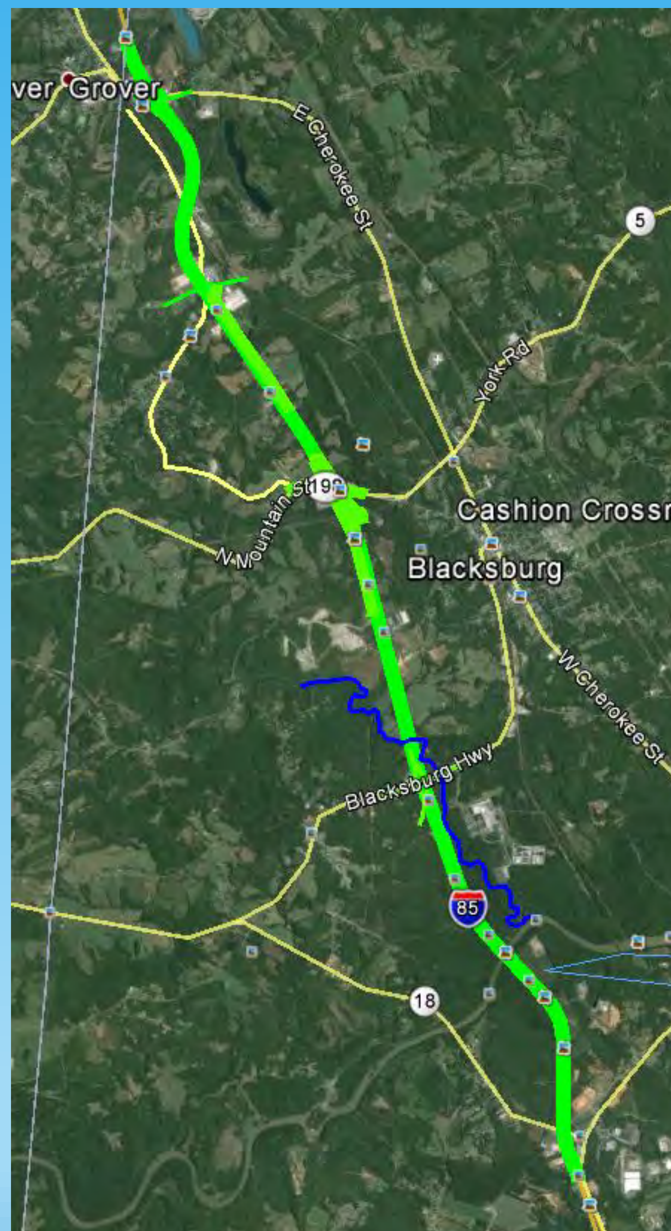
SCDOT

I-85 Widening
Phase 3
MM 98 TO MM 106

Cherokee, SC

May 2017

SCDOT Project ID: P027116



Stormwater Management Design Report

HDR | ICA

Civil Engineering Consulting Services, Inc.

1. Project Summary

The South Carolina Department of Transportation (SCDOT) proposes to widen a portion of Interstate 85 (I-85) from four lanes to six travel lanes in Cherokee County. The project limits begin at the I-85 bridge over the Broad River and extends to the South Carolina/North Carolina state line. The scope of the project includes adding a travel lane in each direction along I-85, improving various interchanges and exit ramps, and replacement of overpass bridges. The purpose of this project is to improve the operational efficiency of I-85 to accommodate traffic volumes. The proposed widening will occur within the existing median of I-85 to minimize right-of-way impacts.

This report provides an inventory of the location and condition of existing drainage structures within the project corridor, a hydrological study of the watershed(s), hydraulic analyses of select existing cross drainage and median drainage structures, and identification of any FEMA floodplain crossings that will be impacted. Existing drainage structures were located using information gathered from existing plans, field investigations, and topographic maps. Location and size of existing drainage structures, as well as their conditions were examined during the field study. Various land uses exist along the corridor and include dense woods, residential areas, commercial areas, and industrial areas. The overall drainage patterns for the project area were established through the use of project mapping, SCDNR LiDAR Data, and U.S. Geological Survey (USGS) quadrangle maps. The proposed I-85 improvements are expected to maintain the current drainage patterns. The ultimate receiving waterbodies for the project area include Buffalo Creek, Bee Branch, Jumping Branch, and Mill Creek. Bee Branch is a tributary the feeds into Buffalo Creek. Buffalo Creek flows across the NC/SC state line and discharges into the Broad River. Jumping Branch and Mill Creek are both tributaries that feed into Kings Creek, which ultimately discharges into the Broad River also.

Project location maps and Federal Emergency Management Agency (FEMA) Flood Insurance Rate Firmette Maps are provided in Section 2 of this report. The following FEMA maps encompass the portion of the I-85 project area within the vicinity of a FEMA floodplain:

Cherokee County FIRM Panel No. 45021C0180D
Cherokee County FIRM Panel No. 45021C0070D
Cherokee County FIRM Panel No. 45021C0185D

Portions of the project will fall within a FEMA managed floodplain. In particular, three Special Flood Hazard Area crossings.

- **Station 1824+00 to Station 1837+00** – FEMA maps indicate a Zone A Special Flood Hazard Area crosses the project site. Due to the Zone A classification, analysis to verify the final design complies with SCDOT Design Requirements for Zone A floodplains will be required. The preliminary analysis suggests that the 8’ x 8’ culvert crossing under I-85 at Sta. 1834+32 (Site 7) will perform adequately with enlargement of the downstream culvert, located under the frontage road. Therefore, I-85 improvements will encroach into FEMA’s floodplain and may have a measurable impact on the effective base flood elevations.

- **Station 1897+50 to Station 1902+00** - FEMA maps indicate a Zone AE Special Flood Hazard Area located downstream of the project site. The proposed Exit 100 interchange improvements will encroach into the floodplain. Additionally, the culvert crossing under I-85 at Sta. 1900+14 (Site 20) may require extension into the floodplain as a result of the wider roadway footprint. However, improvement of the culvert headwall may allow for the culvert extension to be avoided. The proposed roadway improvements may have a measurable impact on the effective base flood elevations.

- **Station 1905+50 to Station 1908+00** - FEMA maps indicate a Zone AE Special Flood Hazard Area located downstream of the project site. The proposed improvements for Blacksburg Highway and Exit 100 interchange will increase the roadway footprint and will encroach into the floodplain. The proposed improvements may have a measurable impact on the effective base flood elevations.

- **Station 1909+50 to Station 1915+50** - FEMA maps indicate a Zone AE Special Flood Hazard Area located downstream of the project site. The proposed Exit 100 interchange and I-85 mainline improvements will increase the roadway footprint and will encroach into the floodplain. Additionally, the culvert crossing under I-85 at Sta. 1909+86 (Site 21) will require an extension into the floodplain. The proposed improvements may have a measurable impact on the effective base flood elevations.

- **Station 1924+00 to Station 1935+00** – I-85 crosses a FEMA Zone AE Special Flood Hazard Area with established floodway. No changes are anticipated for the I-85 bridge over Buffalo Creek, and any minimal amount of fill in the floodplain mimics existing conditions. The minor amount of fill is not expected to measurably impact effective base flood elevations.

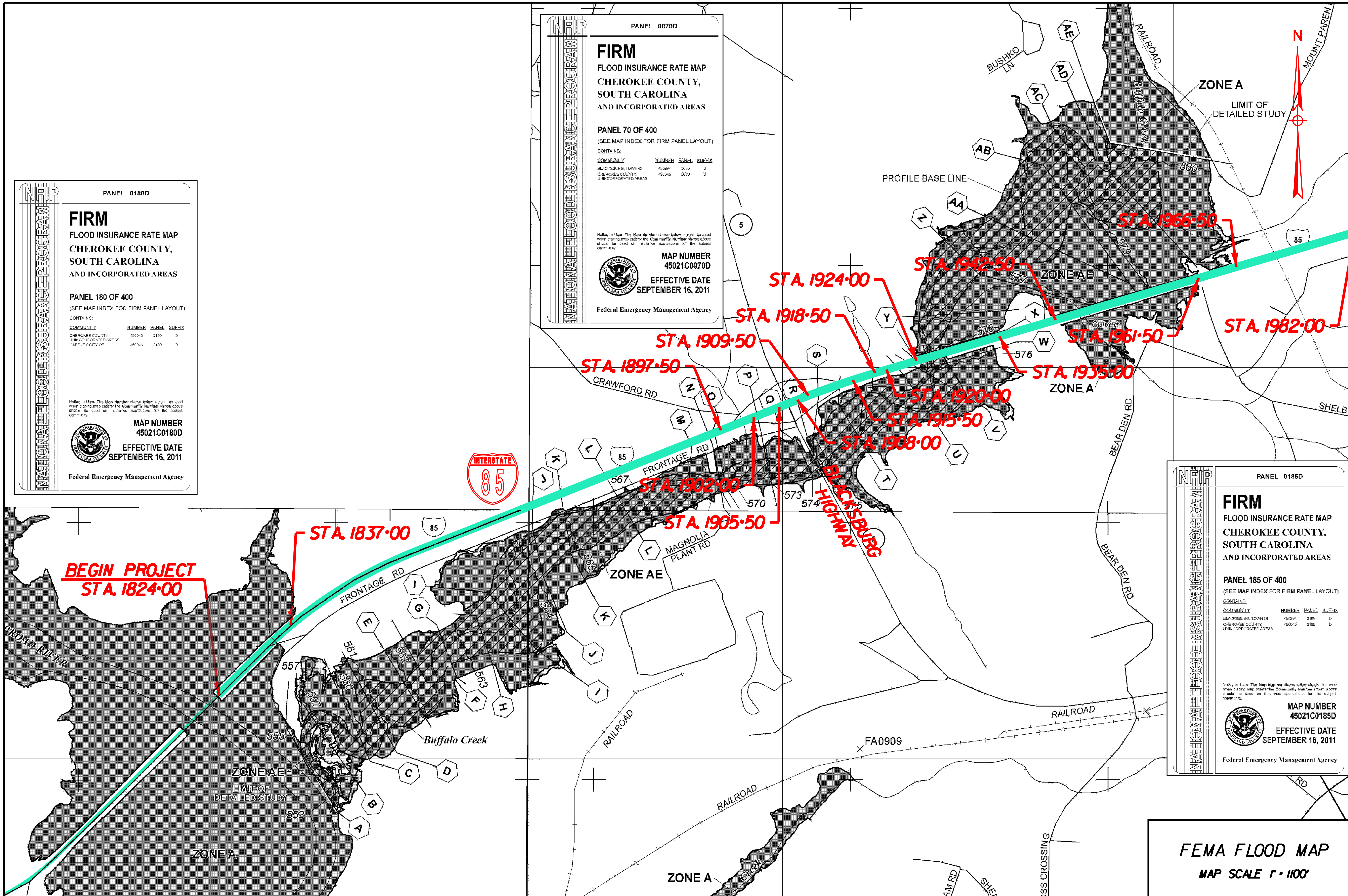
- **Station 1942+50 to Station 1961+50** – I-85 parallels a FEMA Zone AE Special Flood Hazard Area on the left side of the alignment, with a Zone A Special Flood Hazard Area on the right side of the alignment. Due to the proposed roadway being elevated higher than the existing pavement, project construction limits will encroach into the floodplain. Additionally, the culvert crossing under I-85 at Sta. 1945+56 (Site 24) may require both an upstream and downstream extension into the floodplain. However, improvement of the culvert headwalls may allow for the culvert extension to be avoided. The proposed improvements may have a measurable impact on the effective base flood elevations.

- **Station 1918+50 to Station 1920+00; Station 1961+50 to Station 1966+50** – FEMA maps indicate a Zone AE Special Flood Hazard Area located downstream of the project site. Due to the proposed roadway being elevated higher than the existing pavement, construction limits for the project will encroach into the effective floodplain. However, the proposed encroachments will be minimal and are not expected to impact the effective base flood elevations.

- **Station 1837+00 to Station 1897+50; Station 1902+00 to Station 1905+50; Station 1908+00 to Station 1909+50; Station 1915+50 to Station 1918+50; Station 1920+00 to Station 1924+00; Station 1935+00 to Station 1942+50** – FEMA maps indicate a Zone AE Special Flood Hazard Area located downstream of the project site. Any existing culverts located within the floodplain are being retained and culvert extensions are not required for the proposed roadway construction. The proposed construction limits are located outside the floodplain and therefore are not expected to alter the effective base flood elevations.

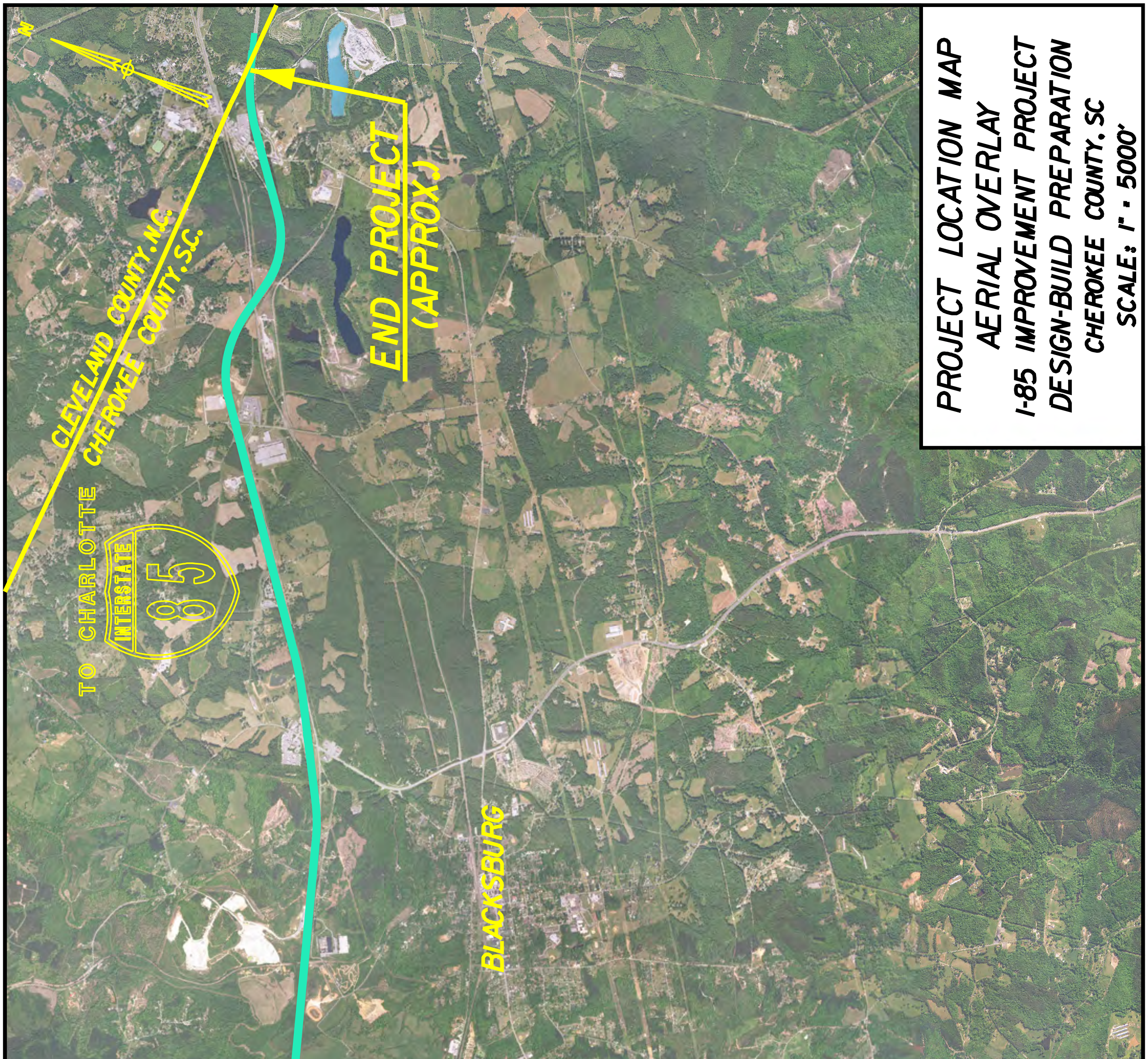
The hydrologic and hydraulic analyses and techniques comply with SCDOT's *Requirements for Hydraulic Design Studies*, dated May 26, 2009.

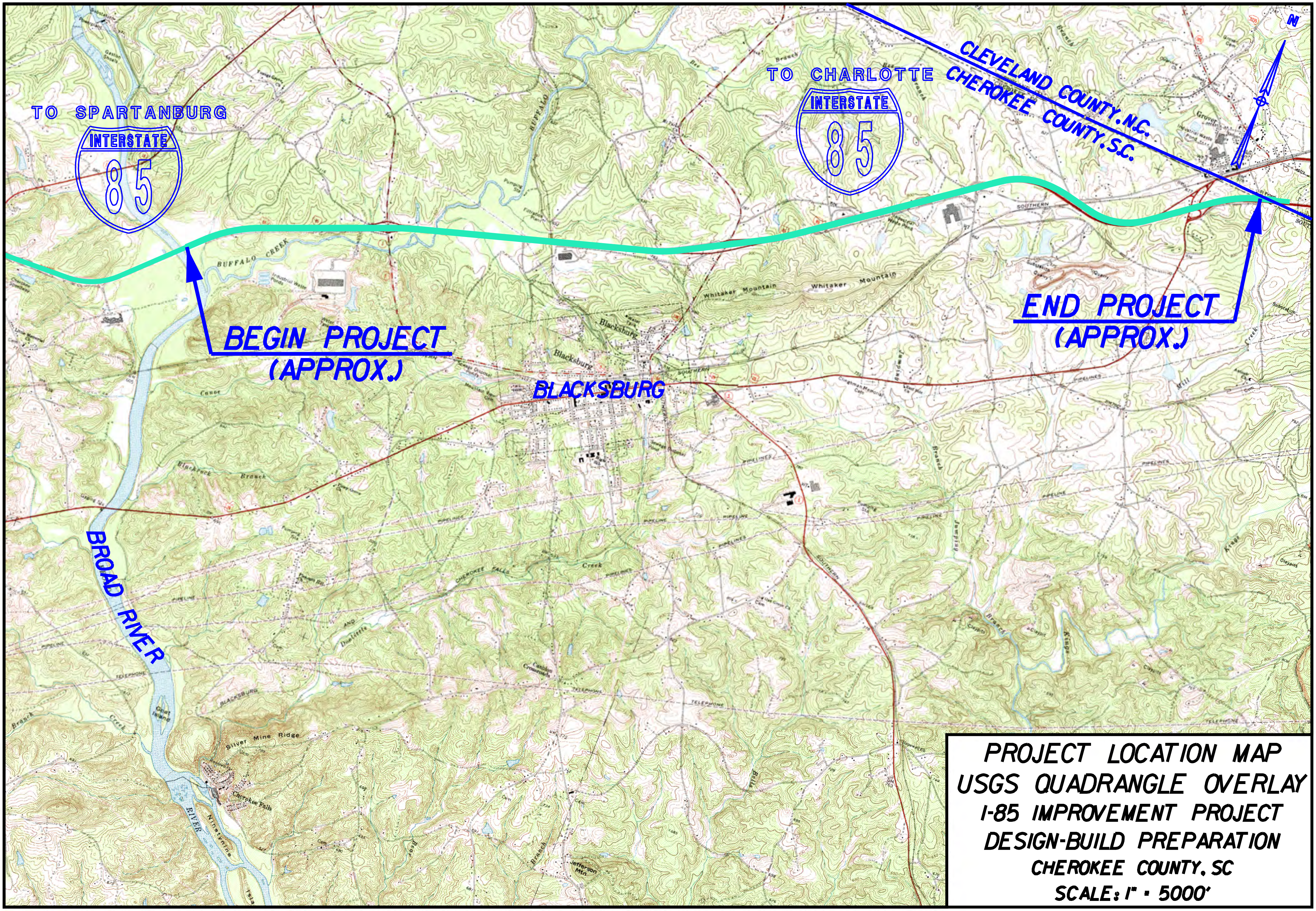
2. Project Maps



FEMA FLOOD MAP

MAP SCALE 1" = 1100'


PROJECT LOCATION MAP
AERIAL OVERLAY
I-85 IMPROVEMENT PROJECT
DESIGN-BUILD PREPARATION
CHEROKEE COUNTY, SC
SCALE: 1" = 5000'
N
END PROJECT
(APPROX.)
CLEVELAND COUNTY, N.C.
CHEROKEE COUNTY, S.C.
TO CHARLOTTE
INTERSTATE
85
BLACKSBURG
BEGIN PROJECT
(APPROX.)
TO SPARTANBURG
INTERSTATE
85
BROAD RIVER

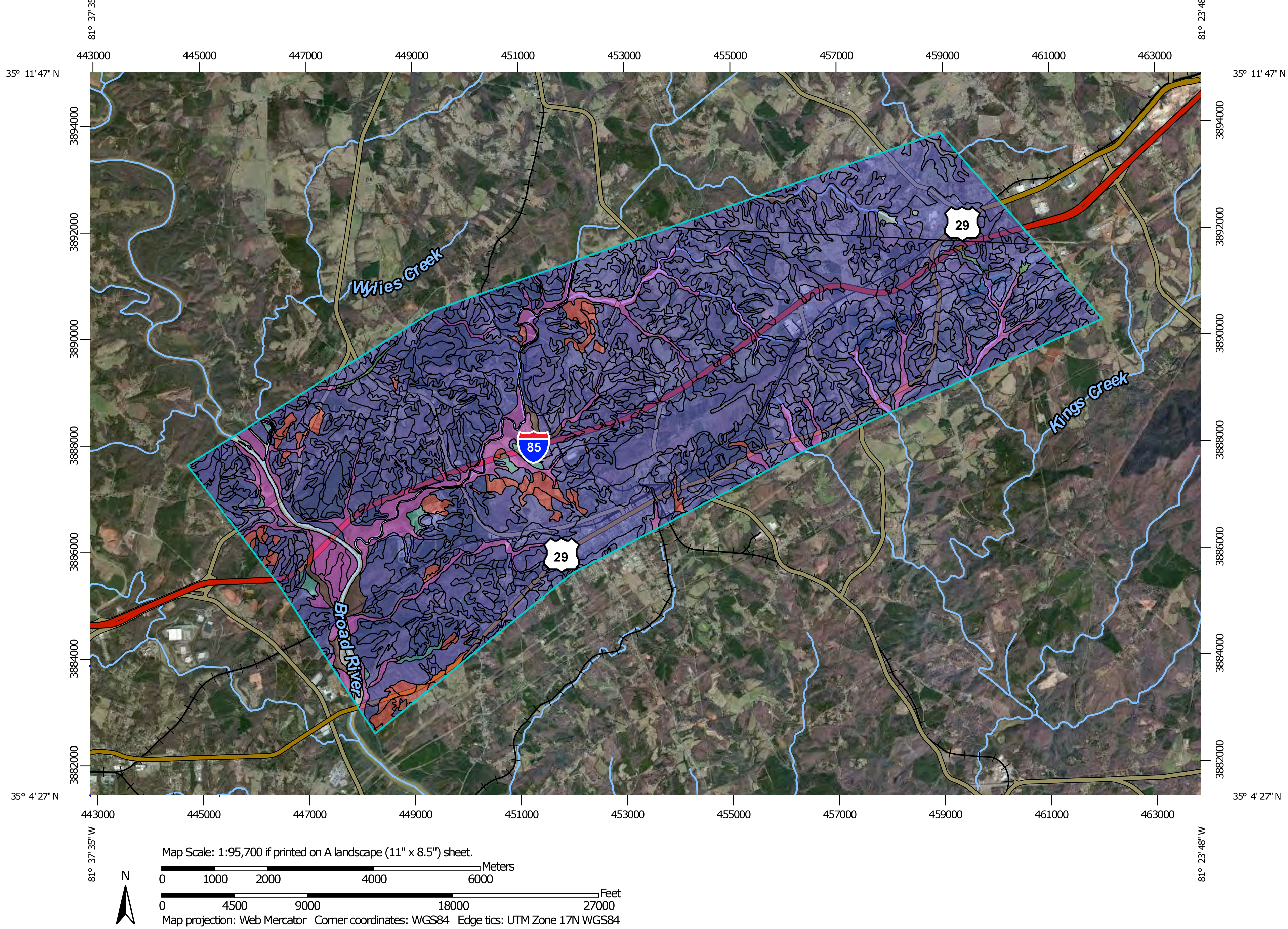


PROJECT LOCATION MAP
USGS QUADRANGLE OVERLAY
I-85 IMPROVEMENT PROJECT
DESIGN-BUILD PREPARATION
CHEROKEE COUNTY, SC
SCALE: 1" = 5000'

2. Soils Information

The I-85 Improvement Project is located in the Piedmont Region of South Carolina. The project limits begin at the I-85 bridge over the Broad River and extend to the South Carolina/North Carolina state line. The Natural Resources Conservation Service (NRCS) Web Soil Survey indicates that the most predominant soil group within the project limits is Hydrologic Soil Group B, which has moderate infiltration when thoroughly wet. There is a vast range of soil types that exist within the area of interest for the project. The NRCS soils information and descriptions are found in this section.

Hydrologic Soil Group—Cherokee County, South Carolina, and Cleveland County, North Carolina



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:20,000 to 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Cherokee County, South Carolina
Survey Area Data: Version 12, Sep 29, 2015

Soil Survey Area: Cleveland County, North Carolina
Survey Area Data: Version 18, Sep 13, 2015

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Feb 14, 2011—Dec 9, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Cherokee County, South Carolina (SC021)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
AfA	Altavista fine sandy loam, 0 to 2 percent slopes	C	33.0	0.2%
AfB2	Altavista fine sandy loam, 2 to 6 percent slopes, eroded	C	86.5	0.4%
ApC	Appling sandy loam, 6 to 10 percent slopes	B	18.3	0.1%
ApD2	Appling sandy loam, 10 to 15 percent slopes, eroded	B	5.0	0.0%
ApE2	Appling sandy loam, 15 to 25 percent slopes, eroded	B	17.5	0.1%
Bc	Buncombe loamy sand	A	205.3	1.0%
CcB3	Cecil clay loam, 2 to 6 percent slopes, severely eroded	B	97.0	0.5%
CcC3	Cecil clay loam, 6 to 10 percent slopes, severely eroded	B	234.2	1.2%
CcD3	Cecil clay loam, 10 to 15 percent slopes, severely eroded	B	304.5	1.5%
CcE3	Cecil clay loam, 15 to 25 percent slopes, severely eroded	B	115.9	0.6%
CdB	Cecil sandy loam, 2 to 6 percent slopes	B	4.5	0.0%
CdB2	Cecil sandy loam, 2 to 6 percent slopes, eroded	B	131.0	0.7%
CdC	Cecil sandy loam, 6 to 10 percent slopes	B	23.1	0.1%
CdC2	Cecil sandy loam, 6 to 10 percent slopes, eroded	B	126.7	0.6%
CdD	Cecil sandy loam, 10 to 15 percent slopes	B	30.2	0.1%
CdD2	Cecil sandy loam, 10 to 15 percent slopes, eroded	B	91.2	0.5%
CdE	Cecil sandy loam, 15 to 25 percent slopes	B	116.6	0.6%

Hydrologic Soil Group— Summary by Map Unit — Cherokee County, South Carolina (SC021)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
CdE2	Cecil sandy loam, 15 to 25 percent slopes, eroded	B	27.4	0.1%
CdF	Cecil sandy loam, 25 to 35 percent slopes	B	71.1	0.4%
Ch	Chewacla silt loam, 0 to 2 percent slopes, occasionally flooded	B/D	33.2	0.2%
Cr	Congaree silt loam	C	24.6	0.1%
DaC2	Davidson loam, 2 to 10 percent slopes, eroded	B	6.4	0.0%
Ga	Gullied land, firm materials	B	122.3	0.6%
GfC	Gullied land, friable materials, 2 to 10 percent slopes	B	129.2	0.6%
GfF	Gullied land, friable materials, 10 to 35 percent slopes	B	1,211.5	6.0%
IrC2	Iredell fine sandy loam, 6 to 10 percent slopes, eroded	D	1.3	0.0%
LcB3	Lloyd clay loam, 2 to 6 percent slopes, severely eroded	B	35.1	0.2%
LcC3	Lloyd clay loam, 6 to 10 percent slopes, severely eroded	B	36.4	0.2%
LcD3	Lloyd clay loam, 10 to 15 percent slopes, severely eroded	B	76.8	0.4%
LcE3	Lloyd clay loam, 15 to 25 percent slopes, severely eroded	B	32.7	0.2%
LdB2	Lloyd loam, 2 to 6 percent slopes, eroded	B	14.3	0.1%
LdD2	Lloyd loam, 10 to 15 percent slopes, eroded	B	6.1	0.0%
LdE	Lloyd loam, 15 to 25 percent slopes	B	28.0	0.1%
LdF	Lloyd loam, 25 to 35 percent slopes	B	10.1	0.1%
Ln	Local alluvial land	B	43.1	0.2%
MaB3	Madison and Cecil clay loams, 2 to 6 percent slopes, severely eroded	B	7.9	0.0%

Hydrologic Soil Group— Summary by Map Unit — Cherokee County, South Carolina (SC021)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
MaC3	Madison and Cecil clay loams, 6 to 10 percent slopes, severely eroded	B	25.3	0.1%
MaD3	Madison and Cecil clay loams, 10 to 15 percent slopes, severely eroded	B	37.5	0.2%
MaE3	Madison and Cecil clay loams, 15 to 25 percent slopes, severely eroded	B	45.4	0.2%
MdB2	Madison and Cecil sandy loams, 2 to 6 percent slopes, eroded	B	85.4	0.4%
MdC2	Madison and Cecil sandy loams, 6 to 10 percent slopes, eroded	B	18.7	0.1%
MdD2	Madison and Cecil sandy loams, 10 to 15 percent slopes, eroded	B	23.5	0.1%
MdE	Madison and Cecil sandy loams, 15 to 25 percent slopes	B	26.9	0.1%
MdE2	Madison and Cecil sandy loams, 15 to 25 percent slopes, eroded	B	4.9	0.0%
MdF2	Madison and Cecil sandy loams, 25 to 35 percent slopes, eroded	B	64.6	0.3%
MeC	Manteo channery silt loam, 2 to 10 percent slopes	D	47.2	0.2%
MeC2	Manteo channery silt loam, 6 to 15 percent slopes, eroded	D	22.0	0.1%
MeD	Manteo channery silt loam, 10 to 15 percent slopes	D	72.0	0.4%
MeE	Manteo channery silt loam, 15 to 35 percent slopes	D	121.0	0.6%
MeE2	Manteo channery silt loam, 15 to 35 percent slopes, eroded	D	82.1	0.4%
Mv	Mixed alluvial land	A	1,357.8	6.7%
Mw	Mixed wet alluvial land	B/D	107.5	0.5%

Hydrologic Soil Group— Summary by Map Unit — Cherokee County, South Carolina (SC021)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
NaB	Nason very fine sandy loam, 2 to 6 percent slopes	B	790.4	3.9%
NaC2	Nason very fine sandy loam, 6 to 10 percent slopes, eroded	B	453.1	2.2%
NaD2	Nason very fine sandy loam, 10 to 15 percent slopes, eroded	B	257.0	1.3%
NaE	Nason very fine sandy loam, 15 to 25 percent slopes	B	411.7	2.0%
NsC3	Nason silty clay loam, 2 to 10 percent slopes, severely eroded	B	185.5	0.9%
NsE3	Nason silty clay loam, 10 to 25 percent slopes, severely eroded	B	493.5	2.4%
Rw	Riverwash		30.6	0.2%
Sa	State fine sandy loam	B	46.8	0.2%
St	Stony land	B	387.6	1.9%
TaB3	Tatum silty clay loam, 2 to 6 percent slopes, severely eroded	B	281.8	1.4%
TaC3	Tatum silty clay loam, 6 to 10 percent slopes, severely eroded	B	1,081.3	5.4%
TaD3	Tatum silty clay loam, 10 to 15 percent slopes, severely eroded	B	1,479.2	7.3%
TaF3	Tatum silty clay loam, 15 to 35 percent slopes, severely eroded	B	798.8	4.0%
TmB	Tatum very fine sandy loam, 2 to 6 percent slopes	B	63.6	0.3%
TmB2	Tatum very fine sandy loam, 2 to 6 percent slopes, eroded	B	1,131.2	5.6%
TmC	Tatum very fine sandy loam, 6 to 10 percent slopes	B	78.1	0.4%
TmC2	Tatum very fine sandy loam, 6 to 10 percent slopes, eroded	B	1,056.9	5.2%
TmD	Tatum very fine sandy loam, 10 to 15 percent slopes	B	231.1	1.1%

Hydrologic Soil Group— Summary by Map Unit — Cherokee County, South Carolina (SC021)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
TmD2	Tatum very fine sandy loam, 10 to 15 percent slopes, eroded	B	599.0	3.0%
TmE	Tatum very fine sandy loam, 15 to 25 percent slopes	B	833.7	4.1%
TmE2	Tatum very fine sandy loam, 15 to 25 percent slopes, eroded	B	590.9	2.9%
TmF	Tatum very fine sandy loam, 25 to 35 percent slopes	B	626.7	3.1%
TrC2	Tirzah silt loam, 6 to 10 percent slopes, eroded	B	4.3	0.0%
TrD2	Tirzah silt loam, 10 to 15 percent slopes, eroded	B	43.2	0.2%
W	Water		234.4	1.2%
WcB	Wickham sandy loam, 2 to 6 percent slopes	B	55.9	0.3%
WcC2	Wickham sandy loam, 2 to 10 percent slopes, eroded	B	117.0	0.6%
WcE3	Wickham sandy loam, 10 to 25 percent slopes, severely eroded	B	54.9	0.3%
WkD	Wilkes sandy loam, 6 to 15 percent slopes	D	32.6	0.2%
WkD2	Wilkes sandy loam, 6 to 15 percent slopes, eroded	D	76.2	0.4%
WkE2	Wilkes sandy loam, 15 to 25 percent slopes, eroded	D	53.8	0.3%
WkF	Wilkes sandy loam, 15 to 35 percent slopes	D	100.1	0.5%
WoB	Worsham sandy loam, 0 to 6 percent slopes	A/D	39.5	0.2%
Subtotals for Soil Survey Area			**18,420.1**	**91.4%**
Totals for Area of Interest			**20,153.0**	**100.0%**

Hydrologic Soil Group— Summary by Map Unit — Cleveland County, North Carolina (NC045)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
ChA	Chewacla loam, 0 to 2 percent slopes, frequently flooded	B/D	37.5	0.2%

Hydrologic Soil Group— Summary by Map Unit — Cleveland County, North Carolina (NC045)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
GrD	Grover gravelly sandy loam, 15 to 30 percent slopes, rocky	B	142.6	0.7%
HeB	Helena-Worsham complex 1 to 6 percent slopes	D	0.0	0.0%
HhB	Hulett gravelly sandy loam, 2 to 8 percent slopes	B	661.4	3.3%
HtC	Hulett gravelly sandy loam, 8 to 15 percent slopes, stony	B	401.4	2.0%
HuC	Hulett-Saw complex, 4 to 15 percent slopes, very rocky	B	41.1	0.2%
HwB	Hulett-Urban land complex, 2 to 8 percent slopes	B	207.3	1.0%
MaB2	Madison gravelly sandy clay loam, 2 to 8 percent slopes, moderately eroded	B	100.6	0.5%
MbB2	Madison-Bethlehem complex, 2 to 8 percent slopes, stony, moderately eroded	B	91.4	0.5%
McC2	Madison-Bethlehem complex, 8 to 15 percent slopes, very stony, moderately eroded	B	2.0	0.0%
TaD	Tatum-Montonia complex, 15 to 30 percent slopes	B	3.8	0.0%
UuB2	Uwharrie silty clay loam, 2 to 8 percent slopes, moderately eroded	B	6.2	0.0%
UwC2	Uwharrie-Tatum complex, 8 to 15 percent slopes, moderately eroded	B	19.0	0.1%
W	Water		18.5	0.1%
Subtotals for Soil Survey Area			**1,732.9**	**8.6%**
Totals for Area of Interest			**20,153.0**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

Map Unit Description (Brief, Generated)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

The Map Unit Description (Brief, Generated) report displays a generated description of the major soils that occur in a map unit. Descriptions of non-soil (miscellaneous areas) and minor map unit components are not included. This description is generated from the underlying soil attribute data.

