HY-8 Culvert Analysis Report

Project Notes

Project Title: Roquemore Road Drainage Improvements

Designer: JEWELL Engineering Consultants

Project Date: February 19, 2009

Notes: NC DENR DWQ requires base flow culvert to be one foot below existing stream bed. Due to significant existing utilities in the residential area, the culvert could not be lowered, but was held as close as possible to existing stream invert at upstream end. An existing 18-inch sanitary force main at the downstream side could be impacted if the culvert were lowered.

Ultimate flow shown is for the 100-year event. Design flow of 439 cfs is used for the 25-year flow as required by the Village of Clemmons ordinance for design.

Solution results in utilizing 2 – 8' x 5' concrete box culvert

Project Units: U.S. Customary Units

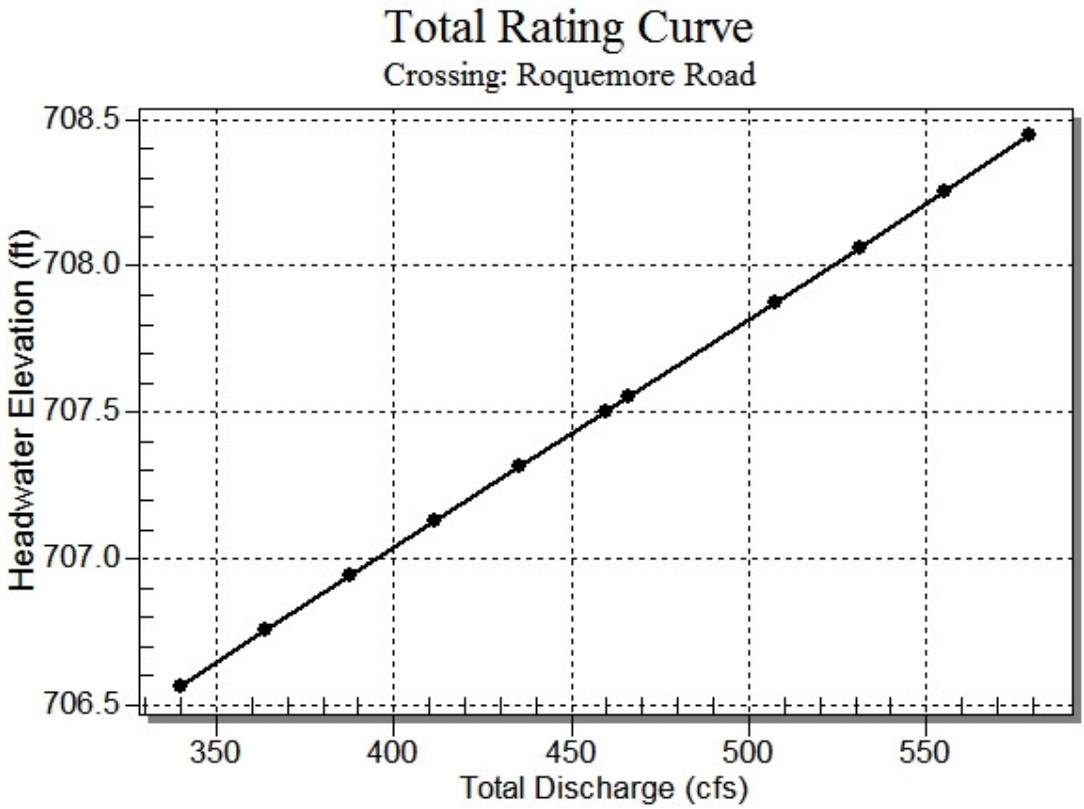
Outlet Control Option: Profiles

Crossing Notes: Roquemore Road

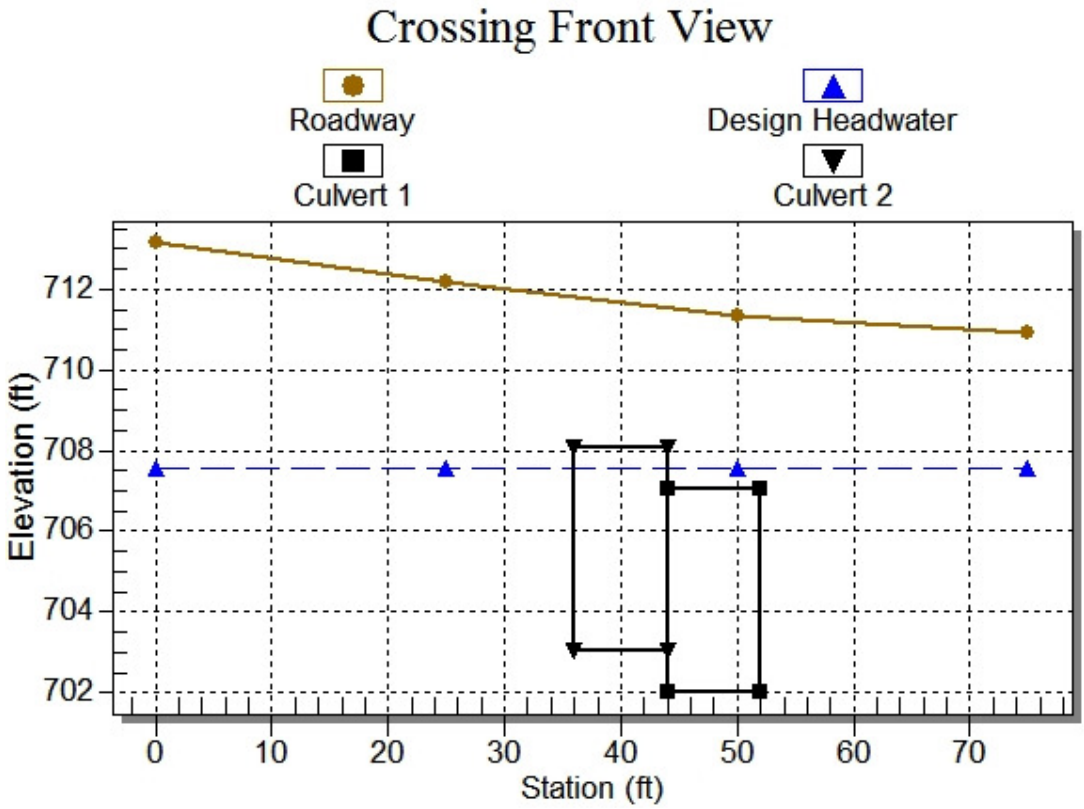
Table 1 - Summary of Culvert Flows at Crossing: Roquemore Road

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Culvert 2 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
706.56	340.00	202.36	137.62	0.00	5
706.76	363.90	214.78	149.12	0.00	3
706.94	387.80	227.06	160.74	0.00	3
707.13	411.70	239.20	172.45	0.00	2
707.32	435.60	251.31	184.39	0.00	2
707.50	459.50	263.18	196.32	0.00	3
707.55	466.00	266.40	199.60	0.00	3
707.87	507.30	286.68	220.62	0.00	3
708.06	531.20	298.28	232.92	0.00	3
708.25	555.10	309.80	245.31	0.00	3
708.45	579.00	321.22	257.79	0.00	3

