

Appendix C

Hydrologic Model Input Data and Results

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- Culvert Data Table
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Appendix C

Table C.1 Haines Branch Hydrologic Inputs

Basin Name	Area (acres)	Basin CN	Basin Lag Time (hr)	Area within Area of Interest (acres)	Percentage of Basin within AOI
HB001	27	94	0.12	27	100%
HB002	19	86	0.16	19	100%
HB003	30	92	0.89	30	100%
HB004	124	86	0.38	99	80%
HB005	158	82	0.52	72	46%
HB006	147	85	0.39	53	36%
HB007	71	79	0.58	16	23%
HB008	146	80	1.14	20	14%
HB009	107	84	0.36	46	43%

Table C.2 Haines Branch Hydrologic Results

Basin Name	Q, 2yr (cfs)	Q, 5yr (cfs)	Q, 10yr (cfs)	Q, 25yr (cfs)	Q, 50yr (cfs)	Q, 100yr (cfs)	Q, 500yr (cfs)
HB001	77.7	105.6	128.2	148.3	166.9	186.8	230.4
HB002	35.6	52.4	66.8	79.7	91.7	104.6	132.7
HB003	74.0	103.3	127.0	148.2	167.7	188.7	234.5
HB004	150.2	226.0	289.4	346.5	399.6	456.8	582.1
HB005	131.4	206.7	270.8	329.2	383.7	443.0	573.1
HB006	167.3	254.9	328.3	394.7	456.4	523.1	669.2
HB007	46.4	76.1	101.8	125.5	148.0	172.7	227.3
HB008	60.8	99.2	132.5	163.2	192.0	223.4	293.0
HB009	121.5	186.5	241.1	290.6	336.7	386.5	495.7

Table C.3

OBJECTID *	Haines Branch				Evaluate	GIS Contour Data			Overtopping Evaluation				
	Shape *	Point_X	Point_Y	Note		Evaluate_(yes/no/in sufficient_data)	Road_elevation	Channel_elevation_Upstream	Channel_depth_at_Road	Approx_Dist_between_DNR_Xsect	DS_Backwater	Approx_100yr_WSE_at_Road	Road_Overtopped_per_DNR_Data
1	Point	123412.5	194102.8	No Culvert Data	Insufficient	1240	1233	7	1645	No	1240.5	Yes	0.5
2	Point	124723.4	189572.8		Yes	1210	1196	14	2630	No	1207.3	No	-2.7
3	Point	129950.9	189541.5	No Xsect, unmodeled Tributary, possible backwater effect	Insufficient	1200	1191	9	0	No	1191.0	No	-9.0
4	Point	133232.2	189497.7	No Xsect, unmodeled Tributary, possible backwater effect	Insufficient	1191	1188	3	0	No	1188.0	No	-3.0
5	Point	133994.2	188550.4	Primary bypass south over roadway before overtopping bridge	Yes	1188	1167	21	1615	No	1186.0	No	-2.0
6	Point	138475.3	186966.3		Yes	1192	1185	7	1300	No	1190.2	No	-1.8
7	Point	132582.8	186883.5	US Xsect only, DS elevation listed is for potential backwater from mainstem.	No	1190	1182	8	250	Yes	1190.7	Yes	0.7
8	Point	146989.8	191119.3	Primary bypass south over roadway before overtopping bridge, Possible Backwater from Salt Creek	Yes	1168	1146	22	3880	No	1166.1	No	-1.9
9	Point	148346.5	191859.3	No Xsect, unmodeled Tributary, possible backwater effect from Salt and/or Haines mainstem	Insufficient	1161	1157	4	0	No	1157.0	No	-4.0
10	Point	152577.7	195432.3	No Xsect, Backwater from Salt	Insufficient	1166	1135	31	0	Yes	0.0	No	-1166.0
11	Point	152697.7	195489.7	No Xsect, Backwater from Salt	Insufficient	1164	1135	29	0	Yes	0.0	No	-1164.0
12	Point	152756.5	195512.7	No Xsect, Backwater from Salt	Insufficient	1165	1135	30	0	Yes	0.0	No	-1165.0
13	Point	152881.3	195591.8	No Xsect, Backwater from Salt	Insufficient	1173	1133	40	0	Yes	0.0	No	-1173.0
14	Point	137267.7	184306		Yes	1208	1200	8	3050	No	1206.0	No	-2.0
15	Point	133930.3	179918.6		Yes	1248	1242	6	2900	No	1246.5	No	-1.5
16	Point	130811.5	184302.1	DS only	No	1216	1212	4	600	No	1216.9	Yes	0.9
17	Point	132556.1	178964.1	No Xsect	Yes	1264	1254	10	1450	No	1259.8	No	-4.2
18	Point	127623.4	192656.3	No Xsect, unmodeled Tributary	Insufficient	1246	1236	10	0	No	1236.0	No	-10.0
19	Point	132688.1	194798.7	No Xsect upstream	No	1229	1226	3	3050	No	1231.8	Yes	2.8
20	Point	132971.2	193688.2	Railroad Track	No			0	0	No	0.0	Yes	0.0
21	Point	126342	188054.5	Railroad Track	No				0	No	0.0	Yes	0.0
22	Point	129689.8	188567.8	Railroad Track	No				0	No	0.0	Yes	0.0
23	Point	133319.6	188698.5	Railroad Track	No			0	0	No	0.0	Yes	0.0
24	Point	135630	188772.5	Railroad Track	No				0	No	0.0	Yes	0.0
25	Point	144942.6	190679.1	Railroad Track	No				0	No	0.0	Yes	0.0