Additional information about the map units described in this report is available in other Soil Data Mart reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the Soil Data Mart reports define some of the properties included in the map unit descriptions.

Report—Map Unit Description (Brief, Generated)

Cherokee County, South Carolina

Map Unit: AfA—Altavista fine sandy loam, 0 to 2 percent slopes

Component: Altavista (100%)

The Altavista component makes up 100 percent of the map unit. Slopes are 0 to 2 percent. This component is on stream terraces on piedmonts. The parent material consists of loamy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is low. This soil is rarely flooded. It is not ponded. A seasonal zone of water saturation is at 24 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Map Unit: AfB2—Altavista fine sandy loam, 2 to 6 percent slopes, eroded

Component: Altavista (100%)

The Altavista component makes up 100 percent of the map unit. Slopes are 2 to 6 percent. This component is on stream terraces on piedmonts. The parent material consists of loamy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is low. This soil is rarely flooded. It is not ponded. A seasonal zone of water saturation is at 24 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map Unit: ApC—Appling sandy loam, 6 to 10 percent slopes

Component: Appling (88%)

The Appling component makes up 88 percent of the map unit. Slopes are 6 to 10 percent. This component is on interfluves, piedmonts. The parent material consists of residuum weathered from gneiss and/or residuum weathered from granite. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Component: Hard Labor (12%)

Generated brief soil descriptions are created for major soil components. The Hard Labor soil is a minor component.

Map Unit: ApD2—Appling sandy loam, 10 to 15 percent slopes, eroded

Component: Appling (100%)

The Appling component makes up 100 percent of the map unit. Slopes are 10 to 15 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map Unit: ApE2—Appling sandy loam, 15 to 25 percent slopes, eroded

Component: Wedowee (100%)

The Wedowee component makes up 100 percent of the map unit. Slopes are 15 to 25 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map Unit: Bc—Buncombe loamy sand

Component: Buncombe (100%)

The Buncombe component makes up 100 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains on piedmonts. The parent material consists of sandy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is rarely flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3s. This soil does not meet hydric criteria.

Map Unit: CcB3—Cecil clay loam, 2 to 6 percent slopes, severely eroded

Component: Cecil, severely eroded (100%)

The Cecil, severely eroded component makes up 100 percent of the map unit. Slopes are 2 to 6 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map Unit: CcC3—Cecil clay loam, 6 to 10 percent slopes, severely eroded

Component: Cecil, severely eroded (100%)

The Cecil, severely eroded component makes up 100 percent of the map unit. Slopes are 6 to 10 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map Unit: CcD3—Cecil clay loam, 10 to 15 percent slopes, severely eroded

Component: Pacolet, severely eroded (100%)

The Pacolet, severely eroded component makes up 100 percent of the map unit. Slopes are 10 to 15 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map Unit: CcE3—Cecil clay loam, 15 to 25 percent slopes, severely eroded

Component: Pacolet, severely eroded (100%)

The Pacolet, severely eroded component makes up 100 percent of the map unit. Slopes are 15 to 25 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Map Unit: CdB—Cecil sandy loam, 2 to 6 percent slopes

Component: Cecil (95%)

The Cecil component makes up 95 percent of the map unit. Slopes are 2 to 6 percent. This component is on interfluves on southern piedmonts. The parent material consists of residuum weathered from gneiss and/or granite. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Component: Cataula (3%)

Generated brief soil descriptions are created for major components. The Cataula soil is a minor component.

Component: Bethlehem (2%)

Generated brief soil descriptions are created for major components. The Bethlehem soil is a minor component.

Map Unit: CdB2—Cecil sandy loam, 2 to 6 percent slopes, eroded

Component: Cecil (100%)

The Cecil component makes up 100 percent of the map unit. Slopes are 2 to 6 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map Unit: CdC—Cecil sandy loam, 6 to 10 percent slopes

Component: Cecil (88%)

The Cecil component makes up 88 percent of the map unit. Slopes are 6 to 10 percent. This component is on interfluves on southern piedmonts. The parent material consists of residuum weathered from granite and/or residuum weathered from gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Component: Bethlehem (10%)

Generated brief soil descriptions are created for major components. The Bethlehem soil is a minor component.

Component: Cataula, moderately eroded (2%)

Generated brief soil descriptions are created for major components. The Cataula soil is a minor component.

Map Unit: CdC2—Cecil sandy loam, 6 to 10 percent slopes, eroded

Component: Cecil (100%)

The Cecil component makes up 100 percent of the map unit. Slopes are 6 to 10 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map Unit: CdD—Cecil sandy loam, 10 to 15 percent slopes

Component: Cecil (95%)

The Cecil component makes up 95 percent of the map unit. Slopes are 10 to 15 percent. This component is on interfluves on southern piedmonts. The parent material consists of residuum weathered from granite and/or residuum weathered from gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Component: Saw (3%)

Generated brief soil descriptions are created for major components. The Saw soil is a minor component.

Component: Cataula, moderately eroded (2%)

Generated brief soil descriptions are created for major components. The Cataula soil is a minor component.

Map Unit: CdD2—Cecil sandy loam, 10 to 15 percent slopes, eroded

Component: Cecil (100%)

The Cecil component makes up 100 percent of the map unit. Slopes are 10 to 15 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map Unit: CdE—Cecil sandy loam, 15 to 25 percent slopes

Component: Pacolet (100%)

The Pacolet component makes up 100 percent of the map unit. Slopes are 15 to 25 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map Unit: CdE2—Cecil sandy loam, 15 to 25 percent slopes, eroded

Component: Pacolet (100%)

The Pacolet component makes up 100 percent of the map unit. Slopes are 15 to 25 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map Unit: CdF—Cecil sandy loam, 25 to 35 percent slopes

Component: Pacolet (100%)

The Pacolet component makes up 100 percent of the map unit. Slopes are 25 to 35 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Map Unit: Ch—Chewacla silt loam, 0 to 2 percent slopes, occasionally flooded

Component: Chewacla, ocassionally flooded (88%)

The Chewacla, ocassionally flooded component makes up 88 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains on southern piedmonts. The parent material consists of alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. A seasonal zone of water saturation is at 10 inches during January, February, March, December. Organic matter content in the surface horizon is about 3 percent. Nonirrigated land capability classification is 3w. This soil does not meet hydric criteria.

Component: Congaree (7%)

Generated brief soil descriptions are created for major components. The Congaree soil is a minor component.

Component: Wehadkee, ponded (5%)

Generated brief soil descriptions are created for major components. The Wehadkee soil is a minor component.

Map Unit: Cr—Congaree silt loam

Component: Congaree (100%)

The Congaree component makes up 100 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains on piedmonts. The parent material consists of loamy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. A seasonal zone of water saturation is at 39 inches during January, February, March, April, November, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Map Unit: DaC2—Davidson loam, 2 to 10 percent slopes, eroded

Component: Davidson (100%)

The Davidson component makes up 100 percent of the map unit. Slopes are 2 to 10 percent. This component is on interfluves on piedmonts. The parent material consists of clayey diabase. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map Unit: Ga—Gullied land, firm materials

Component: Udorthents (100%)

The Udorthents component makes up 100 percent of the map unit. Slopes are 10 to 35 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. Nonirrigated land capability classification is 7e.

Map Unit: GfC—Gullied land, friable materials, 2 to 10 percent slopes

Component: Udorthents (100%)

The Udorthents component makes up 100 percent of the map unit. Slopes are 2 to 10 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. Nonirrigated land capability classification is 6e.

Map Unit: GfF—Gullied land, friable materials, 10 to 35 percent slopes

Component: Udorthents (100%)

The Udorthents component makes up 100 percent of the map unit. Slopes are 10 to 35 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 0 percent. Nonirrigated land capability classification is 7e.

Map Unit: IrC2—Iredell fine sandy loam, 6 to 10 percent slopes, eroded

Component: Iredell (100%)

The Iredell component makes up 100 percent of the map unit. Slopes are 6 to 10 percent. This component is on interfluves on piedmonts. The parent material consists of clayey diabase. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is very high. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 18 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map Unit: LcB3—Lloyd clay loam, 2 to 6 percent slopes, severely eroded

Component: Hiwassee, severely eroded (100%)

The Hiwassee, severely eroded component makes up 100 percent of the map unit. Slopes are 2 to 6 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite gneiss and hornblende schist. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map Unit: LcC3—Lloyd clay loam, 6 to 10 percent slopes, severely eroded

Component: Hiwassee, severely eroded (100%)

The Hiwassee, severely eroded component makes up 100 percent of the map unit. Slopes are 6 to 10 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite gneiss and hornblende schist. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map Unit: LcD3—Lloyd clay loam, 10 to 15 percent slopes, severely eroded

Component: Pacolet, severely eroded (100%)

The Pacolet, severely eroded component makes up 100 percent of the map unit. Slopes are 10 to 15 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map Unit: LcE3—Lloyd clay loam, 15 to 25 percent slopes, severely eroded

Component: Pacolet, severely eroded (100%)

The Pacolet, severely eroded component makes up 100 percent of the map unit. Slopes are 15 to 25 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map Unit: LdB2—Lloyd loam, 2 to 6 percent slopes, eroded

Component: Hiwassee (100%)

The Hiwassee component makes up 100 percent of the map unit. Slopes are 2 to 6 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite gneiss and hornblende schist. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map Unit: LdD2—Lloyd loam, 10 to 15 percent slopes, eroded

Component: Pacolet (100%)

The Pacolet component makes up 100 percent of the map unit. Slopes are 10 to 15 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map Unit: LdE—Lloyd loam, 15 to 25 percent slopes

Component: Pacolet (100%)

The Pacolet component makes up 100 percent of the map unit. Slopes are 15 to 25 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map Unit: LdF—Lloyd loam, 25 to 35 percent slopes

Component: Pacolet (100%)

The Pacolet component makes up 100 percent of the map unit. Slopes are 25 to 35 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Map Unit: Ln—Local alluvial land

Component: Starr (100%)

The Starr component makes up 100 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains on piedmonts. The parent material consists of loamy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is moderate. This soil is occasionally flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria.

Map Unit: MaB3—Madison and Cecil clay loams, 2 to 6 percent slopes, severely eroded

Component: Madison, severely eroded (55%)

The Madison, severely eroded component makes up 55 percent of the map unit. Slopes are 2 to 6 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Component: Cecil, severely eroded (45%)

The Cecil, severely eroded component makes up 45 percent of the map unit. Slopes are 2 to 6 percent. This component is on interfluves, piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map Unit: MaC3—Madison and Cecil clay loams, 6 to 10 percent slopes, severely eroded

Component: Madison, severely eroded (55%)

The Madison, severely eroded component makes up 55 percent of the map unit. Slopes are 6 to 10 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Component: Cecil, severely eroded (45%)

The Cecil, severely eroded component makes up 45 percent of the map unit. Slopes are 6 to 10 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map Unit: MaD3—Madison and Cecil clay loams, 10 to 15 percent slopes, severely eroded

Component: Madison, severely eroded (55%)

The Madison, severely eroded component makes up 55 percent of the map unit. Slopes are 10 to 15 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Component: Pacolet, severely eroded (45%)

The Pacolet, severely eroded component makes up 45 percent of the map unit. Slopes are 10 to 15 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map Unit: MaE3—Madison and Cecil clay loams, 15 to 25 percent slopes, severely eroded

Component: Madison, severely eroded (55%)

The Madison, severely eroded component makes up 55 percent of the map unit. Slopes are 15 to 25 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Component: Pacolet, severely eroded (45%)

The Pacolet, severely eroded component makes up 45 percent of the map unit. Slopes are 15 to 25 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map Unit: MdB2—Madison and Cecil sandy loams, 2 to 6 percent slopes, eroded

Component: Madison (55%)

The Madison component makes up 55 percent of the map unit. Slopes are 2 to 6 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Component: Cecil (45%)

The Cecil component makes up 45 percent of the map unit. Slopes are 2 to 6 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map Unit: MdC2—Madison and Cecil sandy loams, 6 to 10 percent slopes, eroded

Component: Madison (55%)

The Madison component makes up 55 percent of the map unit. Slopes are 6 to 10 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Component: Cecil (45%)

The Cecil component makes up 45 percent of the map unit. Slopes are 6 to 10 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map Unit: MdD2—Madison and Cecil sandy loams, 10 to 15 percent slopes, eroded

Component: Madison (55%)

The Madison component makes up 55 percent of the map unit. Slopes are 10 to 15 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Component: Cecil (45%)

The Cecil component makes up 45 percent of the map unit. Slopes are 10 to 15 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map Unit: MdE—Madison and Cecil sandy loams, 15 to 25 percent slopes

Component: Madison (55%)

The Madison component makes up 55 percent of the map unit. Slopes are 15 to 25 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Component: Pacolet (45%)

The Pacolet component makes up 45 percent of the map unit. Slopes are 15 to 25 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map Unit: MdE2—Madison and Cecil sandy loams, 15 to 25 percent slopes, eroded

Component: Madison (55%)

The Madison component makes up 55 percent of the map unit. Slopes are 15 to 25 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Component: Pacolet (45%)

The Pacolet component makes up 45 percent of the map unit. Slopes are 15 to 25 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map Unit: MdF2—Madison and Cecil sandy loams, 25 to 35 percent slopes, eroded

Component: Madison (55%)

The Madison component makes up 55 percent of the map unit. Slopes are 25 to 35 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Component: Pacolet (45%)

The Pacolet component makes up 45 percent of the map unit. Slopes are 25 to 35 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Map Unit: MeC—Manteo channery silt loam, 2 to 10 percent slopes

Component: Manteo (100%)

The Manteo component makes up 100 percent of the map unit. Slopes are 2 to 10 percent. This component is on interfluves on piedmonts. The parent material consists of clayey serecite schist. Depth to a root restrictive layer, bedrock, lithic, is 10 to 20 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map Unit: MeC2—Manteo channery silt loam, 6 to 15 percent slopes, eroded

Component: Manteo (100%)

The Manteo component makes up 100 percent of the map unit. Slopes are 6 to 15 percent. This component is on interfluves on piedmonts. The parent material consists of clayey serecite schist. Depth to a root restrictive layer, bedrock, lithic, is 10 to 20 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map Unit: MeD—Manteo channery silt loam, 10 to 15 percent slopes

Component: Manteo (100%)

The Manteo component makes up 100 percent of the map unit. Slopes are 10 to 15 percent. This component is on interfluves on piedmonts. The parent material consists of clayey serecite schist. Depth to a root restrictive layer, bedrock, lithic, is 10 to 20 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map Unit: MeE—Manteo channery silt loam, 15 to 35 percent slopes

Component: Manteo (100%)

The Manteo component makes up 100 percent of the map unit. Slopes are 15 to 35 percent. This component is on interfluves on piedmonts. The parent material consists of clayey serecite schist. Depth to a root restrictive layer, bedrock, lithic, is 10 to 20 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Map Unit: MeE2—Manteo channery silt loam, 15 to 35 percent slopes, eroded

Component: Manteo (100%)

The Manteo component makes up 100 percent of the map unit. Slopes are 15 to 35 percent. This component is on interfluves on piedmonts. The parent material consists of clayey serecite schist. Depth to a root restrictive layer, bedrock, lithic, is 10 to 20 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Map Unit: Mv—Mixed alluvial land

Component: Toccoa (55%)

The Toccoa component makes up 55 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains on piedmonts. The parent material consists of loamy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. A seasonal zone of water saturation is at 45 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3w. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 8 percent.

Component: Cartecay (40%)

The Cartecay component makes up 40 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains on piedmonts. The parent material consists of loamy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. A seasonal zone of water saturation is at 12 inches during January, February, March, April. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 5w. This soil does not meet hydric criteria.

Component: Wehadkee (3%)

Generated brief soil descriptions are created for major components. The Wehadkee soil is a minor component.

Map Unit: Mw—Mixed wet alluvial land

Component: Wehadkee (100%)

The Wehadkee component makes up 100 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains on piedmonts. The parent material consists of loamy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is frequently flooded. It is not ponded. A seasonal zone of water saturation is at 6 inches during January, February, March, April, May, November, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 5w. This soil meets hydric criteria.

Map Unit: NaB—Nason very fine sandy loam, 2 to 6 percent slopes

Component: Nason (100%)

The Nason component makes up 100 percent of the map unit. Slopes are 2 to 6 percent. This component is on interfluves on piedmonts. The parent material consists of clayey sericite schist. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map Unit: NaC2—Nason very fine sandy loam, 6 to 10 percent slopes, eroded

Component: Nason (100%)

The Nason component makes up 100 percent of the map unit. Slopes are 6 to 10 percent. This component is on interfluves on piedmonts. The parent material consists of clayey sericite schist. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map Unit: NaD2—Nason very fine sandy loam, 10 to 15 percent slopes, eroded

Component: Nason (100%)

The Nason component makes up 100 percent of the map unit. Slopes are 10 to 15 percent. This component is on interfluves on piedmonts. The parent material consists of clayey sericite schist. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map Unit: NaE—Nason very fine sandy loam, 15 to 25 percent slopes

Component: Nason (100%)

The Nason component makes up 100 percent of the map unit. Slopes are 15 to 25 percent. This component is on interfluves on piedmonts. The parent material consists of clayey sericite schist. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map Unit: NsC3—Nason silty clay loam, 2 to 10 percent slopes, severely eroded

Component: Nason, severely eroded (100%)

The Nason, severely eroded component makes up 100 percent of the map unit. Slopes are 2 to 10 percent. This component is on interfluves on piedmonts. The parent material consists of clayey sericite schist. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map Unit: NsE3—Nason silty clay loam, 10 to 25 percent slopes, severely eroded

Component: Nason, severely eroded (100%)

The Nason, severely eroded component makes up 100 percent of the map unit. Slopes are 10 to 25 percent. This component is on interfluves on piedmonts. The parent material consists of clayey sericite schist. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map Unit: Rw—Riverwash

Component: Riverwash (97%)

Generated brief soil descriptions are created for major soil components. The Riverwash is a miscellaneous area.

Component: Wehadkee (3%)

Generated brief soil descriptions are created for major components. The Wehadkee soil is a minor component.

Map Unit: Sa—State fine sandy loam

Component: State (100%)

The State component makes up 100 percent of the map unit. Slopes are 0 to 2 percent. This component is on stream terraces on piedmonts. The parent material consists of loamy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is rarely flooded. It is not ponded. A seasonal zone of water saturation is at 60 inches during January, February, March, April, May, June, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 1. This soil does not meet hydric criteria.

Map Unit: St—Stony land

Component: Tatum (50%)

The Tatum component makes up 50 percent of the map unit. Slopes are 10 to 40 percent. This component is on interfluves on piedmonts. The parent material consists of clayey sericite schist. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Component: Rock outcrop (50%)

Generated brief soil descriptions are created for major soil components. The Rock outcrop is a miscellaneous area.

Map Unit: TaB3—Tatum silty clay loam, 2 to 6 percent slopes, severely eroded

Component: Tatum, severely eroded (100%)

The Tatum, severely eroded component makes up 100 percent of the map unit. Slopes are 2 to 6 percent. This component is on interfluves on piedmonts. The parent material consists of clayey sericite schist. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map Unit: TaC3—Tatum silty clay loam, 6 to 10 percent slopes, severely eroded

Component: Tatum, severely eroded (100%)

The Tatum, severely eroded component makes up 100 percent of the map unit. Slopes are 6 to 10 percent. This component is on interfluves on piedmonts. The parent material consists of clayey sericite schist. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map Unit: TaD3—Tatum silty clay loam, 10 to 15 percent slopes, severely eroded

Component: Tatum, severely eroded (100%)

The Tatum, severely eroded component makes up 100 percent of the map unit. Slopes are 10 to 15 percent. This component is on interfluves on piedmonts. The parent material consists of clayey sericite schist. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map Unit: TaF3—Tatum silty clay loam, 15 to 35 percent slopes, severely eroded

Component: Tatum, severely eroded (100%)

The Tatum, severely eroded component makes up 100 percent of the map unit. Slopes are 15 to 35 percent. This component is on interfluves on piedmonts. The parent material consists of clayey sericite schist. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map Unit: TmB—Tatum very fine sandy loam, 2 to 6 percent slopes

Component: Tatum (100%)

The Tatum component makes up 100 percent of the map unit. Slopes are 2 to 6 percent. This component is on interfluves on piedmonts. The parent material consists of clayey sericite schist. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map Unit: TmB2—Tatum very fine sandy loam, 2 to 6 percent slopes, eroded

Component: Tatum (100%)

The Tatum component makes up 100 percent of the map unit. Slopes are 2 to 6 percent. This component is on interfluves on piedmonts. The parent material consists of clayey sericite schist. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map Unit: TmC—Tatum very fine sandy loam, 6 to 10 percent slopes

Component: Tatum (100%)

The Tatum component makes up 100 percent of the map unit. Slopes are 6 to 10 percent. This component is on interfluves on piedmonts. The parent material consists of clayey sericite schist. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map Unit: TmC2—Tatum very fine sandy loam, 6 to 10 percent slopes, eroded

Component: Tatum (100%)

The Tatum component makes up 100 percent of the map unit. Slopes are 6 to 10 percent. This component is on interfluves on piedmonts. The parent material consists of clayey sericite schist. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map Unit: TmD—Tatum very fine sandy loam, 10 to 15 percent slopes

Component: Tatum (100%)

The Tatum component makes up 100 percent of the map unit. Slopes are 10 to 15 percent. This component is on interfluves on piedmonts. The parent material consists of clayey sericite schist. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map Unit: TmD2—Tatum very fine sandy loam, 10 to 15 percent slopes, eroded

Component: Tatum (100%)

The Tatum component makes up 100 percent of the map unit. Slopes are 10 to 15 percent. This component is on interfluves on piedmonts. The parent material consists of clayey sericite schist. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map Unit: TmE—Tatum very fine sandy loam, 15 to 25 percent slopes

Component: Tatum (100%)

The Tatum component makes up 100 percent of the map unit. Slopes are 15 to 25 percent. This component is on interfluves on piedmonts. The parent material consists of clayey sericite schist. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map Unit: TmE2—Tatum very fine sandy loam, 15 to 25 percent slopes, eroded

Component: Tatum (100%)

The Tatum component makes up 100 percent of the map unit. Slopes are 15 to 25 percent. This component is on interfluves on piedmonts. The parent material consists of clayey sericite schist. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map Unit: TmF—Tatum very fine sandy loam, 25 to 35 percent slopes

Component: Tatum (100%)

The Tatum component makes up 100 percent of the map unit. Slopes are 25 to 35 percent. This component is on interfluves on piedmonts. The parent material consists of clayey sericite schist. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map Unit: TrC2—Tirzah silt loam, 6 to 10 percent slopes, eroded

Component: Georgeville (100%)

The Georgeville component makes up 100 percent of the map unit. Slopes are 6 to 10 percent. This component is on interfluves on piedmonts. The parent material consists of clayey sericite schist. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map Unit: TrD2—Tirzah silt loam, 10 to 15 percent slopes, eroded

Component: Georgeville (100%)

The Georgeville component makes up 100 percent of the map unit. Slopes are 10 to 15 percent. This component is on interfluves on piedmonts. The parent material consists of clayey sericite schist. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map Unit: W—Water

Component: Water (100%)

Generated brief soil descriptions are created for major soil components. The Water is a miscellaneous area.

Map Unit: WcB—Wickham sandy loam, 2 to 6 percent slopes

Component: Wickham (100%)

The Wickham component makes up 100 percent of the map unit. Slopes are 2 to 6 percent. This component is on stream terraces on piedmonts. The parent material consists of loamy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map Unit: WcC2—Wickham sandy loam, 2 to 10 percent slopes, eroded

Component: Wickham (100%)

The Wickham component makes up 100 percent of the map unit. Slopes are 2 to 10 percent. This component is on stream terraces on piedmonts. The parent material consists of loamy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map Unit: WcE3—Wickham sandy loam, 10 to 25 percent slopes, severely eroded

Component: Pacolet, severely eroded (100%)

The Pacolet, severely eroded component makes up 100 percent of the map unit. Slopes are 10 to 25 percent. This component is on interfluves on piedmonts. The parent material consists of clayey granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map Unit: WkD—Wilkes sandy loam, 6 to 15 percent slopes

Component: Wilkes (100%)

The Wilkes component makes up 100 percent of the map unit. Slopes are 6 to 15 percent. This component is on interfluves on piedmonts. The parent material consists of clayey intermediate and mafic igneous rocks. Depth to a root restrictive layer, bedrock, paralithic, is 10 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map Unit: WkD2—Wilkes sandy loam, 6 to 15 percent slopes, eroded

Component: Wilkes (100%)

The Wilkes component makes up 100 percent of the map unit. Slopes are 6 to 15 percent. This component is on interfluves on piedmonts. The parent material consists of clayey intermediate and mafic igneous rocks. Depth to a root restrictive layer, bedrock, paralithic, is 10 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map Unit: WkE2—Wilkes sandy loam, 15 to 25 percent slopes, eroded

Component: Wilkes (100%)

The Wilkes component makes up 100 percent of the map unit. Slopes are 15 to 25 percent. This component is on interfluves on piedmonts. The parent material consists of clayey intermediate and mafic igneous rocks. Depth to a root restrictive layer, bedrock, paralithic, is 10 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Map Unit: WkF—Wilkes sandy loam, 15 to 35 percent slopes

Component: Wilkes (100%)

The Wilkes component makes up 100 percent of the map unit. Slopes are 15 to 35 percent. This component is on interfluves on piedmonts. The parent material consists of clayey intermediate and mafic igneous rocks. Depth to a root restrictive layer, bedrock, paralithic, is 10 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches (or restricted depth) is very low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

Map Unit: WoB—Worsham sandy loam, 0 to 6 percent slopes

Component: Cartecay (55%)

The Cartecay component makes up 55 percent of the map unit. Slopes are 0 to 6 percent. This component is on flood plains on piedmonts. The parent material consists of loamy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. A seasonal zone of water saturation is at 12 inches during January, February, March, April. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3w. This soil does not meet hydric criteria.

Component: Toccoa (45%)

The Toccoa component makes up 45 percent of the map unit. Slopes are 0 to 6 percent. This component is on flood plains on piedmonts. The parent material consists of loamy alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is rarely flooded. It is not ponded. A seasonal zone of water saturation is at 45 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2w. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 8 percent.

Cleveland County, North Carolina

Map Unit: ChA—Chewacla loam, 0 to 2 percent slopes, frequently flooded

Component: Chewacla, frequently flooded (80%)

The Chewacla, frequently flooded component makes up 80 percent of the map unit. Slopes are 0 to 2 percent. This component is on flood plains on southern piedmonts. The parent material consists of alluvium. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is high. Shrink-swell potential is moderate. This soil is frequently flooded. It is not ponded. A seasonal zone of water saturation is at 10 inches during January, February, March, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4w. This soil does not meet hydric criteria.

Component: Toccoa, frequently flooded (15%)

Generated brief soil descriptions are created for major components. The Toccoa soil is a minor component.

Component: Wehadkee, ponded (5%)

Generated brief soil descriptions are created for major components. The Wehadkee soil is a minor component.

Map Unit: GrD—Grover gravelly sandy loam, 15 to 30 percent slopes, rocky

Component: Grover, rocky (90%)

The Grover, rocky component makes up 90 percent of the map unit. Slopes are 15 to 30 percent. This component is on hillslopes on ridges, uplands. The parent material consists of residuum weathered from mica schist and/or other micaceous metamorphic rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Component: Rock outcrop (1%)

Rock outcrop is a miscellaneous area. It consists of bare hard bedrock, mainly unweathered igneous and metamorphic rock. Land capability classification is 8s.

Map Unit: HeB—Helena-Worsham complex 1 to 6 percent slopes

Component: Helena (65%)

The Helena component makes up 65 percent of the map unit. Slopes are 1 to 6 percent. This component is on depressions, uplands. The parent material consists of saprolite derived from granite and gneiss and/or schist. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is high. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 24 inches during January, February, March, April, December. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Component: Worsham, drained (25%)

The Worsham, drained component makes up 25 percent of the map unit. Slopes are 0 to 3 percent. This component is on depressions, uplands. The parent material consists of alluvium and/or colluvium over saprolite derived from granite and gneiss. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. A seasonal zone of water saturation is at 6 inches during January, December. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 3w. This soil meets hydric criteria.

Map Unit: HhB—Hulett gravelly sandy loam, 2 to 8 percent slopes

Component: Hulett (90%)

The Hulett component makes up 90 percent of the map unit. Slopes are 2 to 8 percent. This component is on interfluves, uplands. The parent material consists of residuum weathered from mica schist and/or other micaceous metamorphic rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map Unit: HtC—Hulett gravelly sandy loam, 8 to 15 percent slopes, stony

Component: Hulett, stony (90%)

The Hulett, stony component makes up 90 percent of the map unit. Slopes are 8 to 15 percent. This component is on hillslopes on ridges, uplands. The parent material consists of residuum weathered from mica schist and/or other micaceous metamorphic rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Map Unit: HuC—Hulett-Saw complex, 4 to 15 percent slopes, very rocky

Component: Hulett, very rocky (70%)

The Hulett, very rocky component makes up 70 percent of the map unit. Slopes are 4 to 15 percent. This component is on hillslopes on ridges, uplands. The parent material consists of residuum weathered from mica schist and/or other micaceous metamorphic rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Component: Saw, very rocky (15%)

The Saw, very rocky component makes up 15 percent of the map unit. Slopes are 4 to 15 percent. This component is on hillslopes on ridges, uplands. The parent material consists of saprolite derived from granite and/or gneiss. Depth to a root restrictive layer, bedrock, lithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 3e. This soil does not meet hydric criteria.

Component: Rock outcrop (5%)

Rock outcrop is a miscellaneous area. It consists of bare hard bedrock, mainly unweathered igneous and metamorphic rock. Land capability classification is 8s.

Map Unit: HwB—Hulett-Urban land complex, 2 to 8 percent slopes

Component: Hulett (75%)

The Hulett component makes up 75 percent of the map unit. Slopes are 2 to 8 percent. This component is on interfluves, uplands. The parent material consists of residuum weathered from mica schist and/or other micaceous metamorphic rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Component: Urban land (25%)

Generated brief soil descriptions are created for major soil components. The Urban land is a miscellaneous area.

Map Unit: MaB2—Madison gravelly sandy clay loam, 2 to 8 percent slopes, moderately eroded

Component: Madison, moderately eroded (85%)

The Madison, moderately eroded component makes up 85 percent of the map unit. Slopes are 2 to 8 percent. This component is on interfluves, uplands. The parent material consists of residuum weathered from mica schist and/or other micaceous metamorphic rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map Unit: MbB2—Madison-Bethlehem complex, 2 to 8 percent slopes, stony, moderately eroded

Component: Madison, moderately eroded (70%)

The Madison, moderately eroded component makes up 70 percent of the map unit. Slopes are 2 to 8 percent. This component is on interfluves, uplands. The parent material consists of residuum weathered from mica schist and/or other micaceous metamorphic rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Component: Bethlehem, moderately eroded (30%)

The Bethlehem, moderately eroded component makes up 30 percent of the map unit. Slopes are 2 to 8 percent. This component is on interfluves, uplands. The parent material consists of residuum weathered from metamorphic rock and/or schist. Depth to a root restrictive layer, bedrock, lithic, is 40 to 96 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map Unit: McC2—Madison-Bethlehem complex, 8 to 15 percent slopes, very stony, moderately eroded

Component: Madison, very stony (60%)

The Madison, very stony component makes up 60 percent of the map unit. Slopes are 8 to 15 percent. This component is on hillslopes on ridges, uplands. The parent material consists of residuum weathered from mica schist and/or other micaceous metamorphic rock. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Component: Bethlehem, very stony (35%)

The Bethlehem, very stony component makes up 35 percent of the map unit. Slopes are 8 to 15 percent. This component is on hillslopes on ridges, uplands. The parent material consists of residuum weathered from metamorphic rock and/or schist. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 6s. This soil does not meet hydric criteria.

Map Unit: TaD—Tatum-Montonia complex, 15 to 30 percent slopes

Component: Tatum (50%)

The Tatum component makes up 50 percent of the map unit. Slopes are 15 to 30 percent. This component is on interfluves, uplands. The parent material consists of residuum weathered from schist and/or other metamorphic rock. Depth to a root restrictive layer, bedrock, lithic, is 60 to 80 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Component: Montonia (45%)

The Montonia component makes up 45 percent of the map unit. Slopes are 15 to 30 percent. This component is on interfluves, uplands. The parent material consists of residuum weathered from schist and/or other metamorphic rock. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 6e. This soil does not meet hydric criteria.

Map Unit: UuB2—Uwharrie silty clay loam, 2 to 8 percent slopes, moderately eroded

Component: Uwharrie, moderately eroded (85%)

The Uwharrie, moderately eroded component makes up 85 percent of the map unit. Slopes are 2 to 8 percent. This component is on uplands, interfluves. The parent material consists of residuum weathered from metavolcanics and/or argillite. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 2e. This soil does not meet hydric criteria.

Map Unit: UwC2—Uwharrie-Tatum complex, 8 to 15 percent slopes, moderately eroded

Component: Uwharrie, moderately eroded (65%)

The Uwharrie, moderately eroded component makes up 65 percent of the map unit. Slopes are 8 to 15 percent. This component is on hillslopes on ridges, uplands. The parent material consists of residuum weathered from metavolcanics and/or argillite. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is high. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Component: Tatum, moderately eroded (30%)

The Tatum, moderately eroded component makes up 30 percent of the map unit. Slopes are 8 to 15 percent. This component is on hillslopes on ridges, uplands. The parent material consists of residuum weathered from metavolcanics and/or argillite. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 4e. This soil does not meet hydric criteria.

Map Unit: W—Water

Component: Water (100%)

Generated brief soil descriptions are created for major soil components. The Water is a miscellaneous area.

Data Source Information

Soil Survey Area: Cherokee County, South Carolina
Survey Area Data: Version 12, Sep 29, 2015

Soil Survey Area: Cleveland County, North Carolina
Survey Area Data: Version 18, Sep 13, 2015

4. Stormwater Analysis

The hydrologic and hydraulic analyses have been completed according to SCDOT's *Requirements for Hydraulic Design Studies*, dated May 26, 2009. Specific design standards and analysis techniques are described below.

Pre Versus Post Construction Analysis:

Drainage areas for the project were delineated using field surveys, U.S. Geological Survey's topographic quadrangles, and StreamStats. Pre and post discharges for the project's watersheds were calculated using either the Rational method, SCS method, or Regression method. The method used depended upon the size of the drainage area specified by SCDOT's *Requirements for Hydraulic Design Studies*, dated May 26, 2009. The rational method was used for drainage areas up to 100 acres, the SCS method was used for drainage areas between 100 acres – 640 acres, and the regression method was used for drainage areas greater than 640 acres. Rainfall intensities are from the SCDOT regional intensity curves and the time of concentrations were determined using the Soil Conservation Services' TR-55 methodology. The minimum time of concentration used was 5 minutes. Lastly, WIN – TR 55 was used for pre/post analyses requiring SCS methods; while equations and methods specified in the USGS SIR 2009-5156 and SIR 2014-5030 were used when regression analysis was warranted.