Rating Curve Plot for Crossing: Roquemore Road



Crossing Front View (Roadway Profile): Roquemore Road



Culvert Notes: Culvert 1

Table 2 - Culvert Summary Table: Culvert 1

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)
340.00	202.36	706.56	4.535	4.535	1-S2n	1.490	2.714	1.840	3.038	13.745	4.292
363.90	214.78	706.76	4.725	4.725	1-S2n	1.549	2.824	1.924	3.155	13.952	4.383
387.80	227.06	706.94	4.913	4.913	1-S2n	1.606	2.931	2.009	3.270	14.128	4.469
411.70	239.20	707.13	5.099	5.099	5-S2n	1.663	3.035	2.092	3.381	14.296	4.551
435.60	251.31	707.32	5.286	5.286	5-S2n	1.720	3.136	2.172	3.488	14.462	4.630
459.50	263.18	707.50	5.471	5.471	5-S2n	1.775	3.234	2.250	3.593	14.621	4.704
466.00	266.40	707.55	5.521	5.521	5-S2n	1.790	3.260	2.270	3.621	14.667	4.725
507.30	286.68	707.87	5.843	5.843	5-S2n	1.885	3.424	2.402	3.794	14.920	4.847
531.20	298.28	708.06	6.032	6.032	5-S2n	1.939	3.516	2.476	3.891	15.061	4.914
555.10	309.80	708.25	6.222	6.222	5-S2n	1.993	3.606	2.550	3.985	15.189	4.980
579.00	321.22	708.45	6.415	6.415	5-S2n	2.042	3.694	2.622	4.079	15.316	5.041

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Inlet Elevation (invert): 702.03 ft, Outlet Elevation (invert): 700.83 ft

