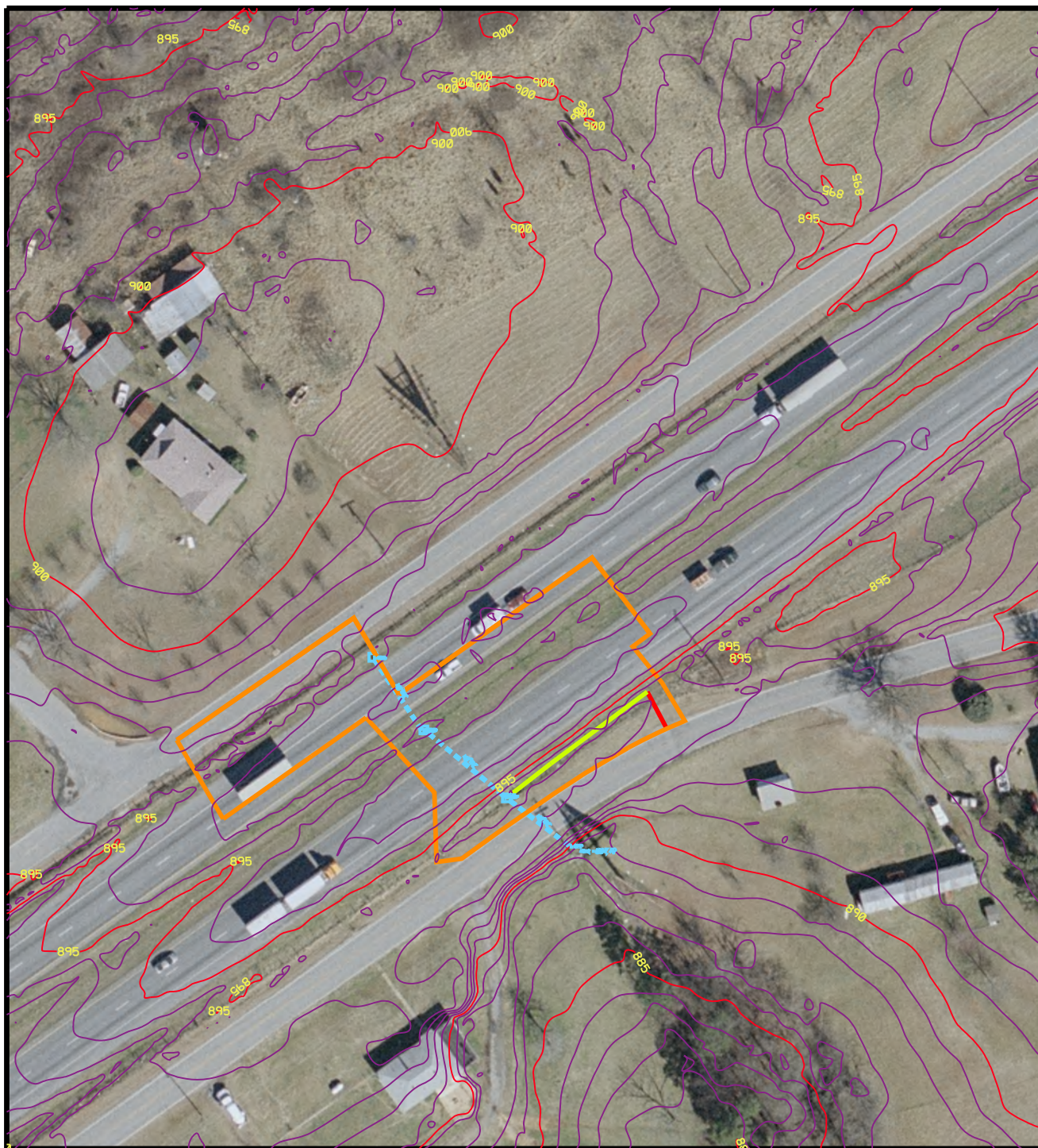


PLAN VIEW SITE # B-1

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







- |   |   |
|---|---|
| <span style="color: orange;">—</span> Watershed           | <span style="color: yellow;">—</span> Ditch Flow                      |
| <span style="color: red;">—</span> Overland               | <span style="color: red;">—</span> Existing 5' Contour Line/Elevation |
| <span style="color: green;">—</span> Shallow Concentrated | <span style="color: purple;">—</span> Existing 1' Contour Line        |

\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-1

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







 PAVEMENT, ROOFS

 GRASS SHOULDERS

## LAND USE MAP - SITE # B-1

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 2.3 cfs

Design Flow: 3.1 cfs

Maximum Flow: 4.8 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-1**

Headwater Elevation (ft)	Total Discharge (cfs)	B-1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
893.43	2.30	2.30	0.00	1
893.48	2.55	2.55	0.00	1
893.53	2.80	2.80	0.00	1
893.58	3.05	3.05	0.00	1
893.59	3.10	3.10	0.00	1
893.66	3.55	3.55	0.00	1
893.70	3.80	3.80	0.00	1
893.74	4.05	4.05	0.00	1
893.78	4.30	4.30	0.00	1
893.82	4.55	4.55	0.00	1
893.86	4.80	4.80	0.00	1
898.00	20.44	20.44	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-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)
2.30	2.30	893.43	0.774	0.0*	1-S2n	0.346	0.569	0.346	0.085	7.389	1.804
2.55	2.55	893.48	0.824	0.0*	1-S2n	0.366	0.602	0.366	0.090	7.588	1.879
2.80	2.80	893.53	0.872	0.0*	1-S2n	0.386	0.634	0.386	0.096	7.759	1.950
3.05	3.05	893.58	0.918	0.0*	1-S2n	0.405	0.664	0.405	0.101	7.909	2.018
3.10	3.10	893.59	0.927	0.0*	1-S2n	0.409	0.670	0.409	0.102	7.937	2.030
3.55	3.55	893.66	1.004	0.0*	1-S2n	0.436	0.719	0.436	0.110	8.368	2.143
3.80	3.80	893.70	1.045	0.0*	1-S2n	0.451	0.745	0.451	0.115	8.579	2.201
4.05	4.05	893.74	1.084	0.0*	1-S2n	0.466	0.770	0.466	0.120	8.623	2.257
4.30	4.30	893.78	1.122	0.0*	1-S2n	0.481	0.794	0.481	0.124	8.766	2.313
4.55	4.55	893.82	1.160	0.0*	1-S2n	0.496	0.817	0.496	0.128	8.898	2.365
4.80	4.80	893.86	1.196	0.0*	1-S2n	0.511	0.839	0.511	0.132	9.020	2.416

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 892.66 ft,    Outlet Elevation (invert): 887.72 ft  
Culvert Length: 177.07 ft,    Culvert Slope: 0.0279  
\*\*\*\*\*

### **Site Data - B-1**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 892.66 ft

Outlet Station: 177.00 ft

Outlet Elevation: 887.72 ft

Number of Barrels: 1

### **Culvert Data Summary - B-1**

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Grooved End Projecting

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-1)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
2.30	887.80	0.08	1.80	0.19	1.09
2.55	887.81	0.09	1.88	0.20	1.10
2.80	887.82	0.10	1.95	0.22	1.11
3.05	887.82	0.10	2.02	0.23	1.12
3.10	887.82	0.10	2.03	0.23	1.12
3.55	887.83	0.11	2.14	0.25	1.14
3.80	887.84	0.12	2.20	0.26	1.14
4.05	887.84	0.12	2.26	0.27	1.15
4.30	887.84	0.12	2.31	0.28	1.16
4.55	887.85	0.13	2.36	0.29	1.16
4.80	887.85	0.13	2.42	0.30	1.17



**Tailwater Channel Data - B-1**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 15.00 ft

Channel Slope: 0.0360

Channel Manning's n: 0.0300

Channel Invert Elevation: 887.72 ft

**Roadway Data for Crossing: B-1**

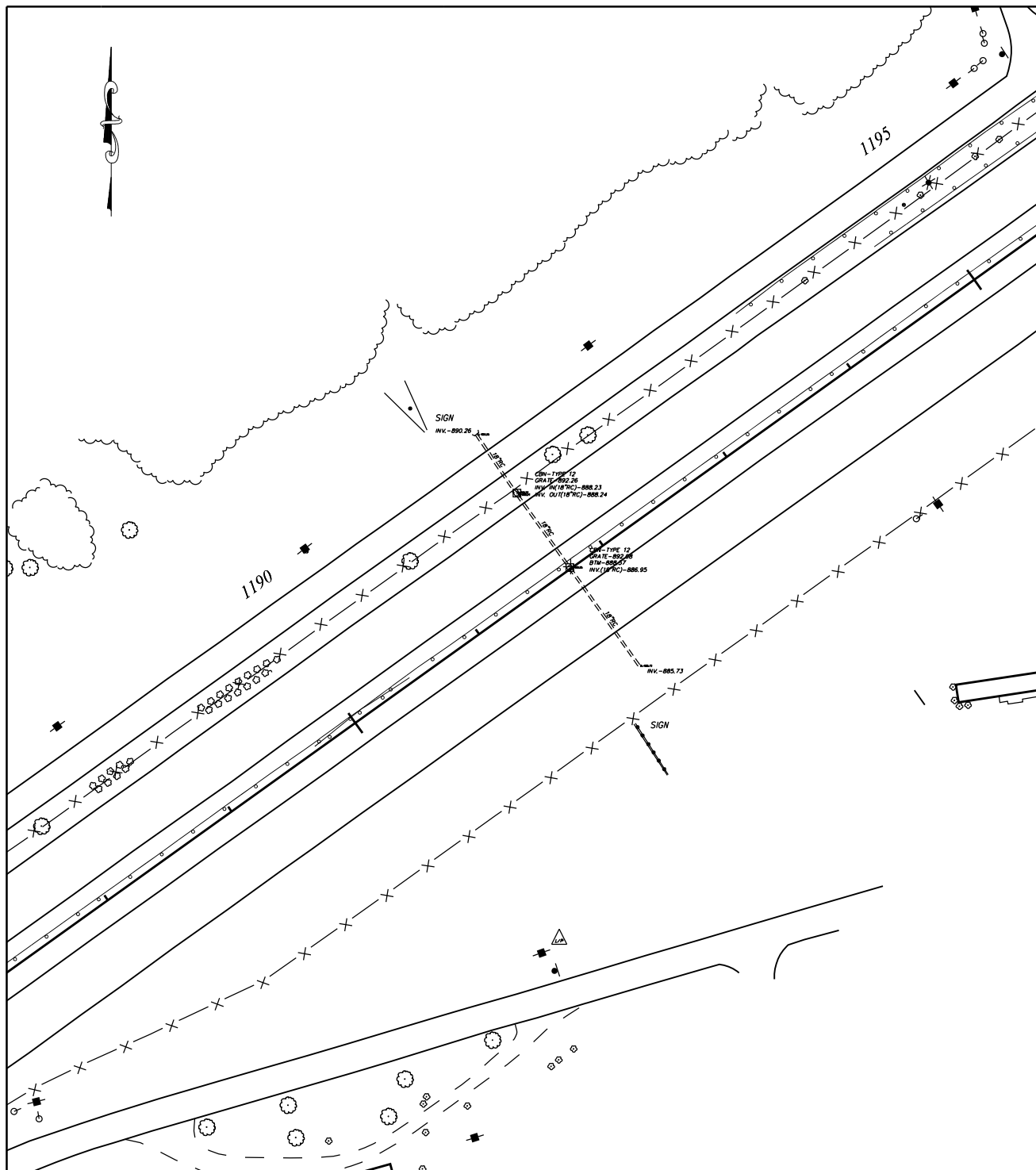
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 898.00 ft

Roadway Surface: Paved

Roadway Top Width: 157.00 ft



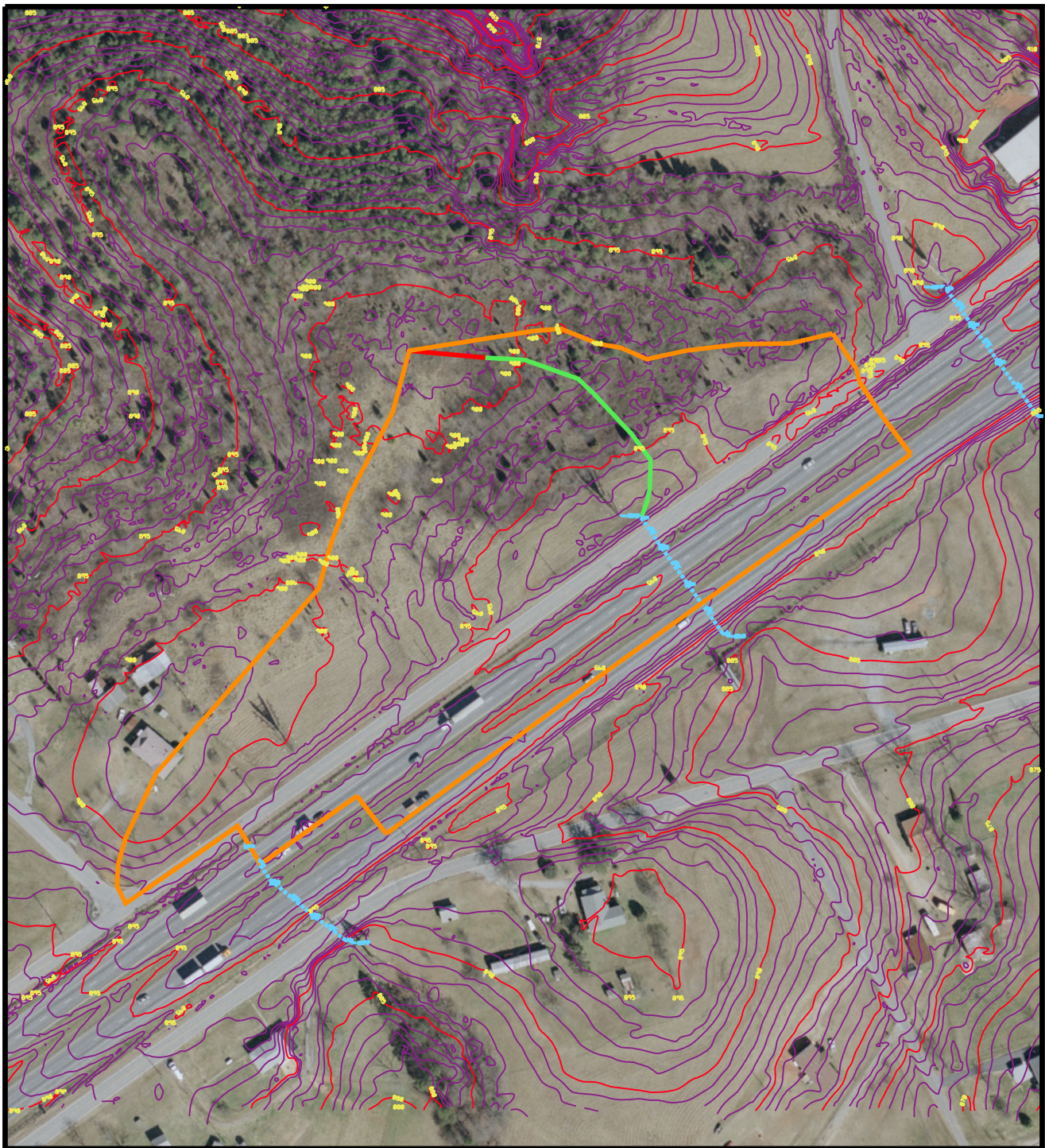
PLAN VIEW SITE # B-2

I-85 WIDENING CHEROKEE CO MM80-96

SPARTANBURG/CHEROKEE COUNTY



SCALE:



- |                        |                                      |
|------------------------|--------------------------------------|
| — Watershed            | — Ditch Flow                         |
| — Overland             | — Existing 5' Contour Line/Elevation |
| — Shallow Concentrated | — Existing 1' Contour Line           |

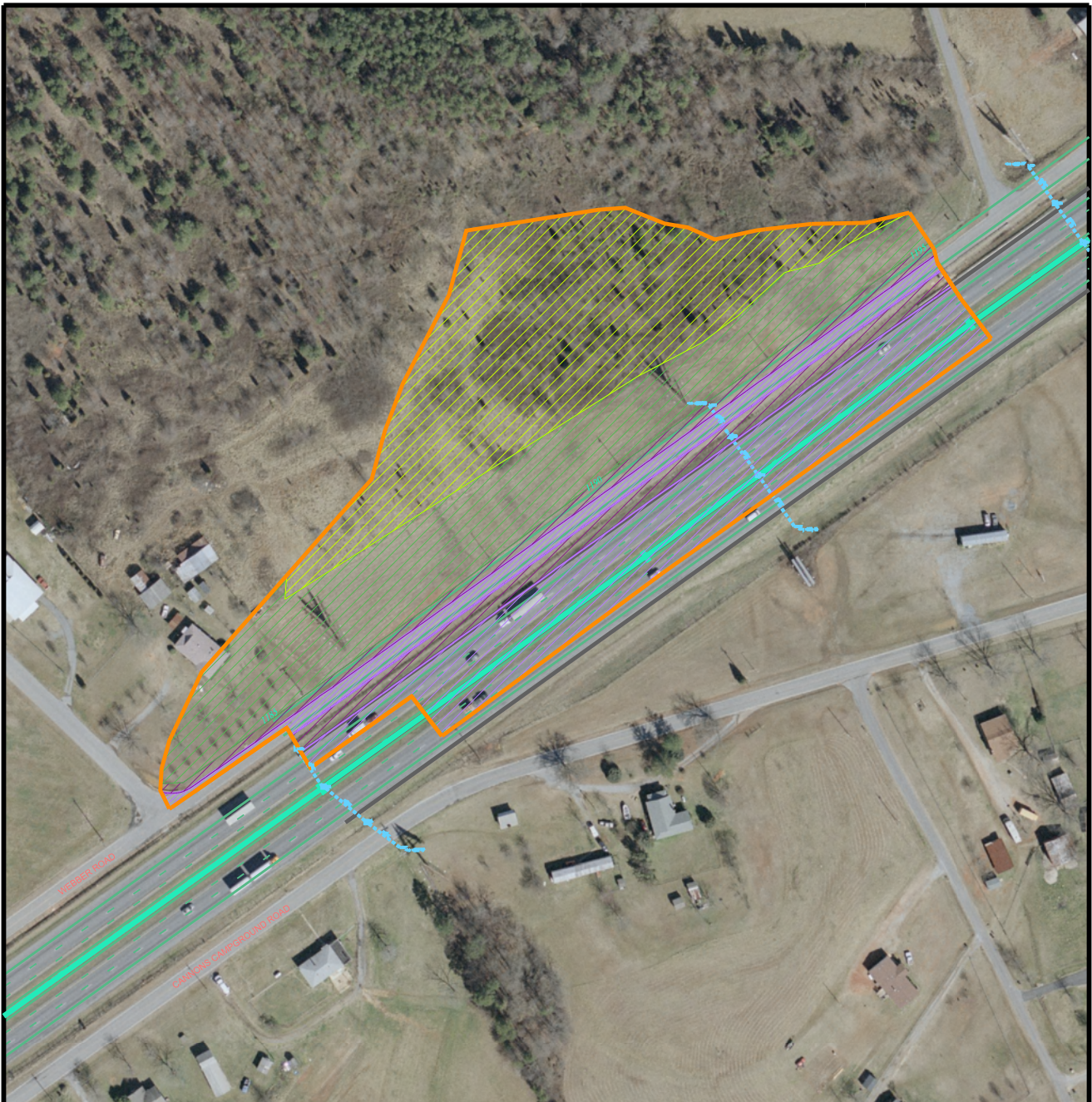
\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-2

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







PAVEMENTS, ROOFS



WOODLAND & FOREST



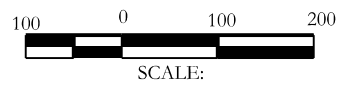
GRASS SHOULDERS



MEADOWS & PASTURES

## LAND USE MAP - SITE # B-2

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 7.8 cfs

Design Flow: 15 cfs

Maximum Flow: 16.9 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-2**

Headwater Elevation (ft)	Total Discharge (cfs)	B-2 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
891.89	7.80	7.80	0.00	1
892.03	8.71	8.71	0.00	1
892.19	9.62	9.62	0.00	1
892.37	10.53	10.53	0.00	1
892.56	11.44	11.44	0.00	1
892.77	12.35	12.35	0.00	1
892.99	13.26	13.26	0.00	1
893.22	14.17	14.17	0.00	1
893.45	15.00	15.00	0.00	1
893.73	15.99	15.99	0.00	1
894.01	16.90	16.90	0.00	1
894.60	18.75	18.75	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-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)
7.80	7.80	891.89	1.626	0.0*	5-S2n	0.695	1.078	0.695	0.202	9.748	3.861
8.71	8.71	892.03	1.774	0.0*	5-S2n	0.740	1.138	0.740	0.216	10.030	4.030
9.62	9.62	892.19	1.935	0.0*	5-S2n	0.785	1.196	0.785	0.230	10.275	4.188
10.53	10.53	892.37	2.110	0.0*	5-S2n	0.830	1.246	0.830	0.243	10.489	4.340
11.44	11.44	892.56	2.301	0.0*	5-S2n	0.875	1.290	0.875	0.255	10.696	4.481
12.35	12.35	892.77	2.508	0.0*	5-S2n	0.920	1.327	0.920	0.268	10.877	4.617
13.26	13.26	892.99	2.729	0.461	5-S2n	0.965	1.360	0.965	0.279	11.027	4.745
14.17	14.17	893.22	2.964	0.979	5-S2n	1.013	1.385	1.013	0.291	11.170	4.869
15.00	15.00	893.45	3.191	1.481	5-S2n	1.057	1.407	1.057	0.301	11.281	4.976
15.99	15.99	893.73	3.475	2.108	5-S2n	1.113	1.420	1.121	0.313	11.275	5.101
16.90	16.90	894.01	3.748	2.702	5-S2n	1.172	1.395	1.175	0.324	11.401	5.210

\* Full Flow Headwater elevation is below inlet invert.



\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 890.26 ft, Outlet Elevation (invert): 885.73 ft  
Culvert Length: 186.06 ft, Culvert Slope: 0.0244  
\*\*\*\*\*

## Site Data - B-2

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 890.26 ft

Outlet Station: 186.00 ft

Outlet Elevation: 885.73 ft

Number of Barrels: 1

## Culvert Data Summary - B-2

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Grooved End in Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-2)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
7.80	885.93	0.20	3.86	0.68	1.51
8.71	885.95	0.22	4.03	0.73	1.53
9.62	885.96	0.23	4.19	0.77	1.54
10.53	885.97	0.24	4.34	0.82	1.55
11.44	885.99	0.26	4.48	0.86	1.56
12.35	886.00	0.27	4.62	0.90	1.57
13.26	886.01	0.28	4.75	0.94	1.58
14.17	886.02	0.29	4.87	0.98	1.59
15.00	886.03	0.30	4.98	1.02	1.60
15.99	886.04	0.31	5.10	1.06	1.61
16.90	886.05	0.32	5.21	1.09	1.61

**Tailwater Channel Data - B-2**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 10.00 ft

Channel Slope: 0.0540

Channel Manning's n: 0.0300

Channel Invert Elevation: 885.73 ft

**Roadway Data for Crossing: B-2**

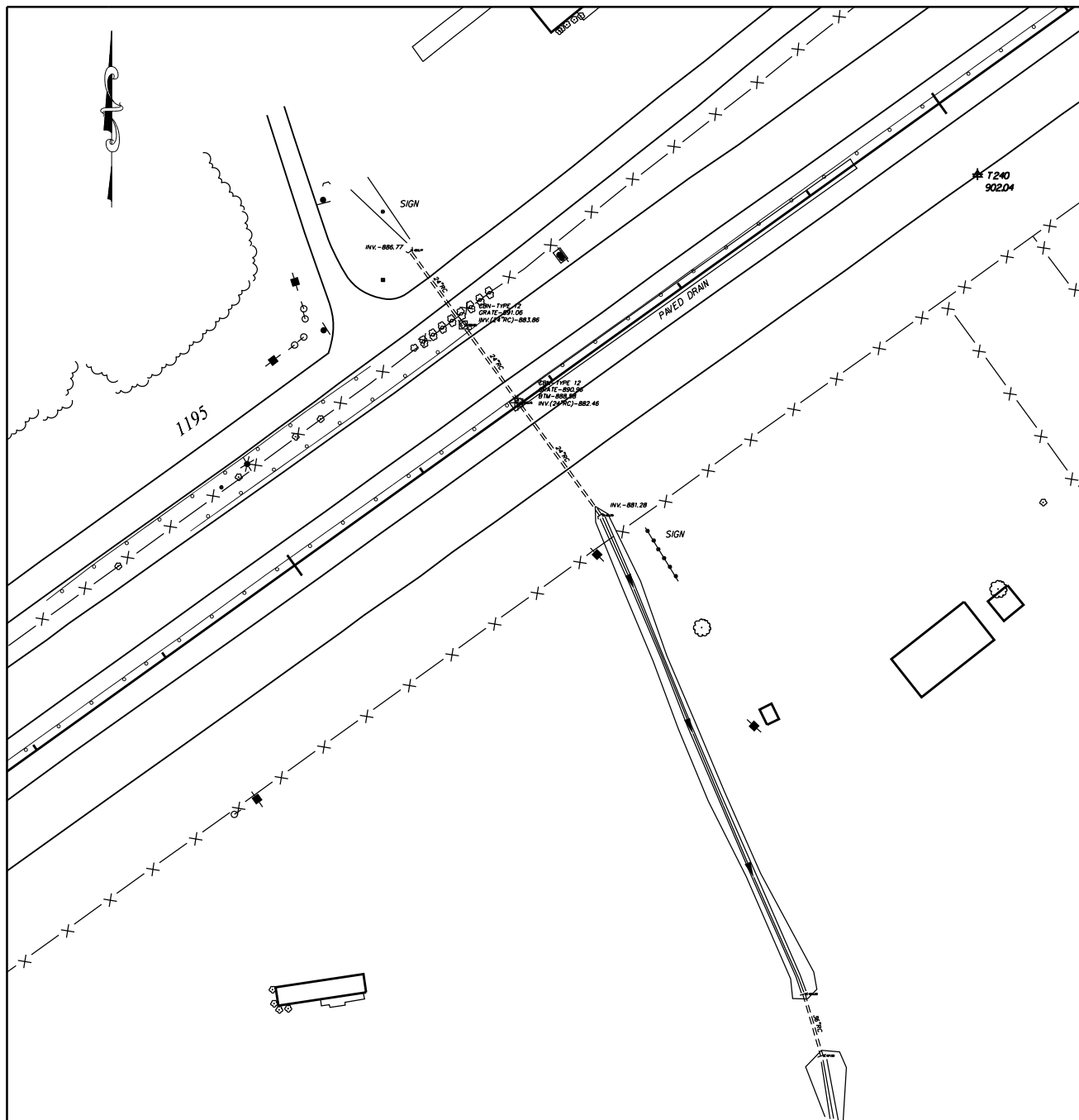
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 894.60 ft

Roadway Surface: Paved

Roadway Top Width: 146.00 ft



# PLAN VIEW SITE # B-3

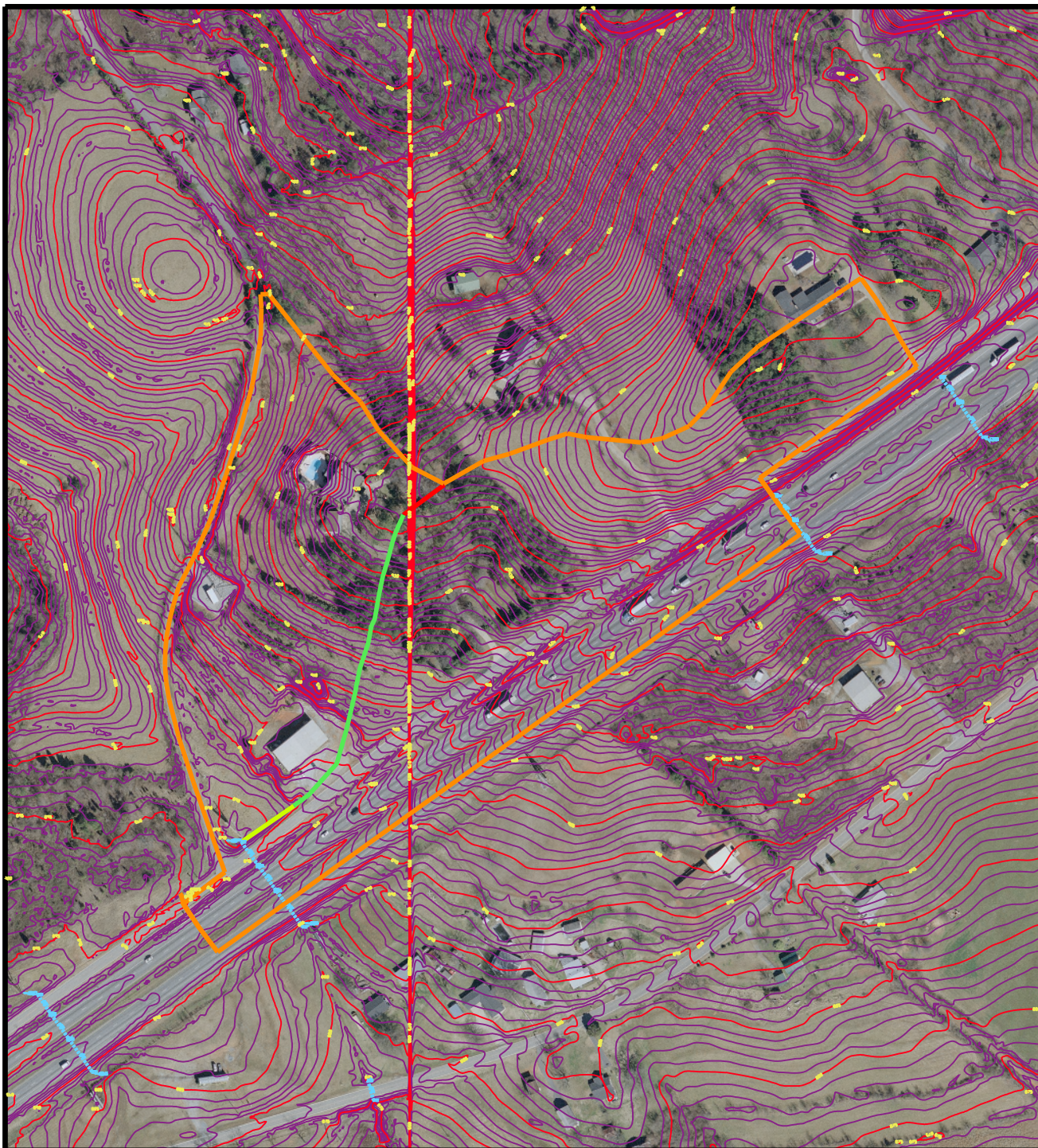
I-85 WIDENING CHEROKEE CO MM80-96

SPARTANBURG/CHEROKEE COUNTY



SCALE:





- |                        |                                      |
|------------------------|--------------------------------------|
| — Watershed            | — Ditch Flow                         |
| — Overland             | — Existing 5' Contour Line/Elevation |
| — Shallow Concentrated | — Existing 1' Contour Line           |

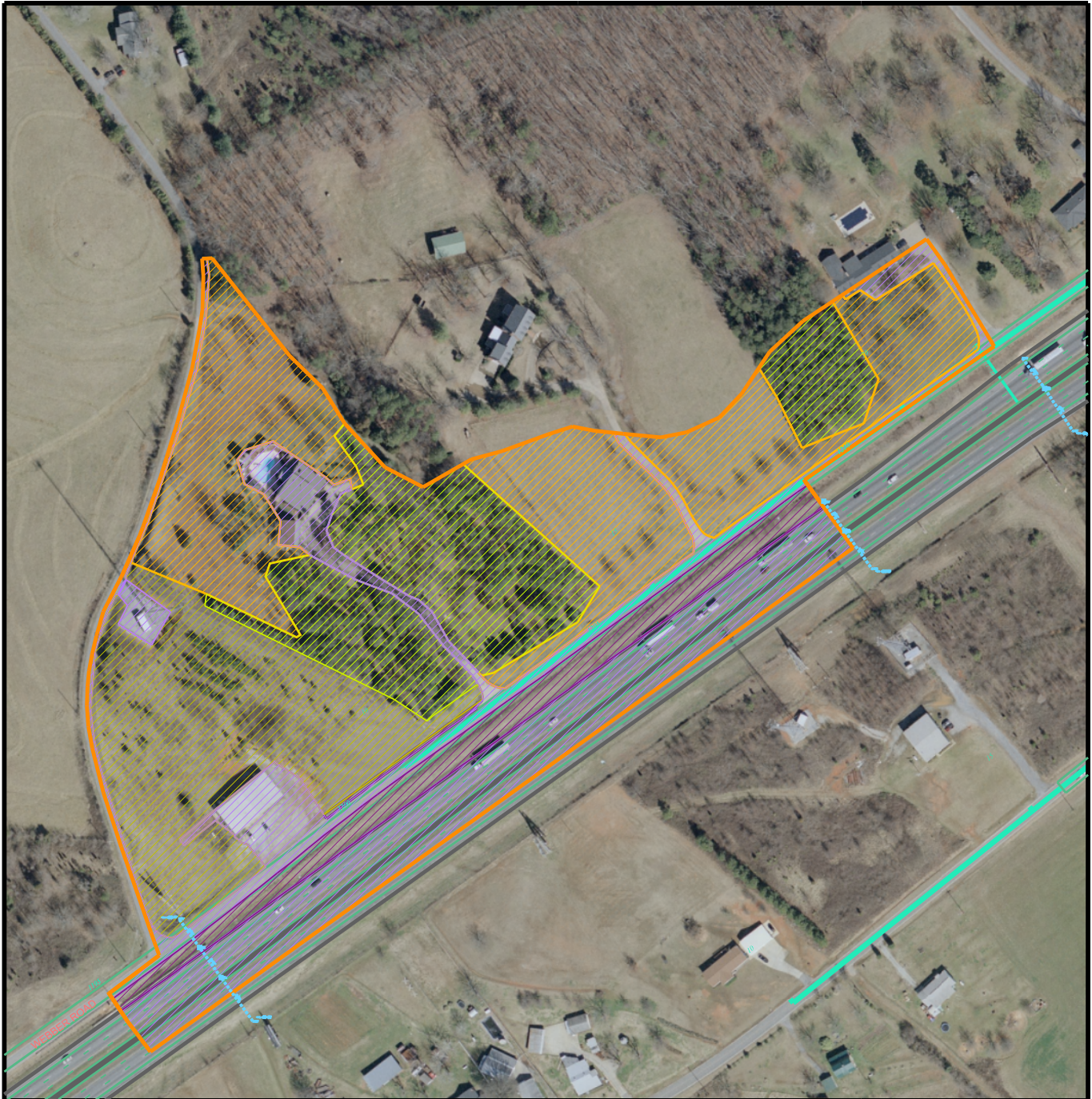
\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-3

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



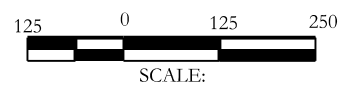




- |   |                  |   |                    |
|---|------------------|---|--------------------|
|  | PAVEMENTS, ROOFS |  | LAWNS, SANDY SOILS |
|  | GRASS SHOULDERS  |  | WOODLAND & FOREST  |
|  | UNIMPROVED AREA  |   |                    |

## LAND USE MAP - SITE # B-3

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 18.6 cfs

Design Flow: 36.2 cfs

Maximum Flow: 40.8 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-3**

Headwater Elevation (ft)	Total Discharge (cfs)	B-3 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
889.21	18.60	18.60	0.00	1
889.48	20.82	20.82	0.00	1
889.77	23.04	23.04	0.00	1
890.10	25.26	25.26	0.00	1
890.45	27.48	27.48	0.00	1
890.83	29.70	29.70	0.00	1
891.23	31.92	31.92	0.00	1
891.66	34.14	34.14	0.00	1
892.07	36.20	36.20	0.00	1
892.57	38.58	38.58	0.00	1
893.11	40.80	40.80	0.00	1
896.98	50.92	50.92	0.00	Overtopping



**Table 2 - Culvert Summary Table: B-3**

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)
18.60	18.60	889.21	2.443	0.0*	5-S2n	0.955	1.551	0.965	0.983	12.394	3.851
20.82	20.82	889.48	2.709	0.0*	5-S2n	1.020	1.634	1.020	1.025	12.921	3.961
23.04	23.04	889.77	3.004	0.0*	5-S2n	1.086	1.707	1.086	1.065	13.229	4.063
25.26	25.26	890.10	3.327	0.0*	5-S2n	1.150	1.768	1.150	1.102	13.518	4.157
27.48	27.48	890.45	3.679	0.409	5-S2n	1.215	1.818	1.229	1.138	13.579	4.246
29.70	29.70	890.83	4.057	1.098	5-S2n	1.280	1.856	1.280	1.171	13.991	4.329
31.92	31.92	891.23	4.460	1.839	5-S2n	1.349	1.891	1.373	1.203	13.900	4.408
34.14	34.14	891.66	4.886	2.621	5-S2n	1.418	1.906	1.446	1.234	14.042	4.482
36.20	36.20	892.07	5.300	3.322	5-S2n	1.488	1.777	1.503	1.262	14.264	4.549
38.58	38.58	892.57	5.803	4.344	5-S2n	1.578	1.941	1.594	1.292	14.395	4.622
40.80	40.80	893.11	6.341	5.304	5-S2n	1.679	2.000	1.679	1.320	14.452	4.687

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 886.77 ft,    Outlet Elevation (invert): 881.28 ft  
Culvert Length: 205.07 ft,    Culvert Slope: 0.0268  
\*\*\*\*\*

### Site Data - B-3

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 886.77 ft

Outlet Station: 205.00 ft

Outlet Elevation: 881.28 ft

Number of Barrels: 1

### Culvert Data Summary - B-3

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Grooved End in Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-3)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
18.60	882.26	0.98	3.85	0.98	0.97
20.82	882.31	1.03	3.96	1.02	0.97
23.04	882.34	1.06	4.06	1.06	0.98
25.26	882.38	1.10	4.16	1.10	0.99
27.48	882.42	1.14	4.25	1.14	0.99
29.70	882.45	1.17	4.33	1.17	1.00
31.92	882.48	1.20	4.41	1.20	1.00
34.14	882.51	1.23	4.48	1.23	1.01
36.20	882.54	1.26	4.55	1.26	1.01
38.58	882.57	1.29	4.62	1.29	1.01
40.80	882.60	1.32	4.69	1.32	1.02

**Tailwater Channel Data - B-3**

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 5.00 (1:1)

Channel Slope: 0.0160

Channel Manning's n: 0.0300

Channel Invert Elevation: 881.28 ft

**Roadway Data for Crossing: B-3**

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 896.98 ft

Roadway Surface: Paved

Roadway Top Width: 150.00 ft

# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 18.6 cfs

Design Flow: 36.2 cfs

Maximum Flow: 40.8 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-3 Proposed**

Headwater Elevation (ft)	Total Discharge (cfs)	B-3 Proposed Discharge (cfs)	Roadway Discharge (cfs)	Iterations
888.74	18.60	18.60	0.00	1
888.88	20.82	20.82	0.00	1
889.02	23.04	23.04	0.00	1
889.15	25.26	25.26	0.00	1
889.28	27.48	27.48	0.00	1
889.41	29.70	29.70	0.00	1
889.54	31.92	31.92	0.00	1
889.67	34.14	34.14	0.00	1
889.80	36.20	36.20	0.00	1
889.94	38.58	38.58	0.00	1
890.08	40.80	40.80	0.00	1
896.98	101.34	101.34	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-3 Proposed**

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)
18.60	18.60	888.74	1.971	0.0*	1-S2n	0.801	1.382	0.831	0.819	11.671	4.541
20.82	20.82	888.88	2.115	0.0*	1-S2n	0.848	1.466	0.848	0.883	12.724	4.714
23.04	23.04	889.02	2.252	0.0*	1-S2n	0.891	1.544	0.906	0.945	12.744	4.874
25.26	25.26	889.15	2.385	0.0*	1-S2n	0.933	1.618	0.933	1.006	13.418	5.021
27.48	27.48	889.28	2.515	0.0*	1-S2n	0.976	1.692	0.976	1.065	13.730	5.159
29.70	29.70	889.41	2.644	0.0*	1-S2n	1.018	1.760	1.051	1.124	13.428	5.287
31.92	31.92	889.54	2.773	0.0*	1-S2n	1.061	1.830	1.061	1.180	14.255	5.408
34.14	34.14	889.67	2.903	0.0*	1-S2n	1.102	1.894	1.132	1.237	14.004	5.522
36.20	36.20	889.80	3.026	0.0*	5-S2n	1.135	1.952	1.159	1.288	14.340	5.622
38.58	38.58	889.94	3.172	0.0*	5-S2n	1.174	2.016	1.211	1.346	14.423	5.732
40.80	40.80	890.08	3.313	0.0*	5-S2n	1.210	2.078	1.245	1.400	14.692	5.829



\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 886.77 ft,    Outlet Elevation (invert): 881.28 ft  
Culvert Length: 205.07 ft,    Culvert Slope: 0.0268  
\*\*\*\*\*

### **Site Data - B-3 Proposed**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 886.77 ft

Outlet Station: 205.00 ft

Outlet Elevation: 881.28 ft

Number of Barrels: 1

### **Culvert Data Summary - B-3 Proposed**

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-3 Proposed)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
18.60	882.10	0.82	4.54	0.82	0.88
20.82	882.16	0.88	4.71	0.88	0.88
23.04	882.23	0.95	4.87	0.94	0.88
25.26	882.29	1.01	5.02	1.00	0.88
27.48	882.35	1.07	5.16	1.06	0.88
29.70	882.40	1.12	5.29	1.12	0.88
31.92	882.46	1.18	5.41	1.18	0.88
34.14	882.52	1.24	5.52	1.23	0.88
36.20	882.57	1.29	5.62	1.29	0.87
38.58	882.63	1.35	5.73	1.34	0.87
40.80	882.68	1.40	5.83	1.40	0.87

**Tailwater Channel Data - B-3 Proposed**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 5.00 ft

Channel Slope: 0.0160

Channel Manning's n: 0.0300

Channel Invert Elevation: 881.28 ft

**Roadway Data for Crossing: B-3 Proposed**

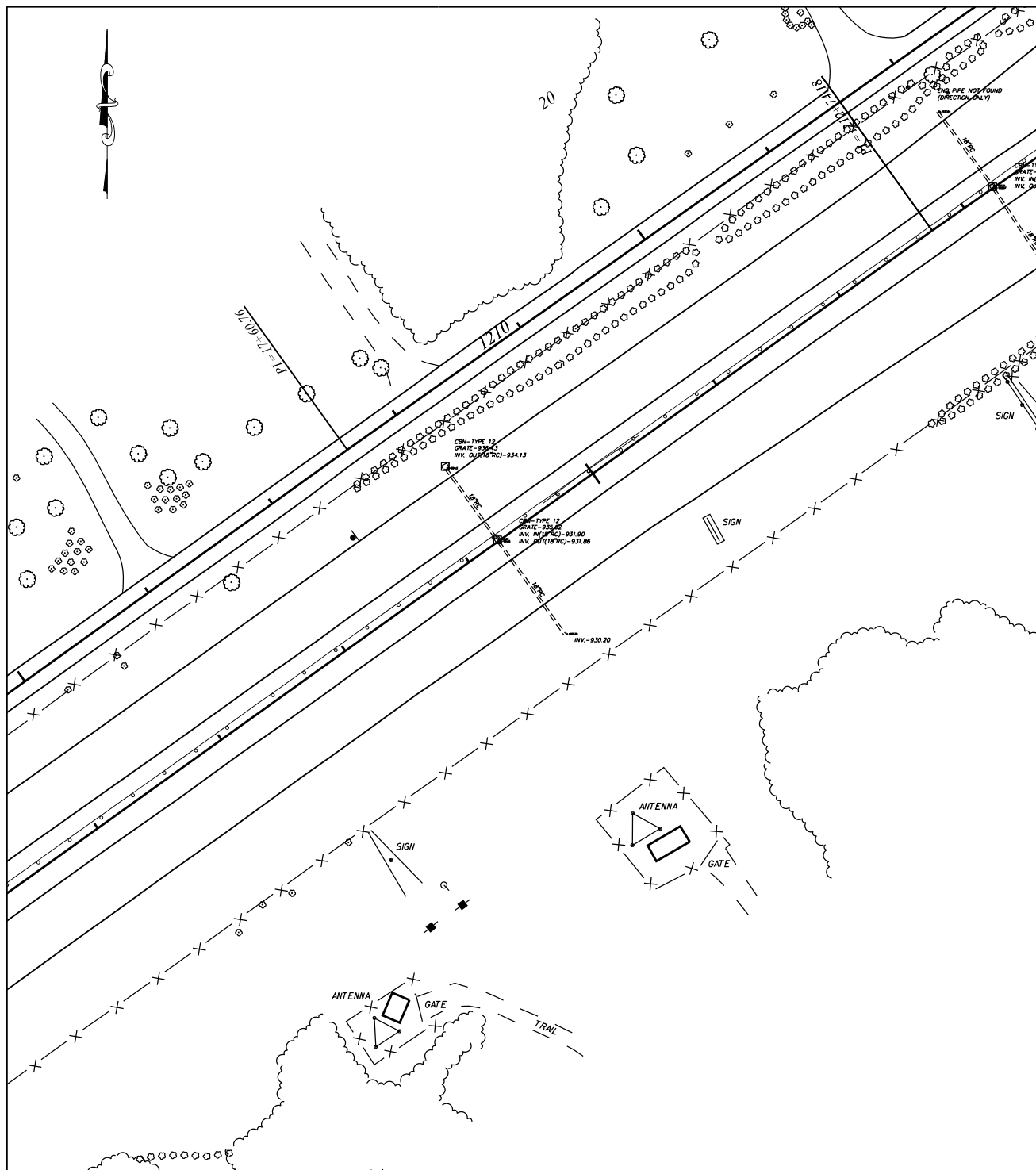
Roadway Profile Shape: Constant Roadway Elevation

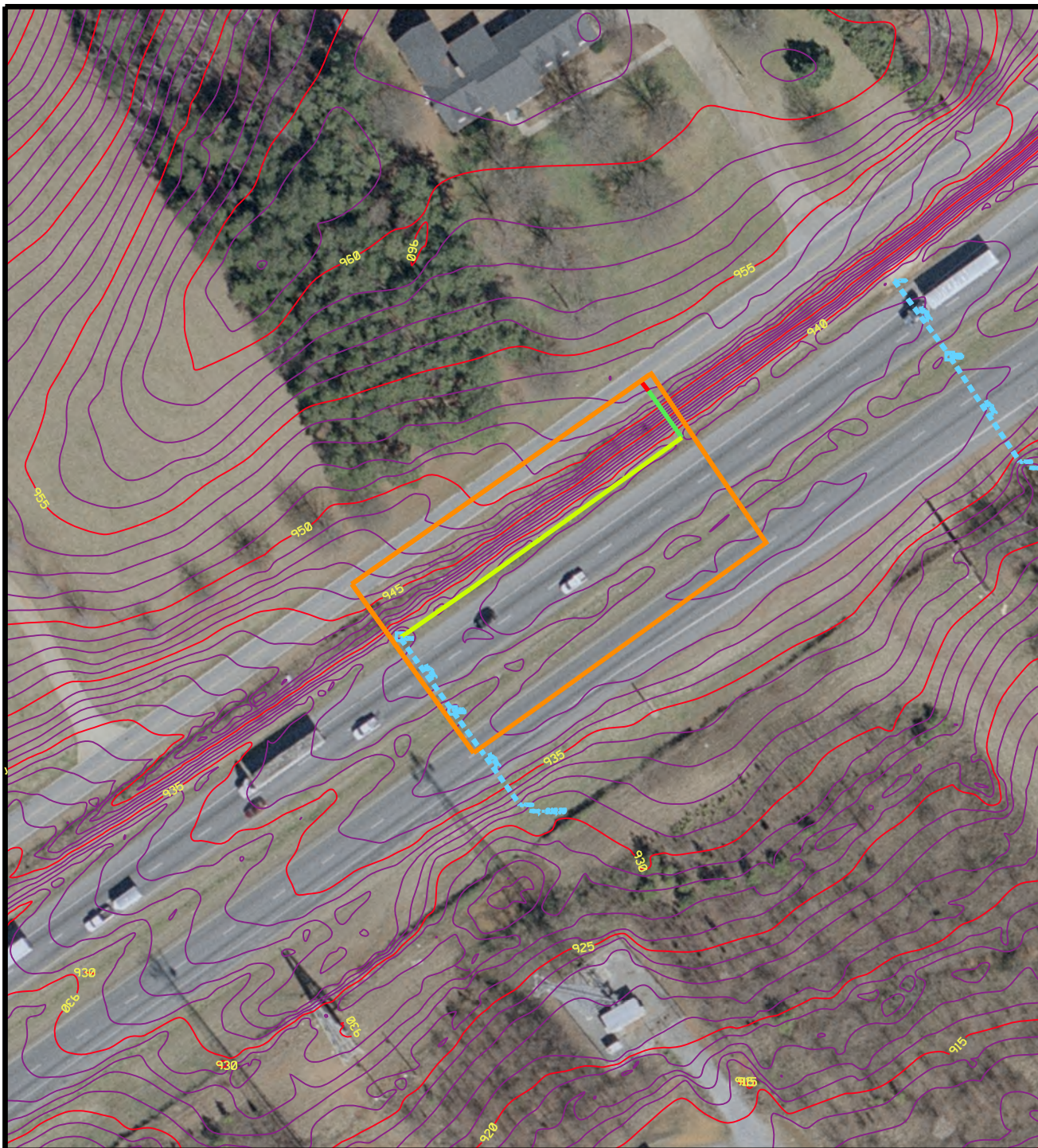
Crest Length: 300.00 ft

Crest Elevation: 896.98 ft

Roadway Surface: Paved

Roadway Top Width: 150.00 ft





- Watershed
- Overland
- Shallow Concentrated

- Ditch Flow
- Existing 5' Contour Line/Elevation
- Existing 1' Contour Line

\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-4


I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







 PAVEMENT, ROOFS

 GRASS SHOULDERS

## LAND USE MAP - SITE # B-4

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 2.59 cfs

Design Flow: 3.5 cfs

Maximum Flow: 5.4 cfs



**Table 1 - Summary of Culvert Flows at Crossing: B-4**

Headwater Elevation (ft)	Total Discharge (cfs)	B-4 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
934.96	2.59	2.59	0.00	1
935.01	2.87	2.87	0.00	1
935.06	3.15	3.15	0.00	1
935.11	3.43	3.43	0.00	1
935.12	3.50	3.50	0.00	1
935.20	4.00	4.00	0.00	1
935.24	4.28	4.28	0.00	1
935.28	4.56	4.56	0.00	1
935.32	4.84	4.84	0.00	1
935.36	5.12	5.12	0.00	1
935.40	5.40	5.40	0.00	1
938.00	17.30	17.30	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-4**

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)
2.59	2.59	934.96	0.829	0.0*	1-S2n	0.365	0.608	0.365	0.048	7.718	1.782
2.87	2.87	935.01	0.881	0.0*	1-S2n	0.387	0.643	0.387	0.052	7.909	1.854
3.15	3.15	935.06	0.931	0.0*	1-S2n	0.409	0.676	0.409	0.055	8.074	1.927
3.43	3.43	935.11	0.979	0.0*	1-S2n	0.426	0.707	0.428	0.057	8.291	1.993
3.50	3.50	935.12	0.990	0.0*	1-S2n	0.429	0.714	0.435	0.058	8.285	2.007
4.00	4.00	935.20	1.069	0.0*	1-S2n	0.459	0.765	0.459	0.063	8.831	2.118
4.28	4.28	935.24	1.112	0.0*	1-S2n	0.475	0.791	0.475	0.066	8.864	2.172
4.56	4.56	935.28	1.153	0.0*	1-S2n	0.492	0.817	0.492	0.068	9.017	2.228
4.84	4.84	935.32	1.194	0.0*	1-S2n	0.508	0.842	0.508	0.071	9.156	2.286
5.12	5.12	935.36	1.234	0.0*	1-S2n	0.525	0.865	0.525	0.073	9.284	2.334
5.40	5.40	935.40	1.274	0.0*	1-S2n	0.541	0.893	0.541	0.075	9.401	2.385

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 934.13 ft,    Outlet Elevation (invert): 930.20 ft  
Culvert Length: 136.06 ft,    Culvert Slope: 0.0289  
\*\*\*\*\*

#### **Site Data - B-4**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 934.13 ft

Outlet Station: 136.00 ft

Outlet Elevation: 930.20 ft

Number of Barrels: 1

#### **Culvert Data Summary - B-4**

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Grooved End in Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-4)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
2.59	930.25	0.05	1.78	0.22	1.43
2.87	930.25	0.05	1.85	0.24	1.44
3.15	930.25	0.05	1.93	0.25	1.45
3.43	930.26	0.06	1.99	0.26	1.47
3.50	930.26	0.06	2.01	0.27	1.47
4.00	930.26	0.06	2.12	0.29	1.49
4.28	930.27	0.07	2.17	0.30	1.49
4.56	930.27	0.07	2.23	0.31	1.50
4.84	930.27	0.07	2.29	0.32	1.52
5.12	930.27	0.07	2.33	0.33	1.52
5.40	930.28	0.08	2.38	0.35	1.53

**Tailwater Channel Data - B-4**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 30.00 ft

Channel Slope: 0.0733

Channel Manning's n: 0.0300

Channel Invert Elevation: 930.20 ft

**Roadway Data for Crossing: B-4**

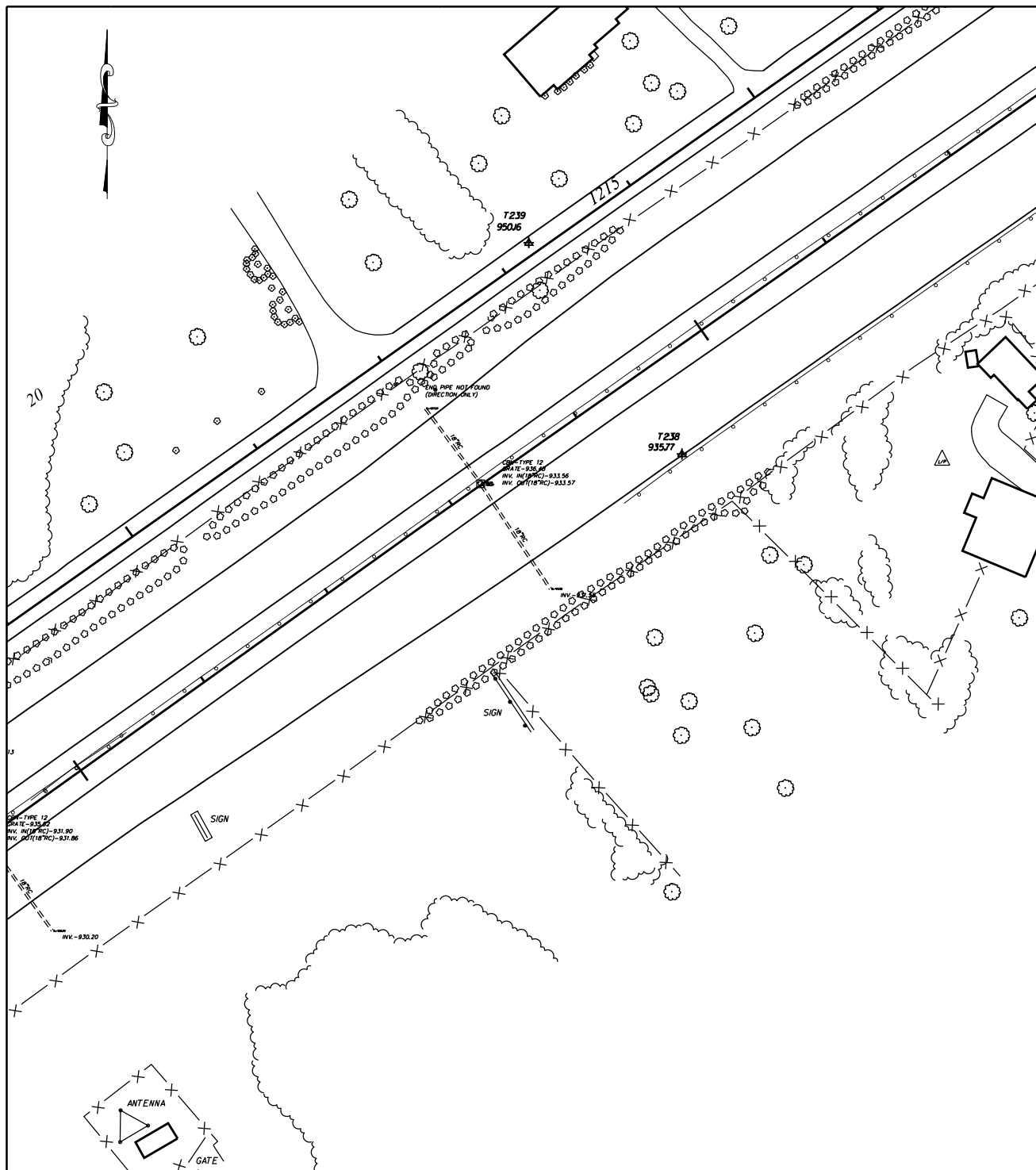
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 300.00 ft

Crest Elevation: 938.00 ft

Roadway Surface: Paved

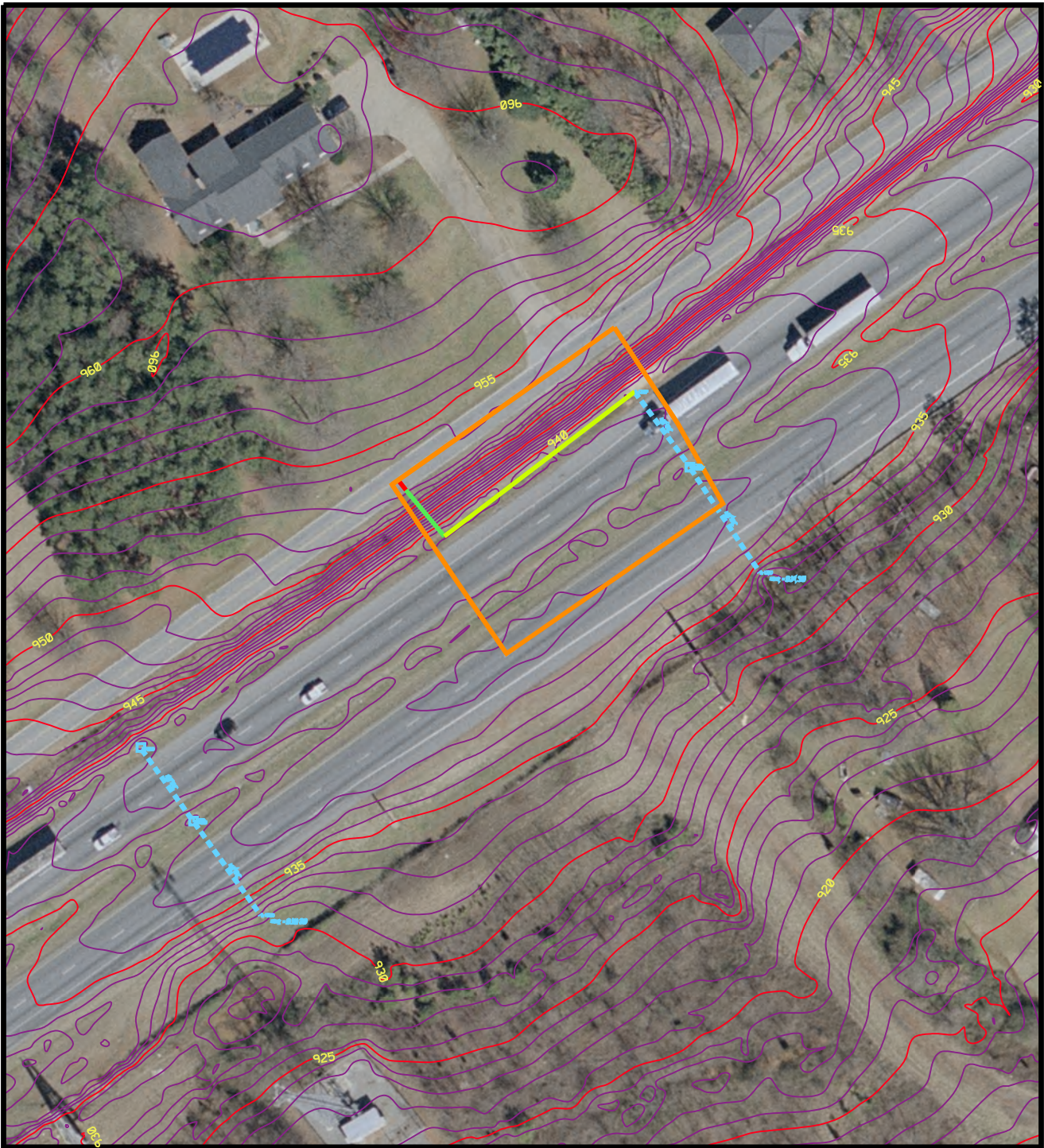
Roadway Top Width: 104.00 ft



## PLAN VIEW SITE # B-5

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY





- |                        |                                      |
|------------------------|--------------------------------------|
| — Watershed            | — Ditch Flow                         |
| — Overland             | — Existing 5' Contour Line/Elevation |
| — Shallow Concentrated | — Existing 1' Contour Line           |