Cross-Line Analysis:

Cross-lines were analyzed according to the SCDOT's *Requirements for Hydraulic Design Studies*, dated May 26, 2009. Design storms used for analyses were determined based on the roadway classification. All existing cross-lines along I-85 were analyzed for the 50-year design storms. Frontage road cross-lines were analyzed for 25-year design storms. All cross-lines were analyzed for performance during 100-year design storms. The Federal Highway Administration's HY-8 program was used to determine headwater elevations for existing cross-lines to evaluate their performance. Additionally, GEOPAK Drainage was used to analyze existing cross-line drainage systems.

The stormwater management analyses are provided in this section.

4.1 Pre Versus Post Construction Outfall Analysis

Analyses were performed on fifty outfalls to determine the potential impact construction may have on the surrounding areas. Pre versus post construction conditions were compared to evaluate the change in runoff. The ultimate receiving bodies for these outfalls include Buffalo Creek, Bee Branch, Jumping Branch, and Mill Creek. Pre and post discharges were calculated using either the Rational method, SCS method, or Regression method. The method used depended upon the size of the drainage area per SCDOT's *Requirements for Hydraulic Design Studies*, dated May 26, 2009. The hydrologic analyses indicated that the increase in discharge at each outfall is negligible relative to the overall watershed. Peak roadway discharge will generally occur well in advance of the overall watershed peak, further reducing impacts to the overall watershed. Detention will unnecessarily add cost to the project, increase long term maintenance costs, and is not recommended to control the negligible changes in discharge. The watershed hydrologic analyses are provided in this section. A summary of the 10-year pre and post outfall discharges are shown in *Table 4.1*.

Table 4.1 – Outfall Pre and Post Discharges

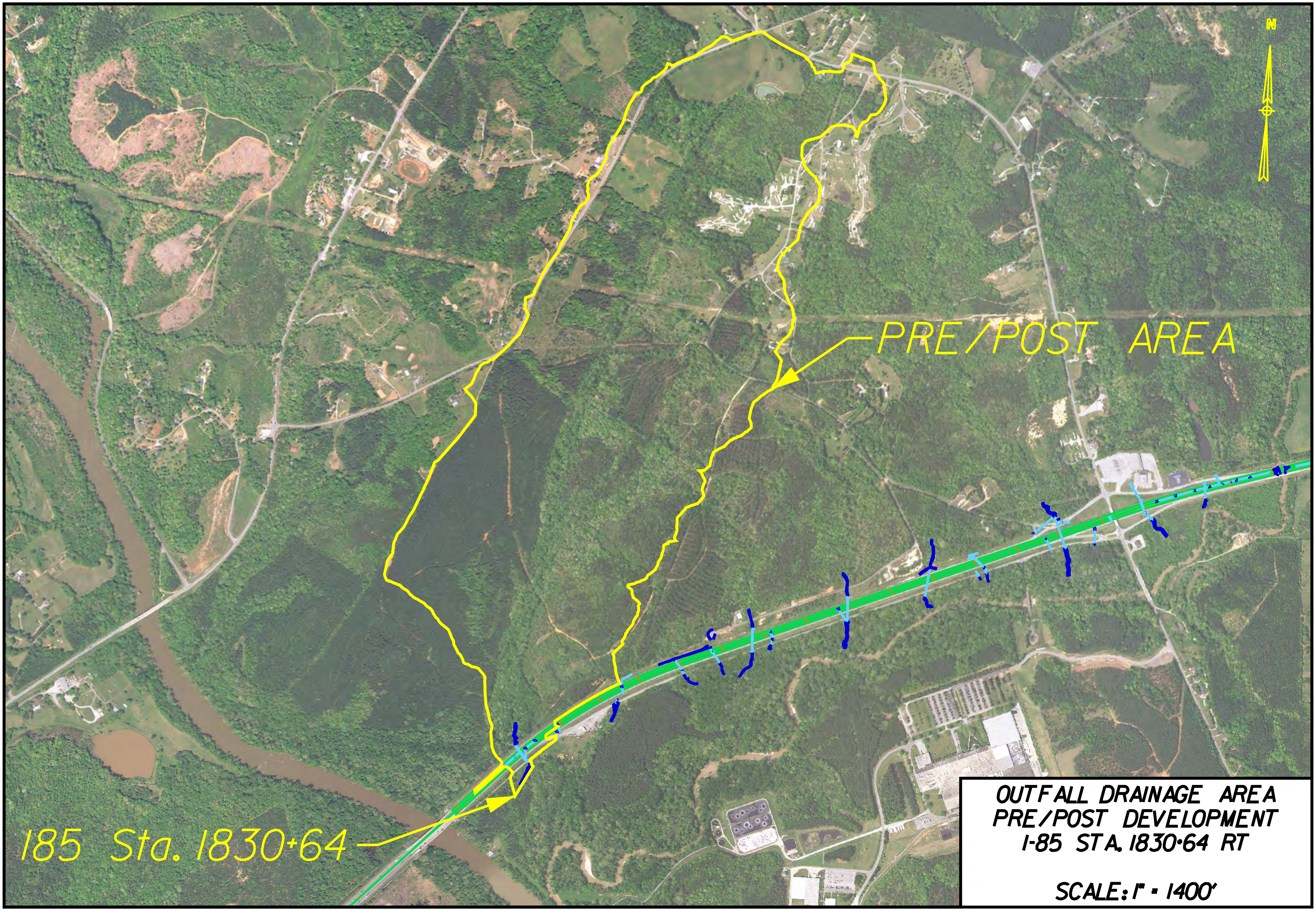
Route	Outfall Channel Station	Outfall Side	Nearest Receiving Waterbody (RWB)	Area (Acres)	Discharge (cfs) 10 - Year Return Interval		
					Pre	Post	Change
I - 85	1830 + 64	RT	Unnamed tributary to Buffalo Creek	462.04	328	328	0
I - 85	1837 + 90	RT	Buffalo Creek	4.52	21	23	2
I - 85	1845 + 09	RT	Buffalo Creek	12.36	12	13	1
I - 85	1855 + 23	RT	Buffalo Creek	9.89	9	9	0
I - 85	1859 + 21	RT	Buffalo Creek	7.12	10	11	1
I - 85	1862 + 53	RT	Buffalo Creek	57.41	42	42	0
I - 85	1864 + 95	RT	Buffalo Creek	3.17	11	13	2
I - 85	1873 + 82	RT	Buffalo Creek	71.73	80	83	3
I - 85	1883 + 42	RT	Buffalo Creek	10.11	8	8	0
I - 85	1891 + 07	RT	Buffalo Creek	4.04	6	6	0
I - 85	1899 + 76	RT	Unnamed tributary to Buffalo Creek	324.82	313	313	0
I - 85	1903 + 38	RT	Buffalo Creek	2.39	9	11	2
I - 85	1910 + 64	RT	Buffalo Creek	96.13	78	82	4
I - 85	1916 + 80	RT	Unnamed tributary to Buffalo Creek	58.54	57	56	-1
I - 85	1924 + 57	CL	Buffalo Creek	1.60	9	10	1
I - 85	1945 + 43	LT	Unnamed tributary to Buffalo Creek	955.00	509	509	0
I - 85	1969 + 52	LT	Unnamed tributary to Buffalo Creek	1.25	3	4	1
I - 85	1973 + 22	LT	Unnamed tributary to Buffalo Creek	2.30	5	6	1
I - 85	1975 + 08	LT	Unnamed tributary to Buffalo Creek	23.68	56	61	5

Route	Outfall Channel Station	Outfall Side	Nearest Receiving Waterbody (RWB)	Area (Acres)	Discharge (cfs)		
					10 - Year Return Interval		
					Pre	Post	Change
I - 85	1997 + 27	LT	Unnamed tributary to Buffalo Creek	8.00	18	20	2
I - 85	2005 + 18	LT	Unnamed tributary to Buffalo Creek	7.15	17	19	2
I - 85	2015 + 32	LT	Unnamed tributary to Buffalo Creek	80.09	99	103	4
I - 85	2017 + 21	LT	Unnamed tributary to Buffalo Creek	50.42	59	64	5
I - 85	2028 + 67	LT	Unnamed tributary to Buffalo Creek	26.76	54	54	0
I - 85	2032 + 83	LT	Unnamed tributary to Buffalo Creek	97.93	175	183	8
I - 85	2038 + 46	LT	Unnamed tributary to Buffalo Creek	59.15	95	98	3
I - 85	2040 + 24	LT	Unnamed tributary to Buffalo Creek	26.84	37	38	1
I - 85	2064 + 90	LT	Unnamed tributary to Bee Branch	96.19	128	132	4
I - 85	2076 + 44	LT	Unnamed tributary to Bee Branch	102.14	117	124	7
I - 85	2081 + 60	LT	Unnamed tributary to Bee Branch	60.42	95	98	3
I - 85	2098 + 61	LT	Unnamed tributary to Bee Branch	23.23	42	42	0
I - 85	2114 + 87	LT	Unnamed tributary to Bee Branch	239.96	246	260	14
I - 85	2124 + 49	LT	Unnamed tributary to Bee Branch	5.70	14	13	-1
I - 85	2129 + 64	LT	Unnamed tributary to Bee Branch	13.58	28	32	4
I - 85	2141 + 13	LT	Bee Branch	87.98	128	136	8
I - 85	2143 + 72	LT	Bee Branch	40.92	78	82	4
I - 85	2149 + 61	LT	Unnamed tributary to Bee Branch	22.71	57	55	-2
I - 85	2153 + 84	LT	Unnamed tributary to Bee Branch	41.18	91	91	0
I - 85	2165 + 54	LT	Unnamed tributary to Bee Branch	27.89	40	45	5

Route	Outfall Channel Station	Outfall Side	Nearest Receiving Waterbody (RWB)	Area (Acres)	Discharge (cfs) 10 - Year Return Interval		
					Pre	Post	Change
I - 85	2170 + 46	LT	Unnamed tributary to Bee Branch	21.89	19	22	3
I - 85	2173 + 17	LT	Unnamed tributary to Bee Branch	15.37	24	27	3
I - 85	2204 + 63	RT	Unnamed tributary to Jumping Branch	33.31	34	37	3
I - 85	2218 + 74	RT	Unnamed tributary to Jumping Branch	42.10	51	55	4
I - 85	2223 + 02	RT	Unnamed tributary to Jumping Branch	49.60	62	66	4
I - 85	2241 + 54	RT	Mill Creek	7.68	10	11	1
I - 85	2246 + 42	RT	Mill Creek	2.65	4	5	1
I - 85	2249 + 11	RT	Mill Creek	23.35	80	77	-3
I - 85	2252 + 39	RT	Mill Creek	43.22	94	95	1
I - 85	2257 + 89	RT	Mill Creek	72.79	130	137	7
I - 85	2268 + 63	RT	Mill Creek	24.74	25	25	0

OUTFALL 1830+64 RT

This outfall receives runoff from offsite areas as well as roadway discharge from Sta. 1827+50 to Sta. 1839+00, which ultimately feeds into Buffalo Creek. The drainage area is approximately 462 acres and is mostly wooded with minimal development. Roadway runoff is routed to the outfall through multiple existing storm sewer systems; while offsite runoff is routed under I-85 through an existing 8' x 8' R.C. box culvert and then into a 96" CMP pipe. Discharge from this outfall is released into a heavily wooded area and is then conveyed to an unnamed tributary that feeds into Buffalo Creek. There will be no change in discharge from pre to post development conditions for the 10-year design storm. Therefore, the proposed I-85 improvements will have no adverse downstream impact.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 1830+64 RT

SCALE: 1" = 1400'

SCS Analysis

HSG	Land Use	Acres	CN
B	Impervious	3.51	98.00
B	Streets and roads: Paved open ditches	13.75	89.00
B	Streets and roads: Dirt	5.95	82.00
B	Residential: 1/3 acre	10.35	72.00
B	Pasture,grassland,or range: Good	54.25	61.00
B	Woods:Good	348.95	55.00
A	Pasture,grassland,or range: Good	1.79	39.00
A	Woods:Good	23.49	30.00
		462.04	

Area Weighted CN
57

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	7.38%	100	0.8				0.342
Shallow Concentrated	Unpaved	7.38%	1472					0.093
Shallow Concentrated								
Channel 1		1.53%	7849	0.04	18	13.7295	5.512184	0.396
Channel 2								
Total			9421				3.1483	0.831

Drainage Area *(acres)*	**462.04**

Curve Number	**57**
Time of Concentration *(minutes)*	**50**

WinTR-55 Current Data Description

--- Identification Data ---

User:	CECS	Date:	12/13/2016
Project:	I-85 Improvement Proj DB Prep	Units:	English
SubTitle:	OUTFALL 1830+64 RT (PRE)	Areal Units:	Acres
State:	South Carolina		
County:	Cherokee_NOAA_B		

Filename: S:\Proj\2014\6114 I-85 mm 96-106\Design\Project PIN Number\Drainage\Calculations\OUTFALL\Q50 AN

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
1830+64 RT		Outlet	462.04	57	0.833

Total area: 462.04 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
3.73	4.68	5.44	6.49	7.35	8.24	3.1

Storm Data Source: Cherokee_NOAA_B County, SC (NRCS)
Rainfall Distribution Type: Type NO_B
Dimensionless Unit Hydrograph: <standard>

CECS I-85 Improvement Proj DB Prep
OUTFALL 1830+64 RT (PRE)
Cherokee_NOAA_B County, South Carolina

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
SUBAREAS				
1830+64 RT	328.49	510.18	673.02	852.33
REACHES				
OUTLET	328.49	510.18	673.02	852.33

SCS Analysis

HSG	Land Use	Acres	CN
B	Impervious	3.85	98.00
B	Streets and roads: Paved open ditches	13.75	89.00
B	Streets and roads: Dirt	5.95	82.00
B	Residential: 1/3 acre	10.35	72.00
B	Pasture,grassland,or range: Good	54.24	61.00
B	Woods:Good	348.95	55.00
A	Pasture,grassland,or range: Good	1.46	39.00
A	Woods:Good	23.49	30.00
		462.04	

Area Weighted CN
57

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	7.38%	100	0.8				0.342
Shallow Concentrated	Unpaved	7.38%	1472					0.093
Shallow Concentrated								
Channel 1		1.53%	7849	0.04	18	13.7295	5.512184	0.396
Channel 2								
Total			9421				3.1483	0.831

Drainage Area *(acres)*	**462.04**

Curve Number	**57**
Time of Concentration *(minutes)*	**50**

WinTR-55 Current Data Description

--- Identification Data ---

User:	CECS	Date:	12/13/2016
Project:	I-85 Improvement Proj DB Prep	Units:	English
SubTitle:	OUTFALL 1830+64 RT (POST)	Areal Units:	Acres
State:	South Carolina		
County:	Cherokee_NOAA_B		
Filename:	S:\Proj\2014\6114 I-85 mm 96-106\Design\Project PIN Number\Drainage\Calculations\OUTFALL\Q50 AN		

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
1830+64 RT		Outlet	462.04	57	0.833

Total area: 462.04 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
3.73	4.68	5.44	6.49	7.35	8.24	3.1

Storm Data Source: Cherokee_NOAA_B County, SC (NRCS)
Rainfall Distribution Type: Type NO_B
Dimensionless Unit Hydrograph: <standard>

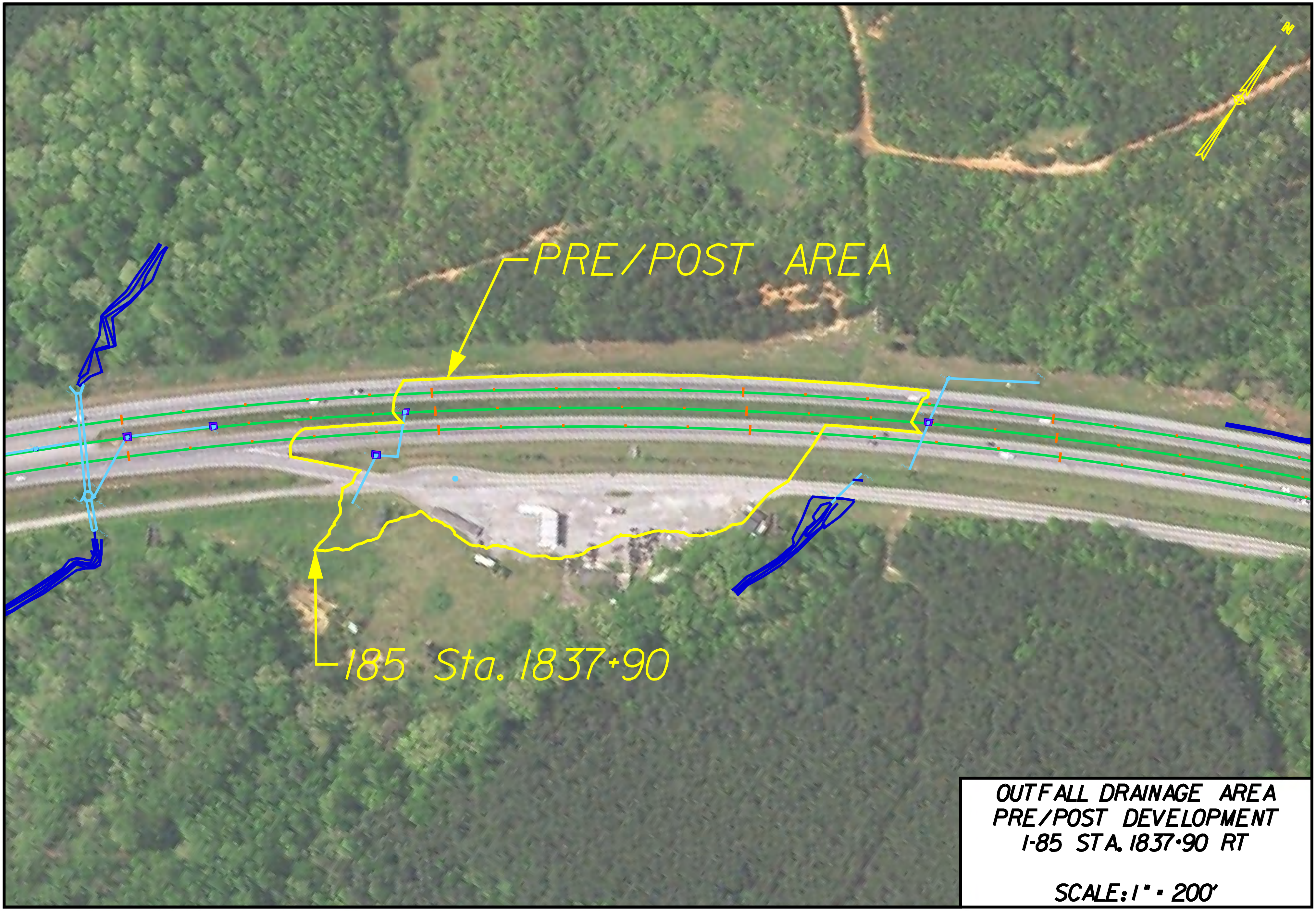
I-85 Improvement Proj DB Prep
OUTFALL 1830+64 RT (POST)
Cherokee_NOAA_B County, South Carolina

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
SUBAREAS				
1830+64 RT	328.49	510.18	673.02	852.33
REACHES				
OUTLET	328.49	510.18	673.02	852.33

OUTFALL 1837+90 RT

This outfall primarily receives roadway discharge from Sta. 1839+00 to Sta. 1848+00. The drainage area is approximately 4.5 acres and encompasses only paved and grassed areas. Roadway discharge is routed under I-85 to the outfall via an existing storm sewer system. Runoff from this outfall is released into a heavily wooded area and is then conveyed to Buffalo Creek. The proposed I-85 improvements will increase imperviousness due to an increase in median pavement. As a result, there will be a negligible increase in discharge of 2 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no downstream impact and detention is not recommended.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 1837+90 RT

SCALE: 1" = 200'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	2.83	0.90	
Rolling, 2%-10%	Side Slopes, Turf	1.69	0.30	Area Weighted C
				0.68
		4.52		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Gaffney

Time of Concentration *(minutes)*	5

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
$\mathbf{Q_{10}}$	1	0.68	6.770	4.52	**21**
$\mathbf{Q_{25}}$	1.1	0.68	7.845	4.52	**26**
$\mathbf{Q_{50}}$	1.2	0.68	8.698	4.52	**32**
$\mathbf{Q_{100}}$	1.25	0.68	9.546	4.52	**36**

Rational Analysis

Land Slope	Land Use	Acres	C
Rolling, 2%-10%	Pavements & Roofs	3.43	0.90
Rolling, 2%-10%	Side Slopes, Turf	1.09	0.30
		4.52	

Area Weighted C
0.76

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

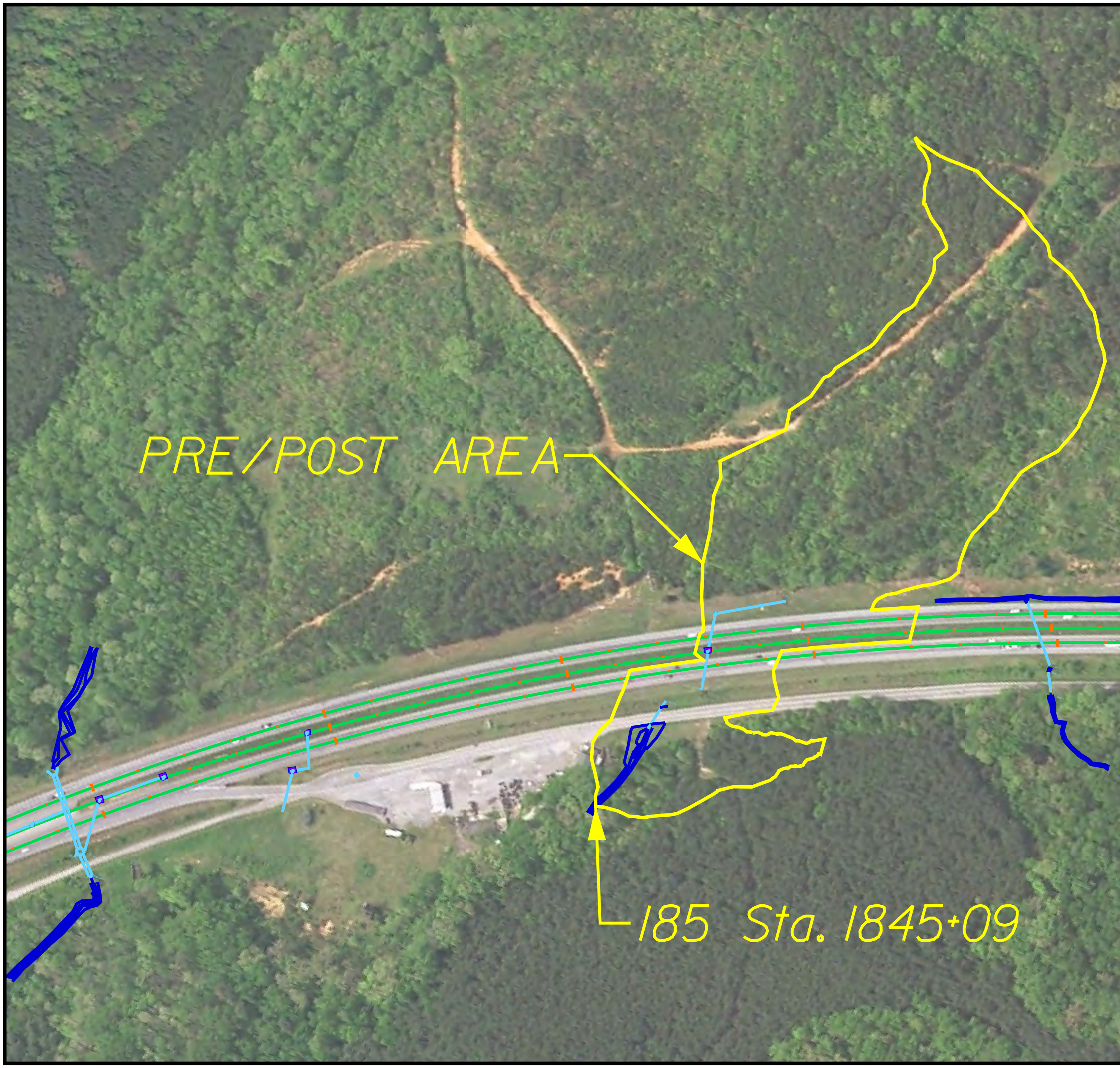
Gaffney

Time of Concentration *(minutes)*	5

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.76	6.770	4.52	**23**
Q_{25}	1.1	0.76	7.845	4.52	**29**
Q_{50}	1.2	0.76	8.698	4.52	**36**
Q_{100}	1.25	0.76	9.546	4.52	**41**

OUTFALL 1845+09 RT

This outfall receives runoff from offsite areas as well as roadway discharge from Sta. 1848+00 to Sta. 1852+00. The drainage area is approximately 12 acres and includes roadway pavement, grassed medians, and wooded areas. Offsite and roadway runoff is routed under I-85 to the outfall via an existing storm sewer system. Discharge from this outfall is released into a heavily wooded area and is then conveyed to Buffalo Creek. The I-85 improvements will increase imperviousness due to the proposed median paving. As a result, there will be a negligible increase in discharge of 1 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 1845+09 RT

SCALE: 1" = 300'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	0.85	0.90	
Rolling, 2%-10%	Unpaved Road, Clay Soils	0.27	0.53	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	1.94	0.30	0.23
Rolling, 2%-10%	Woodland & Forest	9.30	0.15	
		12.36		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusł	5.66%	100	0.8				0.381
Shallow Concentrated	Unpaved	5.66%	869					0.063
Shallow Concentrated								
Channel 1								
Channel 2								
Total			969				0.6070	0.443

Gaffney

Time of Concentration *(minutes)*	27

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.23	4.222	12.36	**12**
Q_{25}	1.1	0.23	4.821	12.36	**15**
Q_{50}	1.2	0.23	5.287	12.36	**18**
Q_{100}	1.25	0.23	5.741	12.36	**21**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	1.15	0.90	
Rolling, 2%-10%	Unpaved Road, Clay Soils	0.27	0.53	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	1.64	0.30	0.25
Rolling, 2%-10%	Woodland & Forest	9.30	0.15	
		12.36		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	5.66%	100	0.8				0.381
Shallow Concentrated	Unpaved	5.66%	869					0.063
Shallow Concentrated								
Channel 1								
Channel 2								
Total			969				0.6070	0.443

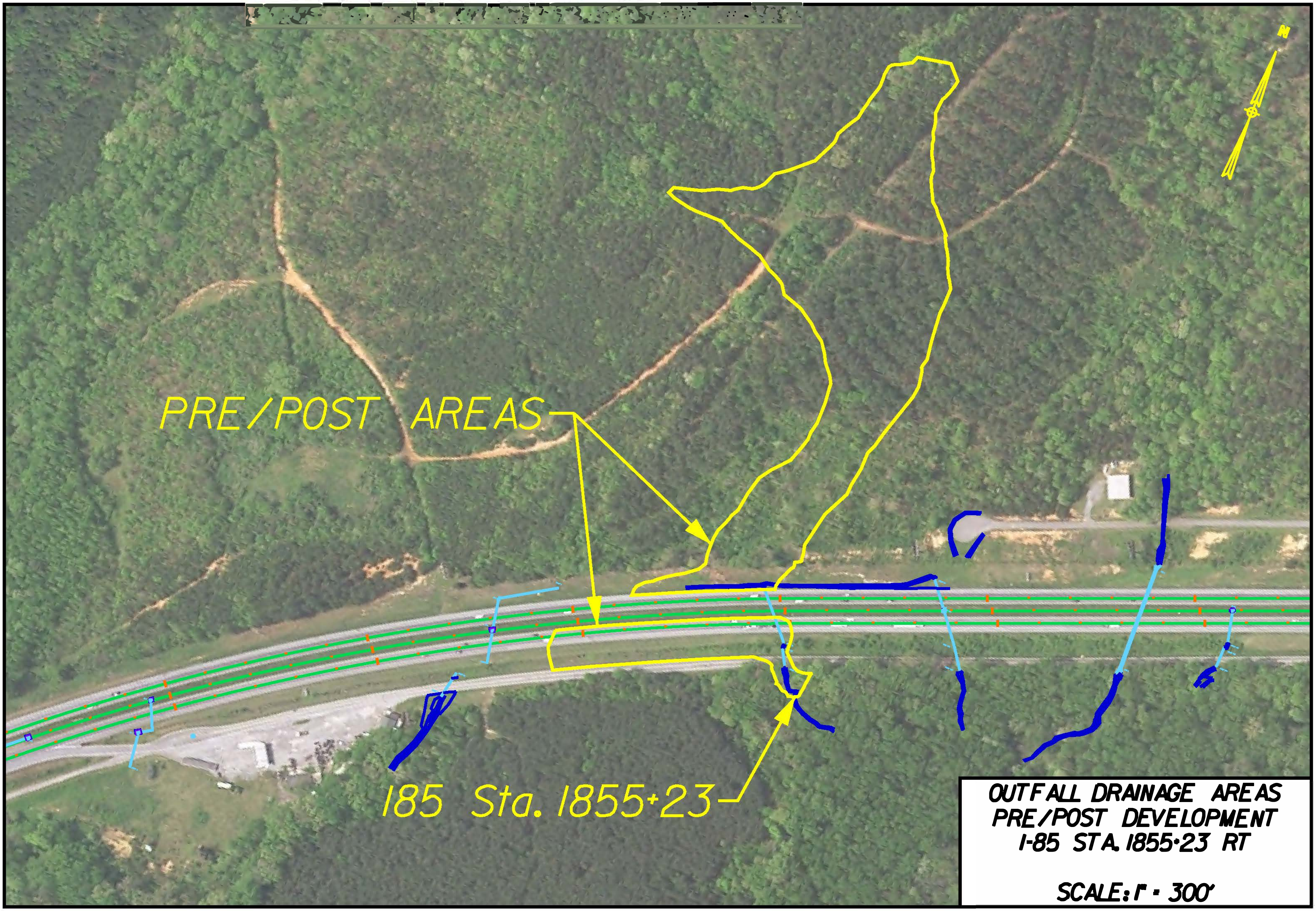
Gaffney

Time of Concentration *(minutes)*	27

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.25	4.222	12.36	**13**
Q_{25}	1.1	0.25	4.821	12.36	**16**
Q_{50}	1.2	0.25	5.287	12.36	**19**
Q_{100}	1.25	0.25	5.741	12.36	**22**

OUTFALL 1855+23 RT

This outfall receives runoff from offsite areas as well as roadway discharge from Sta. 1849+50 to Sta. 1855+00. The drainage area is approximately 10 acres and includes roadway pavement, grassed medians, and wooded areas. Offsite and roadway runoff is routed under I-85 to the outfall via an existing storm sewer system. Discharge from this outfall is released into a heavily wooded area and is then conveyed to Buffalo Creek. There will be no change in discharge from pre to post development conditions for the 10-year design storm. Therefore, the proposed I-85 improvements will have no adverse downstream impact.