Culvert Length: 61.01 ft, Culvert Slope: 0.0197

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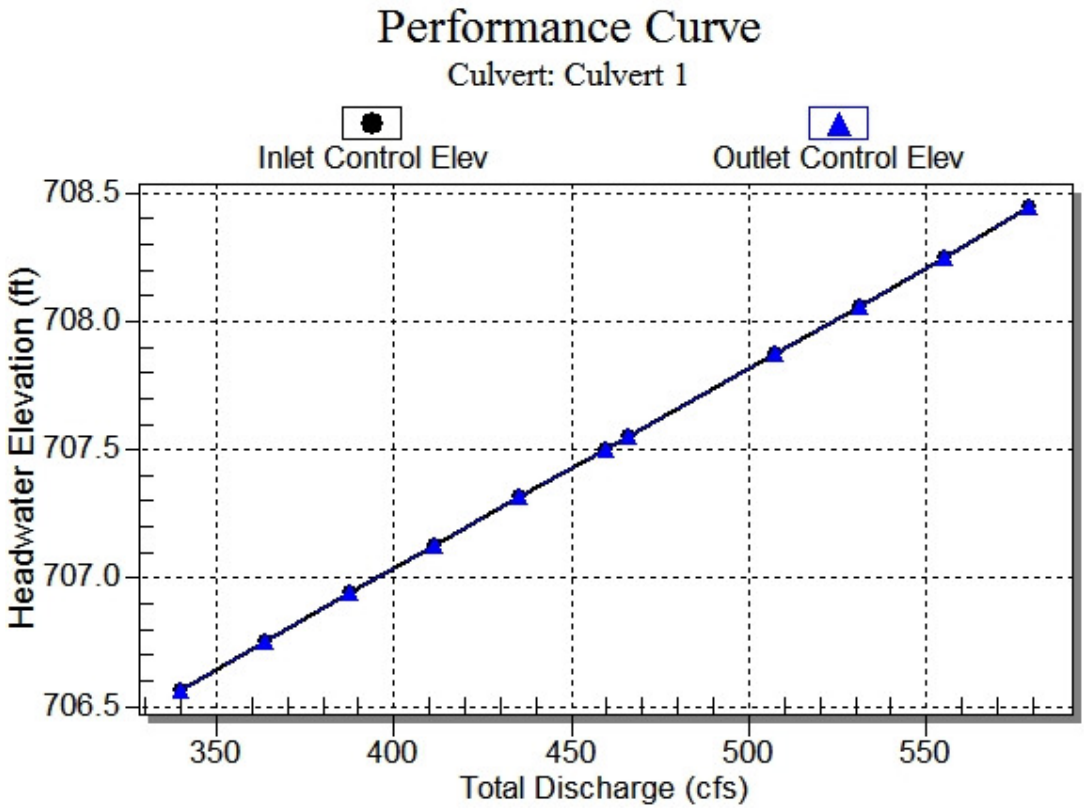
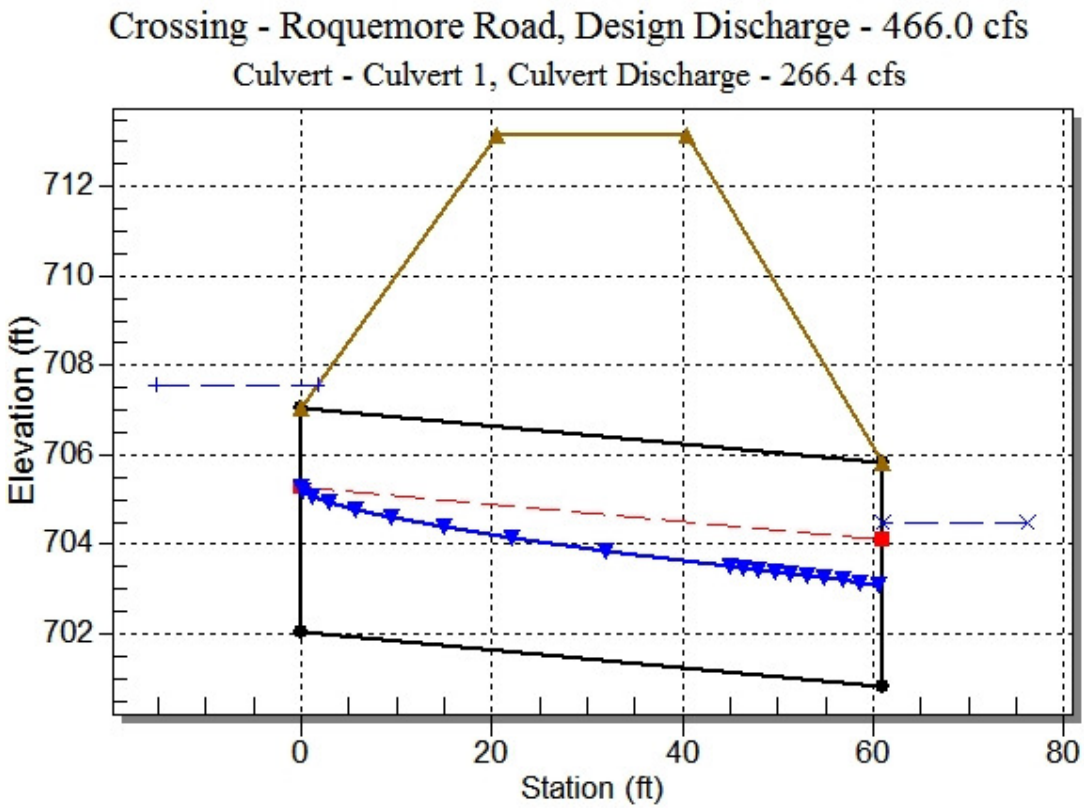
Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 702.03 ft