\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-5

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







 PAVEMENT, ROOFS

 GRASS SHOULDERS

## LAND USE MAP - SITE # B-5

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 2.6 cfs

Design Flow: 4 cfs

Maximum Flow: 4.6 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-5**

Headwater Elevation (ft)	Total Discharge (cfs)	B-5 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
935.77	2.60	2.60	0.00	1
935.81	2.80	2.80	0.00	1
935.85	3.00	3.00	0.00	1
935.89	3.20	3.20	0.00	1
935.93	3.40	3.40	0.00	1
935.97	3.60	3.60	0.00	1
936.00	3.80	3.80	0.00	1
936.04	4.00	4.00	0.00	1
936.07	4.20	4.20	0.00	1
936.10	4.40	4.40	0.00	1
936.14	4.60	4.60	0.00	1
938.00	12.86	12.86	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-5**

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)
2.60	2.60	935.77	0.852	0.0*	1-S2n	0.391	0.609	0.391	0.229	7.066	2.836
2.80	2.80	935.81	0.894	0.0*	1-S2n	0.409	0.634	0.409	0.240	7.182	2.916
3.00	3.00	935.85	0.933	0.0*	1-S2n	0.422	0.658	0.422	0.251	7.379	2.992
3.20	3.20	935.89	0.972	0.0*	1-S2n	0.435	0.681	0.435	0.261	7.563	3.064
3.40	3.40	935.93	1.009	0.0*	1-S2n	0.448	0.703	0.448	0.271	7.734	3.133
3.60	3.60	935.97	1.046	0.0*	1-S2n	0.462	0.725	0.462	0.281	7.766	3.200
3.80	3.80	936.00	1.081	0.0*	1-S2n	0.475	0.745	0.475	0.291	7.884	3.265
4.00	4.00	936.04	1.116	0.0*	1-S2n	0.488	0.765	0.488	0.301	7.994	3.326
4.20	4.20	936.07	1.151	0.0*	1-S2n	0.501	0.784	0.501	0.310	8.096	3.386
4.40	4.40	936.10	1.184	0.0*	1-S2n	0.514	0.803	0.514	0.319	8.191	3.444
4.60	4.60	936.14	1.218	0.0*	1-S2n	0.527	0.821	0.527	0.328	8.280	3.502

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 934.92 ft,    Outlet Elevation (invert): 931.58 ft  
Culvert Length: 146.04 ft,    Culvert Slope: 0.0229  
\*\*\*\*\*

## Site Data - B-5

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 934.92 ft

Outlet Station: 146.00 ft

Outlet Elevation: 931.58 ft

Number of Barrels: 1

## Culvert Data Summary - B-5

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE



**Table 3 - Downstream Channel Rating Curve (Crossing: B-5)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
2.60	931.81	0.23	2.84	0.39	1.04
2.80	931.82	0.24	2.92	0.40	1.05
3.00	931.83	0.25	2.99	0.42	1.05
3.20	931.84	0.26	3.06	0.44	1.06
3.40	931.85	0.27	3.13	0.46	1.06
3.60	931.86	0.28	3.20	0.47	1.06
3.80	931.87	0.29	3.26	0.49	1.07
4.00	931.88	0.30	3.33	0.51	1.07
4.20	931.89	0.31	3.39	0.52	1.07
4.40	931.90	0.32	3.44	0.54	1.07
4.60	931.91	0.33	3.50	0.55	1.08

**Tailwater Channel Data - B-5**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 4.00 ft

Channel Slope: 0.0270

Channel Manning's n: 0.0300

Channel Invert Elevation: 931.58 ft

**Roadway Data for Crossing: B-5**

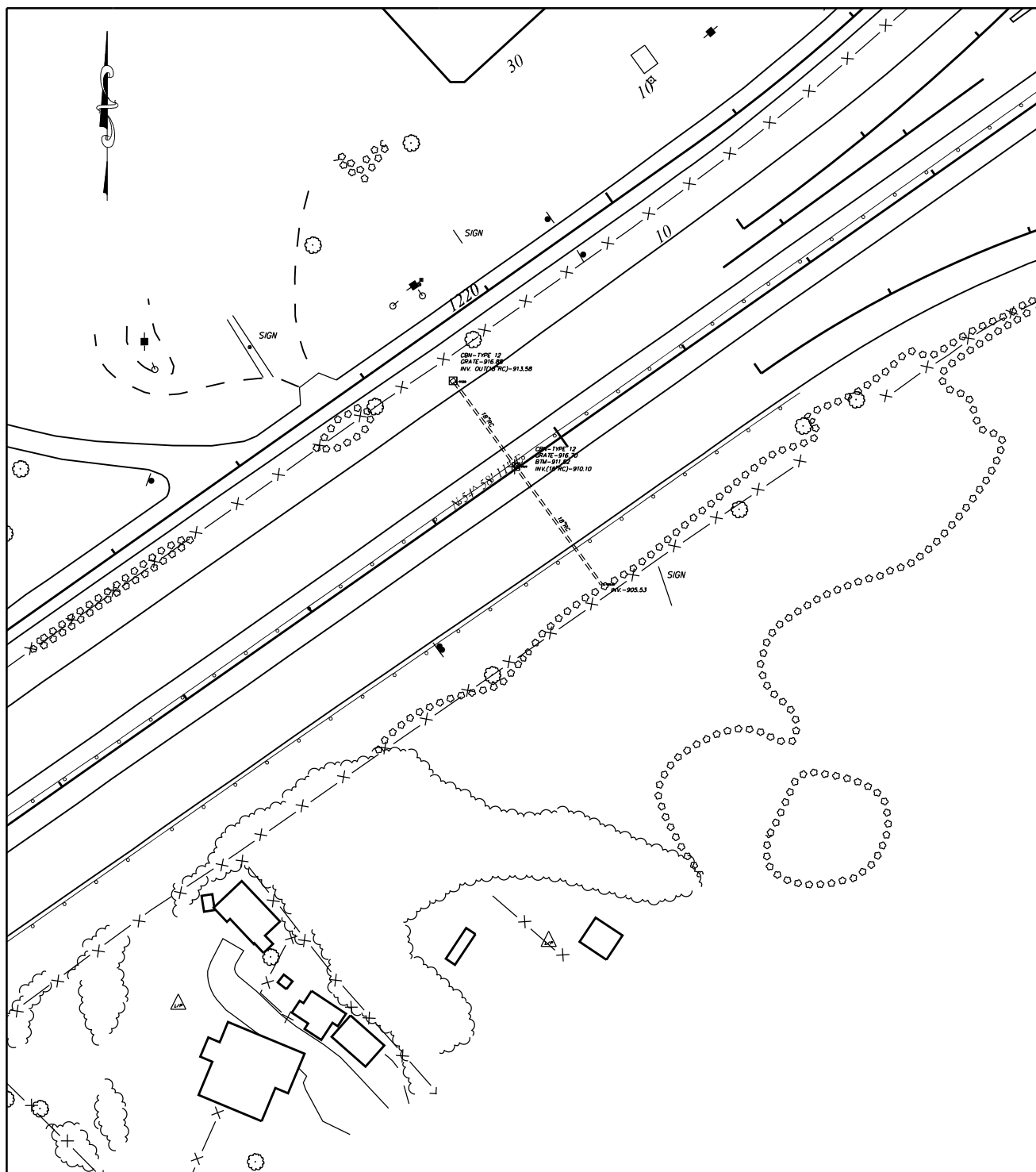
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 938.00 ft

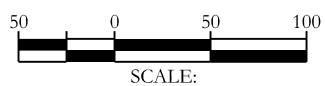
Roadway Surface: Paved

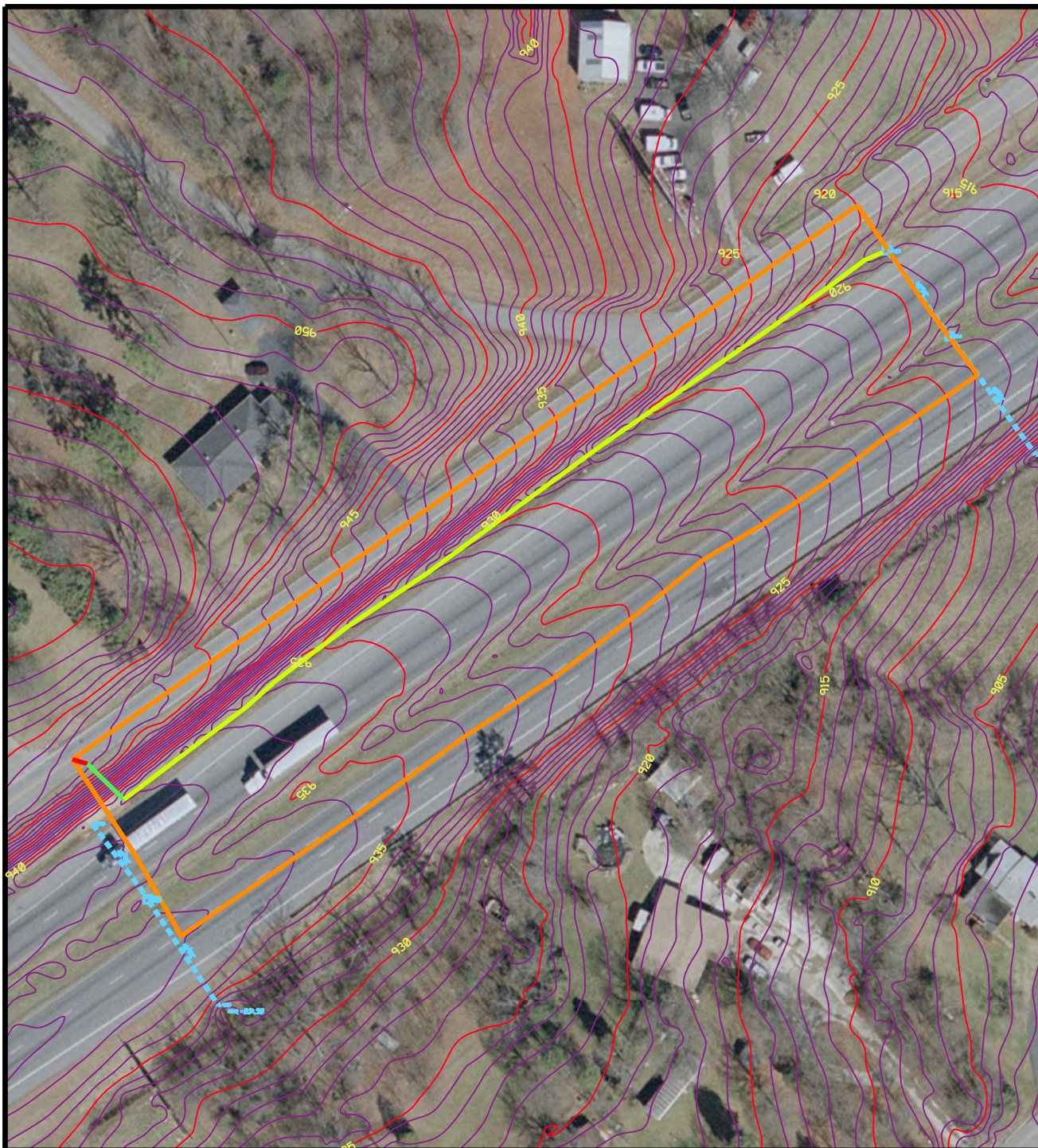
Roadway Top Width: 114.00 ft



**PLAN VIEW SITE # B-6**

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY





- |   |   |
|---|---|
| <span style="color: orange;">—</span> Watershed           | <span style="color: yellow;">—</span> Ditch Flow                      |
| <span style="color: red;">—</span> Overland               | <span style="color: red;">—</span> Existing 5' Contour Line/Elevation |
| <span style="color: green;">—</span> Shallow Concentrated | <span style="color: purple;">—</span> Existing 1' Contour Line        |

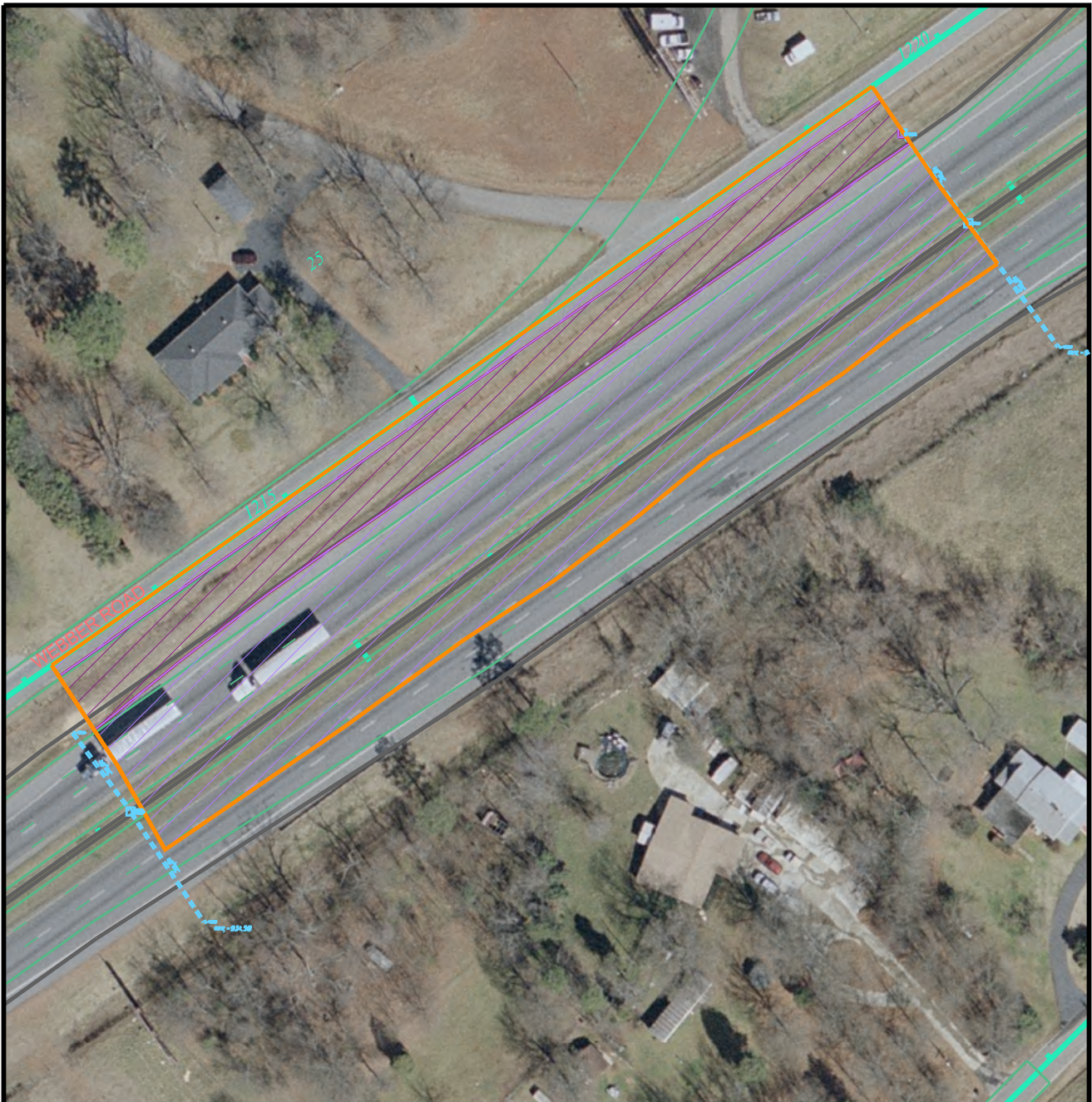
\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-6

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







 PAVEMENT, ROOFS

 GRASS SHOULDERS

## LAND USE MAP - SITE # B-6

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY

50 0 50 100  
SCALE:



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 7.4 cfs

Design Flow: 10 cfs

Maximum Flow: 15.3 cfs



**Table 1 - Summary of Culvert Flows at Crossing: B-6**

Headwater Elevation (ft)	Total Discharge (cfs)	B-6 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
915.13	7.40	7.40	0.00	1
915.25	8.19	8.19	0.00	1
915.38	8.98	8.98	0.00	1
915.52	9.77	9.77	0.00	1
915.57	10.00	10.00	0.00	1
915.84	11.35	11.35	0.00	1
916.02	12.14	12.14	0.00	1
916.21	12.93	12.93	0.00	1
916.41	13.72	13.72	0.00	1
916.62	14.51	14.51	0.00	1
916.84	15.30	15.30	0.00	1
921.00	25.71	25.71	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-6**

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)
7.40	7.40	915.13	1.546	0.0*	5-S2n	0.555	1.050	0.555	0.750	12.470	3.291
8.19	8.19	915.25	1.669	0.0*	5-S2n	0.585	1.105	0.585	0.779	12.891	3.375
8.98	8.98	915.38	1.801	0.0*	5-S2n	0.615	1.155	0.624	0.806	12.908	3.454
9.77	9.77	915.52	1.944	0.0*	5-S2n	0.645	1.205	0.645	0.832	13.441	3.527
10.00	10.00	915.57	1.988	0.0*	5-S2n	0.654	1.218	0.654	0.839	13.518	3.548
11.35	11.35	915.84	2.263	0.0*	5-S2n	0.703	1.286	0.726	0.880	13.405	3.662
12.14	12.14	916.02	2.440	0.0*	5-S2n	0.731	1.320	0.747	0.903	13.817	3.724
12.93	12.93	916.21	2.628	0.0*	5-S2n	0.758	1.349	0.774	0.924	14.067	3.783
13.72	13.72	916.41	2.828	0.0*	5-S2n	0.786	1.374	0.806	0.945	14.188	3.840
14.51	14.51	916.62	3.037	0.0*	5-S2n	0.814	1.393	0.841	0.965	14.231	3.894
15.30	15.30	916.84	3.257	0.0*	5-S2n	0.841	1.410	0.841	0.985	15.005	3.946

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 913.58 ft,    Outlet Elevation (invert): 905.53 ft  
Culvert Length: 163.20 ft,    Culvert Slope: 0.0494  
\*\*\*\*\*

### **Site Data - B-6**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 913.58 ft

Outlet Station: 163.00 ft

Outlet Elevation: 905.53 ft

Number of Barrels: 1

### **Culvert Data Summary - B-6**

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Grooved End in Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-6)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
7.40	906.28	0.75	3.29	0.80	0.95
8.19	906.31	0.78	3.38	0.83	0.95
8.98	906.34	0.81	3.45	0.86	0.96
9.77	906.36	0.83	3.53	0.88	0.96
10.00	906.37	0.84	3.55	0.89	0.97
11.35	906.41	0.88	3.66	0.93	0.97
12.14	906.43	0.90	3.72	0.96	0.98
12.93	906.45	0.92	3.78	0.98	0.98
13.72	906.48	0.95	3.84	1.00	0.98
14.51	906.50	0.97	3.89	1.02	0.99
15.30	906.51	0.98	3.95	1.04	0.99

**Tailwater Channel Data - B-6**

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 4.00 (4:1)

Channel Slope: 0.0170

Channel Manning's n: 0.0300

Channel Invert Elevation: 905.53 ft

**Roadway Data for Crossing: B-6**

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 200.00 ft

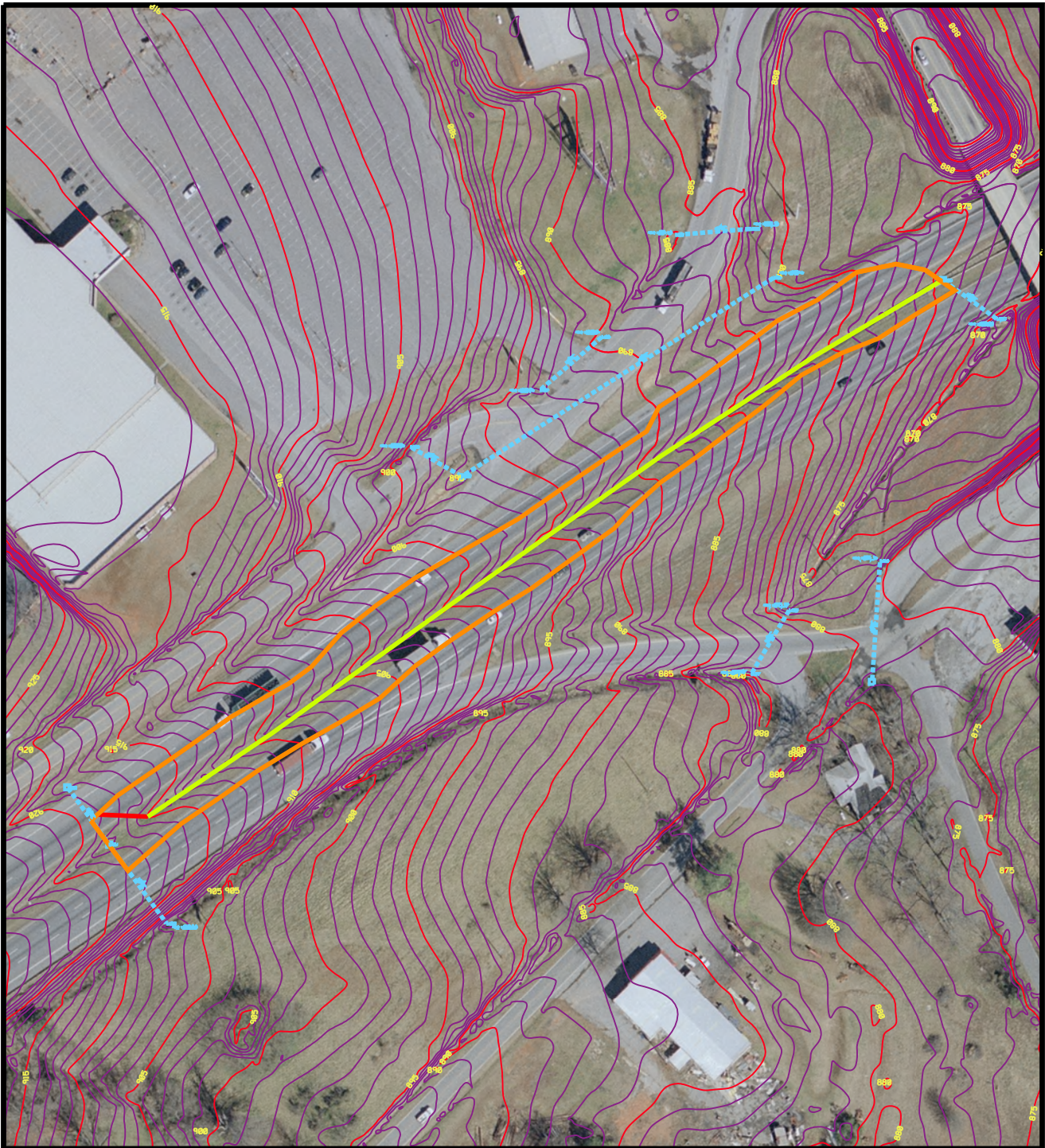
Crest Elevation: 921.00 ft

Roadway Surface: Paved

Roadway Top Width: 127.00 ft







- |  |  |
|--|--|
|  Watershed            |  Ditch Flow                         |
|  Overland             |  Existing 5' Contour Line/Elevation |
|  Shallow Concentrated |  Existing 1' Contour Line           |

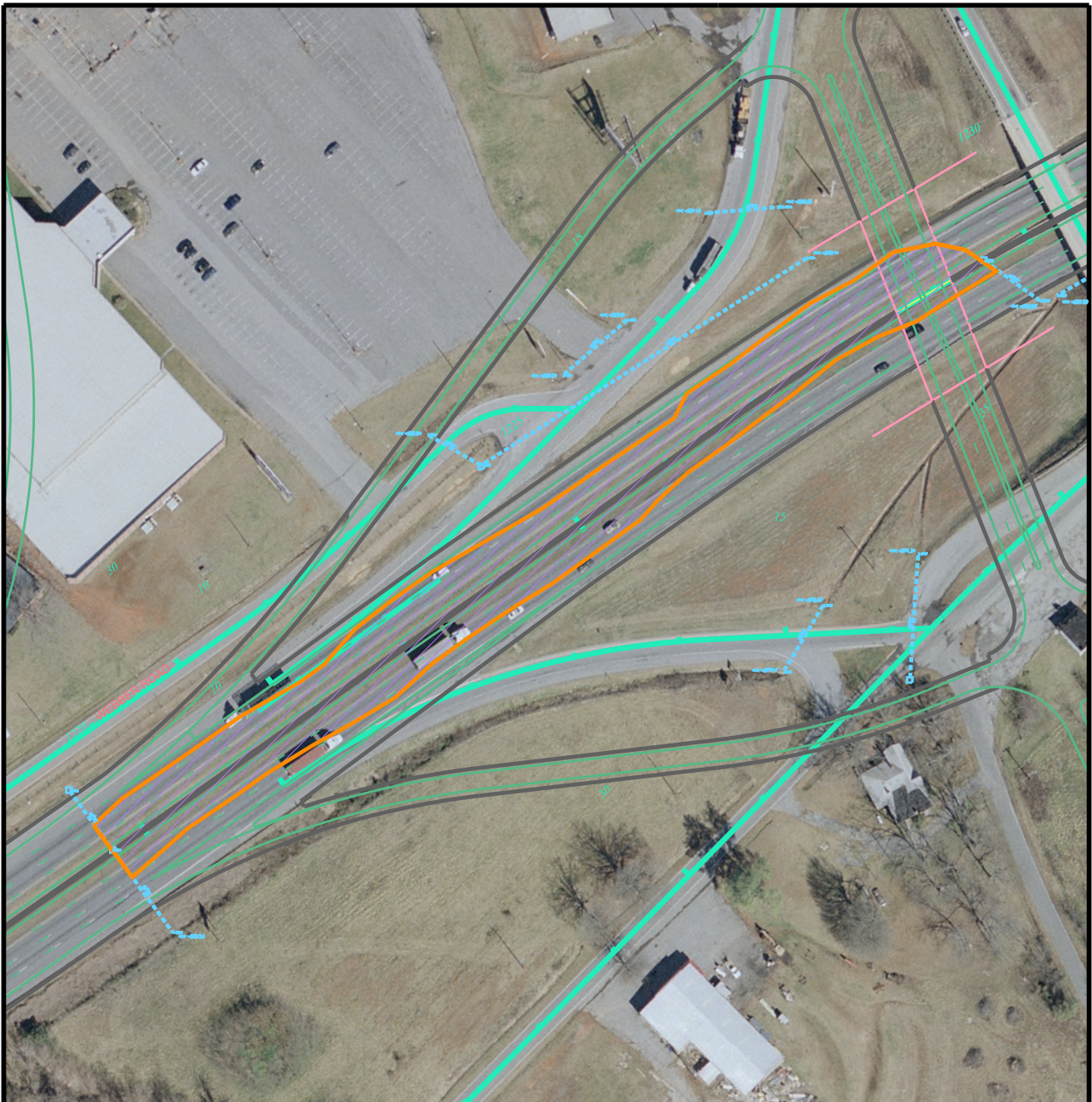
\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-7

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







PAVEMENT, ROOFS

## LAND USE MAP - SITE # B-7

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 6.3 cfs

Design Flow: 8.4 cfs

Maximum Flow: 13 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-7**

Headwater Elevation (ft)	Total Discharge (cfs)	B-7 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
870.59	6.30	6.30	0.00	1
870.68	6.97	6.97	0.00	1
870.78	7.64	7.64	0.00	1
870.89	8.31	8.31	0.00	1
870.90	8.40	8.40	0.00	1
871.12	9.65	9.65	0.00	1
871.25	10.32	10.32	0.00	1
871.39	10.99	10.99	0.00	1
871.53	11.66	11.66	0.00	1
871.69	12.33	12.33	0.00	1
871.85	13.00	13.00	0.00	1
877.19	26.76	26.76	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-7**

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)
6.30	6.30	870.59	1.397	0.0*	1-S2n	0.561	0.965	0.579	0.354	10.044	8.910
6.97	6.97	870.68	1.493	0.0*	1-S2n	0.592	1.019	0.592	0.378	10.808	9.210
7.64	7.64	870.78	1.594	0.0*	5-S2n	0.622	1.067	0.658	0.403	10.241	9.489
8.31	8.31	870.89	1.700	0.0*	5-S2n	0.653	1.112	0.688	0.426	10.512	9.747
8.40	8.40	870.90	1.715	0.0*	5-S2n	0.657	1.118	0.692	0.429	10.552	9.780
9.65	9.65	871.12	1.933	0.117	5-S2n	0.711	1.198	0.747	0.472	10.977	10.218
10.32	10.32	871.25	2.061	0.283	5-S2n	0.740	1.235	0.781	0.495	11.093	10.431
10.99	10.99	871.39	2.198	0.458	5-S2n	0.768	1.269	0.813	0.517	11.238	10.636
11.66	11.66	871.53	2.342	0.640	5-S2n	0.796	1.300	0.843	0.538	11.392	10.829
12.33	12.33	871.69	2.496	0.831	5-S2n	0.824	1.326	0.872	0.560	11.572	11.011
13.00	13.00	871.85	2.657	1.031	5-S2n	0.852	1.351	0.900	0.581	11.752	11.187



\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 869.19 ft,    Outlet Elevation (invert): 866.93 ft  
Culvert Length: 66.04 ft,    Culvert Slope: 0.0342  
\*\*\*\*\*

### **Site Data - B-7**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 869.19 ft

Outlet Station: 66.00 ft

Outlet Elevation: 866.93 ft

Number of Barrels: 1

### **Culvert Data Summary - B-7**

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Grooved End in Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-7)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
6.30	867.28	0.35	8.91	0.68	2.64
6.97	867.31	0.38	9.21	0.73	2.64
7.64	867.33	0.40	9.49	0.78	2.64
8.31	867.36	0.43	9.75	0.82	2.63
8.40	867.36	0.43	9.78	0.83	2.63
9.65	867.40	0.47	10.22	0.91	2.62
10.32	867.42	0.49	10.43	0.96	2.61
10.99	867.45	0.52	10.64	1.00	2.61
11.66	867.47	0.54	10.83	1.04	2.60
12.33	867.49	0.56	11.01	1.08	2.59
13.00	867.51	0.58	11.19	1.12	2.59

**Tailwater Channel Data - B-7**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 2.00 ft

Channel Slope: 0.0310

Channel Manning's n: 0.0120

Channel Invert Elevation: 866.93 ft

**Roadway Data for Crossing: B-7**

Roadway Profile Shape: Constant Roadway Elevation

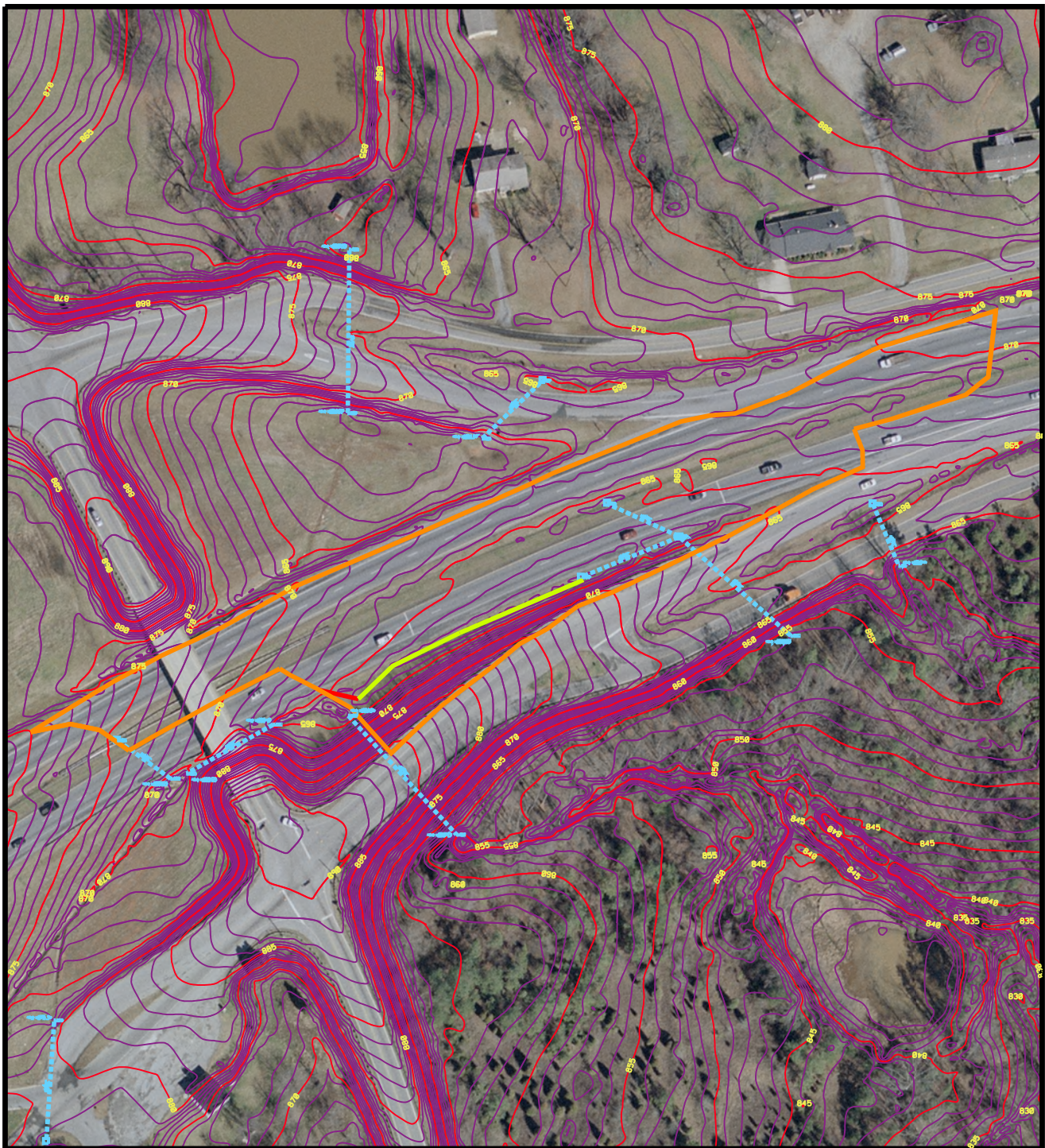
Crest Length: 100.00 ft

Crest Elevation: 877.19 ft

Roadway Surface: Paved

Roadway Top Width: 40.00 ft





- |  |  |
|--|--|
|  Watershed            |  Ditch Flow                         |
|  Overland             |  Existing 5' Contour Line/Elevation |
|  Shallow Concentrated |  Existing 1' Contour Line           |

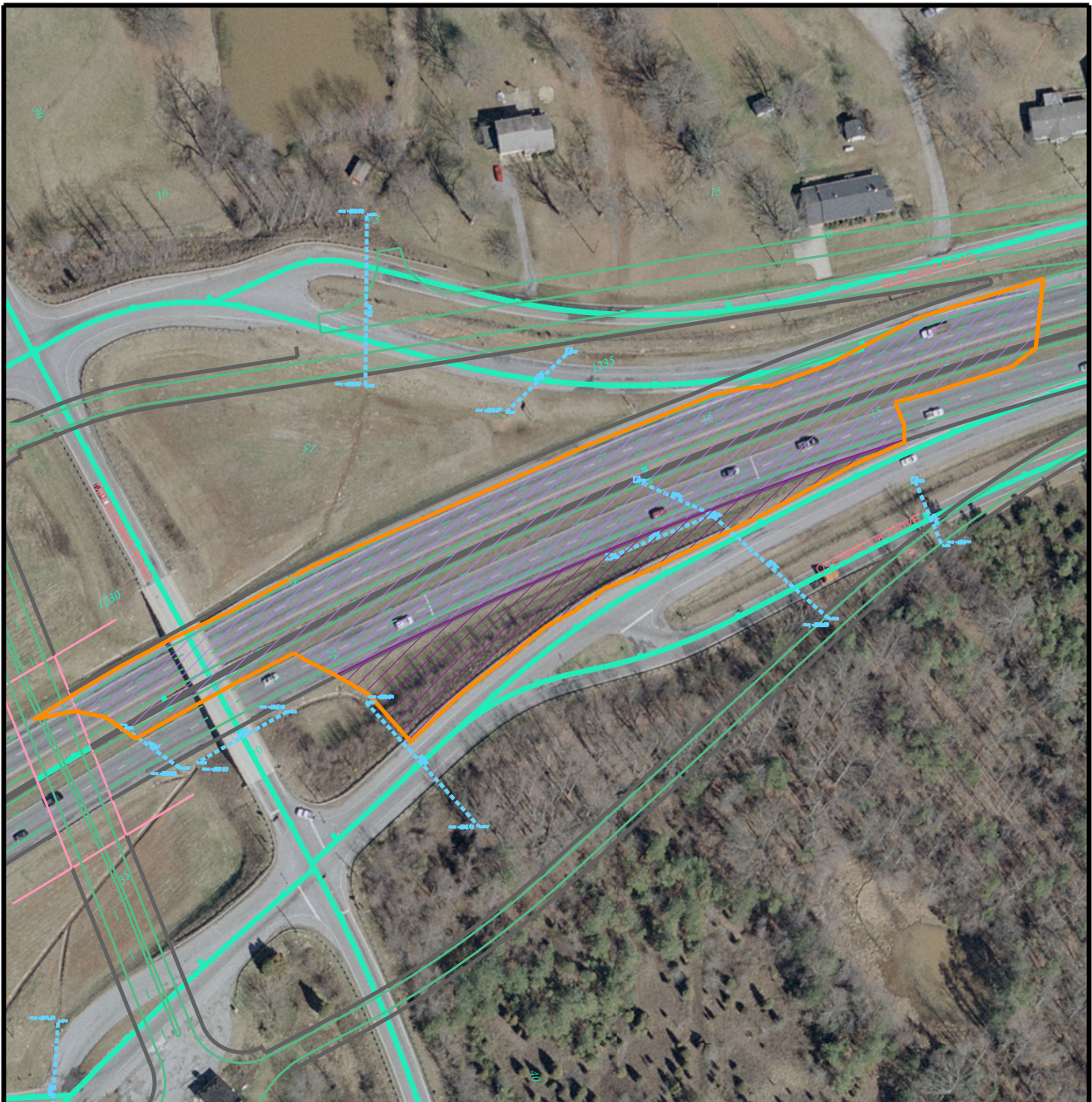
\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-8

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







 PAVEMENT, ROOFS

 GRASS SHOULDERS

## LAND USE MAP - SITE # B-8

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY





# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 9 cfs

Design Flow: 12.1 cfs

Maximum Flow: 18.6 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-8**

Headwater Elevation (ft)	Total Discharge (cfs)	B-8 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
861.17	9.00	9.00	0.00	1
861.35	9.96	9.96	0.00	1
861.54	10.92	10.92	0.00	1
861.75	11.88	11.88	0.00	1
861.80	12.10	12.10	0.00	1
862.21	13.80	13.80	0.00	1
862.47	14.76	14.76	0.00	1
862.74	15.72	15.72	0.00	1
863.03	16.68	16.68	0.00	1
863.33	17.64	17.64	0.00	1
863.64	18.60	18.60	0.00	1
867.02	25.89	25.89	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-8**

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)
9.00	9.00	861.17	1.811	0.0*	5-S2n	0.645	1.156	0.645	0.243	12.365	2.465
9.96	9.96	861.35	1.986	0.0*	5-S2n	0.685	1.215	0.706	0.259	12.197	2.564
10.92	10.92	861.54	2.177	0.0*	5-S2n	0.721	1.265	0.721	0.274	13.004	2.659
11.88	11.88	861.75	2.386	0.0*	5-S2n	0.758	1.309	0.758	0.288	13.267	2.748
12.10	12.10	861.80	2.436	0.0*	5-S2n	0.766	1.318	0.766	0.291	13.327	2.768
13.80	13.80	862.21	2.854	0.0*	5-S2n	0.831	1.376	0.831	0.316	13.737	2.913
14.76	14.76	862.47	3.111	0.0*	5-S2n	0.867	1.397	0.890	0.329	13.532	2.991
15.72	15.72	862.74	3.383	0.0*	5-S2n	0.903	1.423	0.903	0.342	14.156	3.065
16.68	16.68	863.03	3.668	0.0*	5-S2n	0.939	1.422	0.959	0.355	13.977	3.136
17.64	17.64	863.33	3.966	0.0*	5-S2n	0.977	1.332	0.977	0.367	14.471	3.205
18.60	18.60	863.64	4.277	0.177	5-S2n	1.015	1.460	1.012	0.379	14.685	3.273

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 859.36 ft,    Outlet Elevation (invert): 850.09 ft  
Culvert Length: 222.19 ft,    Culvert Slope: 0.0418  
\*\*\*\*\*

### Site Data - B-8

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 859.36 ft

Outlet Station: 222.00 ft

Outlet Elevation: 850.09 ft

Number of Barrels: 1

### Culvert Data Summary - B-8

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Grooved End in Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-8)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
9.00	850.33	0.24	2.47	0.26	0.88
9.96	850.35	0.26	2.56	0.27	0.89
10.92	850.36	0.27	2.66	0.29	0.90
11.88	850.38	0.29	2.75	0.31	0.90
12.10	850.38	0.29	2.77	0.31	0.90
13.80	850.41	0.32	2.91	0.34	0.91
14.76	850.42	0.33	2.99	0.35	0.92
15.72	850.43	0.34	3.07	0.36	0.92
16.68	850.44	0.35	3.14	0.38	0.93
17.64	850.46	0.37	3.21	0.39	0.93
18.60	850.47	0.38	3.27	0.40	0.94

**Tailwater Channel Data - B-8**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 15.00 ft

Channel Slope: 0.0170

Channel Manning's n: 0.0300

Channel Invert Elevation: 850.09 ft

**Roadway Data for Crossing: B-8**

Roadway Profile Shape: Constant Roadway Elevation

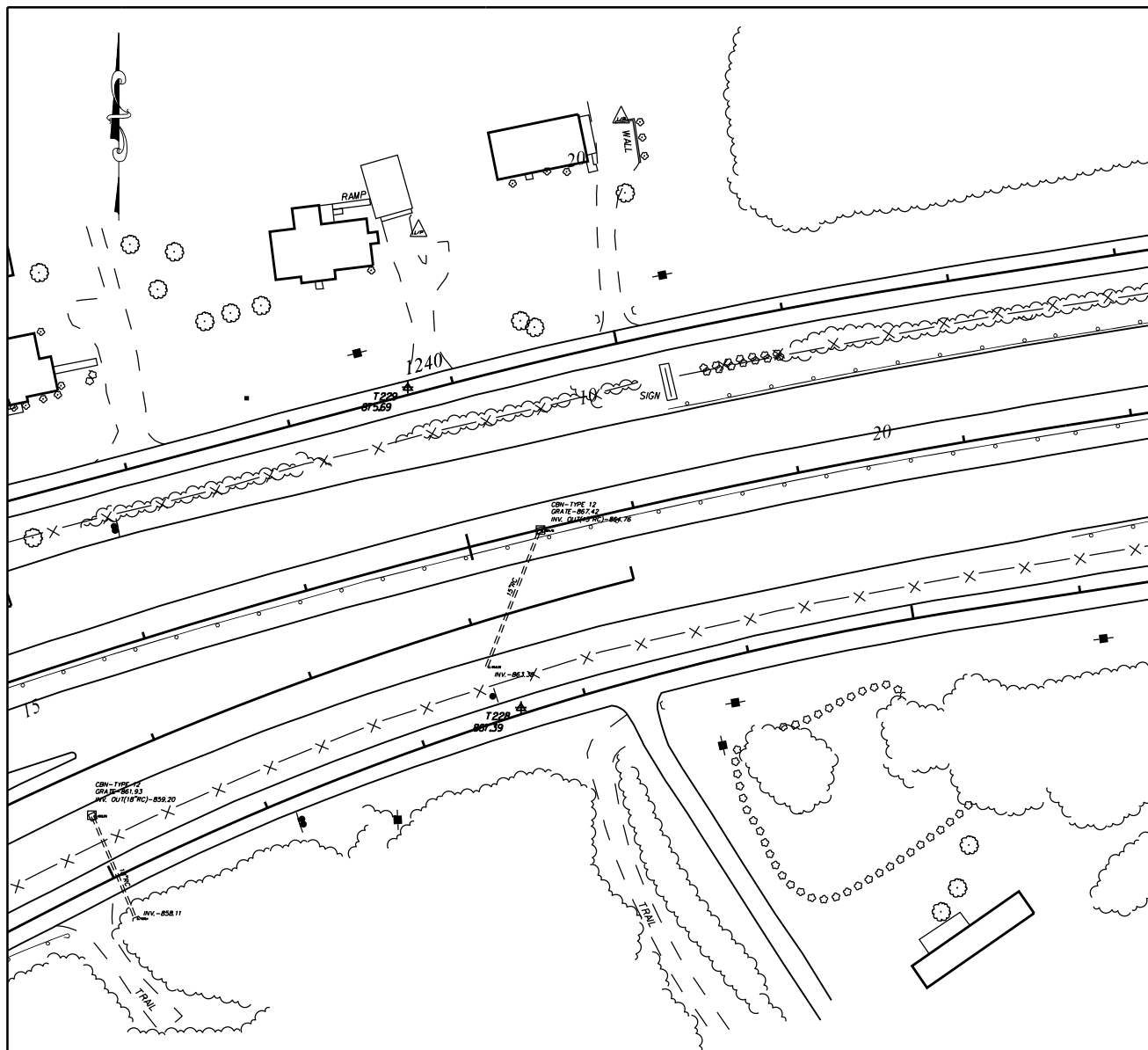
Crest Length: 300.00 ft

Crest Elevation: 867.02 ft

Roadway Surface: Paved

Roadway Top Width: 168.00 ft

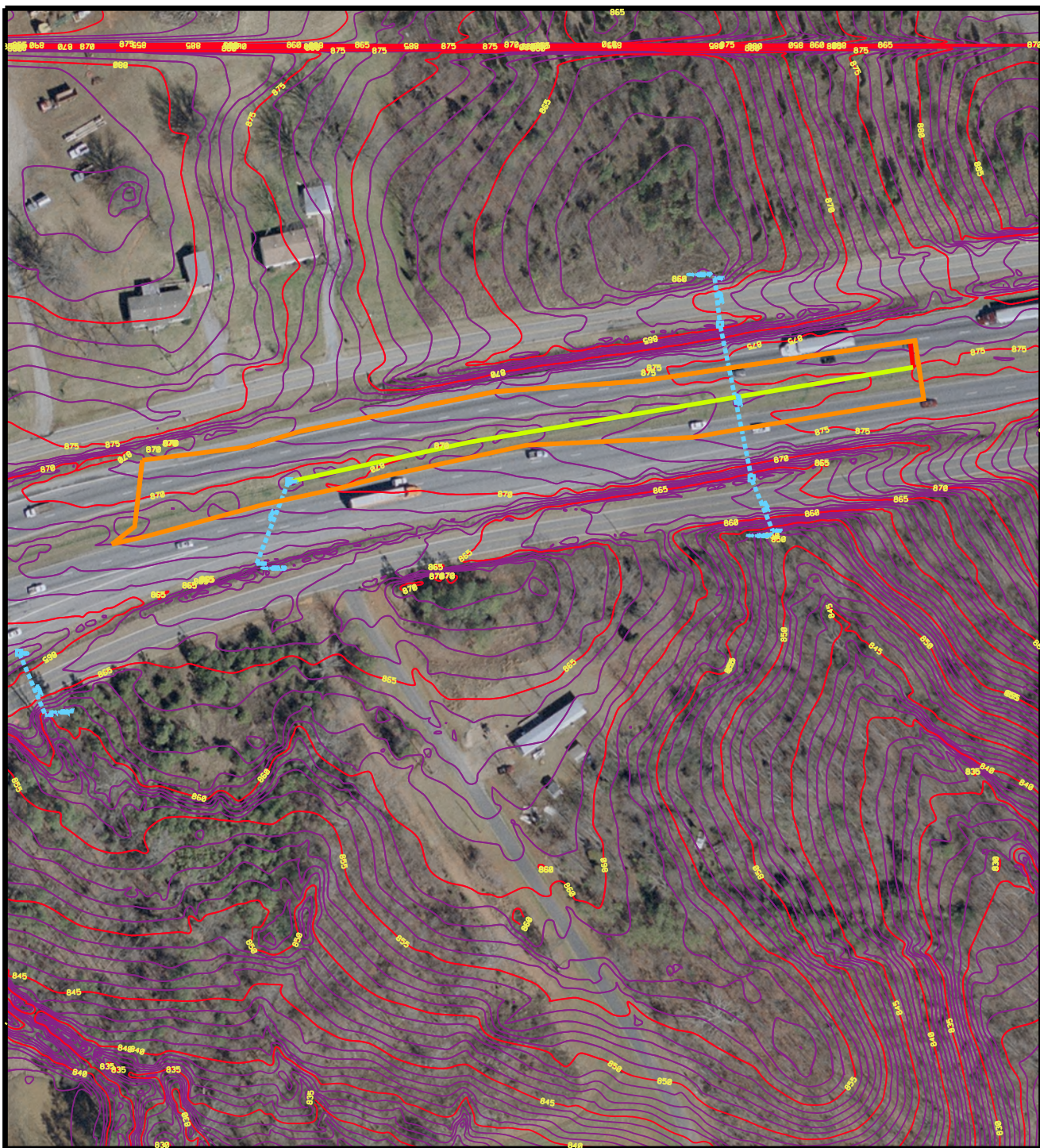




PLAN VIEW SITE # B-9

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY





- |   |   |
|---|---|
| <span style="color: yellow;">—</span> Watershed           | <span style="color: orange;">—</span> Ditch Flow                      |
| <span style="color: red;">—</span> Overland               | <span style="color: red;">—</span> Existing 5' Contour Line/Elevation |
| <span style="color: green;">—</span> Shallow Concentrated | <span style="color: purple;">—</span> Existing 1' Contour Line        |

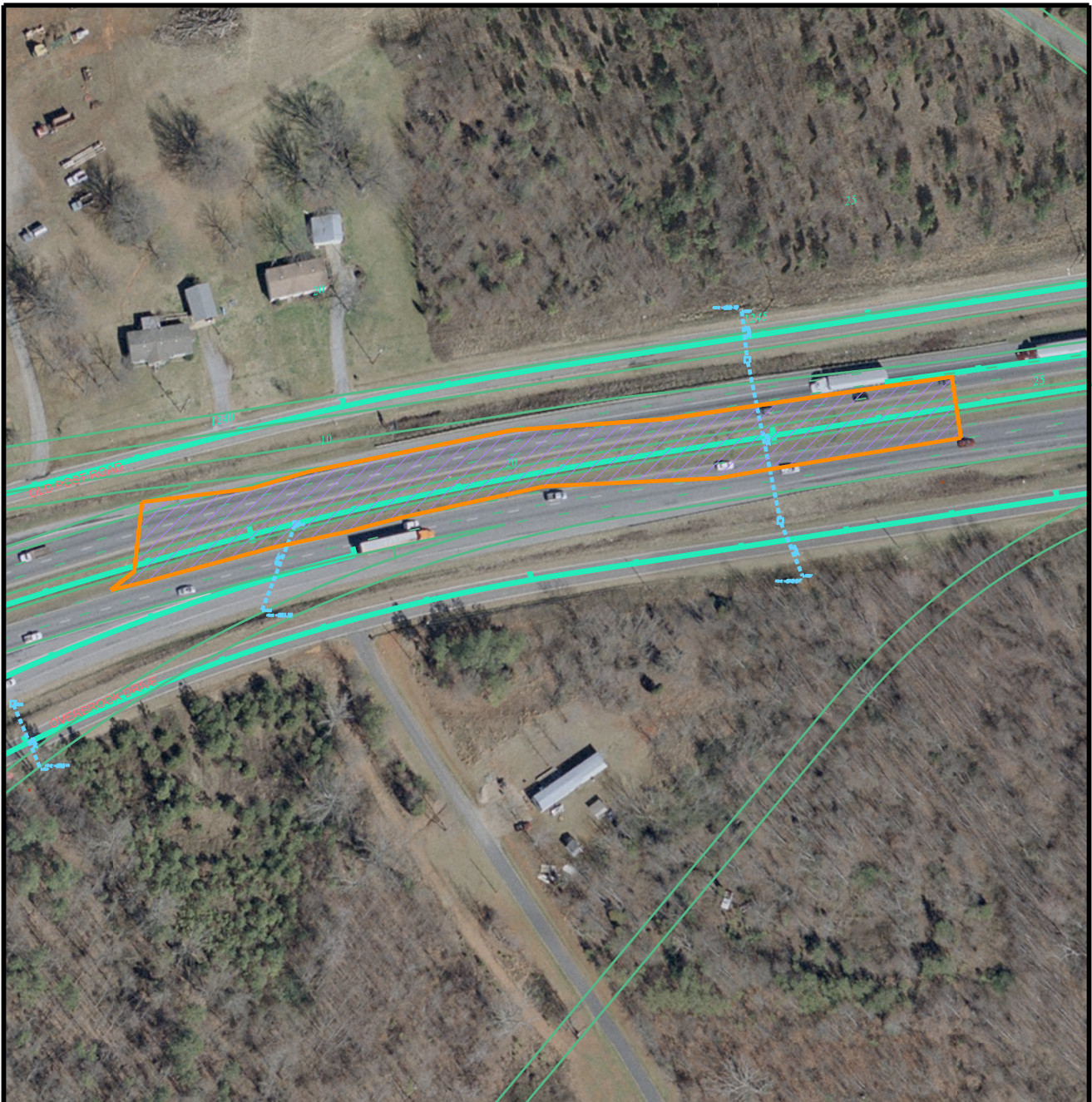
\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-9

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







 PAVEMENT, ROOFS

## LAND USE MAP - SITE # B-9

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY

75 0 75 150  
SCALE:



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5 cfs

Design Flow: 6.6 cfs

Maximum Flow: 10.2 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-9**

Headwater Elevation (ft)	Total Discharge (cfs)	B-9 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
866.13	5.00	5.00	0.00	1
866.24	5.52	5.52	0.00	1
866.36	6.04	6.04	0.00	1
866.49	6.56	6.56	0.00	1
866.50	6.60	6.60	0.00	1
866.79	7.60	7.60	0.00	1
866.95	8.12	8.12	0.00	1
867.12	8.64	8.64	0.00	1
867.30	9.16	9.16	0.00	1
867.49	9.68	9.68	0.00	1
867.75	10.20	10.20	0.00	1
871.41	14.97	14.97	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-9**

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)
5.00	5.00	866.13	1.372	0.280	5-S2n	0.676	0.904	0.676	0.656	7.389	2.325
5.52	5.52	866.24	1.483	0.641	5-S2n	0.719	0.948	0.725	0.681	7.480	2.383
6.04	6.04	866.36	1.604	0.843	5-S2n	0.762	0.990	0.768	0.704	7.648	2.437
6.56	6.56	866.49	1.734	1.060	5-S2n	0.806	1.028	0.806	0.726	7.839	2.488
6.60	6.60	866.50	1.744	1.078	5-S2n	0.810	1.031	0.810	0.728	7.845	2.492
7.60	7.60	866.79	2.025	1.539	5-S2n	0.899	1.093	0.905	0.767	7.985	2.581
8.12	8.12	866.95	2.187	1.799	5-S2n	0.953	1.120	0.953	0.787	8.066	2.624
8.64	8.64	867.12	2.358	2.074	5-S2n	1.009	1.143	1.013	0.805	8.117	2.666
9.16	9.16	867.30	2.538	2.362	5-S2n	1.094	1.160	1.094	0.823	8.067	2.705
9.68	9.68	867.49	2.728	2.650	7-M2c	1.250	1.179	1.179	0.840	8.072	2.742
10.20	10.20	867.75	2.926	2.986	7-M2c	1.250	1.192	1.192	0.857	8.454	2.778

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 864.76 ft,    Outlet Elevation (invert): 863.38 ft  
Culvert Length: 88.01 ft,    Culvert Slope: 0.0157  
\*\*\*\*\*

### **Site Data - B-9**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 864.76 ft

Outlet Station: 88.00 ft

Outlet Elevation: 863.38 ft

Number of Barrels: 1

### **Culvert Data Summary - B-9**

Barrel Shape: Circular

Barrel Diameter: 1.25 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Grooved End in Headwall

Inlet Depression: NONE



**Table 3 - Downstream Channel Rating Curve (Crossing: B-9)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	864.04	0.66	2.32	0.41	0.72
5.52	864.06	0.68	2.38	0.42	0.72
6.04	864.08	0.70	2.44	0.44	0.72
6.56	864.11	0.73	2.49	0.45	0.73
6.60	864.11	0.73	2.49	0.45	0.73
7.60	864.15	0.77	2.58	0.48	0.73
8.12	864.17	0.79	2.62	0.49	0.74
8.64	864.19	0.81	2.67	0.50	0.74
9.16	864.20	0.82	2.70	0.51	0.74
9.68	864.22	0.84	2.74	0.52	0.75
10.20	864.24	0.86	2.78	0.53	0.75

**Tailwater Channel Data - B-9**

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 5.00 (1:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0300

Channel Invert Elevation: 863.38 ft

**Roadway Data for Crossing: B-9**

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 150.00 ft

Crest Elevation: 871.41 ft

Roadway Surface: Paved

Roadway Top Width: 58.00 ft

# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5 cfs

Design Flow: 6.6 cfs

Maximum Flow: 11.7 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-9 Proposed**

Headwater Elevation (ft)	Total Discharge (cfs)	B-9 Proposed Discharge (cfs)	Roadway Discharge (cfs)	Iterations
865.99	5.00	5.00	0.00	1
866.08	5.67	5.67	0.00	1
866.18	6.34	6.34	0.00	1
866.21	6.60	6.60	0.00	1
866.37	7.68	7.68	0.00	1
866.48	8.35	8.35	0.00	1
866.59	9.02	9.02	0.00	1
866.71	9.69	9.69	0.00	1
866.84	10.36	10.36	0.00	1
866.98	11.03	11.03	0.00	1
867.13	11.70	11.70	0.00	1
871.41	22.65	22.65	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-9 Proposed**

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)
5.00	5.00	865.99	1.227	0.0*	1-S2n	0.611	0.856	0.618	0.656	7.270	2.325
5.67	5.67	866.08	1.322	0.0*	1-S2n	0.656	0.915	0.656	0.688	7.629	2.399
6.34	6.34	866.18	1.416	0.099	1-S2n	0.700	0.968	0.707	0.717	7.752	2.467
6.60	6.60	866.21	1.454	0.166	1-S2n	0.716	0.991	0.724	0.728	7.826	2.492
7.68	7.68	866.37	1.614	0.441	5-S2n	0.783	1.070	0.794	0.770	8.086	2.588
8.35	8.35	866.48	1.721	0.622	5-S2n	0.824	1.115	0.837	0.795	8.241	2.643
9.02	9.02	866.59	1.834	0.984	5-S2n	0.865	1.157	0.878	0.818	8.397	2.694
9.69	9.69	866.71	1.954	1.165	5-S2n	0.906	1.200	0.920	0.841	8.533	2.743
10.36	10.36	866.84	2.083	1.354	5-S2n	0.947	1.237	0.962	0.862	8.649	2.789
11.03	11.03	866.98	2.220	1.554	5-S2n	0.991	1.271	1.005	0.882	8.780	2.833
11.70	11.70	867.13	2.365	1.763	5-S2n	1.035	1.301	1.049	0.902	8.879	2.875

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 864.76 ft,    Outlet Elevation (invert): 863.38 ft  
Culvert Length: 88.01 ft,    Culvert Slope: 0.0157  
\*\*\*\*\*

### **Site Data - B-9 Proposed**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 864.76 ft

Outlet Station: 88.00 ft

Outlet Elevation: 863.38 ft

Number of Barrels: 1

### **Culvert Data Summary - B-9 Proposed**

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Grooved End in Headwall

Inlet Depression: NONE



**Table 3 - Downstream Channel Rating Curve (Crossing: B-9 Proposed)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	864.04	0.66	2.32	0.41	0.72
5.67	864.07	0.69	2.40	0.43	0.72
6.34	864.10	0.72	2.47	0.45	0.73
6.60	864.11	0.73	2.49	0.45	0.73
7.68	864.15	0.77	2.59	0.48	0.73
8.35	864.17	0.79	2.64	0.50	0.74
9.02	864.20	0.82	2.69	0.51	0.74
9.69	864.22	0.84	2.74	0.52	0.75
10.36	864.24	0.86	2.79	0.54	0.75
11.03	864.26	0.88	2.83	0.55	0.75
11.70	864.28	0.90	2.88	0.56	0.75

**Tailwater Channel Data - B-9 Proposed**

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 5.00 (1:1)