26	Point	148119.5	192251.7	No Road Crossing, Street stops at top of bank.	No			0	0	No	0.0	Yes	0.0
27	Point	148159.5	192251.6	No Xsect, unmodeled Tributary	Insufficient			0	0	No	0.0	Yes	0.0
28	Point	148721.2	193855.6	Railroad Track	No			0	0	No	0.0	Yes	0.0
29	Point	152109.3	195327.4	No Xsect, Backwater from Salt	Insufficient	1159	1136	23	0	Yes	0.0	No	-1159.0
30	Point	144272.7	186944	No Xsect, unmodeled Tributary	Insufficient	1191	1184	7	0	No	1184.0	No	-7.0
31	Point	145775.9	186948.2	No Xsect, unmodeled Tributary	Insufficient	1189	1184	5	0	No	1184.0	No	-5.0
32	Point	134241.3	186882.8	No Xsect, unmodeled Tributary	Insufficient	1197	1192	5	0	No	1192.0	No	-5.0
33	Point	128681.4	176309.1	No Xsect nearby. Closest is 6,000+ ft downstream.	Insufficient	1302	1300	2	0	No	1300.0	No	-2.0

Culverts to Evaluate

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Table C.3

OBJECTID *	DNR HYDRAULIC STUDY DATA							County Culvert Data						
	US_100yr_ depth	US_100yr_ Elevation	US_Q100	US_Distance_ to_point_ (ft)	DS_100yr_ depth	DS_100yr_ Elevation	DS_Q100	DS_Distance_ to_point_ (ft)	County_ Longitude	County_ Latitude	Known_ WSE_100yr	Road_ Name	Culvert_ Description	Culvert_ Openings
1	6	1244.4	3716	625	8.8	1234.2	3716	1020						
2	5.7	1220.1	3716	2130	9.9	1204.3	3716	500	124722.01872	189568.77298		N225	23'x24'	SINGLE
3									129954.39966	189552.98659		N226	8'x8'x36'	SINGLE
4									133221.68742	189523.78914		N227	5'x4'x35'	TWIN
5	18.2	1189.6	21145	1150	16.2	1184.6	21682	465	133968.76565	188551.45382	1186.8	O119	28'x100'	TRIPLE
6	7.4	1194.8	3950	650	4.2	1185.6	3950	650	138438.18027	186963.14597	1193	O125	10'x8'x45'	TRIPLE
7	8.7	1190.1	2654	250		1189.6			132612.75622	186888.22716		N36	84" x46'	SINGLE
8	20.1	1173.5	21394	3880					147024.30942	191100.50810	1164.8	O132	32'x110'	TRIPLE
9									148365.58364	191697.32056		O1	24'x16'	SINGLE
10														
11														
12														
13														
14	5.3	1209.7	3950	750	7.4	1194.8	3950	2300	137263.80565	184308.11650		O181	95" x67" x54'	SINGLE
15	5.8	1248.2	3950	250	4.9	1228.3	3950	2650	133931.02622	179916.23651		O114	8'x6'x32'	TWIN
16					4.9	1206.3	2654	600	130826.31426	184289.16608		N213	7'x5'x46'	TWIN
17					5.8	1248.2	3950	1450	132484.07177	178944.13740		N129	8'x8'x56'	SINGLE
18									127638.11164	192704.13252		N321	48" x78'	SINGLE
19					5.8	1204.2	2337	3050	132691.61105	194825.11319		MSO	6'x4'x48'	TWIN
20														
21														
22														
23														
24														
25														

