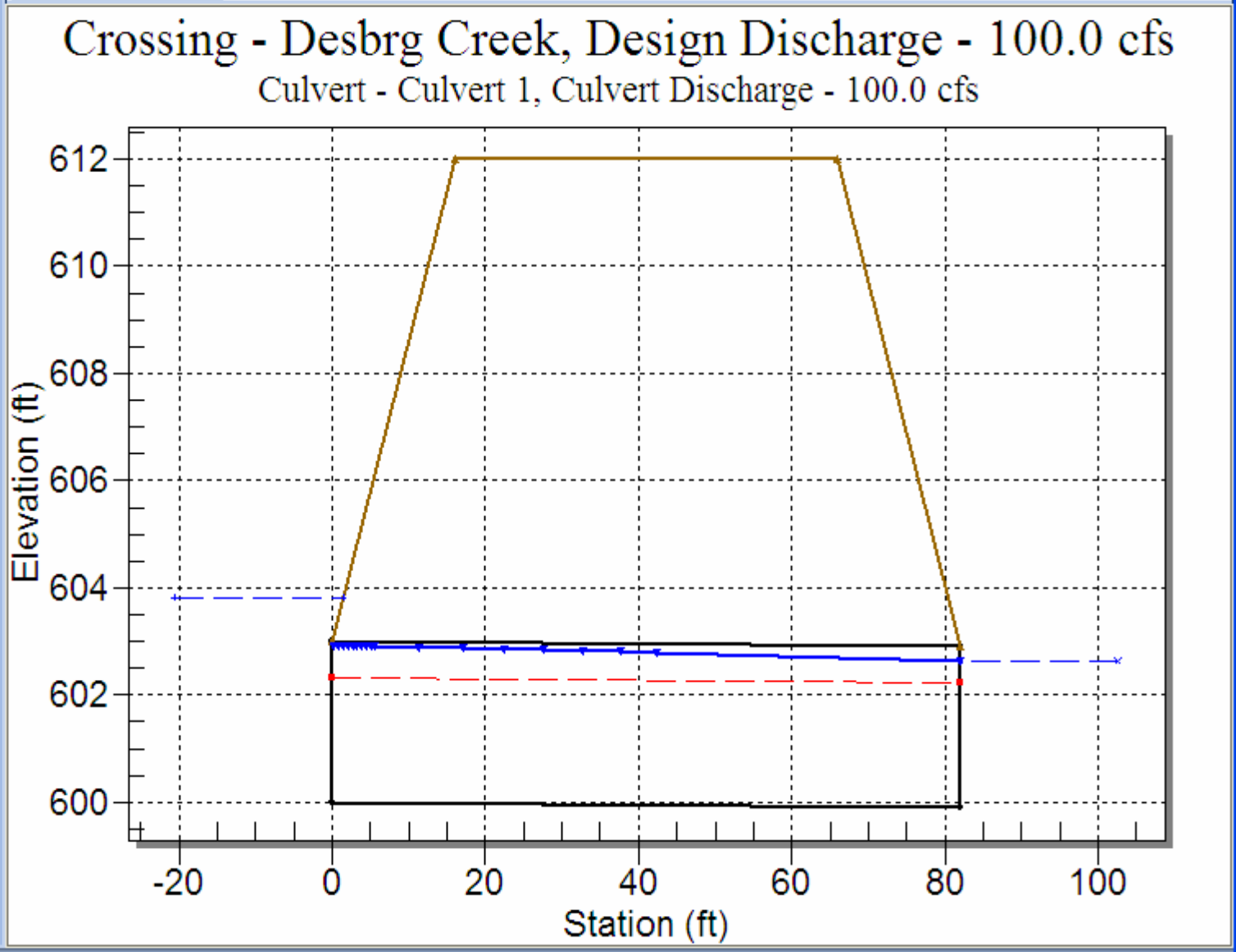
File Display Culvert Window Help

U.S. Customary U | Outlet Control: Profi

Project Explorer

- Project
  - Desbrg Creek
    - Culvert 1

Culvert Stations



Ready

Summary of Flows at Crossing - Desbrg Creek

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
603.79	100.00	100.00	0.00	1
606.60	190.00	166.19	23.79	7
607.30	280.00	166.01	113.96	5
607.72	370.00	161.59	208.26	5
608.05	460.00	156.51	303.34	5
608.31	550.00	151.31	398.56	5
608.55	640.00	146.08	493.80	5
608.75	730.00	140.95	588.55	4
608.94	820.00	135.94	683.85	4
609.11	910.00	130.97	778.96	4
609.27	1000.00	126.01	873.62	3
606.00	159.88	159.88	0.00	Overtopping

Display

- (●) Crossing Summary Table
- ( ) Culvert Summary Tabl — Culvert 1
- ( ) Water Surface Profiles
- ( ) Improved Inlet Table
- ( ) Customized Table — Options...

Geometry

Inlet Elevation:	600.00 ft
Outlet Elevation:	599.90 ft
Culvert Length:	82.00 ft
Culvert Slope:	0.0012
Inlet Crest:	0.00 ft
Inlet Throat:	0.00 ft

Plot

- Crossing Rating Curve
- Culvert Performance Curve
- Selected Water Profile

Help | Flow Types... | Edit Input Data...