Channel Slope: 0.0100

Channel Manning's n: 0.0300

Channel Invert Elevation: 863.38 ft

**Roadway Data for Crossing: B-9 Proposed**

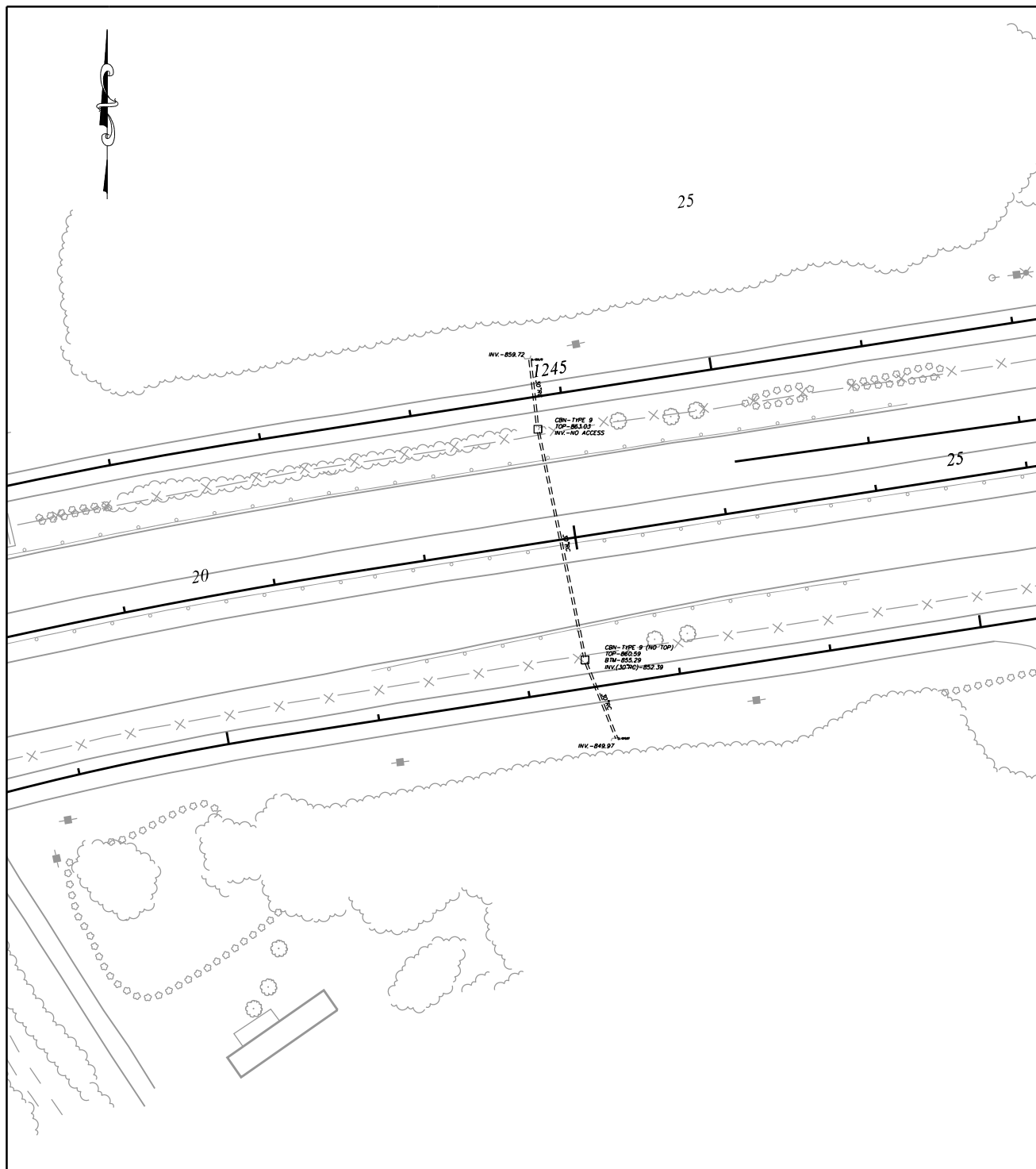
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 150.00 ft

Crest Elevation: 871.41 ft

Roadway Surface: Paved

Roadway Top Width: 58.00 ft



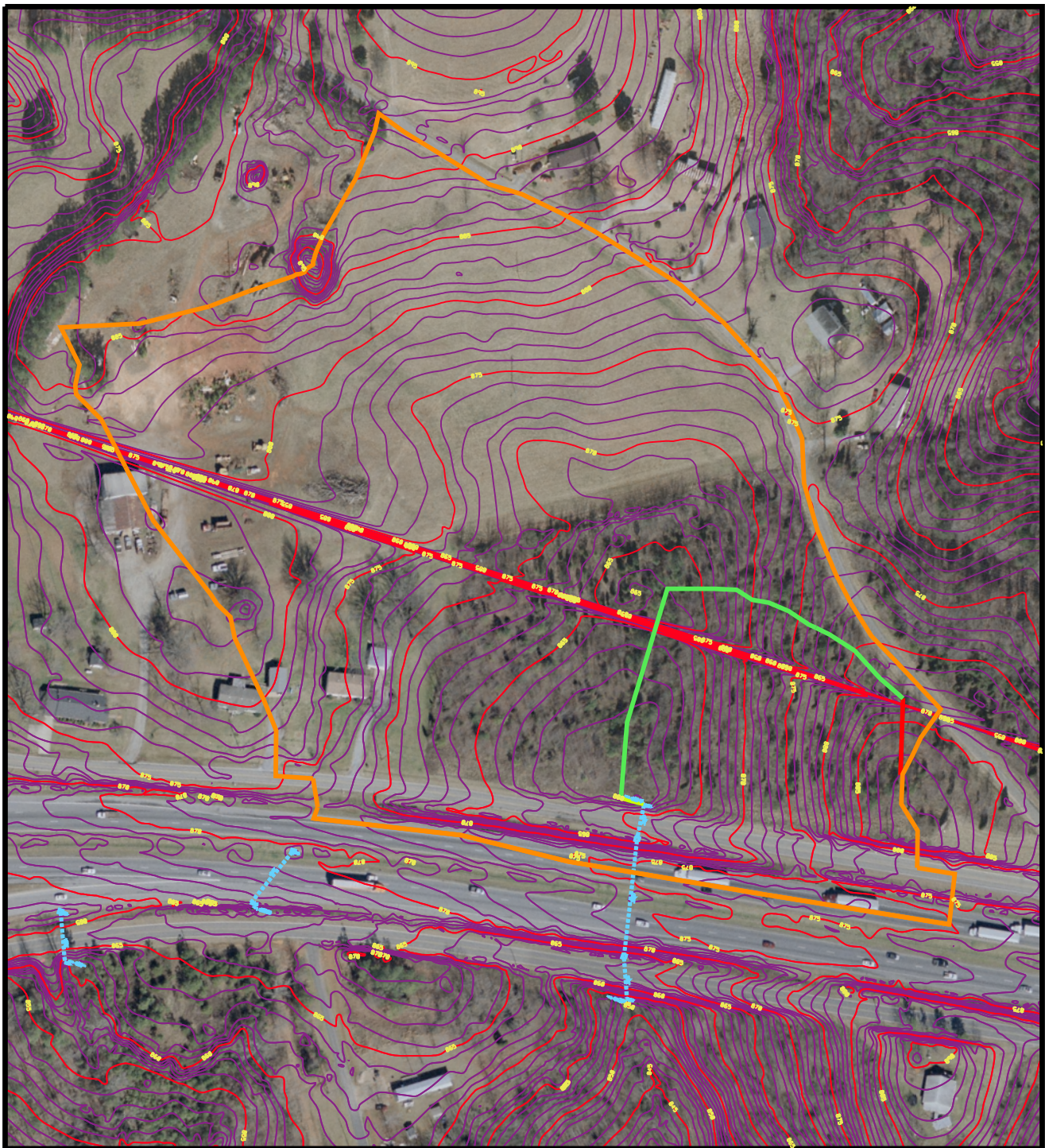
## PLAN VIEW SITE # B-10

I-85 WIDENING CHEROKEE CO MM80-96

SPARTANBURG/CHEROKEE COUNTY



SCALE:



- |   |   |
|---|---|
| <span style="color: orange;">—</span> Watershed           | <span style="color: green;">—</span> Ditch Flow                       |
| <span style="color: red;">—</span> Overland               | <span style="color: red;">—</span> Existing 5' Contour Line/Elevation |
| <span style="color: green;">—</span> Shallow Concentrated | <span style="color: purple;">—</span> Existing 1' Contour Line        |

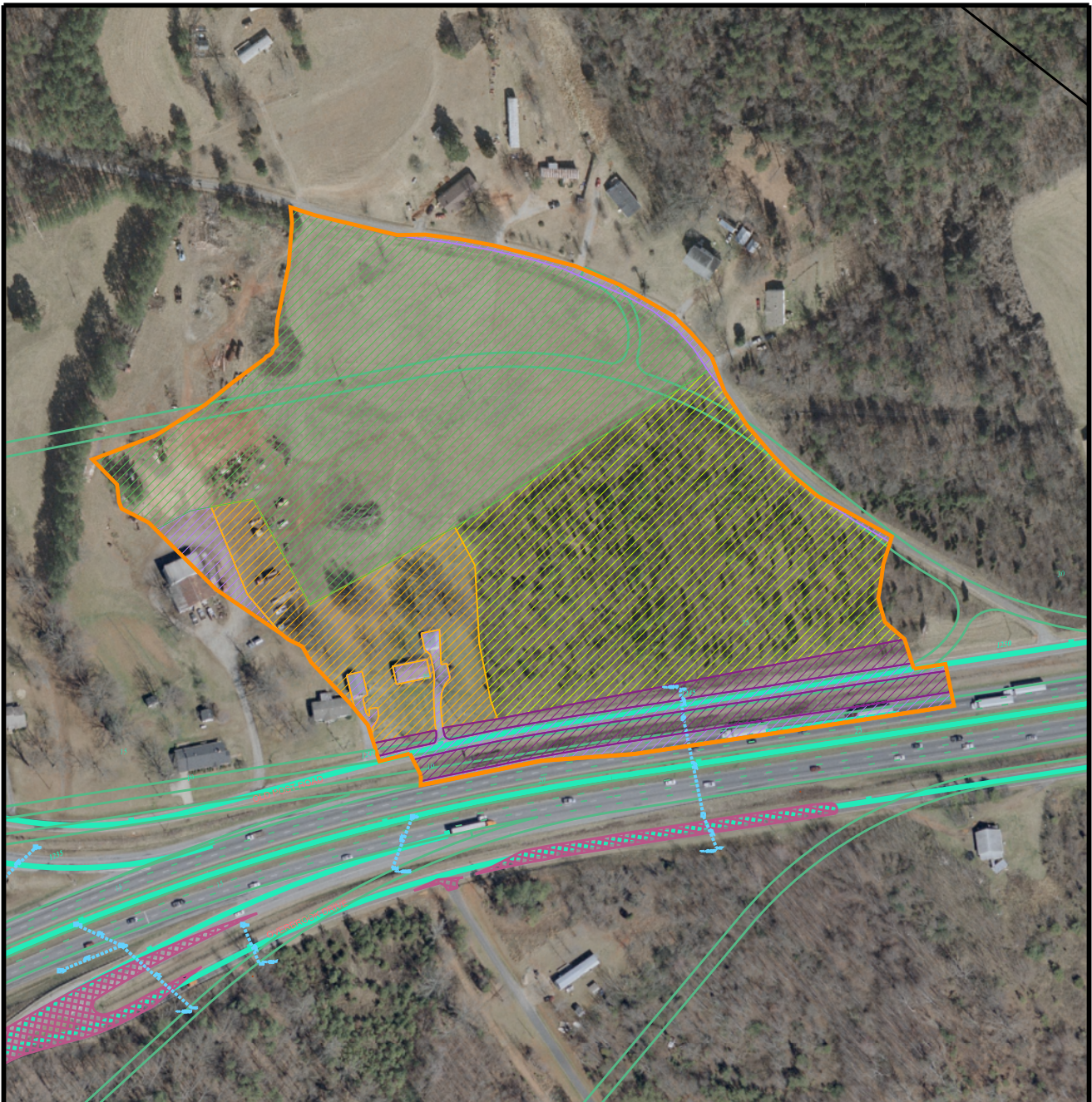
\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

**Tc MAP - SITE # B-10**

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







PAVEMENT, ROOFS



MEADOWS & PASTURE



GRASS SHOULDERS



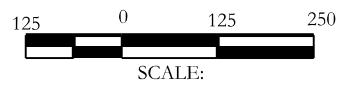
LAWNS SANDY SOILS



WOODLAND & FOREST

## LAND USE MAP - SITE # B-10

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 14.4 cfs

Design Flow: 28.2 cfs

Maximum Flow: 31.9 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-10**

Headwater Elevation (ft)	Total Discharge (cfs)	B-10 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
861.51	14.40	14.40	0.00	1
861.63	16.15	16.15	0.00	1
861.75	17.90	17.90	0.00	1
861.86	19.65	19.65	0.00	1
861.98	21.40	21.40	0.00	1
862.10	23.15	23.15	0.00	1
862.21	24.90	24.90	0.00	1
862.34	26.65	26.65	0.00	1
862.45	28.20	28.20	0.00	1
862.60	30.15	30.15	0.00	1
862.74	31.90	31.90	0.00	1
872.03	88.23	88.23	0.00	Overtopping



**Table 2 - Culvert Summary Table: B-10**

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)
14.40	14.40	861.51	1.785	0.0*	1-S2n	0.000	0.000	0.119	0.119	13.223	1.924
16.15	16.15	861.63	1.909	0.0*	1-S2n	0.000	0.000	0.127	0.127	13.820	2.016
17.90	17.90	861.75	2.027	0.0*	1-S2n	0.000	0.000	0.135	0.135	14.227	2.099
19.65	19.65	861.86	2.144	0.0*	1-S2n	0.000	0.000	0.143	0.143	14.368	2.180
21.40	21.40	861.98	2.259	0.0*	1-S2n	0.000	0.000	0.151	0.151	14.920	2.254
23.15	23.15	862.10	2.375	0.0*	1-S2n	0.000	0.000	0.158	0.158	15.069	2.326
24.90	24.90	862.21	2.494	0.0*	1-S2n	0.000	0.000	0.165	0.165	15.509	2.394
26.65	26.65	862.34	2.617	0.0*	5-S2n	0.000	0.000	0.172	0.172	15.627	2.459
28.20	28.20	862.45	2.730	0.0*	5-S2n	0.000	0.000	0.178	0.178	16.046	2.515
30.15	30.15	862.60	2.878	0.0*	5-S2n	0.000	0.000	0.185	0.185	16.074	2.584
31.90	31.90	862.74	3.019	0.0*	5-S2n	0.000	0.000	0.192	0.192	16.391	2.643

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Single Broken-back Culvert  
Inlet Elevation (invert): 859.72 ft  
Break Elevation (invert): 852.39 ft  
Culvert Length: 258.18 ft  
Upper Culvert Section Slope: 0.0367  
Steep Culvert Section Slope: 0.0417  
\*\*\*\*\*

## Site Data - B-10

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 859.72 ft

Break Station: 200.00 ft

Break Elevation: 852.39 ft

Outlet Station: 258.00 ft

Outlet Elevation: 849.97 ft

Number of Barrels: 1

## **Culvert Data Summary - B-10**

Barrel Shape: Circular

Barrel Diameter: 2.50 ft

Upper Section Material: Concrete

Lower Section Material: Concrete

Embedment: 0.00 in

Upper Section Manning's n: 0.0120

Lower Section Manning's n: 0.0120

Culvert Type: Single Broken-back

Inlet Configuration: Grooved End Projecting

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-10)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
14.40	850.09	0.12	1.92	0.19	0.98
16.15	850.10	0.13	2.02	0.21	1.00
17.90	850.11	0.14	2.10	0.22	1.01
19.65	850.11	0.14	2.18	0.23	1.02
21.40	850.12	0.15	2.25	0.24	1.02
23.15	850.13	0.16	2.33	0.26	1.03
24.90	850.14	0.17	2.39	0.27	1.04
26.65	850.14	0.17	2.46	0.28	1.05
28.20	850.15	0.18	2.52	0.29	1.05
30.15	850.16	0.19	2.58	0.30	1.06
31.90	850.16	0.19	2.64	0.31	1.06

**Tailwater Channel Data - B-10**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 63.00 ft

Channel Slope: 0.0260

Channel Manning's n: 0.0300

Channel Invert Elevation: 849.97 ft

**Roadway Data for Crossing: B-10**

Roadway Profile Shape: Constant Roadway Elevation

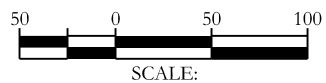
Crest Length: 200.00 ft

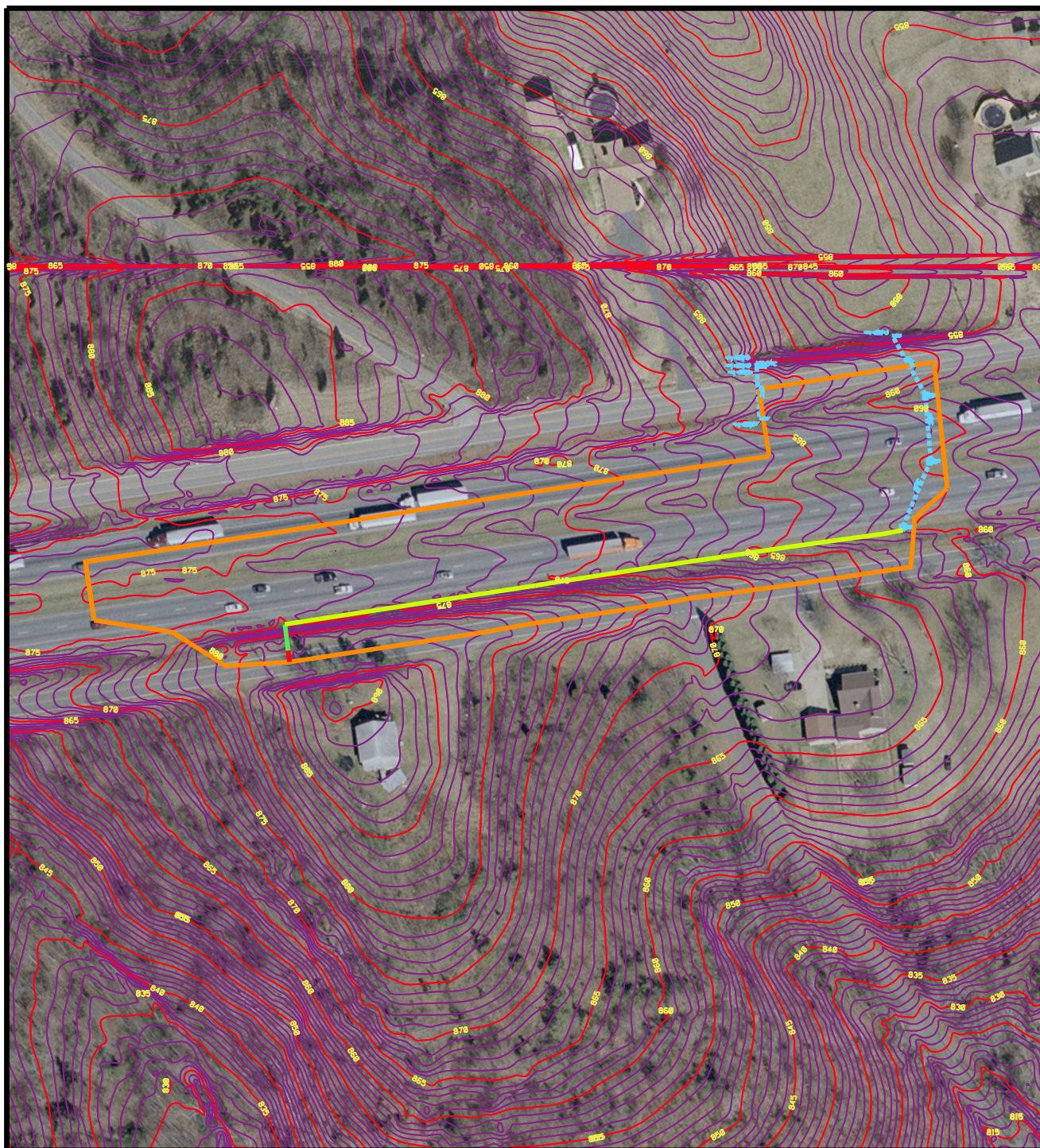
Crest Elevation: 872.03 ft

Roadway Surface: Paved

Roadway Top Width: 215.00 ft







- |  |  |
|--|--|
|  Watershed            |  Ditch Flow                         |
|  Overland             |  Existing 5' Contour Line/Elevation |
|  Shallow Concentrated |  Existing 1' Contour Line           |

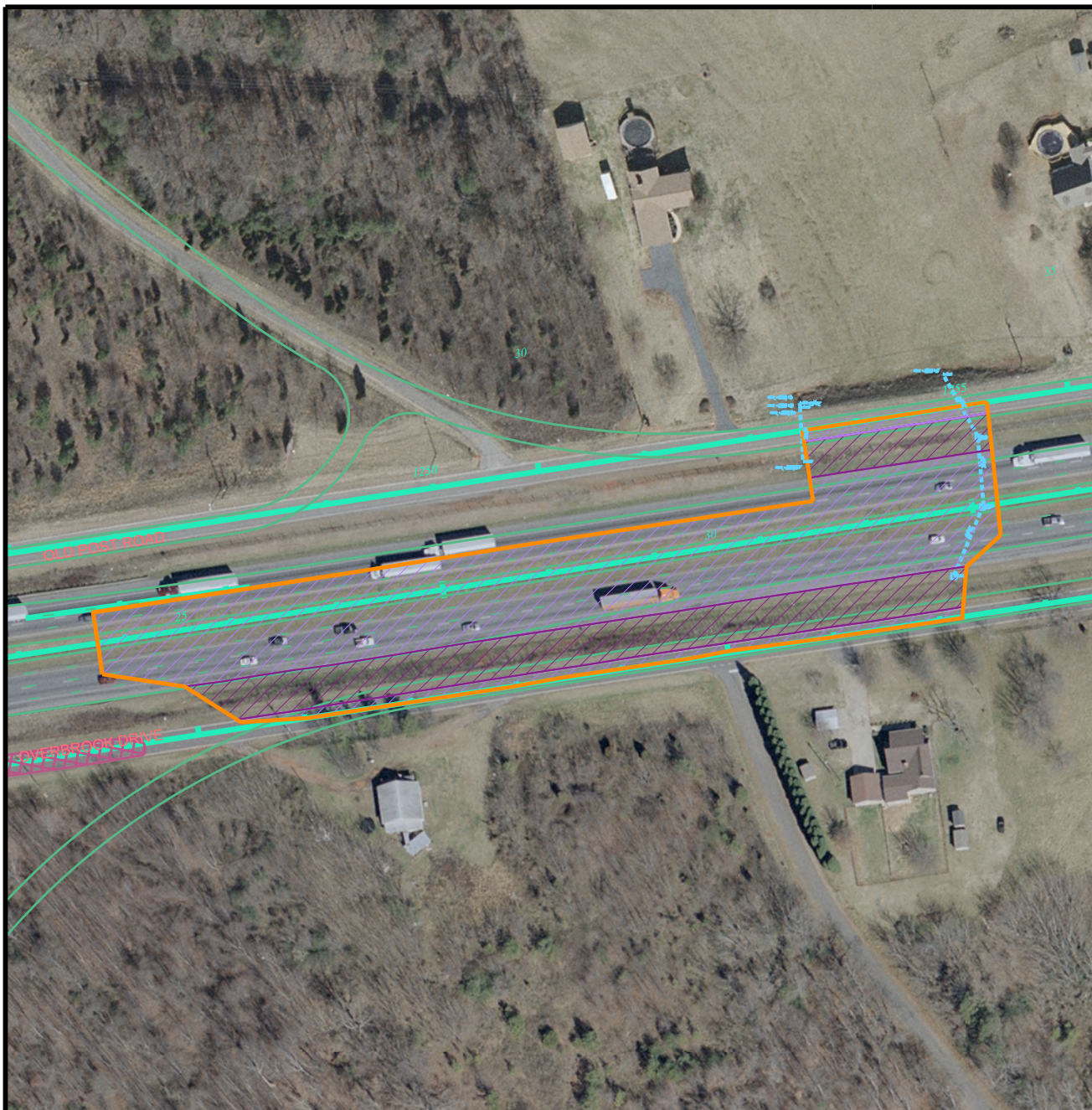
\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

Tc MAP - SITE # B-11

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







PAVEMENT, ROOFS



GRASS SHOULDERS

## LAND USE MAP - SITE # B-11

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 9.5 cfs

Design Flow: 19.6 cfs

Maximum Flow: 22.4 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-11**

Headwater Elevation (ft)	Total Discharge (cfs)	B-11 Upstream Discharge (cfs)	Roadway Discharge (cfs)	Iterations
859.45	9.50	9.50	0.00	1
859.78	10.79	10.79	0.00	1
860.15	12.08	12.08	0.00	1
860.57	13.37	13.37	0.00	1
861.03	14.66	14.66	0.00	1
861.28	15.95	15.30	0.51	33
861.29	17.24	15.33	1.84	5
861.30	18.53	15.35	3.11	4
861.31	19.60	15.37	4.11	3
861.32	21.11	15.39	5.59	3
861.32	22.40	15.41	6.91	3
861.27	15.27	15.27	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-11 Upstream**

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)
9.50	9.50	859.45	2.120	0.0*	5-S2n	0.678	1.189	0.678	0.286	12.245	4.156
10.79	10.79	859.78	2.446	0.0*	5-S2n	0.729	1.259	0.755	0.309	12.108	4.364
12.08	12.08	860.15	2.818	0.0*	5-S2n	0.779	1.317	0.793	0.332	12.742	4.555
13.37	13.37	860.57	3.238	0.0*	5-S2n	0.830	1.363	0.851	0.353	12.927	4.735
14.66	14.66	861.03	3.703	0.0*	5-S2n	0.880	1.395	0.880	0.374	13.620	4.903
15.95	15.30	861.28	3.949	0.0*	5-S2n	0.904	1.410	0.904	0.394	13.748	5.062
17.24	15.33	861.29	3.962	0.0*	5-S2n	0.906	1.410	0.906	0.413	13.754	5.213
18.53	15.35	861.30	3.971	0.0*	5-S2n	0.907	1.411	0.907	0.433	13.759	5.355
19.60	15.37	861.31	3.977	0.0*	5-S2n	0.907	1.411	0.907	0.448	13.762	5.470
21.11	15.39	861.32	3.985	0.0*	5-S2n	0.908	1.411	0.908	0.469	13.766	5.624
22.40	15.41	861.32	3.992	0.0*	5-S2n	0.909	1.411	0.909	0.487	13.769	5.750

\* Full Flow Headwater elevation is below inlet invert.



\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 857.33 ft,    Outlet Elevation (invert): 850.13 ft  
Culvert Length: 183.14 ft,    Culvert Slope: 0.0393  
\*\*\*\*\*

### **Site Data - B-11 Upstream**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 857.33 ft

Outlet Station: 183.00 ft

Outlet Elevation: 850.13 ft

Number of Barrels: 1

### **Culvert Data Summary - B-11 Upstream**

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-11)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
9.50	850.42	0.29	4.16	0.73	1.37
10.79	850.44	0.31	4.36	0.79	1.38
12.08	850.46	0.33	4.55	0.85	1.39
13.37	850.48	0.35	4.73	0.90	1.40
14.66	850.50	0.37	4.90	0.96	1.41
15.95	850.52	0.39	5.06	1.01	1.42
17.24	850.54	0.41	5.21	1.06	1.43
18.53	850.56	0.43	5.36	1.11	1.44
19.60	850.58	0.45	5.47	1.15	1.44
21.11	850.60	0.47	5.62	1.20	1.45
22.40	850.62	0.49	5.75	1.25	1.45

**Tailwater Channel Data - B-11**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 8.00 ft

Channel Slope: 0.0410

Channel Manning's n: 0.0300

Channel Invert Elevation: 850.13 ft

**Roadway Data for Crossing: B-11**

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 200.00 ft

Crest Elevation: 861.27 ft

Roadway Surface: Paved

Roadway Top Width: 152.00 ft

# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 9.5 cfs

Design Flow: 19.6 cfs

Maximum Flow: 22.4 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-11 Proposed**

Headwater Elevation (ft)	Total Discharge (cfs)	B-11 Proposed Discharge (cfs)	Roadway Discharge (cfs)	Iterations
858.75	9.50	9.50	0.00	1
858.87	10.79	10.79	0.00	1
858.98	12.08	12.08	0.00	1
859.09	13.37	13.37	0.00	1
859.20	14.66	14.66	0.00	1
859.30	15.95	15.95	0.00	1
859.40	17.24	17.24	0.00	1
859.49	18.53	18.53	0.00	1
859.58	19.60	19.60	0.00	1
859.69	21.11	21.11	0.00	1
859.79	22.40	22.40	0.00	1
861.27	37.59	37.59	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-11 Proposed**

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)
9.50	9.50	858.75	1.417	0.0*	1-S2n	0.544	1.025	0.544	0.288	11.942	4.123
10.79	10.79	858.87	1.538	0.0*	1-S2n	0.580	1.098	0.580	0.311	12.372	4.330
12.08	12.08	858.98	1.652	0.0*	1-S2n	0.617	1.166	0.622	0.334	12.586	4.521
13.37	13.37	859.09	1.761	0.0*	1-S2n	0.654	1.230	0.654	0.356	13.038	4.698
14.66	14.66	859.20	1.865	0.0*	1-S2n	0.688	1.289	0.688	0.377	13.354	4.866
15.95	15.95	859.30	1.967	0.0*	1-S2n	0.716	1.346	0.716	0.397	13.802	5.024
17.24	17.24	859.40	2.066	0.0*	1-S2n	0.744	1.402	0.744	0.417	14.039	5.172
18.53	18.53	859.49	2.165	0.0*	1-S2n	0.771	1.455	0.771	0.436	14.337	5.314
19.60	19.60	859.58	2.246	0.0*	1-S2n	0.794	1.497	0.811	0.451	14.161	5.428
21.11	21.11	859.69	2.362	0.0*	1-S2n	0.827	1.559	0.827	0.473	14.854	5.581
22.40	22.40	859.79	2.463	0.0*	1-S2n	0.854	1.607	0.874	0.491	14.635	5.706

\* Full Flow Headwater elevation is below inlet invert.



\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 857.33 ft,    Outlet Elevation (invert): 850.13 ft  
Culvert Length: 183.14 ft,    Culvert Slope: 0.0393  
\*\*\*\*\*

### **Site Data - B-11 Proposed**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 857.33 ft

Outlet Station: 183.00 ft

Outlet Elevation: 850.13 ft

Number of Barrels: 1

### **Culvert Data Summary - B-11 Proposed**

Barrel Shape: Circular

Barrel Diameter: 2.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-11 Proposed)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
9.50	850.42	0.29	4.12	0.72	1.35
10.79	850.44	0.31	4.33	0.78	1.37
12.08	850.46	0.33	4.52	0.83	1.38
13.37	850.49	0.36	4.70	0.89	1.39
14.66	850.51	0.38	4.87	0.94	1.40
15.95	850.53	0.40	5.02	0.99	1.41
17.24	850.55	0.42	5.17	1.04	1.41
18.53	850.57	0.44	5.31	1.09	1.42
19.60	850.58	0.45	5.43	1.13	1.42
21.11	850.60	0.47	5.58	1.18	1.43
22.40	850.62	0.49	5.71	1.22	1.44

**Tailwater Channel Data - B-11 Proposed**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 8.00 ft

Channel Slope: 0.0400

Channel Manning's n: 0.0300

Channel Invert Elevation: 850.13 ft

**Roadway Data for Crossing: B-11 Proposed**

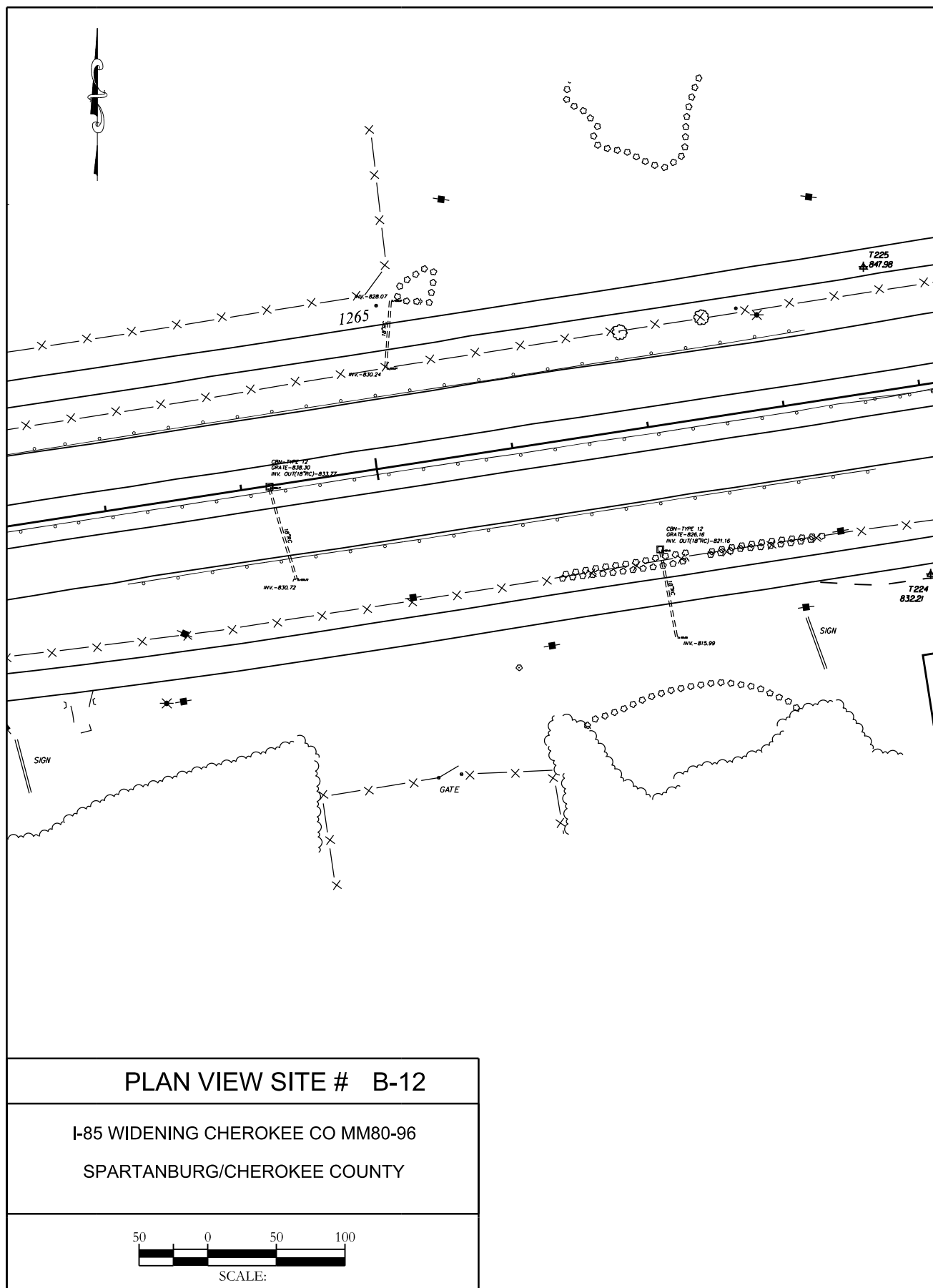
Roadway Profile Shape: Constant Roadway Elevation

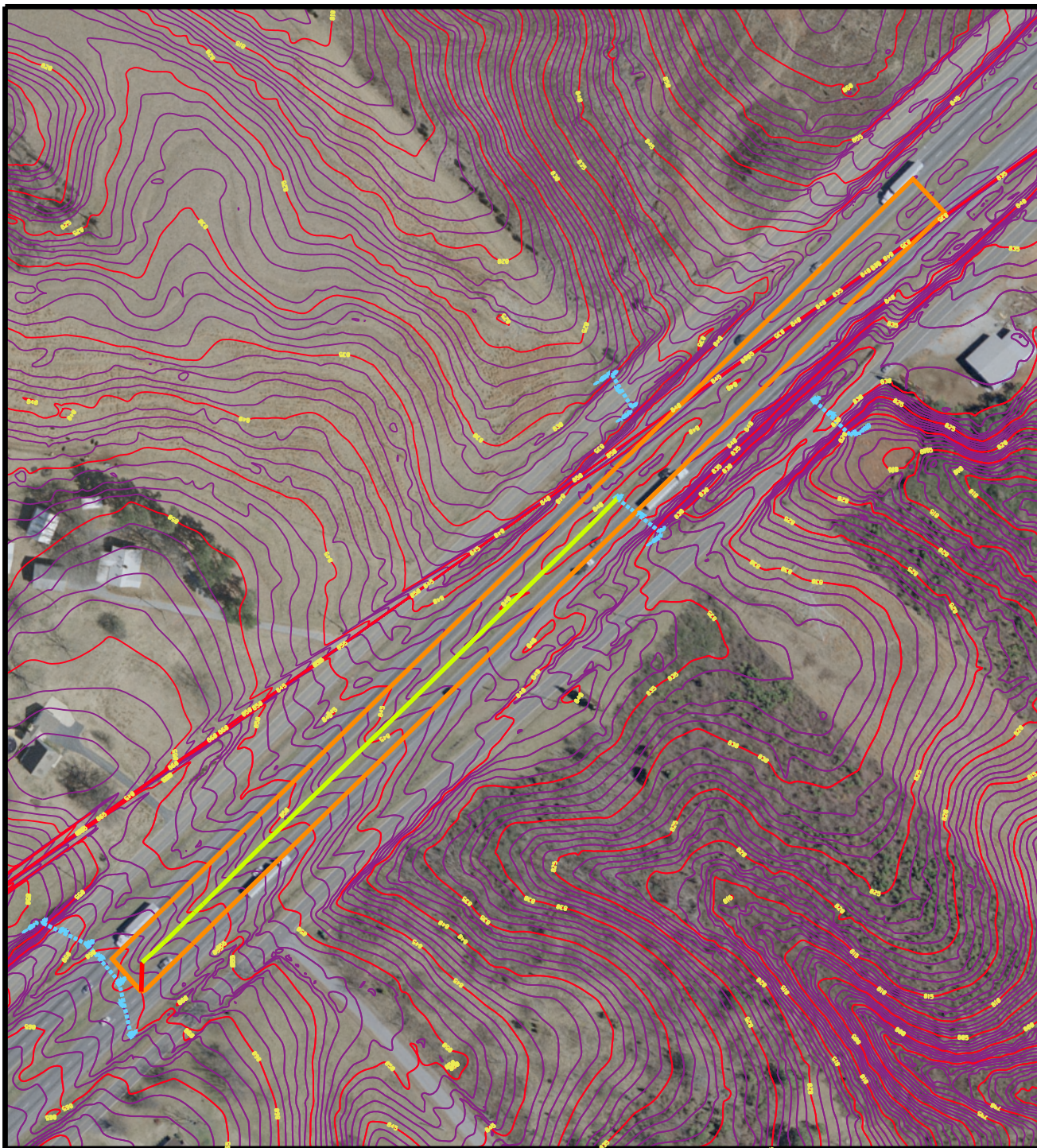
Crest Length: 100.00 ft

Crest Elevation: 861.27 ft

Roadway Surface: Paved

Roadway Top Width: 152.00 ft





- |  |  |
|--|--|
|  Watershed            |  Ditch Flow                         |
|  Overland             |  Existing 5' Contour Line/Elevation |
|  Shallow Concentrated |  Existing 1' Contour Line           |

\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-12

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



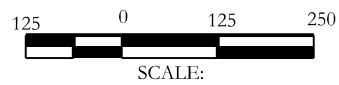




PAVEMENT, ROOFS

## LAND USE MAP - SITE # B-12

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 9.1 cfs

Design Flow: 12.2 cfs

Maximum Flow: 18.9 cfs



**Table 1 - Summary of Culvert Flows at Crossing: B-12**

Headwater Elevation (ft)	Total Discharge (cfs)	B-12 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
835.80	9.10	9.10	0.00	1
836.03	10.08	10.08	0.00	1
836.29	11.06	11.06	0.00	1
836.57	12.04	12.04	0.00	1
836.62	12.20	12.20	0.00	1
837.23	14.00	14.00	0.00	1
837.59	14.98	14.98	0.00	1
837.98	15.96	15.96	0.00	1
838.40	16.94	16.94	0.00	1
838.86	17.92	17.92	0.00	1
839.35	18.90	18.90	0.00	1
840.20	20.49	20.49	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-12**

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)
9.10	9.10	835.80	2.026	0.0*	5-S2n	0.642	1.162	0.672	0.810	11.869	3.465
10.08	10.08	836.03	2.258	0.0*	5-S2n	0.681	1.222	0.718	0.842	12.068	3.555
11.06	11.06	836.29	2.517	0.0*	5-S2n	0.718	1.272	0.761	0.872	12.278	3.638
12.04	12.04	836.57	2.803	0.219	5-S2n	0.754	1.316	0.802	0.900	12.522	3.717
12.20	12.20	836.62	2.852	0.272	5-S2n	0.760	1.322	0.809	0.904	12.561	3.729
14.00	14.00	837.23	3.457	0.907	5-S2n	0.827	1.381	0.878	0.952	13.038	3.859
14.98	14.98	837.59	3.822	1.284	5-S2n	0.863	1.407	0.917	0.977	13.238	3.925
15.96	15.96	837.98	4.212	1.680	5-S2n	0.899	1.420	0.959	1.000	13.375	3.988
16.94	16.94	838.40	4.631	2.080	5-S2n	0.935	1.392	0.994	1.023	13.611	4.048
17.92	17.92	838.86	5.093	2.531	5-S2n	0.973	1.416	1.033	1.045	13.827	4.105
18.90	18.90	839.35	5.580	3.013	5-S2n	1.011	1.453	1.073	1.066	13.985	4.160

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 833.77 ft,    Outlet Elevation (invert): 830.72 ft  
Culvert Length: 70.07 ft,    Culvert Slope: 0.0436  
\*\*\*\*\*

## Site Data - B-12

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 833.77 ft

Outlet Station: 70.00 ft

Outlet Elevation: 830.72 ft

Number of Barrels: 1

## Culvert Data Summary - B-12

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-12)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
9.10	831.53	0.81	3.47	0.86	0.96
10.08	831.56	0.84	3.56	0.89	0.97
11.06	831.59	0.87	3.64	0.92	0.97
12.04	831.62	0.90	3.72	0.95	0.98
12.20	831.62	0.90	3.73	0.96	0.98
14.00	831.67	0.95	3.86	1.01	0.99
14.98	831.70	0.98	3.93	1.04	0.99
15.96	831.72	1.00	3.99	1.06	0.99
16.94	831.74	1.02	4.05	1.09	1.00
17.92	831.76	1.04	4.11	1.11	1.00
18.90	831.79	1.07	4.16	1.13	1.00

**Tailwater Channel Data - B-12**

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 4.00 (1:1)

Channel Slope: 0.0170

Channel Manning's n: 0.0300

Channel Invert Elevation: 830.72 ft

**Roadway Data for Crossing: B-12**

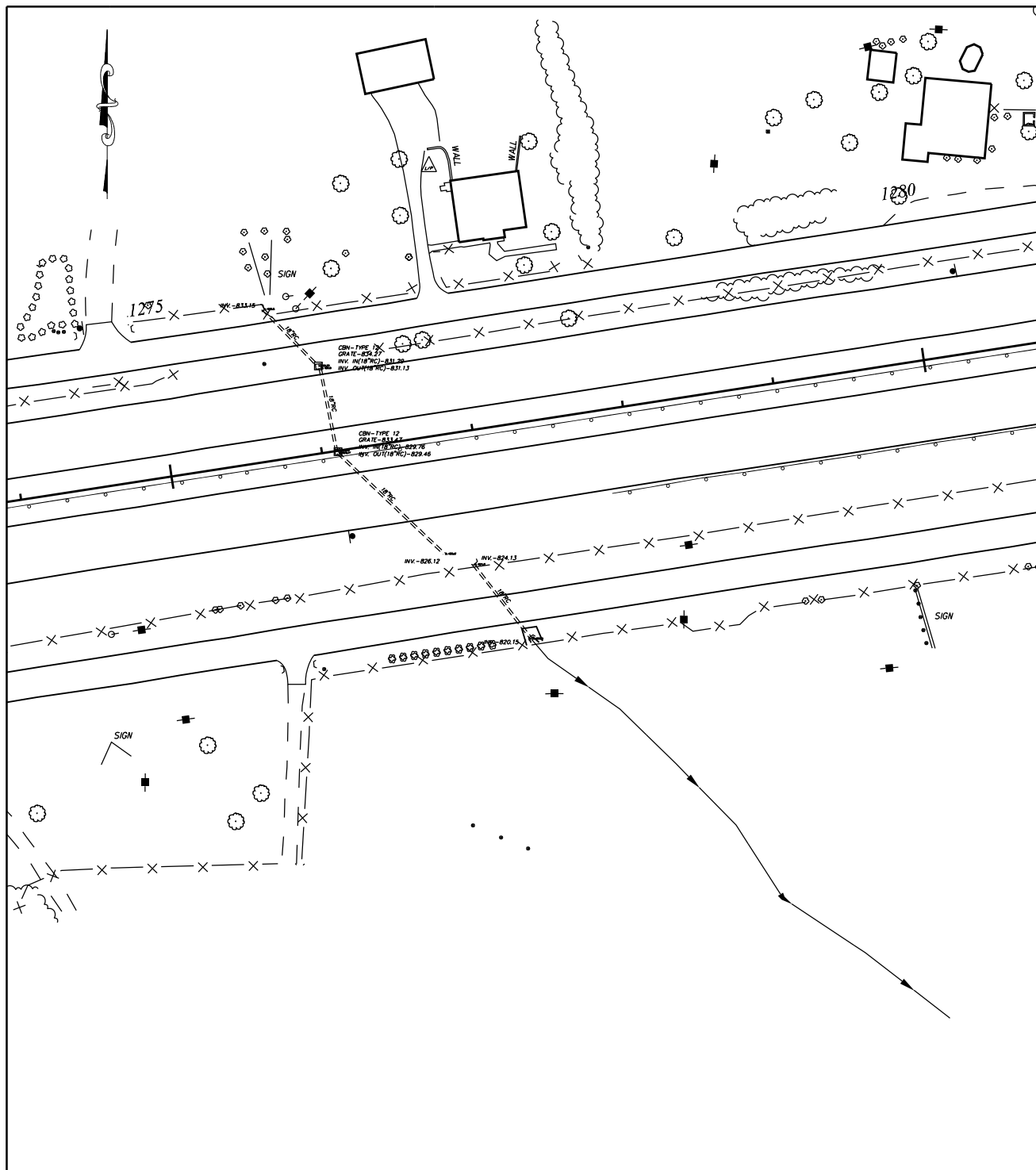
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

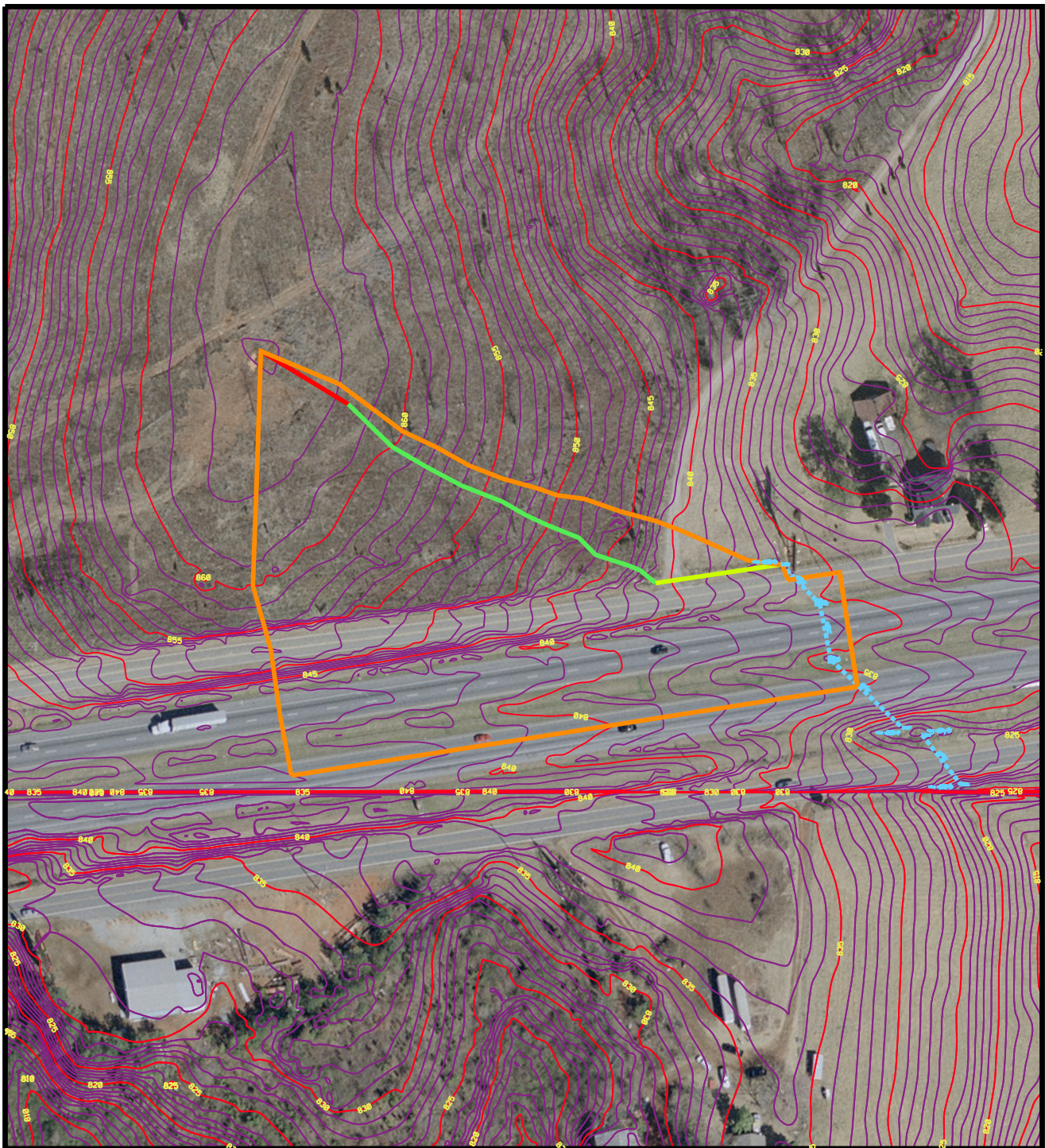
Crest Elevation: 840.20 ft

Roadway Surface: Paved

Roadway Top Width: 40.00 ft







- |  |   |
|--|---|
| <span style="color: blue;">—</span> Watershed              | <span style="color: yellow;">—</span> Ditch Flow                      |
| <span style="color: green;">—</span> Overland              | <span style="color: red;">—</span> Existing 5' Contour Line/Elevation |
| <span style="color: orange;">—</span> Shallow Concentrated | <span style="color: purple;">—</span> Existing 1' Contour Line        |

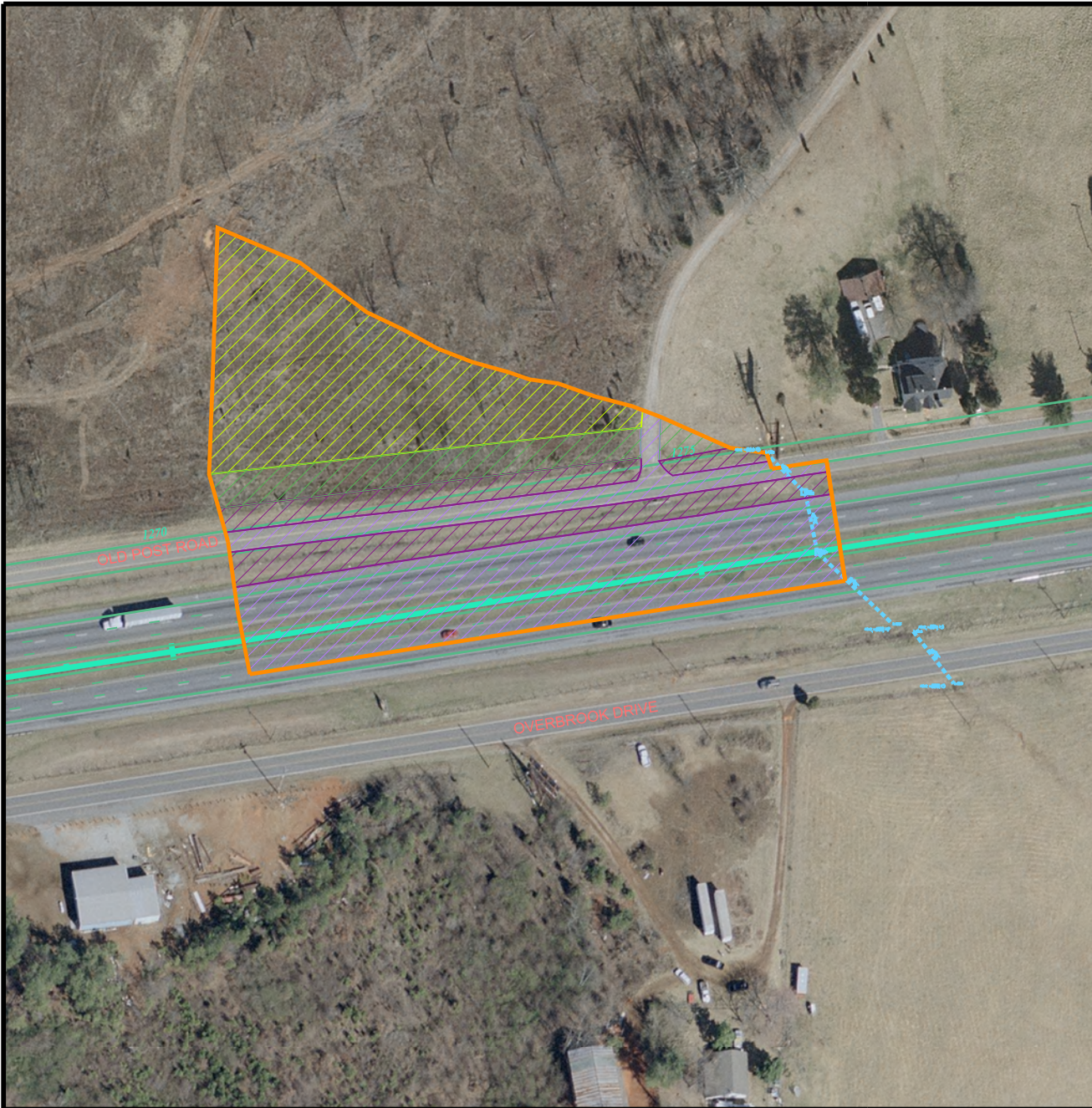
\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-13

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







GRASS SHOULDERS



MEADOWS & PASTURE



PAVEMENTS, ROOF

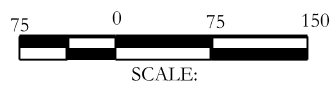


WOODLANDS & FOREST

## LAND USE MAP - SITE # B-13

I-85 WIDENING CHEROKEE CO MM80-96

SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 4 cfs

Design Flow: 7.6 cfs

Maximum Flow: 8.6 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-13**

Headwater Elevation (ft)	Total Discharge (cfs)	B-13 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
834.26	4.00	4.00	0.00	1
834.34	4.46	4.46	0.00	1
834.41	4.92	4.92	0.00	1
834.49	5.38	5.38	0.00	1
834.56	5.84	5.84	0.00	1
834.64	6.30	6.30	0.00	1
834.72	6.76	6.76	0.00	1
834.80	7.22	7.22	0.00	1
834.87	7.60	7.60	0.00	1
834.98	8.14	8.14	0.00	1
835.07	8.60	8.60	0.00	1
836.00	12.17	12.17	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-13**

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)
4.00	4.00	834.26	1.107	0.0*	1-S2n	0.437	0.765	0.437	1.170	9.390	0.000
4.46	4.46	834.34	1.185	0.0*	1-S2n	0.462	0.808	0.462	1.170	9.608	0.000
4.92	4.92	834.41	1.262	0.0*	1-S2n	0.487	0.849	0.487	1.170	9.871	0.000
5.38	5.38	834.49	1.337	0.0*	1-S2n	0.511	0.891	0.511	1.170	10.100	0.000
5.84	5.84	834.56	1.413	0.0*	1-S2n	0.536	0.929	0.536	1.170	10.302	0.000
6.30	6.30	834.64	1.490	0.0*	1-S2n	0.558	0.965	0.558	1.170	10.535	0.000
6.76	6.76	834.72	1.570	0.0*	5-S2n	0.579	1.004	0.579	1.170	10.782	0.000
7.22	7.22	834.80	1.652	0.0*	5-S2n	0.599	1.038	0.601	1.170	10.907	0.000
7.60	7.60	834.87	1.723	0.0*	5-S2n	0.617	1.064	0.617	1.170	11.087	0.000
8.14	8.14	834.98	1.828	0.0*	5-S2n	0.641	1.101	0.641	1.170	11.283	0.000
8.60	8.60	835.07	1.923	0.0*	5-S2n	0.662	1.131	0.662	1.170	11.435	0.000

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 833.15 ft,    Outlet Elevation (invert): 826.12 ft  
Culvert Length: 201.12 ft,    Culvert Slope: 0.0350  
\*\*\*\*\*

### Site Data - B-13

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 833.15 ft

Outlet Station: 201.00 ft

Outlet Elevation: 826.12 ft

Number of Barrels: 1

### Culvert Data Summary - B-13

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE



**Table 3 - Downstream Channel Rating Curve (Crossing: B-13)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
4.00	825.30	1.17
4.46	825.30	1.17
4.92	825.30	1.17
5.38	825.30	1.17
5.84	825.30	1.17
6.30	825.30	1.17
6.76	825.30	1.17
7.22	825.30	1.17
7.60	825.30	1.17
8.14	825.30	1.17
8.60	825.30	1.17

**Tailwater Channel Data - B-13**

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 825.30 ft

**Roadway Data for Crossing: B-13**

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 200.00 ft

Crest Elevation: 836.00 ft

Roadway Surface: Paved

Roadway Top Width: 160.00 ft

## **Crossing Discharge Data**

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 3.3 cfs

Design Flow: 4.52 cfs

Maximum Flow: 7.9 cfs

**Table 4 - Summary of Culvert Flows at Crossing: B-13 Downstream**

Headwater Elevation (ft)	Total Discharge (cfs)	B-13 Downstream Discharge (cfs)	Roadway Discharge (cfs)	Iterations
825.09	3.30	3.30	0.00	1
825.17	3.76	3.76	0.00	1
825.25	4.22	4.22	0.00	1
825.30	4.52	4.52	0.00	1
825.40	5.14	5.14	0.00	1
825.48	5.60	5.60	0.00	1
825.56	6.06	6.06	0.00	1
825.64	6.52	6.52	0.00	1
825.72	6.98	6.98	0.00	1
825.80	7.44	7.44	0.00	1
825.89	7.90	7.90	0.00	1
828.00	15.14	15.14	0.00	Overtopping

**Table 5 - Culvert Summary Table: B-13 Downstream**

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)
3.30	3.30	825.09	0.959	0.0*	1-S2n	0.335	0.692	0.344	0.401	10.697	4.103
3.76	3.76	825.17	1.043	0.0*	1-S2n	0.359	0.741	0.369	0.421	11.069	4.239
4.22	4.22	825.25	1.122	0.0*	1-S2n	0.382	0.786	0.397	0.440	11.241	4.363
4.52	4.52	825.30	1.173	0.0*	1-S2n	0.398	0.814	0.398	0.451	12.010	4.439
5.14	5.14	825.40	1.275	0.0*	1-S2n	0.425	0.867	0.452	0.474	11.583	4.584
5.60	5.60	825.48	1.350	0.0*	1-S2n	0.443	0.909	0.443	0.489	12.943	4.683
6.06	6.06	825.56	1.427	0.0*	1-S2n	0.461	0.946	0.494	0.504	11.914	4.776
6.52	6.52	825.64	1.505	0.0*	5-S2n	0.479	0.985	0.507	0.518	12.358	4.864
6.98	6.98	825.72	1.586	0.0*	5-S2n	0.497	1.020	0.497	0.531	13.617	4.948
7.44	7.44	825.80	1.670	0.0*	5-S2n	0.515	1.053	0.549	0.544	12.699	5.028
7.90	7.90	825.89	1.758	0.0*	5-S2n	0.533	1.085	0.568	0.556	12.916	5.104

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 824.13 ft,    Outlet Elevation (invert): 820.15 ft  
Culvert Length: 61.13 ft,    Culvert Slope: 0.0652  
\*\*\*\*\*

### Site Data - B-13 Downstream

Site Data Option: Culvert Invert Data  
Inlet Station: 0.00 ft  
Inlet Elevation: 824.13 ft  
Outlet Station: 61.00 ft  
Outlet Elevation: 820.15 ft  
Number of Barrels: 1