26														
27														
28														
29														
30									144447.04718	186949.73032	1190.4	O127	7'x5'x45'	SINGLE
31									145748.70370	186947.78380		O129	84"x38'	SINGLE
32									134220.90524	186882.51851		O123	6'x5'x26'	SINGLE
33									128681.12399	176322.40905		N209	60"x42'	SINGLE

Table C.3

Modeled Culvert - per As-Built data from County																
OBJECTID *	Structure Type		Downstream Flowline_(ft)	Tailwater Elevation_(ft)	Assumed Crest Length_(ft)	Embedment_depth_(in)	Culvert type	Inlet Configuration	Number_of_barrels	Inlet Elevation_(ft)	Outlet Elevation_(ft)	Crest Elevation_(ft)	Extra	Roadway Overtopped?	Overtopping Elevation (ft)	Overtopping Depth (ft)
1																
2	IBB															
3	CBC															
4	CBC															
5	CSB										As-built available, but the structure is a bridge.					
6	CBC		1181.5	1185.7	50	0	straight	30-75° flare	3	1181.6	1181.5	1192.9		Yes	1195.02	2.12
7	CMP															
8	CSB										As-built available, but the structure is a bridge.					
9	WB															
10																
11																
12																
13																
14	CMPA															
15	CBC															
16	CBC															
17	CBC		88.1	93.9	50	0	straight	30-75° flare	1	88.7	88.1	99.9		Yes	106.79	6.89
18	CMP															
19	CBC															
20																
21																
22																
23																
24																
25																

26																	
27																	
28																	
29																	
30	CBC																
31	CMP																
32	CBC																
33	CMP																

Appendix C
HY-8 Culvert Analysis Report

Table 1 - Summary of Culvert Flows at Crossing: N-129

Headwater Elevation (ft)	Total Discharge (cfs)	N-129 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
93.90	0.00	0.00	0.00	1
95.80	395.00	395.00	0.00	1
99.93	790.00	789.06	0.73	12
101.46	1185.00	890.17	294.80	5
102.48	1580.00	951.60	628.35	4
103.35	1975.00	1000.94	974.04	3
104.14	2370.00	1043.25	1326.71	3
104.87	2765.00	1080.80	1684.14	3
105.54	3160.00	1114.14	2045.79	3
106.18	3555.00	1144.85	2410.08	3
106.79	3950.00	1173.27	2776.67	3
99.90	786.99	786.99	0.00	Overtopping