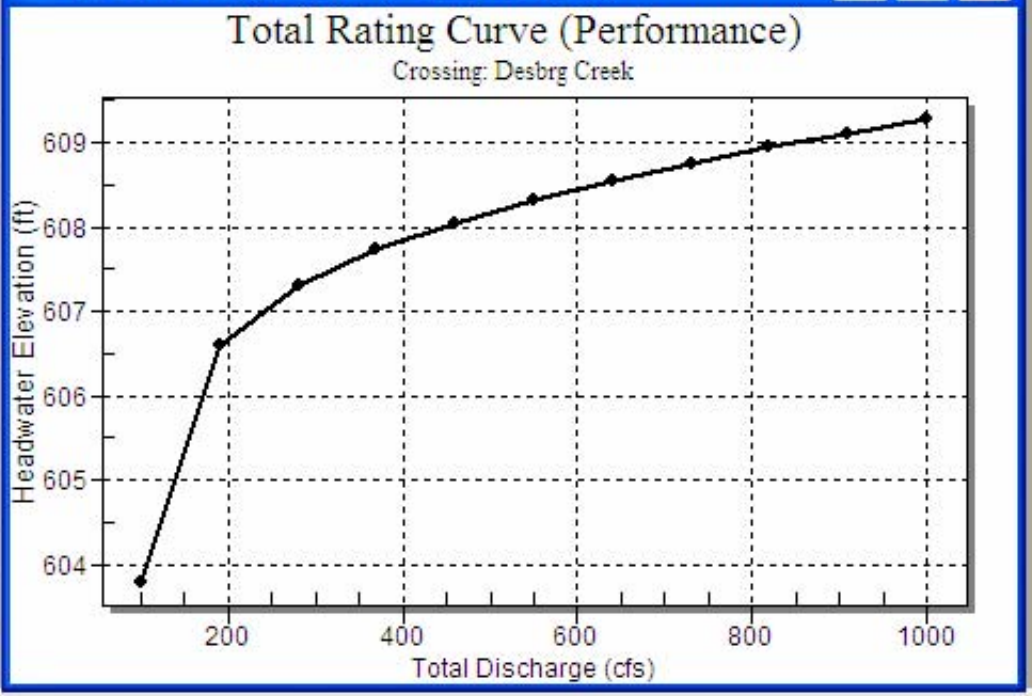
Outlet Control: Profiles

Close

Summary of Flows at Crossing - Desbrg Creek

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
603.79	100.00	100.00	0.00	1
606.60	190.00	166.19	23.79	7
607.30	280.00	166.01	113.96	5
607.72	370.00	161.59	208.26	5
608.05	460.00	156.51	303.34	5
608.31	550.00	151.31	398.56	5
608.55	640.00	146.08	493.80	5
608.75	730.00	140.95	588.55	4
608.94	820.00	135.94	683.85	4
609.11	910.00	130.97	778.96	4
609.27	1000.00	126.01	873.62	3
606.00	159.88	159.88	0.00	Overtopping

Total Rating Curve (Performance)



Display

- (●) Crossing Summary Table
- ( ) Culvert Summary Tabl — Culvert 1
- ( ) Water Surface Profiles
- ( ) Improved Inlet Table
- ( ) Customized Table — Options...

Geometry

Inlet Elevation:	600.00 ft
Outlet Elevation:	599.90 ft
Culvert Length:	82.00 ft
Culvert Slope:	0.0012
Inlet Crest:	0.00 ft
Inlet Throat:	0.00 ft

Plot

- Crossing Rating Curve
- Culvert Performance Curve
- Selected Water Profile

Help | Flow Types... | Edit Input Data...

Outlet Control: Profiles

Close

Water Surface Profile Table - Culvert 1

Total Discharge	Culvert Discharge	Headwater Elevation (ft)	Inlet Control Depth(ft)	Outlet Control Depth(ft)	Flow Type	Length Full (ft)	Length Free (ft)	Last Step (ft)	Mean Slope (%)	First Depth (ft)	Last Depth (ft)
100.00	100.00	603.79	3.76	**3.79**	3-M2t	0.00	81.72	0.60	0.21	2.74	2.92
190.00	166.19	606.60	6.29	**6.60**	4-FFf	82.00	0.00	0.00	0.00	3.00	3.00
280.00	166.01	607.30	6.28	**7.30**	4-FFf	82.00	0.00	0.00	0.00	3.00	3.00
370.00	161.59	607.72	6.08	**7.72**	4-FFf	82.00	0.00	0.00	0.00	3.00	3.00
460.00	156.51	608.05	5.85	**8.05**	4-FFf	82.00	0.00	0.00	0.00	3.00	3.00
550.00	151.31	608.31	5.63	**8.31**	4-FFf	82.00	0.00	0.00	0.00	3.00	3.00
640.00	146.08	608.55	5.41	**8.55**	4-FFf	82.00	0.00	0.00	0.00	3.00	3.00
730.00	140.95	608.75	5.20	**8.75**	4-FFf	82.00	0.00	0.00	0.00	3.00	3.00
820.00	135.94	608.94	5.01	**8.94**	4-FFf	82.00	0.00	0.00	0.00	3.00	3.00
910.00	130.97	609.11	4.82	**9.11**	4-FFf	82.00	0.00	0.00	0.00	3.00	3.00
1000.00	126.01	609.27	4.63	**9.27**	4-FFf	82.00	0.00	0.00	0.00	3.00	3.00

Display

- ○ Crossing Summary Table
- ○ Culvert Summary Tabl — Culvert 1
- ● Water Surface Profiles
- ○ Improved Inlet Table
- ○ Customized Table — Options...

Geometry

Inlet Elevation:	600.00 ft
Outlet Elevation:	599.90 ft
Culvert Length:	82.00 ft
Culvert Slope:	0.0012
Inlet Crest:	0.00 ft
Inlet Throat:	0.00 ft