Outlet Station: 61.00 ft

Outlet Elevation: 700.83 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 1

Barrel Shape: Concrete Box

Barrel Span: 8.00 ft

Barrel Rise: 5.00 ft

Barrel Material: Concrete

Barrel Manning's n: 0.0130

Inlet Type: Conventional

Inlet Edge Condition: Square Edge (90º) Headwall

Inlet Depression: None

Culvert Notes: Culvert 2

Table 3 - Culvert Summary Table: Culvert 2

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)
340.00	137.62	706.56	3.506	3.506	1-S2n	1.141	2.099	1.364	3.038	12.611	4.292
363.90	149.12	706.76	3.696	3.696	1-S2n	1.202	2.214	1.450	3.155	12.851	4.383
387.80	160.74	706.94	3.885	3.885	1-S2n	1.264	2.328	1.536	3.270	13.080	4.469
411.70	172.45	707.13	4.071	4.071	1-S2n	1.326	2.440	1.620	3.381	13.308	4.551
435.60	184.39	707.32	4.257	4.257	1-S2n	1.389	2.551	1.706	3.488	13.509	4.630
459.50	196.32	707.50	4.442	4.442	1-S2n	1.453	2.660	1.790	3.593	13.709	4.704
466.00	199.60	707.55	4.492	4.492	1-S2n	1.470	2.690	1.813	3.621	13.765	4.725
507.30	220.62	707.87	4.814	4.814	1-S2n	1.572	2.875	1.955	3.794	14.104	4.847
531.20	232.92	708.06	5.002	5.002	5-S2n	1.629	2.981	2.040	3.891	14.271	4.914
555.10	245.31	708.25	5.193	5.193	5-S2n	1.687	3.086	2.123	3.985	14.444	4.980
579.00	257.79	708.45	5.386	5.386	5-S2n	1.745	3.190	2.206	4.079	14.609	5.041

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Inlet Elevation (invert): 703.06 ft, Outlet Elevation (invert): 701.83 ft