Rating Curve Plot for Crossing: N-129

Total Rating Curve

Crossing: N-129

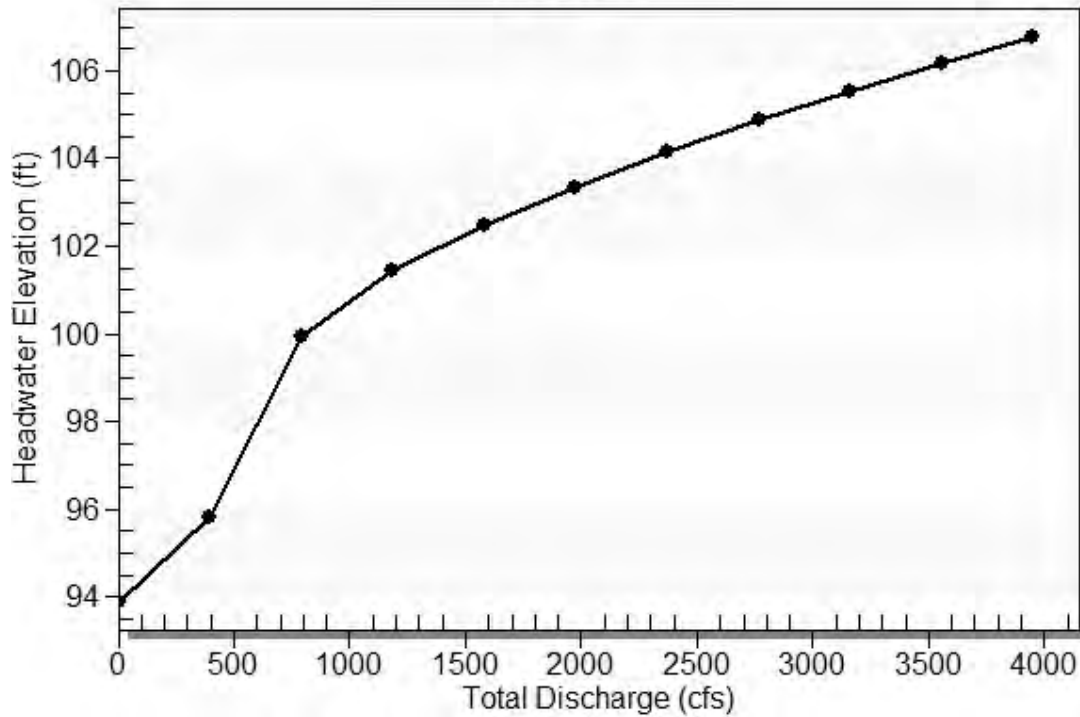
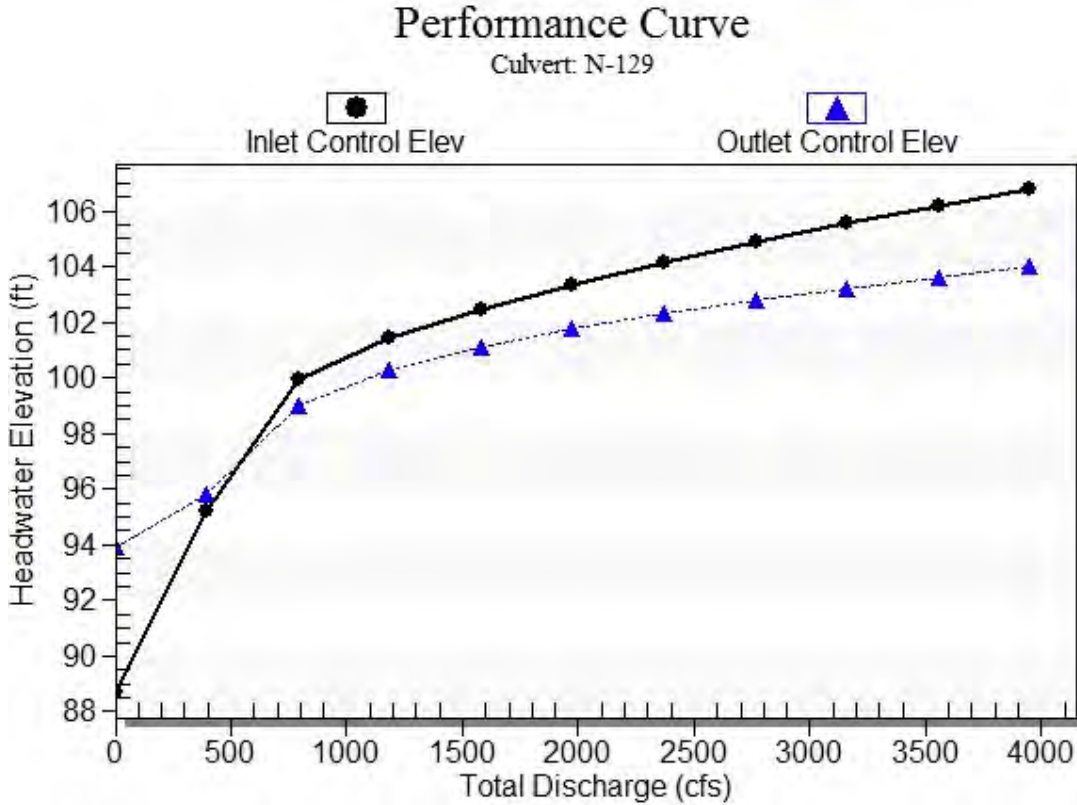