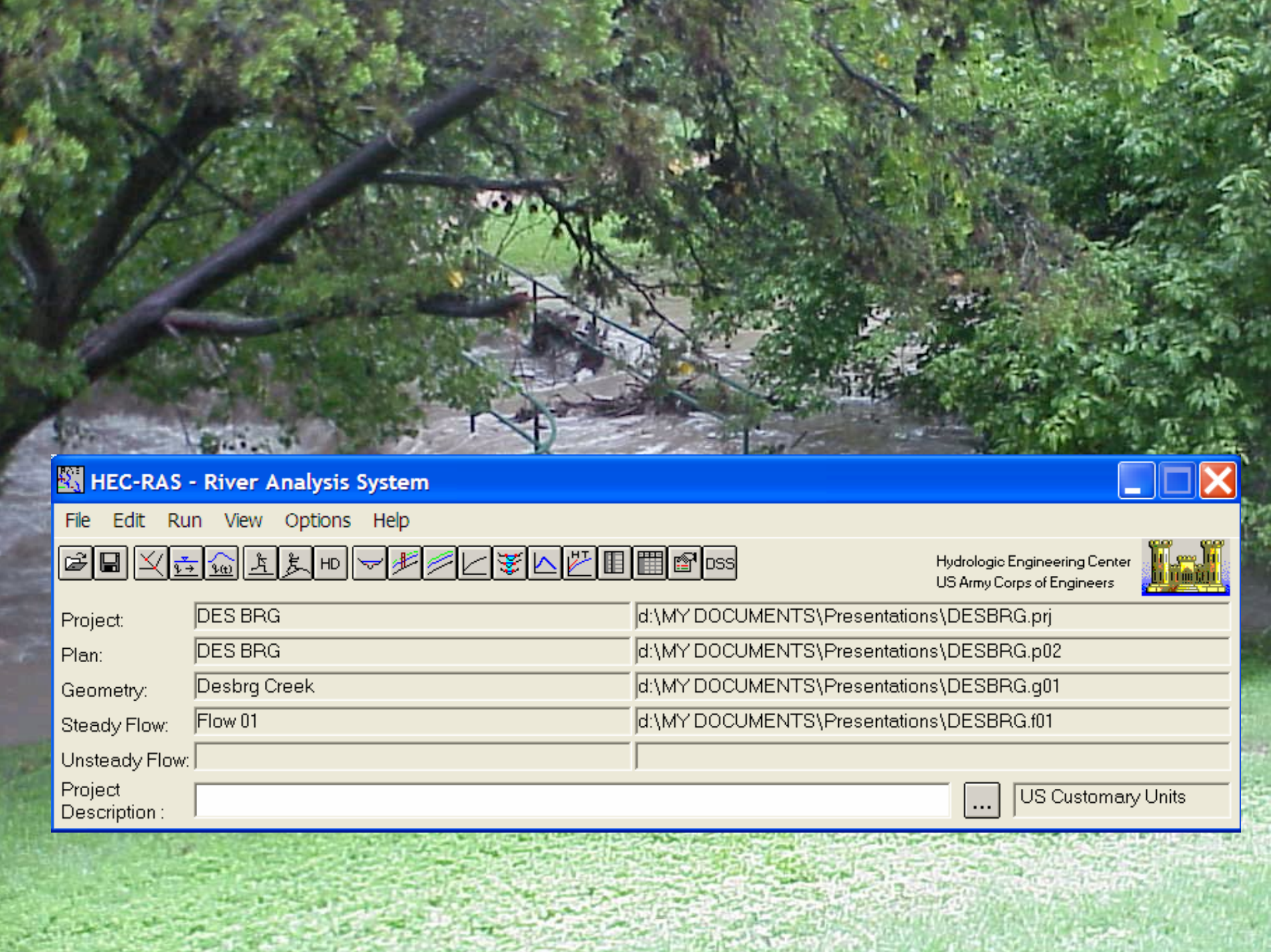
Plot

- Crossing Rating Curve
- Culvert Performance Curve
- Selected Water Profile

Help | Flow Types... | Edit Input Data...

Outlet Control: Profiles

Close


HEC-RAS - River Analysis System
File Edit Run View Options Help
HD
DSS
Hydrologic Engineering Center
US Army Corps of Engineers
Project: DES BRG d:\MY DOCUMENTS\Presentations\DESBRG.prj
Plan: DES BRG d:\MY DOCUMENTS\Presentations\DESBRG.p02
Geometry: Desbrg Creek d:\MY DOCUMENTS\Presentations\DESBRG.g01
Steady Flow: Flow 01 d:\MY DOCUMENTS\Presentations\DESBRG.f01
Unsteady Flow:
Project Description :
...
US Customary Units

HEC-RAS - River Analysis System

File Edit Run View Options Help

Hydrologic Engineering Center
US Army Corps of Engineers

Project: DES BRG d:\MY DOCUMENTS\Presentations\DESBRG.prj

Plan: DES BRG d:\MY DOCUMENTS\Presentations\DESBRG.p02

Bridge Culvert Data - Desbrg Creek

File View Options Help

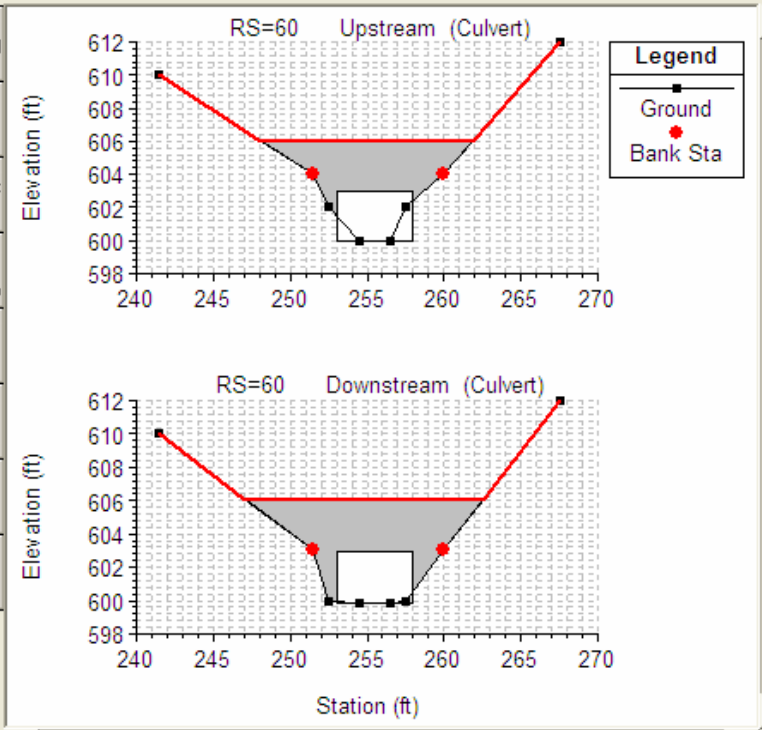
River: Desbrg Creek Apply Data

Reach: SH 4888 River Sta.: 60

Description

Bounding XS's: 102 20 Distance between: 82 (ft)