PRE/POST AREAS
185 Sta. 1855+23
OUTFALL DRAINAGE AREAS
PRE/POST DEVELOPMENT
I-85 STA. 1855+23 RT
SCALE: 1" = 300'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	0.52	0.90	
Rolling, 2%-10%	Unpaved Road, Clay Soils	0.21	0.53	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	1.70	0.30	0.22
Rolling, 2%-10%	Woodland & Forest	7.46	0.15	
		9.89		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	6.28%	100	0.8				0.365
Shallow Concentrated	Unpaved	6.28%	1556					0.107
Shallow Concentrated								
Channel 1								
Channel 2								
Total			1656				0.9745	0.472

Gaffney

Time of Concentration *(minutes)*	29

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.22	4.082	9.89	**9**
Q_{25}	1.1	0.22	4.658	9.89	**11**
Q_{50}	1.2	0.22	5.105	9.89	**14**
Q_{100}	1.25	0.22	5.541	9.89	**15**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	0.51	0.90	
Rolling, 2%-10%	Unpaved Road, Clay Soils	0.21	0.53	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	1.71	0.30	0.22
Rolling, 2%-10%	Woodland & Forest	7.46	0.15	
		9.89		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	6.28%	100	0.8				0.365
Shallow Concentrated	Unpaved	6.28%	1556					0.107
Shallow Concentrated								
Channel 1								
Channel 2								
Total			1656				0.9745	0.472

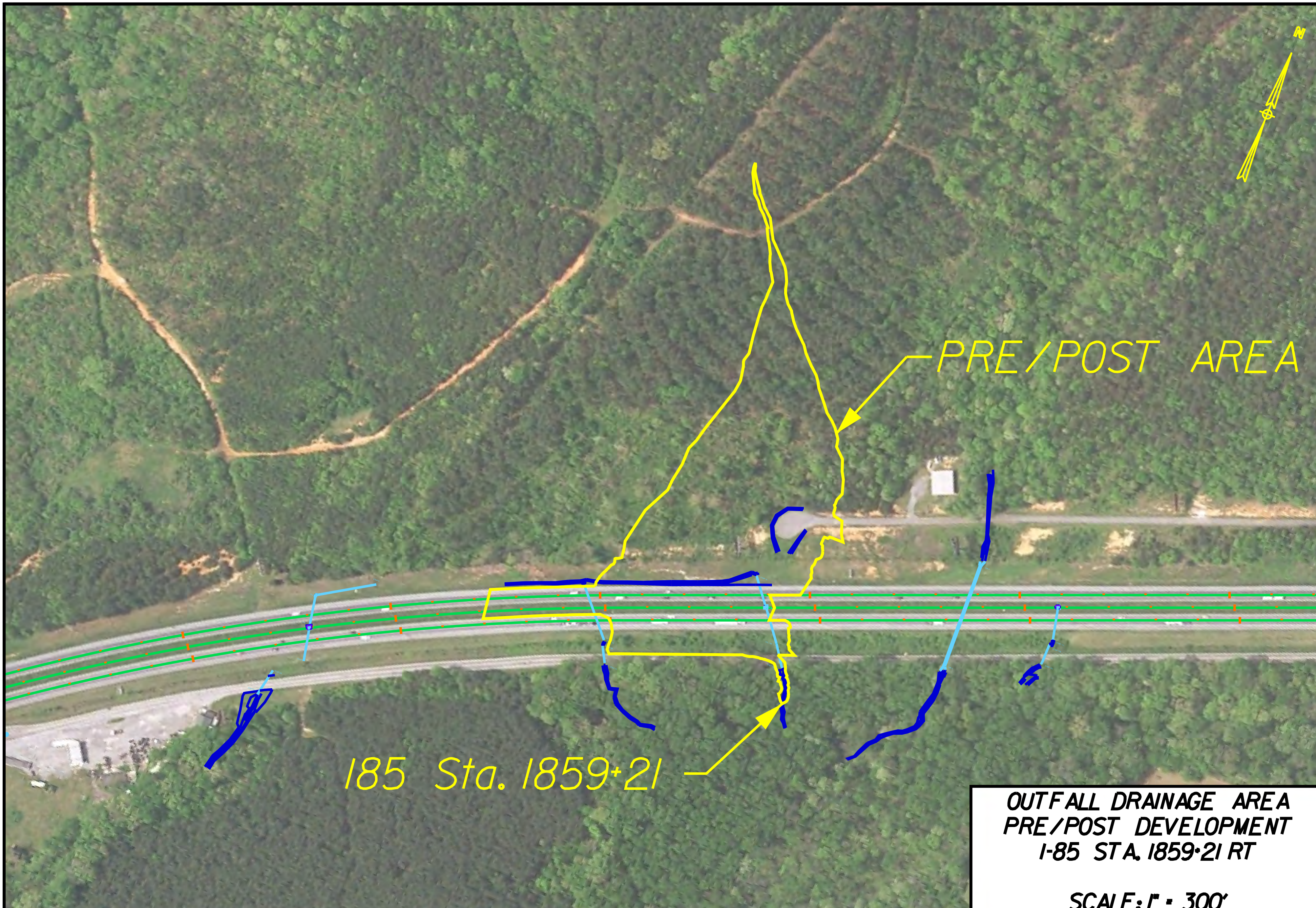
Gaffney

Time of Concentration *(minutes)*	29

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.22	4.082	9.89	**9**
Q_{25}	1.1	0.22	4.658	9.89	**11**
Q_{50}	1.2	0.22	5.105	9.89	**13**
Q_{100}	1.25	0.22	5.541	9.89	**15**

OUTFALL 1859+21 RT

This outfall receives runoff from offsite areas as well as roadway discharge from Sta. 1852+00 to Sta. 1859+00. The drainage area is approximately 7 acres and includes roadway pavement, grassed medians, and wooded areas. Offsite and roadway runoff is routed under I-85 to the outfall via an existing storm sewer system. Discharge from this outfall is released into a heavily wooded area and is then conveyed to Buffalo Creek. The I-85 improvements will increase imperviousness due to the proposed increase in median pavement. As a result, there will be a negligible increase in discharge of 1 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 1859+21 RT

SCALE: 1" = 300'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	1.10	0.90	
Rolling, 2%-10%	Side Slopes, Turf	1.79	0.30	Area Weighted C
Rolling, 2%-10%	Woodland & Forest	4.23	0.15	0.30
		7.12		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusl	8.68%	100	0.8				0.321
Shallow Concentrated	Unpaved	8.68%	571					0.033
Shallow Concentrated								
Channel 1								
Channel 2								
Total			671				0.5261	0.354

Gaffney

Time of Concentration *(minutes)*	22

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.30	4.618	7.12	**10**
Q_{25}	1.1	0.30	5.284	7.12	**13**
Q_{50}	1.2	0.30	5.804	7.12	**15**
Q_{100}	1.25	0.30	6.311	7.12	**17**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	1.59	0.90	
Rolling, 2%-10%	Side Slopes, Turf	1.30	0.30	Area Weighted C
Rolling, 2%-10%	Woodland & Forest	4.23	0.15	0.34
		7.12		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	8.68%	100	0.8				0.321
Shallow Concentrated	Unpaved	8.68%	571					0.033
Shallow Concentrated								
Channel 1								
Channel 2								
Total			671				0.5261	0.354

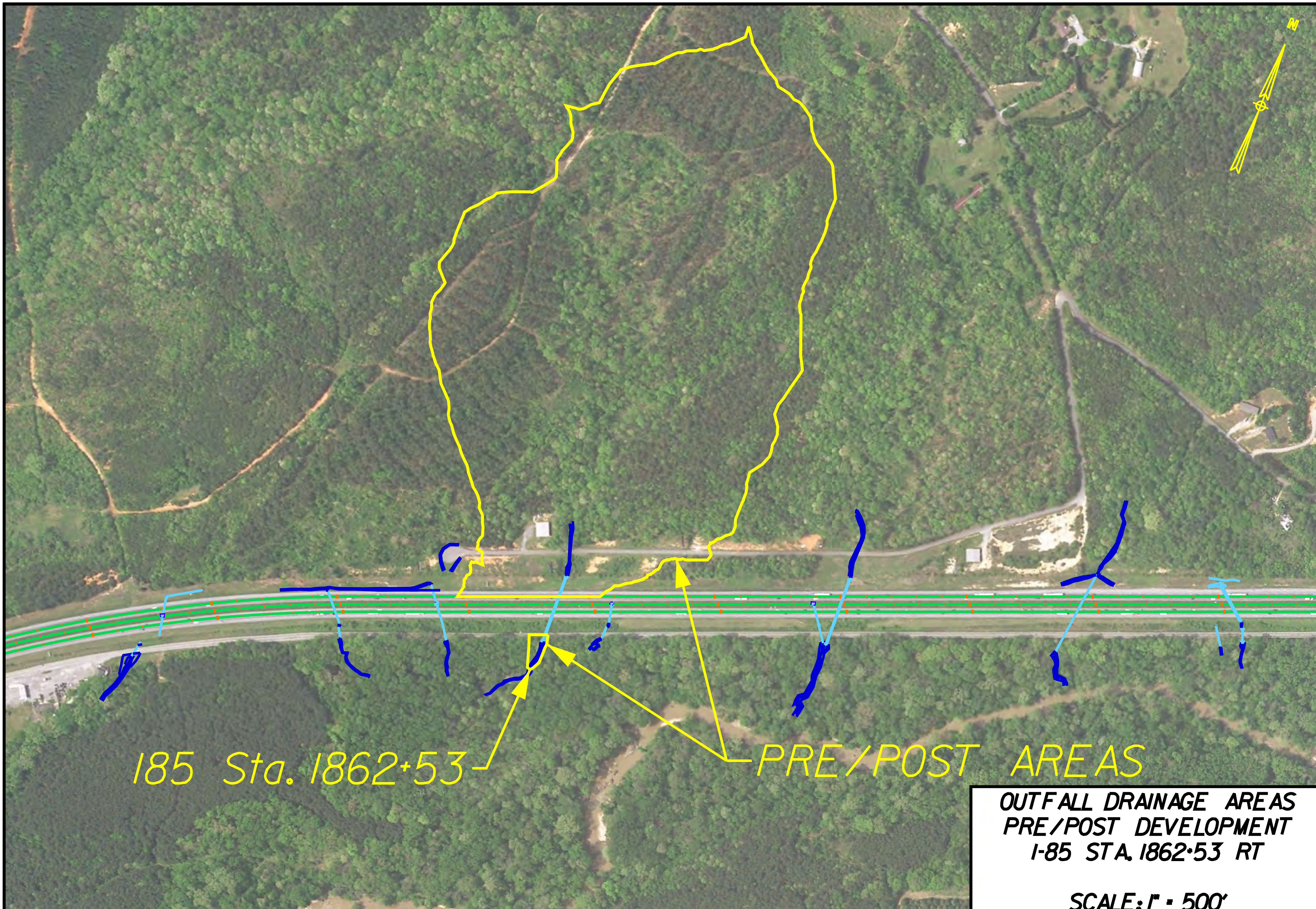
Gaffney

Time of Concentration *(minutes)*	22

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.34	4.618	7.12	**11**
Q_{25}	1.1	0.34	5.284	7.12	**14**
Q_{50}	1.2	0.34	5.804	7.12	**17**
Q_{100}	1.25	0.34	6.311	7.12	**19**

OUTFALL 1862+53 RT

This outfall is approximately 57 acres and primarily receives offsite discharge from a heavily wooded area with minimal pavement and grass. Offsite runoff is routed under I-85 to the outfall via an existing 4' x 6' R.C. box culvert. Discharge from this outfall is released into a heavily wooded area and is then conveyed to Buffalo Creek. There will be no change in discharge from pre to post development conditions for the 10-year design storm. Therefore, the proposed I-85 improvements will have no adverse downstream impact.



OUTFALL DRAINAGE AREAS
PRE/POST DEVELOPMENT
I-85 STA. 1862+53 RT

SCALE: 1" = 500'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	0.74	0.90	
Rolling, 2%-10%	Unpaved Road, Clay Soils	0.61	0.53	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	3.03	0.30	0.18
Rolling, 2%-10%	Unimproved Areas	1.41	0.20	
Hilly, Over 10%	Woodland & Forest	8.02	0.20	
Rolling, 2%-10%	Woodland & Forest	43.60	0.15	
		57.41		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	8.21%	100	0.8				0.328
Shallow Concentrated	Unpaved	8.21%	1434					0.086
Shallow Concentrated								
Channel 1		3.88%	1011	0.045	11.5	18.178	4.80901	0.058
Channel 2								
Total			2545				1.4960	0.473

Gaffney

Time of Concentration *(minutes)*	29

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.18	4.082	57.41	**42**
Q_{25}	1.1	0.18	4.658	57.41	**53**
Q_{50}	1.2	0.18	5.105	57.41	**63**
Q_{100}	1.25	0.18	5.541	57.41	**72**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	0.75	0.90	
Rolling, 2%-10%	Unpaved Road, Clay Soils	0.61	0.53	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	3.02	0.30	0.18
Rolling, 2%-10%	Unimproved Areas	1.41	0.20	
Hilly, Over 10%	Woodland & Forest	8.02	0.20	
Rolling, 2%-10%	Woodland & Forest	43.60	0.15	
		57.41		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusl	8.21%	100	0.8				0.328
Shallow Concentrated	Unpaved	8.21%	1434					0.086
Shallow Concentrated								
Channel 1		3.88%	1011	0.045	11.5	18.178	4.80901	0.058
Channel 2								
Total			2545				1.4960	0.473

Gaffney

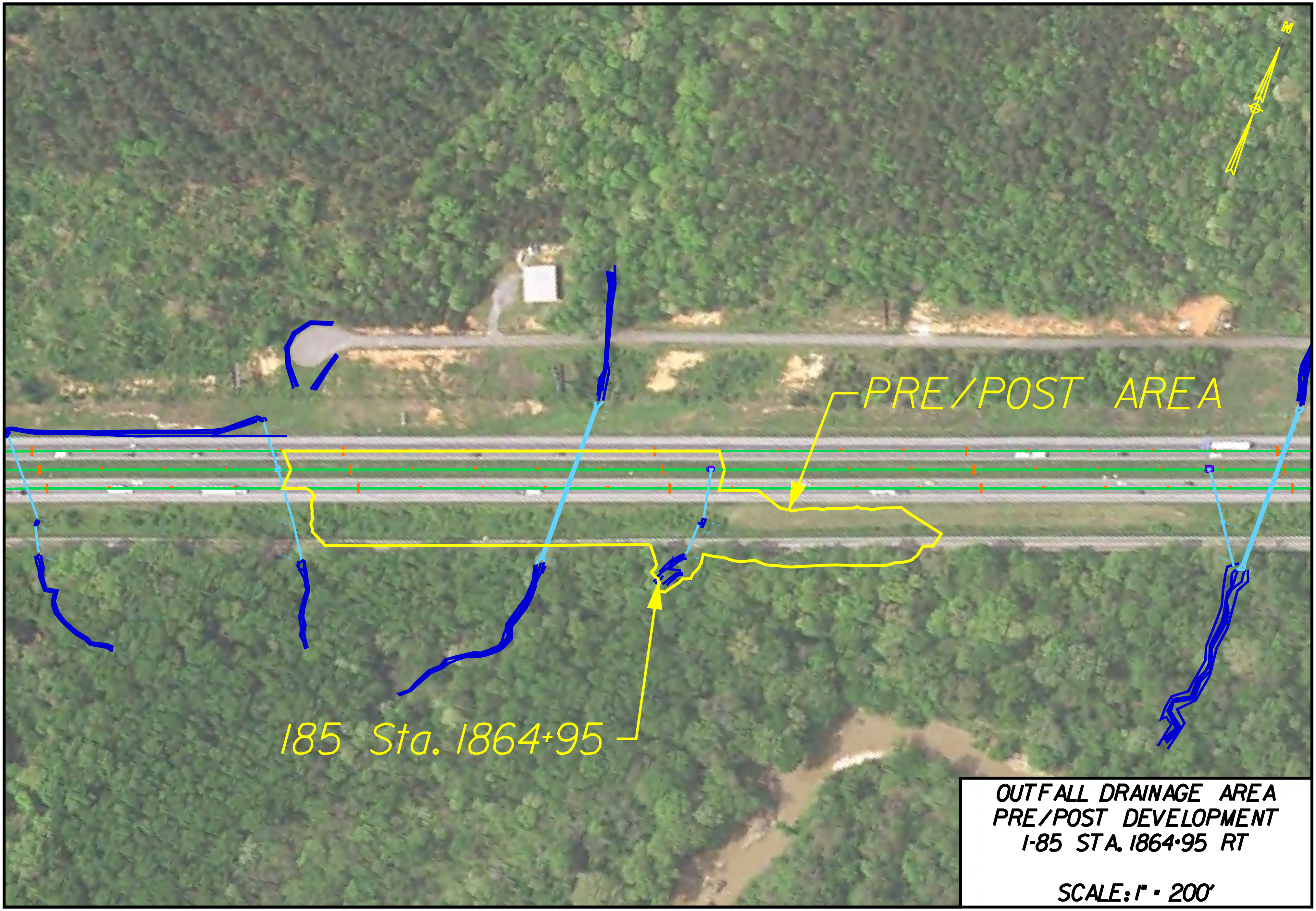
Time of Concentration *(minutes)*	29

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.18	4.082	57.41	**42**
Q_{25}	1.1	0.18	4.658	57.41	**53**
Q_{50}	1.2	0.18	5.105	57.41	**63**
Q_{100}	1.25	0.18	5.541	57.41	**72**

Civil Engineering Consulting Services, Inc.

OUTFALL 1864+95 RT

This outfall primarily receives roadway discharge from Sta. 1859+00 to Sta. 1866+00. The drainage area is approximately 3 acres, and encompasses mostly paved and grassed areas. Roadway discharge is routed under I-85 to the outfall via an existing storm sewer system. Runoff from this outfall is released into a heavily wooded area and is then conveyed to Buffalo Creek. The I-85 improvements will increase imperviousness due to the proposed increase in median pavement. As a result, there will be a negligible increase in discharge of 2 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.


PRE/POST AREA
185 Sta. 1864+95
OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 1864+95 RT
SCALE: 1" = 200'
N

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	1.16	0.90	
Rolling, 2%-10%	Side Slopes, Turf	1.88	0.30	Area Weighted C
Hilly, Over 10%	Woodland & Forest	0.13	0.20	0.52
		3.17		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Gaffney

Time of Concentration *(minutes)*: 5

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.52	6.770	3.17	**11**
Q_{25}	1.1	0.52	7.845	3.17	**14**
Q_{50}	1.2	0.52	8.698	3.17	**17**
Q_{100}	1.25	0.52	9.546	3.17	**19**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	1.65	0.90	
Rolling, 2%-10%	Side Slopes, Turf	1.39	0.30	Area Weighted C
Hilly, Over 10%	Woodland & Forest	0.13	0.20	0.61
		3.17		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

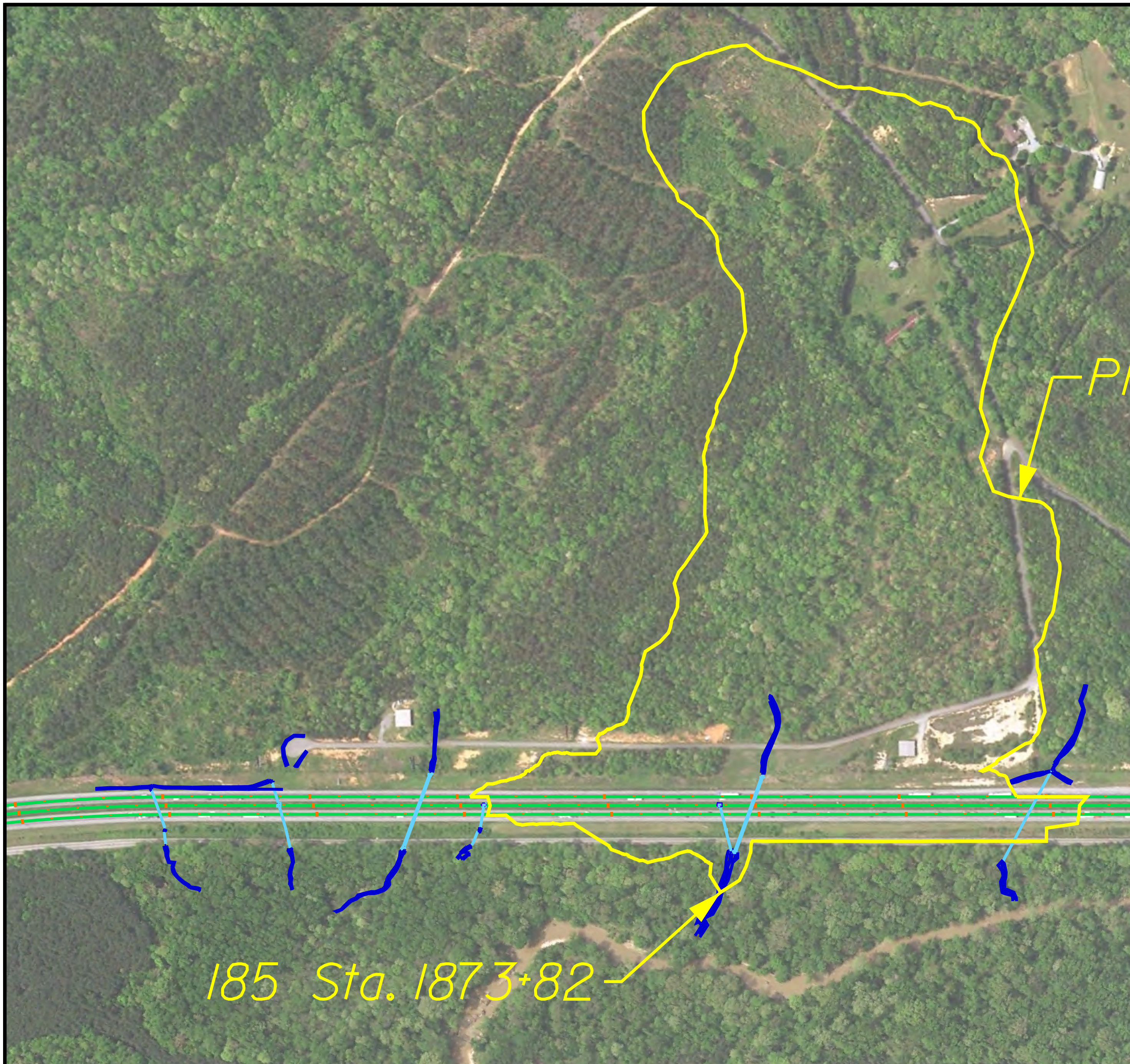
Gaffney

Time of Concentration *(minutes)*	5

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.61	6.770	3.17	**13**
Q_{25}	1.1	0.61	7.845	3.17	**17**
Q_{50}	1.2	0.61	8.698	3.17	**20**
Q_{100}	1.25	0.61	9.546	3.17	**23**

OUTFALL 1873+82 RT

This outfall receives runoff from offsite areas as well as roadway discharge from Sta. 1866+00 to Sta. 1886+00. The drainage area is approximately 72 acres and is mostly wooded with minimal development. Roadway runoff is routed to the outfall through an existing storm sewer system; while offsite runoff is routed under I-85 via an existing 4' x 6' R.C. box culvert. Discharge from this outfall is released into a heavily wooded area and is then conveyed to Buffalo Creek. The I-85 improvements will increase imperviousness due to the proposed median paving. As a result, there will be a negligible increase in discharge of 3 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 1873+82 RT

SCALE: 1" = 500'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	5.47	0.90	
Rolling, 2%-10%	Earth shoulders	1.09	0.50	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	8.75	0.30	0.27
Rolling, 2%-10%	Grass Shoulders	4.03	0.25	
Hilly, Over 10%	Woodland & Forest	52.39	0.20	
		71.73		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusl	8.04%	100	0.8				0.331
Shallow Concentrated	Unpaved	8.04%	1864					0.113
Shallow Concentrated								
Channel 1		2.50%	711	0.04	24	16.301	7.62365	0.026
Channel 2								
Total			2675				1.5816	0.470

Gaffney

Time of Concentration *(minutes)*	29

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.27	4.082	71.73	**80**
Q_{25}	1.1	0.27	4.658	71.73	**100**
Q_{50}	1.2	0.27	5.105	71.73	**120**
Q_{100}	1.25	0.27	5.541	71.73	**136**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	6.89	0.90	
Rolling, 2%-10%	Earth shoulders	1.09	0.50	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	7.33	0.30	0.28
Rolling, 2%-10%	Grass Shoulders	4.03	0.25	
Hilly, Over 10%	Woodland & Forest	52.39	0.20	
		71.73		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusl	8.04%	100	0.8				0.331
Shallow Concentrated	Unpaved	8.04%	1864					0.113
Shallow Concentrated								
Channel 1		2.50%	711	0.04	24	16.301	7.62365	0.026
Channel 2								
Total			2675				1.5816	0.470

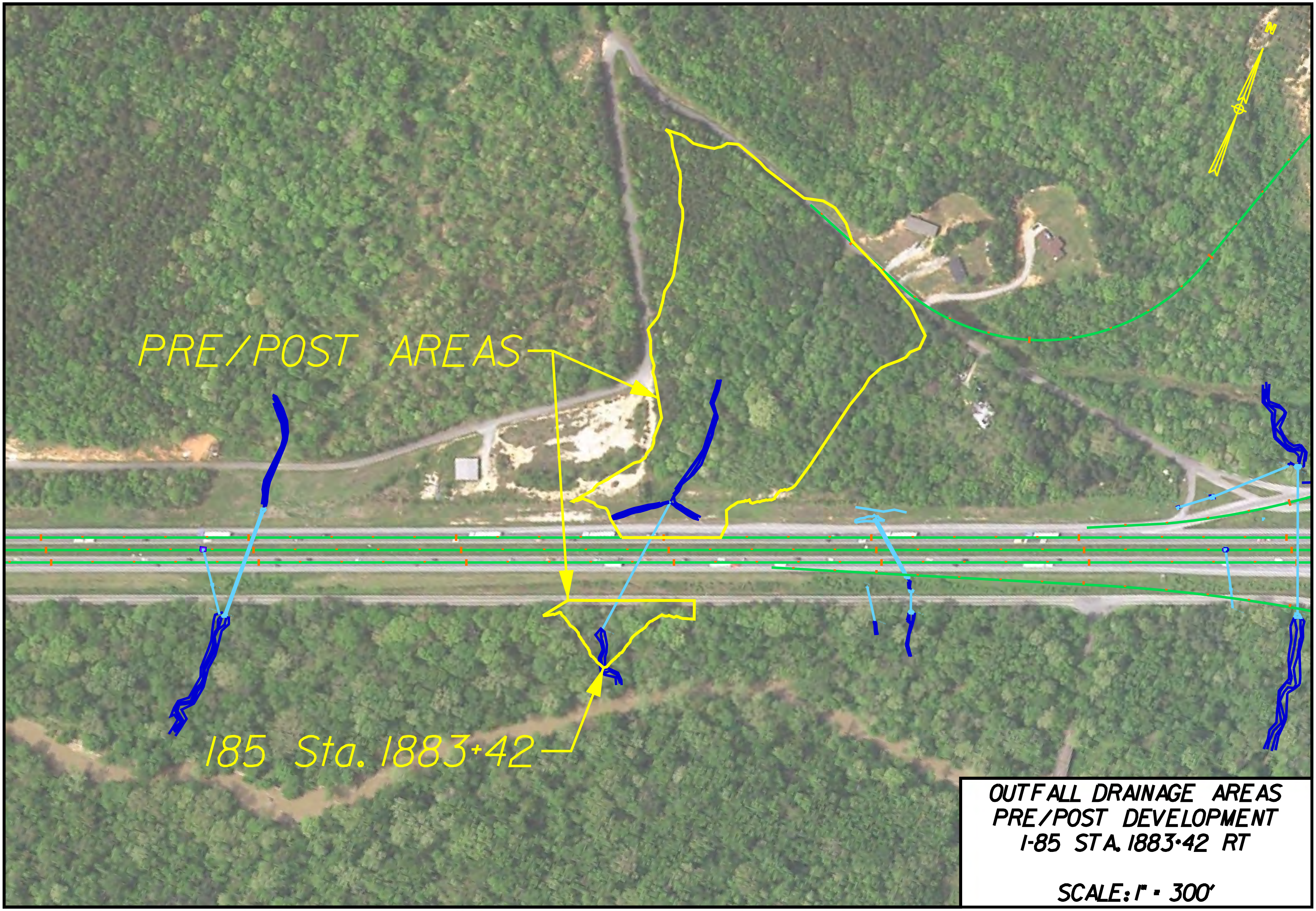
Gaffney

Time of Concentration *(minutes)*	29

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.28	4.082	71.73	**83**
Q_{25}	1.1	0.28	4.658	71.73	**105**
Q_{50}	1.2	0.28	5.105	71.73	**125**
Q_{100}	1.25	0.28	5.541	71.73	**141**

OUTFALL 1883+42 RT

This outfall is approximately 10 acres and primarily receives offsite discharge from a heavily wooded area with minimal pavement and grass. Offsite runoff is routed under I-85 to the outfall via an existing 30” R.C. pipe. Discharge from this outfall is released into a heavily wooded area and is then conveyed to Buffalo Creek. There will be no change in discharge from pre to post development conditions for the 10-year design storm. Therefore, the proposed I-85 improvements will have no adverse downstream impact.



OUTFALL DRAINAGE AREAS
PRE/POST DEVELOPMENT
I-85 STA. 1883+42 RT

SCALE: 1" = 300'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	0.36	0.90	
Rolling, 2%-10%	Side Slopes, Turf	0.74	0.30	Area Weighted C
Rolling, 2%-10%	Woodland & Forest	9.01	0.15	0.19
		10.11		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusl	7.84%	100	0.8				0.334
Shallow Concentrated	Unpaved	7.84%	613					0.038
Shallow Concentrated								
Channel 1		5.24%	326	0.04	10.5	14.335	6.92618	0.013
Channel 2								
Total			1039				0.7498	0.385

Gaffney

Time of Concentration *(minutes)*	24

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.19	4.451	10.11	**8**
Q_{25}	1.1	0.19	5.089	10.11	**11**
Q_{50}	1.2	0.19	5.585	10.11	**13**
Q_{100}	1.25	0.19	6.069	10.11	**14**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	0.36	0.90	
Rolling, 2%-10%	Side Slopes, Turf	0.80	0.30	Area Weighted C
Rolling, 2%-10%	Woodland & Forest	8.95	0.15	0.19
		10.11		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusl	7.84%	100	0.8				0.334
Shallow Concentrated	Unpaved	7.84%	613					0.038
Shallow Concentrated								
Channel 1		5.24%	326	0.04	10.5	14.335	6.92618	0.013
Channel 2								
Total			1039				0.7498	0.385

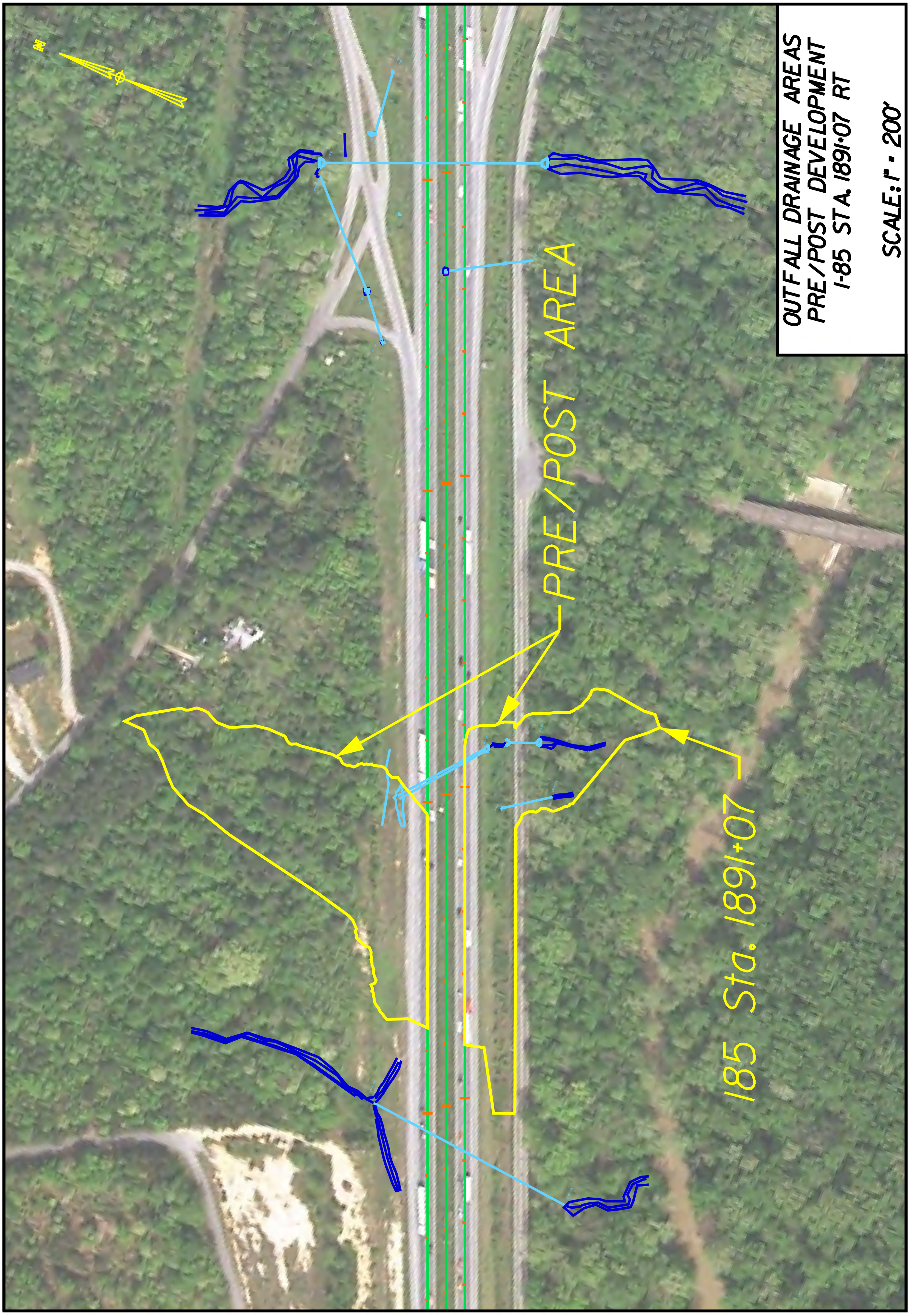
Gaffney

Time of Concentration *(minutes)*	24

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.19	4.451	10.11	**8**
Q_{25}	1.1	0.19	5.089	10.11	**11**
Q_{50}	1.2	0.19	5.585	10.11	**13**
Q_{100}	1.25	0.19	6.069	10.11	**14**

OUTFALL 1891+07 RT

This outfall receives runoff from offsite areas as well as roadway discharge from Sta. 1886+00 to Sta. 1891+00. The drainage area is approximately 4 acres and includes roadway pavement, grassed medians, and wooded areas. Roadway runoff is routed to the outfall through an existing storm sewer system; while offsite runoff is routed under I-85 via an existing 4' x 6' R.C. box culvert. Discharge from this outfall is released into a heavily wooded area and is then conveyed to Buffalo Creek. There will be no change in discharge from pre to post development conditions for the 10-year design storm. Therefore, the proposed I-85 improvements will have no adverse downstream impact.


OUTFALL DRAINAGE AREAS
PRE/POST DEVELOPMENT
I-85 STA. 1891+07 RT
SCALE: 1" = 200'
PRE/POST AREA
I85 Sta. 1891+07
N

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	0.58	0.90	
Rolling, 2%-10%	Side Slopes, Turf	1.30	0.30	Area Weighted C
Rolling, 2%-10%	Woodland & Forest	2.16	0.15	0.31
		4.04		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusl	7.15%	100	0.8				0.347
Shallow Concentrated	Unpaved	7.15%	201					0.013
Shallow Concentrated								
Channel 1		17.39%	150	0.045	22.5	16.195	17.1903	0.002
Channel 2								
Total			451				0.3460	0.362

Gaffney

Time of Concentration *(minutes)*	22			

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.31	4.618	4.04	**6**
Q_{25}	1.1	0.31	5.284	4.04	**7**
Q_{50}	1.2	0.31	5.804	4.04	**9**
Q_{100}	1.25	0.31	6.311	4.04	**10**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	0.63	0.90	
Rolling, 2%-10%	Side Slopes, Turf	1.25	0.30	Area Weighted C
Rolling, 2%-10%	Woodland & Forest	2.16	0.15	0.31
		4.04		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusl	7.15%	100	0.8				0.347
Shallow Concentrated	Unpaved	7.15%	201					0.013
Shallow Concentrated								
Channel 1		17.39%	150	0.045	22.5	16.195	17.1903	0.002
Channel 2								
Total			451				0.3460	0.362

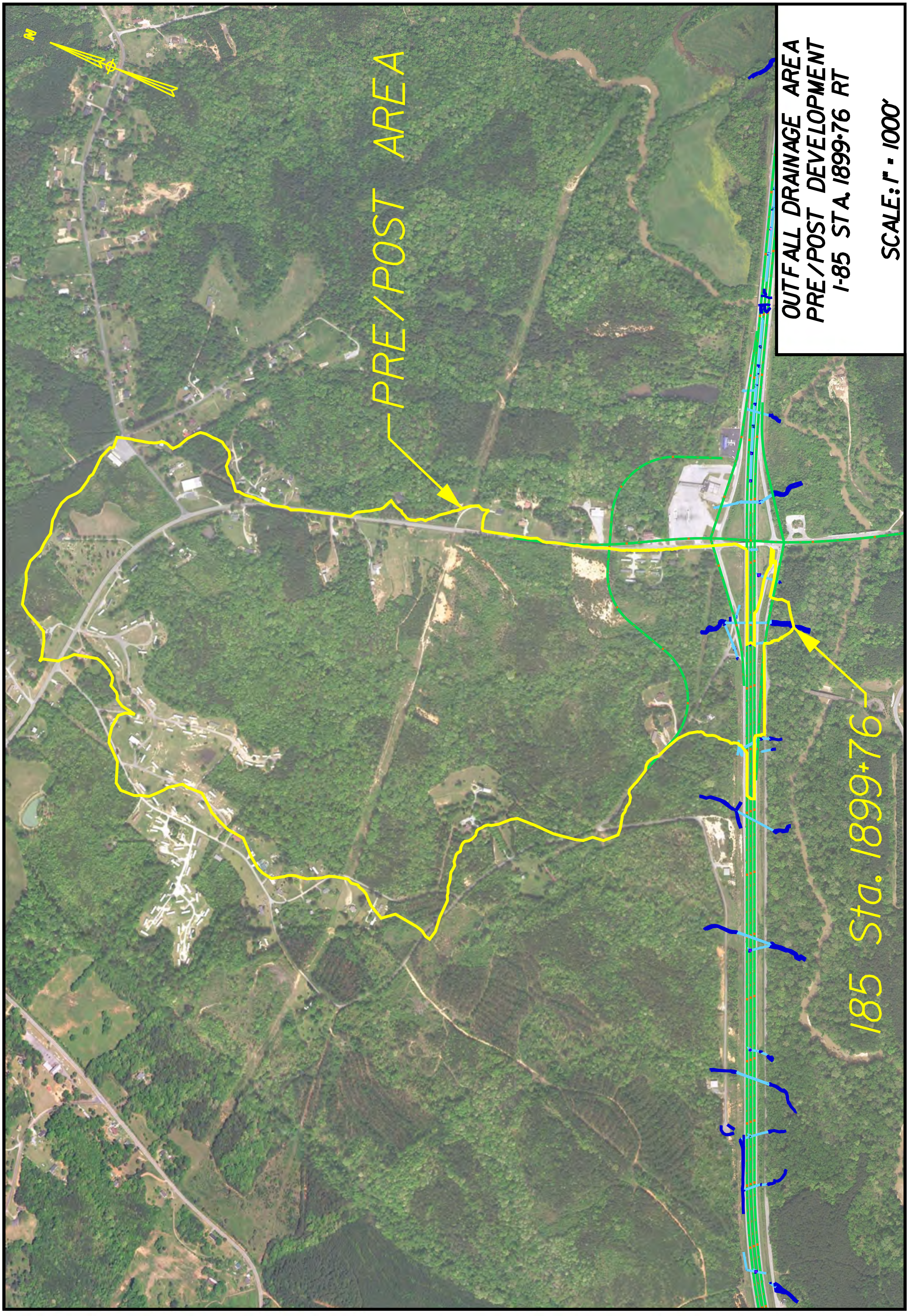
Gaffney

Time of Concentration *(minutes)*	22

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.31	4.618	4.04	**6**
Q_{25}	1.1	0.31	5.284	4.04	**7**
Q_{50}	1.2	0.31	5.804	4.04	**9**
Q_{100}	1.25	0.31	6.311	4.04	**10**

OUTFALL 1899+76 RT

This outfall receives runoff from offsite areas as well as cumulative discharge from the proposed Exit 100 interchange realignment and the I-85 mainline improvements from Sta. 1886+00 to Sta. 1898+50. The drainage area is approximately 325 acres and is mostly wooded with some development. Roadway runoff is routed to the outfall through an existing storm sewer system; while offsite runoff is routed under I-85 via an existing 7’ x 7’ R.C. box culvert. Discharge from this outfall is released into an undeveloped area, and is then conveyed to an unnamed tributary that feeds into Buffalo Creek. There will be no change in discharge from pre to post development conditions for the 10-year design storm. Therefore, the proposed I-85 improvements will have no adverse downstream impact.


OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 1899+76 RT
SCALE: 1" = 1000'
PRE/POST AREA
I85 Sta. 1899+76

SCS Analysis

HSG	Land Use	Acres	CN
B	Impervious	11.87	98.00
B	Fallow: Bare Soil	4.81	86.00
B	Residential: 1 acre	31.89	68.00
B	Pasture,grassland,or range: Good	22.46	61.00
B	Meadow	22.62	58.00
B	Woods:Good	227.01	55.00
A	Pasture,grassland,or range: Good	0.88	39.00
A	Woods:Good	3.28	30.00
		324.82	

Area Weighted CN
59

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	6.92%	100	0.8				0.351
Shallow Concentrated	Unpaved	6.92%	1226					0.080
Shallow Concentrated								
Channel 1		2.88%	3675	0.045	9.45	8.9069	5.849718	0.175
Channel 2								
Total			5001				2.2919	0.606

Drainage Area *(acres)*	**324.82**

Curve Number	**59**
Time of Concentration *(minutes)*	**37**

WinTR-55 Current Data Description

--- Identification Data ---

User:	CECS	Date:	12/13/2016
Project:	I-85 Improvement Proj DB Prep	Units:	English
SubTitle:	OUTFALL 1899+76 RT (PRE)	Areal Units:	Acres
State:	South Carolina		
County:	Cherokee_NOAA_B		
Filename:	S:\Proj\2014\6114 I-85 mm 96-106\Design\Project PIN Number\Drainage\Calculations\OUTFALL\Q50 AN		

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
1899+76 RT		Outlet	324.82	59	0.617

Total area: 324.82 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
3.73	4.68	5.44	6.49	7.35	8.24	3.1

Storm Data Source: Cherokee_NOAA_B County, SC (NRCS)
Rainfall Distribution Type: Type NO_B
Dimensionless Unit Hydrograph: <standard>

OUTFALL 1899+76 RT (PRE)
Cherokee_NOAA_B County, South Carolina

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
SUBAREAS				
1899+76 RT	312.81	473.14	615.13	768.88
REACHES				
OUTLET	312.81	473.14	615.13	768.88

SCS Analysis

HSG	Land Use	Acres	CN	
B	Impervious	13.16	98.00	
B	Fallow: Bare Soil	4.54	86.00	Area Weighted CN
B	Residential: 1 acre	31.86	68.00	59
B	Pasture,grassland,or range: Good	27.59	61.00	
B	Meadow	22.57	58.00	
B	Woods:Good	220.84	55.00	
A	Pasture,grassland,or range: Good	1.44	39.00	
A	Woods:Good	2.82	30.00	
		324.82		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	6.92%	100	0.8				0.351
Shallow Concentrated	Unpaved	6.92%	1226					0.080
Shallow Concentrated								
Channel 1		2.88%	3675	0.045	9.45	8.9069	5.849718	0.175
Channel 2								
Total			5001				2.2919	0.606

Drainage Area *(acres)*	**324.82**

Curve Number	**59**
Time of Concentration *(minutes)*	**37**

Civil Engineering Consulting Services, Inc.

WinTR-55 Current Data Description

--- Identification Data ---

User:	CECS	Date:	12/13/2016
Project:	I-85 Improvement Proj DB Prep	Units:	English
SubTitle:	OUTFALL 1899+76 RT (POST)	Areal Units:	Acres
State:	South Carolina		
County:	Cherokee_NOAA_B		
Filename:	S:\Proj\2014\6114 I-85 mm 96-106\Design\Project PIN Number\Drainage\Calculations\OUTFALL\Q50 AN		

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
1899+76 RT		Outlet	324.82	59	0.617

Total area: 324.82 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
3.73	4.68	5.44	6.49	7.35	8.24	3.1

Storm Data Source: Cherokee_NOAA_B County, SC (NRCS)
Rainfall Distribution Type: Type NO_B
Dimensionless Unit Hydrograph: <standard>

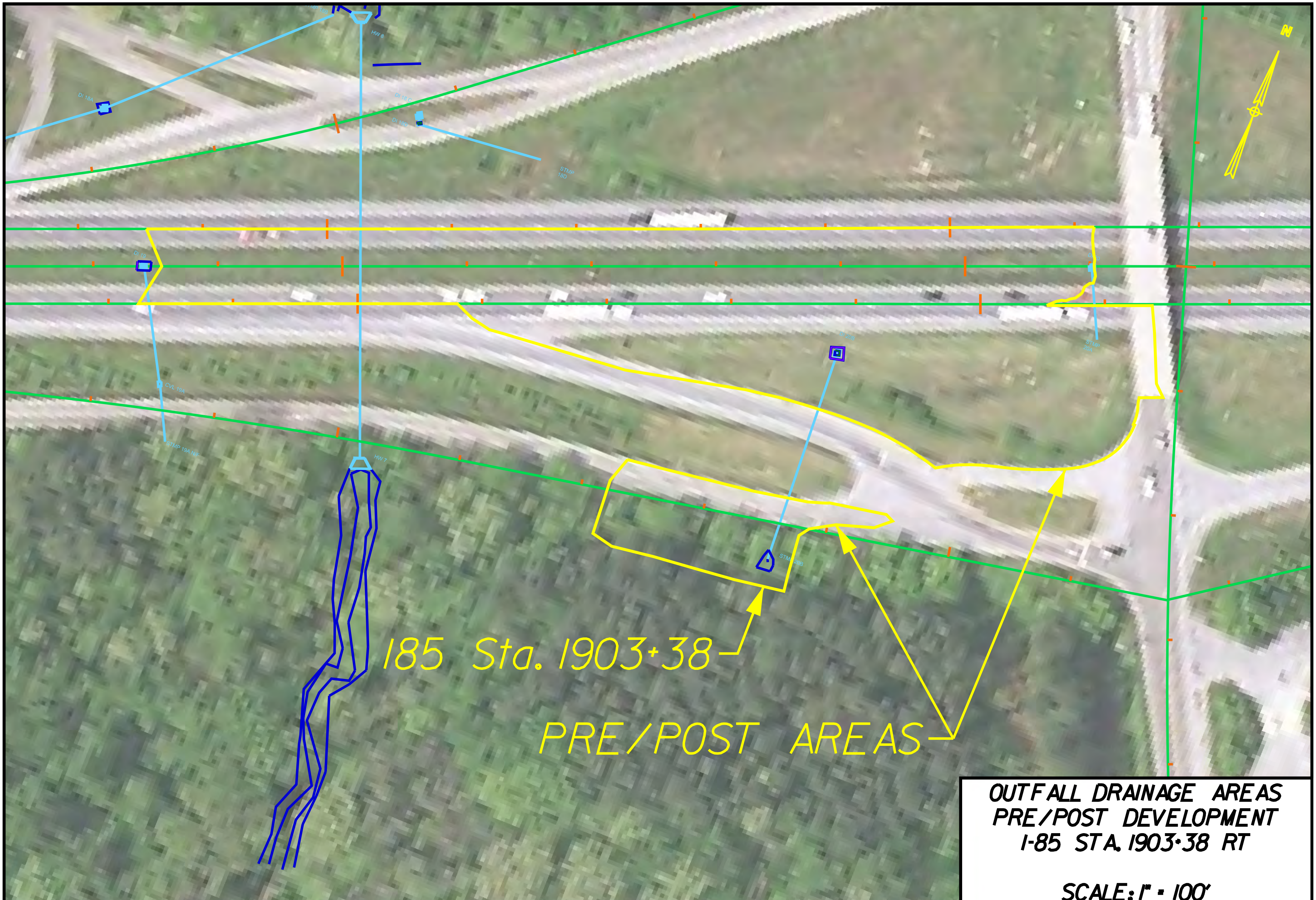
OUTFALL 1899+76 RT (POST)
Cherokee_NOAA_B County, South Carolina

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
SUBAREAS				
1899+76 RT	312.81	473.14	615.13	768.88
REACHES				
OUTLET	312.81	473.14	615.13	768.88

OUTFALL 1903+38 RT

This outfall primarily receives runoff from the Exit 100 interchange and the I-85 mainline from Sta. 1898+50 to Sta. 1906+00. The drainage area is approximately 2 acres and includes roadway pavement, grassed medians, and minimal offsite woodlands. Roadway discharge is routed under I-85 to the outfall via an existing storm sewer system. Runoff from this outfall is released into a heavily wooded area and is then conveyed to Buffalo Creek. The I-85 improvements will increase imperviousness due to the proposed median paving and Exit 100 interchange realignment. As a result, there will be a negligible increase in discharge of 2 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.



OUTFALL DRAINAGE AREAS
PRE/POST DEVELOPMENT
I-85 STA. 1903+38 RT

SCALE: 1" = 100'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	0.94	0.90	
Rolling, 2%-10%	Side Slopes, Turf	1.41	0.30	Area Weighted C
Rolling, 2%-10%	Woodland & Forest	0.04	0.15	0.53
		2.39		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Gaffney

Time of Concentration *(minutes)*: 5

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.53	6.770	2.39	**9**
Q_{25}	1.1	0.53	7.845	2.39	**11**
Q_{50}	1.2	0.53	8.698	2.39	**13**
Q_{100}	1.25	0.53	9.546	2.39	**15**

Rational Analysis

Land Slope	Land Use	Acres	C
Rolling, 2%-10%	Pavements & Roofs	1.43	0.90
Rolling, 2%-10%	Side Slopes, Turf	0.96	0.30
		2.39	

Area Weighted C
0.66

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

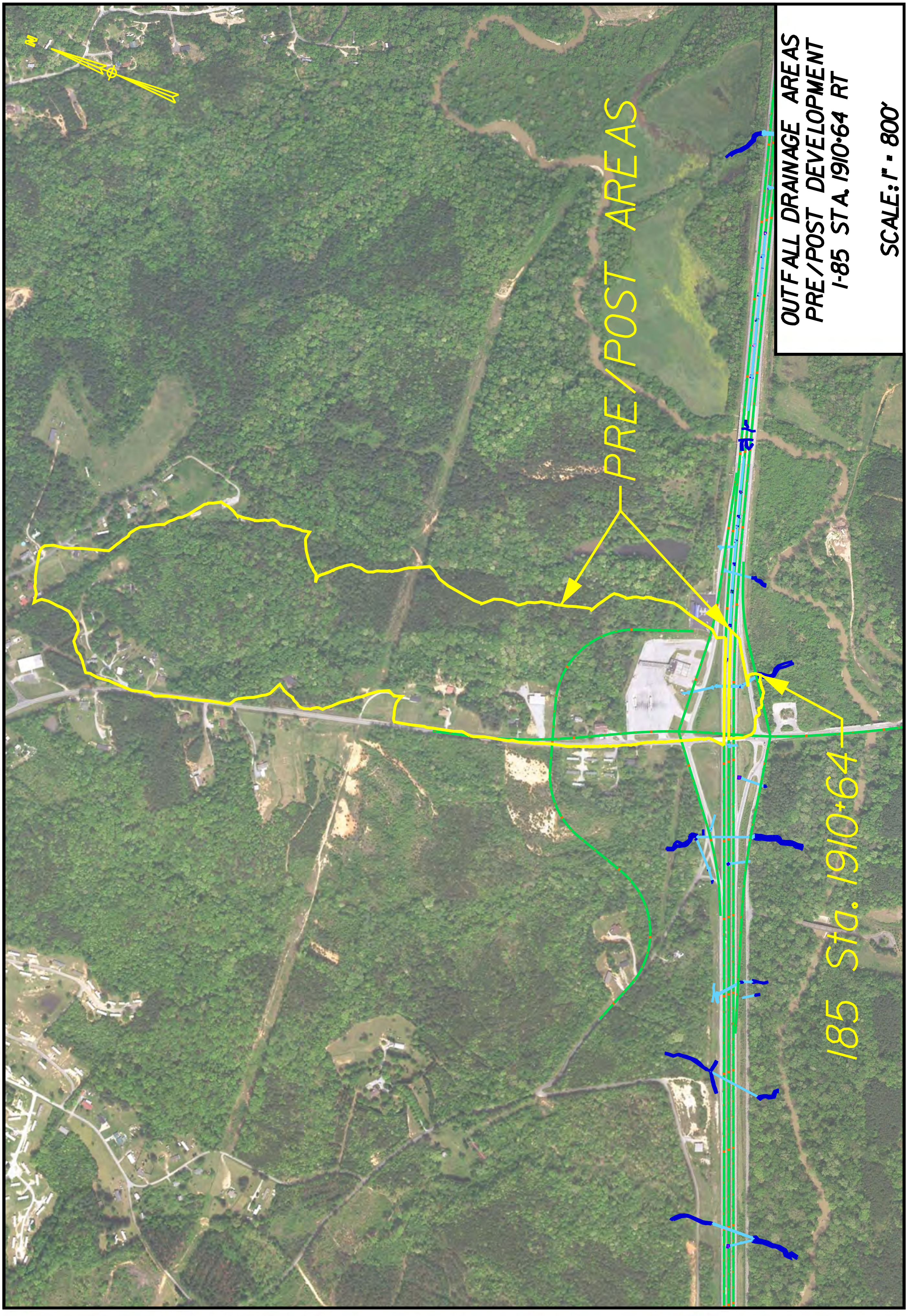
Gaffney

Time of Concentration *(minutes)*	5

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.66	6.770	2.39	**11**
Q_{25}	1.1	0.66	7.845	2.39	**14**
Q_{50}	1.2	0.66	8.698	2.39	**16**
Q_{100}	1.25	0.66	9.546	2.39	**19**

OUTFALL 1910+64 RT

The outfall's contributing drainage area is approximately 96 acres and receives runoff from offsite areas as well as cumulative discharge from the proposed Exit 100 interchange realignment and mainline improvements from Sta. 1906+00 to Sta. 1913+00. The drainage area is mostly wooded with limited rural development, and has an existing roadside truck stop near the interstate. Offsite and roadway runoff is routed under I-85 to the outfall via a system of 4' x 6' R.C. box culverts. Discharge from this outfall is released into a heavily wooded area and is then conveyed to Buffalo Creek. The I-85 improvements will increase imperviousness due to the proposed median paving along the mainline and the reconfiguration of the Exit 100 Interchange. As a result, there will be a negligible increase in discharge of 4 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.


OUTFALL DRAINAGE AREAS
PRE/POST DEVELOPMENT
I-85 STA. 1910+64 RT
SCALE: 1" = 800'
PRE/POST AREAS
I85 Sta. 1910+64
N

Rational Analysis

Land Slope	Land Use	Acres	C
Rolling, 2%-10%	Pavements & Roofs	8.78	0.90
Rolling, 2%-10%	Gravel Pavements	0.50	0.55
Rolling, 2%-10%	Meadows & Pasture Land	3.10	0.30
Rolling, 2%-10%	Side Slopes, Turf	6.55	0.30
Rolling, 2%-10%	Grass Shoulders	3.02	0.25
Rolling, 2%-10%	Unimproved Areas	0.58	0.20
Rolling, 2%-10%	Woodland & Forest	73.60	0.15
		96.13	

Area Weighted C
0.24

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	4.91%	100	0.8				0.403
Shallow Concentrated	Unpaved	4.91%	3481					0.271
Shallow Concentrated								
Channel 1								
Channel 2								
Total			3581				1.4764	0.674

Gaffney

Time of Concentration *(minutes)*	41

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.24	3.403	96.13	**78**
Q_{25}	1.1	0.24	3.872	96.13	**98**
Q_{50}	1.2	0.24	4.234	96.13	**117**
Q_{100}	1.25	0.24	4.584	96.13	**132**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	9.42	0.90	
Rolling, 2%-10%	Gravel Pavements	0.44	0.55	Area Weighted C
Rolling, 2%-10%	Meadows & Pasture Land	3.10	0.30	0.25
Rolling, 2%-10%	Side Slopes, Turf	12.13	0.30	
Rolling, 2%-10%	Grass Shoulders	2.26	0.25	
Rolling, 2%-10%	Unimproved Areas	0.58	0.20	
Rolling, 2%-10%	Woodland & Forest	68.20	0.15	
		96.13		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	4.91%	100	0.8				0.403
Shallow Concentrated	Unpaved	4.91%	3481					0.271
Shallow Concentrated								
Channel 1								
Channel 2								
Total			3581				1.4764	0.674

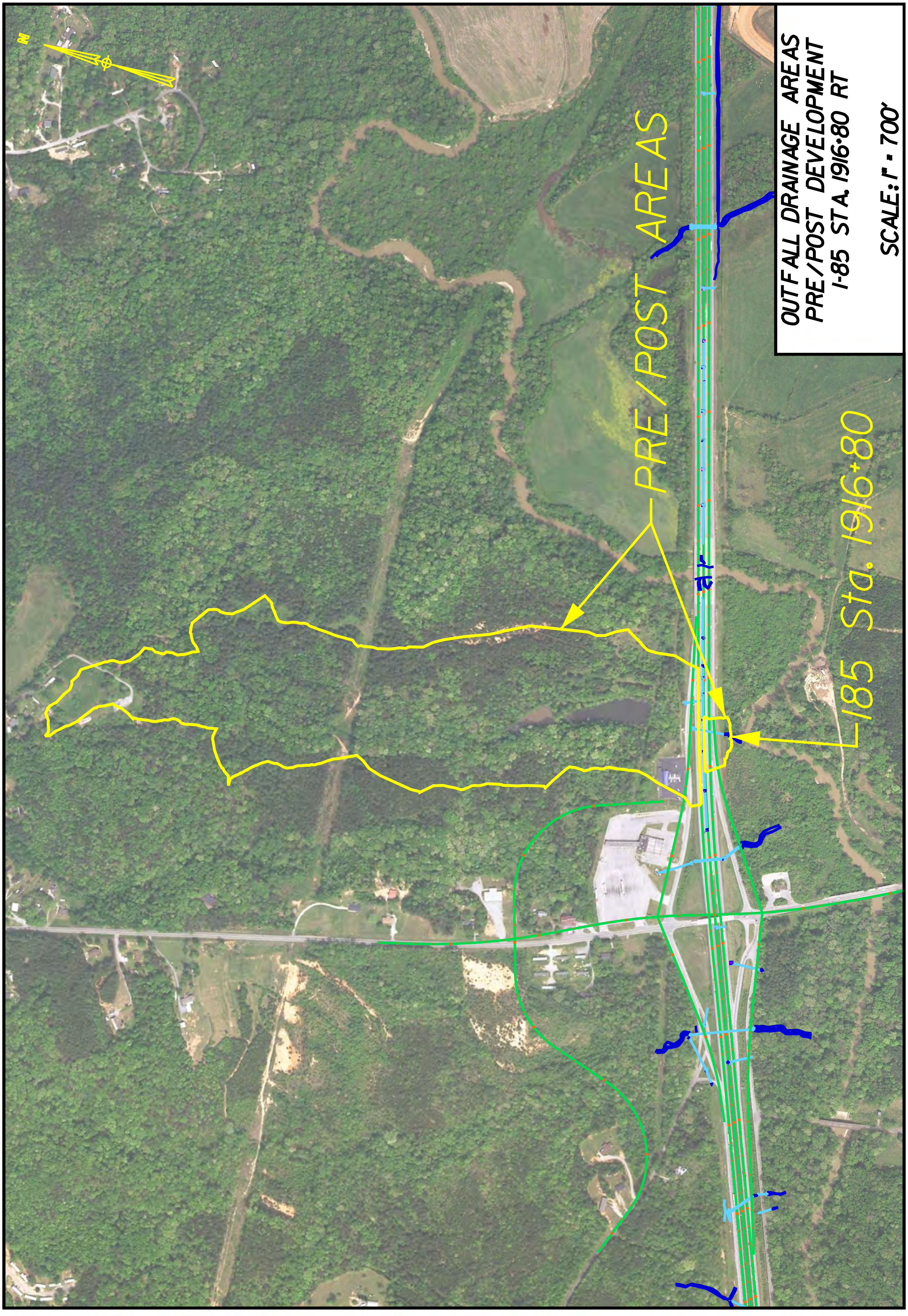
Gaffney

Time of Concentration *(minutes)*	41

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.25	3.403	96.13	**82**
Q_{25}	1.1	0.25	3.872	96.13	**103**
Q_{50}	1.2	0.25	4.234	96.13	**123**
Q_{100}	1.25	0.25	4.584	96.13	**139**

OUTFALL 1916+80 RT

This outfall receives runoff from offsite areas, the Exit 100 interchange, and the I-85 mainline from Sta. 1913+00 to Sta. 1921+00. The drainage area is approximately 59 acres, is mostly wooded, and includes an existing 0.9-acre impoundment. Offsite and roadway runoff is routed under I-85 to the outfall via an existing storm sewer system. Discharge from this outfall is released into a heavily wooded area and is then conveyed to an unnamed tributary that feeds into Buffalo Creek. The proposed Exit 100 interchange realignment will reduce imperviousness within the drainage area. As a result, there will be a decrease in discharge of 1 cfs from pre to post development conditions for the 10-year design storm. Therefore, the proposed I-85 improvements will have no adverse downstream impact.


OUTFALL DRAINAGE AREAS
PRE/POST DEVELOPMENT
I-85 STA. 1916+80 RT
SCALE: 1" = 700'
PRE/POST AREAS
I85 Sta. 1916+80

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	3.64	0.90	
Rolling, 2%-10%	Side Slopes, Turf	2.16	0.30	Area Weighted C
Rolling, 2%-10%	Grass Shoulders	2.22	0.25	0.25
Hilly, Over 10%	Woodland & Forest	50.52	0.20	
		58.54		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	5.38%	100	0.8				0.388
Shallow Concentrated	Unpaved	5.38%	1869					0.139
Shallow Concentrated								
Channel 1								
Channel 2								
Total			1969				1.0375	0.527

Gaffney

Time of Concentration *(minutes)*	32

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.25	3.888	58.54	**57**
Q_{25}	1.1	0.25	4.433	58.54	**71**
Q_{50}	1.2	0.25	4.855	58.54	**85**
Q_{100}	1.25	0.25	5.266	58.54	**96**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	3.44	0.90	
Rolling, 2%-10%	Side Slopes, Turf	2.45	0.30	Area Weighted C
Rolling, 2%-10%	Grass Shoulders	2.22	0.25	0.25
Hilly, Over 10%	Woodland & Forest	50.43	0.20	
		58.54		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	5.38%	100	0.8				0.388
Shallow Concentrated	Unpaved	5.38%	1869					0.139
Shallow Concentrated								
Channel 1								
Channel 2								
Total			1969				1.0375	0.527

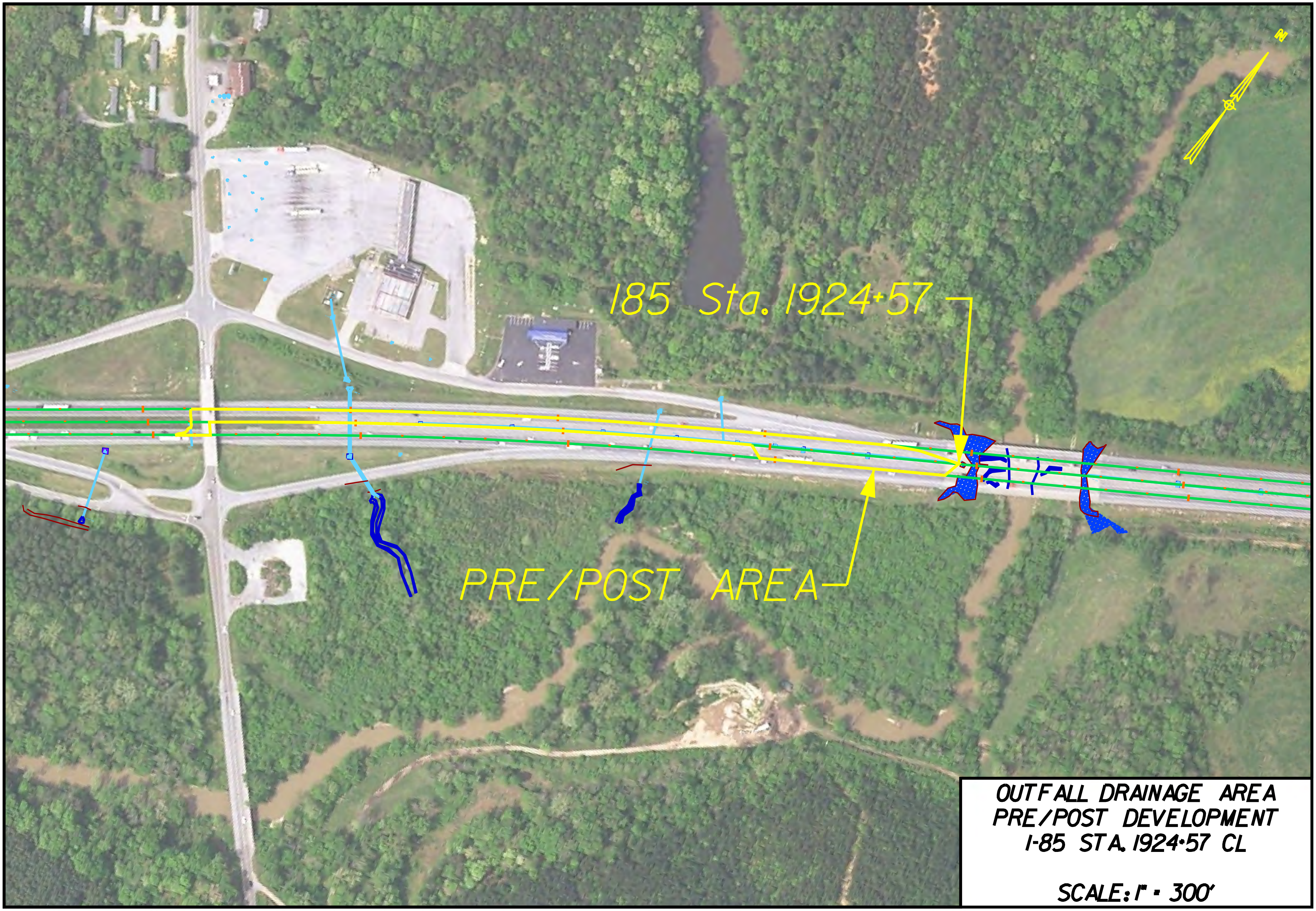
Gaffney

Time of Concentration *(minutes)*	32

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.25	3.888	58.54	**56**
Q_{25}	1.1	0.25	4.433	58.54	**71**
Q_{50}	1.2	0.25	4.855	58.54	**84**
Q_{100}	1.25	0.25	5.266	58.54	**95**

OUTFALL 1924+57 CL

This outfall primarily receives roadway discharge from Sta. 1906+00 to Sta. 1924+50. The drainage area is approximately 2 acres and is mostly roadway pavement. Roadway runoff is routed under I-85 to the outfall via an existing storm sewer system that discharges directly into Buffalo Creek. The I-85 improvements will increase imperviousness due to the proposed median paving. As a result, there will be a negligible increase in discharge of 1 cfs from pre to post development conditions for the 10-year design storm. The slight increase of runoff will have no adverse downstream impact and detention is not recommended.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 1924+57 CL

SCALE: 1" = 300'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	1.48	0.90	
Rolling, 2%-10%	Side Slopes, Turf	0.12	0.30	Area Weighted C
				0.86
		1.60		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Gaffney

Time of Concentration *(minutes)*	5

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.86	6.770	1.60	**9**
Q_{25}	1.1	0.86	7.845	1.60	**12**
Q_{50}	1.2	0.86	8.698	1.60	**14**
Q_{100}	1.25	0.86	9.546	1.60	**16**

Rational Analysis

Land Slope	Land Use	Acres	C
Rolling, 2%-10%	Pavements & Roofs	1.60	0.90
		1.60	

Area Weighted C
0.90

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

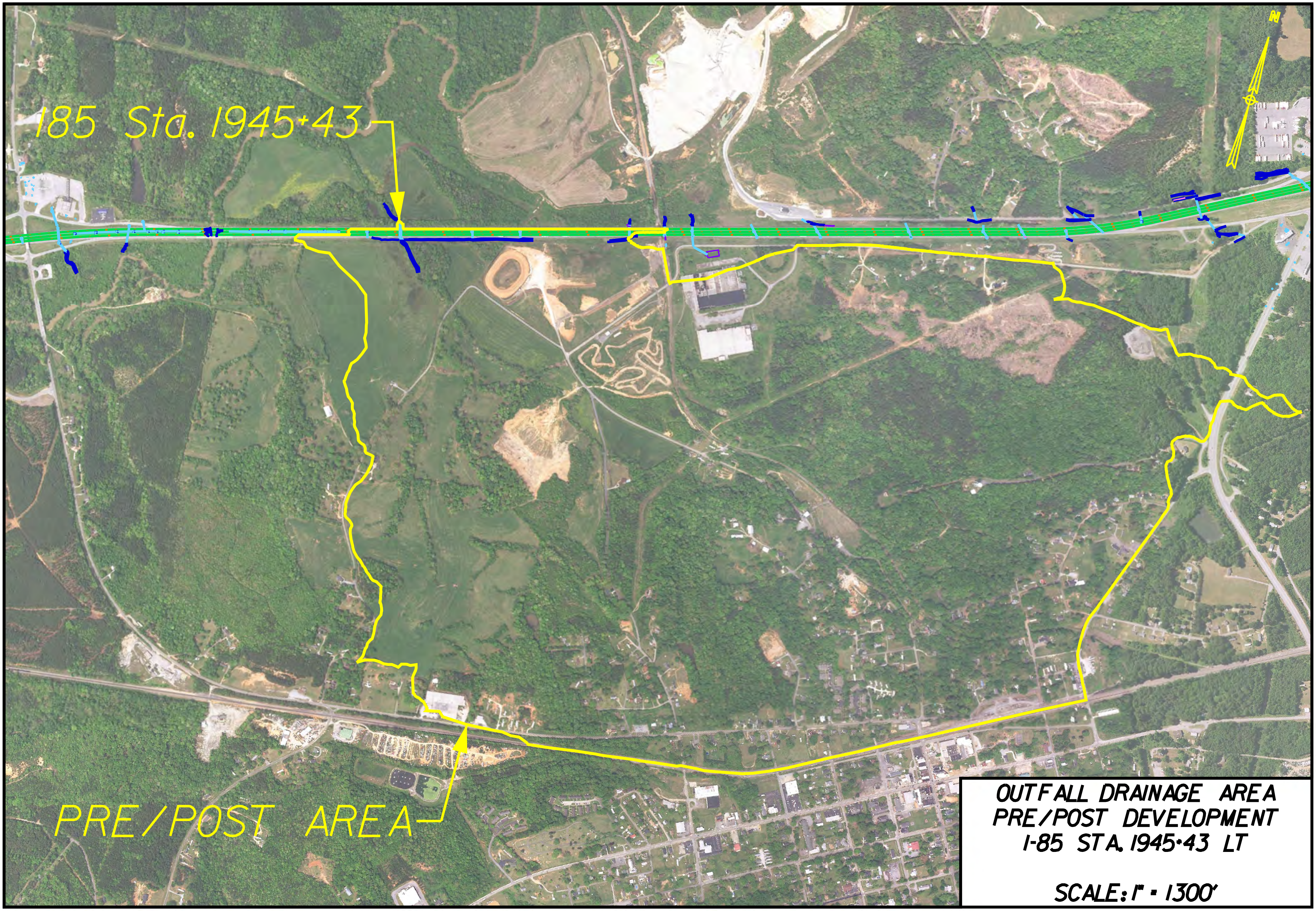
Gaffney

Time of Concentration *(minutes)*	5

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
$\mathbf{Q_{10}}$	1	0.90	6.770	1.60	**10**
$\mathbf{Q_{25}}$	1.1	0.90	7.845	1.60	**12**
$\mathbf{Q_{50}}$	1.2	0.90	8.698	1.60	**15**
$\mathbf{Q_{100}}$	1.25	0.90	9.546	1.60	**17**

OUTFALL 1945+43 LT

This outfall receives runoff from offsite areas as well as roadway discharge from Sta. 1940+00 to Sta. 1973+00. The drainage area is approximately 1.5 square-miles and is characterized by large wooded areas, open grassed fields, and urban developments in the Town of Blacksburg, South Carolina. Additionally, the area encompasses multiple unnamed tributaries that merge together before crossing under I-85. Offsite runoff is routed under I-85 to the outfall through an existing 12' x 10' R.C. box culvert; while roadway runoff is collected by multiple existing storm sewer systems and routed to the box culvert via roadside ditches. Discharge from this outfall is conveyed by an unnamed tributary, with undeveloped surroundings, that ultimately feeds into Buffalo Creek. There will be no change in discharge from pre to post development conditions for the 10-year design storm. Therefore, the proposed I-85 improvements will have no adverse downstream impact.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 1945+43 LT

SCALE: 1" = 1300'

REGRESSION ANALYSIS

This spreadsheet computes the 50-, 20-, 10-, 4-, 2-, 1-, 0.5-, and 0.2-percent chance exceedance flows for an ungaged site in Georgia, South Carolina, and North Carolina. The spreasheet also includes the 95-percent prediction intervals, the minus and plus standard error of prediction intervals, and the average standard error of prediction. To use the spreadsheet, enter requested information in the yellow cells below.