Table 2 - Culvert Summary Table: N-129

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	93.90	0.000	5.200	0-NF	0.000	0.000	5.800	5.800	0.000	0.000
395.00	395.00	95.80	6.502	7.103	1-S1t	2.932	4.230	5.800	5.800	8.513	0.000
790.00	789.06	99.93	11.229	10.317	5-S2n	4.910	6.710	5.769	5.800	17.096	0.000
1185.00	890.17	101.46	12.757	11.569	5-S2n	5.390	7.272	6.304	5.800	17.650	0.000
1580.00	951.60	102.48	13.778	12.381	5-S2n	5.680	7.603	6.621	5.800	17.965	0.000
1975.00	1000.94	103.35	14.651	13.063	5-S2n	5.910	7.863	6.872	5.800	18.208	0.000
2370.00	1043.25	104.14	15.439	13.626	5-S2n	6.106	8.000	7.083	5.800	18.410	0.000
2765.00	1080.80	104.87	16.169	14.082	5-S2n	6.280	8.000	7.254	5.800	18.624	0.000
3160.00	1114.14	105.54	16.841	14.501	5-S2n	6.434	8.000	7.389	5.800	18.849	0.000
3555.00	1144.85	106.18	17.481	14.897	5-S2n	6.575	8.000	7.498	5.800	19.086	0.000
3950.00	1173.27	106.79	18.090	15.274	5-S2n	6.705	8.000	7.590	5.800	19.324	0.000

 Straight Culvert
 Inlet Elevation (invert): 88.70 ft, Outlet Elevation (invert): 88.10 ft
 Culvert Length: 56.00 ft, Culvert Slope: 0.0107

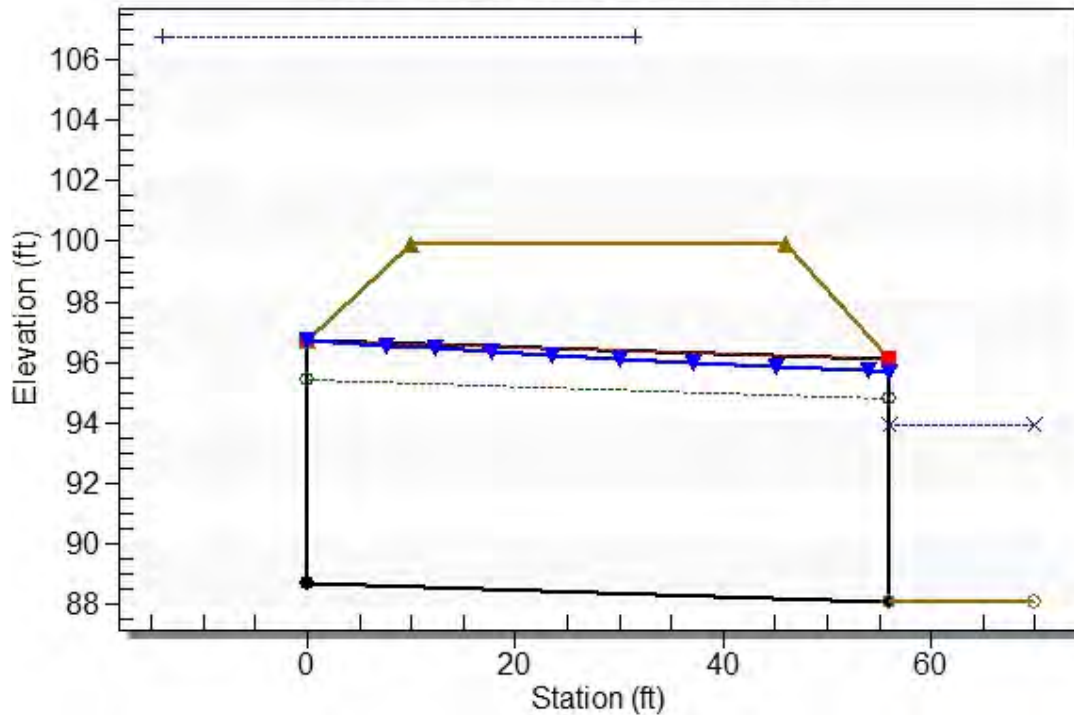
Culvert Performance Curve Plot: N-129



Water Surface Profile Plot for Culvert: N-129

Crossing - N-129, Design Discharge - 3950.0 cfs

Culvert - N-129, Culvert Discharge - 1173.3 cfs



Site Data - N-129

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 88.70 ft

Outlet Station: 56.00 ft

Outlet Elevation: 88.10 ft

Number of Barrels: 1

Culvert Data Summary - N-129

Barrel Shape: Concrete Box

Barrel Span: 8.00 ft

Barrel Rise: 8.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75° flare) Wingwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: N-129)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
0.00	93.90	5.80
395.00	93.90	5.80
790.00	93.90	5.80
1185.00	93.90	5.80
1580.00	93.90	5.80
1975.00	93.90	5.80
2370.00	93.90	5.80
2765.00	93.90	5.80
3160.00	93.90	5.80
3555.00	93.90	5.80
3950.00	93.90	5.80