Deck/Roadway
Pier
Sloping Abutment
Bridge Modeling Approach
Culvert
Multiple Opening Analysis
HTab Param.
Bridge Design



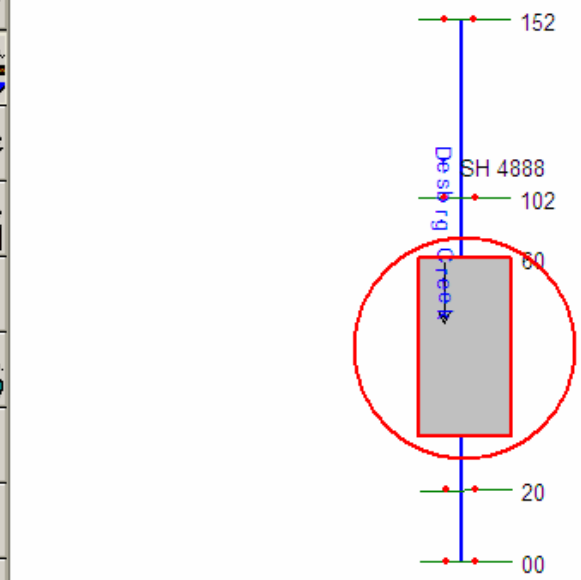
Select the river for Bridge/Culvert Editing

Geometric Data - Desbrg Creek

File Edit View Tables Tools Help

Tools Editors | River Reach | Storage Area | S.A. Conn. | Pump Station | RS 12.99

Junct.
Cross Section
Brdg/Culv.
Inline Structure
Lateral Structure
Storage Area
Storage Area Conn.
Pump Station
HTab Param.
View Picture



0.7400, 0.9398

Cross Section Data - Desbrg Creek

Exit Edit Options Plot Help

River: Desbrg Creek | Apply Data | Plot Options | Keep Prev XS Plots | Clear Prev

Reach: SH 4888 | River Sta.: 00

Description: 20 ft downstream of outlet

Del Row | Ins Row

Cross Section X-Y Coordinates

	Station	Elevation
1	241.5	610
2	251.5	603
3	252.5	600
4	254.5	598
5	256.5	598
6	257.5	600
7	260	603
8	267.5	612
9		
10		
11		

Downstream Reach Lengths

LOB	Channel	ROB
0	0	0

Manning's n Values

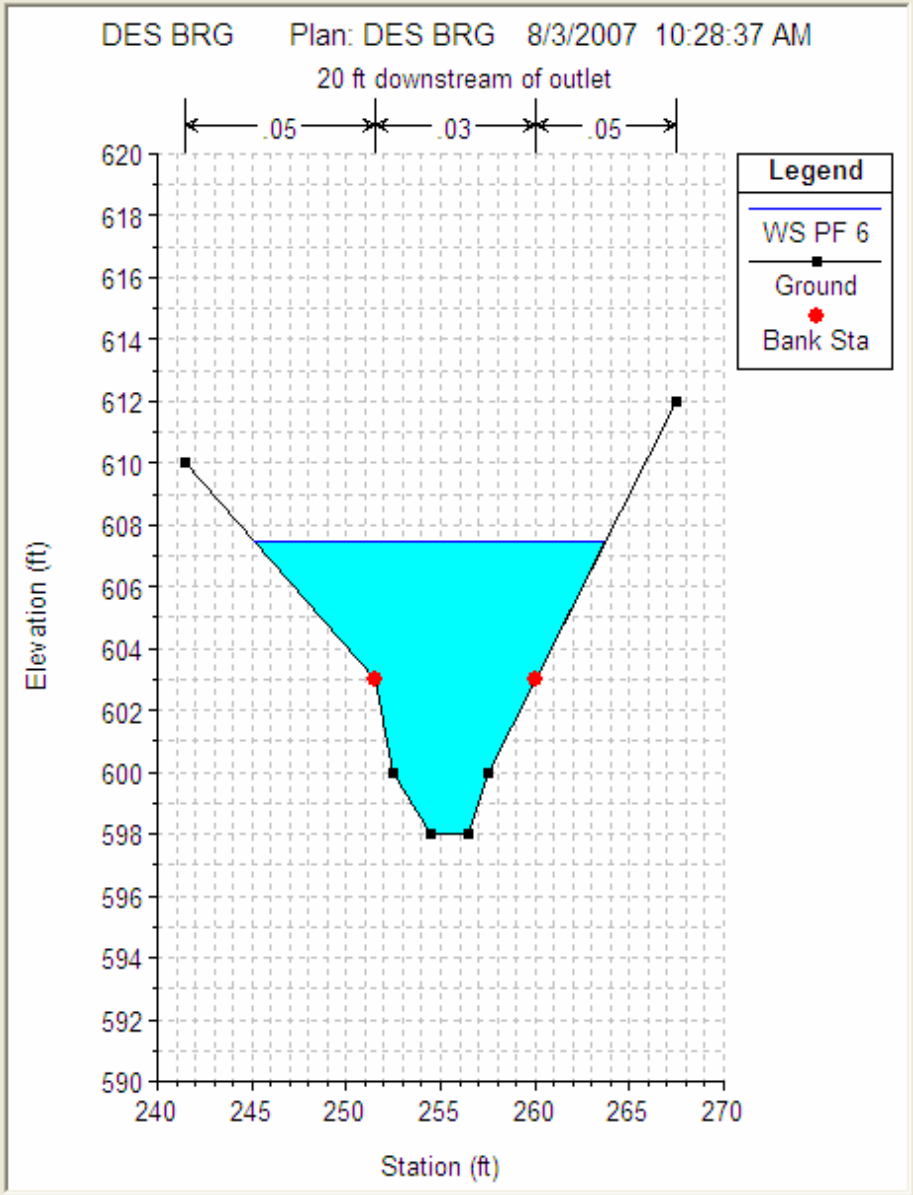
LOB	Channel	ROB
0.05	0.03	0.05

Main Channel Bank Stations

Left Bank	Right Bank
251.5	260

Cont\Exp Coefficients

Contraction	Expansion
0.1	0.3



Select river station for cross section editing.