### Culvert Data Summary - B-13 Downstream

Barrel Shape: Circular  
Barrel Diameter: 1.50 ft  
Barrel Material: Concrete  
Embedment: 0.00 in  
Barrel Manning's n: 0.0120  
Culvert Type: Straight  
Inlet Configuration: Square Edge with Headwall  
Inlet Depression: NONE



**Table 6 - Downstream Channel Rating Curve (Crossing: B-13 Downstream)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
3.30	820.55	0.40	4.10	1.50	1.61
3.76	820.57	0.42	4.24	1.58	1.63
4.22	820.59	0.44	4.36	1.65	1.64
4.52	820.60	0.45	4.44	1.69	1.65
5.14	820.62	0.47	4.58	1.77	1.66
5.60	820.64	0.49	4.68	1.83	1.67
6.06	820.65	0.50	4.78	1.89	1.68
6.52	820.67	0.52	4.86	1.94	1.68
6.98	820.68	0.53	4.95	1.99	1.69
7.44	820.69	0.54	5.03	2.04	1.70
7.90	820.71	0.56	5.10	2.08	1.71

**Tailwater Channel Data - B-13 Downstream**

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 5.00 (1:1)

Channel Slope: 0.0600

Channel Manning's n: 0.0300

Channel Invert Elevation: 820.15 ft

**Roadway Data for Crossing: B-13 Downstream**

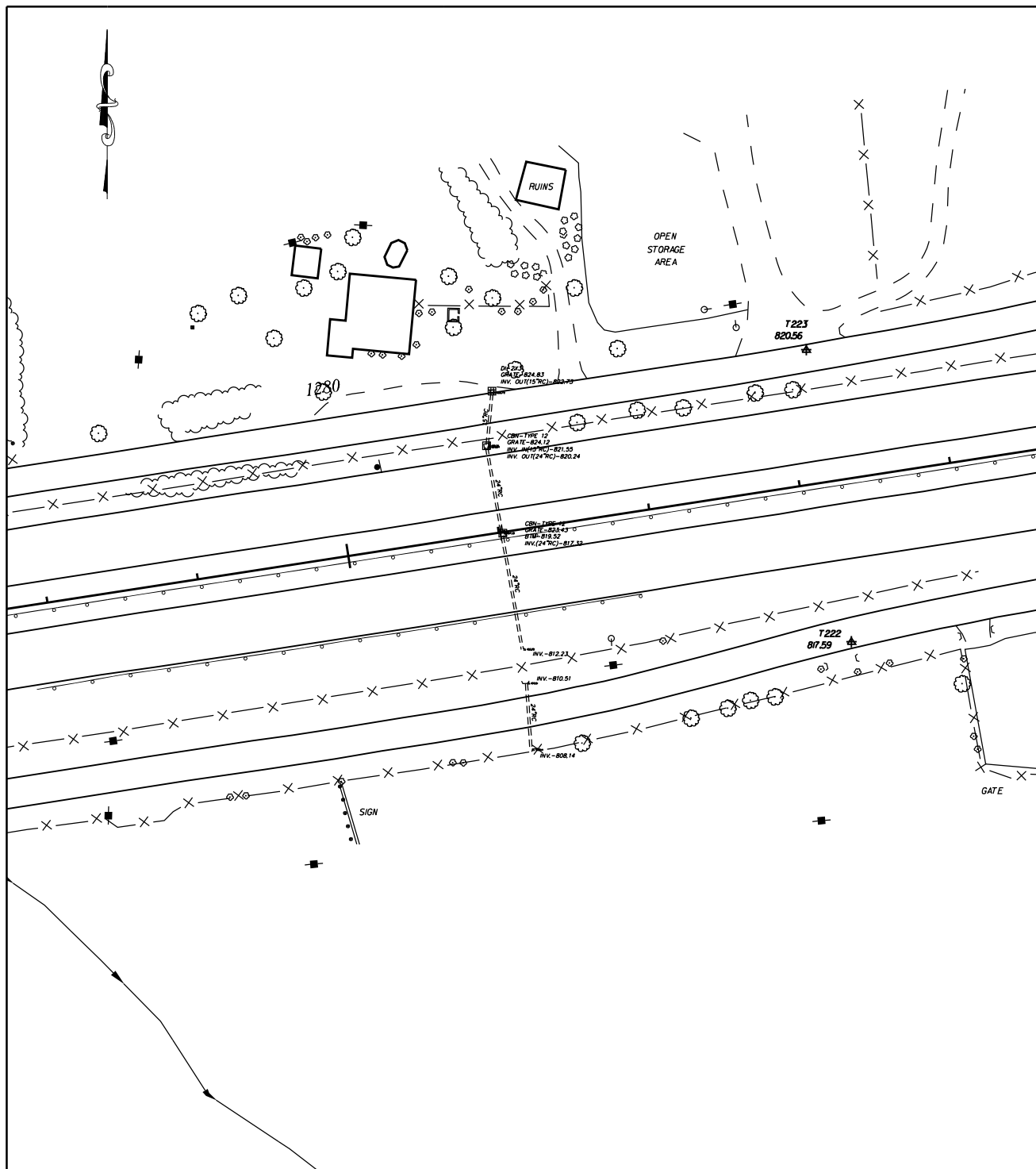
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 828.00 ft

Roadway Surface: Paved

Roadway Top Width: 22.00 ft



# PLAN VIEW SITE # B-14

I-85 WIDENING CHEROKEE CO MM80-96

SPARTANBURG/CHEROKEE COUNTY



SCALE:



- |  |  |
|--|--|
|  Watershed            |  Ditch Flow                         |
|  Overland             |  Existing 5' Contour Line/Elevation |
|  Shallow Concentrated |  Existing 1' Contour Line           |

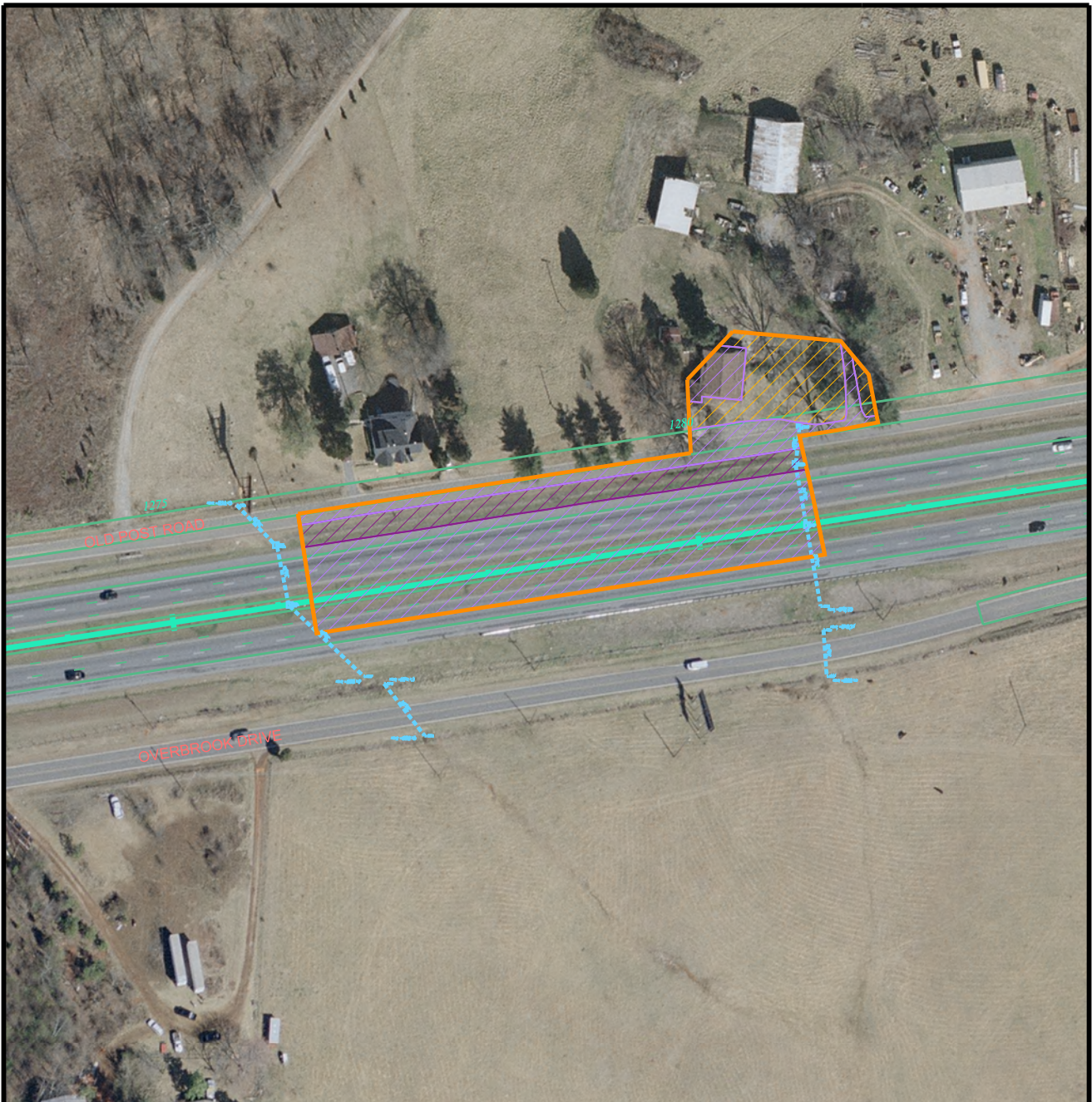
\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-14

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







GRASS SHOULDERS



PAVEMENTS, ROOF



LAWNS SANDY SOIL

## LAND USE MAP - SITE # B-14

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 5.1 cfs

Design Flow: 10.5 cfs

Maximum Flow: 11.9 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-14**

Headwater Elevation (ft)	Total Discharge (cfs)	B-14 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
823.79	5.10	5.10	0.00	1
823.89	5.78	5.78	0.00	1
823.97	6.46	6.46	0.00	1
824.06	7.14	7.14	0.00	1
824.13	7.82	7.82	0.00	1
824.21	8.50	8.50	0.00	1
824.29	9.18	9.18	0.00	1
824.36	9.86	9.86	0.00	1
824.43	10.50	10.50	0.00	1
824.50	11.22	11.22	0.00	1
824.58	11.90	11.90	0.00	1
826.00	22.33	22.33	0.00	Overtopping



**Table 2 - Culvert Summary Table: B-14**

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)
5.10	5.10	823.79	1.064	0.0*	1-S2n	0.386	0.792	0.386	0.680	12.141	0.000
5.78	5.78	823.89	1.156	0.0*	1-S2n	0.408	0.848	0.425	0.680	11.727	0.000
6.46	6.46	823.97	1.243	0.0*	1-S2n	0.430	0.900	0.430	0.680	12.888	0.000
7.14	7.14	824.06	1.325	0.0*	1-S2n	0.452	0.949	0.453	0.680	13.246	0.000
7.82	7.82	824.13	1.405	0.0*	1-S2n	0.475	0.995	0.475	0.680	13.585	0.000
8.50	8.50	824.21	1.481	0.0*	1-S2n	0.497	1.038	0.510	0.680	13.378	0.000
9.18	9.18	824.29	1.556	0.0*	1-S2n	0.519	1.079	0.519	0.680	14.122	0.000
9.86	9.86	824.36	1.629	0.0*	1-S2n	0.541	1.118	0.541	0.680	14.347	0.000
10.50	10.50	824.43	1.697	0.0*	1-S2n	0.558	1.158	0.558	0.680	14.678	0.000
11.22	11.22	824.50	1.774	0.0*	1-S2n	0.576	1.198	0.576	0.680	15.058	0.000
11.90	11.90	824.58	1.847	0.0*	1-S2n	0.593	1.234	0.608	0.680	14.670	0.000

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 822.73 ft,    Outlet Elevation (invert): 812.23 ft  
Culvert Length: 168.33 ft,    Culvert Slope: 0.0625  
\*\*\*\*\*

### **Site Data - B-14**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 822.73 ft

Outlet Station: 168.00 ft

Outlet Elevation: 812.23 ft

Number of Barrels: 1

### **Culvert Data Summary - B-14**

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-14)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
5.10	812.91	0.68
5.78	812.91	0.68
6.46	812.91	0.68
7.14	812.91	0.68
7.82	812.91	0.68
8.50	812.91	0.68
9.18	812.91	0.68
9.86	812.91	0.68
10.50	812.91	0.68
11.22	812.91	0.68
11.90	812.91	0.68

**Tailwater Channel Data - B-14**

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 812.91 ft

**Roadway Data for Crossing: B-14**

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 826.00 ft

Roadway Surface: Paved

Roadway Top Width: 142.00 ft

## **Crossing Discharge Data**

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 8.1 cfs

Design Flow: 16.6 cfs

Maximum Flow: 18.9 cfs

**Table 4 - Summary of Culvert Flows at Crossing: B-14 Downstream**

Headwater Elevation (ft)	Total Discharge (cfs)	B-14 Downstream Discharge (cfs)	Roadway Discharge (cfs)	Iterations
811.95	8.10	8.10	0.00	1
812.07	9.18	9.18	0.00	1
812.19	10.26	10.26	0.00	1
812.31	11.34	11.34	0.00	1
812.42	12.42	12.42	0.00	1
812.54	13.50	13.50	0.00	1
812.67	14.58	14.58	0.00	1
812.80	15.66	15.66	0.00	1
812.91	16.60	16.60	0.00	1
813.08	17.82	17.82	0.00	1
813.23	18.90	18.90	0.00	1
815.00	28.27	28.27	0.00	Overtopping



**Table 5 - Culvert Summary Table: B-14 Downstream**

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)
8.10	8.10	811.95	1.445	0.0*	1-S2n	0.504	1.013	0.556	0.277	11.391	3.194
9.18	9.18	812.07	1.564	0.0*	1-S2n	0.542	1.079	0.594	0.291	11.830	3.296
10.26	10.26	812.19	1.680	0.0*	1-S2n	0.572	1.144	0.635	0.303	11.918	3.388
11.34	11.34	812.31	1.795	0.0*	1-S2n	0.601	1.204	0.673	0.314	12.184	3.474
12.42	12.42	812.42	1.912	0.0*	1-S2n	0.629	1.265	0.709	0.325	12.448	3.554
13.50	13.50	812.54	2.031	0.0*	5-S2n	0.658	1.320	0.747	0.336	12.639	3.629
14.58	14.58	812.67	2.155	0.0*	5-S2n	0.687	1.372	0.779	0.346	12.857	3.700
15.66	15.66	812.80	2.285	0.0*	5-S2n	0.716	1.422	0.815	0.355	13.007	3.766
16.60	16.60	812.91	2.404	0.0*	5-S2n	0.739	1.467	0.846	0.363	13.129	3.822
17.82	17.82	813.08	2.568	0.371	5-S2n	0.766	1.519	0.882	0.373	13.344	3.890
18.90	18.90	813.23	2.723	0.515	5-S2n	0.790	1.562	0.912	0.381	13.546	3.948

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 810.51 ft,    Outlet Elevation (invert): 808.14 ft  
Culvert Length: 44.06 ft,    Culvert Slope: 0.0539  
\*\*\*\*\*

### Site Data - B-14 Downstream

Site Data Option: Culvert Invert Data  
Inlet Station: 0.00 ft  
Inlet Elevation: 810.51 ft  
Outlet Station: 44.00 ft  
Outlet Elevation: 808.14 ft  
Number of Barrels: 1

### Culvert Data Summary - B-14 Downstream

Barrel Shape: Circular  
Barrel Diameter: 2.00 ft  
Barrel Material: Concrete  
Embedment: 0.00 in  
Barrel Manning's n: 0.0120  
Culvert Type: Straight  
Inlet Configuration: Square Edge with Headwall  
Inlet Depression: NONE

**Table 6 - Downstream Channel Rating Curve (Crossing: B-14 Downstream)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
8.10	808.42	0.28	3.19	1.00	1.51
9.18	808.43	0.29	3.30	1.05	1.52
10.26	808.44	0.30	3.39	1.10	1.53
11.34	808.45	0.31	3.47	1.14	1.54
12.42	808.47	0.33	3.55	1.18	1.55
13.50	808.48	0.34	3.63	1.22	1.56
14.58	808.49	0.35	3.70	1.25	1.57
15.66	808.49	0.35	3.77	1.28	1.58
16.60	808.50	0.36	3.82	1.31	1.58
17.82	808.51	0.37	3.89	1.35	1.59
18.90	808.52	0.38	3.95	1.38	1.59

**Tailwater Channel Data - B-14 Downstream**

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 33.00 (1:1)

Channel Slope: 0.0580

Channel Manning's n: 0.0300

Channel Invert Elevation: 808.14 ft

**Roadway Data for Crossing: B-14 Downstream**

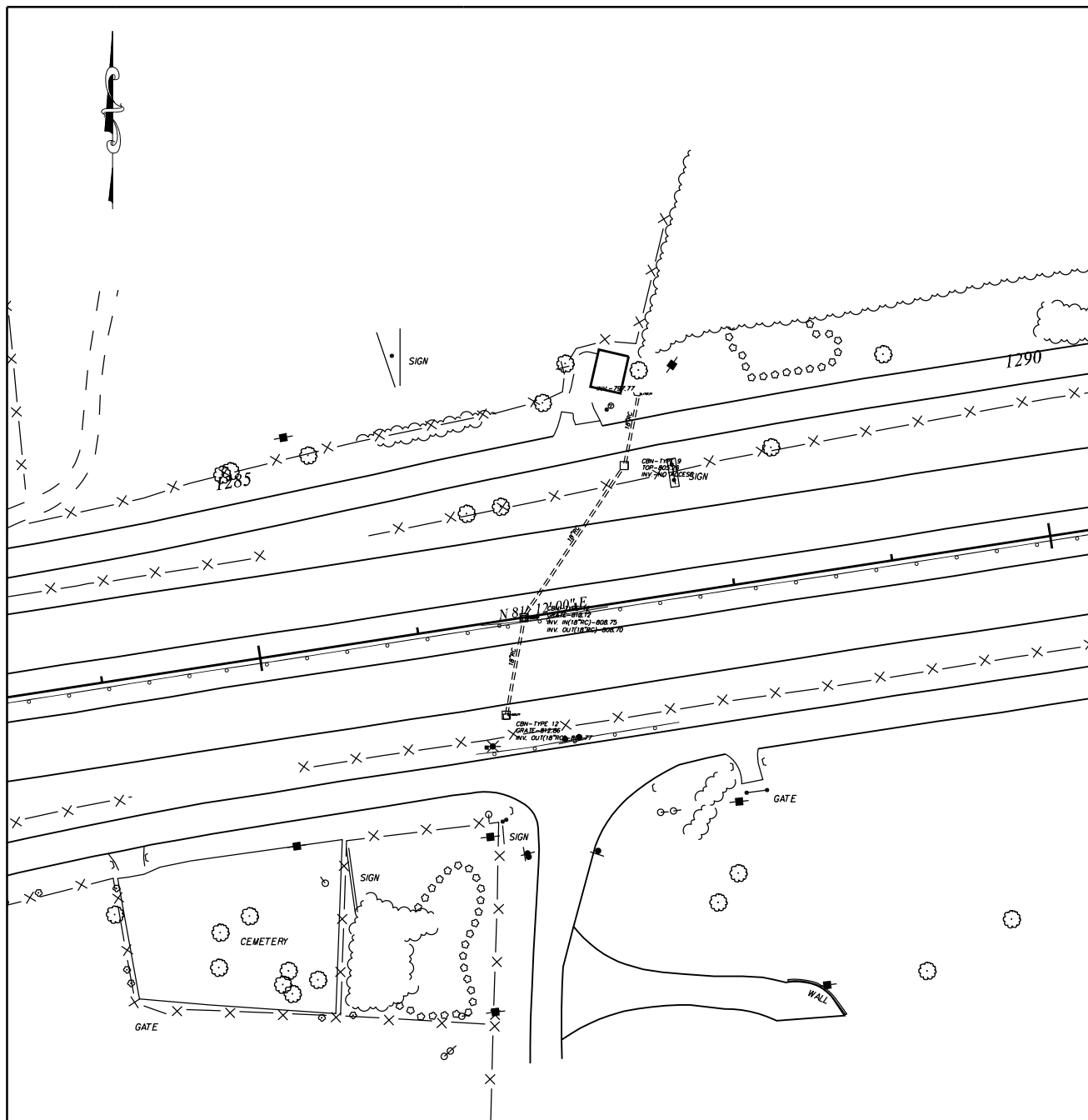
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 815.00 ft

Roadway Surface: Paved

Roadway Top Width: 20.00 ft



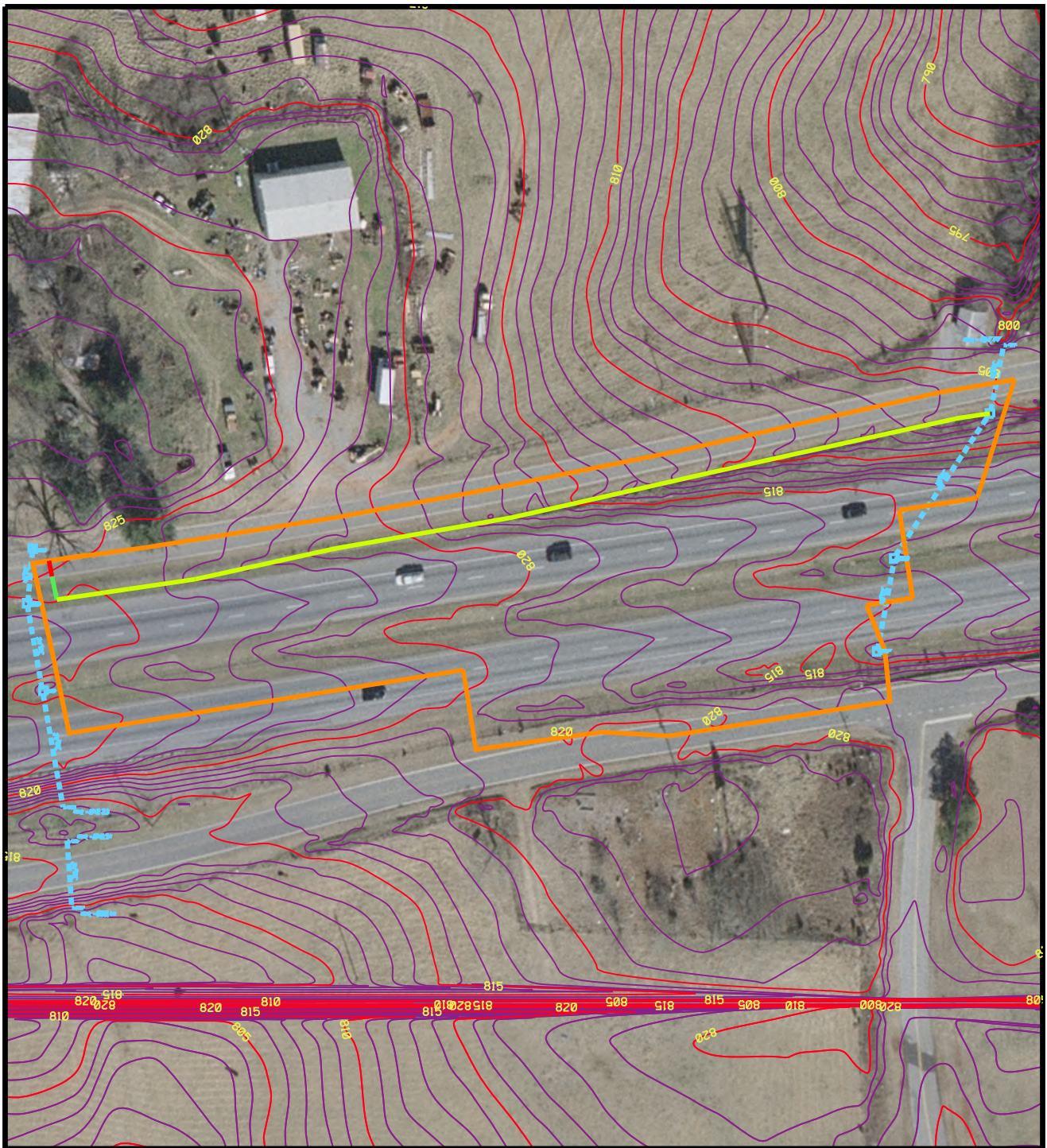
# PLAN VIEW SITE # B-15

I-85 WIDENING CHEROKEE CO MM80-96

SPARTANBURG/CHEROKEE COUNTY



SCALE:



- |                      |                                    |
|----------------------|------------------------------------|
| Watershed            | Ditch Flow                         |
| Overland             | Existing 5' Contour Line/Elevation |
| Shallow Concentrated | Existing 1' Contour Line           |

\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-15

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







GRASS SHOULDERS



PAVEMENTS, ROOF

## LAND USE MAP - SITE # B-15

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 7.2 cfs

Design Flow: 14.9 cfs

Maximum Flow: 17.1 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-15**

Headwater Elevation (ft)	Total Discharge (cfs)	B-15 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
811.40	7.20	7.20	0.00	1
811.59	8.19	8.19	0.00	1
811.80	9.18	9.18	0.00	1
812.04	10.17	10.17	0.00	1
812.31	11.16	11.16	0.00	1
812.60	12.15	12.15	0.00	1
812.92	13.14	13.14	0.00	1
813.26	14.13	14.13	0.00	1
813.55	14.90	14.90	0.00	1
813.99	16.11	16.00	0.00	66
814.02	17.10	16.08	0.90	6
814.00	16.03	16.03	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-15**

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)
7.20	7.20	811.40	1.633	0.0*	5-S2n	0.529	1.036	0.529	0.538	12.917	4.143
8.19	8.19	811.59	1.823	0.0*	5-S2n	0.567	1.105	0.562	0.565	13.553	4.278
9.18	9.18	811.80	2.035	0.0*	5-S2n	0.602	1.167	0.602	0.590	13.816	4.402
10.17	10.17	812.04	2.272	0.0*	5-S2n	0.638	1.227	0.638	0.613	14.198	4.516
11.16	11.16	812.31	2.536	0.0*	5-S2n	0.673	1.277	0.673	0.634	14.512	4.622
12.15	12.15	812.60	2.828	0.0*	5-S2n	0.707	1.320	0.707	0.655	14.851	4.722
13.14	13.14	812.92	3.148	0.0*	5-S2n	0.739	1.356	0.739	0.674	15.145	4.815
14.13	14.13	813.26	3.495	0.0*	5-S2n	0.772	1.384	0.772	0.693	15.417	4.903
14.90	14.90	813.55	3.782	0.0*	5-S2n	0.797	1.405	0.797	0.707	15.610	4.969
16.11	16.00	813.99	4.221	0.0*	5-S2n	0.834	1.428	0.829	0.728	15.961	5.067
17.10	16.08	814.02	4.251	0.0*	5-S2n	0.836	1.430	0.833	0.744	15.951	5.143

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 809.77 ft,    Outlet Elevation (invert): 797.77 ft  
Culvert Length: 216.33 ft,    Culvert Slope: 0.0556  
\*\*\*\*\*

## Site Data - B-15

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 809.77 ft

Outlet Station: 216.00 ft

Outlet Elevation: 797.77 ft

Number of Barrels: 1

## Culvert Data Summary - B-15

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-15)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
7.20	798.31	0.54	4.14	1.38	1.41
8.19	798.33	0.56	4.28	1.45	1.42
9.18	798.36	0.59	4.40	1.51	1.43
10.17	798.38	0.61	4.52	1.57	1.44
11.16	798.40	0.63	4.62	1.62	1.45
12.15	798.42	0.65	4.72	1.68	1.45
13.14	798.44	0.67	4.81	1.73	1.46
14.13	798.46	0.69	4.90	1.77	1.47
14.90	798.48	0.71	4.97	1.81	1.47
16.11	798.50	0.73	5.07	1.86	1.48
17.10	798.51	0.74	5.14	1.90	1.49



**Tailwater Channel Data - B-15**

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 6.00 (1:1)

Channel Slope: 0.0410

Channel Manning's n: 0.0300

Channel Invert Elevation: 797.77 ft

**Roadway Data for Crossing: B-15**

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 814.00 ft

Roadway Surface: Paved

Roadway Top Width: 196.00 ft

# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 7.2 cfs

Design Flow: 14.9 cfs

Maximum Flow: 17.1 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-15 Proposed**

Headwater Elevation (ft)	Total Discharge (cfs)	B-15 Proposed Discharge (cfs)	Roadway Discharge (cfs)	Iterations
811.11	7.20	7.20	0.00	1
811.22	8.19	8.19	0.00	1
811.33	9.18	9.18	0.00	1
811.44	10.17	10.17	0.00	1
811.54	11.16	11.16	0.00	1
811.65	12.15	12.15	0.00	1
811.76	13.14	13.14	0.00	1
811.87	14.13	14.13	0.00	1
811.96	14.90	14.90	0.00	1
812.11	16.11	16.11	0.00	1
812.24	17.10	17.10	0.00	1
814.00	27.12	27.12	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-15 Proposed**

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)
7.20	7.20	811.11	1.339	0.0*	1-S2n	0.469	0.953	0.469	0.538	12.729	4.143
8.19	8.19	811.22	1.453	0.0*	1-S2n	0.503	1.019	0.503	0.565	13.144	4.278
9.18	9.18	811.33	1.563	0.0*	1-S2n	0.537	1.079	0.537	0.590	13.490	4.402
10.17	10.17	811.44	1.669	0.0*	1-S2n	0.565	1.136	0.565	0.613	13.985	4.516
11.16	11.16	811.54	1.774	0.0*	1-S2n	0.591	1.194	0.591	0.634	14.483	4.622
12.15	12.15	811.65	1.881	0.0*	1-S2n	0.617	1.247	0.617	0.655	14.684	4.722
13.14	13.14	811.76	1.989	0.0*	1-S2n	0.643	1.302	0.643	0.674	15.006	4.815
14.13	14.13	811.87	2.101	0.0*	5-S2n	0.669	1.350	0.669	0.693	15.294	4.903
14.90	14.90	811.96	2.191	0.0*	5-S2n	0.689	1.387	0.689	0.707	15.498	4.969
16.11	16.11	812.11	2.340	0.0*	5-S2n	0.721	1.442	0.721	0.728	15.788	5.067
17.10	17.10	812.24	2.469	0.0*	5-S2n	0.744	1.489	0.742	0.744	16.138	5.143

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 809.77 ft,    Outlet Elevation (invert): 797.77 ft  
Culvert Length: 216.33 ft,    Culvert Slope: 0.0556  
\*\*\*\*\*

### **Site Data - B-15 Proposed**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 809.77 ft

Outlet Station: 216.00 ft

Outlet Elevation: 797.77 ft

Number of Barrels: 1

### **Culvert Data Summary - B-15 Proposed**

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-15 Proposed)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
7.20	798.31	0.54	4.14	1.38	1.41
8.19	798.33	0.56	4.28	1.45	1.42
9.18	798.36	0.59	4.40	1.51	1.43
10.17	798.38	0.61	4.52	1.57	1.44
11.16	798.40	0.63	4.62	1.62	1.45
12.15	798.42	0.65	4.72	1.68	1.45
13.14	798.44	0.67	4.81	1.73	1.46
14.13	798.46	0.69	4.90	1.77	1.47
14.90	798.48	0.71	4.97	1.81	1.47
16.11	798.50	0.73	5.07	1.86	1.48
17.10	798.51	0.74	5.14	1.90	1.49



### **Tailwater Channel Data - B-15 Proposed**

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 6.00 (1:1)

Channel Slope: 0.0410

Channel Manning's n: 0.0300

Channel Invert Elevation: 797.77 ft

### **Roadway Data for Crossing: B-15 Proposed**

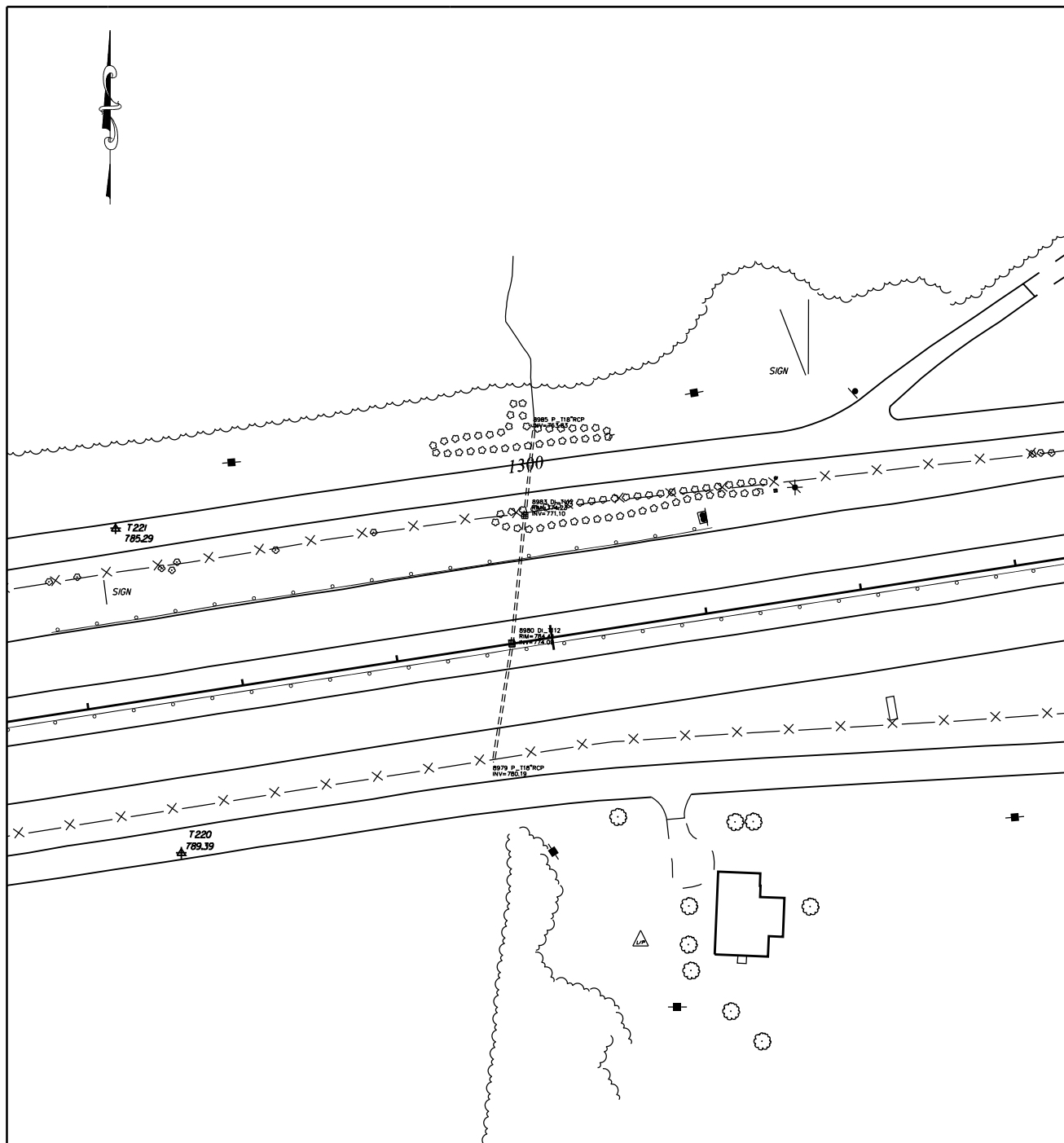
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 814.00 ft

Roadway Surface: Paved

Roadway Top Width: 196.00 ft

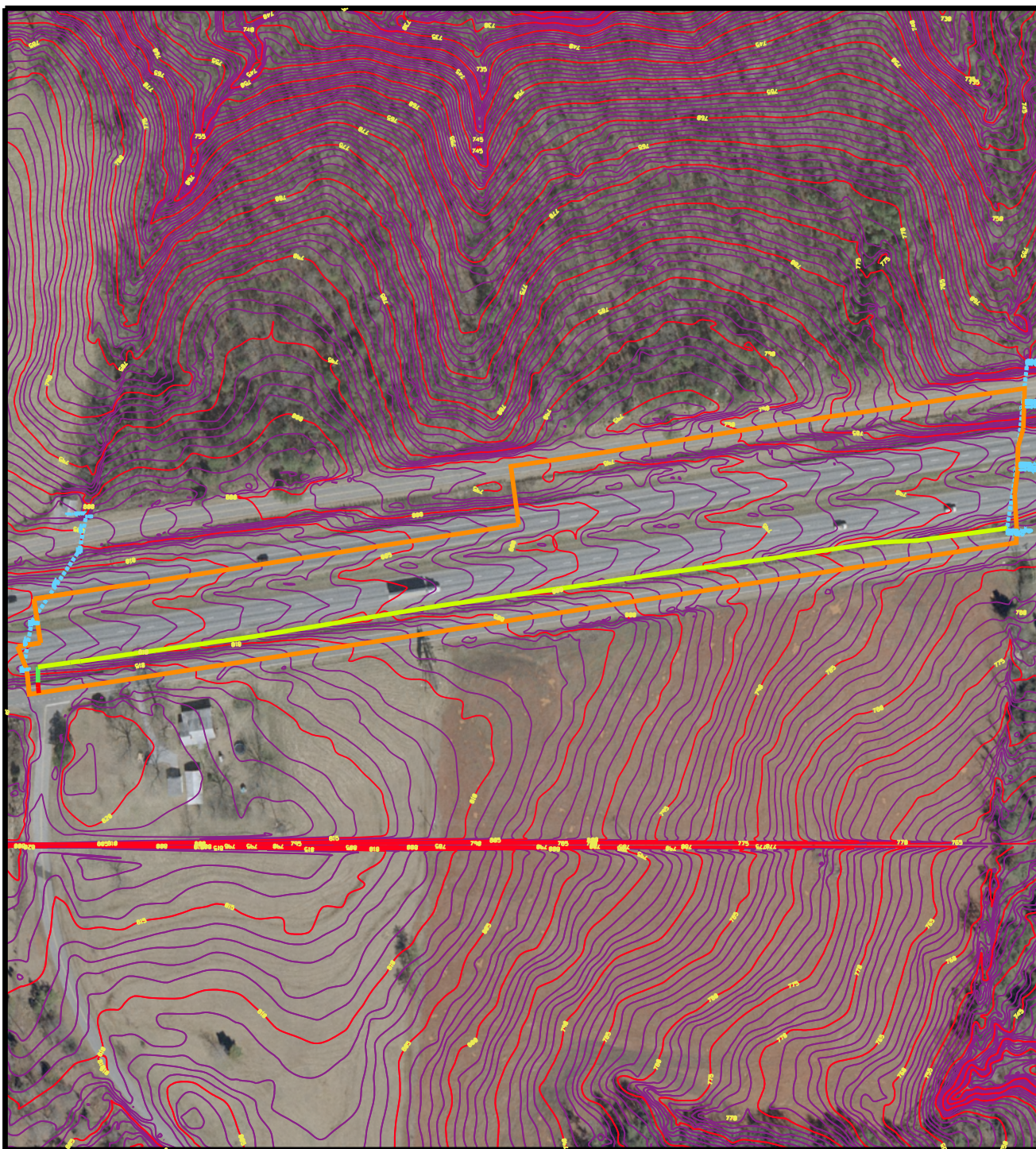


PLAN VIEW SITE # B-16

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



SCALE:



- Watershed
- Overland
- Shallow Concentrated

- Ditch Flow
- Existing 5' Contour Line/Elevation
- Existing 1' Contour Line

\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-16

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







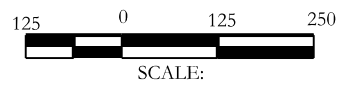
GRASS SHOULDERS



PAVEMENTS, ROOF

## LAND USE MAP - SITE # B-16

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 17.1 cfs

Design Flow: 35.3 cfs

Maximum Flow: 40.3 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-16**

Headwater Elevation (ft)	Total Discharge (cfs)	B-16 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
784.87	17.10	17.10	0.00	1
786.01	19.42	19.42	0.00	1
787.29	21.74	21.74	0.00	1
787.46	24.06	22.04	1.89	14
787.49	26.38	22.08	4.22	5
787.51	28.70	22.11	6.49	4
787.53	31.02	22.14	8.82	4
787.54	33.34	22.17	11.03	3
787.56	35.30	22.19	13.00	3
787.57	37.98	22.22	15.67	3
787.58	40.30	22.24	18.00	3
787.43	21.98	21.98	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-16**

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)
17.10	17.10	784.87	4.678	0.0*	5-S2n	0.790	1.380	0.797	0.210	17.931	5.079
19.42	19.42	786.01	5.816	0.0*	5-S2n	0.855	1.500	0.855	0.227	18.650	5.342
21.74	21.74	787.29	7.099	0.0*	5-S2n	0.920	1.500	0.920	0.243	19.138	5.584
24.06	22.04	787.46	7.275	0.0*	5-S2n	0.929	1.500	0.929	0.259	19.194	5.811
26.38	22.08	787.49	7.299	0.0*	5-S2n	0.930	1.500	0.930	0.274	19.201	6.023
28.70	22.11	787.51	7.319	0.0*	5-S2n	0.931	1.500	0.931	0.288	19.207	6.224
31.02	22.14	787.53	7.336	0.0*	5-S2n	0.931	1.500	0.931	0.302	19.213	6.419
33.34	22.17	787.54	7.352	0.0*	5-S2n	0.932	1.500	0.932	0.316	19.217	6.601
35.30	22.19	787.56	7.365	0.0*	5-S2n	0.933	1.500	0.933	0.327	19.221	6.750
37.98	22.22	787.57	7.381	0.0*	5-S2n	0.934	1.500	0.934	0.342	19.226	6.944
40.30	22.24	787.58	7.394	0.0*	5-S2n	0.934	1.500	0.934	0.354	19.230	7.109

\* Full Flow Headwater elevation is below inlet invert.



\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 780.19 ft,    Outlet Elevation (invert): 763.83 ft  
Culvert Length: 217.62 ft,    Culvert Slope: 0.0754  
\*\*\*\*\*

## Site Data - B-16

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 780.19 ft

Outlet Station: 217.00 ft

Outlet Elevation: 763.83 ft

Number of Barrels: 1

## Culvert Data Summary - B-16

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-16)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
17.10	764.04	0.21	5.08	1.14	1.95
19.42	764.06	0.23	5.34	1.23	1.98
21.74	764.07	0.24	5.58	1.32	2.00
24.06	764.09	0.26	5.81	1.40	2.01
26.38	764.10	0.27	6.02	1.49	2.03
28.70	764.12	0.29	6.22	1.56	2.04
31.02	764.13	0.30	6.42	1.64	2.06
33.34	764.15	0.32	6.60	1.71	2.07
35.30	764.16	0.33	6.75	1.77	2.08
37.98	764.17	0.34	6.94	1.86	2.09
40.30	764.18	0.35	7.11	1.92	2.10

**Tailwater Channel Data - B-16**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 16.00 ft

Channel Slope: 0.0870

Channel Manning's n: 0.0300

Channel Invert Elevation: 763.83 ft

**Roadway Data for Crossing: B-16**

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 787.43 ft

Roadway Surface: Paved

Roadway Top Width: 170.00 ft

# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 17.1 cfs

Design Flow: 35.3 cfs

Maximum Flow: 40.3 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-16 Proposed**

Headwater Elevation (ft)	Total Discharge (cfs)	B-16 Proposed Discharge (cfs)	Roadway Discharge (cfs)	Iterations
781.99	17.10	17.10	0.00	1
782.14	19.42	19.42	0.00	1
782.29	21.74	21.74	0.00	1
782.43	24.06	24.06	0.00	1
782.57	26.38	26.38	0.00	1
782.70	28.70	28.70	0.00	1
782.84	31.02	31.02	0.00	1
782.97	33.34	33.34	0.00	1
783.09	35.30	35.30	0.00	1
783.25	37.98	37.98	0.00	1
783.40	40.30	40.30	0.00	1
787.43	82.08	82.08	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-16 Proposed**

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)
17.10	17.10	781.99	1.797	0.0*	1-S2n	0.587	1.321	0.587	0.210	17.751	5.079
19.42	19.42	782.14	1.952	0.0*	1-S2n	0.622	1.414	0.657	0.227	16.766	5.342
21.74	21.74	782.29	2.099	0.0*	1-S2n	0.658	1.499	0.696	0.243	17.312	5.584
24.06	24.06	782.43	2.241	0.0*	1-S2n	0.693	1.579	0.693	0.259	19.291	5.811
26.38	26.38	782.57	2.378	0.0*	1-S2n	0.728	1.653	0.728	0.274	19.754	6.023
28.70	28.70	782.70	2.513	0.0*	1-S2n	0.763	1.730	0.763	0.288	20.160	6.224
31.02	31.02	782.84	2.647	0.0*	1-S2n	0.798	1.803	0.798	0.302	20.518	6.419
33.34	33.34	782.97	2.783	0.0*	1-S2n	0.830	1.872	0.851	0.316	20.296	6.601
35.30	35.30	783.09	2.899	0.0*	1-S2n	0.852	1.927	0.852	0.327	21.435	6.750
37.98	37.98	783.25	3.062	0.0*	5-S2n	0.883	2.000	0.883	0.342	21.803	6.944
40.30	40.30	783.40	3.208	0.0*	5-S2n	0.909	2.065	0.936	0.354	21.309	7.109

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 780.19 ft,    Outlet Elevation (invert): 763.83 ft  
Culvert Length: 217.62 ft,    Culvert Slope: 0.0754  
\*\*\*\*\*

### **Site Data - B-16 Proposed**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 780.19 ft

Outlet Station: 217.00 ft

Outlet Elevation: 763.83 ft

Number of Barrels: 1

### **Culvert Data Summary - B-16 Proposed**

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE



**Table 3 - Downstream Channel Rating Curve (Crossing: B-16 Proposed)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
17.10	764.04	0.21	5.08	1.14	1.95
19.42	764.06	0.23	5.34	1.23	1.98
21.74	764.07	0.24	5.58	1.32	2.00
24.06	764.09	0.26	5.81	1.40	2.01
26.38	764.10	0.27	6.02	1.49	2.03
28.70	764.12	0.29	6.22	1.56	2.04
31.02	764.13	0.30	6.42	1.64	2.06
33.34	764.15	0.32	6.60	1.71	2.07
35.30	764.16	0.33	6.75	1.77	2.08
37.98	764.17	0.34	6.94	1.86	2.09
40.30	764.18	0.35	7.11	1.92	2.10

**Tailwater Channel Data - B-16 Proposed**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 16.00 ft

Channel Slope: 0.0870

Channel Manning's n: 0.0300

Channel Invert Elevation: 763.83 ft

**Roadway Data for Crossing: B-16 Proposed**

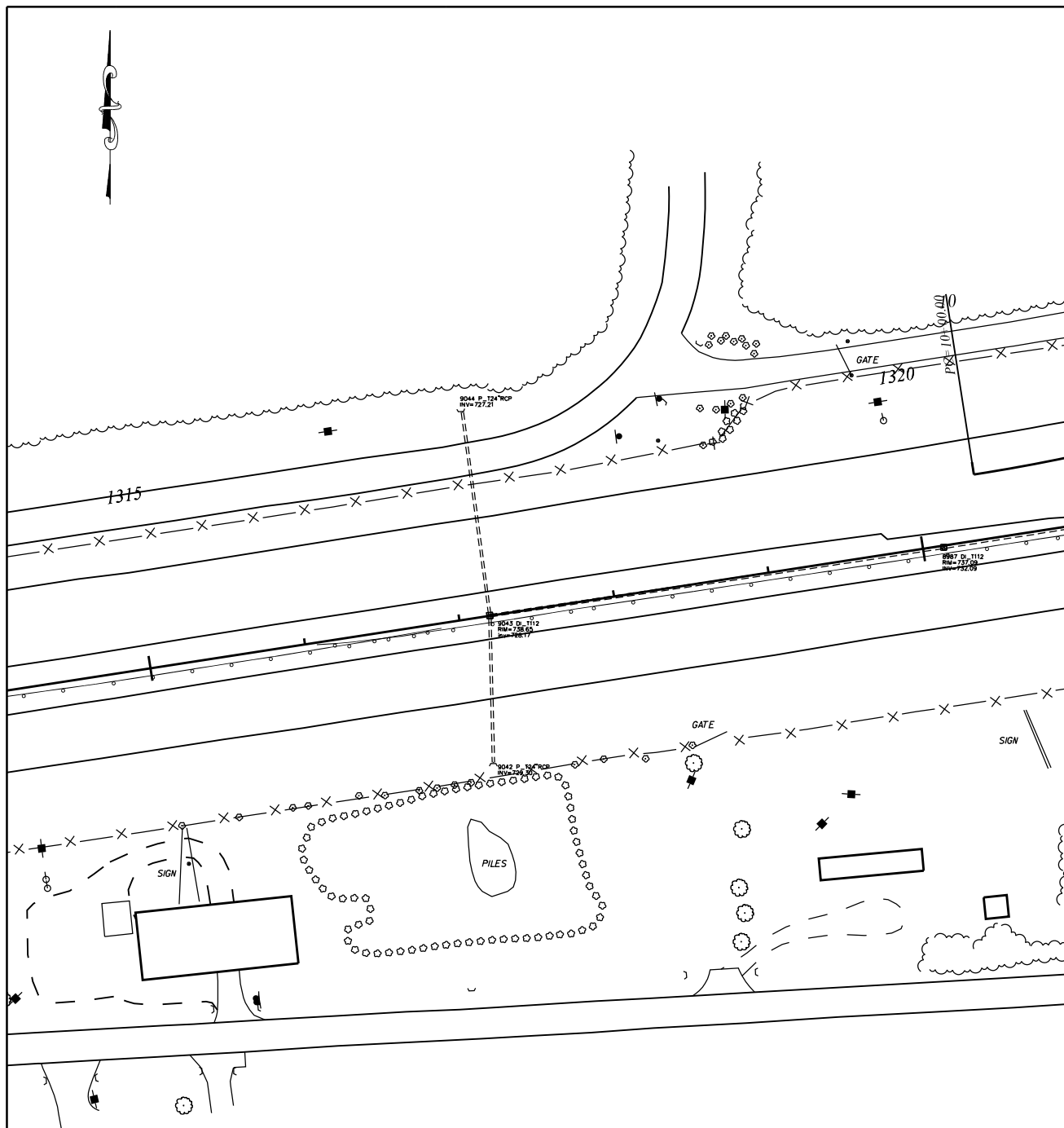
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 787.43 ft

Roadway Surface: Paved

Roadway Top Width: 170.00 ft



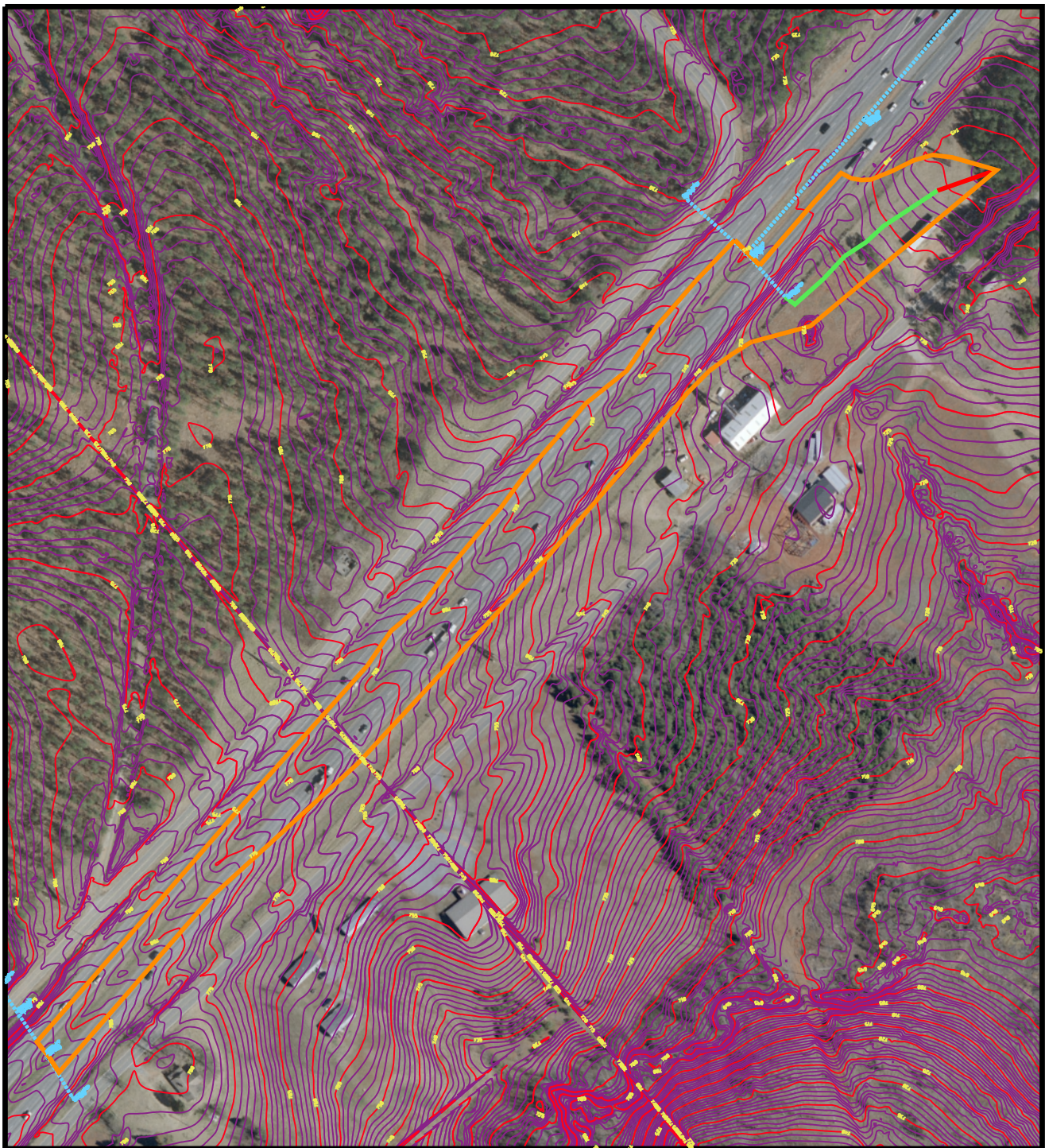
## PLAN VIEW SITE # B-17

I-85 WIDENING CHEROKEE CO MM80-96

SPARTANBURG/CHEROKEE COUNTY



SCALE:



- |  |  |
|--|--|
|  Watershed            |  Ditch Flow                         |
|  Overland             |  Existing 5' Contour Line/Elevation |
|  Shallow Concentrated |  Existing 1' Contour Line           |

\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-17

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







PAVEMENTS, ROOF



GRASS SHOULDERS



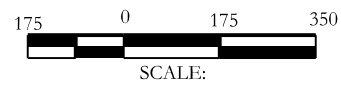
LAWNS SANDY SOIL



UNIMPROVED AREAS

## LAND USE MAP - SITE # B-17

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 11.3 cfs

Design Flow: 22.5 cfs

Maximum Flow: 25.4 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-17**

Headwater Elevation (ft)	Total Discharge (cfs)	B-17 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
731.14	11.30	11.30	0.00	1
731.29	12.71	12.71	0.00	1
731.45	14.12	14.12	0.00	1
731.61	15.53	15.53	0.00	1
731.79	16.94	16.94	0.00	1
731.99	18.35	18.35	0.00	1
732.20	19.76	19.76	0.00	1
732.42	21.17	21.17	0.00	1
732.65	22.50	22.50	0.00	1
732.93	23.99	23.99	0.00	1
733.21	25.40	25.40	0.00	1
742.00	45.78	45.78	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-17**

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)
11.30	11.30	731.14	1.836	0.0*	1-S2n	0.974	1.202	0.974	0.274	7.445	4.129
12.71	12.71	731.29	1.988	0.175	1-S2n	1.044	1.280	1.044	0.294	7.662	4.321
14.12	14.12	731.45	2.146	0.477	5-S2n	1.114	1.350	1.114	0.314	7.848	4.500
15.53	15.53	731.61	2.314	0.798	5-S2n	1.184	1.416	1.184	0.333	8.025	4.668
16.94	16.94	731.79	2.494	1.143	5-S2n	1.254	1.482	1.254	0.351	8.175	4.828
18.35	18.35	731.99	2.687	1.735	5-S2n	1.327	1.541	1.332	0.369	8.268	4.978
19.76	19.76	732.20	2.897	2.090	5-S2n	1.402	1.595	1.402	0.386	8.411	5.120
21.17	21.17	732.42	3.124	2.468	5-S2n	1.481	1.646	1.484	0.403	8.458	5.256
22.50	22.50	732.65	3.353	2.844	5-S2n	1.567	1.690	1.567	0.418	8.538	5.381
23.99	23.99	732.93	3.630	3.289	5-S2n	1.681	1.734	1.681	0.435	8.490	5.514
25.40	25.40	733.21	3.910	3.481	7-M2c	2.000	1.772	1.772	0.451	8.631	5.635



\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 729.30 ft,    Outlet Elevation (invert): 727.21 ft  
Culvert Length: 226.01 ft,    Culvert Slope: 0.0092  
\*\*\*\*\*

### **Site Data - B-17**

Site Data Option: Culvert Invert Data  
Inlet Station: 0.00 ft  
Inlet Elevation: 729.30 ft  
Outlet Station: 226.00 ft  
Outlet Elevation: 727.21 ft  
Number of Barrels: 1

### **Culvert Data Summary - B-17**

Barrel Shape: Circular  
Barrel Diameter: 2.00 ft  
Barrel Material: Concrete  
Embedment: 0.00 in  
Barrel Manning's n: 0.0120  
Culvert Type: Straight  
Inlet Configuration: Square Edge with Headwall  
Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-17)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
11.30	727.48	0.27	4.13	0.72	1.39
12.71	727.50	0.29	4.32	0.77	1.40
14.12	727.52	0.31	4.50	0.82	1.42
15.53	727.54	0.33	4.67	0.87	1.43
16.94	727.56	0.35	4.83	0.92	1.44
18.35	727.58	0.37	4.98	0.97	1.44
19.76	727.60	0.39	5.12	1.01	1.45
21.17	727.61	0.40	5.26	1.06	1.46
22.50	727.63	0.42	5.38	1.10	1.47
23.99	727.65	0.44	5.51	1.14	1.47
25.40	727.66	0.45	5.64	1.18	1.48

**Tailwater Channel Data - B-17**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 10.00 ft

Channel Slope: 0.0420

Channel Manning's n: 0.0300

Channel Invert Elevation: 727.21 ft

**Roadway Data for Crossing: B-17**

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 150.00 ft

Crest Elevation: 742.00 ft

Roadway Surface: Paved

Roadway Top Width: 167.00 ft

# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 11.3 cfs

Design Flow: 22.5 cfs

Maximum Flow: 25.4 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-17 Proposed**

Headwater Elevation (ft)	Total Discharge (cfs)	B-17 Proposed Discharge (cfs)	Roadway Discharge (cfs)	Iterations
730.92	11.30	11.30	0.00	1
731.04	12.71	12.71	0.00	1
731.16	14.12	14.12	0.00	1
731.27	15.53	15.53	0.00	1
731.38	16.94	16.94	0.00	1
731.49	18.35	18.35	0.00	1
731.60	19.76	19.76	0.00	1
731.70	21.17	21.17	0.00	1
731.81	22.50	22.50	0.00	1
731.93	23.99	23.99	0.00	1
732.04	25.40	25.40	0.00	1
742.00	76.41	76.41	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-17 Proposed**

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)
11.30	11.30	730.92	1.621	0.0*	1-S2n	0.874	1.126	0.874	0.274	7.382	4.129
12.71	12.71	731.04	1.743	0.0*	1-S2n	0.932	1.198	0.932	0.294	7.628	4.321
14.12	14.12	731.16	1.860	0.0*	1-S2n	0.985	1.265	0.985	0.314	7.848	4.500
15.53	15.53	731.27	1.972	0.0*	1-S2n	1.038	1.328	1.045	0.333	7.975	4.668
16.94	16.94	731.38	2.081	0.0*	1-S2n	1.091	1.387	1.091	0.351	8.228	4.828
18.35	18.35	731.49	2.189	0.067	1-S2n	1.143	1.448	1.143	0.369	8.389	4.978
19.76	19.76	731.60	2.296	0.235	1-S2n	1.192	1.503	1.192	0.386	8.558	5.120
21.17	21.17	731.70	2.405	0.414	1-S2n	1.240	1.561	1.240	0.403	8.711	5.256
22.50	22.50	731.81	2.508	0.586	5-S2n	1.286	1.610	1.286	0.418	8.841	5.381
23.99	23.99	731.93	2.628	0.785	5-S2n	1.338	1.664	1.338	0.435	8.974	5.514
25.40	25.40	732.04	2.744	0.981	5-S2n	1.386	1.713	1.386	0.451	9.091	5.635

\* Full Flow Headwater elevation is below inlet invert.