Tailwater Channel Data - N-129

Tailwater Channel Option: Enter Constant Tailwater Elevation
Constant Tailwater Elevation: 93.90 ft

Roadway Data for Crossing: N-129

Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 50.00 ft
Crest Elevation: 99.90 ft
Roadway Surface: Paved
Roadway Top Width: 36.00 ft

Table 4 - Summary of Culvert Flows at Crossing: O-125

Headwater Elevation (ft)	Total Discharge (cfs)	O-125 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1185.70	0.00	0.00	0.00	1
1185.93	395.00	395.00	0.00	1
1186.61	790.00	790.00	0.00	1
1187.72	1185.00	1185.00	0.00	1
1189.02	1580.00	1580.00	0.00	1
1190.21	1975.00	1975.00	0.00	1
1191.33	2370.00	2370.00	0.00	1
1192.38	2765.00	2765.00	0.00	1
1193.42	3160.00	3102.80	56.98	4
1194.27	3555.00	3310.62	244.31	3
1195.02	3950.00	3481.87	468.04	3
1192.90	2968.14	2968.14	0.00	Overtopping

Rating Curve Plot for Crossing: O-125

Total Rating Curve
Crossing: O-125

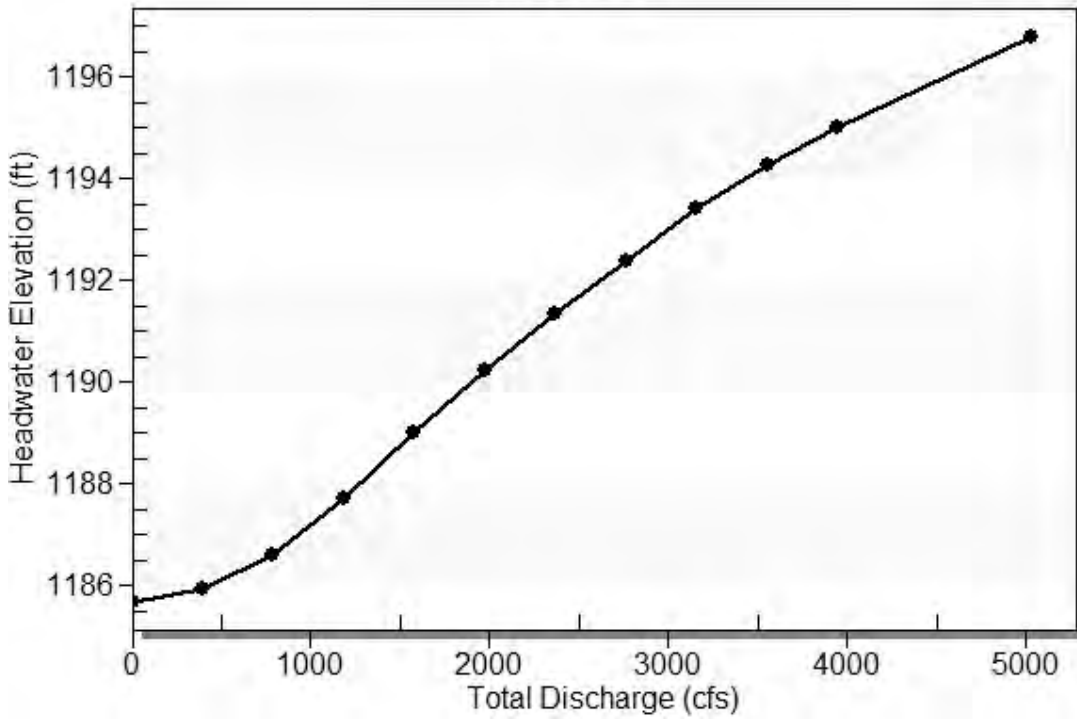