Cross Section Data - Desbrg Creek

Exit Edit Options Plot Help

River: De

Reach: SH

Description

Del Row

Apply Data

Plot Options

Keep Prev XS Plots

Clear Prev

- Add a new Cross Section ...
- Copy Current Cross Section ...
- Rename River Station ...
- Delete Cross Section ...
- Adjust Elevations ...
- Adjust Stations
- Adjust n or K values ...
- Skew Cross Section ...
- Ineffective Flow Areas ...
- Levees ...
- Obstructions ...
- Add a Lid to XS ...
- Add Ice Cover ...
- Add a Rating Curve ...
- Horizontal Variation in n Values
- Horizontal Variation in K Values
- Vertical Variation in n Values ...

Cross S

	Sta
1	241.5
2	251.5
3	252.5
4	254.5
5	256.5
6	257.5
7	260
8	267.5
9	
10	
11	

nstream Reach Lengths

Channel	ROB
0	0

anning's n Values

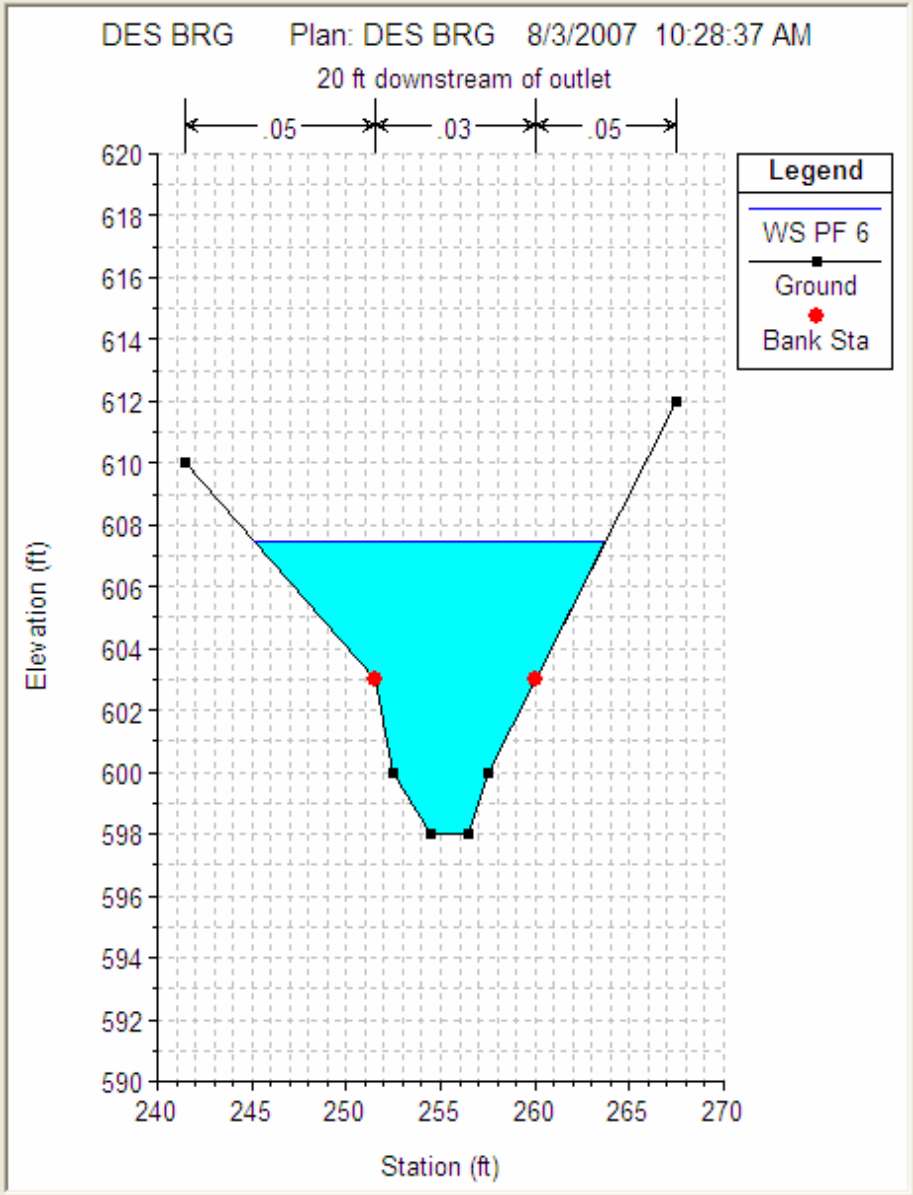
Channel	ROB
0.03	0.05

Channel Bank Stations

ank	Right Bank
	260

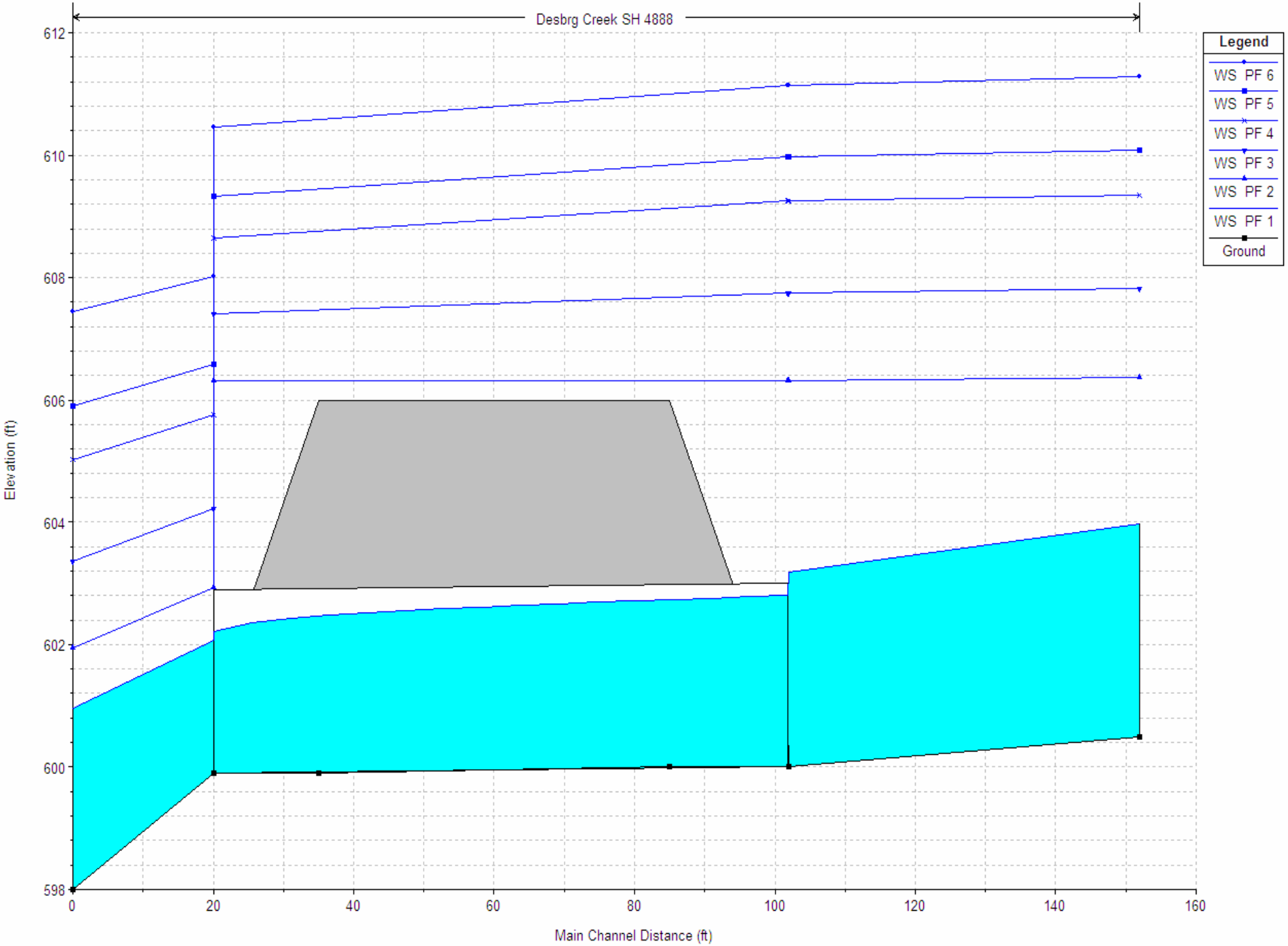
ont\Exp Coefficients

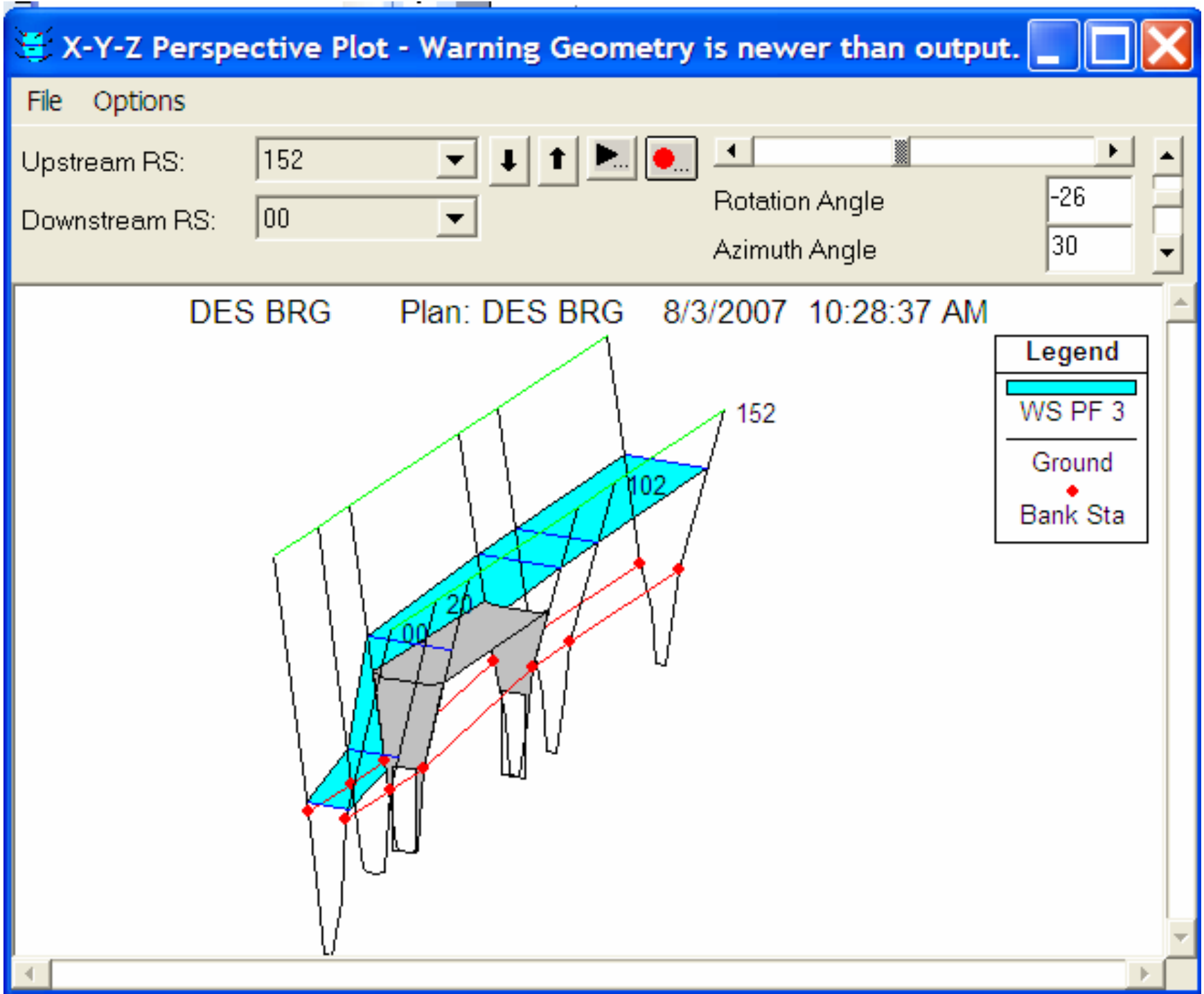
ction	Expansion
	0.3



Select river station for cross section editing.