\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 729.30 ft,    Outlet Elevation (invert): 727.21 ft  
Culvert Length: 226.01 ft,    Culvert Slope: 0.0092  
\*\*\*\*\*

### **Site Data - B-17 Proposed**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 729.30 ft

Outlet Station: 226.00 ft

Outlet Elevation: 727.21 ft

Number of Barrels: 1

### **Culvert Data Summary - B-17 Proposed**

Barrel Shape: Circular

Barrel Diameter: 2.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-17 Proposed )**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
11.30	727.48	0.27	4.13	0.72	1.39
12.71	727.50	0.29	4.32	0.77	1.40
14.12	727.52	0.31	4.50	0.82	1.42
15.53	727.54	0.33	4.67	0.87	1.43
16.94	727.56	0.35	4.83	0.92	1.44
18.35	727.58	0.37	4.98	0.97	1.44
19.76	727.60	0.39	5.12	1.01	1.45
21.17	727.61	0.40	5.26	1.06	1.46
22.50	727.63	0.42	5.38	1.10	1.47
23.99	727.65	0.44	5.51	1.14	1.47
25.40	727.66	0.45	5.64	1.18	1.48

**Tailwater Channel Data - B-17 Proposed**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 10.00 ft

Channel Slope: 0.0420

Channel Manning's n: 0.0300

Channel Invert Elevation: 727.21 ft

**Roadway Data for Crossing: B-17 Proposed**

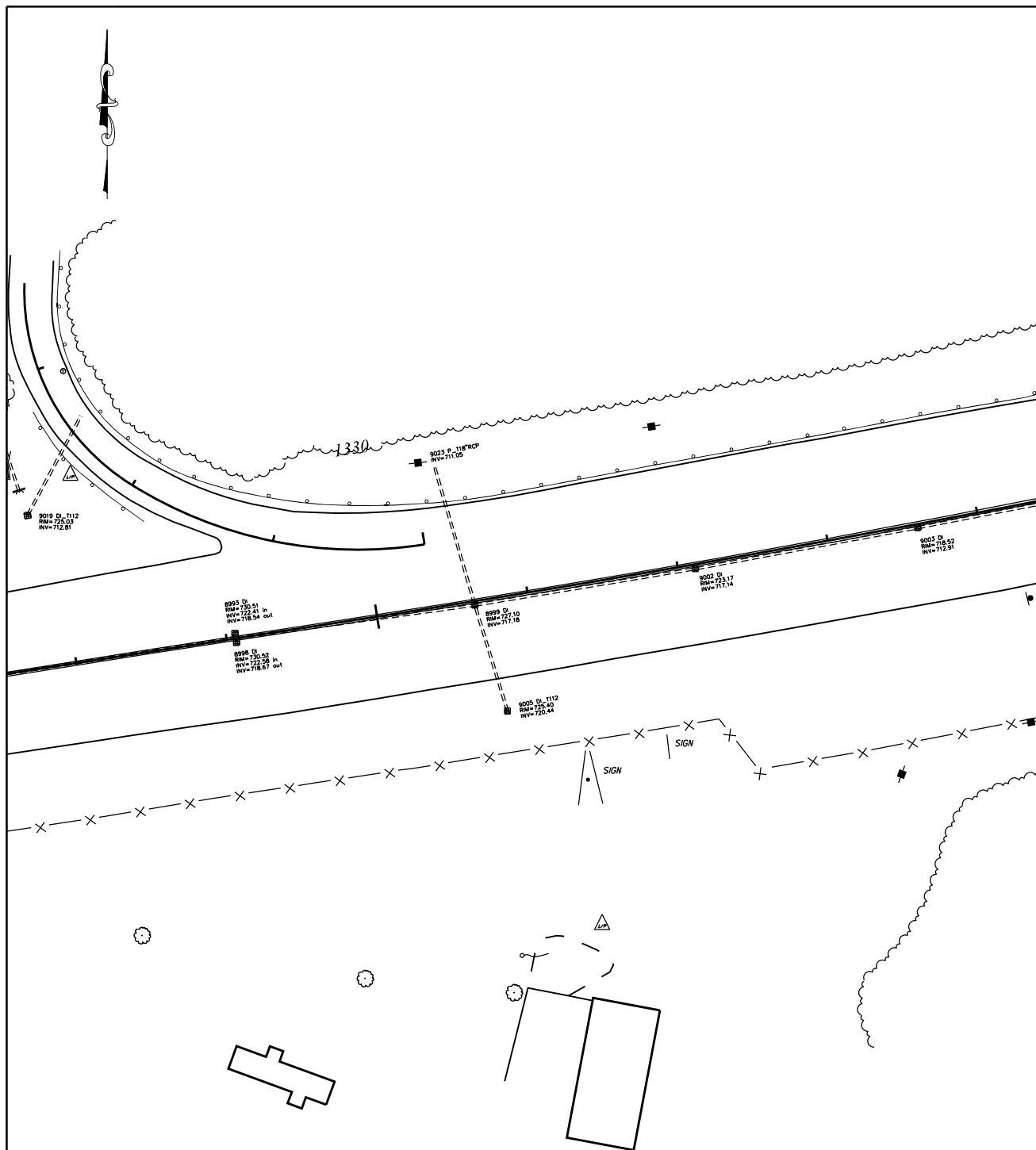
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 150.00 ft

Crest Elevation: 742.00 ft

Roadway Surface: Paved

Roadway Top Width: 167.00 ft



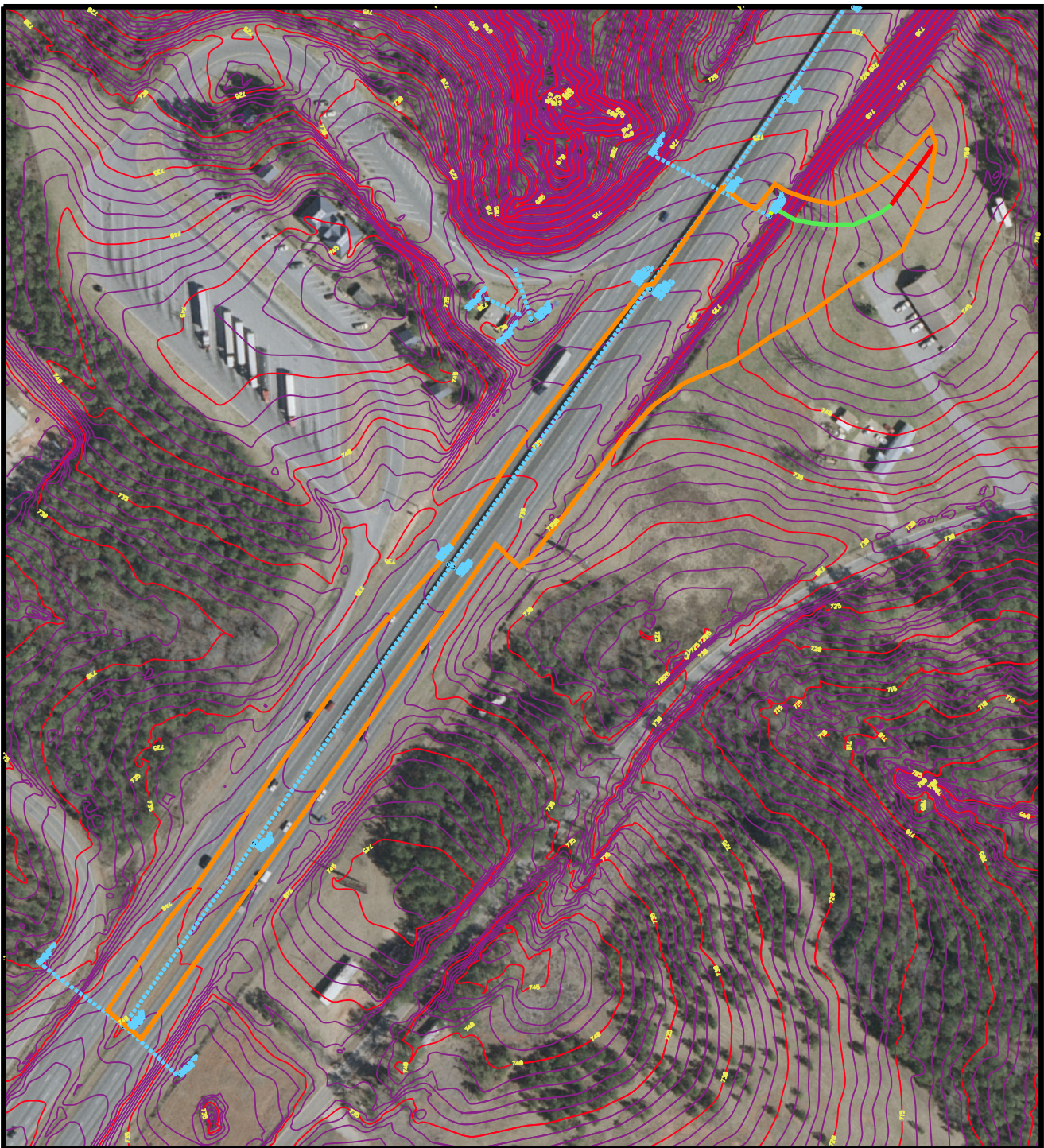
# PLAN VIEW SITE # B-18

I-85 WIDENING CHEROKEE CO MM80-96

SPARTANBURG/CHEROKEE COUNTY



SCALE:

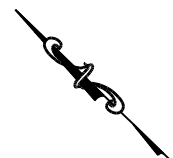


- |                      |                                    |
|----------------------|------------------------------------|
| Watershed            | Ditch Flow                         |
| Overland             | Existing 5' Contour Line/Elevation |
| Shallow Concentrated | Existing 1' Contour Line           |

\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B18

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







PAVEMENTS, ROOF



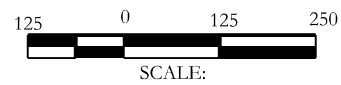
GRASS SHOULDERS



LAWNS SANDY SOIL

## LAND USE MAP - SITE # B-18

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 7.5 cfs

Design Flow: 14.9 cfs

Maximum Flow: 16.9 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-18**

Headwater Elevation (ft)	Total Discharge (cfs)	B-18 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
722.13	7.50	7.50	0.00	1
722.31	8.44	8.44	0.00	1
722.52	9.38	9.38	0.00	1
722.75	10.32	10.32	0.00	1
723.00	11.26	11.26	0.00	1
723.28	12.20	12.20	0.00	1
723.59	13.14	13.14	0.00	1
723.92	14.08	14.08	0.00	1
724.22	14.90	14.90	0.00	1
724.64	15.96	15.96	0.00	1
725.04	16.90	16.90	0.00	1
729.39	24.66	24.66	0.00	Overtopping



**Table 2 - Culvert Summary Table: B-18**

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)
7.50	7.50	722.13	1.687	0.0*	5-S2n	0.538	1.057	0.538	0.094	13.162	5.294
8.44	8.44	722.31	1.873	0.0*	5-S2n	0.572	1.121	0.572	0.101	13.658	5.546
9.38	9.38	722.52	2.079	0.0*	5-S2n	0.606	1.182	0.606	0.108	14.019	5.785
10.32	10.32	722.75	2.309	0.0*	5-S2n	0.639	1.235	0.635	0.115	14.480	6.008
11.26	11.26	723.00	2.563	0.0*	5-S2n	0.672	1.282	0.672	0.121	14.677	6.220
12.20	12.20	723.28	2.842	0.0*	5-S2n	0.704	1.322	0.704	0.127	14.998	6.422
13.14	13.14	723.59	3.147	0.0*	5-S2n	0.734	1.356	0.734	0.132	15.282	6.613
14.08	14.08	723.92	3.475	0.0*	5-S2n	0.765	1.383	0.765	0.138	15.546	6.793
14.90	14.90	724.22	3.781	0.0*	5-S2n	0.791	1.405	0.791	0.143	15.755	6.948
15.96	15.96	724.64	4.202	0.0*	5-S2n	0.826	1.420	0.840	0.149	15.668	7.139
16.90	16.90	725.04	4.601	0.0*	5-S2n	0.856	1.395	0.877	0.154	15.765	7.302

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 720.44 ft,    Outlet Elevation (invert): 711.05 ft  
Culvert Length: 165.27 ft,    Culvert Slope: 0.0569  
\*\*\*\*\*

### Site Data - B-18

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 720.44 ft

Outlet Station: 165.00 ft

Outlet Elevation: 711.05 ft

Number of Barrels: 1

### Culvert Data Summary - B-18

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-18)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
7.50	711.14	0.09	5.29	1.59	3.04
8.44	711.15	0.10	5.55	1.71	3.07
9.38	711.16	0.11	5.79	1.82	3.10
10.32	711.16	0.11	6.01	1.93	3.13
11.26	711.17	0.12	6.22	2.03	3.15
12.20	711.18	0.13	6.42	2.13	3.18
13.14	711.18	0.13	6.61	2.23	3.20
14.08	711.19	0.14	6.79	2.33	3.22
14.90	711.19	0.14	6.95	2.41	3.24
15.96	711.20	0.15	7.14	2.51	3.26
16.90	711.20	0.15	7.30	2.60	3.28

**Tailwater Channel Data - B-18**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 15.00 ft

Channel Slope: 0.2700

Channel Manning's n: 0.0300

Channel Invert Elevation: 711.05 ft

**Roadway Data for Crossing: B-18**

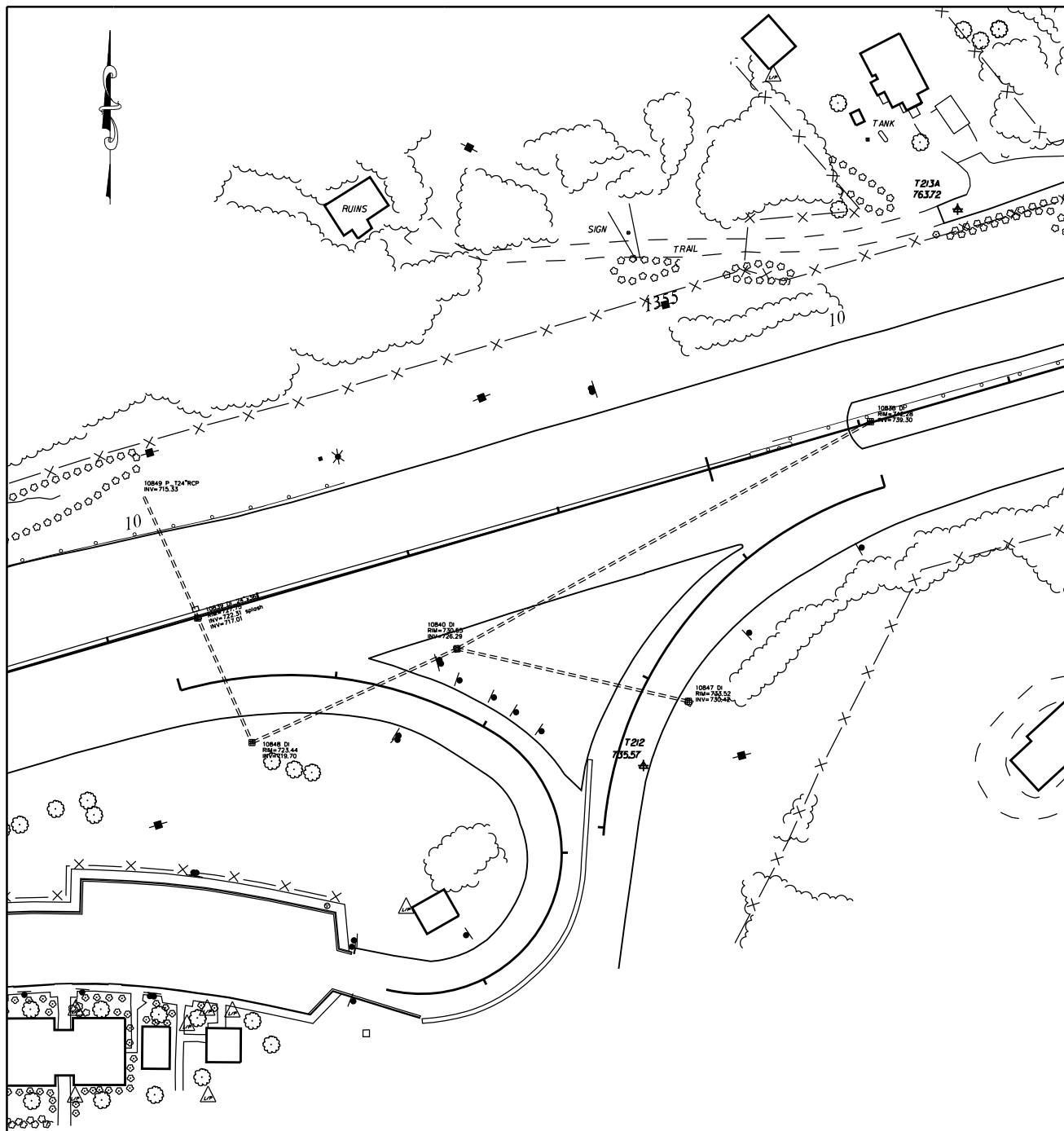
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 150.00 ft

Crest Elevation: 729.39 ft

Roadway Surface: Paved

Roadway Top Width: 121.00 ft



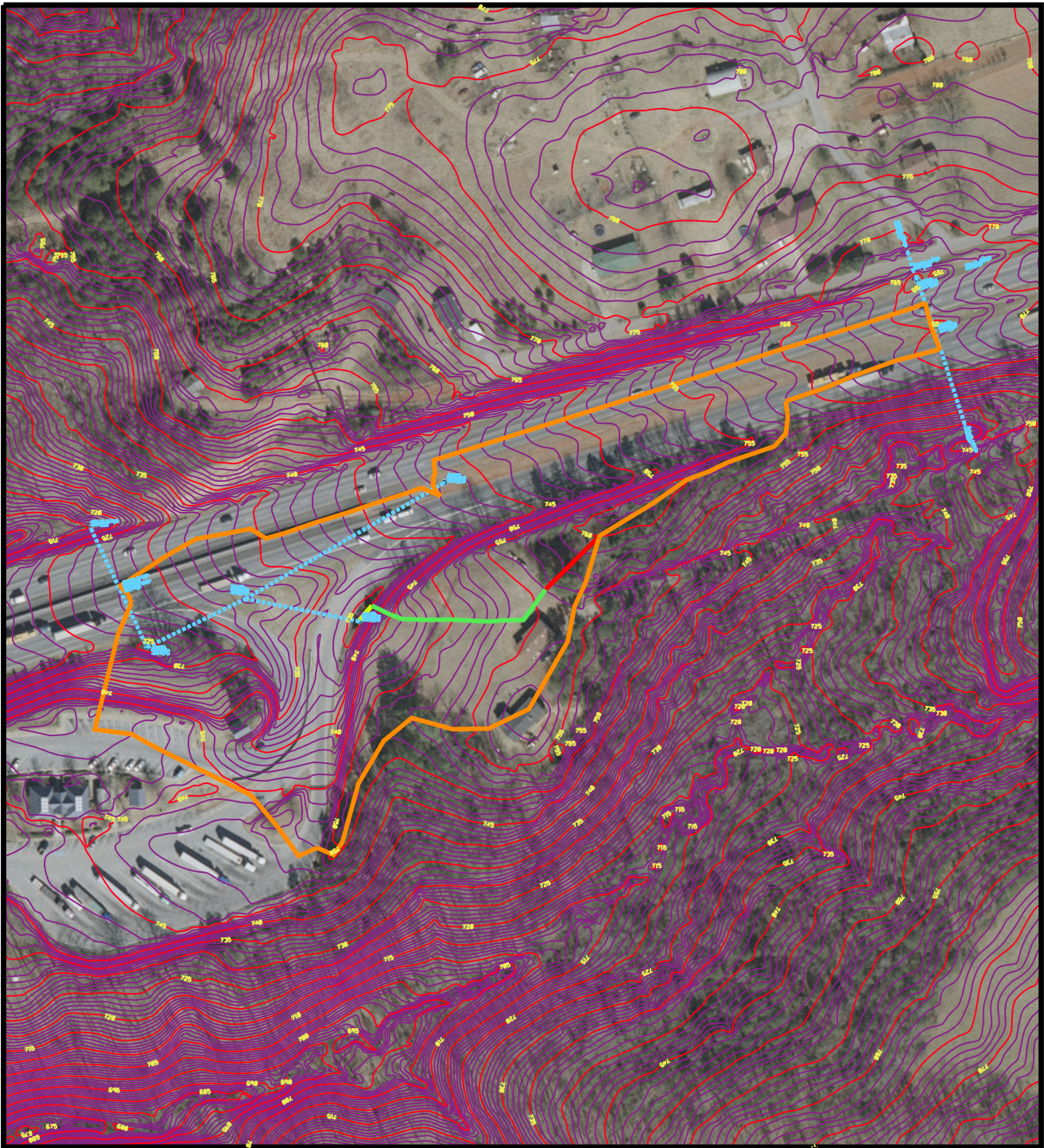
## PLAN VIEW SITE # B-19

I-85 WIDENING CHEROKEE CO MM80-96

SPARTANBURG/CHEROKEE COUNTY



SCALE:



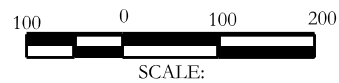
- Watershed
- Overland
- Shallow Concentrated

- Ditch Flow
- Existing 5' Contour Line/Elevation
- Existing 1' Contour Line

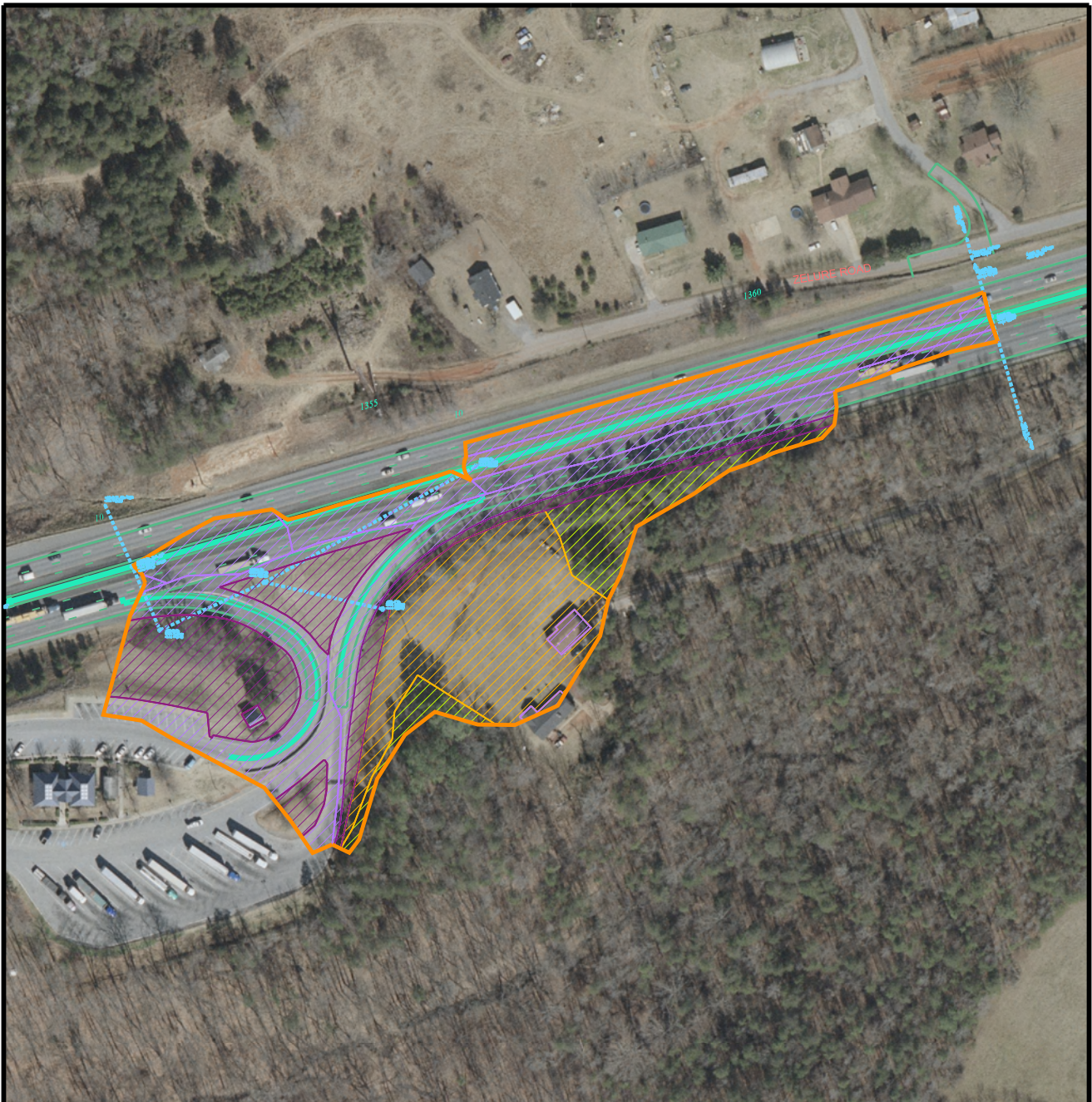
\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-19

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







PAVEMENTS, ROOF



WOODLAND & FOREST



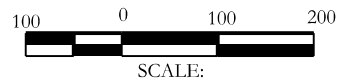
GRASS SHOULDERS



LAWNS SANDY SOIL

## LAND USE MAP - SITE # B-19

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY





# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 10.3 cfs

Design Flow: 20.3 cfs

Maximum Flow: 22.9 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-19**

Headwater Elevation (ft)	Total Discharge (cfs)	B-19 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
721.41	10.30	10.30	0.00	1
721.55	11.56	11.56	0.00	1
721.68	12.82	12.82	0.00	1
721.83	14.08	14.08	0.00	1
721.97	15.34	15.34	0.00	1
722.13	16.60	16.60	0.00	1
722.30	17.86	17.86	0.00	1
722.48	19.12	19.12	0.00	1
722.67	20.30	20.30	0.00	1
722.89	21.64	21.64	0.00	1
723.11	22.90	22.90	0.00	1
729.31	44.77	44.77	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-19**

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)
10.30	10.30	721.41	1.713	0.0*	1-S2n	0.696	1.147	0.696	0.299	10.583	11.494
11.56	11.56	721.55	1.847	0.0*	1-S2n	0.742	1.216	0.742	0.322	10.919	11.977
12.82	12.82	721.68	1.984	0.0*	1-S2n	0.783	1.285	0.783	0.344	11.236	12.421
14.08	14.08	721.83	2.125	0.0*	5-S2n	0.824	1.348	0.824	0.365	11.525	12.841
15.34	15.34	721.97	2.274	0.0*	5-S2n	0.865	1.407	0.884	0.387	11.445	13.227
16.60	16.60	722.13	2.433	0.0*	5-S2n	0.906	1.467	0.906	0.407	12.001	13.590
17.86	17.86	722.30	2.602	0.0*	5-S2n	0.944	1.521	0.944	0.427	12.250	13.935
19.12	19.12	722.48	2.783	0.0*	5-S2n	0.982	1.571	1.008	0.447	12.047	14.266
20.30	20.30	722.67	2.965	0.0*	5-S2n	1.017	1.615	1.039	0.465	12.306	14.555
21.64	21.64	722.89	3.186	0.0*	5-S2n	1.058	1.662	1.076	0.485	12.558	14.875
22.90	22.90	723.11	3.409	0.195	5-S2n	1.095	1.702	1.114	0.504	12.738	15.157

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 719.70 ft, Outlet Elevation (invert): 715.33 ft  
Culvert Length: 170.06 ft, Culvert Slope: 0.0257  
\*\*\*\*\*

### Site Data - B-19

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 719.70 ft

Outlet Station: 170.00 ft

Outlet Elevation: 715.33 ft

Number of Barrels: 1

### Culvert Data Summary - B-19

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-19)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
10.30	715.63	0.30	11.49	1.03	3.71
11.56	715.65	0.32	11.98	1.10	3.72
12.82	715.67	0.34	12.42	1.18	3.73
14.08	715.70	0.37	12.84	1.25	3.74
15.34	715.72	0.39	13.23	1.33	3.75
16.60	715.74	0.41	13.59	1.40	3.75
17.86	715.76	0.43	13.93	1.47	3.76
19.12	715.78	0.45	14.27	1.53	3.76
20.30	715.79	0.46	14.56	1.60	3.76
21.64	715.81	0.48	14.87	1.66	3.76
22.90	715.83	0.50	15.16	1.73	3.76

**Tailwater Channel Data - B-19**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 3.00 ft

Channel Slope: 0.0550

Channel Manning's n: 0.0120

Channel Invert Elevation: 715.33 ft

**Roadway Data for Crossing: B-19**

Roadway Profile Shape: Constant Roadway Elevation

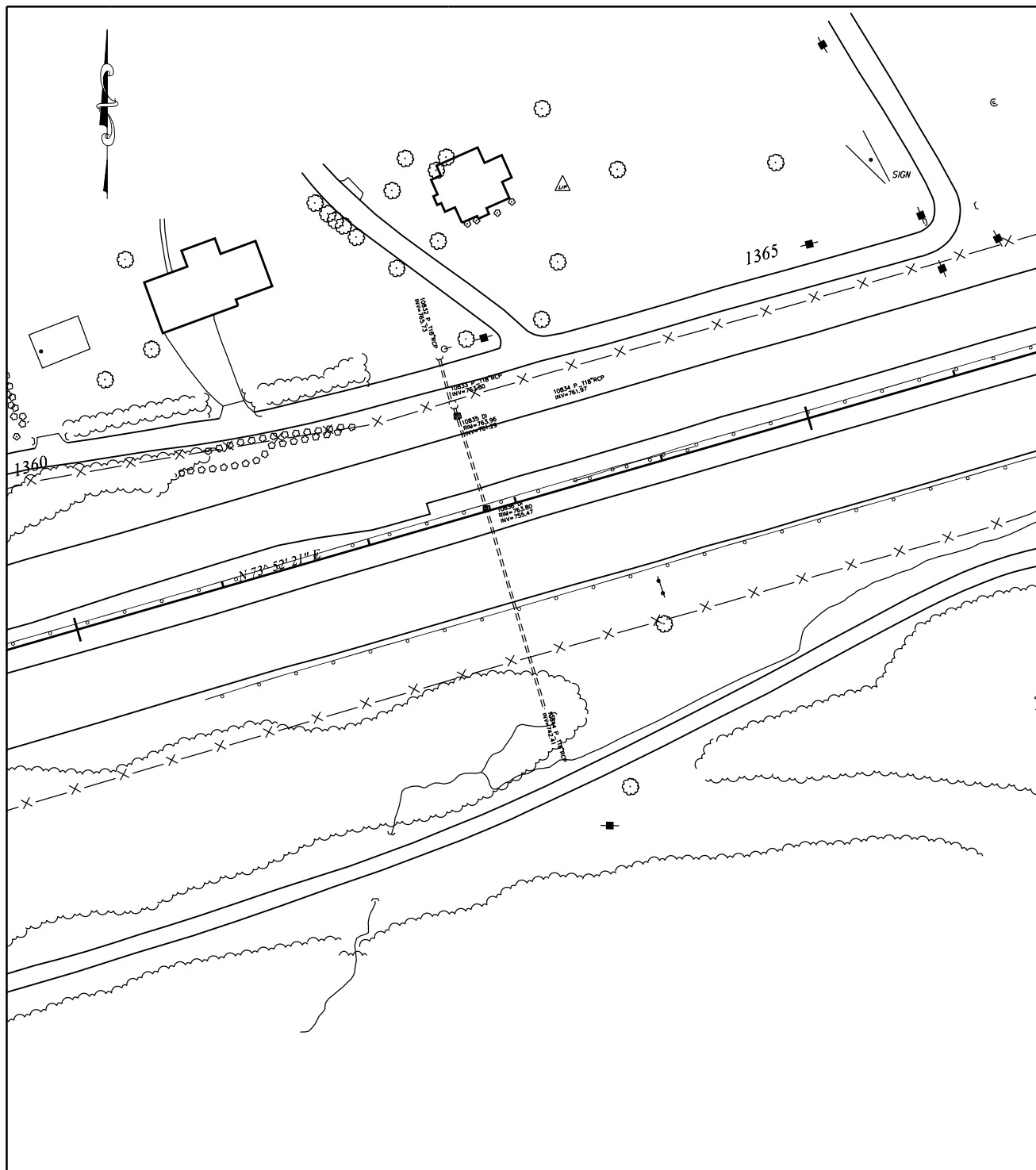
Crest Length: 100.00 ft

Crest Elevation: 729.31 ft

Roadway Surface: Paved

Roadway Top Width: 130.00 ft





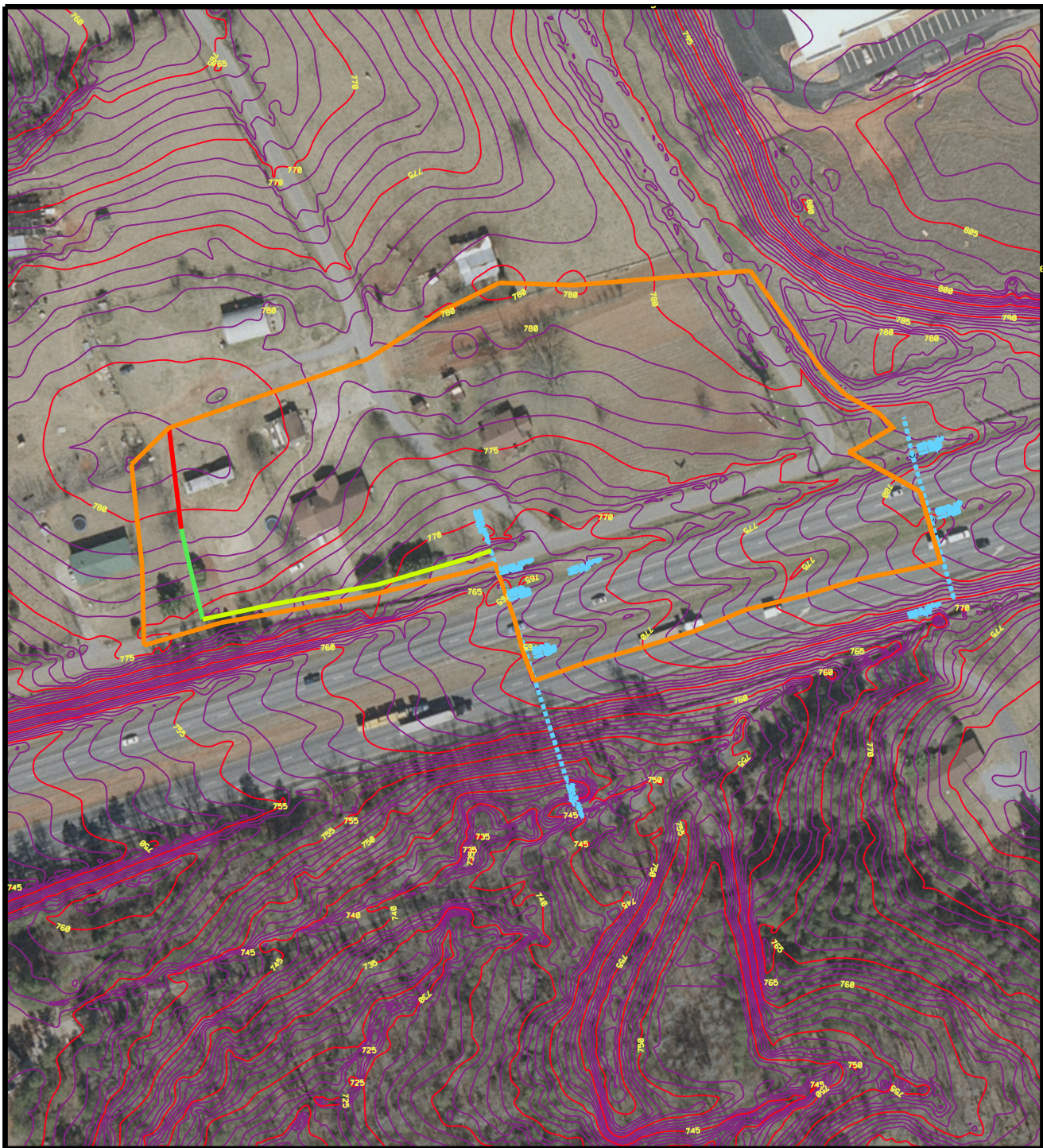
PLAN VIEW SITE # B-20

I-85 WIDENING CHEROKEE CO MM80-96

SPARTANBURG/CHEROKEE COUNTY



SCALE:



- |   |   |
|---|---|
| <span style="color: orange;">—</span> Watershed           | <span style="color: yellow;">—</span> Ditch Flow                      |
| <span style="color: red;">—</span> Overland               | <span style="color: red;">—</span> Existing 5' Contour Line/Elevation |
| <span style="color: green;">—</span> Shallow Concentrated | <span style="color: purple;">—</span> Existing 1' Contour Line        |

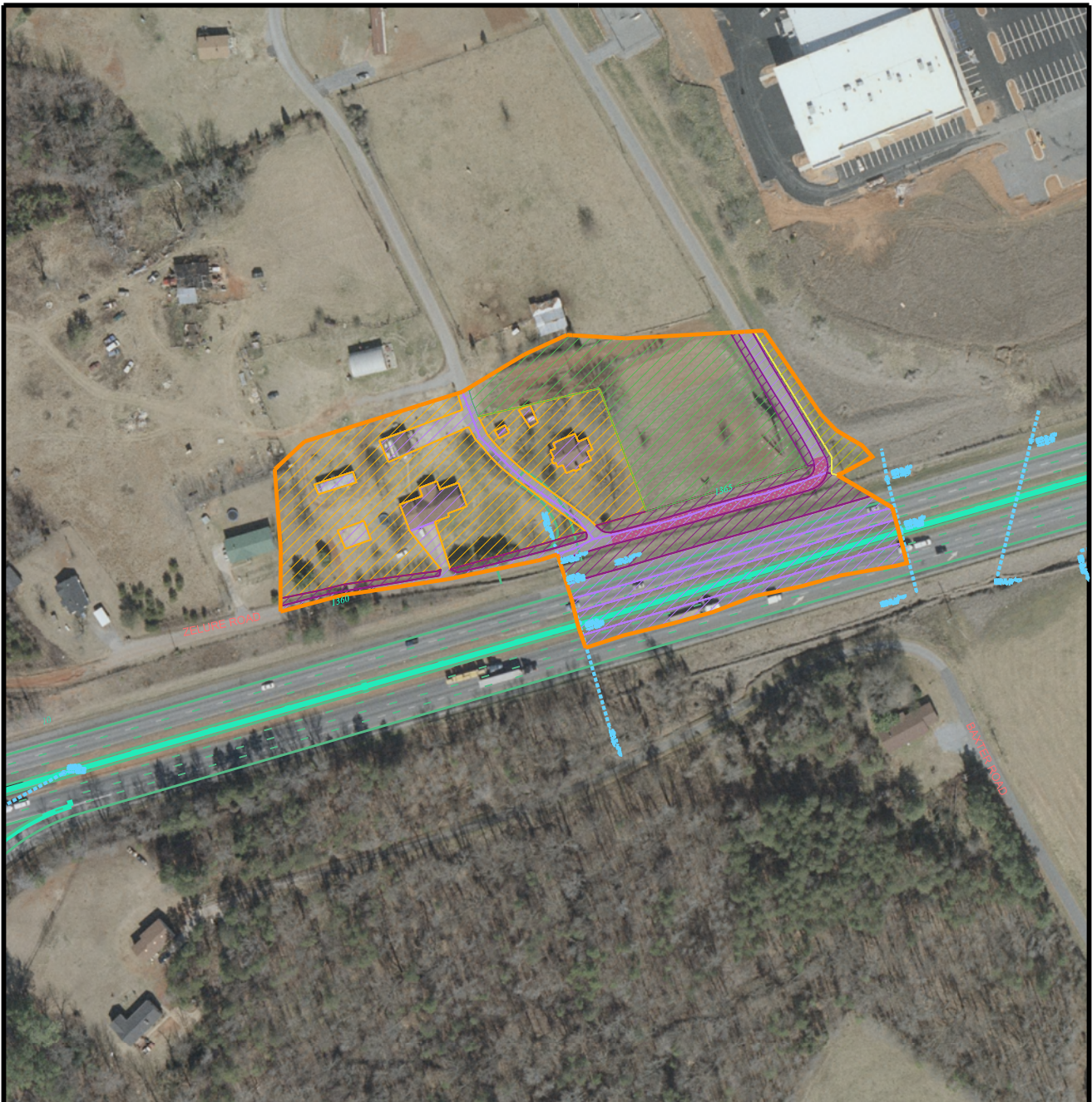
\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-20

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







PAVEMENTS, ROOF



UNIMPROVED AREAS



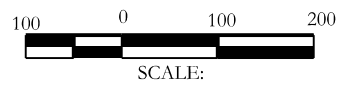
GRASS SHOULDERS



LAWNS SANDY SOIL

## LAND USE MAP - SITE # B-20

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 7.9 cfs

Design Flow: 15.8 cfs

Maximum Flow: 18 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-20**

Headwater Elevation (ft)	Total Discharge (cfs)	B-20 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
763.03	7.90	7.90	0.00	1
763.24	8.91	8.91	0.00	1
763.47	9.92	9.92	0.00	1
763.73	10.93	10.93	0.00	1
764.03	11.94	11.94	0.00	1
764.35	12.95	12.95	0.00	1
764.70	13.96	13.96	0.00	1
765.07	14.97	14.97	0.00	1
765.40	15.80	15.80	0.00	1
765.90	16.99	16.99	0.00	1
766.38	18.00	18.00	0.00	1
767.59	20.36	20.36	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-20**

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)
7.90	7.90	763.03	1.738	0.0*	5-S2n	0.484	1.085	0.484	0.673	15.944	5.809
8.91	8.91	763.24	1.947	0.0*	5-S2n	0.518	1.151	0.539	0.704	15.576	5.986
9.92	9.92	763.47	2.182	0.0*	5-S2n	0.550	1.213	0.550	0.733	16.895	6.149
10.93	10.93	763.73	2.445	0.0*	5-S2n	0.578	1.266	0.583	0.760	17.281	6.300
11.94	11.94	764.03	2.736	0.0*	5-S2n	0.607	1.311	0.607	0.786	17.806	6.441
12.95	12.95	764.35	3.057	0.0*	5-S2n	0.635	1.349	0.635	0.810	18.185	6.573
13.96	13.96	764.70	3.406	0.0*	5-S2n	0.663	1.380	0.663	0.834	18.523	6.697
14.97	14.97	765.07	3.782	0.0*	5-S2n	0.690	1.407	0.690	0.856	18.852	6.815
15.80	15.80	765.40	4.111	0.0*	5-S2n	0.712	1.425	0.712	0.873	19.141	6.908
16.99	16.99	765.90	4.614	0.0*	5-S2n	0.742	1.388	0.742	0.897	19.485	7.035
18.00	18.00	766.38	5.088	0.0*	5-S2n	0.768	1.446	0.768	0.917	19.763	7.137

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 761.29 ft,    Outlet Elevation (invert): 742.41 ft  
Culvert Length: 206.86 ft,    Culvert Slope: 0.0917  
\*\*\*\*\*

## Site Data - B-20

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 761.29 ft

Outlet Station: 206.00 ft

Outlet Elevation: 742.41 ft

Number of Barrels: 1

## Culvert Data Summary - B-20

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE



**Table 3 - Downstream Channel Rating Curve (Crossing: B-20)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
7.90	743.08	0.67	5.81	2.65	1.76
8.91	743.11	0.70	5.99	2.77	1.78
9.92	743.14	0.73	6.15	2.88	1.79
10.93	743.17	0.76	6.30	2.99	1.80
11.94	743.20	0.79	6.44	3.09	1.81
12.95	743.22	0.81	6.57	3.19	1.82
13.96	743.24	0.83	6.70	3.28	1.83
14.97	743.27	0.86	6.82	3.36	1.84
15.80	743.28	0.87	6.91	3.43	1.84
16.99	743.31	0.90	7.03	3.53	1.85
18.00	743.33	0.92	7.14	3.60	1.86

**Tailwater Channel Data - B-20**

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 3.00 (1:1)

Channel Slope: 0.0630

Channel Manning's n: 0.0300

Channel Invert Elevation: 742.41 ft

**Roadway Data for Crossing: B-20**

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 767.59 ft

Roadway Surface: Paved

Roadway Top Width: 116.00 ft

# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 7.9 cfs

Design Flow: 15.8 cfs

Maximum Flow: 18 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-20 Proposed**

Headwater Elevation (ft)	Total Discharge (cfs)	B-20 Proposed Discharge (cfs)	Roadway Discharge (cfs)	Iterations
762.67	7.90	7.90	0.00	1
762.79	8.91	8.91	0.00	1
762.90	9.92	9.92	0.00	1
763.00	10.93	10.93	0.00	1
763.11	11.94	11.94	0.00	1
763.22	12.95	12.95	0.00	1
763.34	13.96	13.96	0.00	1
763.45	14.97	14.97	0.00	1
763.55	15.80	15.80	0.00	1
763.71	16.99	16.99	0.00	1
763.85	18.00	18.00	0.00	1
767.59	35.37	35.37	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-20 Proposed**

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)
7.90	7.90	762.67	1.384	0.0*	1-S2n	0.432	1.000	0.432	0.673	15.652	5.809
8.91	8.91	762.79	1.497	0.0*	1-S2n	0.459	1.063	0.459	0.704	16.189	5.986
9.92	9.92	762.90	1.606	0.0*	1-S2n	0.487	1.122	0.487	0.733	16.644	6.149
10.93	10.93	763.00	1.714	0.0*	1-S2n	0.514	1.182	0.514	0.760	17.035	6.300
11.94	11.94	763.11	1.822	0.0*	1-S2n	0.541	1.236	0.541	0.786	17.373	6.441
12.95	12.95	763.22	1.932	0.0*	1-S2n	0.563	1.292	0.563	0.810	17.902	6.573
13.96	13.96	763.34	2.046	0.0*	5-S2n	0.584	1.342	0.584	0.834	18.421	6.697
14.97	14.97	763.45	2.164	0.0*	5-S2n	0.604	1.390	0.629	0.856	17.634	6.815
15.80	15.80	763.55	2.265	0.0*	5-S2n	0.621	1.428	0.621	0.873	18.927	6.908
16.99	16.99	763.71	2.418	0.0*	5-S2n	0.645	1.484	0.667	0.897	18.475	7.035
18.00	18.00	763.85	2.555	0.0*	5-S2n	0.666	1.526	0.666	0.917	19.602	7.137

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 761.29 ft,    Outlet Elevation (invert): 742.41 ft  
Culvert Length: 206.86 ft,    Culvert Slope: 0.0917  
\*\*\*\*\*

### **Site Data - B-20 Proposed**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 761.29 ft

Outlet Station: 206.00 ft

Outlet Elevation: 742.41 ft

Number of Barrels: 1

### **Culvert Data Summary - B-20 Proposed**

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-20 Proposed)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
7.90	743.08	0.67	5.81	2.65	1.76
8.91	743.11	0.70	5.99	2.77	1.78
9.92	743.14	0.73	6.15	2.88	1.79
10.93	743.17	0.76	6.30	2.99	1.80
11.94	743.20	0.79	6.44	3.09	1.81
12.95	743.22	0.81	6.57	3.19	1.82
13.96	743.24	0.83	6.70	3.28	1.83
14.97	743.27	0.86	6.82	3.36	1.84
15.80	743.28	0.87	6.91	3.43	1.84
16.99	743.31	0.90	7.03	3.53	1.85
18.00	743.33	0.92	7.14	3.60	1.86



**Tailwater Channel Data - B-20 Proposed**

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 3.00 (1:1)

Channel Slope: 0.0630

Channel Manning's n: 0.0300

Channel Invert Elevation: 742.41 ft

**Roadway Data for Crossing: B-20 Proposed**

Roadway Profile Shape: Constant Roadway Elevation

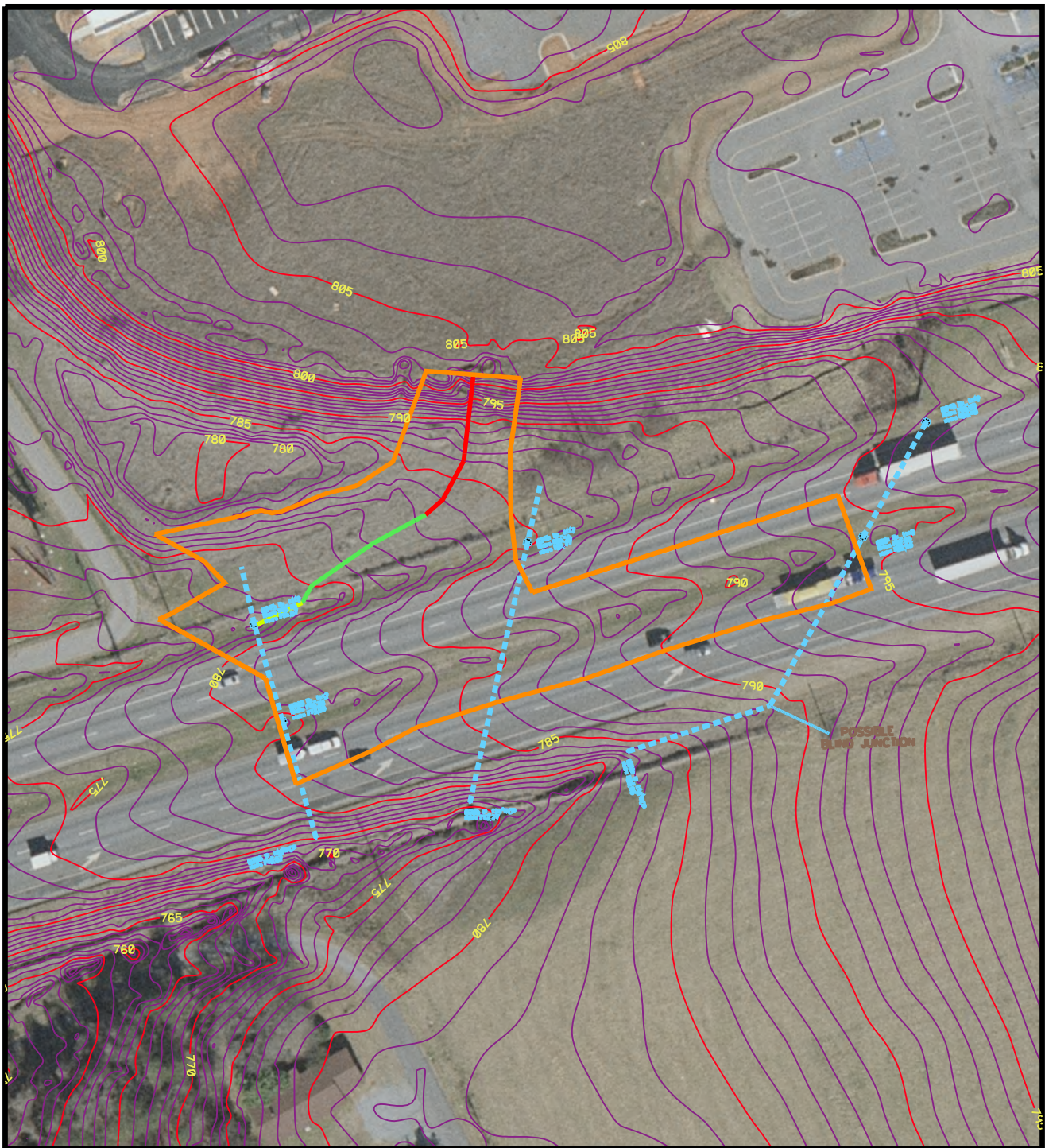
Crest Length: 100.00 ft

Crest Elevation: 767.59 ft

Roadway Surface: Paved

Roadway Top Width: 116.00 ft





- |   |   |
|---|---|
| <span style="color: orange;">—</span> Watershed           | <span style="color: green;">—</span> Ditch Flow                       |
| <span style="color: red;">—</span> Overland               | <span style="color: red;">—</span> Existing 5' Contour Line/Elevation |
| <span style="color: green;">—</span> Shallow Concentrated | <span style="color: purple;">—</span> Existing 1' Contour Line        |

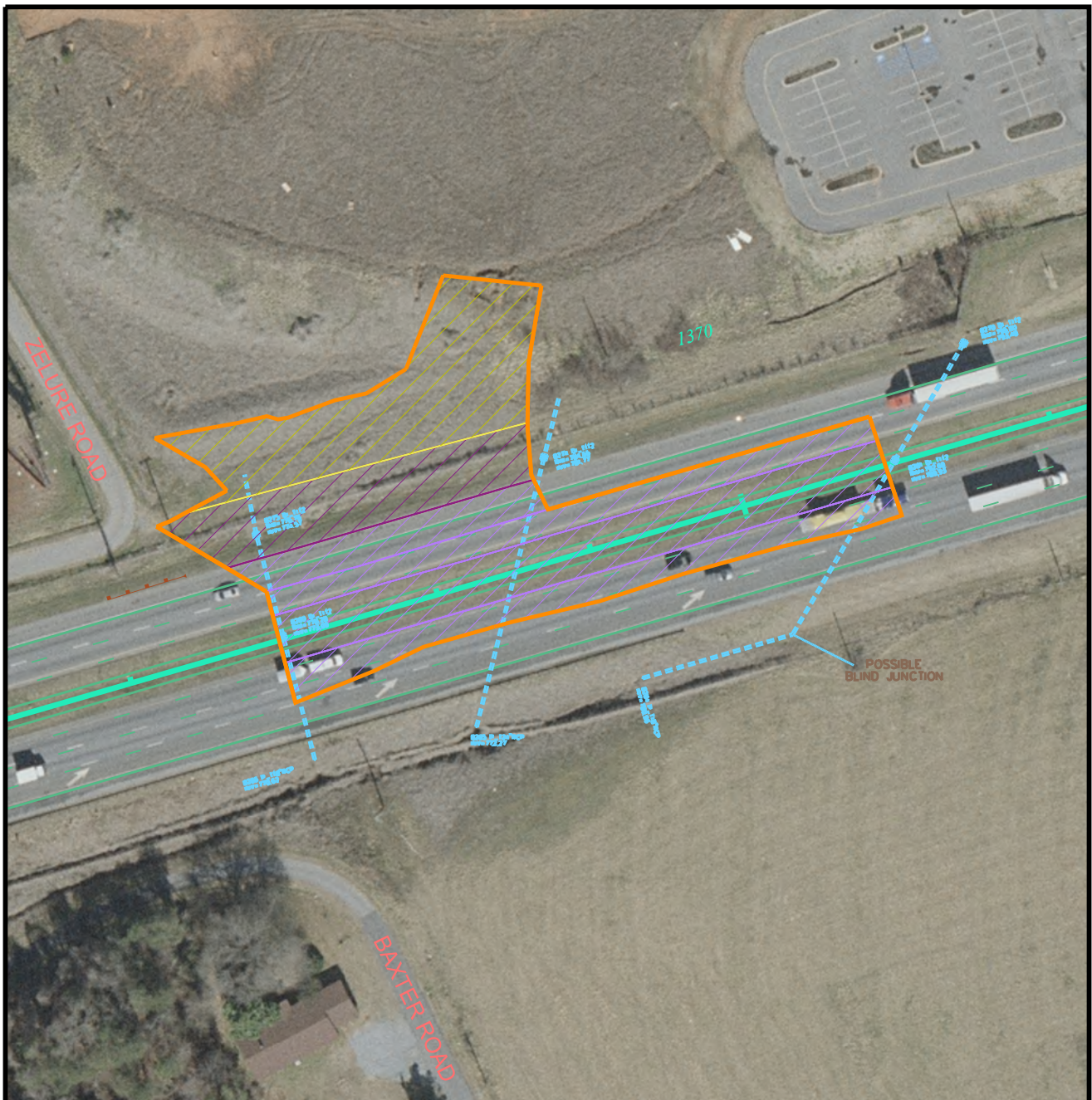
\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.




Tc MAP - SITE # B-21

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







-  PAVEMENTS, ROOF
-  GRASS SHOULDERS
-  UNIMPROVED AREAS

## LAND USE MAP - SITE # B-21

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 3.6 cfs

Design Flow: 7.3 cfs

Maximum Flow: 8.4 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-21**

Headwater Elevation (ft)	Total Discharge (cfs)	B-21 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
775.61	3.60	3.60	0.00	1
775.70	4.08	4.08	0.00	1
775.78	4.56	4.56	0.00	1
775.86	5.04	5.04	0.00	1
775.94	5.52	5.52	0.00	1
776.02	6.00	6.00	0.00	1
776.10	6.48	6.48	0.00	1
776.18	6.96	6.96	0.00	1
776.24	7.30	7.30	0.00	1
776.36	7.92	7.92	0.00	1
776.46	8.40	8.40	0.00	1
781.35	21.08	21.08	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-21**

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)
3.60	3.60	775.61	1.043	0.0*	1-S2n	0.442	0.725	0.444	0.619	8.289	4.703
4.08	4.08	775.70	1.127	0.0*	1-S2n	0.472	0.773	0.472	0.648	8.544	4.852
4.56	4.56	775.78	1.208	0.0*	1-S2n	0.501	0.817	0.501	0.676	8.801	4.989
5.04	5.04	775.86	1.287	0.0*	1-S2n	0.530	0.859	0.530	0.702	9.020	5.116
5.52	5.52	775.94	1.366	0.0*	1-S2n	0.557	0.903	0.557	0.726	9.254	5.233
6.00	6.00	776.02	1.445	0.0*	1-S2n	0.582	0.942	0.582	0.749	9.510	5.343
6.48	6.48	776.10	1.527	0.0*	5-S2n	0.606	0.982	0.606	0.771	9.671	5.447
6.96	6.96	776.18	1.611	0.0*	5-S2n	0.631	1.019	0.631	0.792	9.853	5.545
7.30	7.30	776.24	1.673	0.0*	5-S2n	0.648	1.043	0.648	0.806	9.971	5.612
7.92	7.92	776.36	1.790	0.0*	5-S2n	0.680	1.087	0.680	0.832	10.167	5.728
8.40	8.40	776.46	1.887	0.0*	5-S2n	0.703	1.118	0.703	0.850	10.337	5.812

\* Full Flow Headwater elevation is below inlet invert.