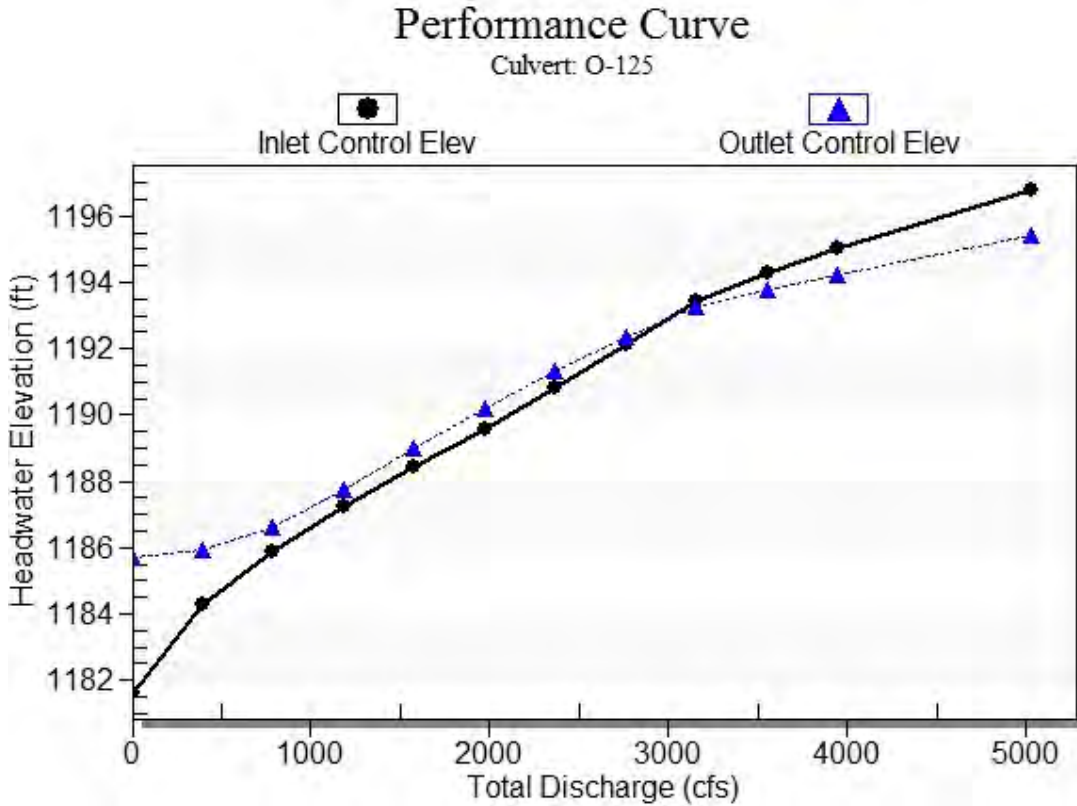


Table 5 - Culvert Summary Table: O-125

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	1185.70	0.000	4.100	0-NF	0.000	0.000	4.200	4.200	0.000	0.000
395.00	395.00	1185.93	2.688	4.328	3-M1t	1.935	1.753	4.200	4.200	3.135	0.000
790.00	790.00	1186.61	4.278	5.011	3-M1t	3.140	2.782	4.200	4.200	6.270	0.000
1185.00	1185.00	1187.72	5.627	6.125	3-M2t	4.212	3.646	4.200	4.200	9.405	0.000
1580.00	1580.00	1189.02	6.829	7.423	2-M2c	5.219	4.416	4.416	4.200	11.925	0.000
1975.00	1975.00	1190.21	7.996	8.613	7-M2c	6.187	5.125	5.125	4.200	12.846	0.000
2370.00	2370.00	1191.33	9.214	9.726	7-M2c	7.130	5.787	5.787	4.200	13.651	0.000
2765.00	2765.00	1192.38	10.549	10.778	7-M2c	8.000	6.414	6.414	4.200	14.371	0.000
3160.00	3102.80	1193.42	11.821	11.639	7-M2c	8.000	6.926	6.926	4.200	14.934	0.000
3555.00	3310.62	1194.27	12.674	12.152	7-M2c	8.000	7.232	7.232	4.200	15.260	0.000
3950.00	3481.87	1195.02	13.419	12.630	7-M2c	8.000	7.479	7.479	4.200	15.518	0.000