DES BRG Plan: DES BRG 8/3/2007 10:28:37 AM




X-Y-Z Perspective Plot - Warning Geometry is newer than output.
File
Options
Upstream RS:
152
Downstream RS:
00
Rotation Angle
-26
Azimuth Angle
30
DES BRG
Plan: DES BRG
8/3/2007
10:28:37 AM
Legend
WS PF 3
Ground
Bank Sta
152
102
20
00

Profile Output Table - Standard Table 1

File Options Std. Tables Locations Help

HEC-RAS Plan: DES BRG River: Desbrg Creek Reach: SH 4888

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SH 4888	152	PF 1	100.00	600.50	603.98		604.52	0.008719	5.91	16.92	8.44	0.74
SH 4888	152	PF 2	175.00	600.50	606.38		606.67	0.001734	4.45	44.72	14.70	0.37
SH 4888	152	PF 3	325.00	600.50	607.83		608.31	0.002053	5.86	68.78	18.47	0.43
SH 4888	152	PF 4	550.00	600.50	609.34		610.06	0.002391	7.37	99.71	22.41	0.48
SH 4888	152	PF 5	700.00	600.50	610.08		610.96	0.002633	8.24	117.00	24.20	0.51
SH 4888	152	PF 6	1000.00	600.50	611.28		612.46	0.003052	9.73	146.69	25.33	0.56
SH 4888	102	PF 1	100.00	600.00	603.18	602.98	603.96	0.013465	7.10	14.09	7.06	0.89
SH 4888	102	PF 2	175.00	600.00	606.32	603.93	606.58	0.001482	4.16	47.30	14.55	0.34
SH 4888	102	PF 3	325.00	600.00	607.76	605.24	608.20	0.001893	5.61	70.83	18.29	0.40
SH 4888	102	PF 4	550.00	600.00	609.25	606.77	609.94	0.002315	7.16	101.01	22.17	0.46
SH 4888	102	PF 5	700.00	600.00	609.97	607.60	610.82	0.002604	8.07	117.71	24.05	0.49
SH 4888	102	PF 6	1000.00	600.00	611.15	608.98	612.30	0.003088	9.58	146.61	25.20	0.55
SH 4888	60		Culvert									
SH 4888	20	PF 1	100.00	599.90	602.06	602.06	602.96	0.016113	7.61	13.14	7.41	1.01
SH 4888	20	PF 2	175.00	599.90	602.92	602.92	604.12	0.015768	8.78	19.94	8.41	1.00
SH 4888	20	PF 3	325.00	599.90	604.21	604.21	605.88	0.012588	10.40	32.59	11.25	0.96
SH 4888	20	PF 4	550.00	599.90	605.75	605.75	607.85	0.010288	11.90	52.58	14.73	0.92
SH 4888	20	PF 5	700.00	599.90	606.58	606.58	608.92	0.009631	12.71	65.53	16.60	0.91
SH 4888	20	PF 6	1000.00	599.90	608.02	608.02	610.69	0.008644	13.90	91.83	19.86	0.90
SH 4888	00	PF 1	100.00	598.00	600.96	600.96	601.98	0.018536	8.12	12.31	6.12	1.01
SH 4888	00	PF 2	175.00	598.00	601.95	601.95	603.27	0.018133	9.23	18.97	7.27	1.01
SH 4888	00	PF 3	325.00	598.00	603.36	603.36	605.14	0.016958	10.72	30.44	9.31	1.00
SH 4888	00	PF 4	550.00	598.00	605.02	605.02	607.24	0.012928	12.09	49.05	13.07	0.93
SH 4888	00	PF 5	700.00	598.00	605.91	605.91	608.36	0.011793	12.82	61.62	15.09	0.91
SH 4888	00	PF 6	1000.00	598.00	607.44	607.44	610.19	0.010331	13.92	87.32	18.55	0.89

Culvert Output

File Type Options Help

River: Desbrg Creek | Profile: PF 1 | Culv Group: Culvert #1

Reach: SH 4888 | RS: | Plan: DES BRG

PF 1
PF 2
PF 3
PF 4
PF 5
PF 6

Plan: DES BRG Desbrg Creek SH Culvert #1 Profile: PF 1

Q Culv Group (cfs)			
# Barrels			7.14
Q Barrel (cfs)	100.00	Culv Vel DS (ft/s)	8.64
E.G. US. (ft)	603.96	Culv Inv El Up (ft)	600.00
W.S. US. (ft)	603.18	Culv Inv El Dn (ft)	599.90
E.G. DS (ft)	602.96	Culv Frctn Ls (ft)	0.22
W.S. DS (ft)	602.06	Culv Exit Loss (ft)	0.41
Delta EG (ft)	1.00	Culv Entr Loss (ft)	0.37
Delta WS (ft)	1.11	Q Weir (cfs)	
E.G. IC (ft)	603.96	Weir Sta Lft (ft)	
E.G. OC (ft)	603.75	Weir Sta Rgt (ft)	
Culvert Control	Inlet	Weir Submerg	
Culv WS Inlet (ft)	602.80	Weir Max Depth (ft)	
Culv WS Outlet (ft)	602.22	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	3.00	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.32	Min El Weir Flow (ft)	606.01

Errors, Warnings and Notes

Note:	The normal depth exceeds the height of the culvert. The program assumes that the normal depth is equal to the height of the culvert.