\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 774.57 ft,   Outlet Elevation (invert): 770.62 ft  
Culvert Length: 146.05 ft,   Culvert Slope: 0.0271  
\*\*\*\*\*

## Site Data - B-21

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 774.57 ft

Outlet Station: 146.00 ft

Outlet Elevation: 770.62 ft

Number of Barrels: 1

## Culvert Data Summary - B-21

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-21)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
3.60	771.24	0.62	4.70	1.93	1.49
4.08	771.27	0.65	4.85	2.02	1.50
4.56	771.30	0.68	4.99	2.11	1.51
5.04	771.32	0.70	5.12	2.19	1.52
5.52	771.35	0.73	5.23	2.27	1.53
6.00	771.37	0.75	5.34	2.34	1.54
6.48	771.39	0.77	5.45	2.41	1.55
6.96	771.41	0.79	5.55	2.47	1.55
7.30	771.43	0.81	5.61	2.52	1.56
7.92	771.45	0.83	5.73	2.59	1.57
8.40	771.47	0.85	5.81	2.65	1.57

**Tailwater Channel Data - B-21**

Tailwater Channel Option: Triangular Channel

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

Channel Slope: 0.0500

Channel Manning's n: 0.0300

Channel Invert Elevation: 770.62 ft

**Roadway Data for Crossing: B-21**

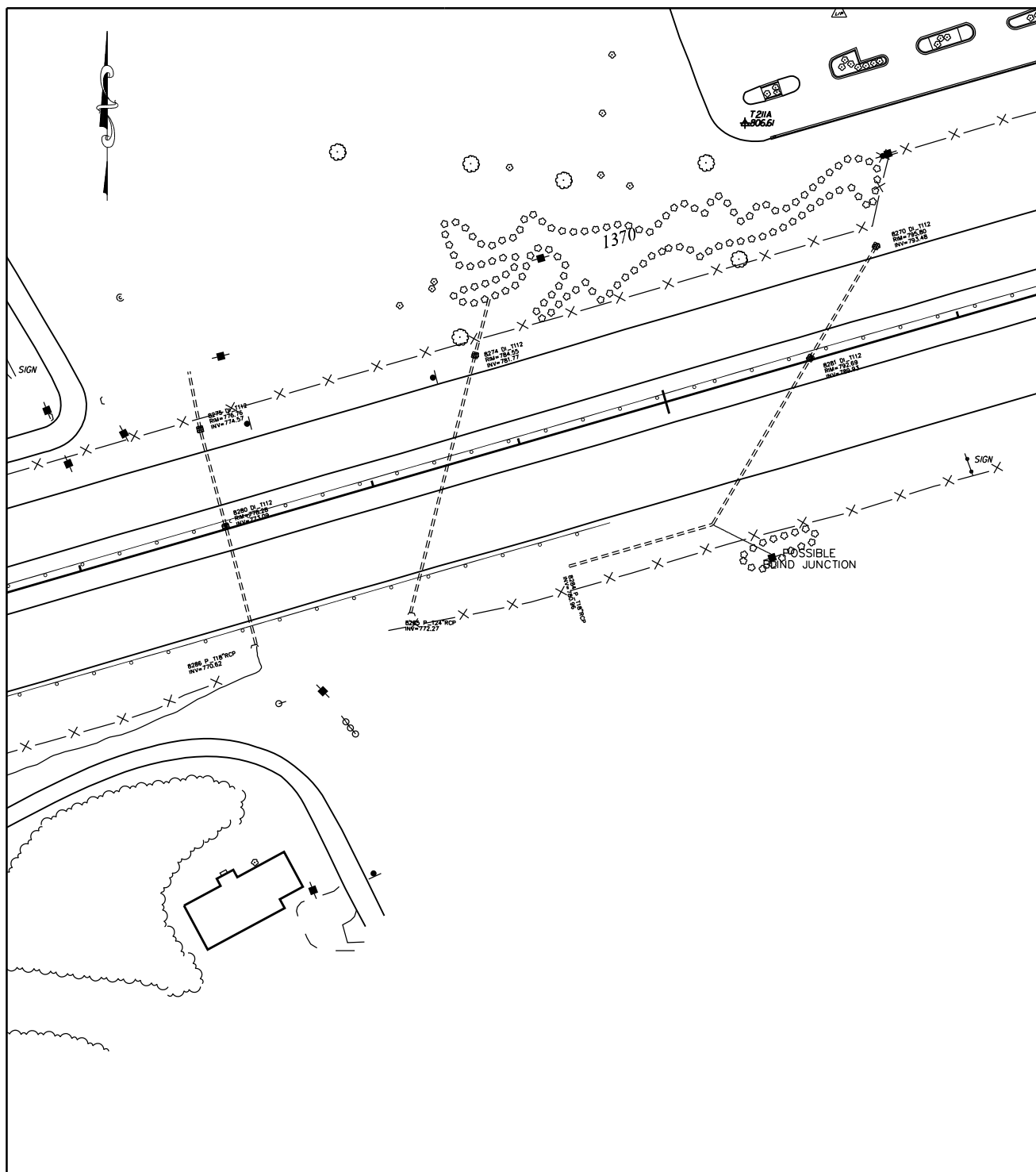
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 781.35 ft

Roadway Surface: Paved

Roadway Top Width: 116.00 ft



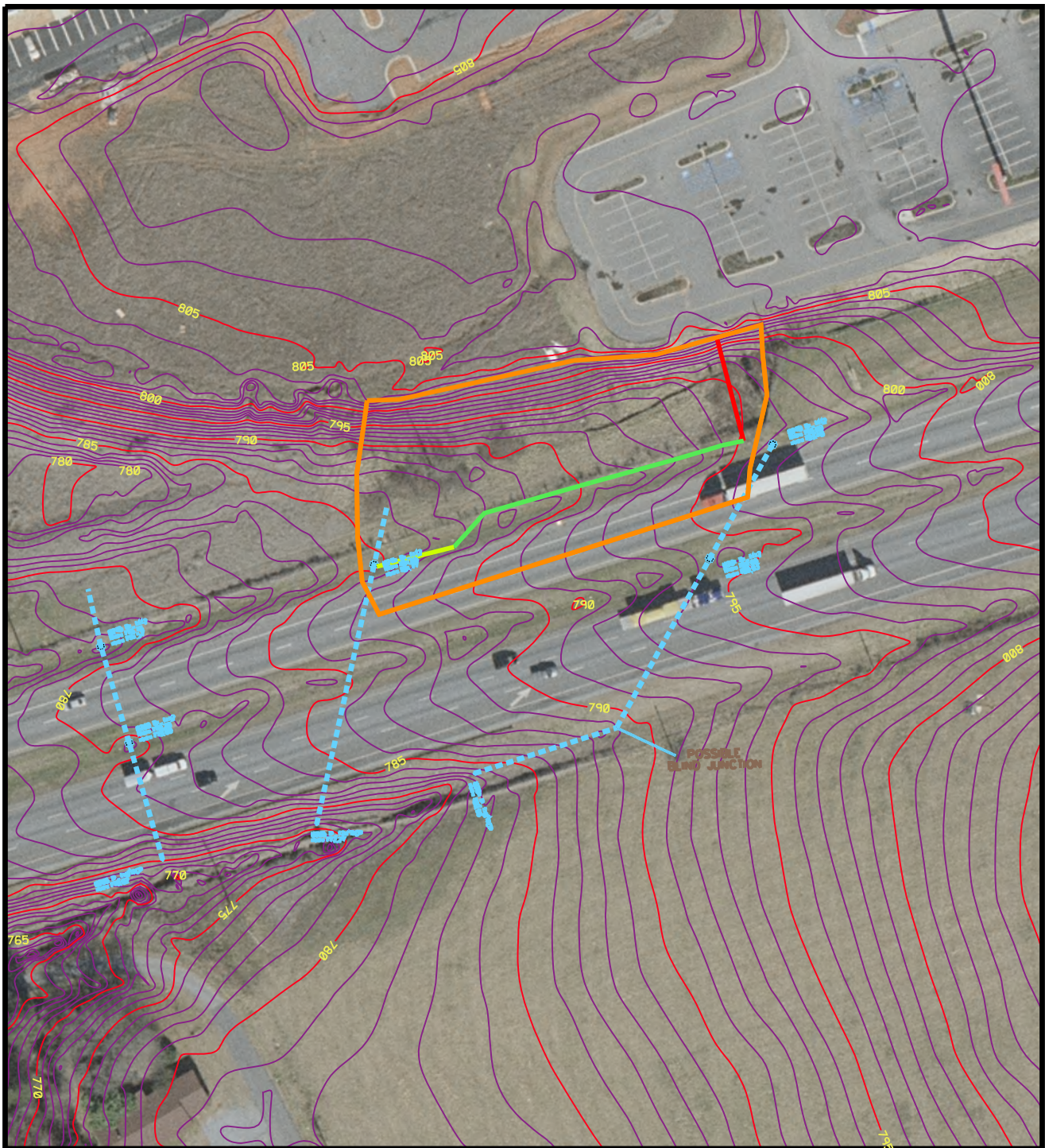
## PLAN VIEW SITE # B-22

I-85 WIDENING CHEROKEE CO MM80-96

SPARTANBURG/CHEROKEE COUNTY



SCALE:



- |   |   |
|---|---|
| <span style="color: blue;">———</span> Watershed             | <span style="color: orange;">———</span> Ditch Flow                      |
| <span style="color: red;">———</span> Overland               | <span style="color: red;">———</span> Existing 5' Contour Line/Elevation |
| <span style="color: green;">———</span> Shallow Concentrated | <span style="color: purple;">———</span> Existing 1' Contour Line        |

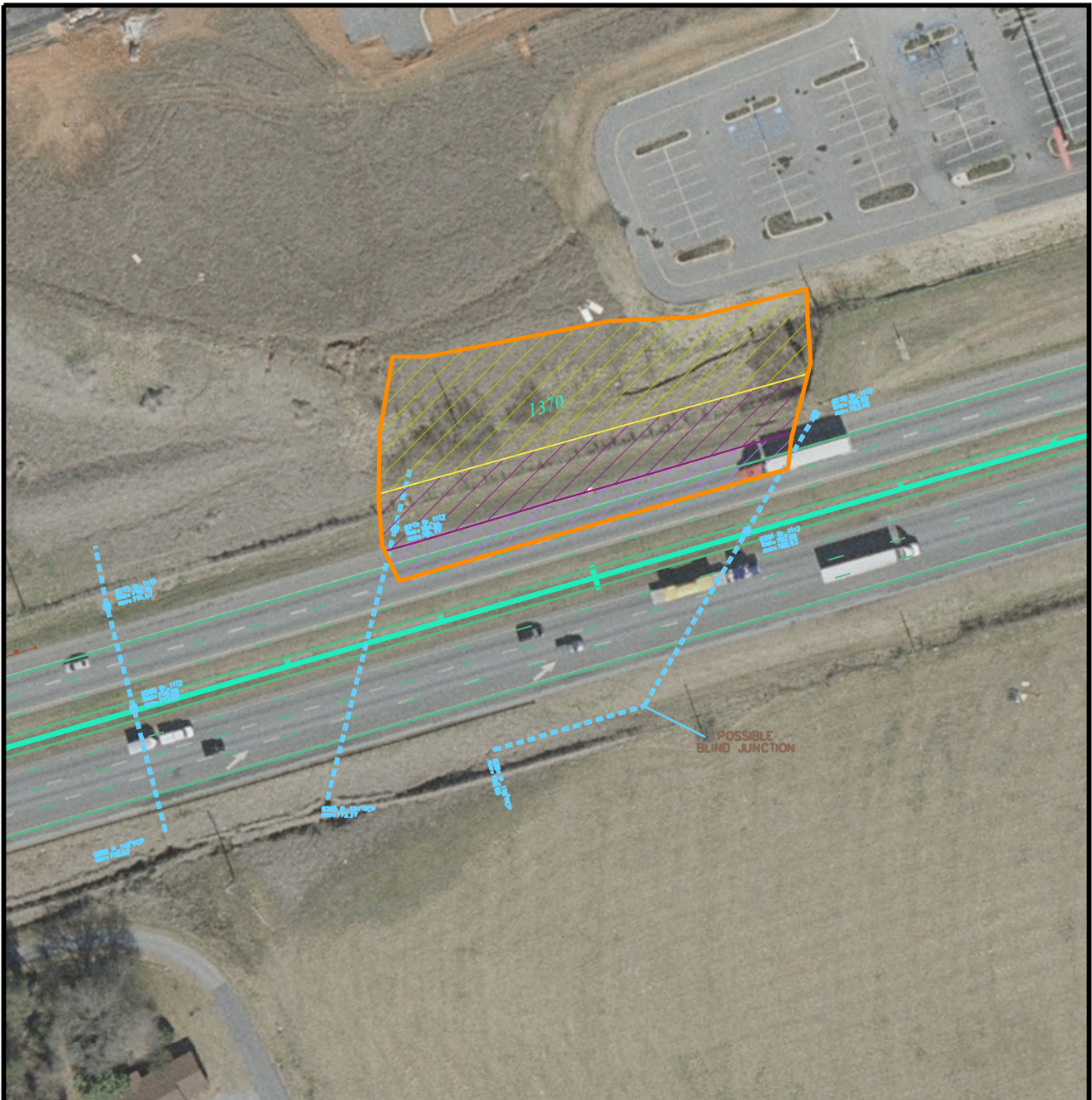
\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.




## Tc MAP - SITE # B-22

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







-  PAVEMENTS, ROOF
-  GRASS SHOULDERS
-  UNIMPROVED AREAS

## LAND USE MAP - SITE # B-22

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 1.2 cfs

Design Flow: 2.6 cfs

Maximum Flow: 2.9 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-22**

Headwater Elevation (ft)	Total Discharge (cfs)	B-22 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
782.26	1.20	1.20	0.00	1
782.30	1.37	1.37	0.00	1
782.33	1.54	1.54	0.00	1
782.36	1.71	1.71	0.00	1
782.39	1.88	1.88	0.00	1
782.42	2.05	2.05	0.00	1
782.45	2.22	2.22	0.00	1
782.47	2.39	2.39	0.00	1
782.50	2.56	2.56	0.00	1
782.51	2.60	2.60	0.00	1
782.55	2.90	2.90	0.00	1
787.54	33.38	33.38	0.00	Overtopping



**Table 2 - Culvert Summary Table: B-22**

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)
1.20	1.20	782.26	0.494	0.0*	1-S2n	0.194	0.374	0.194	0.418	8.483	3.435
1.37	1.37	782.30	0.533	0.0*	1-S2n	0.204	0.401	0.215	0.439	9.974	3.551
1.54	1.54	782.33	0.558	0.0*	1-S2n	0.214	0.426	0.214	0.459	11.180	3.656
1.71	1.71	782.36	0.590	0.0*	1-S2n	0.224	0.450	0.224	0.477	12.699	3.753
1.88	1.88	782.39	0.620	0.0*	1-S2n	0.233	0.473	0.233	0.495	8.854	3.843
2.05	2.05	782.42	0.649	0.0*	1-S2n	0.243	0.491	0.243	0.511	9.085	3.927
2.22	2.22	782.45	0.677	0.0*	1-S2n	0.253	0.513	0.253	0.526	9.291	4.006
2.39	2.39	782.47	0.705	0.0*	1-S2n	0.263	0.533	0.263	0.541	9.475	4.081
2.56	2.56	782.50	0.732	0.0*	1-S2n	0.272	0.553	0.272	0.555	9.640	4.151
2.60	2.60	782.51	0.738	0.0*	1-S2n	0.275	0.558	0.275	0.559	9.677	4.167
2.90	2.90	782.55	0.784	0.0*	1-S2n	0.292	0.591	0.311	0.582	9.117	4.283

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 781.77 ft,    Outlet Elevation (invert): 772.27 ft  
Culvert Length: 173.26 ft,    Culvert Slope: 0.0549  
\*\*\*\*\*

## Site Data - B-22

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 781.77 ft

Outlet Station: 173.00 ft

Outlet Elevation: 772.27 ft

Number of Barrels: 1

## Culvert Data Summary - B-22

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-22)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
1.20	772.69	0.42	3.43	1.17	1.32
1.37	772.71	0.44	3.55	1.23	1.34
1.54	772.73	0.46	3.66	1.29	1.35
1.71	772.75	0.48	3.75	1.34	1.35
1.88	772.76	0.49	3.84	1.39	1.36
2.05	772.78	0.51	3.93	1.43	1.37
2.22	772.80	0.53	4.01	1.48	1.38
2.39	772.81	0.54	4.08	1.52	1.38
2.56	772.83	0.56	4.15	1.56	1.39
2.60	772.83	0.56	4.17	1.57	1.39
2.90	772.85	0.58	4.28	1.63	1.40

**Tailwater Channel Data - B-22**

Tailwater Channel Option: Triangular Channel

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

Channel Slope: 0.0450

Channel Manning's n: 0.0300

Channel Invert Elevation: 772.27 ft

**Roadway Data for Crossing: B-22**

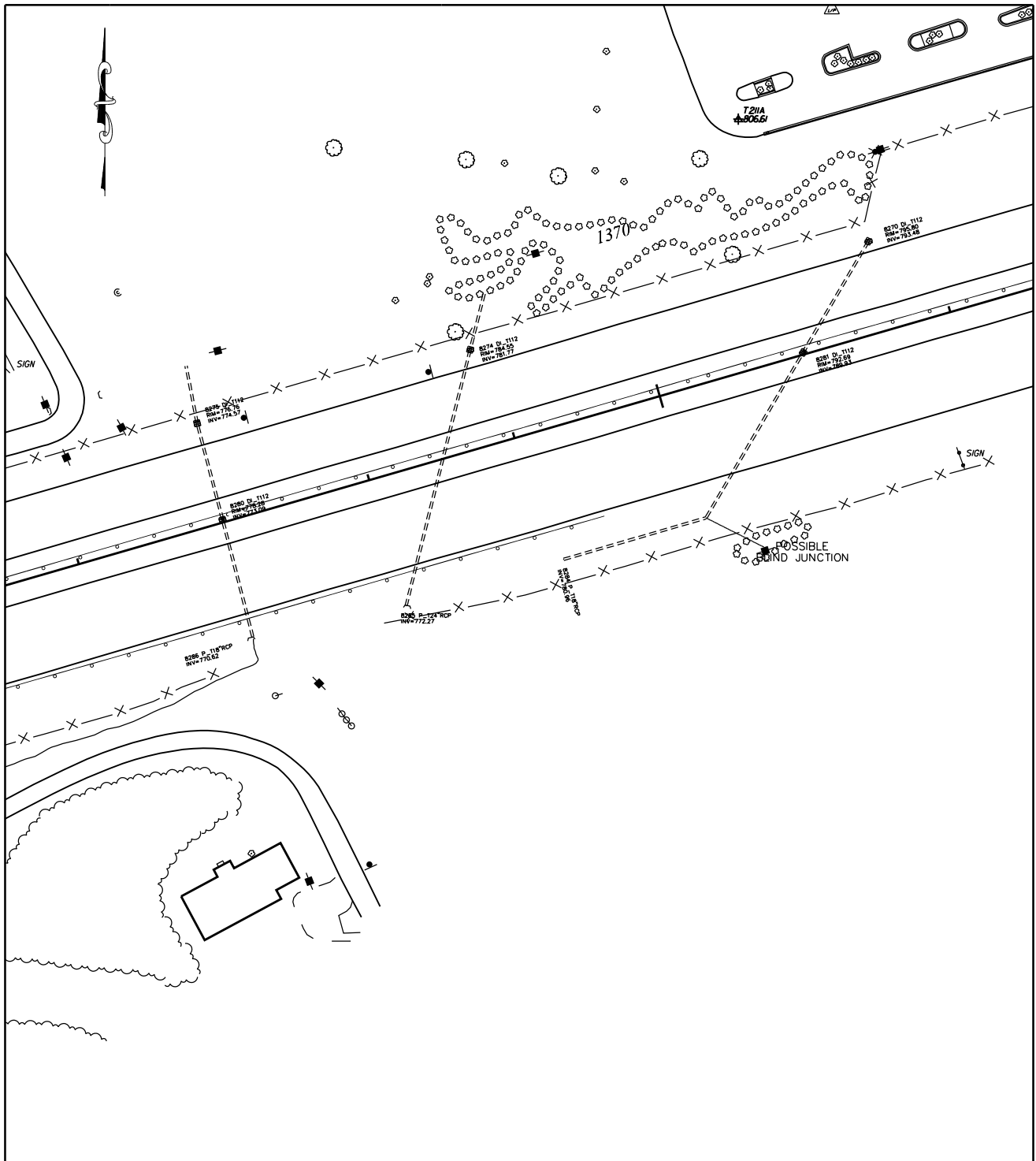
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 787.54 ft

Roadway Surface: Paved

Roadway Top Width: 135.00 ft



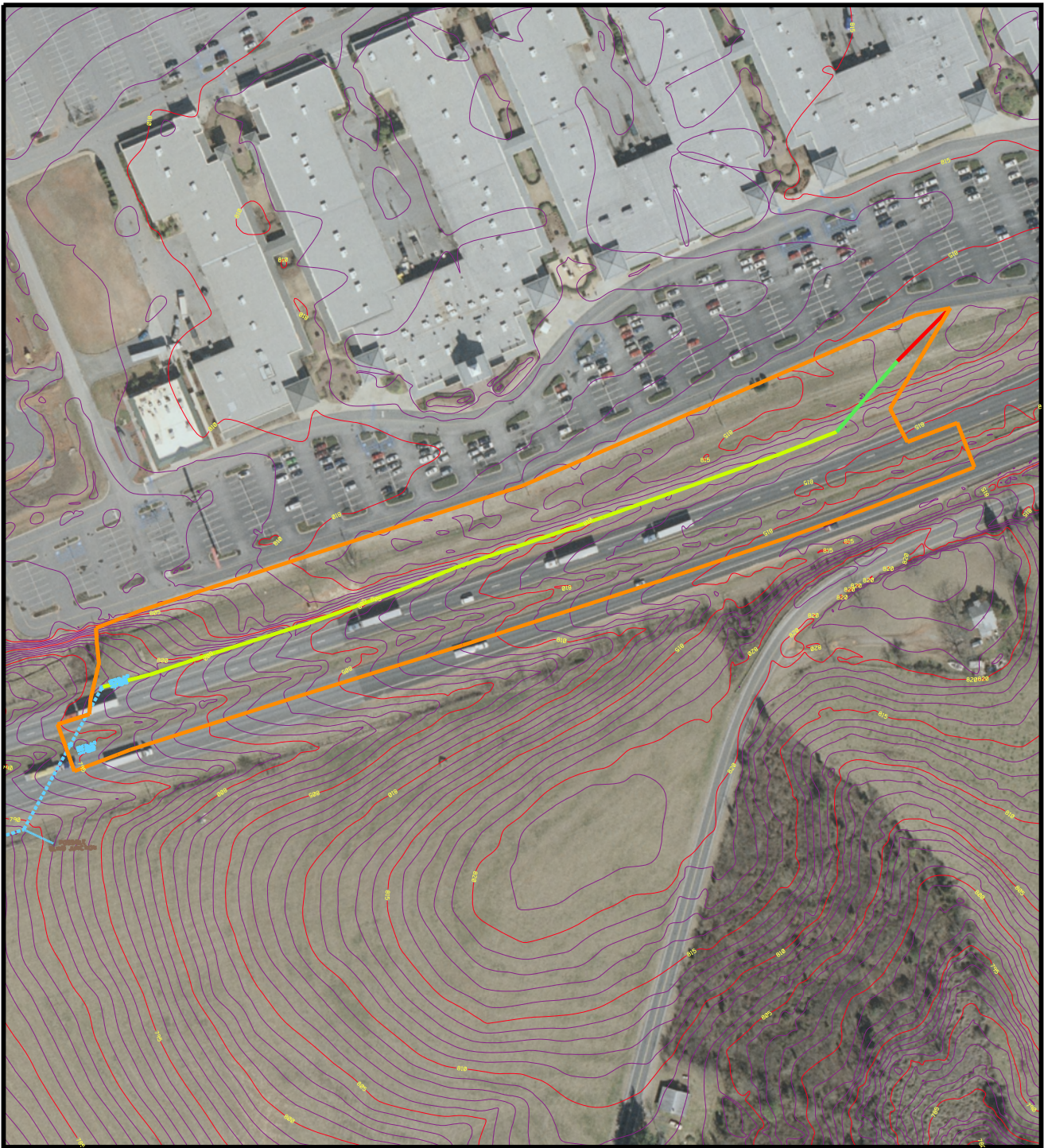
PLAN VIEW SITE # B-23

I-85 WIDENING CHEROKEE CO MM80-96

SPARTANBURG/CHEROKEE COUNTY



SCALE:

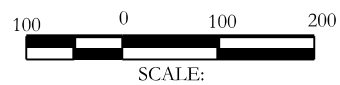


- |                        |                                      |
|------------------------|--------------------------------------|
| — Watershed            | — Ditch Flow                         |
| — Overland             | — Existing 5' Contour Line/Elevation |
| — Shallow Concentrated | — Existing 1' Contour Line           |

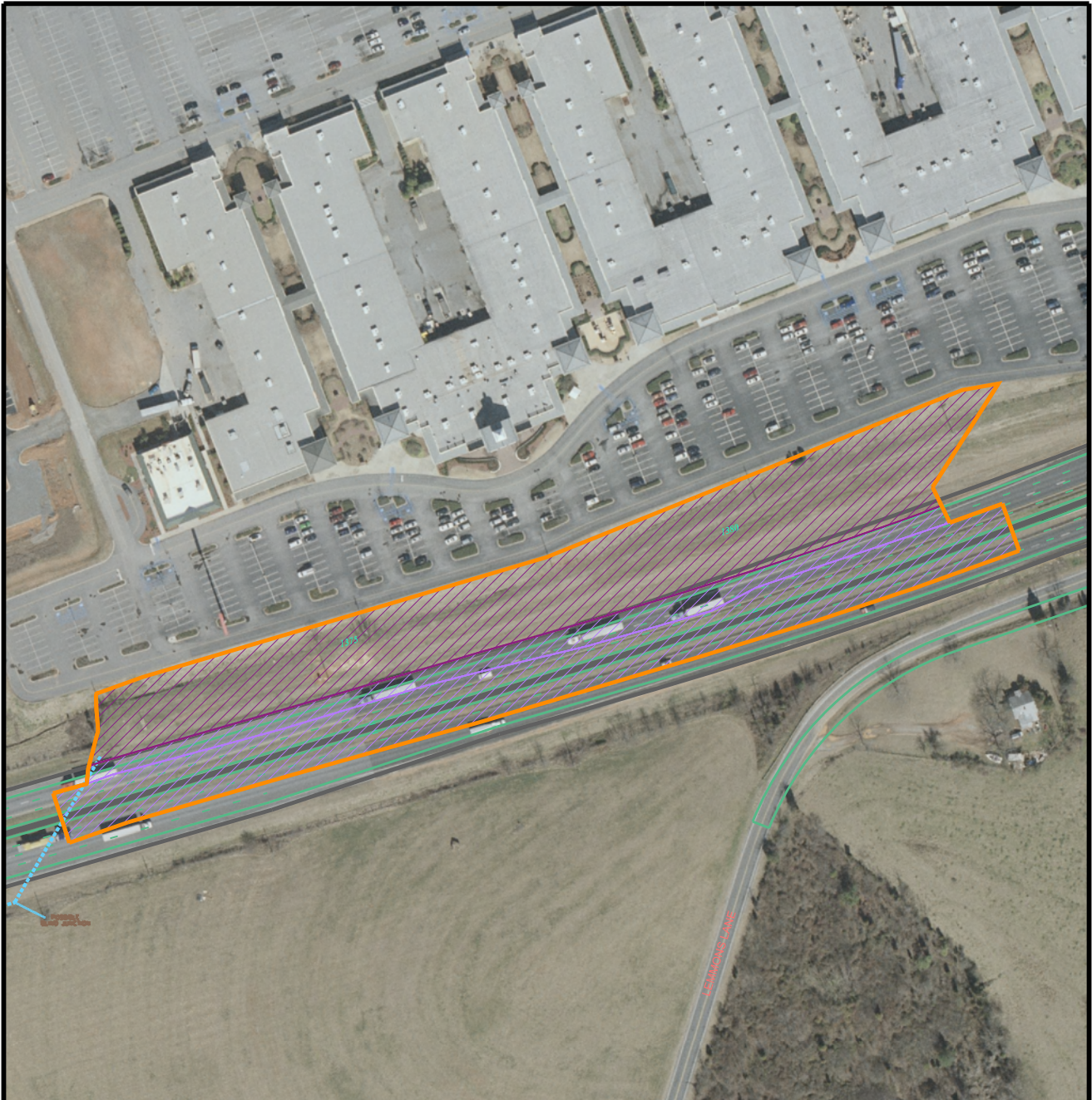
\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-23

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







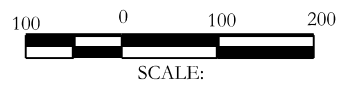
PAVEMENTS, ROOF



GRASS SHOULDERS

## LAND USE MAP - SITE # B-23

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY





# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 8.4 cfs

Design Flow: 16.8 cfs

Maximum Flow: 19 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-23**

Headwater Elevation (ft)	Total Discharge (cfs)	B-23 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
795.35	8.40	8.40	0.00	1
795.59	9.46	9.46	0.00	1
795.85	10.52	10.52	0.00	1
796.15	11.58	11.58	0.00	1
796.36	12.64	12.28	0.24	30
796.38	13.70	12.34	1.28	5
796.39	14.76	12.38	2.31	4
796.40	15.82	12.42	3.28	3
796.41	16.80	12.45	4.25	3
796.42	17.94	12.48	5.38	3
796.43	19.00	12.51	6.44	3
796.35	12.26	12.26	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-23**

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)
8.40	8.40	795.35	1.875	0.0*	5-S2n	0.614	1.118	0.614	0.632	12.317	7.015
9.46	9.46	795.59	2.108	0.0*	5-S2n	0.657	1.187	0.685	0.661	12.044	7.226
10.52	10.52	795.85	2.371	0.0*	5-S2n	0.699	1.245	0.699	0.687	13.042	7.421
11.58	11.58	796.15	2.665	0.0*	5-S2n	0.738	1.296	0.738	0.713	13.367	7.601
12.64	12.28	796.36	2.879	0.0*	5-S2n	0.765	1.324	0.765	0.736	13.563	7.769
13.70	12.34	796.38	2.897	0.0*	5-S2n	0.767	1.327	0.767	0.759	13.579	7.927
14.76	12.38	796.39	2.910	0.0*	5-S2n	0.768	1.328	0.768	0.781	13.590	8.076
15.82	12.42	796.40	2.920	0.0*	5-S2n	0.770	1.330	0.770	0.801	13.598	8.218
16.80	12.45	796.41	2.930	0.0*	5-S2n	0.771	1.331	0.771	0.819	13.606	8.342
17.94	12.48	796.42	2.940	0.0*	5-S2n	0.772	1.332	0.772	0.840	13.614	8.480
19.00	12.51	796.43	2.949	0.0*	5-S2n	0.773	1.333	0.773	0.858	13.622	8.603

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 793.48 ft,    Outlet Elevation (invert): 780.96 ft  
Culvert Length: 289.27 ft,    Culvert Slope: 0.0433  
\*\*\*\*\*

### **Site Data - B-23**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 793.48 ft

Outlet Station: 289.00 ft

Outlet Elevation: 780.96 ft

Number of Barrels: 1

### **Culvert Data Summary - B-23**

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-23)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
8.40	781.59	0.63	7.01	3.94	2.20
9.46	781.62	0.66	7.23	4.12	2.22
10.52	781.65	0.69	7.42	4.29	2.23
11.58	781.67	0.71	7.60	4.45	2.24
12.64	781.70	0.74	7.77	4.60	2.26
13.70	781.72	0.76	7.93	4.74	2.27
14.76	781.74	0.78	8.08	4.87	2.28
15.82	781.76	0.80	8.22	5.00	2.29
16.80	781.78	0.82	8.34	5.11	2.30
17.94	781.80	0.84	8.48	5.24	2.31
19.00	781.82	0.86	8.60	5.35	2.31

**Tailwater Channel Data - B-23**

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 3.00 (1:1)

Channel Slope: 0.1000

Channel Manning's n: 0.0300

Channel Invert Elevation: 780.96 ft

**Roadway Data for Crossing: B-23**

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 796.35 ft

Roadway Surface: Paved

Roadway Top Width: 165.00 ft

# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 8.4 cfs

Design Flow: 16.8 cfs

Maximum Flow: 19 cfs



**Table 1 - Summary of Culvert Flows at Crossing: B-23 Proposed**

Headwater Elevation (ft)	Total Discharge (cfs)	B-23 Proposed Discharge (cfs)	Roadway Discharge (cfs)	Iterations
794.78	8.40	8.40	0.00	1
794.89	9.46	9.46	0.00	1
794.99	10.52	10.52	0.00	1
795.08	11.58	11.58	0.00	1
795.17	12.64	12.64	0.00	1
795.26	13.70	13.70	0.00	1
795.35	14.76	14.76	0.00	1
795.43	15.82	15.82	0.00	1
795.51	16.80	16.80	0.00	1
795.59	17.94	17.94	0.00	1
795.68	19.00	19.00	0.00	1
796.35	27.35	27.35	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-23 Proposed**

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)
8.40	8.40	794.78	1.303	0.0*	1-S2n	0.501	0.962	0.501	0.632	12.195	7.015
9.46	9.46	794.89	1.408	0.0*	1-S2n	0.530	1.023	0.538	0.661	12.065	7.226
10.52	10.52	794.99	1.508	0.0*	1-S2n	0.558	1.083	0.558	0.687	12.725	7.421
11.58	11.58	795.08	1.603	0.0*	1-S2n	0.587	1.141	0.587	0.713	13.059	7.601
12.64	12.64	795.17	1.695	0.0*	1-S2n	0.616	1.194	0.616	0.736	13.351	7.769
13.70	13.70	795.26	1.783	0.0*	1-S2n	0.645	1.245	0.645	0.759	13.607	7.927
14.76	14.76	795.35	1.868	0.0*	1-S2n	0.673	1.294	0.673	0.781	13.835	8.076
15.82	15.82	795.43	1.952	0.0*	1-S2n	0.697	1.340	0.697	0.801	14.170	8.218
16.80	16.80	795.51	2.027	0.0*	1-S2n	0.717	1.381	0.717	0.819	14.503	8.342
17.94	17.94	795.59	2.115	0.0*	1-S2n	0.741	1.431	0.749	0.840	14.454	8.480
19.00	19.00	795.68	2.196	0.0*	1-S2n	0.762	1.474	0.762	0.858	14.945	8.603

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 793.48 ft,    Outlet Elevation (invert): 780.96 ft  
Culvert Length: 289.27 ft,    Culvert Slope: 0.0433  
\*\*\*\*\*

### **Site Data - B-23 Proposed**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 793.48 ft

Outlet Station: 289.00 ft

Outlet Elevation: 780.96 ft

Number of Barrels: 1

### **Culvert Data Summary - B-23 Proposed**

Barrel Shape: Circular

Barrel Diameter: 2.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-23 Proposed)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
8.40	781.59	0.63	7.01	3.94	2.20
9.46	781.62	0.66	7.23	4.12	2.22
10.52	781.65	0.69	7.42	4.29	2.23
11.58	781.67	0.71	7.60	4.45	2.24
12.64	781.70	0.74	7.77	4.60	2.26
13.70	781.72	0.76	7.93	4.74	2.27
14.76	781.74	0.78	8.08	4.87	2.28
15.82	781.76	0.80	8.22	5.00	2.29
16.80	781.78	0.82	8.34	5.11	2.30
17.94	781.80	0.84	8.48	5.24	2.31
19.00	781.82	0.86	8.60	5.35	2.31

**Tailwater Channel Data - B-23 Proposed**

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 3.00 (1:1)

Channel Slope: 0.1000

Channel Manning's n: 0.0300

Channel Invert Elevation: 780.96 ft

**Roadway Data for Crossing: B-23 Proposed**

Roadway Profile Shape: Constant Roadway Elevation

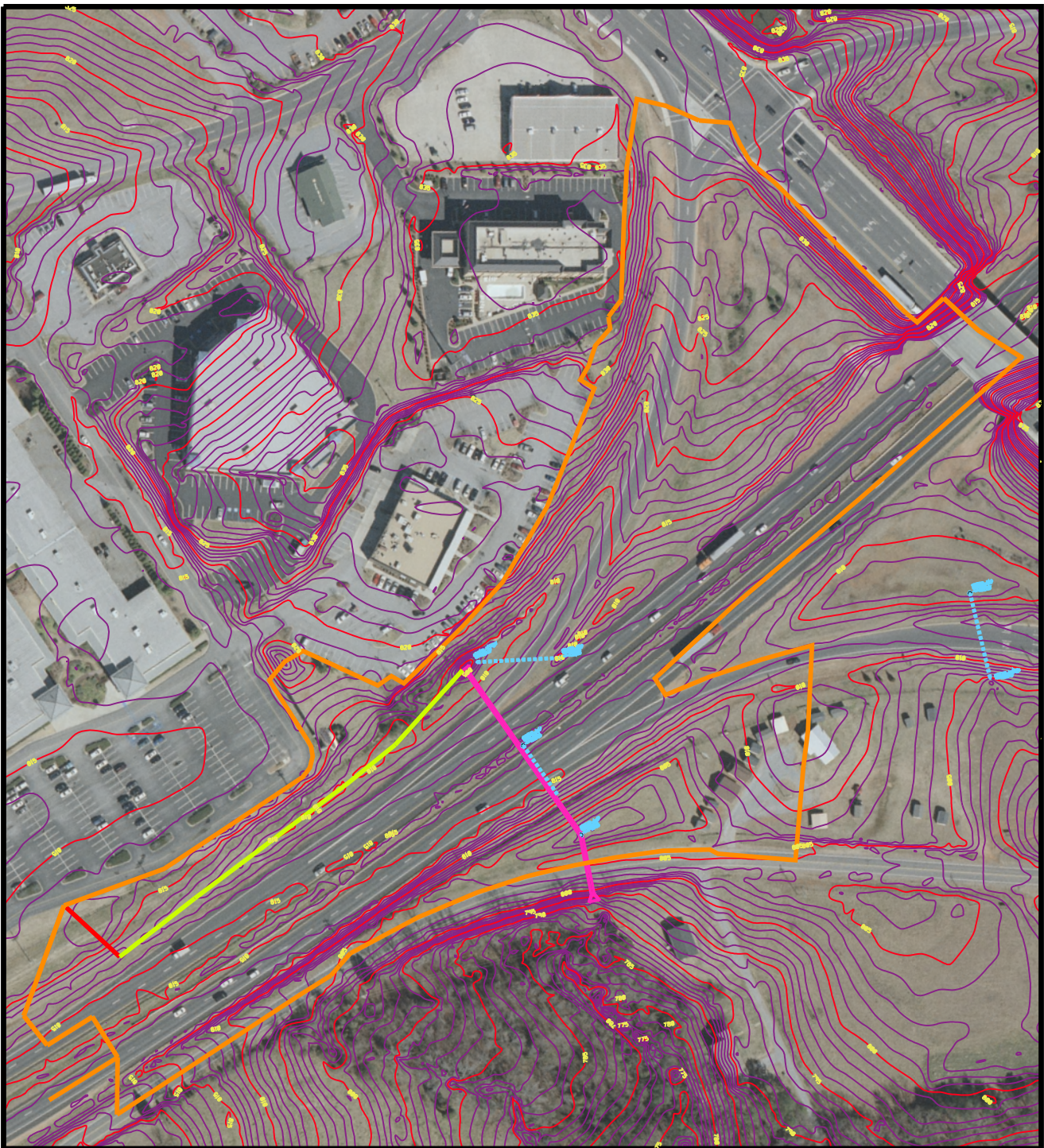
Crest Length: 100.00 ft

Crest Elevation: 796.35 ft

Roadway Surface: Paved

Roadway Top Width: 165.00 ft



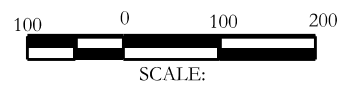


- |                      |                                    |
|----------------------|------------------------------------|
| Watershed            | Ditch Flow                         |
| Overland             | Existing 5' Contour Line/Elevation |
| Shallow Concentrated | Existing 1' Contour Line           |

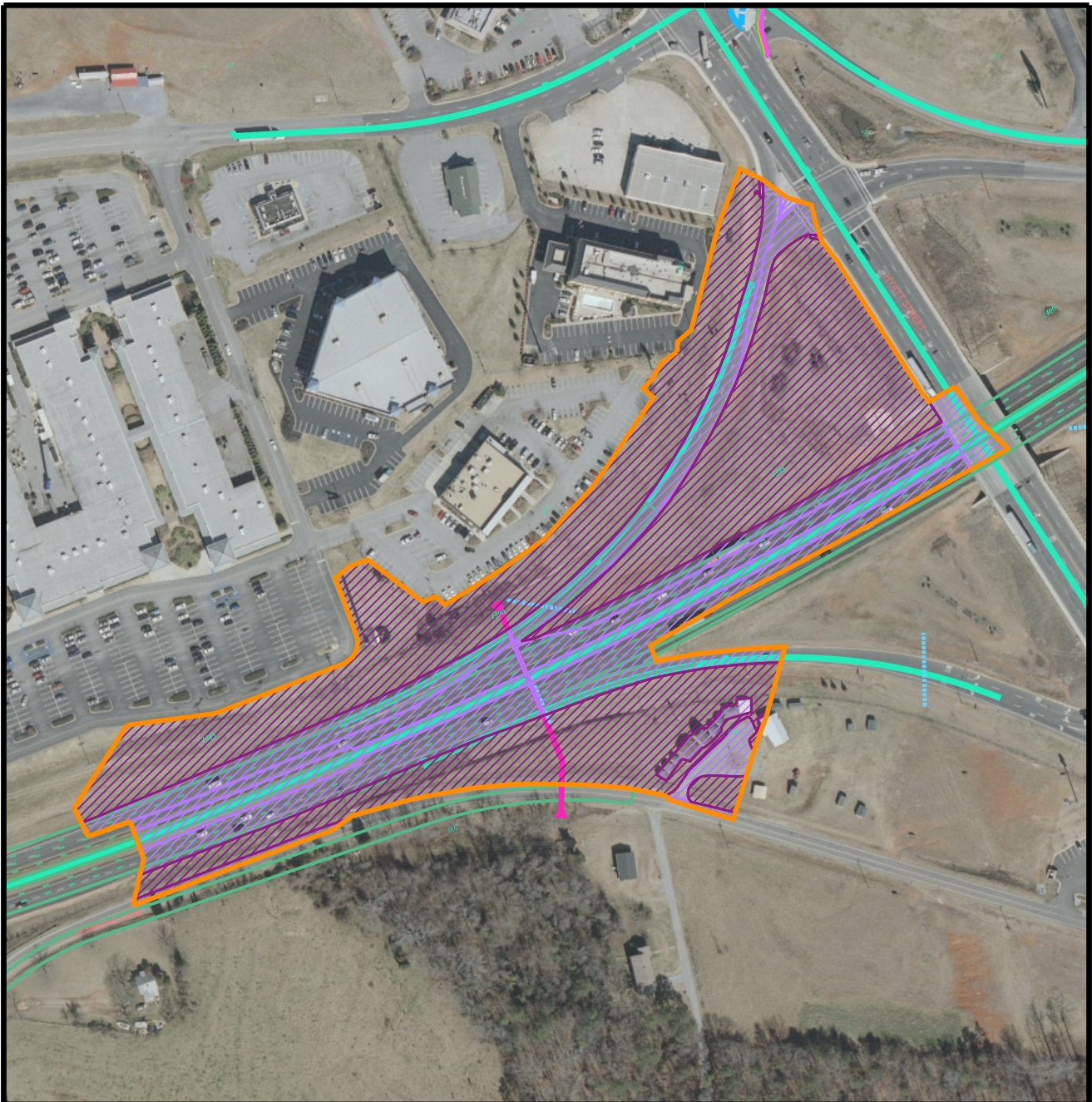
\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-24

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







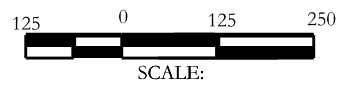
PAVEMENTS, ROOF



GRASS SHOULDERS

## LAND USE MAP - SITE # B-24

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 27.7 cfs

Design Flow: 55.8 cfs

Maximum Flow: 63.5 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-24**

Headwater Elevation (ft)	Total Discharge (cfs)	B-24 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
801.31	27.70	27.70	0.00	1
801.42	31.28	31.28	0.00	1
801.53	34.86	34.86	0.00	1
801.63	38.44	38.44	0.00	1
801.73	42.02	42.02	0.00	1
801.82	45.60	45.60	0.00	1
801.91	49.18	49.18	0.00	1
802.01	52.76	52.76	0.00	1
802.09	55.80	55.80	0.00	1
802.19	59.92	59.92	0.00	1
802.28	63.50	63.50	0.00	1
810.96	373.04	373.04	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-24**

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)
27.70	27.70	801.31	1.292	0.0*	1-S2n	0.416	0.871	0.416	0.400	11.102	6.924
31.28	31.28	801.42	1.401	0.0*	1-S2n	0.447	0.945	0.447	0.431	11.676	7.254
34.86	34.86	801.53	1.506	0.0*	1-S2n	0.477	1.016	0.477	0.461	12.176	7.556
38.44	38.44	801.63	1.608	0.0*	1-S2n	0.508	1.084	0.508	0.490	12.616	7.843
42.02	42.02	801.73	1.706	0.0*	1-S2n	0.538	1.151	0.538	0.518	13.005	8.110
45.60	45.60	801.82	1.802	0.0*	1-S2n	0.569	1.215	0.600	0.545	12.674	8.363
49.18	49.18	801.91	1.895	0.0*	1-S2n	0.600	1.278	0.600	0.572	13.665	8.604
52.76	52.76	802.01	1.986	0.0*	1-S2n	0.630	1.339	0.630	0.597	13.947	8.834
55.80	55.80	802.09	2.066	0.0*	1-S2n	0.657	1.390	0.657	0.619	14.165	9.019
59.92	59.92	802.19	2.173	0.0*	1-S2n	0.692	1.458	0.692	0.647	14.435	9.261
63.50	63.50	802.28	2.264	0.0*	1-S2n	0.722	1.515	0.716	0.671	14.780	9.463

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 800.02 ft,    Outlet Elevation (invert): 790.13 ft  
Culvert Length: 346.14 ft,    Culvert Slope: 0.0286  
\*\*\*\*\*

## Site Data - B-24

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 800.02 ft

Outlet Station: 346.00 ft

Outlet Elevation: 790.13 ft

Number of Barrels: 1

## Culvert Data Summary - B-24

Barrel Shape: Concrete Box

Barrel Span: 6.00 ft

Barrel Rise: 4.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: 1:1 Bevel (45° flare) Wingwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-24)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
27.70	790.53	0.40	6.92	2.50	1.93
31.28	790.56	0.43	7.25	2.69	1.95
34.86	790.59	0.46	7.56	2.88	1.96
38.44	790.62	0.49	7.84	3.06	1.97
42.02	790.65	0.52	8.11	3.23	1.99
45.60	790.68	0.55	8.36	3.40	2.00
49.18	790.70	0.57	8.60	3.57	2.01
52.76	790.73	0.60	8.83	3.73	2.01
55.80	790.75	0.62	9.02	3.86	2.02
59.92	790.78	0.65	9.26	4.04	2.03
63.50	790.80	0.67	9.46	4.19	2.04

**Tailwater Channel Data - B-24**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 10.00 ft

Channel Slope: 0.1000

Channel Manning's n: 0.0350

Channel Invert Elevation: 790.13 ft

**Roadway Data for Crossing: B-24**

Roadway Profile Shape: Constant Roadway Elevation

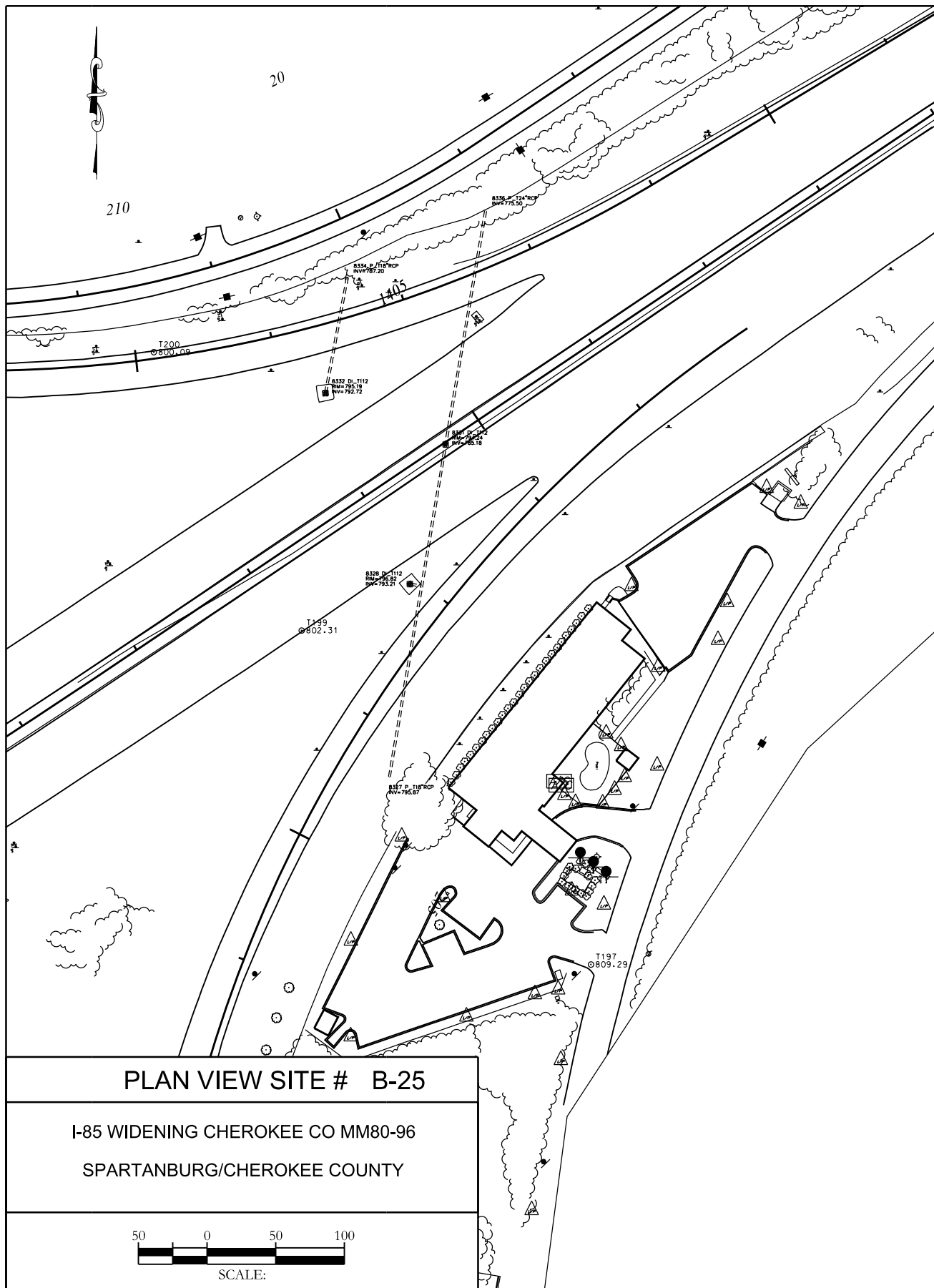
Crest Length: 120.00 ft

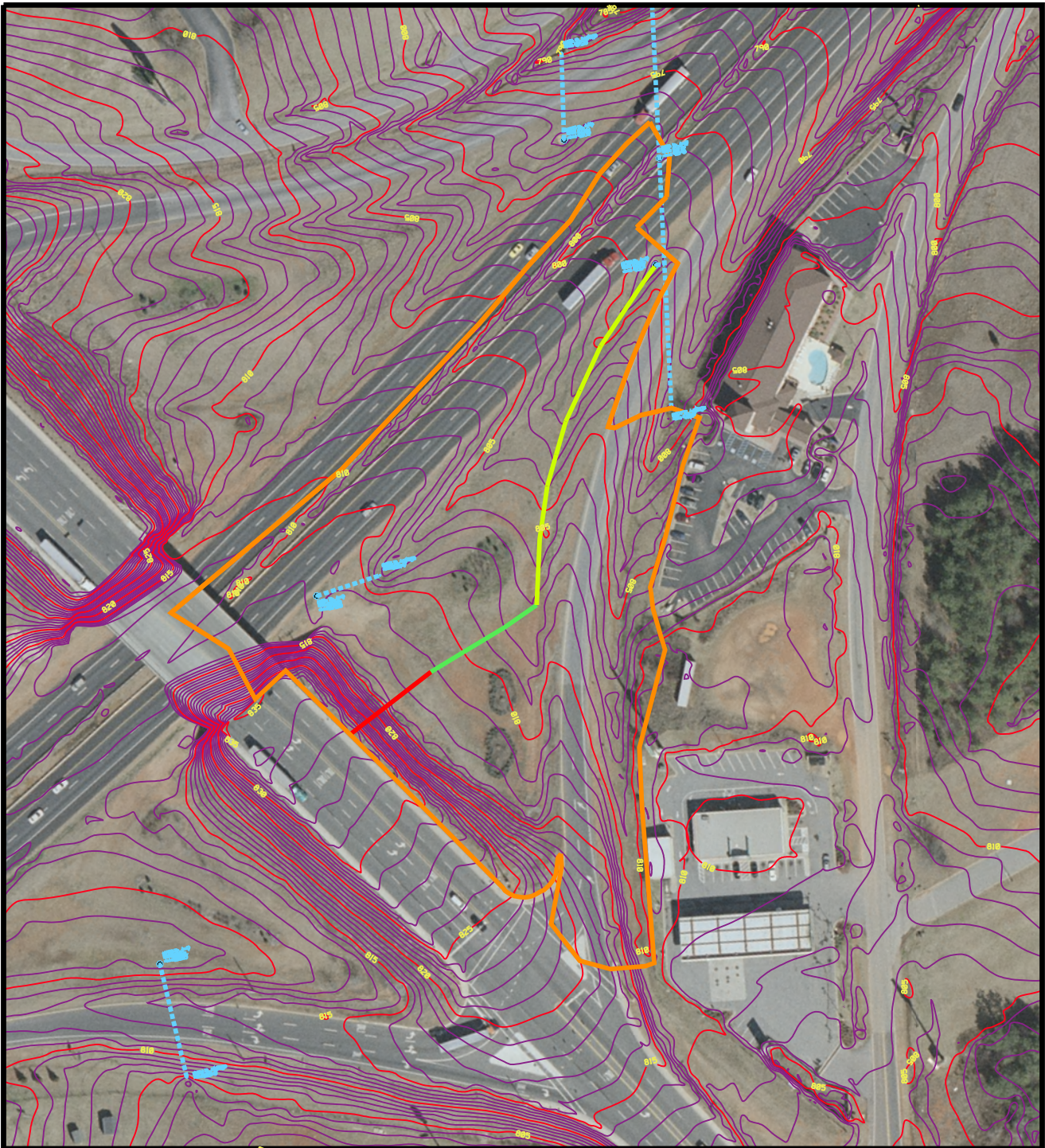
Crest Elevation: 810.96 ft

Roadway Surface: Paved

Roadway Top Width: 280.00 ft







- |   |   |
|---|---|
| <span style="color: orange;">—</span> Watershed           | <span style="color: yellow;">—</span> Ditch Flow                      |
| <span style="color: red;">—</span> Overland               | <span style="color: red;">—</span> Existing 5' Contour Line/Elevation |
| <span style="color: green;">—</span> Shallow Concentrated | <span style="color: purple;">—</span> Existing 1' Contour Line        |

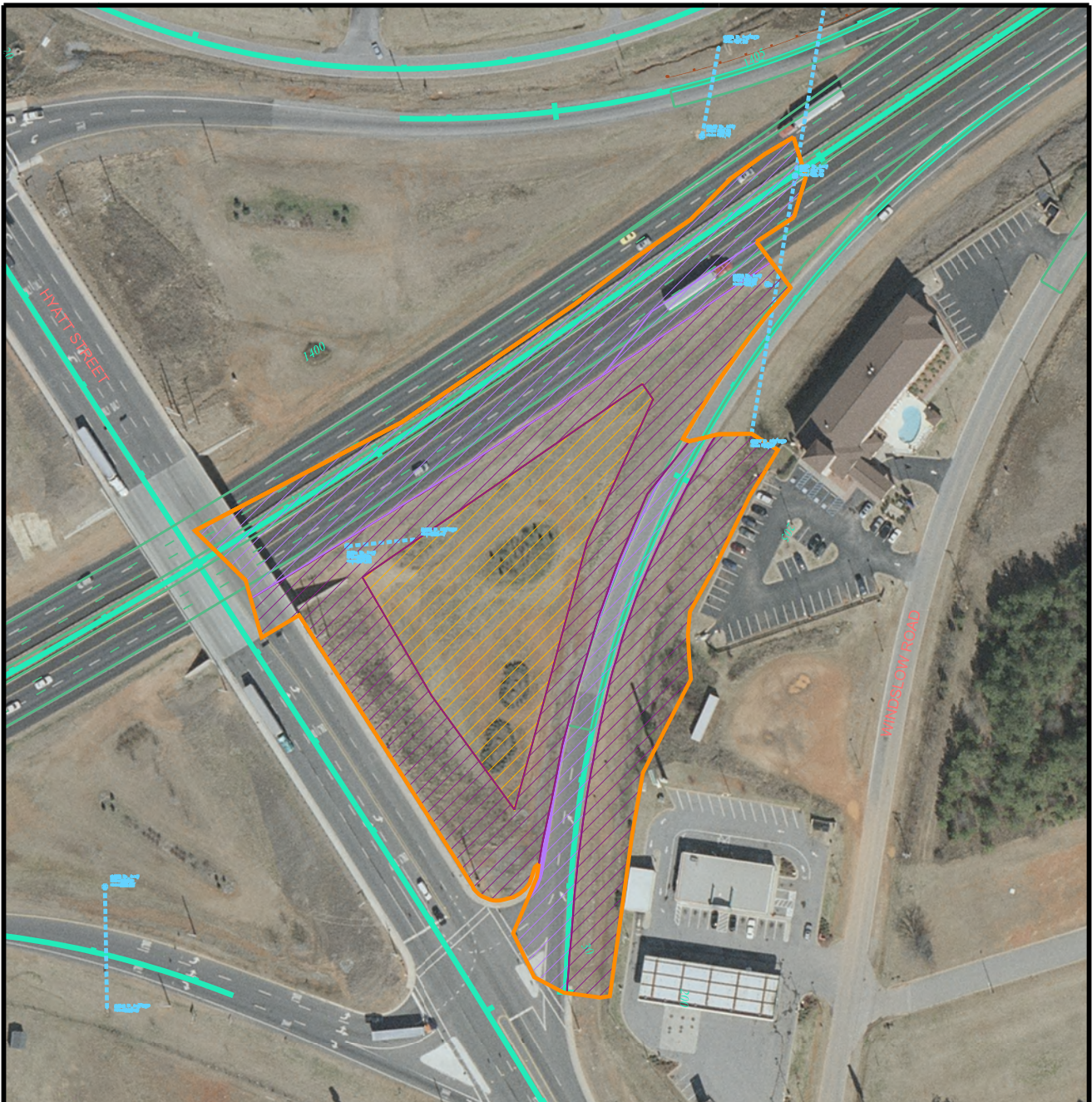
\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-25

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







PAVEMENTS, ROOF



GRASS SHOULDERS



LAWNS SANDY SOIL

## LAND USE MAP - SITE # B-25

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 10 cfs

Design Flow: 20.6 cfs

Maximum Flow: 23.5 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-25**

Headwater Elevation (ft)	Total Discharge (cfs)	B-25 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
798.10	10.00	10.00	0.00	1
798.46	11.35	11.35	0.00	1
798.88	12.70	12.70	0.00	1
799.34	14.05	14.05	0.00	1
799.48	15.40	14.43	0.89	16
799.50	16.75	14.48	2.14	4
799.51	18.10	14.52	3.51	4
799.52	19.45	14.55	4.77	3
799.53	20.60	14.57	5.92	3
799.55	22.15	14.61	7.46	3
799.56	23.50	14.63	8.81	3
799.46	14.38	14.38	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-25**

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)
10.00	10.00	798.10	2.234	0.0*	5-S2n	0.000	0.000	0.896	0.896	14.182	3.114
11.35	11.35	798.46	2.595	0.0*	5-S2n	0.000	0.000	0.940	0.940	14.573	3.214
12.70	12.70	798.88	3.007	0.0*	5-S2n	0.000	0.000	0.980	0.980	14.978	3.305
14.05	14.05	799.34	3.471	0.0*	5-S2n	0.000	0.000	1.018	1.018	15.355	3.390
15.40	14.43	799.48	3.611	0.0*	5-S2n	0.000	0.000	1.054	1.054	15.456	3.468
16.75	14.48	799.50	3.628	0.0*	5-S2n	0.000	0.000	1.087	1.087	15.468	3.542
18.10	14.52	799.51	3.643	0.0*	5-S2n	0.000	0.000	1.119	1.119	15.478	3.611
19.45	14.55	799.52	3.654	0.0*	5-S2n	0.000	0.000	1.150	1.150	15.486	3.677
20.60	14.57	799.53	3.664	0.0*	5-S2n	0.000	0.000	1.175	1.175	15.493	3.730
22.15	14.61	799.55	3.677	0.0*	5-S2n	0.000	0.000	1.207	1.207	15.501	3.798
23.50	14.63	799.56	3.687	0.0*	5-S2n	0.000	0.000	1.235	1.235	15.508	3.855

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Single Broken-back Culvert  
Inlet Elevation (invert): 795.87 ft  
Break Elevation (invert): 785.18 ft  
Culvert Length: 419.49 ft  
Upper Culvert Section Slope: 0.0435  
Steep Culvert Section Slope: 0.0560  
\*\*\*\*\*

## Site Data - B-25

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 795.87 ft

Break Station: 246.00 ft

Break Elevation: 785.18 ft

Outlet Station: 419.00 ft

Outlet Elevation: 775.50 ft

Number of Barrels: 1



### **Culvert Data Summary - B-25**

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Upper Section Material: Concrete

Lower Section Material: Concrete

Embedment: 0.00 in

Upper Section Manning's n: 0.0120

Lower Section Manning's n: 0.0120

Culvert Type: Single Broken-back

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-25)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
10.00	776.40	0.90	3.11	0.67	0.82
11.35	776.44	0.94	3.21	0.70	0.83
12.70	776.48	0.98	3.31	0.73	0.83
14.05	776.52	1.02	3.39	0.76	0.84
15.40	776.55	1.05	3.47	0.79	0.84
16.75	776.59	1.09	3.54	0.81	0.85
18.10	776.62	1.12	3.61	0.84	0.85
19.45	776.65	1.15	3.68	0.86	0.85
20.60	776.68	1.18	3.73	0.88	0.86
22.15	776.71	1.21	3.80	0.90	0.86
23.50	776.73	1.23	3.85	0.92	0.86

**Tailwater Channel Data - B-25**

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 4.00 (1:1)

Channel Slope: 0.0120

Channel Manning's n: 0.0300

Channel Invert Elevation: 775.50 ft

**Roadway Data for Crossing: B-25**

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 799.46 ft

Roadway Surface: Paved

Roadway Top Width: 314.00 ft

# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 10 cfs

Design Flow: 20.6 cfs

Maximum Flow: 23.5 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-25 Proposed**

Headwater Elevation (ft)	Total Discharge (cfs)	B-25 Proposed Discharge (cfs)	Roadway Discharge (cfs)	Iterations
797.32	10.00	10.00	0.00	1
797.45	11.35	11.35	0.00	1
797.56	12.70	12.70	0.00	1
797.67	14.05	14.05	0.00	1
797.78	15.40	15.40	0.00	1
797.89	16.75	16.75	0.00	1
797.99	18.10	18.10	0.00	1
798.09	19.45	19.45	0.00	1
798.18	20.60	20.60	0.00	1
798.30	22.15	22.15	0.00	1
798.41	23.50	23.50	0.00	1
799.46	34.67	34.67	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-25 Proposed**