Enter a site-description name: OUTFALL 1945+43 LT PRE & POST

Enter the explanatory variables:

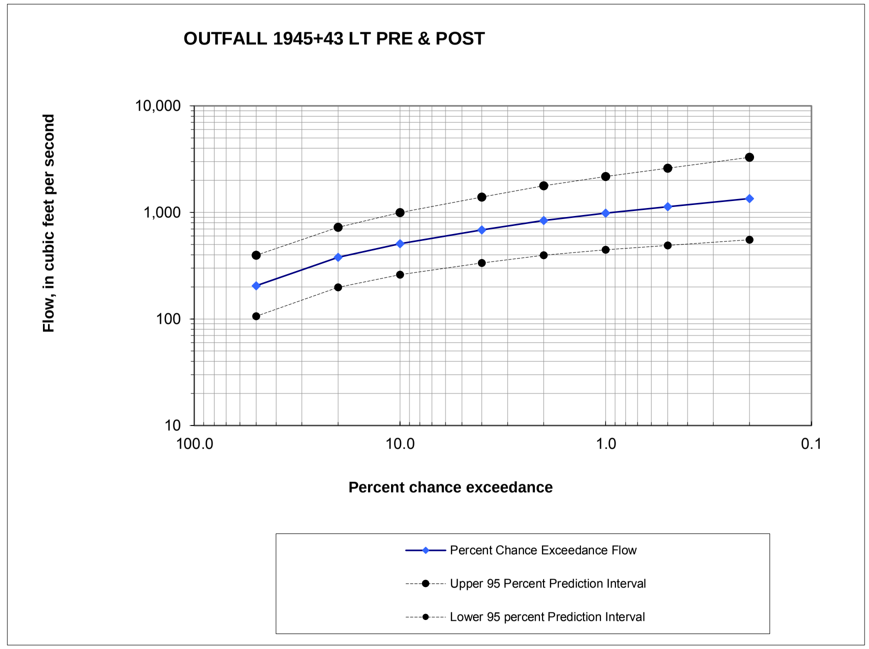
Drainage area, in square miles	1.49
Percent of basin in Hydrologic Region 1	100
Percent of basin in Hydrologic Region 2	0
Percent of basin in Hydrologic Region 3	0
Percent of basin in Hydrologic Region 4	0
Percent of basin in Hydrologic Region 5	0

Applicable range of draingage area is 1 to 9,000 square miles.
Hydrologic Region 1 corresponds to the USEPA Level III Ridge and Valley and Piedmont ecoregions
Hydrologic Region 2 corresponds to the USEPA Level III Blue Ridge ecoregion
Hydrologic Region 3 corresponds to the USEPA Level IV Sand Hills ecoregion
Hydrologic Region 4 corresponds to the USEPA Level III Southeastern, Middle Atlantic Coastal, and Southern Coastal Plain ecoregions
Hydrologic Region 5 corresponds to the lower portion of the USEPA Level IV Tifton Uplands ecoregion.

Sum of region percentages	100

Drainage area check
DRAINAGE AREA WITHIN APPLICABLE LIMITS.

Percent chance exceedance	Percent chance exceedance flow, in ft^3/s	Lower 95 percent prediction interval flow, in ft^3/s	Upper 95 percent prediction interval flow, in ft^3/s	$-S_{P,i}$ (percent)	$+S_{P,i}$ (percent)	Average $S_{p,i}$ (percent)
50	205	106	396	-28.5	39.9	34.6
20	379	198	726	-28.2	39.3	34.1
10	509	260	995	-29.0	40.8	35.2
4	684	336	1,390	-30.5	43.8	37.6
2	839	396	1,780	-31.8	46.6	39.7
1	984	446	2,170	-33.2	49.7	42.0
0.5	1,130	491	2,600	-34.6	52.9	44.5
0.2	1,350	554	3,290	-36.5	57.5	47.9



UNITS	TOTAL AREA		IMPERVIOUS AREA	% IMPERVIOUS
SQ. METERS	3867664		258448	6.68%
SQ. MILES	1.49		0.10	6.68%

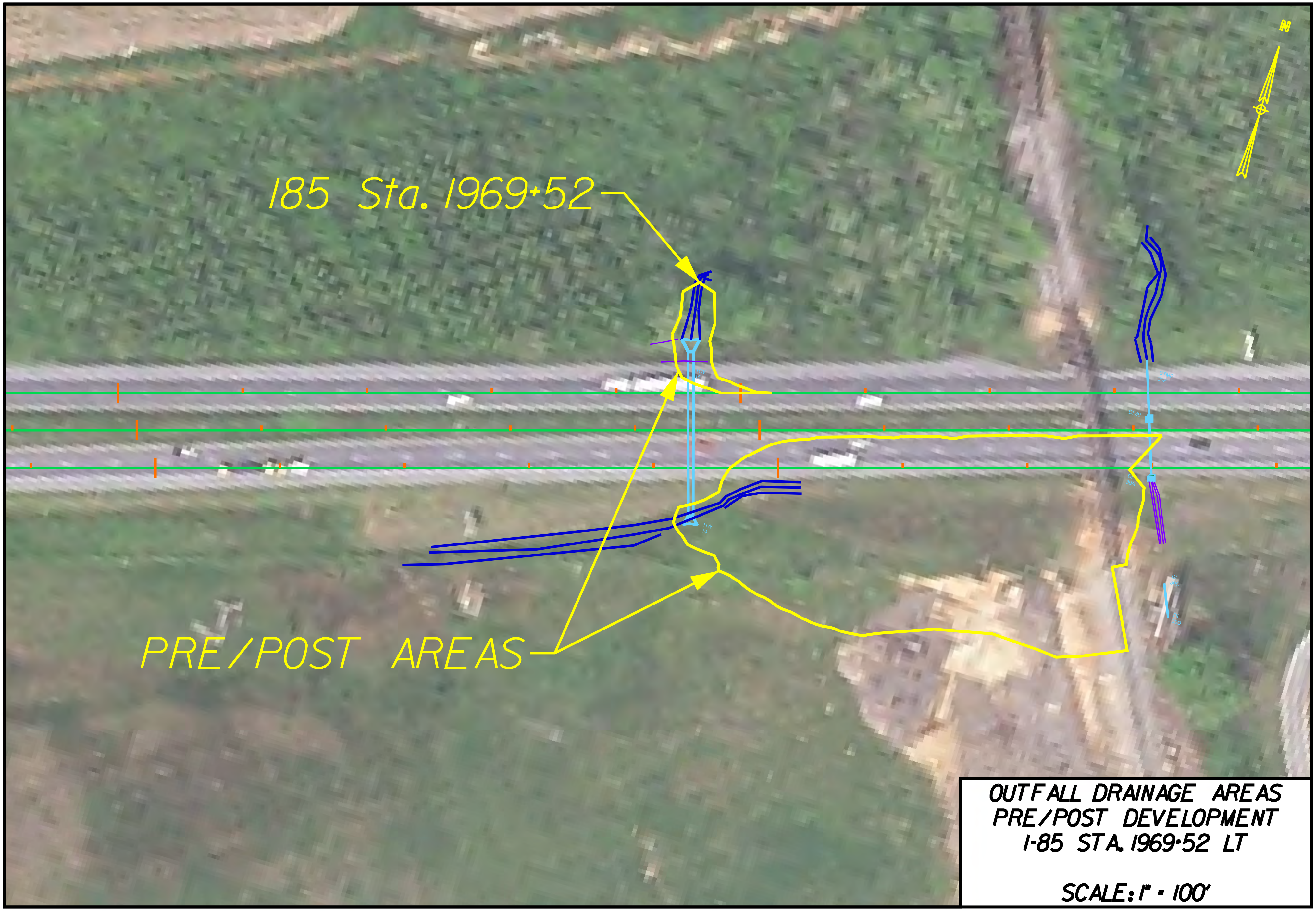
Note: Data derived from NLCD 2006 Impervious Surface, 30-meter resolution

UNITS	TOTAL AREA		IMPERVIOUS AREA	% IMPERVIOUS
SQ. METERS	3867664		267351	6.91%
SQ. MILES	1.49		0.10	6.91%

Note: Data derived from NLCD 2006 Impervious Surface, 30-meter resolution

OUTFALL 1969+52 LT

This outfall receives runoff from limited offsite areas as well as roadway discharge Sta. 1970+00 to Sta. 1973+00. The drainage area is approximately 1 acre and includes roadway pavement, grassed medians, railway, and a clay racetrack. Offsite and roadway runoff is routed under I-85 to the outfall via an existing 4’ x 6’ R.C. box culvert. Discharge from this outfall is released into a heavily wooded area and is then conveyed to an unnamed tributary that feeds into Buffalo Creek. The I-85 improvements will increase imperviousness due to the proposed median paving. As a result, there will be a negligible increase in discharge of 1 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.



N
185 Sta. 1969+52
PRE/POST AREAS
OUTFALL DRAINAGE AREAS
PRE/POST DEVELOPMENT
I-85 STA. 1969+52 LT
SCALE: 1" = 100'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	0.25	0.90	
Rolling, 2%-10%	Side Slopes, Earth	0.20	0.60	Area Weighted C
Rolling, 2%-10%	Gravel Pavements	0.04	0.55	0.48
Rolling, 2%-10%	Side Slopes, Turf	0.76	0.30	
		1.25		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	11.90%	100	0.41				0.166
Shallow Concentrated	Unpaved	11.90%	211					0.011
Shallow Concentrated								
Channel 1		10.82%	100	0.045	4.5	9.2221	6.75059	0.004
Channel 2								
Total			411				0.6331	0.180

Gaffney

Time of Concentration *(minutes)*	11

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.48	5.815	1.25	**3**
Q_{25}	1.1	0.48	6.699	1.25	**4**
Q_{50}	1.2	0.48	7.395	1.25	**5**
Q_{100}	1.25	0.48	8.080	1.25	**6**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	0.36	0.90	
Rolling, 2%-10%	Side Slopes, Earth	0.20	0.60	Area Weighted C
Rolling, 2%-10%	Gravel Pavements	0.04	0.55	0.53
Rolling, 2%-10%	Side Slopes, Turf	0.65	0.30	
		1.25		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	11.90%	100	0.41				0.166
Shallow Concentrated	Unpaved	11.90%	211					0.011
Shallow Concentrated								
Channel 1		10.82%	100	0.045	4.5	9.2221	6.75059	0.004
Channel 2								
Total			411				0.6331	0.180

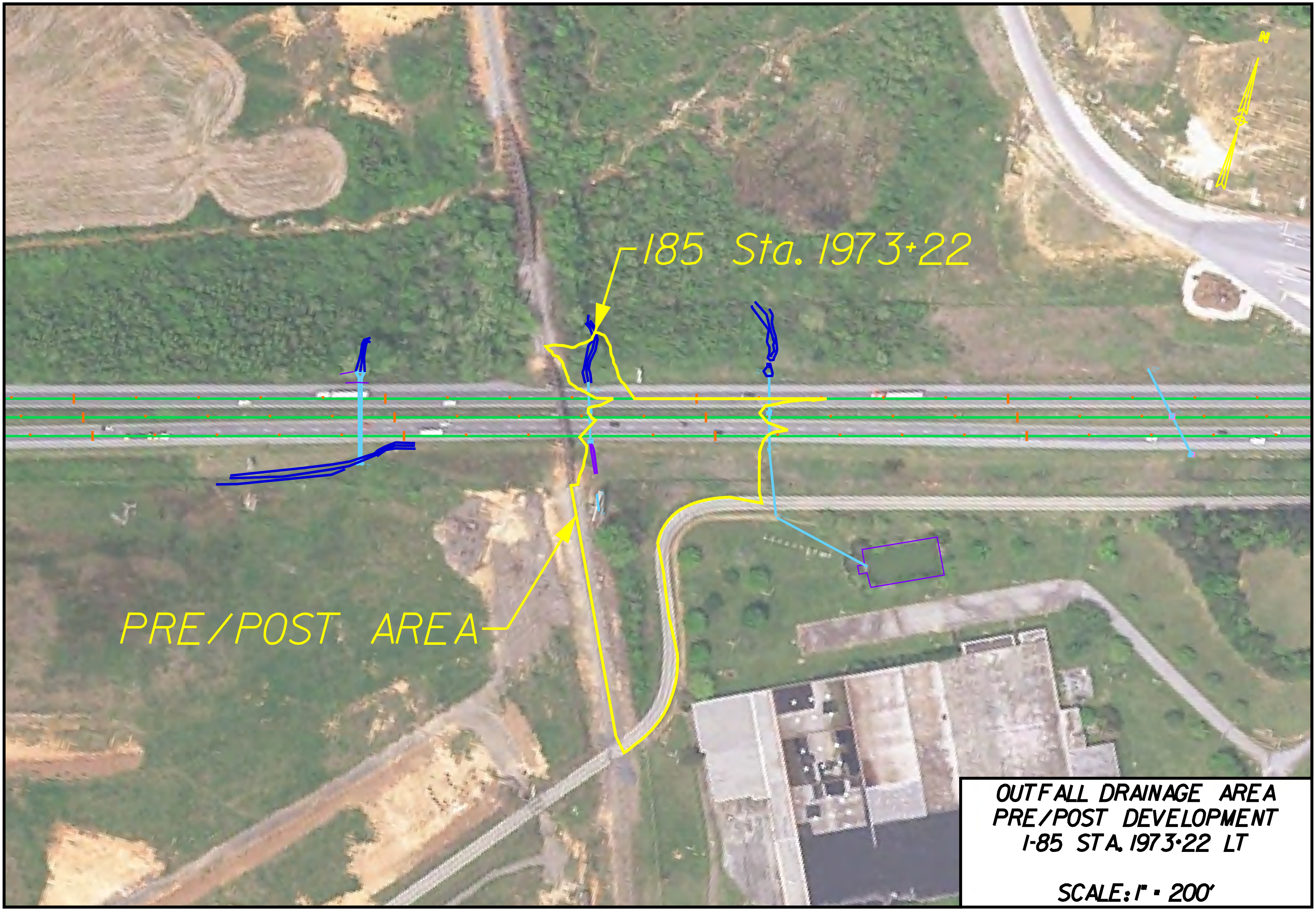
Gaffney

Time of Concentration *(minutes)*	11

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.53	5.815	1.25	**4**
Q_{25}	1.1	0.53	6.699	1.25	**5**
Q_{50}	1.2	0.53	7.395	1.25	**6**
Q_{100}	1.25	0.53	8.080	1.25	**7**

OUTFALL 1973+22 LT

This outfall receives runoff from limited offsite areas as well as roadway discharge from Sta. 1973+00 to Sta. 1976+00. The drainage area is approximately 2 acres and includes roadway pavement, grassed medians, railway, and minimal offsite woodlands. Offsite and roadway runoff is routed under I-85 to the outfall via an existing storm sewer system. Discharge from this outfall is released into a heavily wooded area and is then conveyed to an unnamed tributary that feeds into Buffalo Creek. The I-85 improvements will increase imperviousness due to the proposed median paving. As a result, there will be a negligible increase in discharge of 1 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.


N
I85 Sta. 1973+22
PRE/POST AREA
OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 1973+22 LT
SCALE: 1" = 200'

Rational Analysis

Land Slope	Land Use	Acres	C
Rolling, 2%-10%	Pavements & Roofs	0.50	0.90
Rolling, 2%-10%	Gravel Pavements	0.22	0.55
Rolling, 2%-10%	Side Slopes, Turf	1.18	0.30
Rolling, 2%-10%	Unimproved Areas	0.40	0.20
		2.30	

Area Weighted C
0.44

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	4.59%	100	0.41				0.242
Shallow Concentrated	Unpaved	4.59%	344					0.028
Shallow Concentrated								
Channel 1		32.51%	49	0.045	4	6.4721	13.698	0.001
Channel 2								
Total			493				0.5051	0.271

Gaffney

Time of Concentration *(minutes)*	17

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.44	5.095	2.30	**5**
Q_{25}	1.1	0.44	5.845	2.30	**6**
Q_{50}	1.2	0.44	6.432	2.30	**8**
Q_{100}	1.25	0.44	7.007	2.30	**9**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	0.71	0.90	
Rolling, 2%-10%	Gravel Pavements	0.22	0.55	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	0.97	0.30	0.49
Rolling, 2%-10%	Unimproved Areas	0.40	0.20	
		2.30		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	4.59%	100	0.41				0.242
Shallow Concentrated	Unpaved	4.59%	344					0.028
Shallow Concentrated								
Channel 1		32.51%	49	0.045	4	6.4721	13.698	0.001
Channel 2								
Total			493				0.5051	0.271

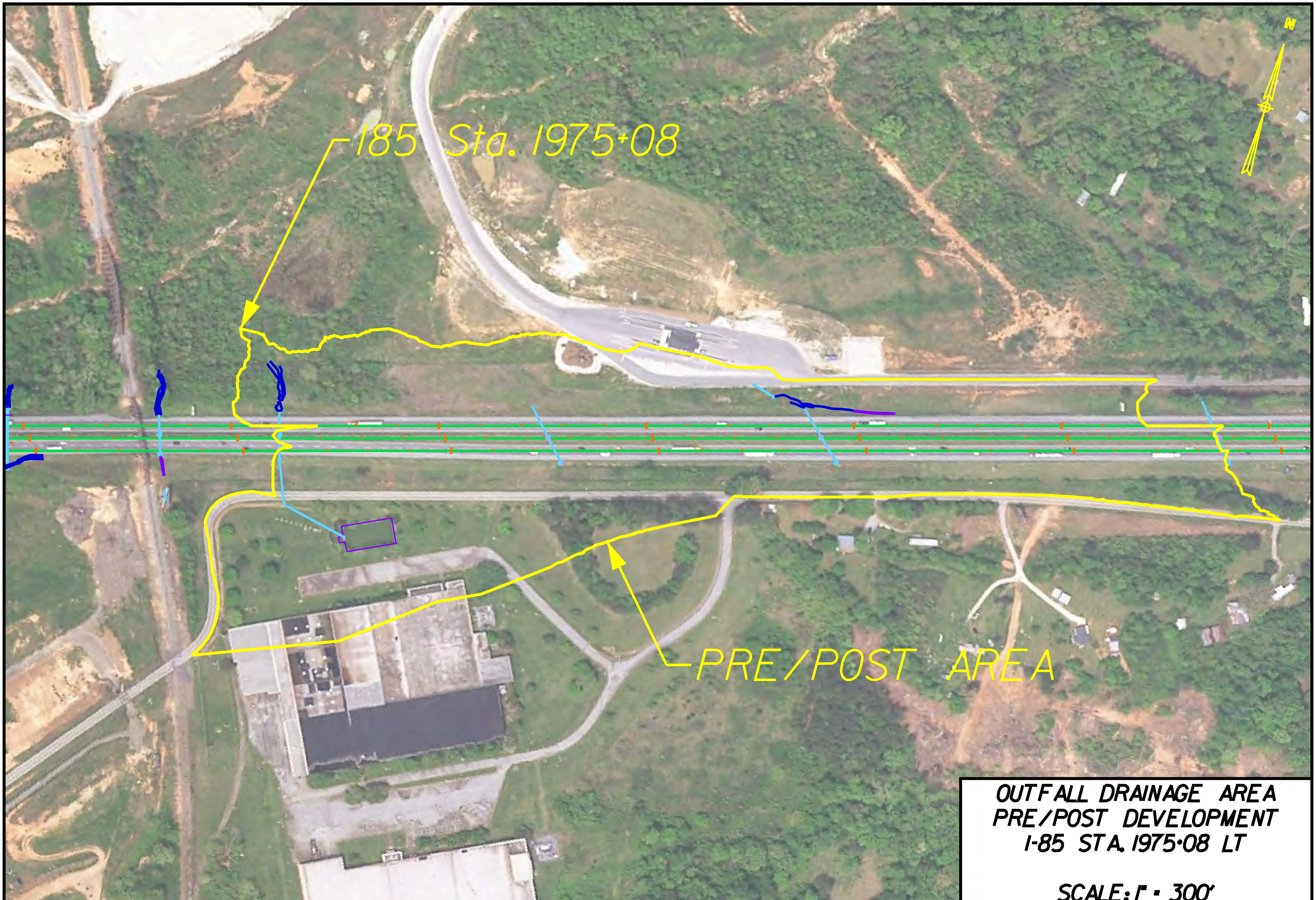
Gaffney

Time of Concentration *(minutes)*	17

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.49	5.095	2.30	**6**
Q_{25}	1.1	0.49	5.845	2.30	**7**
Q_{50}	1.2	0.49	6.432	2.30	**9**
Q_{100}	1.25	0.49	7.007	2.30	**10**

OUTFALL 1975+08 LT

This outfall receives runoff from offsite areas as well as roadway discharge from Sta. 1976+00 to Sta. 1998+50. The drainage area is approximately 24 acres and is characterized by an existing 0.2-acre impoundment, pavement, grassed medians, and wooded areas. Offsite and roadway runoff is routed under I-85 to the outfall by multiple existing storm sewer systems. Discharge from this outfall is released into a heavily wooded area and is then conveyed to an unnamed tributary that feeds into Buffalo Creek. The I-85 improvements will increase imperviousness due to the proposed median paving. As a result, there will be a negligible increase in discharge of 5 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 1975+08 LT

SCALE: 1" = 300'

Rational Analysis

Land Slope	Land Use	Acres	C
Rolling, 2%-10%	Pavements & Roofs	6.88	0.90
Rolling, 2%-10%	Gravel Pavements	0.07	0.55
Rolling, 2%-10%	Side Slopes, Turf	15.12	0.30
Rolling, 2%-10%	Unimproved Areas	0.30	0.20
Rolling, 2%-10%	Woodland & Forest	1.31	0.15
		23.68	

Area Weighted C
0.47

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	5.49%	100	0.41				0.226
Shallow Concentrated	Unpaved	5.49%	762					0.056
Shallow Concentrated								
Channel 1								
Channel 2								
Total			862				0.8501	0.282

Gaffney

Time of Concentration *(minutes)*	17

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.47	5.095	23.68	**56**
Q_{25}	1.1	0.47	5.845	23.68	**71**
Q_{50}	1.2	0.47	6.432	23.68	**85**
Q_{100}	1.25	0.47	7.007	23.68	**97**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	8.49	0.90	
Rolling, 2%-10%	Gravel Pavements	0.07	0.55	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	13.51	0.30	0.51
Rolling, 2%-10%	Unimproved Areas	0.30	0.20	
Rolling, 2%-10%	Woodland & Forest	1.31	0.15	
		23.68		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	5.49%	100	0.41				0.226
Shallow Concentrated	Unpaved	5.49%	762					0.056
Shallow Concentrated								
Channel 1								
Channel 2								
Total			862				0.8501	0.282

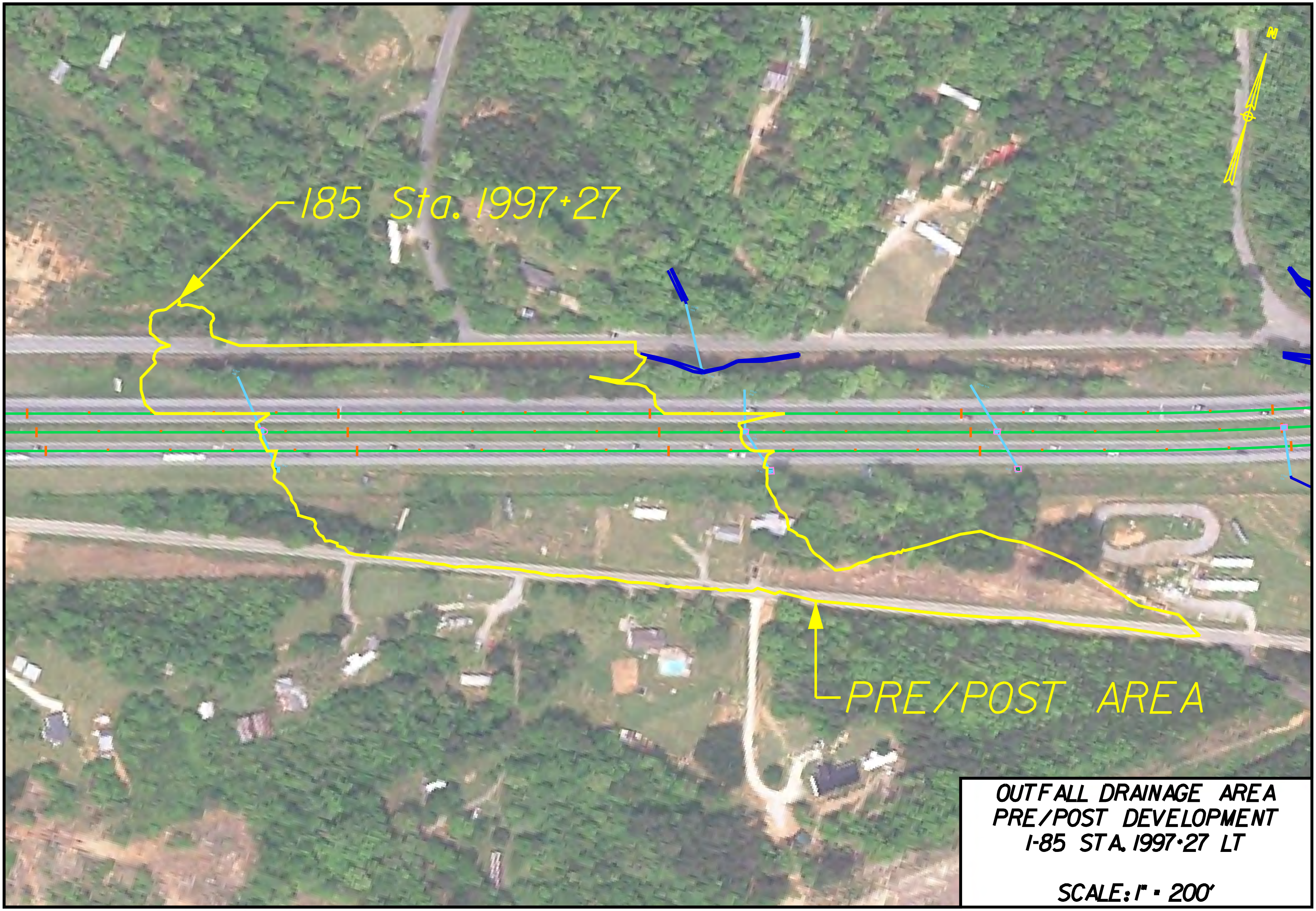
Gaffney

Time of Concentration *(minutes)*	17

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.51	5.095	23.68	**61**
Q_{25}	1.1	0.51	5.845	23.68	**77**
Q_{50}	1.2	0.51	6.432	23.68	**93**
Q_{100}	1.25	0.51	7.007	23.68	**105**

OUTFALL 1997+27 LT

This outfall receives runoff from minimal offsite areas as well as roadway discharge from Sta. 1998+50 to Sta. 2006+50. The drainage area is approximately 8 acres and consists of roadway pavement, grassed medians, sparse residential tracts, and wooded areas. Offsite and roadway runoff is routed under I-85 to the outfall via an existing storm sewer system. Discharge from this outfall is released into a heavily wooded area and is then conveyed to an unnamed tributary that feeds into Buffalo Creek. The I-85 improvements will increase imperviousness due to the proposed median paving. As a result, there will be a negligible increase in discharge of 2 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 1997+27 LT

SCALE: 1" = 200'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	2.04	0.90	
Rolling, 2%-10%	Side Slopes, Turf	5.92	0.30	Area Weighted C
Rolling, 2%-10%	Woodland & Forest	0.04	0.15	0.45
		8.00		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	5.49%	100	0.41				0.226
Shallow Concentrated	Unpaved	5.49%	689					0.051
Shallow Concentrated								
Channel 1		3.10%	142	0.045	18	18.49	5.72504	0.007
Channel 2								
Total			931				0.9132	0.283

Gaffney

Time of Concentration *(minutes)*	17

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.45	5.095	8.00	**18**
Q_{25}	1.1	0.45	5.845	8.00	**23**
Q_{50}	1.2	0.45	6.432	8.00	**28**
Q_{100}	1.25	0.45	7.007	8.00	**32**

Civil Engineering Consulting Services, Inc.

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	2.58	0.90	
Rolling, 2%-10%	Side Slopes, Turf	5.38	0.30	Area Weighted C
Rolling, 2%-10%	Woodland & Forest	0.04	0.15	0.49
		8.00		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	5.49%	100	0.41				0.226
Shallow Concentrated	Unpaved	5.49%	689					0.051
Shallow Concentrated								
Channel 1		3.10%	142	0.045	18	18.49	5.72504	0.007
Channel 2								
Total			931				0.9132	0.283

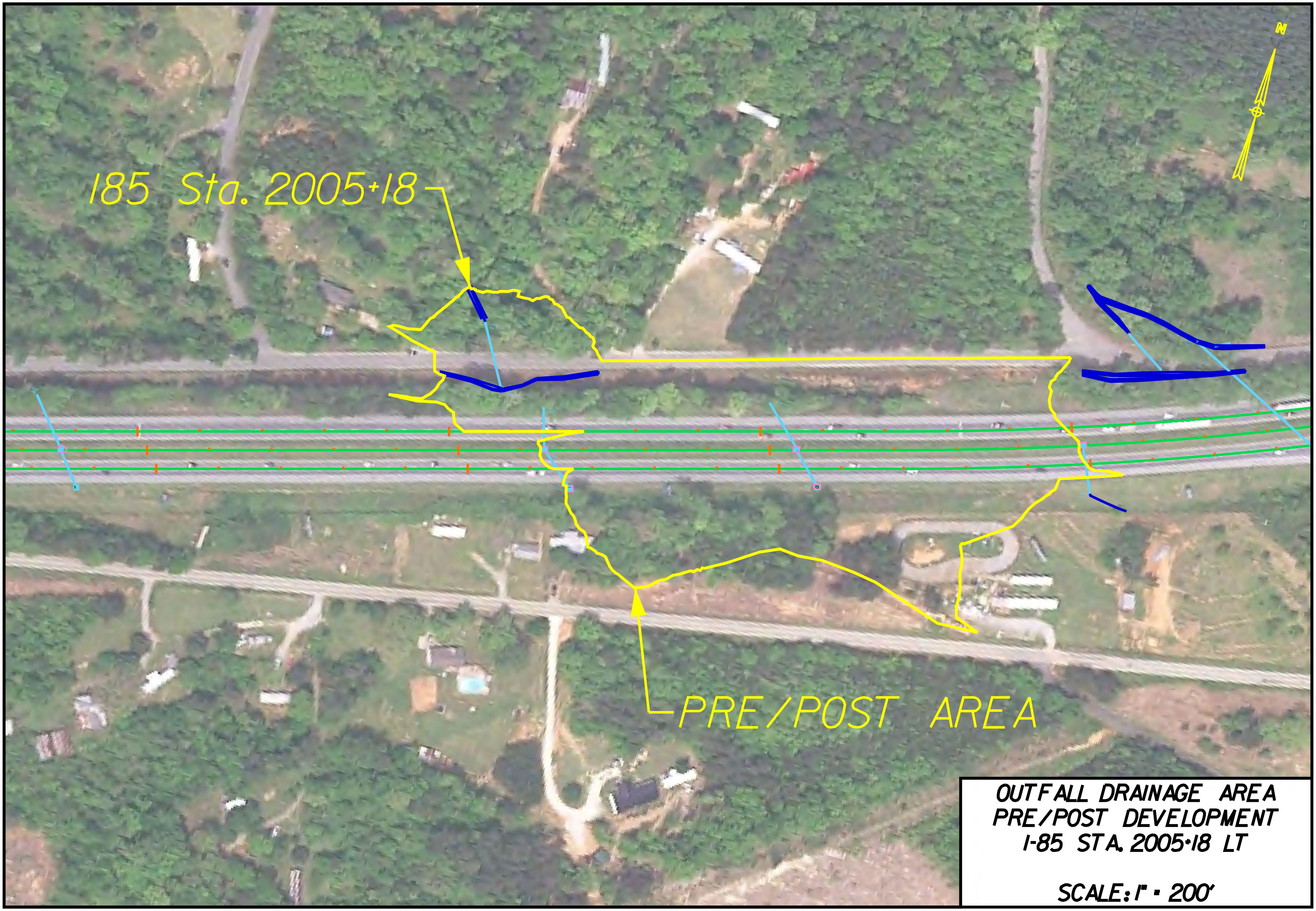
Gaffney

Time of Concentration *(minutes)*	17

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.49	5.095	8.00	**20**
Q_{25}	1.1	0.49	5.845	8.00	**25**
Q_{50}	1.2	0.49	6.432	8.00	**30**
Q_{100}	1.25	0.49	7.007	8.00	**35**

OUTFALL 2005+18 LT

This outfall receives runoff from limited offsite areas as well as roadway discharge from Sta. 2006+50 to Sta. 2015+00. The drainage area is approximately 7 acres and includes roadway pavement, grassed medians, and wooded areas. Offsite and roadway runoff is routed under I-85 via existing parallel storm sewer systems along the mainline. Water from these systems is carried to the outlet point by an existing storm sewer system under the Frontage Road. Discharge from this outfall is released into a heavily wooded area and is then conveyed to an unnamed tributary that feeds into Buffalo Creek. The I-85 improvements will increase imperviousness due to the proposed median paving and Exit 102 interchange realignment. As a result, there will be a negligible increase in discharge of 2 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2005+18 LT

SCALE: 1" = 200'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	2.03	0.90	
Rolling, 2%-10%	Side Slopes, Turf	3.64	0.30	Area Weighted C
Hilly, Over 10%	Woodland & Forest	1.48	0.20	0.45
		7.15		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusl	16.43%	100	0.8				0.249
Shallow Concentrated	Unpaved	16.43%	65					0.003
Shallow Concentrated								
Channel 1		3.10%	81	0.045	5.5	11.194	3.62924	0.006
Channel 2								
Total			246				0.2653	0.258

Gaffney

Time of Concentration *(minutes)*	16

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.45	5.203	7.15	**17**
Q_{25}	1.1	0.45	5.972	7.15	**21**
Q_{50}	1.2	0.45	6.575	7.15	**25**
Q_{100}	1.25	0.45	7.166	7.15	**29**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	2.62	0.90	
Rolling, 2%-10%	Side Slopes, Turf	3.05	0.30	Area Weighted C
Hilly, Over 10%	Woodland & Forest	1.48	0.20	0.50
		7.15		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusl	16.43%	100	0.8				0.249
Shallow Concentrated	Unpaved	16.43%	65					0.003
Shallow Concentrated								
Channel 1		3.10%	81	0.045	5.5	11.194	3.62924	0.006
Channel 2								
Total			246				0.2653	0.258