Select Profile

Comparison of Headwater Elevations (datum = 600 ft.)

Freq. Flow	50 % (2 yr) 100 cfs	20 % (5 yr) 175 cfs	10 % (10 Yr) 325 cfs	4 % (25 yr) 550 cfs	2 % (50 yr) 700 cfs	1 % (100 yr) 1000 cfs
HEC-RAS	3.18	6.32	7.76	9.25	9.97	11.15
HY 8	3.79	6.00	7.50	8.31	8.65	9.27
Culvert	3.80	6.20 (7.02 outlet)	7.05 (9.49 outlet)	8.29	8.76 (13.49 outlet)	10.31

Comparison of Flows (cfs through barrel / depth over road)

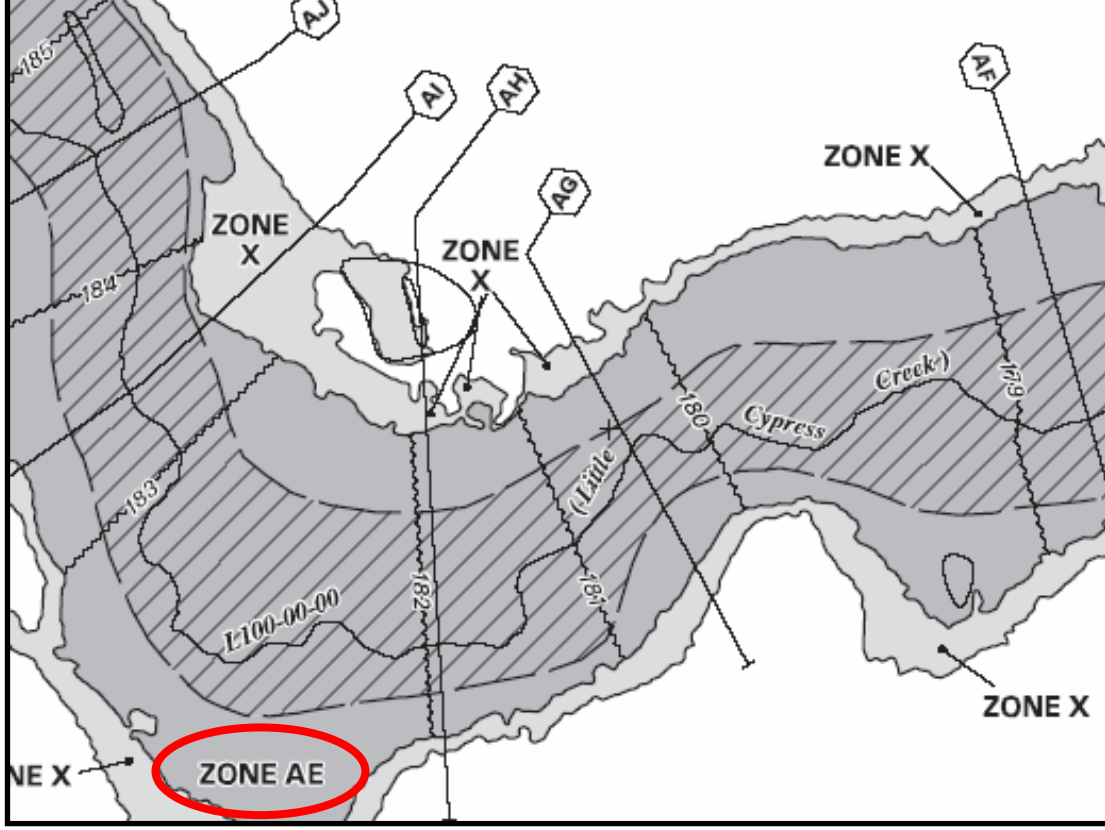
Freq. Flow	50 % (2 yr) 100 cfs	20 % (5 yr) 175 cfs	10 % (10 Yr) 325 cfs	4 % (25 yr) 550 cfs	2 % (50 yr) 700 cfs	1 % (100 yr) 1000 cfs
Culvert	100 0 ft	163 0.20 ft	180 1.05 ft	73 2.29 ft	211 8.76 ft	43 4.32 ft
HY 8	100 0 ft	152 0.13 ft	164 1.51 ft	151 2.31 ft	143 2.68 ft	126 3.27 ft
HEC-RAS	100 0 ft	159 0.59 ft	192 2.21 ft	196 3.95 ft	198 4.82 ft	198 6.29 ft

Comparison of Velocities (tailwater in Feet per Second)

Freq. Flow	50 % (2 yr) 100 cfs	20 % (5 yr) 175 cfs	10 % (10 Yr) 325 cfs	4 % (25 yr) 550 cfs	2 % (50 yr) 700 cfs	1 % (100 yr) 1000 cfs
Culvert	6.7	10.8	12.0	4.9	14.1	2.9
HY 8	7.7	8.4	10.5	11.7	12.5	13.6
HEC-RAS	7.6	8.8	10.4	11.9	12.7	13.9

LONGHORN

HEC-RAS, CULVERT or HY-8?



Use HEC-RAS For:

- **FEMA "AE" Zones ***
- **Bridge Class Culverts Or Culverts Serving Drainage Areas Greater Than One Square Mile**
- **Low Water Crossings**
- **Sensitive Drainage Conditions**

*** FEMA CONSIDERS CULVERT AND HY-8 AS APPROXIMATE METHODS**

Which One?

- Culvert?
- HY-8?
- HEC-RAS?

Which One?

- ~~Culvert?~~
- HY-8?
- HEC-RAS?

Which One?

- ~~Culvert?~~
- ~~HY-8?~~
- HEC-RAS?

Which One?

- ~~Culvert?~~
- ~~HY-8?~~
- HEC-RAS

“But, I wanna use Culvert…”

- ~~Culvert?~~
- ~~HY-8?~~
- HEC-RAS