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)
10.00	10.00	797.32	1.453	0.0*	1-S2n	0.000	0.000	0.896	0.896	13.478	3.114
11.35	11.35	797.45	1.577	0.0*	1-S2n	0.000	0.000	0.940	0.940	14.398	3.214
12.70	12.70	797.56	1.693	0.0*	1-S2n	0.000	0.000	0.980	0.980	14.455	3.305
14.05	14.05	797.67	1.805	0.0*	1-S2n	0.000	0.000	1.018	1.018	14.865	3.390
15.40	15.40	797.78	1.912	0.0*	1-S2n	0.000	0.000	1.054	1.054	15.246	3.468
16.75	16.75	797.89	2.017	0.0*	1-S2n	0.000	0.000	1.087	1.087	15.635	3.542
18.10	18.10	797.99	2.120	0.0*	1-S2n	0.000	0.000	1.119	1.119	16.109	3.611
19.45	19.45	798.09	2.223	0.0*	1-S2n	0.000	0.000	1.150	1.150	16.319	3.677
20.60	20.60	798.18	2.311	0.0*	1-S2n	0.000	0.000	1.175	1.175	16.570	3.730
22.15	22.15	798.30	2.432	0.0*	1-S2n	0.000	0.000	1.207	1.207	16.908	3.798
23.50	23.50	798.41	2.539	0.0*	5-S2n	0.000	0.000	1.235	1.235	17.174	3.855

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Single Broken-back Culvert  
Inlet Elevation (invert): 795.87 ft  
Break Elevation (invert): 785.18 ft  
Culvert Length: 419.49 ft  
Upper Culvert Section Slope: 0.0435  
Steep Culvert Section Slope: 0.0560  
\*\*\*\*\*

## Site Data - B-25 Proposed

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 795.87 ft

Break Station: 246.00 ft

Break Elevation: 785.18 ft

Outlet Station: 419.00 ft

Outlet Elevation: 775.50 ft

Number of Barrels: 1



### **Culvert Data Summary - B-25 Proposed**

Barrel Shape: Circular

Barrel Diameter: 2.50 ft

Upper Section Material: Concrete

Lower Section Material: Concrete

Embedment: 0.00 in

Upper Section Manning's n: 0.0120

Lower Section Manning's n: 0.0120

Culvert Type: Single Broken-back

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-25 Proposed)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
10.00	776.40	0.90	3.11	0.67	0.82
11.35	776.44	0.94	3.21	0.70	0.83
12.70	776.48	0.98	3.31	0.73	0.83
14.05	776.52	1.02	3.39	0.76	0.84
15.40	776.55	1.05	3.47	0.79	0.84
16.75	776.59	1.09	3.54	0.81	0.85
18.10	776.62	1.12	3.61	0.84	0.85
19.45	776.65	1.15	3.68	0.86	0.85
20.60	776.68	1.18	3.73	0.88	0.86
22.15	776.71	1.21	3.80	0.90	0.86
23.50	776.73	1.23	3.85	0.92	0.86

**Tailwater Channel Data - B-25 Proposed**

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 4.00 (4:1)

Channel Slope: 0.0120

Channel Manning's n: 0.0300

Channel Invert Elevation: 775.50 ft

**Roadway Data for Crossing: B-25 Proposed**

Roadway Profile Shape: Constant Roadway Elevation

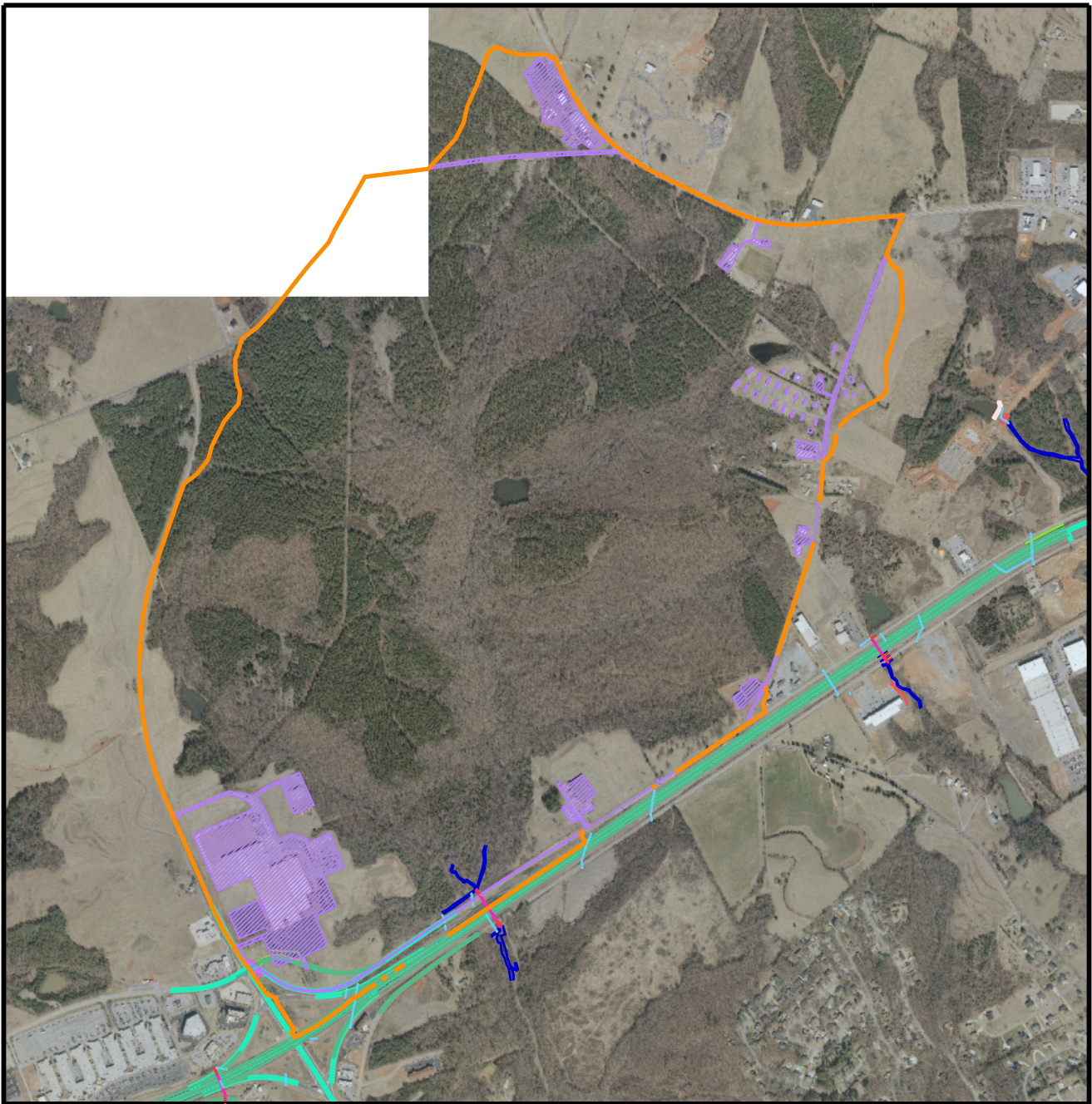
Crest Length: 100.00 ft

Crest Elevation: 799.46 ft

Roadway Surface: Paved

Roadway Top Width: 314.00 ft

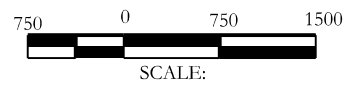


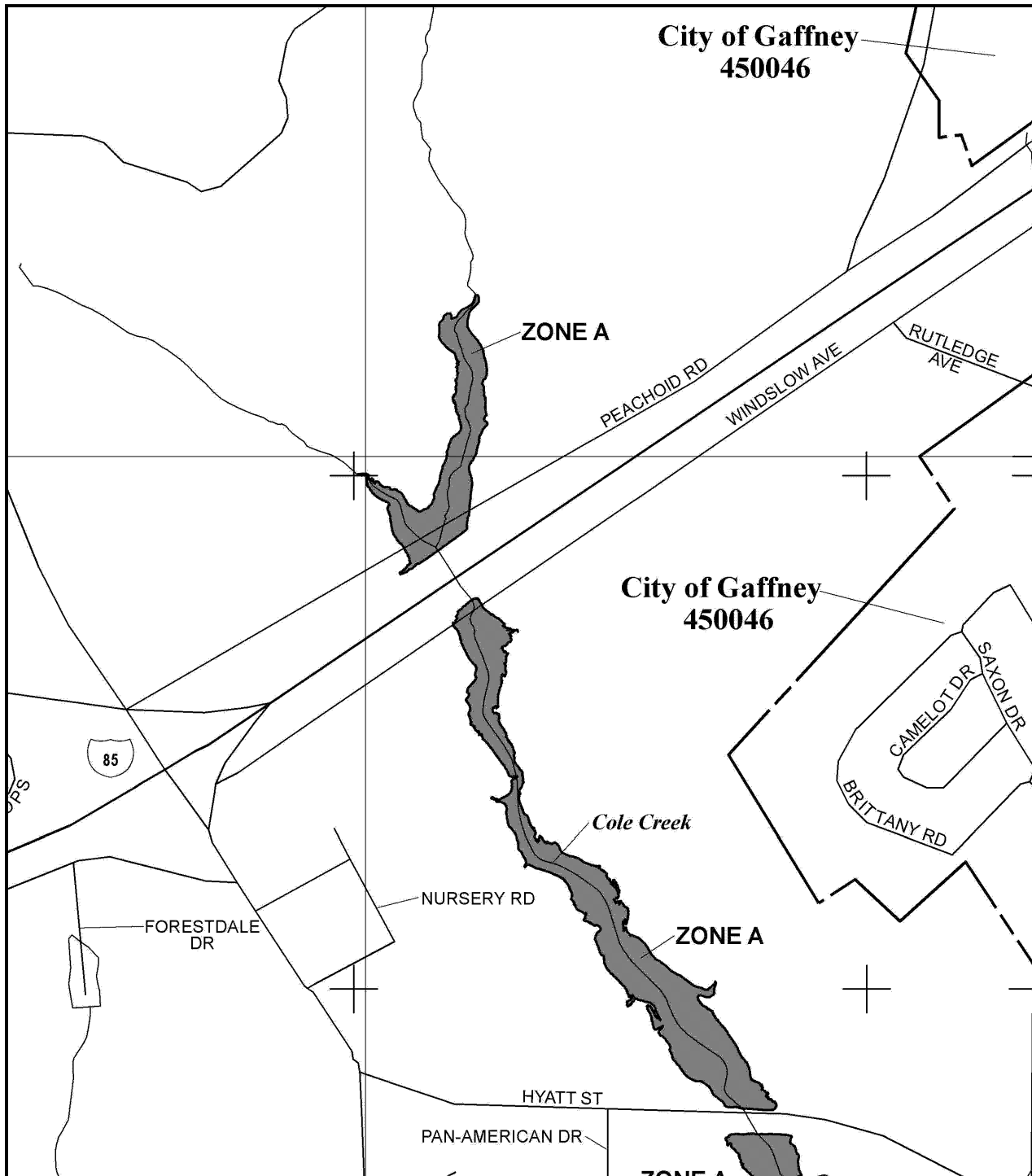


IMPERVIOUS AREA

## LAND USE MAP - SITE # B-26

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY

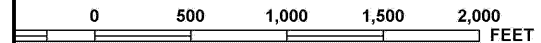




ance Program at 1-800-638-6620.



MAP SCALE 1" = 1000'



NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0155D

## FIRM

FLOOD INSURANCE RATE MAP  
CHEROKEE COUNTY,  
SOUTH CAROLINA  
AND INCORPORATED AREAS

PANEL 155 OF 400

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CHEROKEE COUNTY, UNINCORPORATED AREAS	450045	0155	D
GAFFNEY, CITY OF	450046	0155	D

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.



MAP NUMBER  
45021C0155D

EFFECTIVE DATE  
SEPTEMBER 16, 2011

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at [www.msc.fema.gov](http://www.msc.fema.gov)

# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 160.59 cfs

Design Flow: 512.93 cfs

Maximum Flow: 593 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-26**

Headwater Elevation (ft)	Total Discharge (cfs)	B-26 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
712.32	160.59	160.59	0.00	1
712.93	203.83	203.83	0.00	1
713.52	247.07	247.07	0.00	1
714.08	290.31	290.31	0.00	1
714.63	333.55	333.55	0.00	1
715.15	376.79	376.79	0.00	1
715.67	420.04	420.04	0.00	1
716.17	463.28	463.28	0.00	1
716.68	506.52	506.52	0.00	1
716.75	512.93	512.93	0.00	1
717.69	593.00	593.00	0.00	1
735.38	1590.82	1590.82	0.00	Overtopping



**Table 2 - Culvert Summary Table: B-26**

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)
160.59	160.59	712.32	3.508	0.0*	1-S2n	1.578	2.322	1.615	2.193	12.430	5.229
203.83	203.83	712.93	4.118	0.0*	1-S2n	1.854	2.722	1.901	2.572	13.405	5.661
247.07	247.07	713.52	4.710	0.101	1-S2n	2.130	3.094	2.179	2.929	14.176	6.025
290.31	290.31	714.08	5.274	0.615	1-S2n	2.382	3.445	2.443	3.271	14.854	6.340
333.55	333.55	714.63	5.817	1.138	1-S2n	2.628	3.779	2.708	3.600	15.398	6.618
376.79	376.79	715.15	6.342	1.673	1-S2n	2.875	4.099	2.961	3.920	15.906	6.866
420.04	420.04	715.67	6.856	2.222	1-S2n	3.107	4.407	3.209	4.231	16.360	7.091
463.28	463.28	716.17	7.362	2.787	1-S2n	3.338	4.705	3.454	4.535	16.764	7.296
506.52	506.52	716.68	7.865	3.369	1-S2n	3.568	4.993	3.696	4.834	17.131	7.484
512.93	512.93	716.75	7.940	3.457	1-S2n	3.602	5.035	3.732	4.878	17.181	7.511
593.00	593.00	717.69	8.877	4.588	5-S2n	4.011	5.547	4.169	5.417	17.781	7.820

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 708.81 ft,    Outlet Elevation (invert): 705.39 ft  
Culvert Length: 390.01 ft,    Culvert Slope: 0.0088  
\*\*\*\*\*

## Site Data - B-26

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 708.81 ft

Outlet Station: 390.00 ft

Outlet Elevation: 705.39 ft

Number of Barrels: 1

## Culvert Data Summary - B-26

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: 0.0120

Culvert Type: Straight

Inlet Configuration: 1:1 Bevel (45° flare) Wingwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-26)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
160.59	707.58	2.19	5.23	1.37	0.62
203.83	707.96	2.57	5.66	1.60	0.62
247.07	708.32	2.93	6.02	1.83	0.62
290.31	708.66	3.27	6.34	2.04	0.62
333.55	708.99	3.60	6.62	2.25	0.61
376.79	709.31	3.92	6.87	2.45	0.61
420.04	709.62	4.23	7.09	2.64	0.61
463.28	709.93	4.54	7.30	2.83	0.60
506.52	710.22	4.83	7.48	3.02	0.60
512.93	710.27	4.88	7.51	3.04	0.60
593.00	710.81	5.42	7.82	3.38	0.59

**Tailwater Channel Data - B-26**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 14.00 ft

Channel Slope: 0.0100

Channel Manning's n: 0.0400

Channel Invert Elevation: 705.39 ft

**Roadway Data for Crossing: B-26**

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

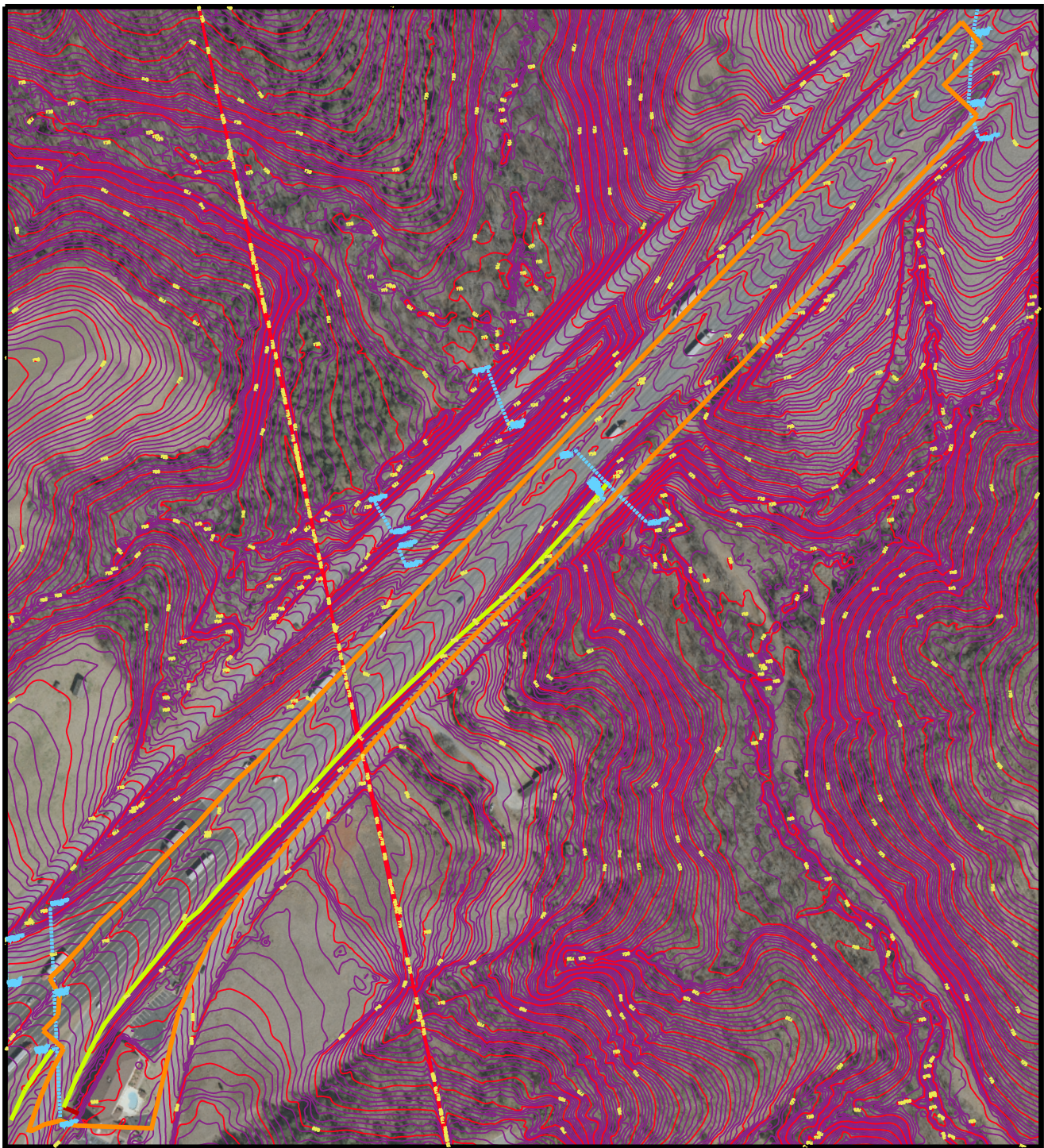
Crest Elevation: 735.38 ft

Roadway Surface: Paved

Roadway Top Width: 310.00 ft







- |                        |                                      |
|------------------------|--------------------------------------|
| — Watershed            | — Ditch Flow                         |
| — Overland             | — Existing 5' Contour Line/Elevation |
| — Shallow Concentrated | — Existing 1' Contour Line           |

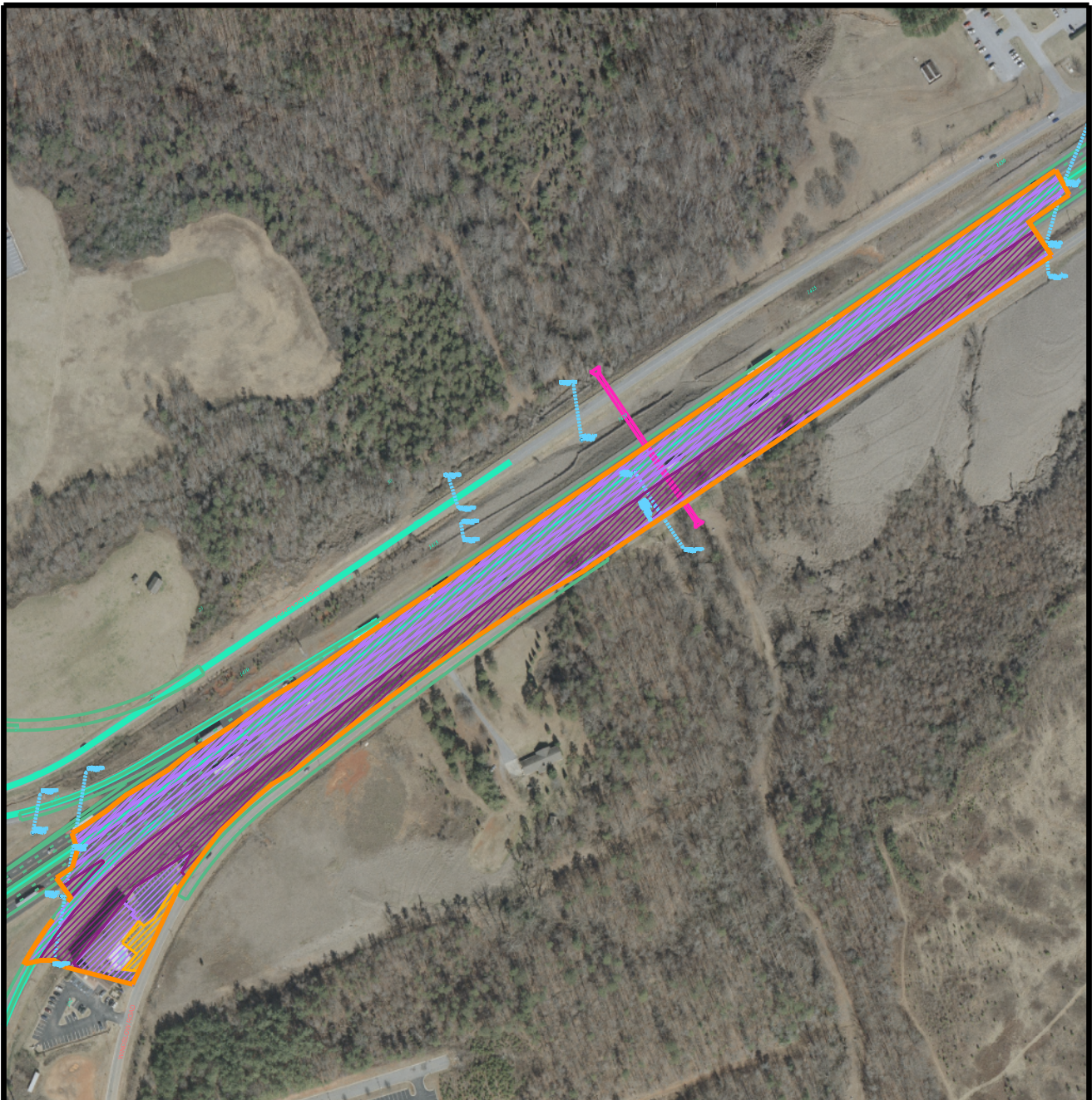
\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-27

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







PAVEMENT & ROOFS



GRASS SHOULDERS



LAWNS SANDY SOIL

## LAND USE MAP - SITE # B-27

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY





# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 31.4 cfs

Design Flow: 42 cfs

Maximum Flow: 64.7 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-27**

Headwater Elevation (ft)	Total Discharge (cfs)	B-27 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
752.75	31.40	25.37	5.94	26
752.78	34.73	25.37	9.19	4
752.80	38.06	25.37	12.59	4
752.82	41.39	25.37	15.96	4
752.83	42.00	25.37	16.42	2
752.86	48.05	25.37	22.63	4
752.88	51.38	25.37	25.91	3
752.89	54.71	25.37	29.26	3
752.91	58.04	25.37	32.61	3
752.92	61.37	25.37	35.96	3
752.94	64.70	25.37	39.30	3
752.68	25.37	25.37	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-27**

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)
31.40	25.37	752.75	9.223	11.791	6-FFc	1.500	1.500	1.500	0.770	14.356	2.912
34.73	25.37	752.78	9.223	11.791	6-FFc	1.500	1.500	1.500	0.820	14.356	3.024
38.06	25.37	752.80	9.223	11.791	6-FFc	1.500	1.500	1.500	0.869	14.356	3.129
41.39	25.37	752.82	9.223	11.791	6-FFc	1.500	1.500	1.500	0.916	14.356	3.228
42.00	25.37	752.83	9.223	11.791	6-FFc	1.500	1.500	1.500	0.924	14.356	3.245
48.05	25.37	752.86	9.223	11.791	6-FFc	1.500	1.500	1.500	1.006	14.356	3.411
51.38	25.37	752.88	9.223	0.0*	5-S2n	1.500	1.500	1.500	1.050	15.036	3.496
54.71	25.37	752.89	9.223	11.791	6-FFc	1.500	1.500	1.500	1.092	14.356	3.577
58.04	25.37	752.91	9.223	11.791	6-FFc	1.500	1.500	1.500	1.134	14.356	3.655
61.37	25.37	752.92	9.223	11.791	6-FFc	1.500	1.500	1.500	1.175	14.356	3.730
64.70	25.37	752.94	9.223	11.791	6-FFc	1.500	1.500	1.500	1.215	14.356	3.803

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 742.16 ft,    Outlet Elevation (invert): 707.93 ft  
Culvert Length: 200.94 ft,    Culvert Slope: 0.1729  
\*\*\*\*\*

### **Site Data - B-27**

Site Data Option: Culvert Invert Data  
Inlet Station: 0.00 ft  
Inlet Elevation: 742.16 ft  
Outlet Station: 198.00 ft  
Outlet Elevation: 707.93 ft  
Number of Barrels: 1

### **Culvert Data Summary - B-27**

Barrel Shape: Circular  
Barrel Diameter: 1.50 ft  
Barrel Material: Concrete  
Embedment: 0.00 in  
Barrel Manning's n: 0.0240  
Culvert Type: Straight  
Inlet Configuration: Square Edge with Headwall  
Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-27)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
31.40	708.70	0.77	2.91	0.48	0.58
34.73	708.75	0.82	3.02	0.51	0.59
38.06	708.80	0.87	3.13	0.54	0.59
41.39	708.85	0.92	3.23	0.57	0.59
42.00	708.85	0.92	3.25	0.58	0.59
48.05	708.94	1.01	3.41	0.63	0.60
51.38	708.98	1.05	3.50	0.66	0.60
54.71	709.02	1.09	3.58	0.68	0.60
58.04	709.06	1.13	3.66	0.71	0.60
61.37	709.11	1.18	3.73	0.73	0.61
64.70	709.15	1.22	3.80	0.76	0.61

**Tailwater Channel Data - B-27**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 14.00 ft

Channel Slope: 0.0100

Channel Manning's n: 0.0400

Channel Invert Elevation: 707.93 ft

**Roadway Data for Crossing: B-27**

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 752.68 ft

Roadway Surface: Paved

Roadway Top Width: 124.00 ft

# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 31.4 cfs

Design Flow: 42 cfs

Maximum Flow: 74 cfs



**Table 1 - Summary of Culvert Flows at Crossing: B-27 Proposed**

Headwater Elevation (ft)	Total Discharge (cfs)	B-27 Proposed Discharge (cfs)	Roadway Discharge (cfs)	Iterations
744.68	31.40	31.40	0.00	1
744.93	35.66	35.66	0.00	1
745.20	39.92	39.92	0.00	1
745.33	42.00	42.00	0.00	1
745.78	48.44	48.44	0.00	1
746.12	52.70	52.70	0.00	1
746.48	56.96	56.96	0.00	1
746.87	61.22	61.22	0.00	1
747.29	65.48	65.48	0.00	1
747.75	69.74	69.74	0.00	1
748.24	74.00	74.00	0.00	1
752.68	104.70	104.70	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-27 Proposed**

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)
31.40	31.40	744.68	2.523	0.0*	1-S2n	0.642	1.815	0.642	0.770	28.015	2.912
35.66	35.66	744.93	2.775	0.0*	1-S2n	0.685	1.937	0.713	0.834	27.476	3.054
39.92	39.92	745.20	3.038	0.0*	5-S2n	0.728	2.055	0.728	0.895	29.908	3.185
42.00	42.00	745.33	3.173	0.0*	5-S2n	0.749	2.109	0.765	0.924	29.400	3.245
48.44	48.44	745.78	3.624	0.0*	5-S2n	0.813	2.263	0.833	1.011	30.319	3.421
52.70	52.70	746.12	3.955	0.0*	5-S2n	0.846	2.357	0.867	1.067	31.298	3.529
56.96	56.96	746.48	4.316	0.0*	5-S2n	0.879	2.443	0.906	1.121	31.532	3.630
61.22	61.22	746.87	4.709	0.0*	5-S2n	0.911	2.521	0.947	1.173	31.860	3.727
65.48	65.48	747.29	5.134	0.0*	5-S2n	0.943	2.592	0.985	1.225	32.325	3.819
69.74	69.74	747.75	5.591	0.0*	5-S2n	0.975	2.654	1.012	1.275	33.162	3.907
74.00	74.00	748.24	6.080	0.0*	5-S2n	1.007	2.707	1.052	1.324	33.430	3.991

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 742.16 ft,    Outlet Elevation (invert): 707.93 ft  
Culvert Length: 200.94 ft,    Culvert Slope: 0.1729  
\*\*\*\*\*

### **Site Data - B-27 Proposed**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 742.16 ft

Outlet Station: 198.00 ft

Outlet Elevation: 707.93 ft

Number of Barrels: 1

### **Culvert Data Summary - B-27 Proposed**

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-27 Proposed)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
31.40	708.70	0.77	2.91	0.48	0.58
35.66	708.76	0.83	3.05	0.52	0.59
39.92	708.83	0.90	3.19	0.56	0.59
42.00	708.85	0.92	3.25	0.58	0.59
48.44	708.94	1.01	3.42	0.63	0.60
52.70	709.00	1.07	3.53	0.67	0.60
56.96	709.05	1.12	3.63	0.70	0.60
61.22	709.10	1.17	3.73	0.73	0.61
65.48	709.15	1.22	3.82	0.76	0.61
69.74	709.21	1.28	3.91	0.80	0.61
74.00	709.25	1.32	3.99	0.83	0.61

**Tailwater Channel Data - B-27 Proposed**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 14.00 ft

Channel Slope: 0.0100

Channel Manning's n: 0.0400

Channel Invert Elevation: 707.93 ft

**Roadway Data for Crossing: B-27 Proposed**

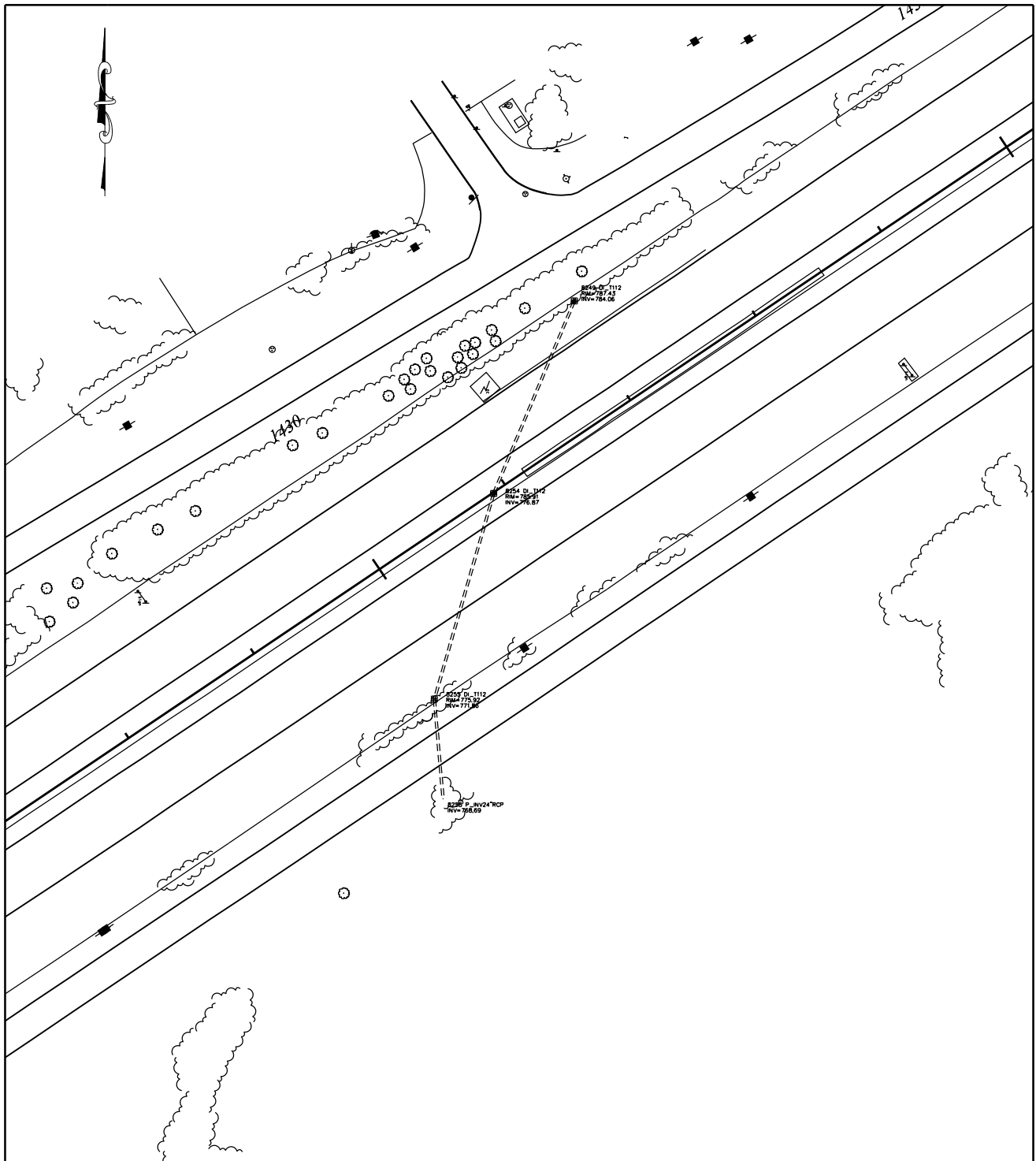
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 752.68 ft

Roadway Surface: Paved

Roadway Top Width: 124.00 ft

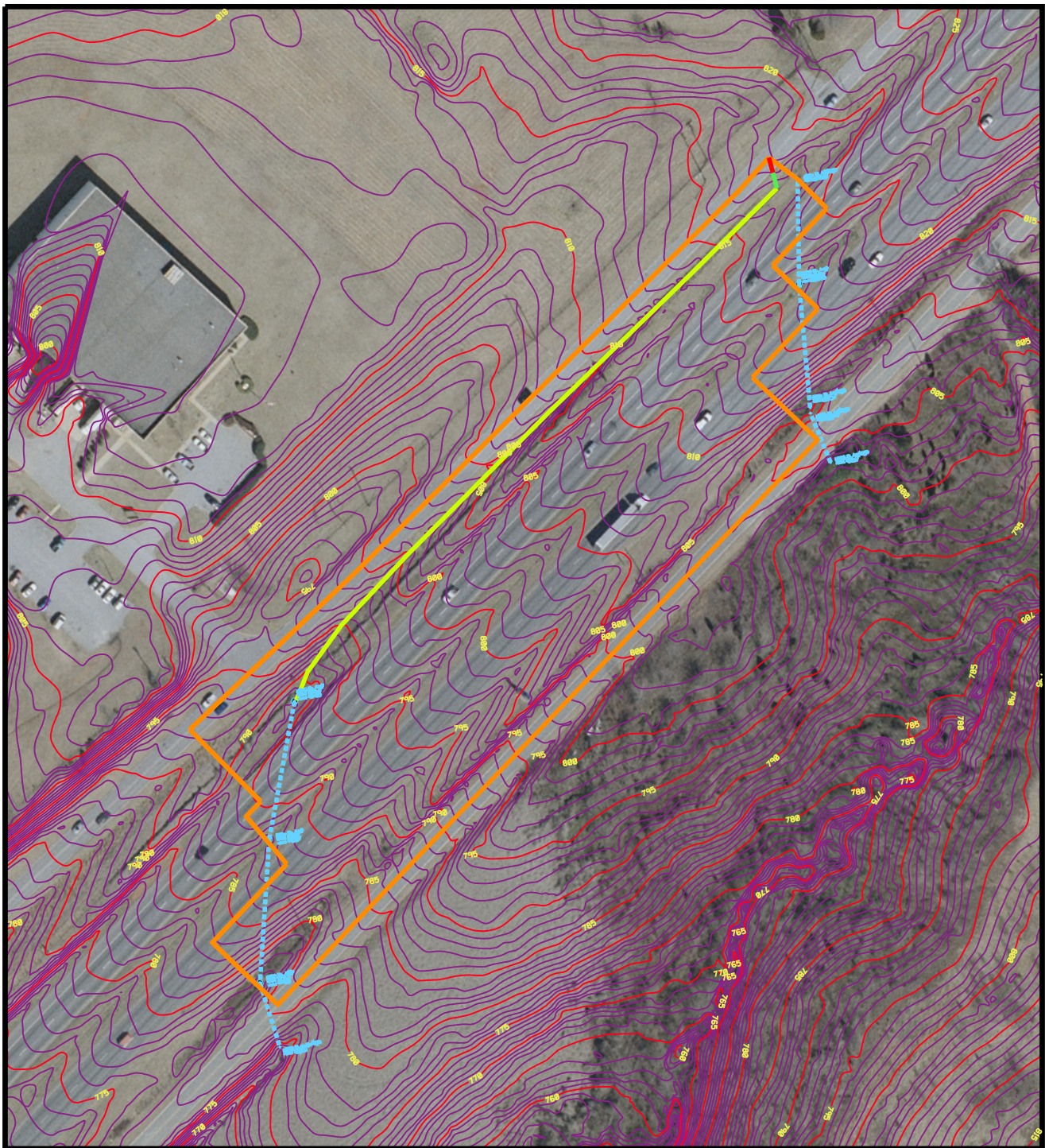


PLAN VIEW SITE # B-28

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



SCALE:



- |  |  |
|--|--|
|  Watershed            |  Ditch Flow                         |
|  Overland             |  Existing 5' Contour Line/Elevation |
|  Shallow Concentrated |  Existing 1' Contour Line           |

\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-28

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 13.1 cfs

Design Flow: 27 cfs

Maximum Flow: 30.9 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-28**

Headwater Elevation (ft)	Total Discharge (cfs)	B-28 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
786.06	13.10	13.10	0.00	1
786.26	14.88	14.88	0.00	1
786.48	16.66	16.66	0.00	1
786.73	18.44	18.44	0.00	1
786.99	20.22	20.22	0.00	1
787.29	22.00	22.00	0.00	1
787.61	23.78	23.78	0.00	1
787.97	25.56	25.56	0.00	1
788.27	27.00	27.00	0.00	1
788.76	29.12	29.12	0.00	1
789.19	30.90	30.90	0.00	1
791.76	39.57	39.57	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-28**

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)
13.10	13.10	786.06	1.996	0.0*	1-S2n	0.685	1.300	0.685	1.139	13.741	6.732
14.88	14.88	786.26	2.201	0.0*	5-S2n	0.736	1.386	0.736	1.195	14.198	6.950
16.66	16.66	786.48	2.422	0.0*	5-S2n	0.780	1.470	0.770	1.246	14.976	7.149
18.44	18.44	786.73	2.666	0.0*	5-S2n	0.825	1.544	0.825	1.295	15.071	7.333
20.22	20.22	786.99	2.934	0.0*	5-S2n	0.869	1.612	0.869	1.340	15.425	7.504
22.00	22.00	787.29	3.230	0.0*	5-S2n	0.913	1.674	0.913	1.383	15.743	7.664
23.78	23.78	787.61	3.555	0.0*	5-S2n	0.954	1.728	0.954	1.424	16.093	7.814
25.56	25.56	787.97	3.908	0.0*	5-S2n	0.995	1.775	1.020	1.463	15.872	7.956
27.00	27.00	788.27	4.214	0.0*	5-S2n	1.028	1.808	1.053	1.494	16.107	8.066
29.12	29.12	788.76	4.698	0.0*	5-S2n	1.077	1.848	1.077	1.537	16.891	8.220
30.90	30.90	789.19	5.133	0.0*	5-S2n	1.117	1.878	1.117	1.571	17.119	8.343

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 784.06 ft,    Outlet Elevation (invert): 768.69 ft  
Culvert Length: 350.34 ft,    Culvert Slope: 0.0439  
\*\*\*\*\*

### **Site Data - B-28**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 784.06 ft

Outlet Station: 350.00 ft

Outlet Elevation: 768.69 ft

Number of Barrels: 1

### **Culvert Data Summary - B-28**

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-28)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
13.10	769.83	1.14	6.73	3.55	1.57
14.88	769.88	1.19	6.95	3.73	1.58
16.66	769.94	1.25	7.15	3.89	1.60
18.44	769.98	1.29	7.33	4.04	1.61
20.22	770.03	1.34	7.50	4.18	1.62
22.00	770.07	1.38	7.66	4.32	1.62
23.78	770.11	1.42	7.81	4.44	1.63
25.56	770.15	1.46	7.96	4.57	1.64
27.00	770.18	1.49	8.07	4.66	1.64
29.12	770.23	1.54	8.22	4.79	1.65
30.90	770.26	1.57	8.34	4.90	1.66

**Tailwater Channel Data - B-28**

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 1.50 (1:1)

Channel Slope: 0.0500

Channel Manning's n: 0.0300

Channel Invert Elevation: 768.69 ft

**Roadway Data for Crossing: B-28**

Roadway Profile Shape: Constant Roadway Elevation

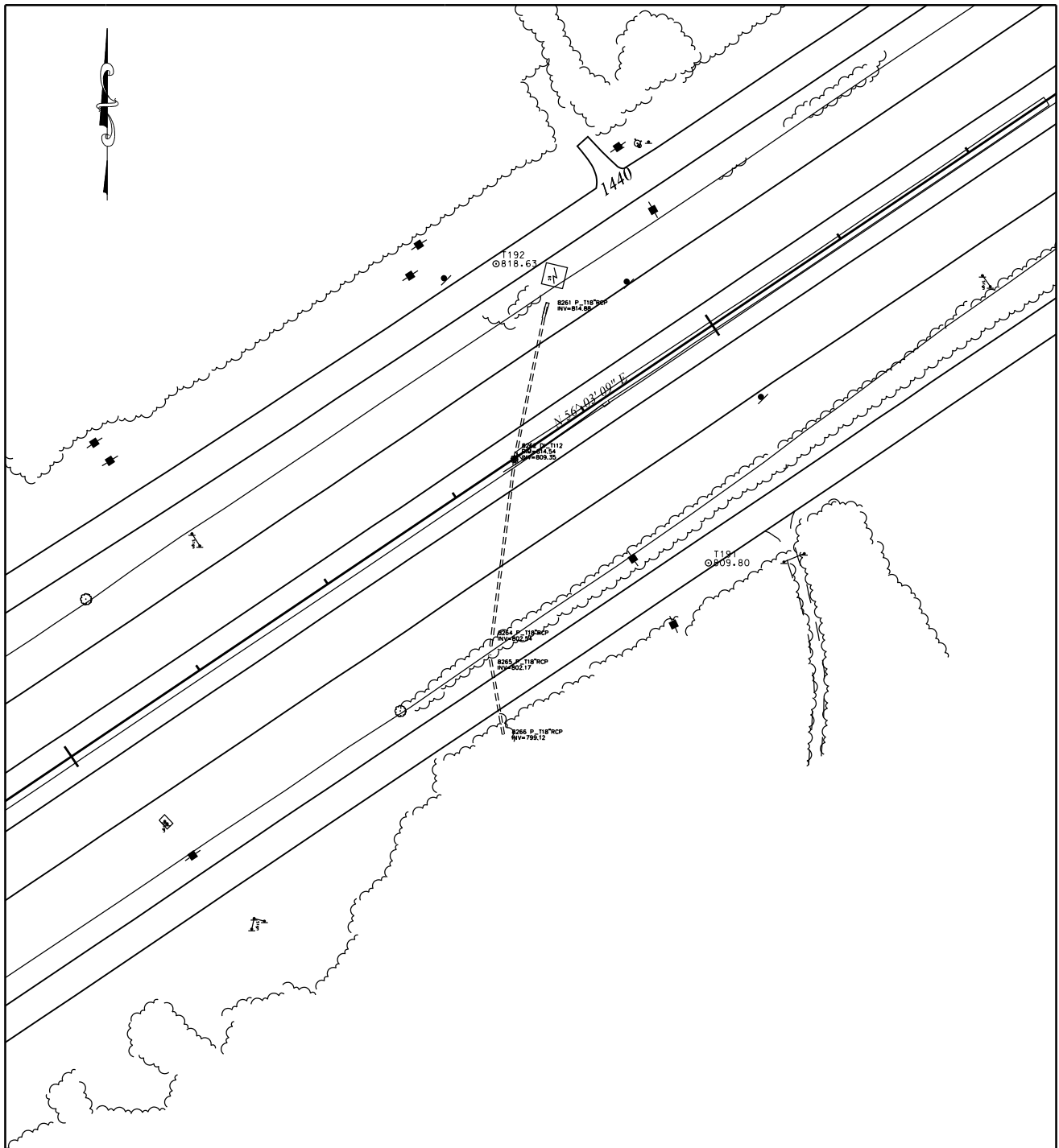
Crest Length: 100.00 ft

Crest Elevation: 791.76 ft

Roadway Surface: Paved

Roadway Top Width: 270.00 ft





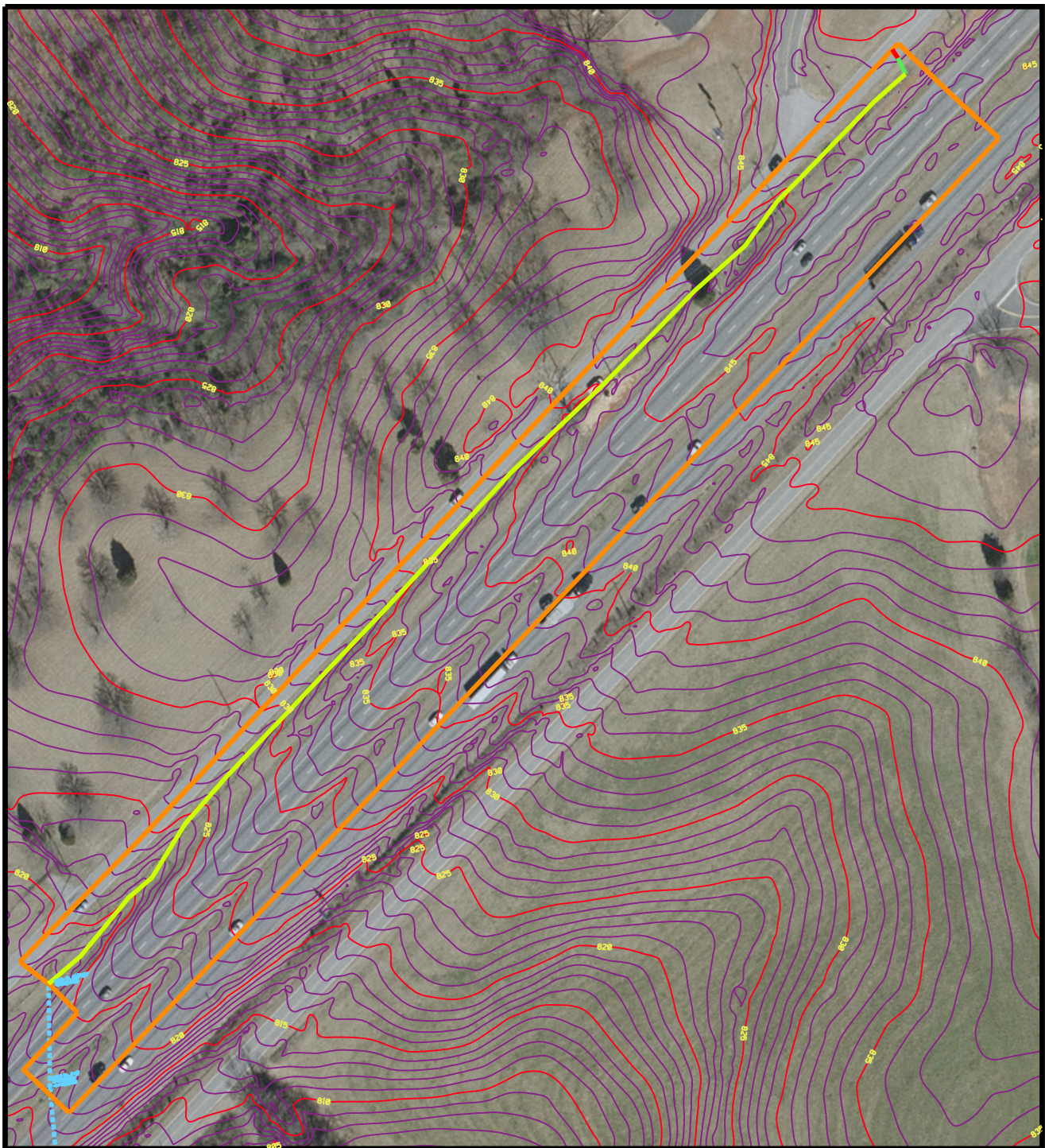
## PLAN VIEW SITE # B-29

I-85 WIDENING CHEROKEE CO MM80-96

SPARTANBURG/CHEROKEE COUNTY



SCALE:



- Watershed
- Overland
- Shallow Concentrated

- Ditch Flow
- Existing 5' Contour Line/Elevation
- Existing 1' Contour Line

\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-29

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







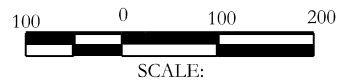
PAVEMENT & ROOFS



GRASS SHOULDERS

## LAND USE MAP - SITE # B-29

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 14.5 cfs

Design Flow: 29.9 cfs

Maximum Flow: 34.2 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-29**

Headwater Elevation (ft)	Total Discharge (cfs)	B-29 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
818.01	14.50	14.50	0.00	1
818.64	16.47	16.47	0.00	1
819.34	18.44	18.44	0.00	1
819.75	20.41	19.42	0.86	30
819.78	22.38	19.48	2.80	5
819.79	24.35	19.52	4.72	4
819.81	26.32	19.56	6.70	4
819.82	28.29	19.60	8.55	3
819.84	29.90	19.62	10.17	3
819.85	32.23	19.66	12.48	3
819.86	34.20	19.69	14.45	3
819.73	19.37	19.37	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-29**

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)
14.50	14.50	818.01	3.131	0.0*	5-S2n	0.787	1.392	0.787	0.191	15.435	9.497
16.47	16.47	818.64	3.761	0.0*	5-S2n	0.852	1.436	0.868	0.206	15.544	9.979
18.44	18.44	819.34	4.465	0.0*	5-S2n	0.917	1.500	0.917	0.221	16.304	10.424
20.41	19.42	819.75	4.870	0.0*	5-S2n	0.949	1.500	0.949	0.235	16.482	10.844
22.38	19.48	819.78	4.895	0.0*	5-S2n	0.951	1.500	0.951	0.249	16.492	11.239
24.35	19.52	819.79	4.914	0.0*	5-S2n	0.952	1.500	0.952	0.262	16.499	11.607
26.32	19.56	819.81	4.931	0.0*	5-S2n	0.954	1.500	0.954	0.275	16.506	11.964
28.29	19.60	819.82	4.945	0.0*	5-S2n	0.955	1.500	0.955	0.288	16.511	12.300
29.90	19.62	819.84	4.956	0.0*	5-S2n	0.956	1.500	0.956	0.298	16.515	12.562
32.23	19.66	819.85	4.972	0.0*	5-S2n	0.957	1.500	0.957	0.312	16.519	12.929
34.20	19.69	819.86	4.984	0.0*	5-S2n	0.958	1.500	0.958	0.323	16.522	13.224

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 814.88 ft,    Outlet Elevation (invert): 802.54 ft  
Culvert Length: 225.34 ft,    Culvert Slope: 0.0548  
\*\*\*\*\*

### **Site Data - B-29**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 814.88 ft

Outlet Station: 225.00 ft

Outlet Elevation: 802.54 ft

Number of Barrels: 1

### **Culvert Data Summary - B-29**

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Grooved End Projecting

Inlet Depression: NONE



**Table 3 - Downstream Channel Rating Curve (Crossing: B-29)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
14.50	802.36	0.19	9.50	0.68	3.83
16.47	802.38	0.21	9.98	0.73	3.87
18.44	802.39	0.22	10.42	0.79	3.91
20.41	802.41	0.24	10.84	0.84	3.94
22.38	802.42	0.25	11.24	0.89	3.97
24.35	802.43	0.26	11.61	0.93	3.99
26.32	802.44	0.27	11.96	0.98	4.02
28.29	802.46	0.29	12.30	1.02	4.04
29.90	802.47	0.30	12.56	1.06	4.06
32.23	802.48	0.31	12.93	1.11	4.08
34.20	802.49	0.32	13.22	1.15	4.10

**Tailwater Channel Data - B-29**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 8.00 ft

Channel Slope: 0.0570

Channel Manning's n: 0.0120

Channel Invert Elevation: 802.17 ft

**Roadway Data for Crossing: B-29**

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 819.73 ft

Roadway Surface: Paved

Roadway Top Width: 142.00 ft

# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 14.5 cfs

Design Flow: 29.9 cfs

Maximum Flow: 34.2 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-29 Proposed**

Headwater Elevation (ft)	Total Discharge (cfs)	B-29 Proposed Discharge (cfs)	Roadway Discharge (cfs)	Iterations
816.52	14.50	14.50	0.00	1
816.66	16.47	16.47	0.00	1
816.80	18.44	18.44	0.00	1
816.93	20.41	20.41	0.00	1
817.05	22.38	22.38	0.00	1
817.17	24.35	24.35	0.00	1
817.29	26.32	26.32	0.00	1
817.40	28.29	28.29	0.00	1
817.49	29.90	29.90	0.00	1
817.63	32.23	32.23	0.00	1
817.74	34.20	34.20	0.00	1
819.73	60.84	60.84	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-29 Proposed**

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)
14.50	14.50	816.52	1.641	0.0*	1-S2n	0.586	1.208	0.586	0.191	15.100	9.497
16.47	16.47	816.66	1.784	0.0*	1-S2n	0.621	1.295	0.621	0.206	15.441	9.979
18.44	18.44	816.80	1.918	0.0*	1-S2n	0.656	1.375	0.656	0.221	15.973	10.424
20.41	20.41	816.93	2.047	0.0*	1-S2n	0.691	1.451	0.691	0.235	16.430	10.844
22.38	22.38	817.05	2.170	0.0*	1-S2n	0.726	1.522	0.753	0.249	16.020	11.239
24.35	24.35	817.17	2.289	0.0*	1-S2n	0.761	1.588	0.761	0.262	17.173	11.607
26.32	26.32	817.29	2.405	0.0*	1-S2n	0.796	1.651	0.796	0.275	17.480	11.964
28.29	28.29	817.40	2.520	0.0*	1-S2n	0.828	1.717	0.847	0.288	17.309	12.300
29.90	29.90	817.49	2.613	0.0*	1-S2n	0.849	1.766	0.849	0.298	18.233	12.562
32.23	32.23	817.63	2.749	0.0*	1-S2n	0.881	1.839	0.891	0.312	18.251	12.929
34.20	34.20	817.74	2.865	0.0*	1-S2n	0.907	1.896	0.940	0.323	17.974	13.224

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 814.88 ft,    Outlet Elevation (invert): 802.54 ft  
Culvert Length: 225.34 ft,    Culvert Slope: 0.0548  
\*\*\*\*\*

### **Site Data - B-29 Proposed**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 814.88 ft

Outlet Station: 225.00 ft

Outlet Elevation: 802.54 ft

Number of Barrels: 1

### **Culvert Data Summary - B-29 Proposed**

Barrel Shape: Circular

Barrel Diameter: 3.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-29 Proposed)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
14.50	802.36	0.19	9.50	0.68	3.83
16.47	802.38	0.21	9.98	0.73	3.87
18.44	802.39	0.22	10.42	0.79	3.91
20.41	802.41	0.24	10.84	0.84	3.94
22.38	802.42	0.25	11.24	0.89	3.97
24.35	802.43	0.26	11.61	0.93	3.99
26.32	802.44	0.27	11.96	0.98	4.02
28.29	802.46	0.29	12.30	1.02	4.04
29.90	802.47	0.30	12.56	1.06	4.06
32.23	802.48	0.31	12.93	1.11	4.08
34.20	802.49	0.32	13.22	1.15	4.10



**Tailwater Channel Data - B-29 Proposed**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 8.00 ft

Channel Slope: 0.0570

Channel Manning's n: 0.0120

Channel Invert Elevation: 802.17 ft

**Roadway Data for Crossing: B-29 Proposed**

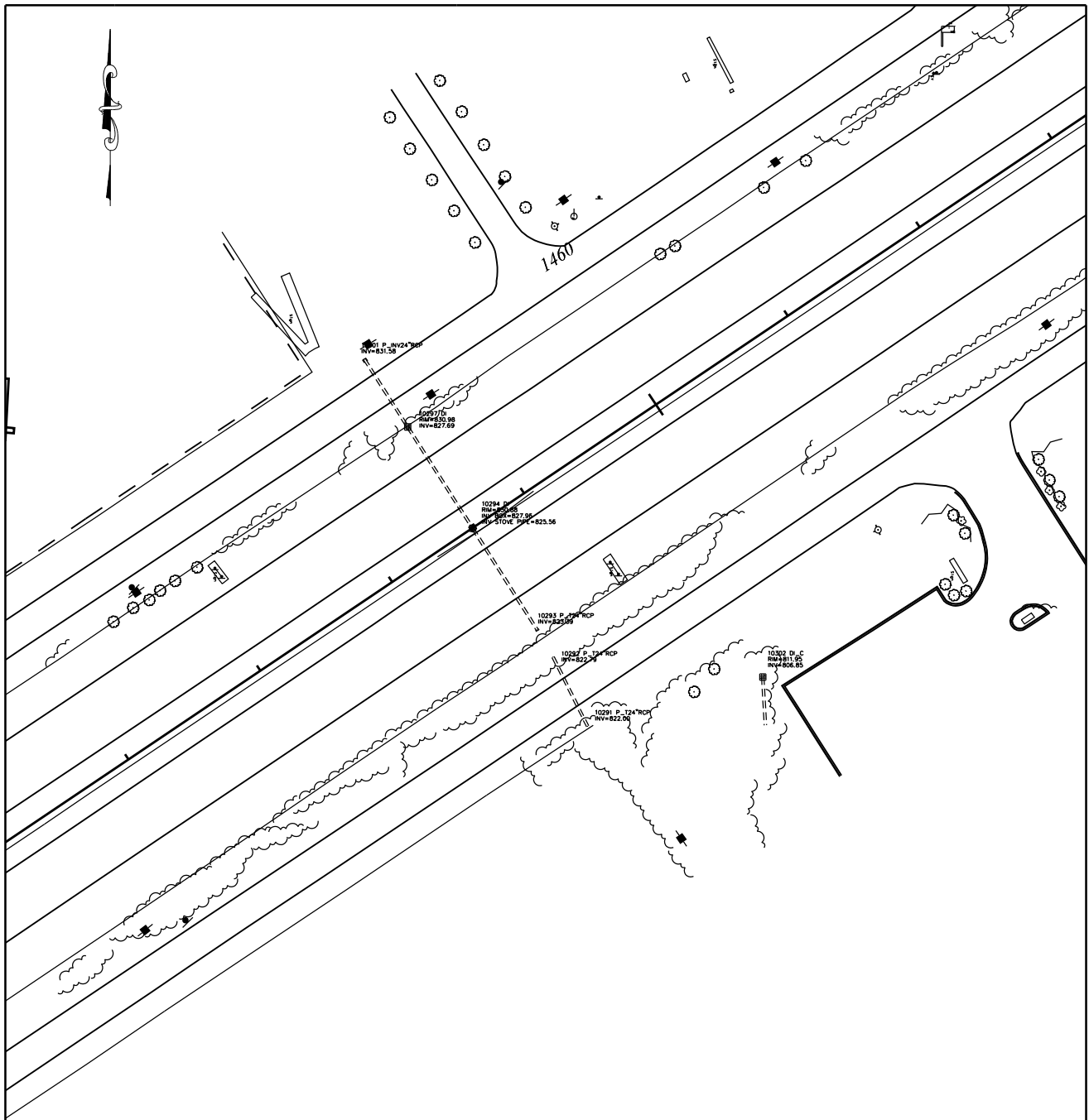
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 819.73 ft