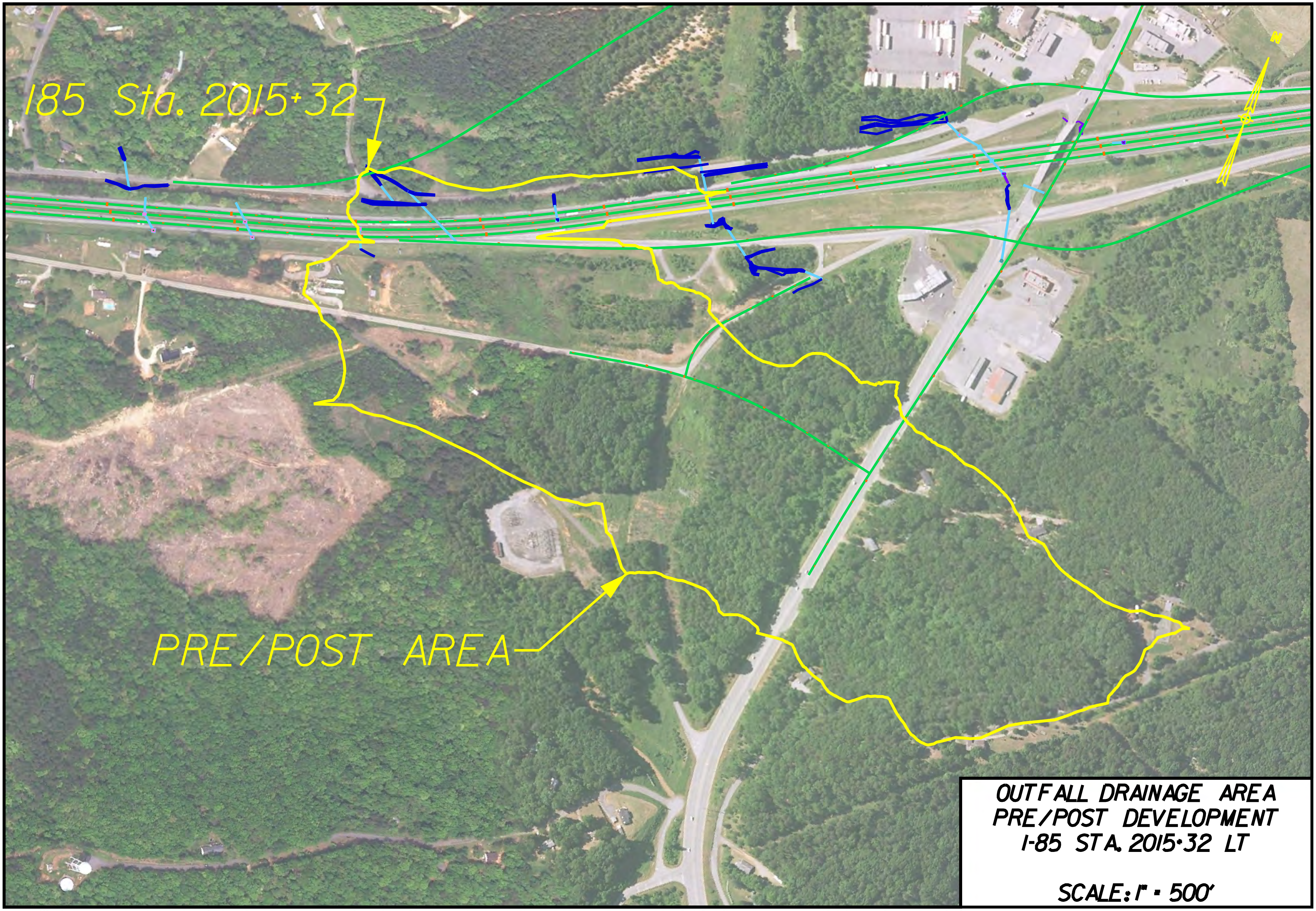
Gaffney

Time of Concentration *(minutes)*	16

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.50	5.203	7.15	**19**
Q_{25}	1.1	0.50	5.972	7.15	**23**
Q_{50}	1.2	0.50	6.575	7.15	**28**
Q_{100}	1.25	0.50	7.166	7.15	**32**

OUTFALL 2015+32 LT

This outfall receives runoff from offsite areas, the Exit 102 interchange, and the I-85 mainline from Sta. 2015+00 to Sta. 2029+00. The drainage area is approximately 80 acres and includes roadway pavement, grassed medians, unimproved areas, sparse residential tracts, and large wooded areas. Offsite and roadway runoff is routed under I-85 to the outfall via multiple existing storm sewer systems. Discharge from this outfall is released into a heavily wooded area and is then conveyed to an unnamed tributary that feeds into Buffalo Creek. The I-85 improvements will increase imperviousness due to the proposed median paving and Exit 102 interchange realignment. As a result, there will be a negligible increase in discharge of 4 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2015+32 LT

SCALE: 1" = 500'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	7.33	0.90	
Rolling, 2%-10%	Earth shoulders	0.19	0.50	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	17.24	0.30	0.28
Rolling, 2%-10%	Unimproved Areas	7.91	0.20	
Hilly, Over 10%	Woodland & Forest	43.78	0.20	
Rolling, 2%-10%	Woodland & Forest	3.64	0.15	
		80.09		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusl	6.15%	100	0.8				0.368
Shallow Concentrated	Unpaved	6.15%	634					0.044
Shallow Concentrated								
Channel 1								
Channel 2								
Total			734				0.4946	0.412

Gaffney

Time of Concentration *(minutes)*	25			
	C_f	C	I [in/hr]	**AREA (ac)**	CFS

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.28	4.372	80.09	**99**
Q_{25}	1.1	0.28	4.996	80.09	**125**
Q_{50}	1.2	0.28	5.482	80.09	**150**
Q_{100}	1.25	0.28	5.956	80.09	**169**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	8.27	0.90	
Rolling, 2%-10%	Earth shoulders	0.19	0.50	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	18.73	0.30	0.29
Rolling, 2%-10%	Unimproved Areas	7.49	0.20	
Hilly, Over 10%	Woodland & Forest	41.83	0.20	
Rolling, 2%-10%	Woodland & Forest	3.58	0.15	
		80.09		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusł	6.15%	100	0.8				0.368
Shallow Concentrated	Unpaved	6.15%	634					0.044
Shallow Concentrated								
Channel 1								
Channel 2								
Total			734				0.4946	0.412

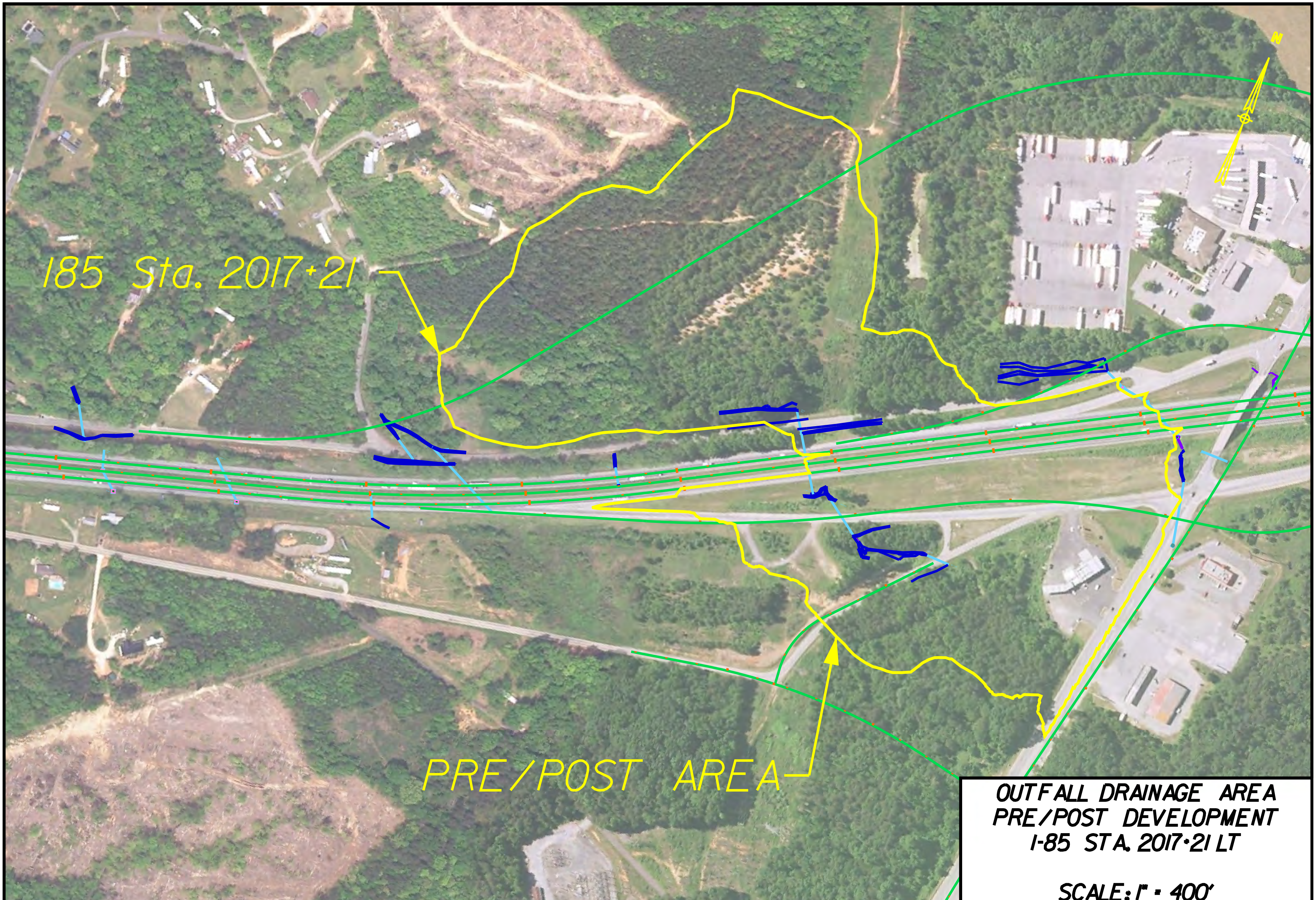
Gaffney

Time of Concentration *(minutes)*	25

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.29	4.372	80.09	**103**
Q_{25}	1.1	0.29	4.996	80.09	**129**
Q_{50}	1.2	0.29	5.482	80.09	**155**
Q_{100}	1.25	0.29	5.956	80.09	**175**

OUTFALL 2017+21 LT

This outfall receives cumulative discharge from Outfall 2028+67 LT, the Exit 102 Interchange, and limited offsite areas. The analysis point is offsite in order to capture the sheet flow impacts to the approximately 50-acre drainage area which includes roadway pavement, grassed medians, and large wooded areas. Offsite and roadway runoff is routed under I-85 to the outfall via a series of existing storm sewer systems. Discharge from this outfall is released to heavily wooded surroundings, and is then conveyed to an unnamed tributary that feeds into Buffalo Creek. The I-85 improvements will increase imperviousness due to the proposed median paving along the mainline and the reconfiguration of the Exit 102 Interchange. As a result, there will be a negligible increase in discharge of 5 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2017+21 LT

SCALE: 1" = 400'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	6.41	0.90	
Rolling, 2%-10%	Earth shoulders	0.83	0.50	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	14.52	0.30	0.31
Hilly, Over 10%	Woodland & Forest	18.59	0.20	
Rolling, 2%-10%	Woodland & Forest	10.07	0.15	
		50.42		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	3.09%	100	0.8				0.485
Shallow Concentrated	Unpaved	3.09%	755					0.074
Shallow Concentrated								
Channel 1								
Channel 2								
Total			855				0.4247	0.559

Gaffney

Time of Concentration *(minutes)*	34			
	C_f	C	I [in/hr]	**AREA (ac)**	CFS

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.31	3.769	50.42	**59**
Q_{25}	1.1	0.31	4.295	50.42	**74**
Q_{50}	1.2	0.31	4.702	50.42	**89**
Q_{100}	1.25	0.31	5.097	50.42	**100**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	7.04	0.90	
Rolling, 2%-10%	Earth shoulders	0.83	0.50	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	19.60	0.30	0.33
Hilly, Over 10%	Woodland & Forest	15.58	0.20	
Rolling, 2%-10%	Woodland & Forest	7.37	0.15	
		50.42		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusl	3.09%	100	0.8				0.485
Shallow Concentrated	Unpaved	3.09%	755					0.074
Shallow Concentrated								
Channel 1								
Channel 2								
Total			855				0.4247	0.559

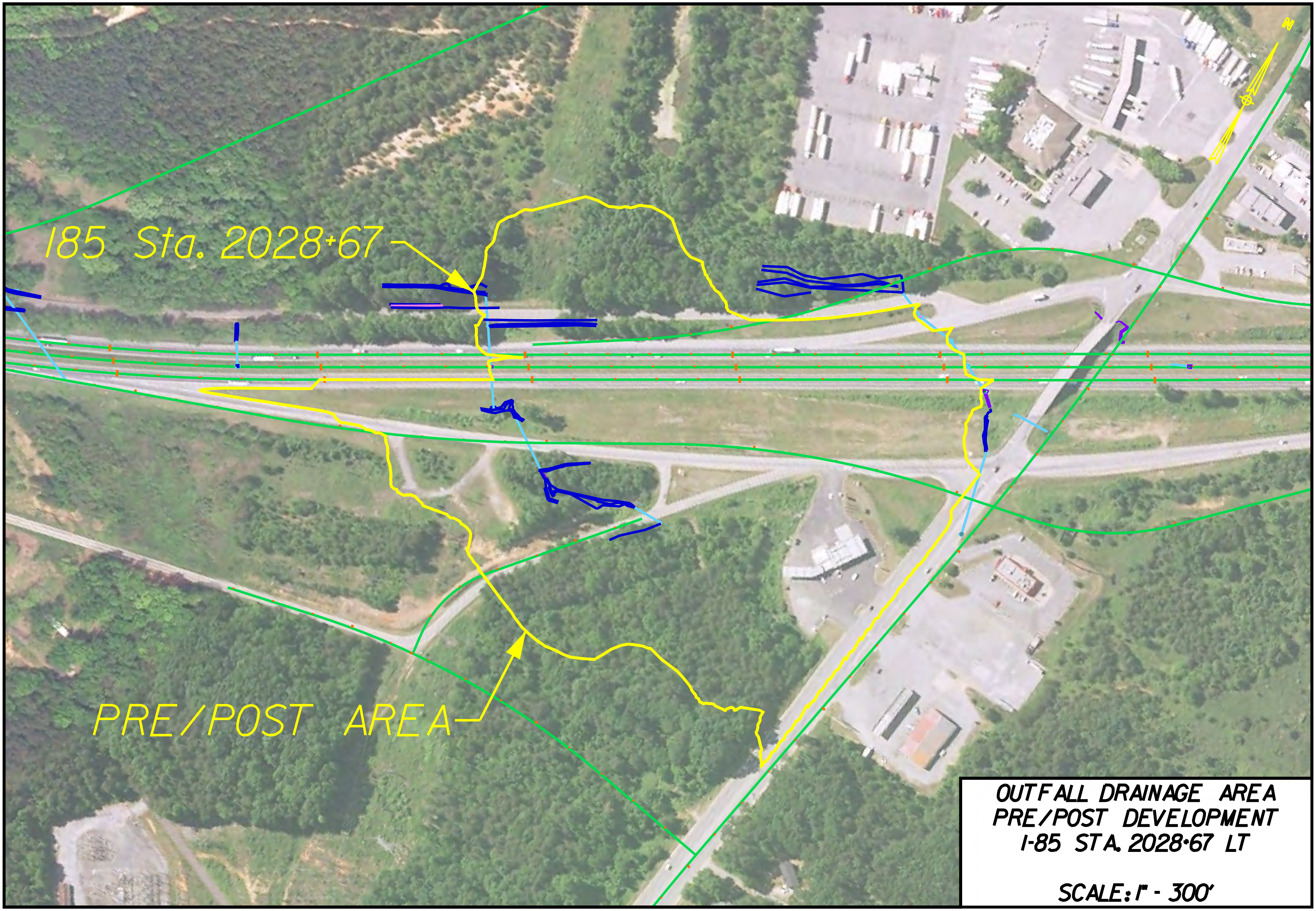
Gaffney

Time of Concentration *(minutes)*	34

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.33	3.769	50.42	**64**
Q_{25}	1.1	0.33	4.295	50.42	**80**
Q_{50}	1.2	0.33	4.702	50.42	**95**
Q_{100}	1.25	0.33	5.097	50.42	**107**

OUTFALL 2028+67 LT

This outfall receives runoff from offsite areas, the Exit 102 interchange, and the I-85 mainline from Sta. 2029+00 to Sta. 2040+50. The drainage area is approximately 27 acres and is characterized by roadway pavement, grassed medians, and large wooded areas. Offsite and roadway runoff is routed under I-85 to the outfall via a series of existing storm sewer systems. Discharge from this outfall is released to heavily wooded surroundings, and is then conveyed to an unnamed tributary that feeds into Buffalo Creek. There will be no change in discharge from pre to post development conditions for the 10-year design storm. Therefore, the proposed I-85 improvements will have no adverse downstream impact.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2028+67 LT

SCALE: 1" - 300'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	6.37	0.90	
Rolling, 2%-10%	Side Slopes, Turf	12.96	0.30	Area Weighted C
Hilly, Over 10%	Woodland & Forest	7.43	0.20	0.42
		26.76		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	12.65%	100	0.8				0.276
Shallow Concentrated	Unpaved	12.65%	523					0.025
Shallow Concentrated								
Channel 1								
Channel 2								
Total			623				0.5743	0.301

Gaffney

Time of Concentration *(minutes)*	19

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.42	4.893	26.76	**54**
Q_{25}	1.1	0.42	5.607	26.76	**69**
Q_{50}	1.2	0.42	6.165	26.76	**82**
Q_{100}	1.25	0.42	6.711	26.76	**93**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	6.13	0.90	
Rolling, 2%-10%	Side Slopes, Turf	13.84	0.30	Area Weighted C
Hilly, Over 10%	Woodland & Forest	6.79	0.20	0.41
		26.76		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	12.65%	100	0.8				0.276
Shallow Concentrated	Unpaved	12.65%	523					0.025
Shallow Concentrated								
Channel 1								
Channel 2								
Total			623				0.5743	0.301

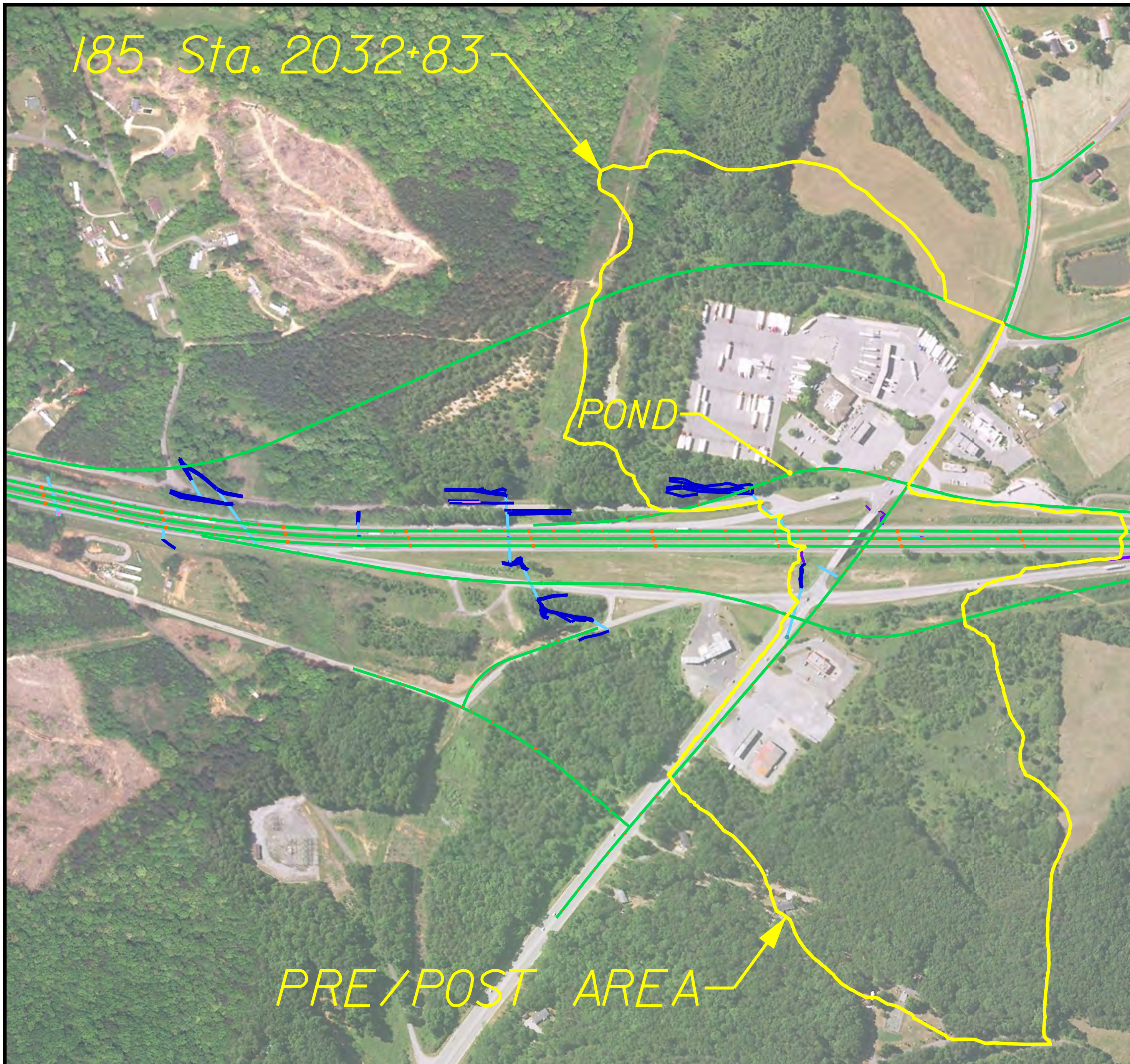
Gaffney

Time of Concentration *(minutes)*	19

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.41	4.893	26.76	**54**
Q_{25}	1.1	0.41	5.607	26.76	**68**
Q_{50}	1.2	0.41	6.165	26.76	**82**
Q_{100}	1.25	0.41	6.711	26.76	**93**

OUTFALL 2032+83 LT

This outfall receives cumulative discharge from Outfall 2038+46 LT, the Exit 102 Interchange, and limited offsite areas. The analysis point is offsite in order to capture the sheet flow impacts to the approximately 98-acre drainage area which includes roadway pavement, grassed medians, some commercial development, and large wooded areas. Offsite and roadway runoff is routed under I-85 to the outfall via a series of existing storm sewer systems. Discharge from this outfall is released into a heavily wooded area and is then conveyed to an unnamed tributary that feeds into Buffalo Creek. The proposed interchange design impacts an existing offsite detention pond. The pond will need to be reestablished unless the potential additional increase in discharge, resulting from the pond’s removal, can be addressed with the proposed interchange improvements. The I-85 improvements will increase imperviousness due to the proposed median paving along the mainline and the reconfiguration of the Exit 102 Interchange. As a result, there will be a negligible increase in discharge of 8 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and additional detention is not recommended.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2032+83 LT

SCALE: 1" = 600'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	24.09	0.90	
Rolling, 2%-10%	Side Slopes, Turf	11.59	0.30	Area Weighted C
Rolling, 2%-10%	Meadows & Pasture Land	2.76	0.30	0.39
Hilly, Over 10%	Woodland & Forest	59.49	0.20	
		97.93		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	8.58%	100	0.8				0.322
Shallow Concentrated	Unpaved	8.58%	699					0.041
Shallow Concentrated								
Channel 1								
Channel 2								
Total			799				0.6108	0.363

Gaffney

Time of Concentration *(minutes)*	22

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.39	4.618	97.93	**175**
Q_{25}	1.1	0.39	5.284	97.93	**220**
Q_{50}	1.2	0.39	5.804	97.93	**264**
Q_{100}	1.25	0.39	6.311	97.93	**299**

Civil Engineering Consulting Services, Inc.

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	25.63	0.90	
Rolling, 2%-10%	Side Slopes, Turf	19.04	0.30	Area Weighted C
Rolling, 2%-10%	Meadows & Pasture Land	1.76	0.30	0.40
Hilly, Over 10%	Woodland & Forest	51.50	0.20	
		97.93		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	8.58%	100	0.8				0.322
Shallow Concentrated	Unpaved	8.58%	699					0.041
Shallow Concentrated								
Channel 1								
Channel 2								
Total			799				0.6108	0.363

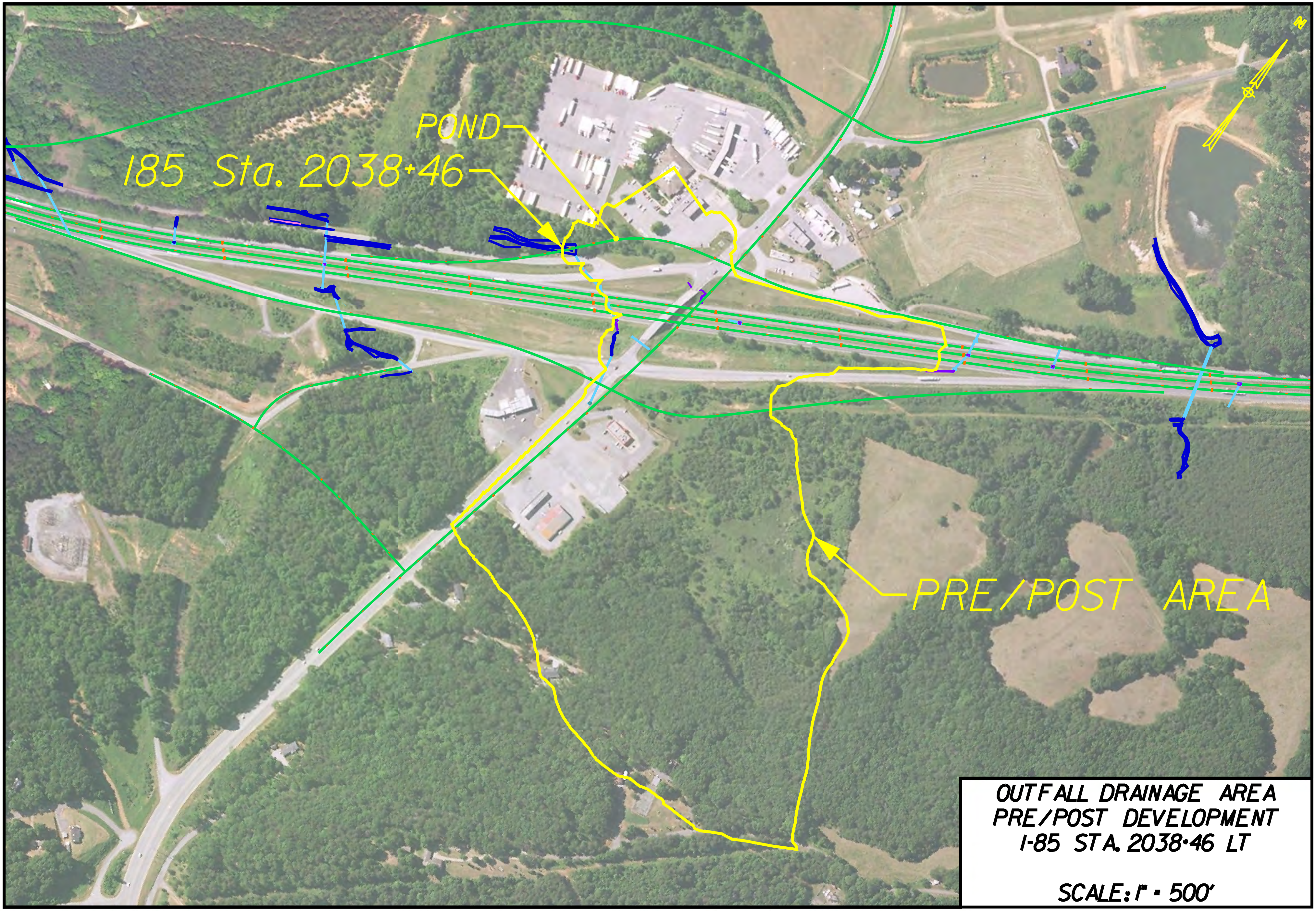
Gaffney

Time of Concentration *(minutes)*	22

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.40	4.618	97.93	**183**
Q_{25}	1.1	0.40	5.284	97.93	**230**
Q_{50}	1.2	0.40	5.804	97.93	**276**
Q_{100}	1.25	0.40	6.311	97.93	**312**

OUTFALL 2038+46 LT

This outfall receives runoff from offsite areas, the Exit 102 interchange, and the I-85 mainline from Sta. 2040+50 to Sta. 2054+00. The drainage area is approximately 59 acres and is characterized by roadway pavement, grassed medians, commercial development, and large wooded areas. Offsite and roadway runoff is routed under I-85 to the outfall via a series of existing storm sewer systems. Discharge from this outfall is released into a heavily wooded area and is then conveyed to an unnamed tributary that feeds into Buffalo Creek. The proposed interchange design impacts an existing offsite detention pond. The pond will need to be reestablished unless the potential additional increase in discharge, resulting from the pond's removal, can be addressed with the proposed interchange improvements. The I-85 improvements will increase imperviousness due to the proposed median paving along the mainline and the reconfiguration of the Exit 102 Interchange. As a result, there will be a negligible increase in discharge of 3 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and additional detention is not recommended.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2038+46 LT

SCALE: 1" = 500'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	11.05	0.90	
Rolling, 2%-10%	Side Slopes, Turf	10.18	0.30	Area Weighted C
Hilly, Over 10%	Woodland & Forest	37.92	0.20	0.35
		59.15		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	8.58%	100	0.8				0.322
Shallow Concentrated	Unpaved	8.58%	699					0.041
Shallow Concentrated								
Channel 1								
Channel 2								
Total			799				0.6108	0.363

Gaffney

Time of Concentration *(minutes)*	22

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.35	4.618	59.15	**95**
Q_{25}	1.1	0.35	5.284	59.15	**120**
Q_{50}	1.2	0.35	5.804	59.15	**143**
Q_{100}	1.25	0.35	6.311	59.15	**162**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	11.66	0.90	
Rolling, 2%-10%	Side Slopes, Turf	11.89	0.30	Area Weighted C
Hilly, Over 10%	Woodland & Forest	35.60	0.20	0.36
		59.15		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	8.58%	100	0.8				0.322
Shallow Concentrated	Unpaved	8.58%	699					0.041
Shallow Concentrated								
Channel 1								
Channel 2								
Total			799				0.6108	0.363

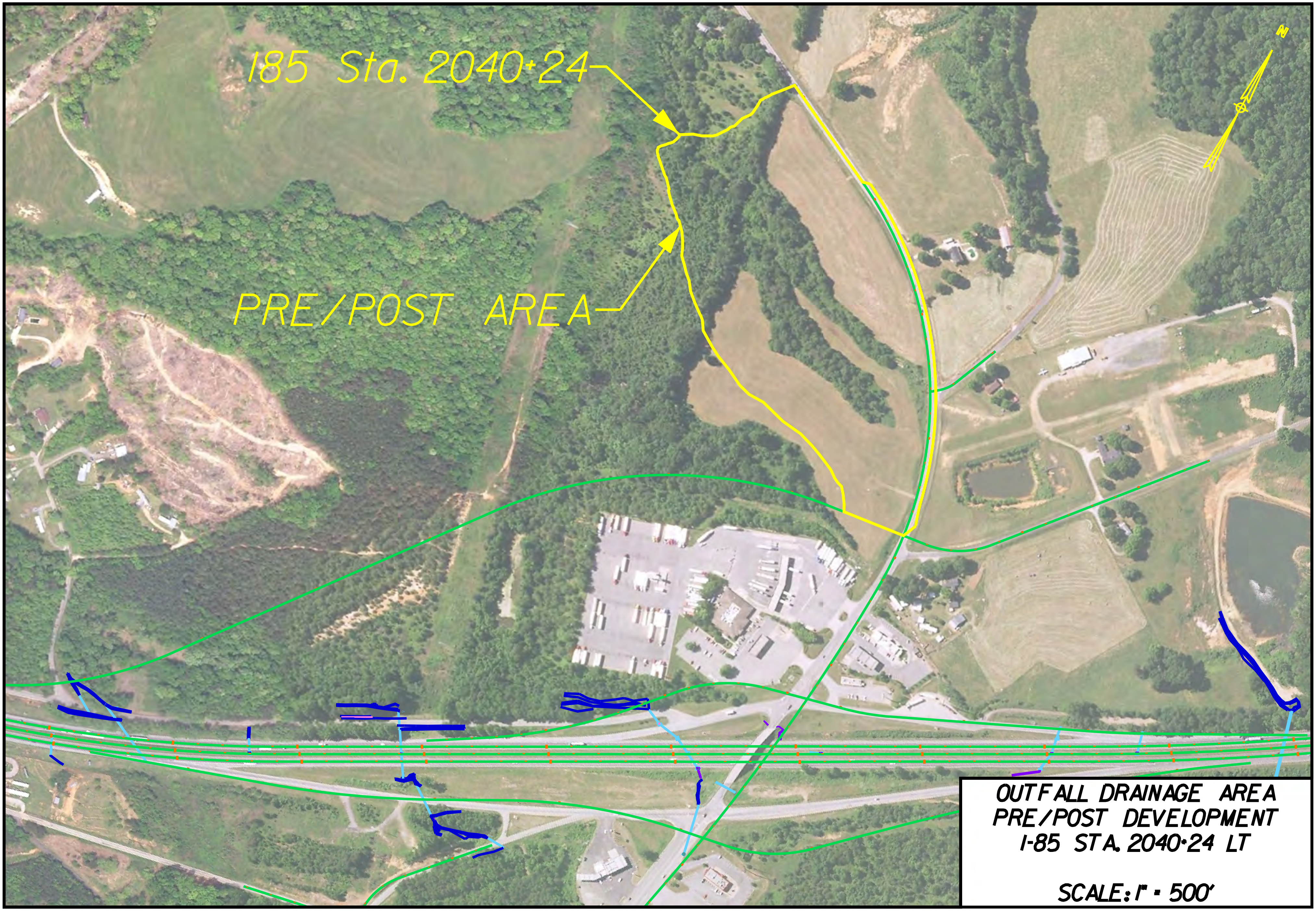
Gaffney

Time of Concentration *(minutes)*	22

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.36	4.618	59.15	**98**
Q_{25}	1.1	0.36	5.284	59.15	**123**
Q_{50}	1.2	0.36	5.804	59.15	**148**
Q_{100}	1.25	0.36	6.311	59.15	**167**

OUTFALL 2040+24 LT

This outfall receives runoff from Rock Springs Road and limited offsite areas. Offsite and roadway runoff sheet flows from Rock Springs Road to the outfall. The analysis point is offsite in order to capture the sheet flow impacts to the approximately 27-acre drainage area which includes roadway pavement, grassed fields, and wooded areas. Discharge from this outfall is released into a heavily wooded area and is then conveyed to an unnamed tributary that feeds into Buffalo Creek. The proposed widening of Rock Springs Road occurring with the Exit 102 interchange improvements will increase imperviousness. As a result, there will be a negligible increase in discharge of 1 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.