Culvert Length: 62.01 ft, Culvert Slope: 0.0198

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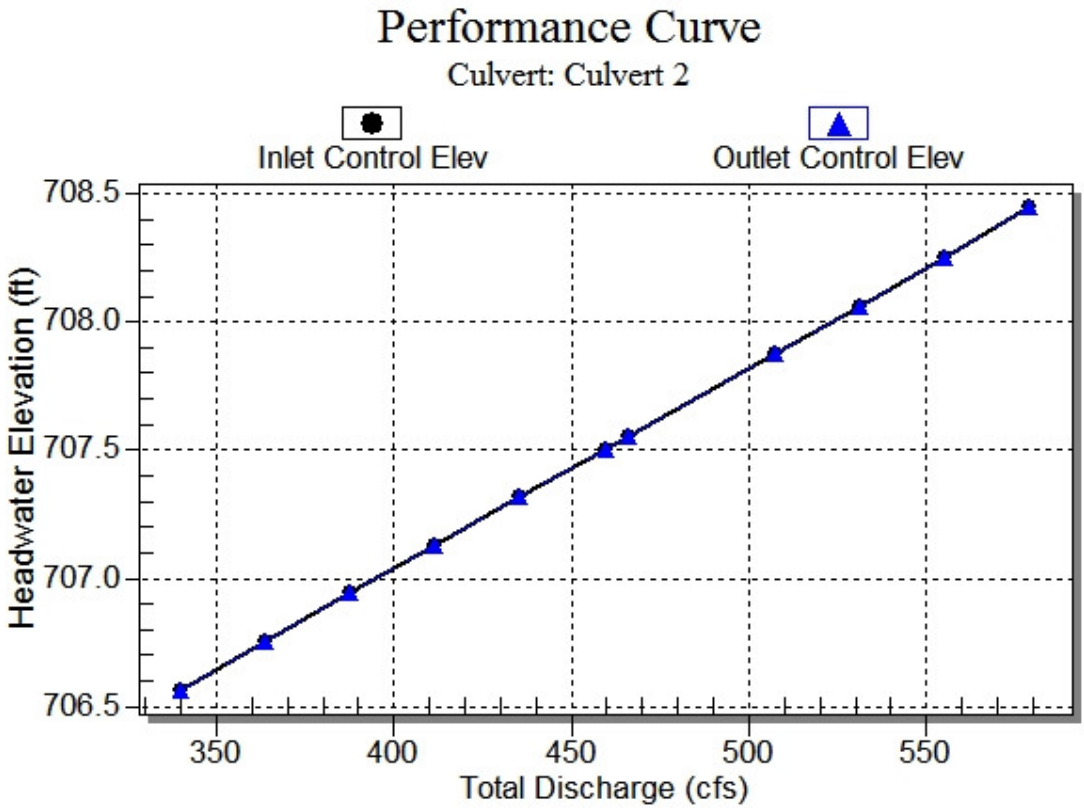
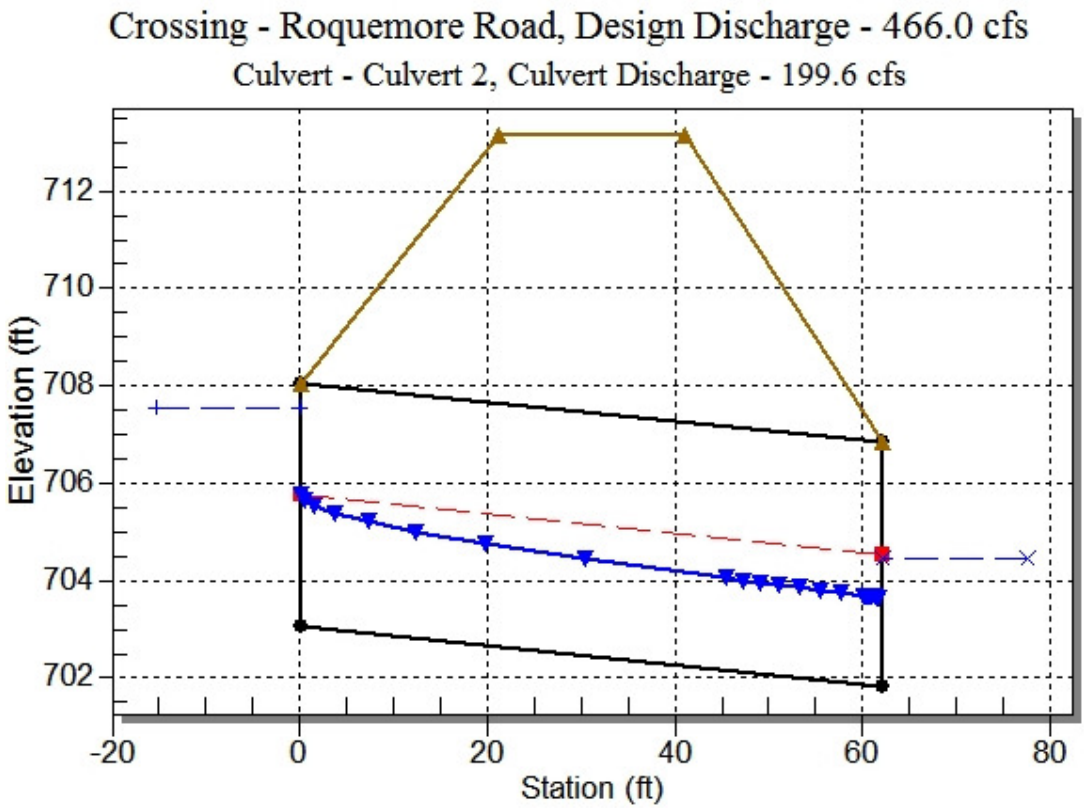
Culvert Performance Curve Plot: Culvert 2



Water Surface Profile Plot for Culvert: Culvert 2



Site Data - Culvert 2

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 703.06 ft

Outlet Station: 62.00 ft

Outlet Elevation: 701.83 ft

Number of Barrels: 1

Culvert Data Summary - Culvert 2

Barrel Shape: Concrete Box

Barrel Span: 8.00 ft

Barrel Rise: 5.00 ft

Barrel Material: Concrete

Barrel Manning's n: 0.0130

Inlet Type: Conventional

Inlet Edge Condition: Square Edge (90º) Headwall

Inlet Depression: None

Table 4 - Downstream Channel Rating Curve (Crossing: Roquemore Road)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
340.00	703.89	3.04	4.29	3.22	0.48
363.90	704.01	3.16	4.38	3.35	0.48
387.80	704.12	3.27	4.47	3.47	0.49
411.70	704.23	3.38	4.55	3.59	0.49
435.60	704.34	3.49	4.63	3.70	0.49
459.50	704.44	3.59	4.70	3.81	0.49
466.00	704.47	3.62	4.72	3.84	0.49
507.30	704.64	3.79	4.85	4.02	0.50
531.20	704.74	3.89	4.91	4.13	0.50
555.10	704.84	3.99	4.98	4.23	0.50
579.00	704.93	4.08	5.04	4.33	0.50