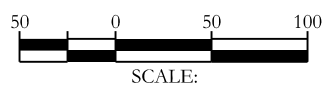
Roadway Surface: Paved

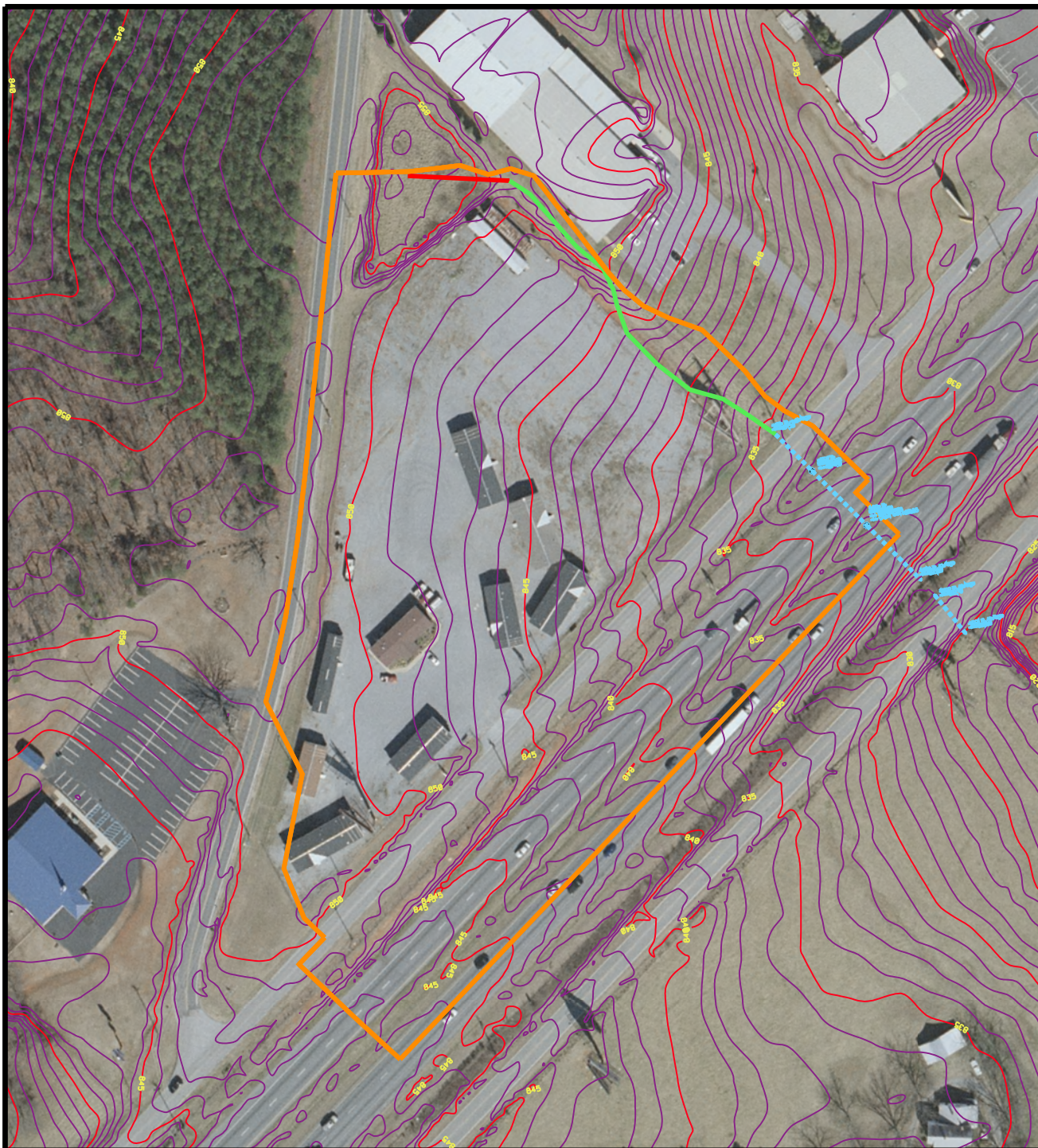
Roadway Top Width: 142.00 ft



PLAN VIEW SITE # B-30

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY





- |   |   |
|---|---|
| <span style="color: yellow;">—</span> Watershed           | <span style="color: blue;">—</span> Ditch Flow                        |
| <span style="color: orange;">—</span> Overland            | <span style="color: red;">—</span> Existing 5' Contour Line/Elevation |
| <span style="color: green;">—</span> Shallow Concentrated | <span style="color: purple;">—</span> Existing 1' Contour Line        |

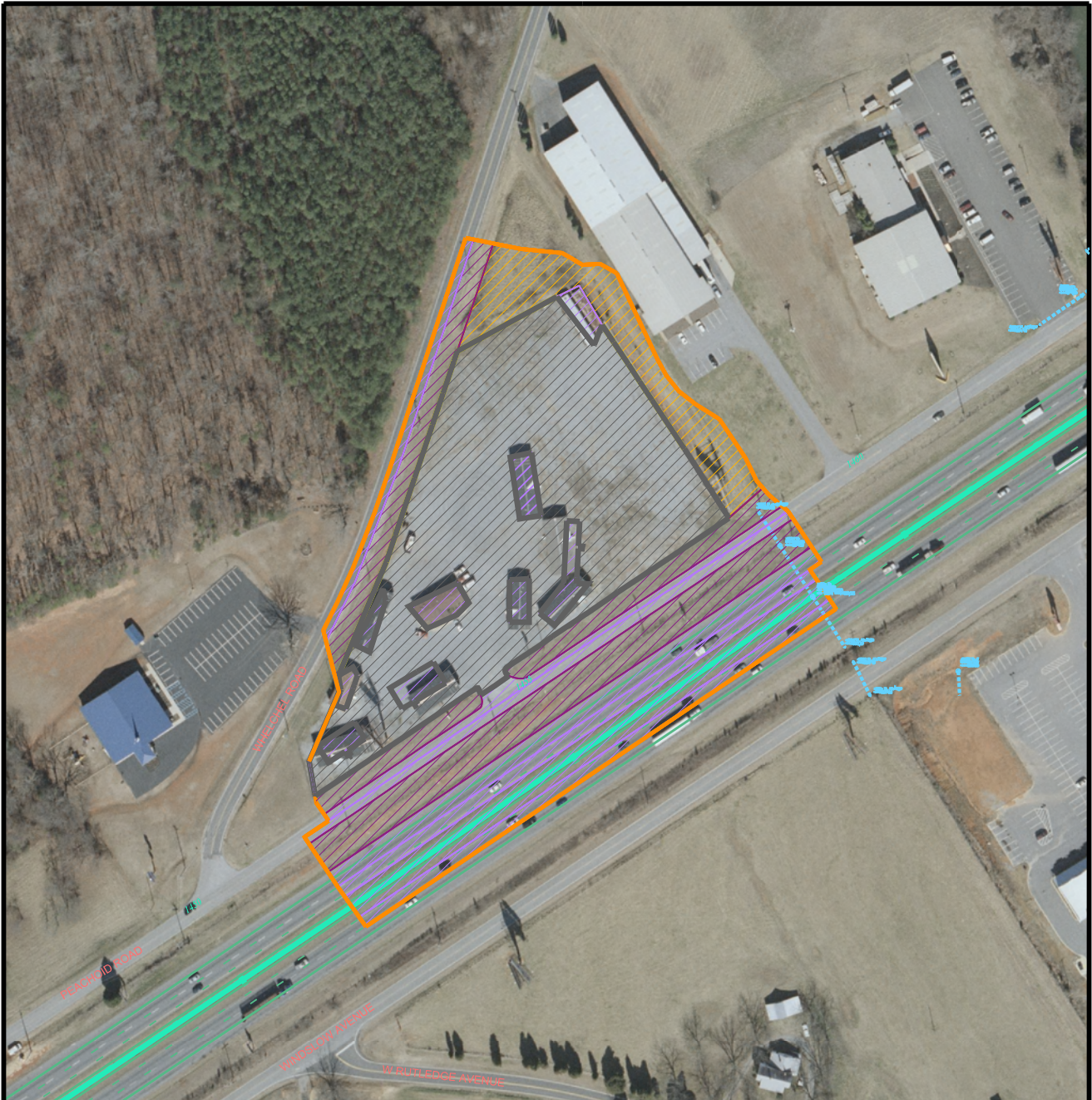
\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-30

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







PAVEMENT & ROOFS



LAWNS SANDY SOIL



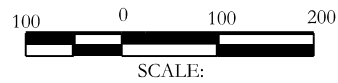
GRASS SHOULDERS



GRAVEL PAVEMENT

## LAND USE MAP - SITE # B-30

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 10.7 cfs

Design Flow: 21.7 cfs

Maximum Flow: 24.7 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-30**

Headwater Elevation (ft)	Total Discharge (cfs)	B-30 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
833.32	10.70	10.70	0.00	1
833.47	12.10	12.10	0.00	1
833.62	13.50	13.50	0.00	1
833.79	14.90	14.90	0.00	1
833.96	16.30	16.30	0.00	1
834.02	17.70	16.77	0.85	10
834.04	19.10	16.90	2.07	4
834.05	20.50	17.01	3.41	4
834.06	21.70	17.09	4.48	3
834.07	23.30	17.19	5.98	3
834.09	24.70	17.27	7.34	3
834.00	16.62	16.62	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-30**

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)
10.70	10.70	833.32	1.740	0.0*	1-S2n	0.627	1.169	0.635	0.890	12.443	0.000
12.10	12.10	833.47	1.890	0.0*	1-S2n	0.670	1.244	0.670	0.890	13.073	0.000
13.50	13.50	833.62	2.044	0.0*	5-S2n	0.713	1.320	0.713	0.890	13.427	0.000
14.90	14.90	833.79	2.206	0.0*	5-S2n	0.751	1.387	0.771	0.890	13.379	0.000
16.30	16.30	833.96	2.379	0.0*	5-S2n	0.788	1.451	0.788	0.890	14.160	0.000
17.70	16.77	834.02	2.440	0.0*	5-S2n	0.800	1.475	0.800	0.890	14.272	0.000
19.10	16.90	834.04	2.457	0.0*	5-S2n	0.803	1.480	0.803	0.890	14.301	0.000
20.50	17.01	834.05	2.472	0.0*	5-S2n	0.806	1.485	0.806	0.890	14.326	0.000
21.70	17.09	834.06	2.482	0.0*	5-S2n	0.808	1.488	0.808	0.890	14.343	0.000
23.30	17.19	834.07	2.495	0.0*	5-S2n	0.811	1.492	0.841	0.890	13.697	0.000
24.70	17.27	834.09	2.506	0.0*	5-S2n	0.813	1.496	0.841	0.890	13.745	0.000

\* Full Flow Headwater elevation is below inlet invert.



\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 831.58 ft,    Outlet Elevation (invert): 823.39 ft  
Culvert Length: 202.17 ft,    Culvert Slope: 0.0405  
\*\*\*\*\*

### **Site Data - B-30**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 831.58 ft

Outlet Station: 202.00 ft

Outlet Elevation: 823.39 ft

Number of Barrels: 1

### **Culvert Data Summary - B-30**

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-30)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
10.70	824.28	0.89
12.10	824.28	0.89
13.50	824.28	0.89
14.90	824.28	0.89
16.30	824.28	0.89
17.70	824.28	0.89
19.10	824.28	0.89
20.50	824.28	0.89
21.70	824.28	0.89
23.30	824.28	0.89
24.70	824.28	0.89

**Tailwater Channel Data - B-30**

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 824.28 ft

**Roadway Data for Crossing: B-30**

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 834.00 ft

Roadway Surface: Paved

Roadway Top Width: 168.00 ft

## **Crossing Discharge Data**

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 3.8 cfs

Design Flow: 8 cfs

Maximum Flow: 9.2 cfs

**Table 4 - Summary of Culvert Flows at Crossing: B-30 Downstream**

Headwater Elevation (ft)	Total Discharge (cfs)	B-30 Downstream Discharge (cfs)	Roadway Discharge (cfs)	Iterations
823.71	3.80	3.80	0.00	1
823.78	4.34	4.34	0.00	1
823.85	4.88	4.88	0.00	1
823.92	5.42	5.42	0.00	1
823.99	5.96	5.96	0.00	1
824.05	6.50	6.50	0.00	1
824.11	7.04	7.04	0.00	1
824.17	7.58	7.58	0.00	1
824.21	8.00	8.00	0.00	1
824.28	8.66	8.66	0.00	1
824.33	9.20	9.20	0.00	1
828.00	34.51	34.51	0.00	Overtopping

**Table 5 - Culvert Summary Table: B-30 Downstream**

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)
3.80	3.80	823.71	0.922	0.0*	1-S2n	0.461	0.678	0.480	0.128	6.499	2.961
4.34	4.34	823.78	0.992	0.0*	1-S2n	0.495	0.729	0.515	0.139	6.748	3.117
4.88	4.88	823.85	1.064	0.046	1-S2n	0.530	0.773	0.548	0.149	6.980	3.266
5.42	5.42	823.92	1.134	0.107	1-S2n	0.560	0.819	0.580	0.159	7.206	3.403
5.96	5.96	823.99	1.200	0.167	1-S2n	0.586	0.862	0.612	0.169	7.284	3.532
6.50	6.50	824.05	1.263	0.226	1-S2n	0.612	0.903	0.642	0.178	7.443	3.654
7.04	7.04	824.11	1.323	0.285	1-S2n	0.638	0.942	0.671	0.187	7.588	3.771
7.58	7.58	824.17	1.381	0.343	1-S2n	0.664	0.979	0.699	0.195	7.735	3.880
8.00	8.00	824.21	1.425	0.388	1-S2n	0.684	1.006	0.721	0.202	7.841	3.964
8.66	8.66	824.28	1.491	0.459	1-S2n	0.716	1.048	0.755	0.212	7.996	4.087
9.20	9.20	824.33	1.544	0.518	1-S2n	0.740	1.081	0.781	0.220	8.083	4.185

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 822.79 ft,    Outlet Elevation (invert): 822.00 ft  
Culvert Length: 48.01 ft,    Culvert Slope: 0.0165  
\*\*\*\*\*

### Site Data - B-30 Downstream

Site Data Option: Culvert Invert Data  
Inlet Station: 0.00 ft  
Inlet Elevation: 822.79 ft  
Outlet Station: 48.00 ft  
Outlet Elevation: 822.00 ft  
Number of Barrels: 1

### Culvert Data Summary - B-30 Downstream

Barrel Shape: Circular  
Barrel Diameter: 2.00 ft  
Barrel Material: Concrete  
Embedment: 0.00 in  
Barrel Manning's n: 0.0120  
Culvert Type: Straight  
Inlet Configuration: Grooved End Projecting  
Inlet Depression: NONE



**Table 6 - Downstream Channel Rating Curve (Crossing: B-30 Downstream)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
3.80	822.13	0.13	2.96	0.46	1.46
4.34	822.14	0.14	3.12	0.50	1.47
4.88	822.15	0.15	3.27	0.53	1.49
5.42	822.16	0.16	3.40	0.57	1.50
5.96	822.17	0.17	3.53	0.60	1.52
6.50	822.18	0.18	3.65	0.63	1.53
7.04	822.19	0.19	3.77	0.66	1.54
7.58	822.20	0.20	3.88	0.69	1.55
8.00	822.20	0.20	3.96	0.72	1.55
8.66	822.21	0.21	4.09	0.75	1.56
9.20	822.22	0.22	4.19	0.78	1.57

### **Tailwater Channel Data - B-30 Downstream**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 10.00 ft

Channel Slope: 0.0570

Channel Manning's n: 0.0300

Channel Invert Elevation: 822.00 ft

### **Roadway Data for Crossing: B-30 Downstream**

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 828.00 ft

Roadway Surface: Paved

Roadway Top Width: 20.00 ft

# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 10.7 cfs

Design Flow: 21.7 cfs

Maximum Flow: 24.7 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-30 Proposed**

Headwater Elevation (ft)	Total Discharge (cfs)	B-30 Proposed Discharge (cfs)	Roadway Discharge (cfs)	Iterations
832.70	10.70	10.70	0.00	1
832.79	12.10	12.10	0.00	1
832.88	13.50	13.50	0.00	1
832.96	14.90	14.90	0.00	1
833.04	16.30	16.30	0.00	1
833.12	17.70	17.70	0.00	1
833.20	19.10	19.10	0.00	1
833.27	20.50	20.50	0.00	1
833.34	21.70	21.70	0.00	1
833.42	23.30	23.30	0.00	1
833.50	24.70	24.70	0.00	1
834.00	33.23	33.23	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-30 Proposed**

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)
10.70	10.70	832.70	1.120	0.0*	1-S2n	0.436	0.813	0.436	0.890	10.465	0.000
12.10	12.10	832.79	1.213	0.0*	1-S2n	0.465	0.869	0.465	0.890	10.827	0.000
13.50	13.50	832.88	1.300	0.0*	1-S2n	0.493	0.921	0.493	0.890	11.133	0.000
14.90	14.90	832.96	1.384	0.0*	1-S2n	0.521	0.970	0.521	0.890	11.394	0.000
16.30	16.30	833.04	1.464	0.0*	1-S2n	0.549	1.016	0.549	0.890	11.649	0.000
17.70	17.70	833.12	1.542	0.0*	1-S2n	0.570	1.060	0.572	0.890	11.997	0.000
19.10	19.10	833.20	1.618	0.0*	1-S2n	0.592	1.101	0.592	0.890	12.380	0.000
20.50	20.50	833.27	1.693	0.0*	1-S2n	0.613	1.144	0.613	0.890	12.499	0.000
21.70	21.70	833.34	1.756	0.0*	1-S2n	0.632	1.178	0.628	0.890	12.799	0.000
23.30	23.30	833.42	1.842	0.0*	1-S2n	0.656	1.221	0.656	0.890	12.946	0.000
24.70	24.70	833.50	1.917	0.0*	1-S2n	0.678	1.261	0.706	0.890	12.446	0.000

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 831.58 ft,    Outlet Elevation (invert): 823.39 ft  
Culvert Length: 202.17 ft,    Culvert Slope: 0.0405  
\*\*\*\*\*

### **Site Data - B-30 Proposed**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 831.58 ft

Outlet Station: 202.00 ft

Outlet Elevation: 823.39 ft

Number of Barrels: 2

### **Culvert Data Summary - B-30 Proposed**

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-30 Proposed)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
10.70	824.28	0.89
12.10	824.28	0.89
13.50	824.28	0.89
14.90	824.28	0.89
16.30	824.28	0.89
17.70	824.28	0.89
19.10	824.28	0.89
20.50	824.28	0.89
21.70	824.28	0.89
23.30	824.28	0.89
24.70	824.28	0.89



### **Tailwater Channel Data - B-30 Proposed**

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 824.28 ft

### **Roadway Data for Crossing: B-30 Proposed**

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 834.00 ft

Roadway Surface: Paved

Roadway Top Width: 168.00 ft



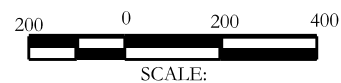


- |                        |                                      |
|------------------------|--------------------------------------|
| — Watershed            | — Ditch Flow                         |
| — Overland             | — Existing 5' Contour Line/Elevation |
| — Shallow Concentrated | — Existing 1' Contour Line           |

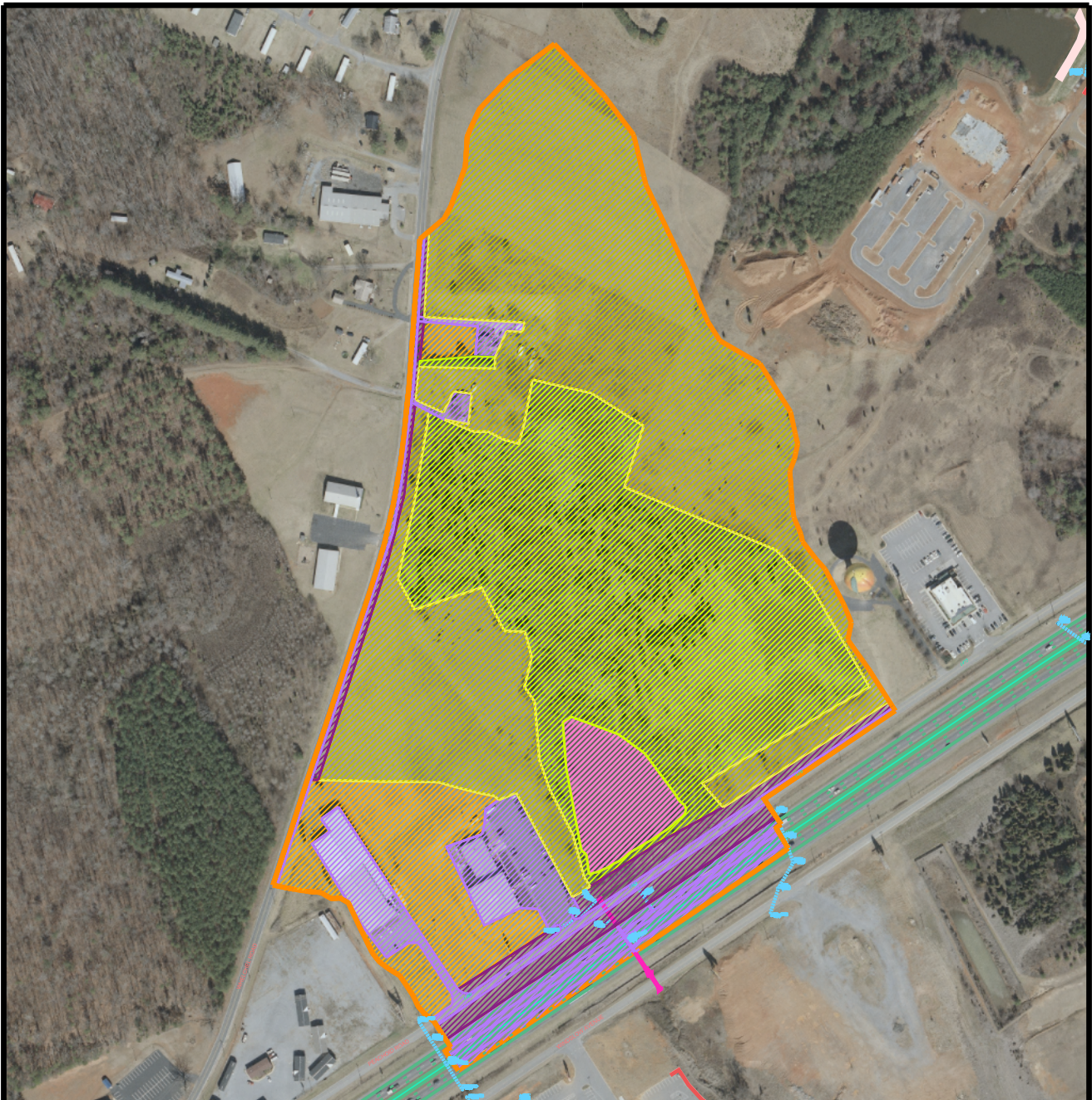
\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-31

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



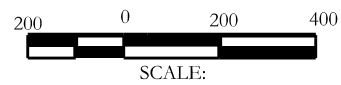




- |   |                  |   |                   |
|---|------------------|---|-------------------|
|  | PAVEMENT & ROOFS |  | LAWNS SANDY SOIL  |
|  | GRASS SHOULDERS  |  | WOODLAND & FOREST |
|  | UNIMPROVED AREA  |  | WATER             |

## LAND USE MAP - SITE # B-31

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 37.3 cfs

Design Flow: 72.8 cfs

Maximum Flow: 82.2 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-31**

Headwater Elevation (ft)	Total Discharge (cfs)	B-31 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
817.71	37.30	37.30	0.00	1
817.88	41.79	41.79	0.00	1
818.03	46.28	46.28	0.00	1
818.18	50.77	50.77	0.00	1
818.33	55.26	55.26	0.00	1
818.47	59.75	59.75	0.00	1
818.61	64.24	64.24	0.00	1
818.75	68.73	68.73	0.00	1
818.88	72.80	72.80	0.00	1
819.03	77.71	77.71	0.00	1
819.17	82.20	82.20	0.00	1
825.00	285.77	285.77	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-31**

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)
37.30	37.30	817.71	2.045	0.0*	1-S2n	0.614	1.393	0.614	0.640	15.183	0.000
41.79	41.79	817.88	2.206	0.0*	1-S2n	0.659	1.502	0.700	0.640	14.930	0.000
46.28	46.28	818.03	2.361	0.0*	1-S2n	0.704	1.608	0.745	0.640	15.539	0.000
50.77	50.77	818.18	2.511	0.0*	1-S2n	0.749	1.710	0.791	0.640	16.050	0.000
55.26	55.26	818.33	2.657	0.0*	1-S2n	0.794	1.810	0.838	0.640	16.484	0.000
59.75	59.75	818.47	2.799	0.0*	1-S2n	0.839	1.906	0.886	0.640	16.862	0.000
64.24	64.24	818.61	2.938	0.0*	1-S2n	0.884	2.001	0.933	0.640	17.206	0.000
68.73	68.73	818.75	3.079	0.0*	1-S2n	0.929	2.093	0.980	0.640	17.532	0.000
72.80	72.80	818.88	3.209	0.0*	1-S2n	0.970	2.175	1.020	0.640	17.846	0.000
77.71	77.71	819.03	3.363	0.0*	1-S2n	1.019	2.272	1.068	0.640	18.185	0.000
82.20	82.20	819.17	3.502	0.0*	1-S2n	1.064	2.358	1.110	0.640	18.506	0.000

\* Full Flow Headwater elevation is below inlet invert.



\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 815.67 ft,    Outlet Elevation (invert): 807.65 ft  
Culvert Length: 205.16 ft,    Culvert Slope: 0.0391  
\*\*\*\*\*

### Site Data - B-31

Site Data Option: Culvert Invert Data  
Inlet Station: 0.00 ft  
Inlet Elevation: 815.67 ft  
Outlet Station: 205.00 ft  
Outlet Elevation: 807.65 ft  
Number of Barrels: 1

### Culvert Data Summary - B-31

Barrel Shape: Concrete Box  
Barrel Span: 4.00 ft  
Barrel Rise: 6.00 ft  
Barrel Material: Concrete  
Embedment: 0.00 in  
Barrel Manning's n: 0.0120  
Culvert Type: Straight  
Inlet Configuration: 1:1 Bevel (45° flare) Wingwall  
Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-31)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
37.30	808.29	0.64
41.79	808.29	0.64
46.28	808.29	0.64
50.77	808.29	0.64
55.26	808.29	0.64
59.75	808.29	0.64
64.24	808.29	0.64
68.73	808.29	0.64
72.80	808.29	0.64
77.71	808.29	0.64
82.20	808.29	0.64

### **Tailwater Channel Data - B-31**

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 808.29 ft

### **Roadway Data for Crossing: B-31**

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 825.00 ft

Roadway Surface: Paved

Roadway Top Width: 169.00 ft

## **Crossing Discharge Data**

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 4.7 cfs

Design Flow: 9.9 cfs

Maximum Flow: 11.2 cfs

**Table 4 - Summary of Culvert Flows at Crossing: B-31 Downstream**

Headwater Elevation (ft)	Total Discharge (cfs)	B-32 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
806.78	4.70	4.70	0.00	1
806.82	5.35	5.35	0.00	1
806.85	6.00	6.00	0.00	1
806.88	6.65	6.65	0.00	1
806.91	7.30	7.30	0.00	1
806.94	7.95	7.95	0.00	1
806.97	8.60	8.60	0.00	1
807.00	9.25	9.25	0.00	1
807.03	9.90	9.90	0.00	1
807.03	9.90	9.90	0.00	1
807.09	11.20	11.20	0.00	1
816.00	339.93	339.93	0.00	Overtopping

**Table 5 - Culvert Summary Table: B-32**

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)
4.70	4.70	806.78	0.390	0.0*	1-S2n	0.063	0.267	0.124	0.167	6.336	1.560
5.35	5.35	806.82	0.425	0.0*	1-S2n	0.072	0.291	0.134	0.181	6.670	1.643
6.00	6.00	806.85	0.459	0.0*	1-S2n	0.080	0.314	0.145	0.194	6.886	1.719
6.65	6.65	806.88	0.492	0.0*	1-S2n	0.089	0.337	0.152	0.206	7.303	1.790
7.30	7.30	806.91	0.523	0.0*	1-S2n	0.098	0.358	0.163	0.218	7.474	1.856
7.95	7.95	806.94	0.554	0.0*	1-S2n	0.106	0.379	0.174	0.230	7.597	1.920
8.60	8.60	806.97	0.583	0.0*	1-S2n	0.115	0.400	0.179	0.241	8.001	1.980
9.25	9.25	807.00	0.612	0.0*	1-S2n	0.124	0.419	0.188	0.252	8.202	2.037
9.90	9.90	807.03	0.641	0.0*	1-S2n	0.132	0.439	0.200	0.263	8.252	2.093
9.90	9.90	807.03	0.641	0.0*	1-S2n	0.132	0.439	0.200	0.263	8.252	2.093
11.20	11.20	807.09	0.696	0.0*	1-S2n	0.150	0.477	0.218	0.283	8.565	2.197

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 806.39 ft,    Outlet Elevation (invert): 804.22 ft  
Culvert Length: 48.05 ft,    Culvert Slope: 0.0452  
\*\*\*\*\*

### **Site Data - B-32**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 806.39 ft

Outlet Station: 48.00 ft

Outlet Elevation: 804.22 ft

Number of Barrels: 1

### **Culvert Data Summary - B-32**

Barrel Shape: Concrete Box

Barrel Span: 6.00 ft

Barrel Rise: 4.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: 1:1 Bevel (45° flare) Wingwall

Inlet Depression: NONE



**Table 6 - Downstream Channel Rating Curve (Crossing: B-31 Downstream)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
4.70	804.39	0.17	1.56	0.16	0.67
5.35	804.40	0.18	1.64	0.17	0.68
6.00	804.41	0.19	1.72	0.18	0.69
6.65	804.43	0.21	1.79	0.19	0.69
7.30	804.44	0.22	1.86	0.20	0.70
7.95	804.45	0.23	1.92	0.22	0.71
8.60	804.46	0.24	1.98	0.23	0.71
9.25	804.47	0.25	2.04	0.24	0.71
9.90	804.48	0.26	2.09	0.25	0.72
9.90	804.48	0.26	2.09	0.25	0.72
11.20	804.50	0.28	2.20	0.27	0.73

**Tailwater Channel Data - B-31 Downstream**

Tailwater Channel Option: Rectangular Channel

Bottom Width: 18.00 ft

Channel Slope: 0.0150

Channel Manning's n: 0.0350

Channel Invert Elevation: 804.22 ft

**Roadway Data for Crossing: B-31 Downstream**

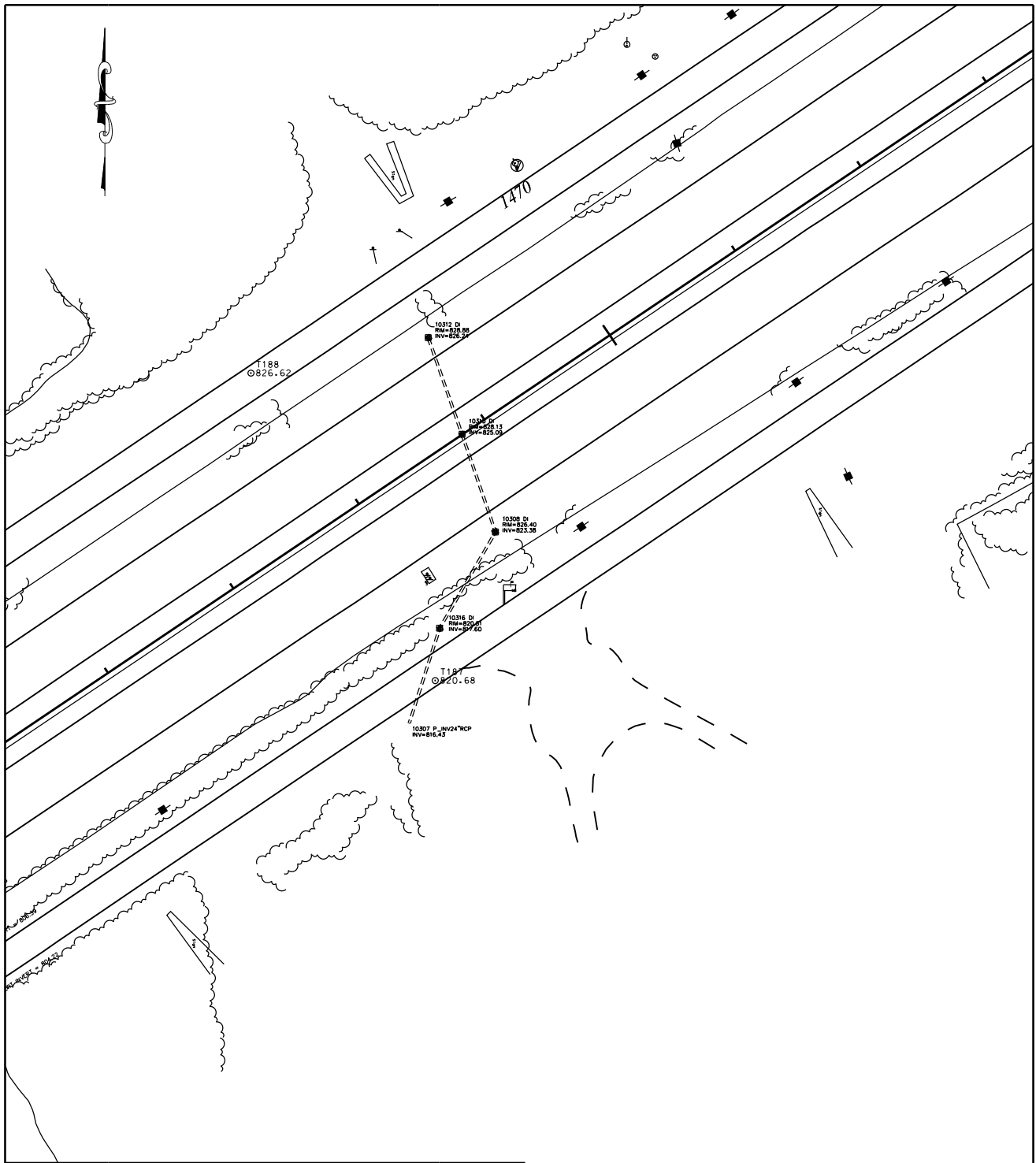
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 816.00 ft

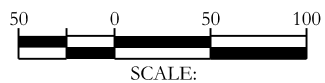
Roadway Surface: Paved

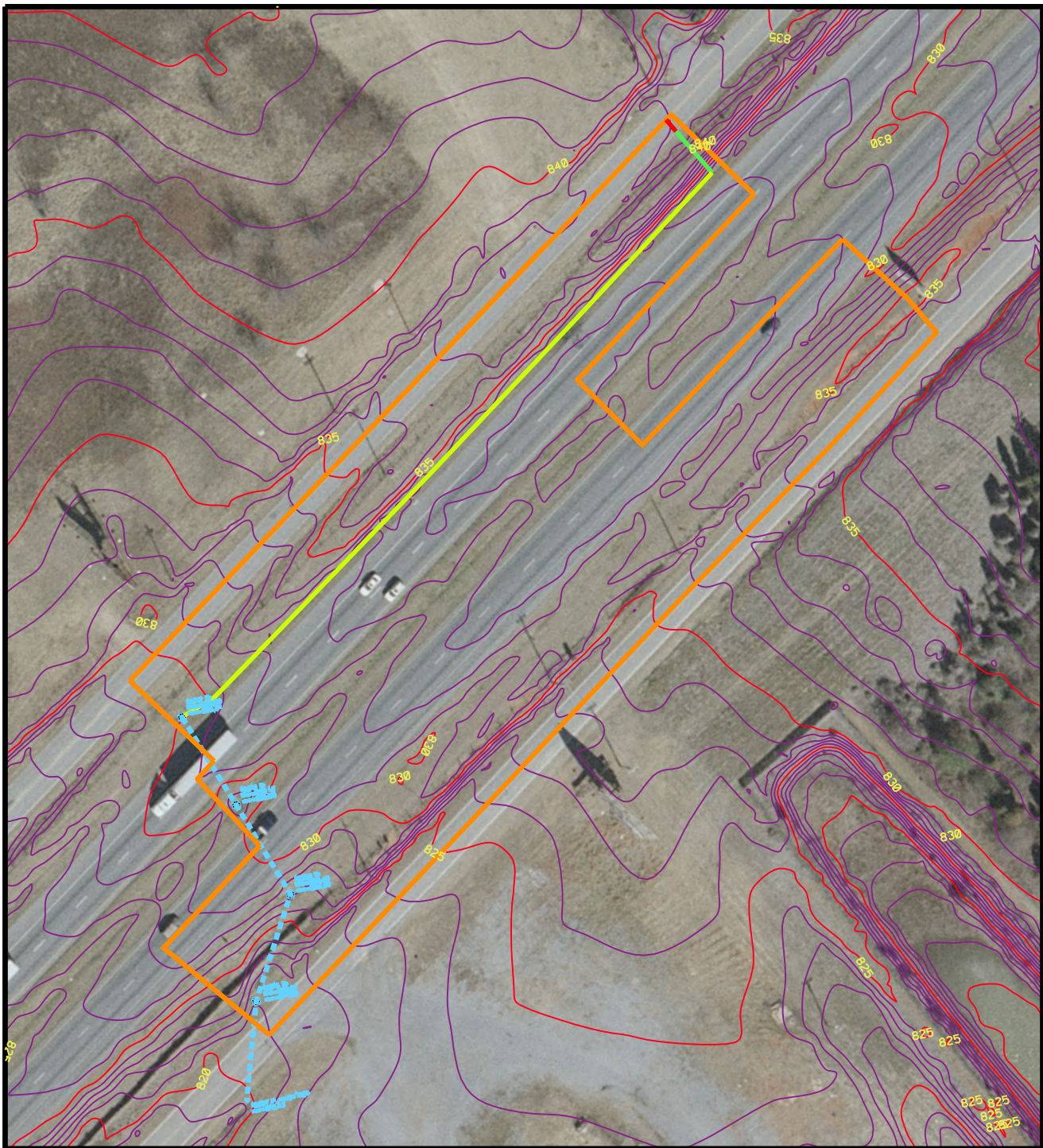
Roadway Top Width: 20.00 ft



PLAN VIEW SITE # B-32

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY





- |  |  |
|--|--|
|  Watershed            |  Ditch Flow                         |
|  Overland             |  Existing 5' Contour Line/Elevation |
|  Shallow Concentrated |  Existing 1' Contour Line           |

\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-32

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 8.1 cfs

Design Flow: 16.8 cfs

Maximum Flow: 19.2 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-32**

Headwater Elevation (ft)	Total Discharge (cfs)	B-32 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
827.65	8.10	8.10	0.00	1
827.75	9.21	9.21	0.00	1
827.86	10.32	10.32	0.00	1
827.96	11.43	11.43	0.00	1
828.06	12.54	12.54	0.00	1
828.16	13.65	13.65	0.00	1
828.27	14.76	14.76	0.00	1
828.38	15.87	15.87	0.00	1
828.48	16.80	16.80	0.00	1
828.61	18.09	18.09	0.00	1
828.74	19.20	19.20	0.00	1
830.50	30.90	30.90	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-32**

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)
8.10	8.10	827.65	1.405	0.0*	1-S2n	0.554	1.013	0.554	0.627	11.439	3.435
9.21	9.21	827.75	1.514	0.0*	1-S2n	0.589	1.081	0.589	0.658	12.015	3.547
10.32	10.32	827.86	1.618	0.0*	1-S2n	0.624	1.148	0.624	0.687	12.290	3.649
11.43	11.43	827.96	1.720	0.0*	1-S2n	0.659	1.209	0.659	0.713	12.634	3.744
12.54	12.54	828.06	1.822	0.0*	1-S2n	0.694	1.271	0.694	0.739	12.932	3.831
13.65	13.65	828.16	1.925	0.0*	1-S2n	0.728	1.327	0.728	0.762	13.197	3.914
14.76	14.76	828.27	2.030	0.0*	5-S2n	0.758	1.380	0.758	0.785	13.549	3.991
15.87	15.87	828.38	2.140	0.0*	5-S2n	0.788	1.431	0.783	0.807	13.903	4.064
16.80	16.80	828.48	2.235	0.0*	5-S2n	0.812	1.476	0.812	0.824	14.006	4.122
18.09	18.09	828.61	2.374	0.0*	5-S2n	0.847	1.530	0.871	0.847	13.755	4.199
19.20	19.20	828.74	2.501	0.0*	5-S2n	0.877	1.574	0.877	0.866	14.488	4.262



\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 826.24 ft,    Outlet Elevation (invert): 816.43 ft  
Culvert Length: 255.19 ft,    Culvert Slope: 0.0385  
\*\*\*\*\*

### **Site Data - B-32**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 826.24 ft

Outlet Station: 255.00 ft

Outlet Elevation: 816.43 ft

Number of Barrels: 1

### **Culvert Data Summary - B-32**

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Grooved End in Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-32)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
8.10	817.06	0.63	3.43	0.90	1.08
9.21	817.09	0.66	3.55	0.94	1.09
10.32	817.12	0.69	3.65	0.99	1.10
11.43	817.14	0.71	3.74	1.02	1.10
12.54	817.17	0.74	3.83	1.06	1.11
13.65	817.19	0.76	3.91	1.09	1.12
14.76	817.22	0.79	3.99	1.13	1.12
15.87	817.24	0.81	4.06	1.16	1.13
16.80	817.25	0.82	4.12	1.18	1.13
18.09	817.28	0.85	4.20	1.22	1.14
19.20	817.30	0.87	4.26	1.24	1.14

**Tailwater Channel Data - B-32**

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 6.00 (1:1)

Channel Slope: 0.0230

Channel Manning's n: 0.0300

Channel Invert Elevation: 816.43 ft

**Roadway Data for Crossing: B-32**

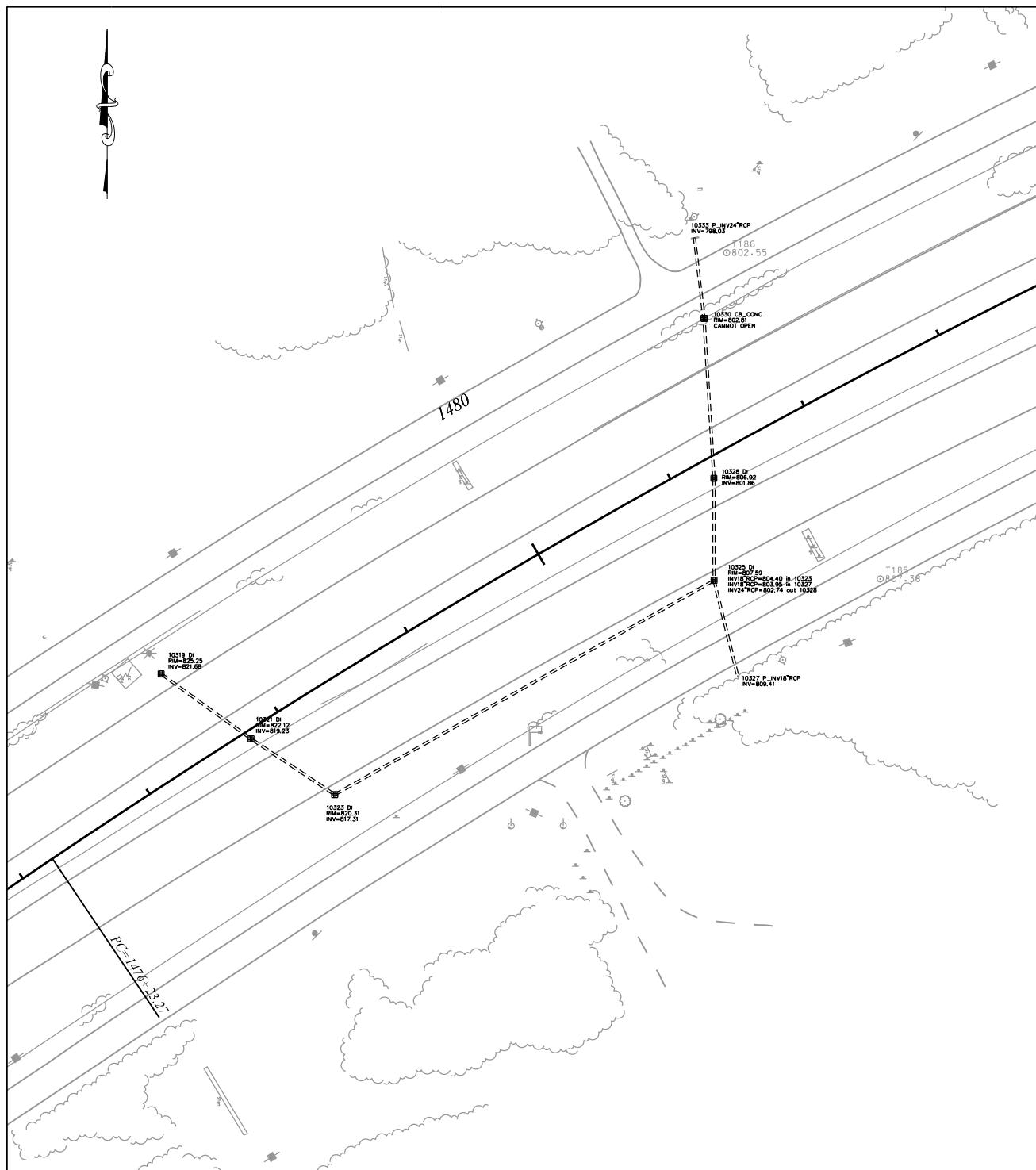
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 830.50 ft

Roadway Surface: Paved

Roadway Top Width: 225.00 ft



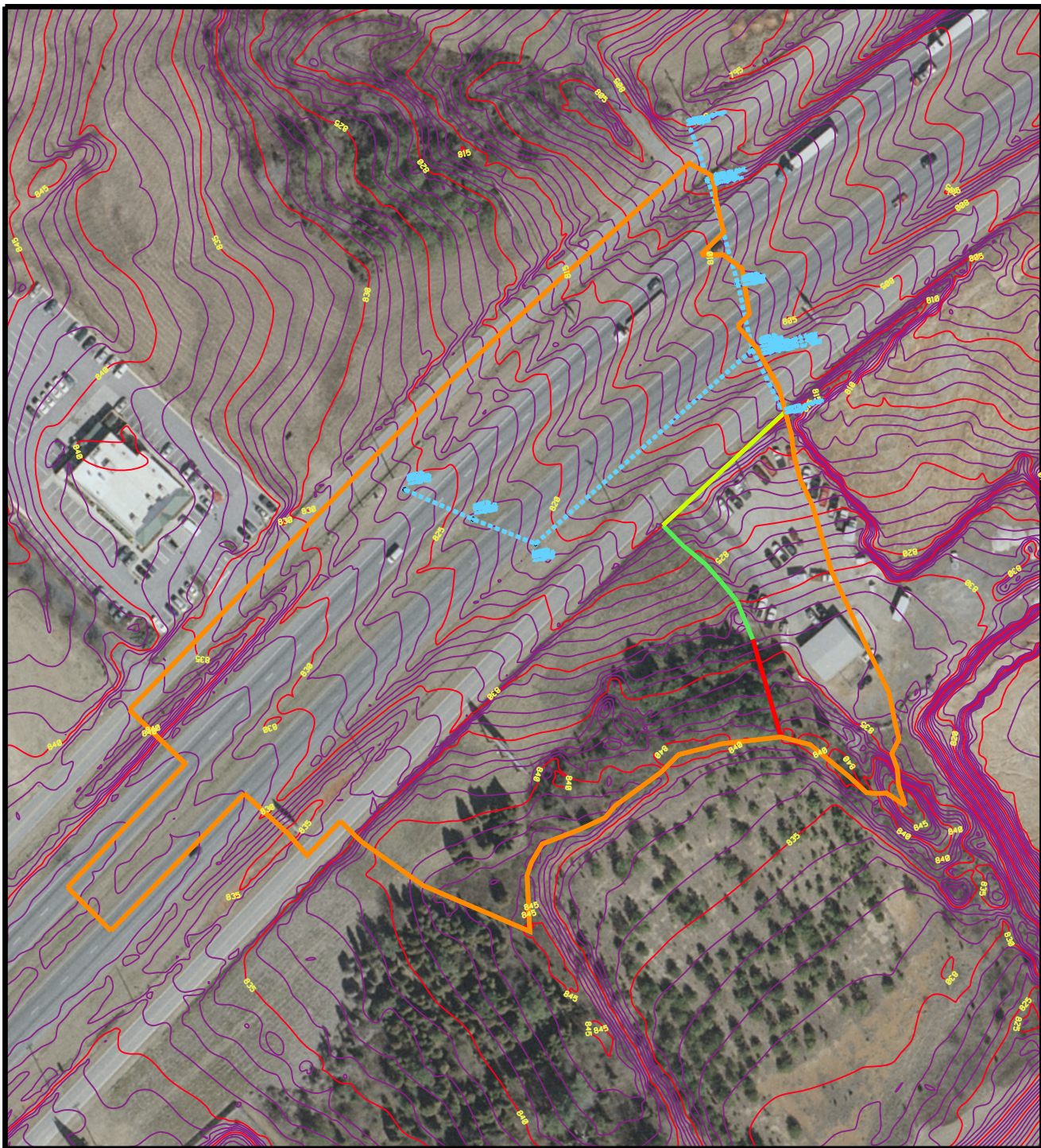
## PLAN VIEW SITE # B-33

I-85 WIDENING CHEROKEE CO MM80-96

SPARTANBURG/CHEROKEE COUNTY



SCALE:



- |  |  |
|--|--|
|  Watershed            |  Ditch Flow                         |
|  Overland             |  Existing 5' Contour Line/Elevation |
|  Shallow Concentrated |  Existing 1' Contour Line           |

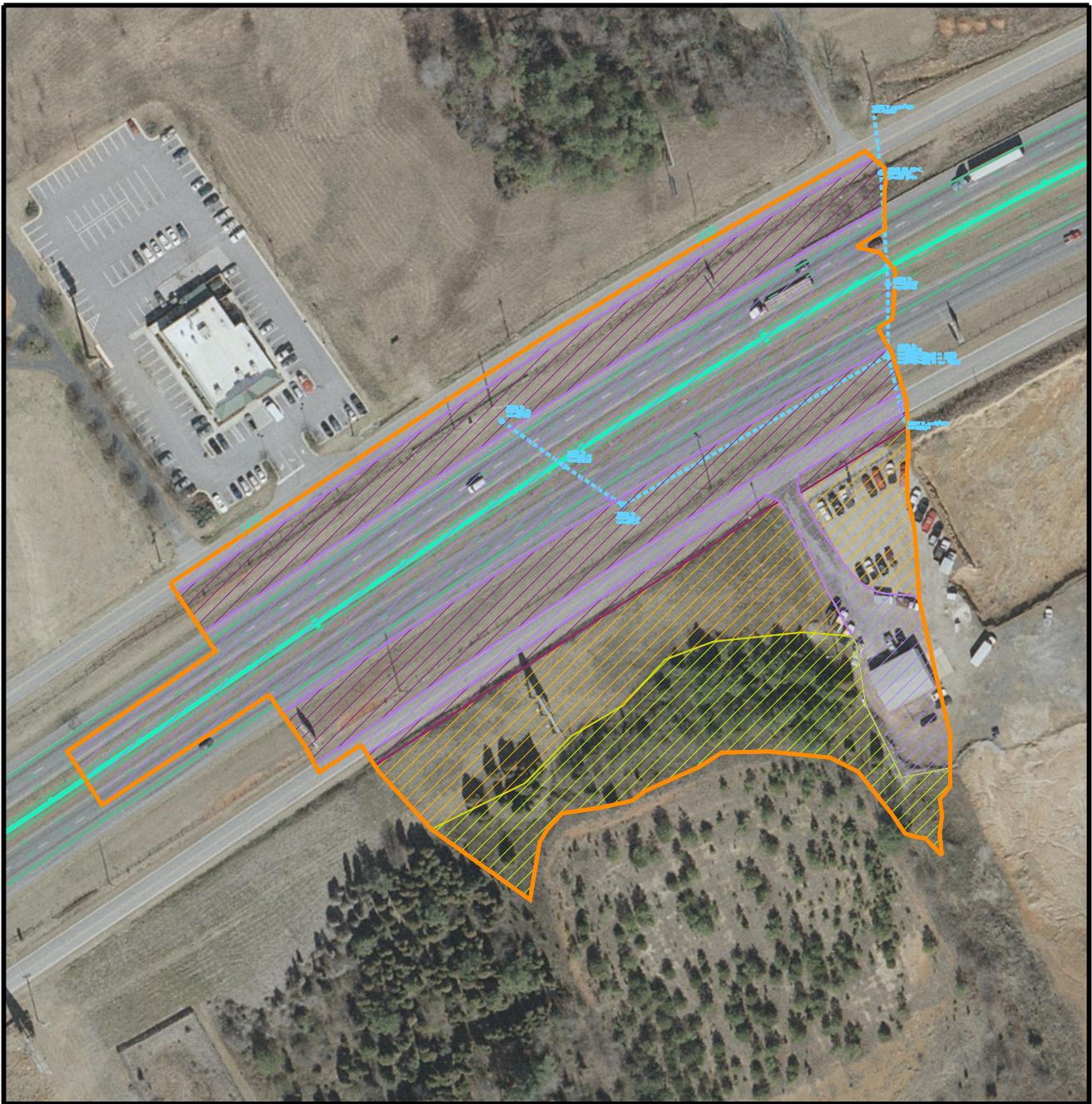
\* Existing contours shown for reference only. Drainage area and flowpath are based upon proposed typical section.

## Tc MAP - SITE # B-33

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY







PAVEMENT & ROOFS



LAWNS SANDY SOIL



GRASS SHOULDERS



WOODLAND & FOREST

## LAND USE MAP - SITE # B-33

I-85 WIDENING CHEROKEE CO MM80-96  
SPARTANBURG/CHEROKEE COUNTY



# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 12 cfs

Design Flow: 23.8 cfs

Maximum Flow: 27 cfs



**Table 1 - Summary of Culvert Flows at Crossing: B-33**

Headwater Elevation (ft)	Total Discharge (cfs)	B-33 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
811.29	12.00	12.00	0.00	1
811.46	13.50	13.50	0.00	1
811.63	15.00	15.00	0.00	1
811.82	16.50	16.50	0.00	1
812.02	18.00	18.00	0.00	1
812.24	19.50	19.50	0.00	1
812.48	21.00	21.00	0.00	1
812.52	22.50	21.29	1.11	8
812.54	23.80	21.38	2.30	4
812.56	25.50	21.48	3.94	4
812.57	27.00	21.55	5.30	3
812.50	21.14	21.14	0.00	Overtopping

**Table 2 - Culvert Summary Table: B-33**

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)
12.00	12.00	811.29	1.882	0.0*	1-S2n	0.679	1.239	0.679	0.416	12.725	8.893
13.50	13.50	811.46	2.047	0.0*	5-S2n	0.727	1.320	0.727	0.442	13.088	9.191
15.00	15.00	811.63	2.221	0.0*	5-S2n	0.767	1.392	0.767	0.466	13.556	9.466
16.50	16.50	811.82	2.407	0.0*	5-S2n	0.808	1.459	0.808	0.490	13.867	9.718
18.00	18.00	812.02	2.609	0.0*	5-S2n	0.848	1.526	0.848	0.512	14.184	9.954
19.50	19.50	812.24	2.828	0.0*	5-S2n	0.888	1.586	0.888	0.533	14.464	10.175
21.00	21.00	812.48	3.067	0.0*	5-S2n	0.927	1.640	0.927	0.553	14.745	10.383
22.50	21.29	812.52	3.115	0.0*	5-S2n	0.934	1.650	0.934	0.572	14.802	10.581
23.80	21.38	812.54	3.130	0.0*	5-S2n	0.936	1.653	0.936	0.588	14.819	10.745
25.50	21.48	812.56	3.147	0.0*	5-S2n	0.939	1.657	0.939	0.609	14.839	10.945
27.00	21.55	812.57	3.159	0.0*	5-S2n	0.941	1.659	0.941	0.626	14.853	11.115

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 809.41 ft,    Outlet Elevation (invert): 798.03 ft  
Culvert Length: 300.22 ft,    Culvert Slope: 0.0379  
\*\*\*\*\*

### **Site Data - B-33**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 809.41 ft

Outlet Station: 300.00 ft

Outlet Elevation: 798.03 ft

Number of Barrels: 1

### **Culvert Data Summary - B-33**

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-33)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
12.00	798.45	0.42	8.89	0.81	2.86
13.50	798.47	0.44	9.19	0.86	2.88
15.00	798.50	0.47	9.47	0.91	2.90
16.50	798.52	0.49	9.72	0.96	2.92
18.00	798.54	0.51	9.95	1.00	2.94
19.50	798.56	0.53	10.18	1.04	2.95
21.00	798.58	0.55	10.38	1.08	2.97
22.50	798.60	0.57	10.58	1.12	2.98
23.80	798.62	0.59	10.74	1.15	2.99
25.50	798.64	0.61	10.95	1.19	3.00
27.00	798.66	0.63	11.12	1.22	3.02

**Tailwater Channel Data - B-33**

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 2.00 ft

Side Slope (H:V): 3.00 (1:1)

Channel Slope: 0.0313

Channel Manning's n: 0.0130

Channel Invert Elevation: 798.03 ft

**Roadway Data for Crossing: B-33**

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 812.50 ft

Roadway Surface: Paved

Roadway Top Width: 270.00 ft

# HY-8 Culvert Analysis Report

## Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 12 cfs

Design Flow: 23.8 cfs

Maximum Flow: 27 cfs

**Table 1 - Summary of Culvert Flows at Crossing: B-33 Proposed**

Headwater Elevation (ft)	Total Discharge (cfs)	B-33 Proposed Discharge (cfs)	Roadway Discharge (cfs)	Iterations
811.06	12.00	12.00	0.00	1
811.18	13.50	13.50	0.00	1
811.30	15.00	15.00	0.00	1
811.42	16.50	16.50	0.00	1
811.54	18.00	18.00	0.00	1
811.65	19.50	19.50	0.00	1
811.77	21.00	21.00	0.00	1
811.88	22.50	22.50	0.00	1
811.99	23.80	23.80	0.00	1
812.13	25.50	25.50	0.00	1
812.26	27.00	27.00	0.00	1
812.50	29.68	29.68	0.00	Overtopping



**Table 2 - Culvert Summary Table: B-33 Proposed**

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)
12.00	12.00	811.06	1.647	0.0*	1-S2n	0.621	1.162	0.627	0.416	12.364	8.893
13.50	13.50	811.18	1.773	0.0*	1-S2n	0.664	1.236	0.664	0.442	12.882	9.191
15.00	15.00	811.30	1.894	0.0*	1-S2n	0.701	1.304	0.701	0.466	13.328	9.466
16.50	16.50	811.42	2.011	0.0*	1-S2n	0.734	1.369	0.761	0.490	13.002	9.718
18.00	18.00	811.54	2.126	0.0*	1-S2n	0.767	1.434	0.767	0.512	14.035	9.954
19.50	19.50	811.65	2.240	0.0*	1-S2n	0.800	1.493	0.806	0.533	14.209	10.175
21.00	21.00	811.77	2.356	0.0*	1-S2n	0.833	1.554	0.833	0.553	14.634	10.383
22.50	22.50	811.88	2.472	0.0*	1-S2n	0.865	1.610	0.862	0.572	14.962	10.581
23.80	23.80	811.99	2.576	0.0*	5-S2n	0.894	1.657	0.894	0.588	15.089	10.745
25.50	25.50	812.13	2.716	0.0*	5-S2n	0.928	1.716	0.938	0.609	15.173	10.945
27.00	27.00	812.26	2.845	0.0*	5-S2n	0.955	1.770	0.955	0.626	15.693	11.115

\* Full Flow Headwater elevation is below inlet invert.

\*\*\*\*\*  
Straight Culvert  
Inlet Elevation (invert): 809.41 ft,    Outlet Elevation (invert): 798.03 ft  
Culvert Length: 300.22 ft,    Culvert Slope: 0.0379  
\*\*\*\*\*

### **Site Data - B-33 Proposed**

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 809.41 ft

Outlet Station: 300.00 ft

Outlet Elevation: 798.03 ft

Number of Barrels: 1

### **Culvert Data Summary - B-33 Proposed**

Barrel Shape: Circular

Barrel Diameter: 2.50 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: NONE

**Table 3 - Downstream Channel Rating Curve (Crossing: B-33 Proposed)**

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
12.00	798.45	0.42	8.89	0.81	2.86
13.50	798.47	0.44	9.19	0.86	2.88
15.00	798.50	0.47	9.47	0.91	2.90
16.50	798.52	0.49	9.72	0.96	2.92
18.00	798.54	0.51	9.95	1.00	2.94
19.50	798.56	0.53	10.18	1.04	2.95
21.00	798.58	0.55	10.38	1.08	2.97
22.50	798.60	0.57	10.58	1.12	2.98
23.80	798.62	0.59	10.74	1.15	2.99
25.50	798.64	0.61	10.95	1.19	3.00
27.00	798.66	0.63	11.12	1.22	3.02

**Tailwater Channel Data - B-33 Proposed**

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 2.00 ft

Side Slope (H:V): 3.00 (1:1)

Channel Slope: 0.0313

Channel Manning's n: 0.0130

Channel Invert Elevation: 798.03 ft

**Roadway Data for Crossing: B-33 Proposed**

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 812.50 ft

Roadway Surface: Paved

Roadway Top Width: 270.00 ft