 Straight Culvert
 Inlet Elevation (invert): 1181.60 ft, Outlet Elevation (invert): 1181.50 ft
 Culvert Length: 45.00 ft, Culvert Slope: 0.0022

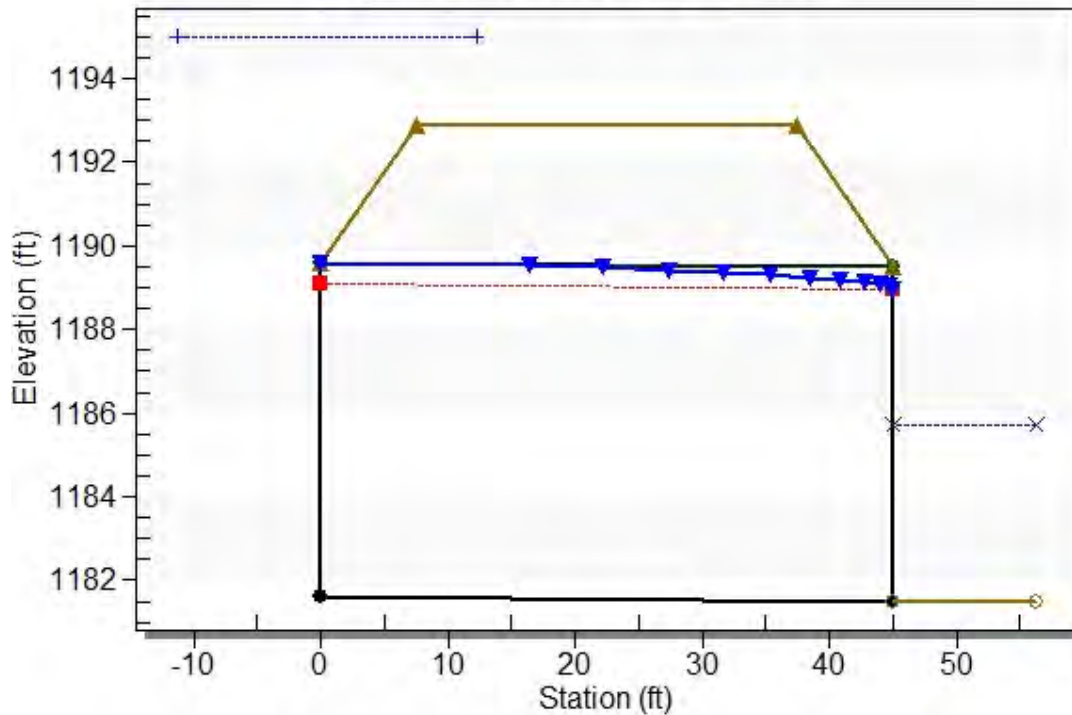
Culvert Performance Curve Plot: O-125



Water Surface Profile Plot for Culvert: O-125

Crossing - O-125, Design Discharge - 3950.0 cfs

Culvert - O-125, Culvert Discharge - 3481.9 cfs



Site Data - O-125

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 1181.60 ft

Outlet Station: 45.00 ft

Outlet Elevation: 1181.50 ft

Number of Barrels: 3

Culvert Data Summary - O-125

Barrel Shape: Concrete Box

Barrel Span: 10.00 ft

Barrel Rise: 8.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0130

Culvert Type: Straight

Inlet Configuration: Square Edge (30-75° flare) Wingwall

Inlet Depression: NONE

Table 6 - Downstream Channel Rating Curve (Crossing: O-125)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
0.00	1185.70	4.20
395.00	1185.70	4.20
790.00	1185.70	4.20
1185.00	1185.70	4.20
1580.00	1185.70	4.20
1975.00	1185.70	4.20
2370.00	1185.70	4.20
2765.00	1185.70	4.20
3160.00	1185.70	4.20
3555.00	1185.70	4.20
3950.00	1185.70	4.20

Tailwater Channel Data - O-125

Tailwater Channel Option: Enter Constant Tailwater Elevation
Constant Tailwater Elevation: 1185.70 ft

Roadway Data for Crossing: O-125

Roadway Profile Shape: Constant Roadway Elevation
Crest Length: 50.00 ft
Crest Elevation: 1192.90 ft
Roadway Surface: Paved
Roadway Top Width: 30.00 ft