Tailwater Channel Data - Roquemore Road

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 20.00 ft

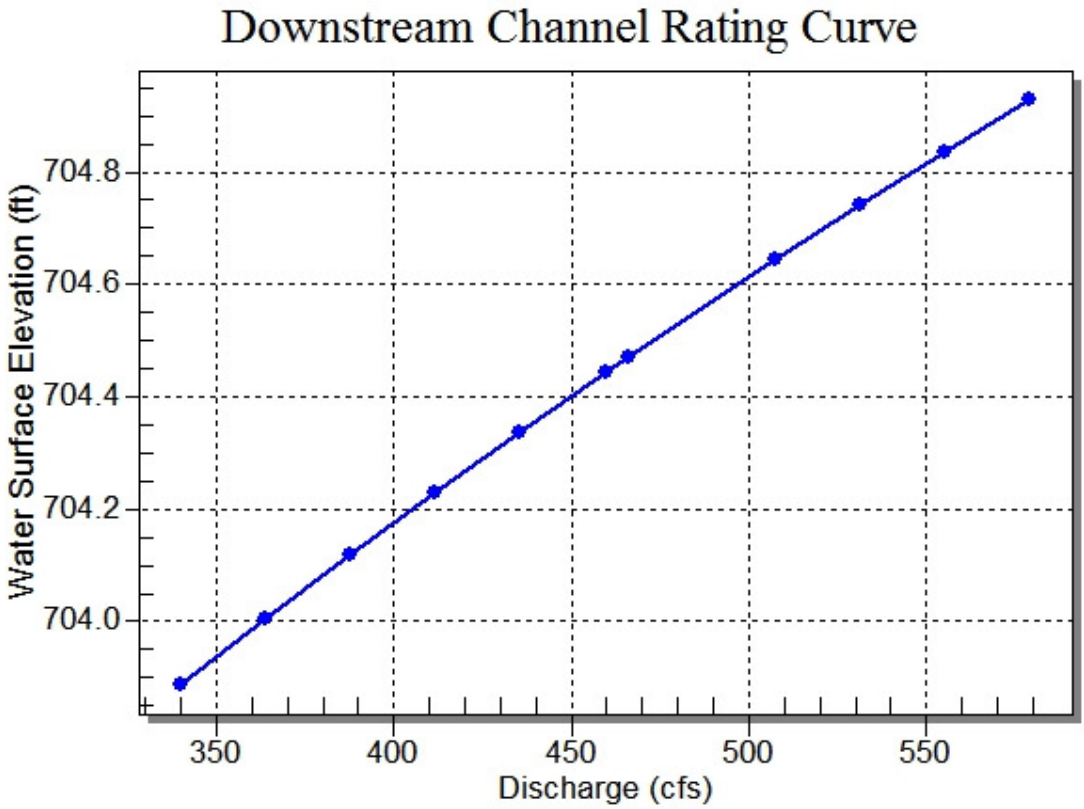
Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.0170

Channel Manning's n: 0.0800

Channel Invert Elevation: 700.85 ft

Tailwater Rating Curve Plot for Crossing: Roquemore Road



Roadway Data for Crossing: Roquemore Road

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
1	0.00	713.14
2	25.00	712.16
3	50.00	711.36
4	75.00	710.92
5	100.00	710.22

Roadway Surface: Paved

Roadway Top Width: 20.00 ft