185 Sta. 2040+24
PRE/POST AREA
N
OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2040+24 LT
SCALE: 1" = 500'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	1.27	0.90	
Rolling, 2%-10%	Side Slopes, Turf	0.67	0.30	Area Weighted C
Rolling, 2%-10%	Meadows & Pasture Land	14.51	0.30	0.29
Hilly, Over 10%	Woodland & Forest	10.39	0.20	
		26.84		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	4.64%	100	0.41				0.241
Shallow Concentrated	Unpaved	4.64%	1278					0.102
Shallow Concentrated								
Channel 1								
Channel 2								
Total			1378				1.1144	0.343

Gaffney

Time of Concentration *(minutes)*	21

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.29	4.706	26.84	**37**
Q_{25}	1.1	0.29	5.388	26.84	**46**
Q_{50}	1.2	0.29	5.919	26.84	**55**
Q_{100}	1.25	0.29	6.439	26.84	**63**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	1.77	0.90	
Rolling, 2%-10%	Side Slopes, Turf	2.24	0.30	Area Weighted C
Rolling, 2%-10%	Meadows & Pasture Land	12.46	0.30	0.30
Hilly, Over 10%	Woodland & Forest	10.37	0.20	
		26.84		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	4.64%	100	0.41				0.241
Shallow Concentrated	Unpaved	4.64%	1278					0.102
Shallow Concentrated								
Channel 1								
Channel 2								
Total			1378				1.1144	0.343

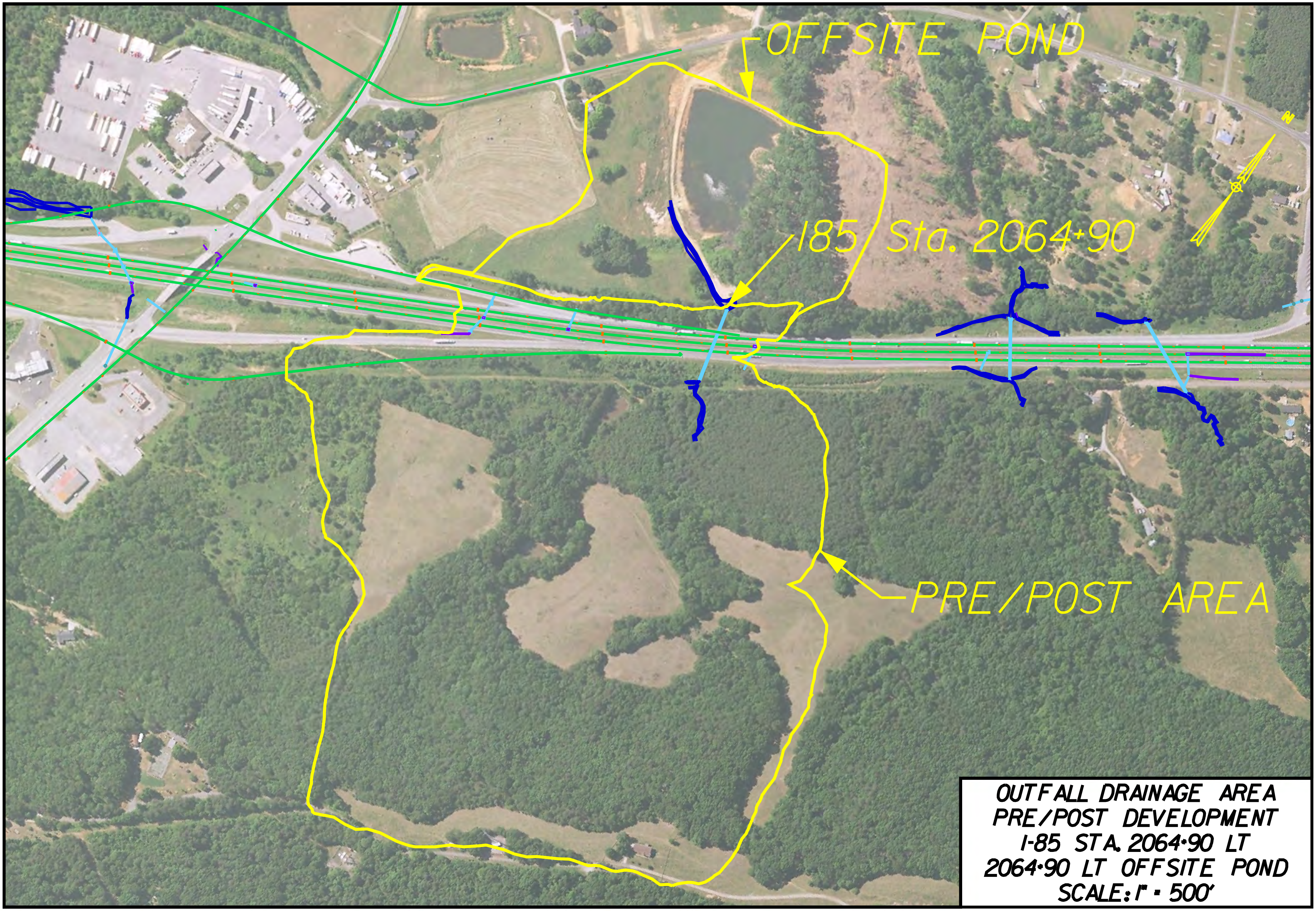
Gaffney

Time of Concentration *(minutes)*	21

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.30	4.706	26.84	**38**
Q_{25}	1.1	0.30	5.388	26.84	**48**
Q_{50}	1.2	0.30	5.919	26.84	**57**
Q_{100}	1.25	0.30	6.439	26.84	**65**

OUTFALL 2064+90 LT

This outfall receives runoff from offsite areas, the Exit 102 interchange, and the I-85 mainline from Sta. 2054+00 to Sta. 2066+00. The drainage area is approximately 96 acres and is characterized by an existing 0.4-acre impoundment, roadway pavement, grassed medians, large grassed fields, and dense wooded areas. Roadway runoff is routed to the outfall through multiple existing storm sewer systems; while offsite runoff is routed under I-85 through an existing 4' x 6' R.C. box culvert. Discharge from this outfall flows into an existing offsite pond before reaching an unnamed tributary that feeds into Bee Branch. The I-85 improvements will increase imperviousness due to the proposed median paving. As a result, there will be a negligible increase in discharge of 4 cfs from pre to post development conditions for the 10-year design storm. Additional hydrologic analysis was conducted at the offsite pond to determine total project impacts. The downstream analysis found no change in discharge from pre to post development conditions. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2064+90 LT
2064+90 LT OFFSITE POND
SCALE: 1" = 500'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	4.15	0.90	
Rolling, 2%-10%	Side Slopes, Turf	8.68	0.30	Area Weighted C
Rolling, 2%-10%	Meadows & Pasture Land	7.50	0.30	0.28
Hilly, Over 10%	Meadows & Pasture Land	19.86	0.35	
Hilly, Over 10%	Woodland & Forest	56.00	0.20	
		96.19		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	18.93%	100	0.8				0.235
Shallow Concentrated	Unpaved	18.93%	1485					0.059
Shallow Concentrated								
Channel 1		5.72%	1268	0.04	27	19.078	11.2286	0.031
Channel 2								
Total			2853				2.4382	0.325

Gaffney

Time of Concentration *(minutes)*	20

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.28	4.798	96.19	**128**
Q_{25}	1.1	0.28	5.495	96.19	**162**
Q_{50}	1.2	0.28	6.040	96.19	**194**
Q_{100}	1.25	0.28	6.572	96.19	**220**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	5.31	0.90	
Rolling, 2%-10%	Side Slopes, Turf	8.06	0.30	Area Weighted C
Rolling, 2%-10%	Meadows & Pasture Land	7.50	0.30	0.29
Hilly, Over 10%	Meadows & Pasture Land	19.86	0.35	
Hilly, Over 10%	Woodland & Forest	55.46	0.20	
		96.19		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	18.93%	100	0.8				0.235
Shallow Concentrated	Unpaved	18.93%	1485					0.059
Shallow Concentrated								
Channel 1		5.72%	1268	0.04	27	19.078	11.2286	0.031
Channel 2								
Total			2853				2.4382	0.325

Gaffney

Time of Concentration *(minutes)*	20

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.29	4.798	96.19	**132**
Q_{25}	1.1	0.29	5.495	96.19	**166**
Q_{50}	1.2	0.29	6.040	96.19	**199**
Q_{100}	1.25	0.29	6.572	96.19	**226**

SCS Analysis

HSG	Land Use	Acres	CN
B	Impervious	6.91	98.00
B	Pasture,grassland,or range: Good	35.21	61.00
B	Woods:Good	63.87	55.00
B	Open Space: Fair Condition	3.56	68.00
B	Open Space: Good Condition	10.43	61.00
		119.98	

Area Weighted CN
60

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	18.93%	100	0.8				0.235
Shallow Concentrated	Unpaved	18.93%	1485					0.059
Shallow Concentrated								
Channel 1		5.72%	1268	0.04	27	19.0775	11.22863	0.031
Channel 2		2.80%	286	0.04	9.75	19.6431	3.905576	0.020
Total			3139				2.5246	0.345

Drainage Area *(acres)*	**119.98**

Curve Number	**60**
Time of Concentration *(minutes)*	**21**

WinTR-55 Current Data Description

--- Identification Data ---

User:	DRH	Date:	5/12/2017
Project:	6114	Units:	English
SubTitle:	2064+90 Pond Outfall Pre	Areal Units:	Acres
State:	South Carolina		
County:	Cherokee NOAA-14		

Filename: S:\Proj\2014\6114 I-85 mm 96-106\Design\Project PIN Number\Drainage\Calculations\OUTFALL\2064

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
Outfall		Outlet	119.98	60	0.350

Total area: 119.98 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
3.73	4.68	5.44	6.49	7.35	8.24	3.1

Storm Data Source: Cherokee NOAA-14 County, SC (NRCS)
Rainfall Distribution Type: Type II
Dimensionless Unit Hydrograph: <standard>

2064+90 Pond Outfall Pre
Cherokee NOAA-14 County, South Carolina

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
SUBAREAS				
Outfall	187.60	279.48	361.32	447.86
REACHES				
OUTLET	187.60	279.48	361.32	447.86

SCS Analysis

HSG	Land Use	Acres	CN
B	Impervious	7.89	98.00
B	Pasture,grassland,or range: Good	34.95	61.00
B	Woods:Good	63.33	55.00
B	Open Space: Good Condition	10.25	61.00
B	Open Space: Fair Condition	3.56	68.00
		119.98	

Area Weighted CN
60

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	18.93%	100	0.8				0.235
Shallow Concentrated	Unpaved	18.93%	1485					0.059
Shallow Concentrated								
Channel 1		5.72%	1268	0.04	27	19.0775	11.22863	0.031
Channel 2		2.80%	286	0.04	9.75	19.6431	3.905576	0.020
Total			3139				2.5246	0.345

Drainage Area *(acres)*	**119.98**

Curve Number	**60**
Time of Concentration *(minutes)*	**21**

Civil Engineering Consulting Services, Inc.

WinTR-55 Current Data Description

--- Identification Data ---

User: DRH
Project: 6114
SubTitle: 2064+90 Pond Outfall Post
State: South Carolina
County: Cherokee NOAA-14
Filename: S:\Proj\2014\6114 I-85 mm 96-106\Design\Project PIN Number\Drainage\Calculations\OUTFALL\206

Date: 5/12/2017
Units: English
Areal Units: Acres

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
Outfall		Outlet	119.98	60	0.350

Total area: 119.98 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
3.73	4.68	5.44	6.49	7.35	8.24	3.1

Storm Data Source: Cherokee NOAA-14 County, SC (NRCS)
Rainfall Distribution Type: Type II
Dimensionless Unit Hydrograph: <standard>

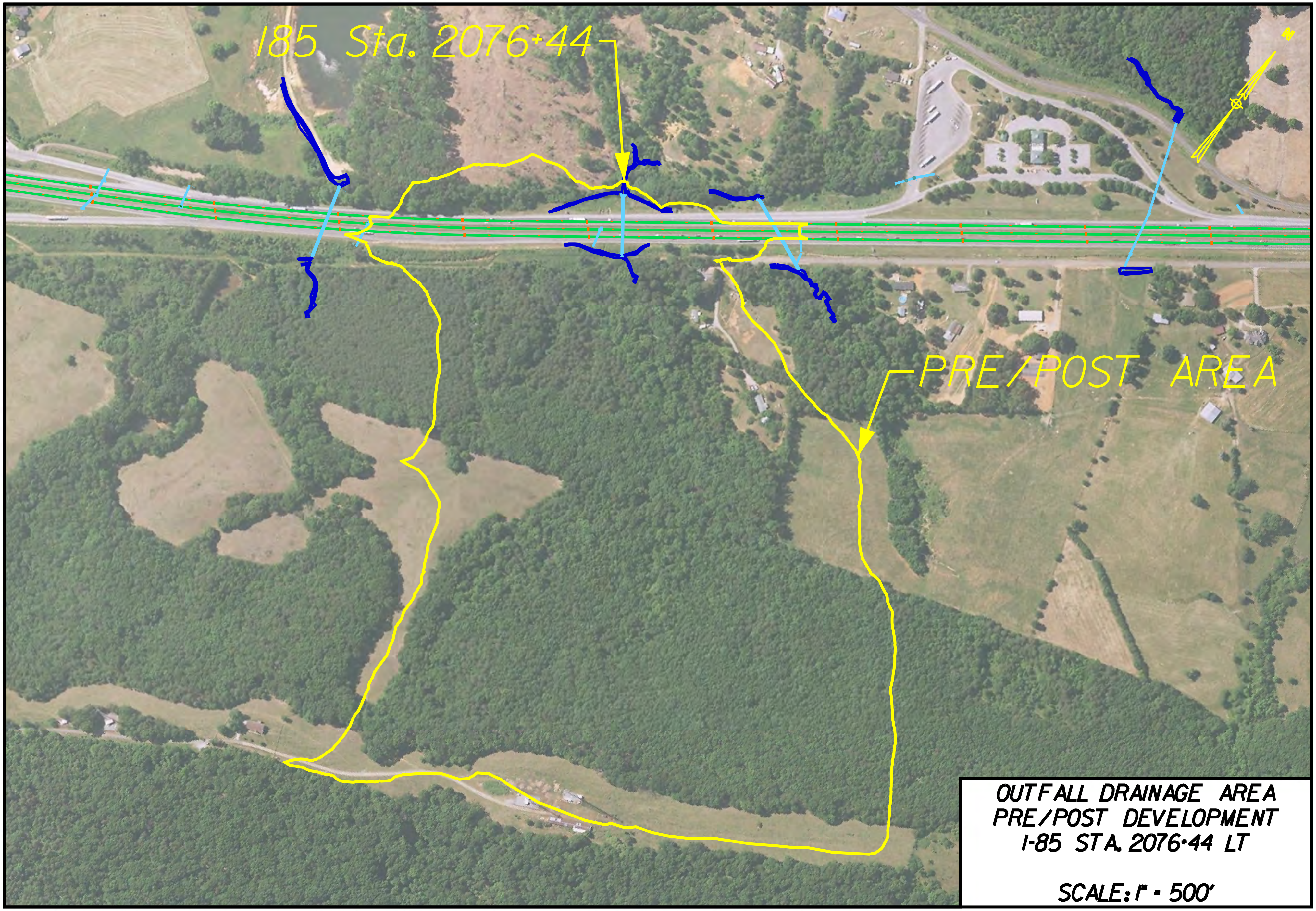
2064+90 Pond Outfall Post
Cherokee NOAA-14 County, South Carolina

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
SUBAREAS				
Outfall	187.60	279.48	361.32	447.86
REACHES				
OUTLET	187.60	279.48	361.32	447.86

OUTFALL 2076+44 LT

This outfall receives runoff from offsite areas as well as roadway discharge from Sta. 2066+00 to Sta. 2083+50. The drainage area is approximately 102 acres and is comprised of roadway pavement, grassed medians and fields, sparse residential tracts, and dense wooded areas. Offsite runoff is routed under I-85 to the outfall via an existing 4' x 6' R.C. box culvert; while roadway runoff is collected by an existing storm sewer system and routed to the entrance of the box culvert via roadside ditches. Discharge from this outfall is conveyed by an unnamed tributary into Bee Branch. The I-85 improvements will increase imperviousness due to the proposed median paving. As a result, there will be a negligible increase in discharge of 7 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.


I85 Sta. 2076+44
PRE/POST AREA
OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2076+44 LT
SCALE: 1" = 500'

SCS Analysis

HSG	Land Use	Acres	CN
B	Impervious	3.08	98.00
B	Pasture,grassland,or range: Good	24.65	61.00
B	Woods:Good	74.41	55.00
		102.14	

Area Weighted CN
58

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	17.41%	100	0.8				0.243
Shallow Concentrated	Unpaved	17.41%	1451					0.060
Shallow Concentrated								
Channel 1		3.97%	1724	0.04	2.8	4.98249	5.054951	0.095
Channel 2								
Total			3275				2.2889	0.397

Drainage Area *(acres)*	**102.14**

Curve Number	**58**
Time of Concentration *(minutes)*	**24**

WinTR-55 Current Data Description

--- Identification Data ---

User:	CECS	Date:	12/13/2016
Project:	I-85 Improvement Proj DB Prep	Units:	English
SubTitle:	OUTFALL 2076+44 LT (PRE)	Areal Units:	Acres
State:	South Carolina		
County:	Cherokee_NOAA_B		
Filename:	S:\Proj\2014\6114 I-85 mm 96-106\Design\Project PIN Number\Drainage\Calculations\OUTFALL\Q50 AN		

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
2076+44 LT		Outlet	102.14	58	0.400

Total area: 102.14 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
3.73	4.68	5.44	6.49	7.35	8.24	3.1

Storm Data Source: Cherokee_NOAA_B County, SC (NRCS)
Rainfall Distribution Type: Type NO_B
Dimensionless Unit Hydrograph: <standard>

OUTFALL 2076+44 LT (PRE)
Cherokee_NOAA_B County, South Carolina

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
SUBAREAS				
2076+44 LT	116.62	178.38	233.18	293.01
REACHES				
OUTLET	116.62	178.38	233.18	293.01

SCS Analysis

HSG	Land Use	Acres	CN	
B	Impervious	4.15	98.00	
B	Pasture,grassland,or range: Good	23.58	61.00	Area Weighted CN
B	Woods:Good	74.41	55.00	59
		102.14		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	17.41%	100	0.8				0.243
Shallow Concentrated	Unpaved	17.41%	1451					0.060
Shallow Concentrated								
Channel 1		3.97%	1724	0.04	2.8	4.98249	5.054951	0.095
Channel 2								
Total			3275				2.2889	0.397

Drainage Area *(acres)*	**102.14**

Curve Number	**59**
Time of Concentration *(minutes)*	**24**

Civil Engineering Consulting Services, Inc.

WinTR-55 Current Data Description

--- Identification Data ---

User: CECS   Date: 12/13/2016
Project: I-85 Improvement Proj DB Prep   Units: English
SubTitle: OUTFALL 2076+44 LT (POST)   Areal Units: Acres
State: South Carolina
County: Cherokee_NOAA_B
Filename: S:\Proj\2014\6114 I-85 mm 96-106\Design\Project PIN Number\Drainage\Calculations\OUTFALL\Q50 AN

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
2076+44 LT		Outlet	102.14	59	0.400

Total area: 102.14 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
3.73	4.68	5.44	6.49	7.35	8.24	3.1

Storm Data Source: Cherokee_NOAA_B County, SC (NRCS)
Rainfall Distribution Type: Type NO_B
Dimensionless Unit Hydrograph: <standard>

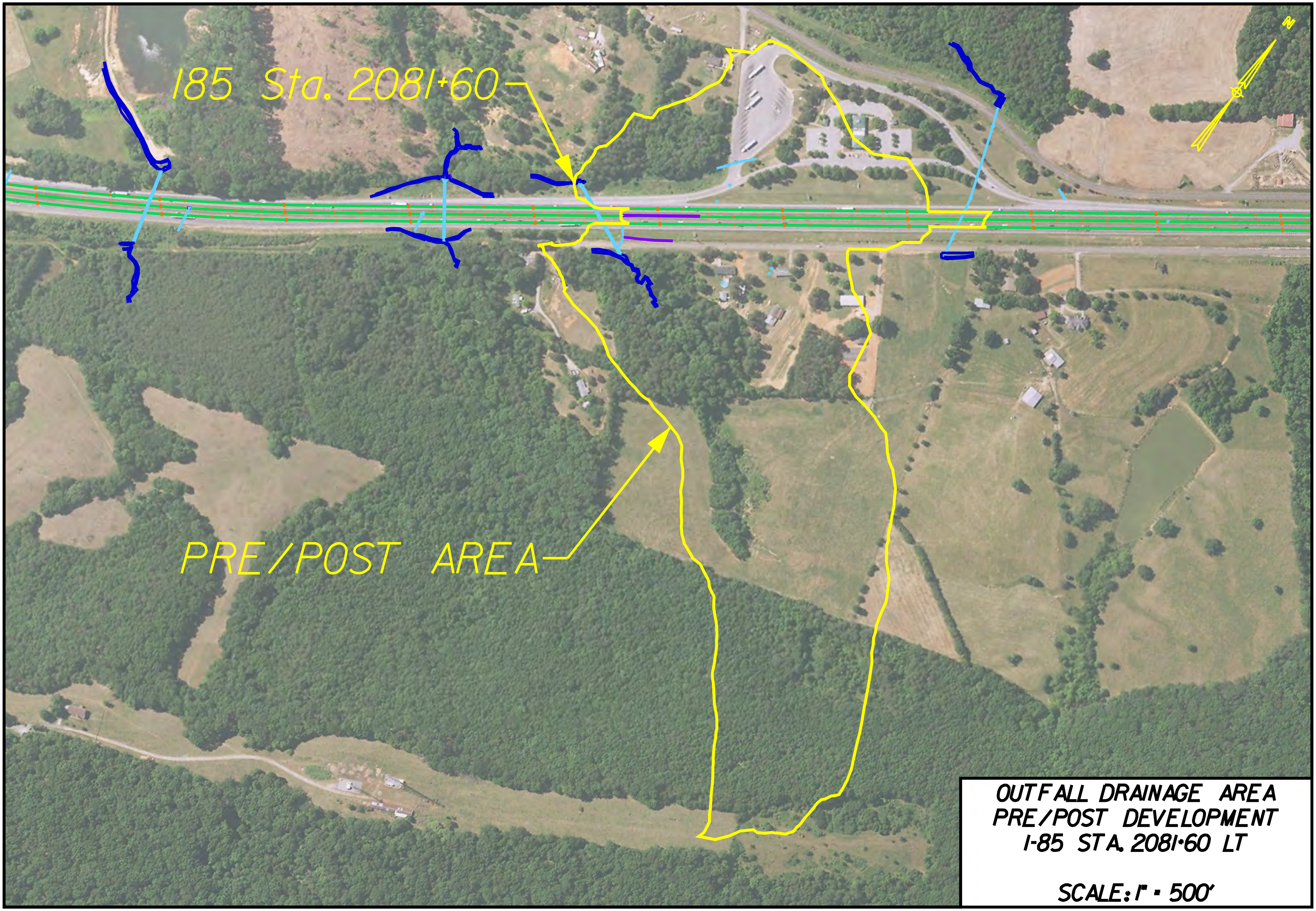
OUTFALL 2076+44 LT (POST)
Cherokee_NOAA_B County, South Carolina

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
SUBAREAS				
2076+44 LT	124.36	187.49	243.29	304.32
REACHES				
OUTLET	124.36	187.49	243.29	304.32

OUTFALL 2081+60 LT

This outfall receives runoff from offsite areas as well as roadway discharge from Sta. 2083+50 to Sta. 2098+00. The drainage area is approximately 60 acres and includes roadway pavement, grassed medians and fields, sparse residential tracts, a rest stop area, and dense wooded areas. Offsite runoff is routed under I-85 to the outfall via an existing 4’ x 4’ R.C. box culvert; while roadway runoff is routed to the head of the box culvert via an existing storm sewer system. Discharge from this outfall is conveyed by an unnamed tributary into Bee Branch. The I-85 improvements will increase imperviousness due to the proposed median paving. As a result, there will be a negligible increase in discharge of 3 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2081+60 LT

SCALE: 1" = 500'

Rational Analysis

Land Slope	Land Use	Acres	C
Rolling, 2%-10%	Pavements & Roofs	7.04	0.90
Rolling, 2%-10%	Side Slopes, Turf	27.44	0.30
Hilly, Over 10%	Woodland & Forest	21.16	0.20
Rolling, 2%-10%	Woodland & Forest	4.78	0.15
		60.42	

Area Weighted C
0.32

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	18.77%	100	0.8				0.236
Shallow Concentrated	Unpaved	18.77%	1145					0.046
Shallow Concentrated								
Channel 1		4.85%	1536	0.04	132.5	45.427	16.7428	0.025
Channel 2								
Total			2781				2.5190	0.307

Gaffney

Time of Concentration *(minutes)*	19

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
$\mathbf{Q_{10}}$	1	0.32	4.893	60.42	**95**
$\mathbf{Q_{25}}$	1.1	0.32	5.607	60.42	**120**
$\mathbf{Q_{50}}$	1.2	0.32	6.165	60.42	**144**
$\mathbf{Q_{100}}$	1.25	0.32	6.711	60.42	**164**

Rational Analysis

Land Slope	Land Use	Acres	C
Rolling, 2%-10%	Pavements & Roofs	8.05	0.90
Rolling, 2%-10%	Side Slopes, Turf	26.43	0.30
Hilly, Over 10%	Woodland & Forest	21.16	0.20
Rolling, 2%-10%	Woodland & Forest	4.78	0.15
		60.42	

Area Weighted C
0.33

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusl	18.77%	100	0.8				0.236
Shallow Concentrated	Unpaved	18.77%	1145					0.046
Shallow Concentrated								
Channel 1		4.85%	1536	0.04	132.5	45.427	16.7428	0.025
Channel 2								
Total			2781				2.5190	0.307

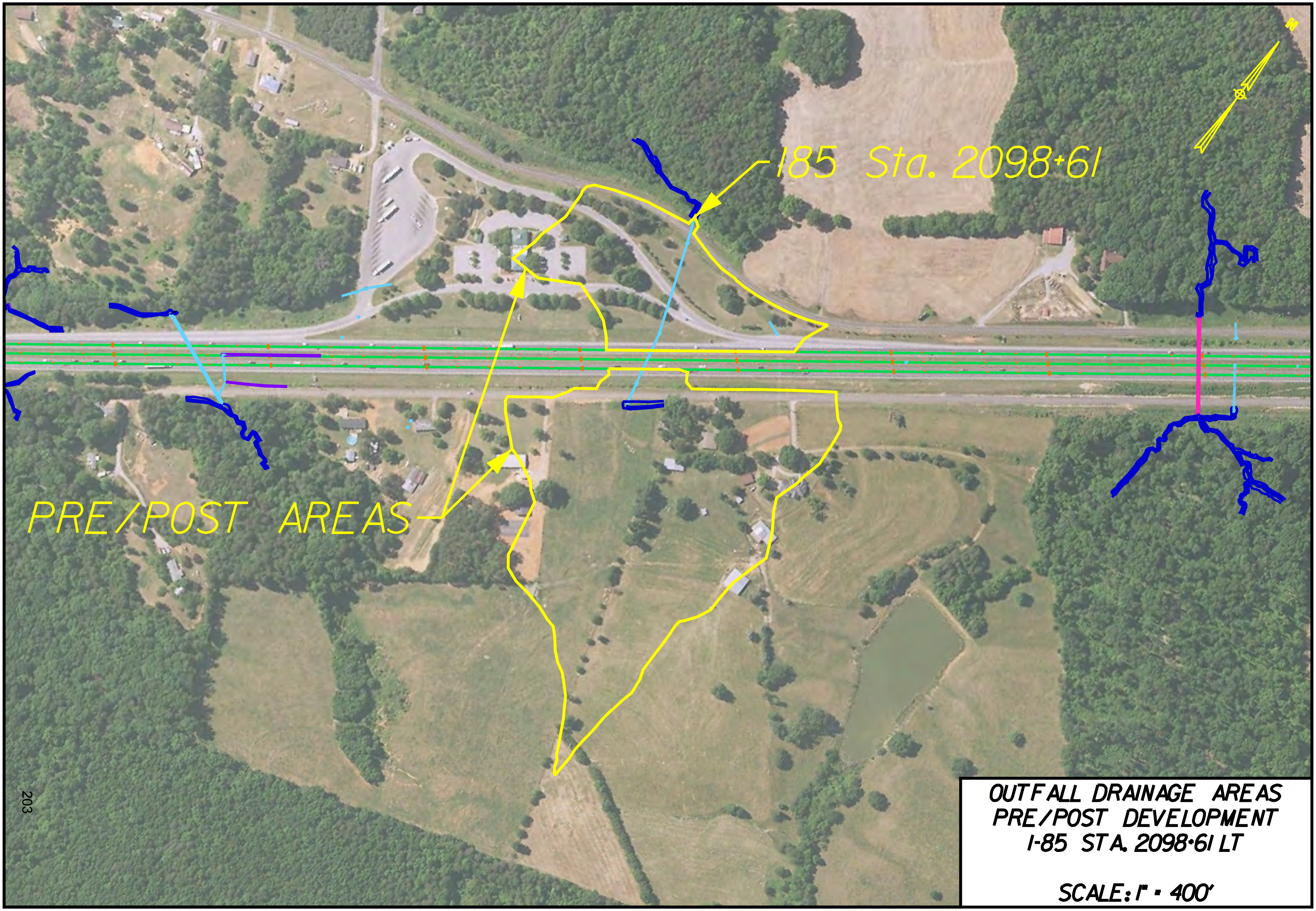
Gaffney

Time of Concentration *(minutes)*	19

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.33	4.893	60.42	**98**
Q_{25}	1.1	0.33	5.607	60.42	**124**
Q_{50}	1.2	0.33	6.165	60.42	**149**
Q_{100}	1.25	0.33	6.711	60.42	**169**

OUTFALL 2098+61 LT

This outfall receives runoff from offsite areas as well as roadway discharge from Sta. 2095+50 to Sta. 2098+00. The drainage area is approximately 23 acres and is comprised of roadway pavement, grassed medians and fields, sparse residential tracts, and a rest stop area. Discharge from this outfall is released into a heavily wooded area and is then conveyed to an unnamed tributary that feeds into Bee Branch. There will be no change in discharge from pre to post development conditions for the 10-year design storm. Therefore, the proposed I-85 improvements will have no adverse downstream impact.



OUTFALL DRAINAGE AREAS
PRE/POST DEVELOPMENT
I-85 STA. 2098+61 LT

SCALE: 1" = 400'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	2.91	0.90	
Rolling, 2%-10%	Side Slopes, Turf	20.32	0.30	Area Weighted C
				0.38
		23.23		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	5.27%	100	0.41				0.229
Shallow Concentrated	Unpaved	5.27%	1212					0.091
Shallow Concentrated								
Channel 1								
Channel 2								
Total			1312				1.1377	0.320

Gaffney

Time of Concentration *(minutes)*	20

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.38	4.798	23.23	**42**
Q_{25}	1.1	0.38	5.495	23.23	**53**
Q_{50}	1.2	0.38	6.040	23.23	**63**
Q_{100}	1.25	0.38	6.572	23.23	**72**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	2.91	0.90	
Rolling, 2%-10%	Side Slopes, Turf	20.32	0.30	Area Weighted C
				0.38
		23.23		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	5.27%	100	0.41				0.229
Shallow Concentrated	Unpaved	5.27%	1212					0.091
Shallow Concentrated								
Channel 1								
Channel 2								
Total			1312				1.1377	0.320

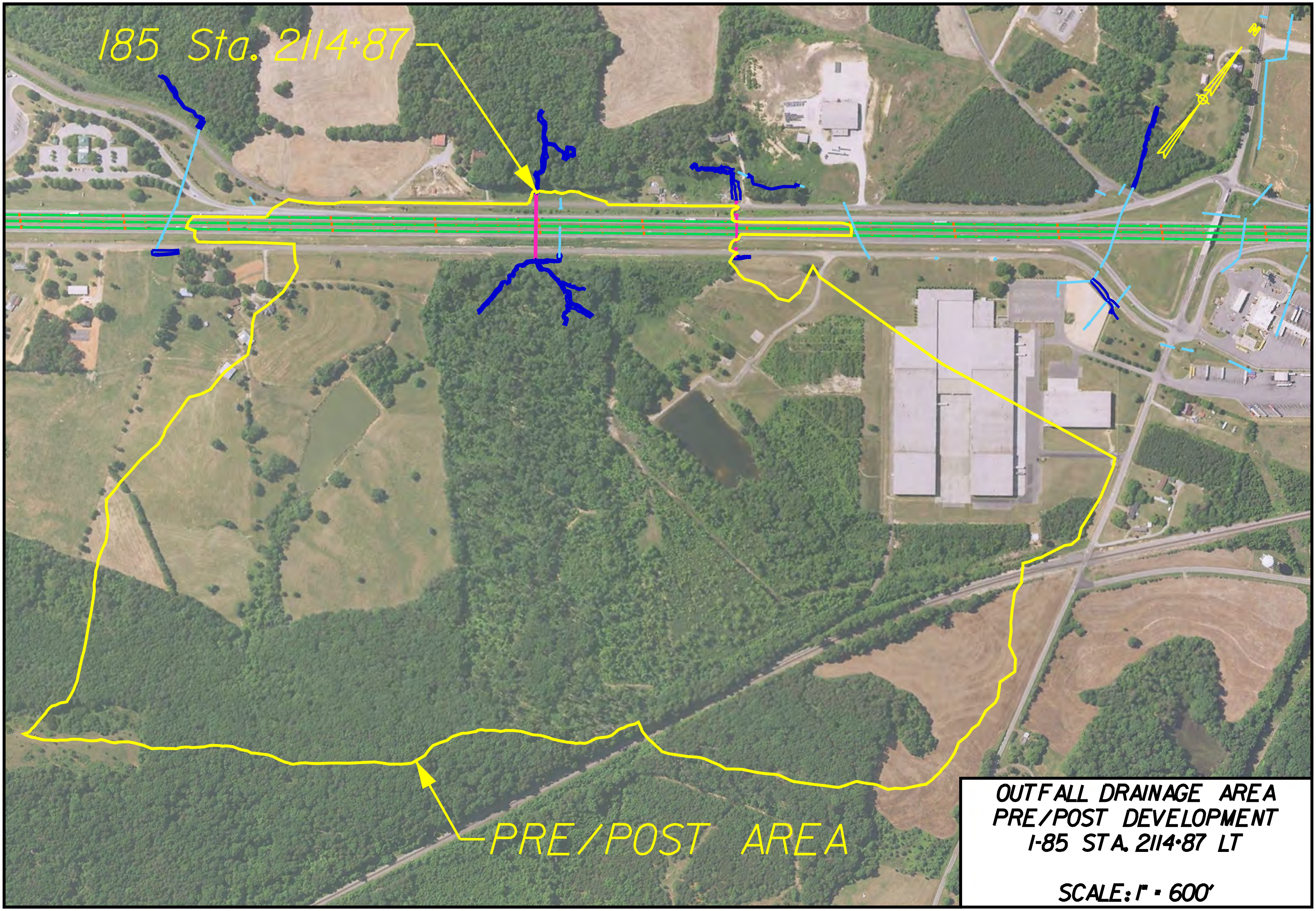
Gaffney

Time of Concentration *(minutes)*	20

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.38	4.798	23.23	**42**
Q_{25}	1.1	0.38	5.495	23.23	**53**
Q_{50}	1.2	0.38	6.040	23.23	**63**
Q_{100}	1.25	0.38	6.572	23.23	**72**

OUTFALL 2114+87 LT

This outfall receives runoff from offsite areas as well as roadway discharge from Sta. 2098+00 to Sta. 2130+00. The drainage area is approximately 240 acres and is characterized by roadway pavement, grassed medians and fields, commercial development, and dense wooded areas. Additionally, the area includes two 3-acre impoundments, which outfall into two separate, unnamed tributaries that merge together before crossing under I-85. Offsite runoff is routed under I-85 to the outfall via an existing 6' x 6' R.C. box culvert; while roadway runoff is collected by an existing storm sewer system and routed to the entrance of the box culvert via roadside ditches. Discharge from this outfall ultimately feeds into Bee Branch. The I-85 improvements will increase imperviousness due to the proposed median paving. As a result, there will be a negligible 14 cfs increase in discharge from pre to post development conditions for the 10-year design storm. The receiving channel was analyzed to determine what impact the increase in discharge would have on the channel; the increase in discharge will cause less than 0.1 foot change in water surface elevation from pre to post development for the 10-year design storm. There will be no adverse downstream impact and detention is not recommended.


185 Sta. 2114+87
PRE/POST AREA
OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2114+87 LT
SCALE: 1" = 600'

SCS Analysis

HSG	Land Use	Acres	CN
B	Impervious	23.17	98.00
B	Streets and roads: Gravel	2.04	85.00
B	Pasture,grassland,or range: Good	76.62	61.00
B	Woods:Good	133.07	55.00
A	Pasture,grassland,or range: Good	1.64	39.00
A	Woods:Good	3.42	30.00
		239.96	

Area Weighted CN
61

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	4.76%	100	0.8				0.408
Shallow Concentrated	Unpaved	4.76%	2177					0.172
Shallow Concentrated	Paved	4.76%	545					0.034
Channel 1		4.00%	1025	0.04	1.5	3.65028	4.117809	0.069
Channel 2								
Total			3847				1.5649	0.683

Drainage Area (*acres*)	**239.96**

Curve Number	**61**
Time of Concentration (*minutes*)	**41**

WinTR-55 Current Data Description

--- Identification Data ---

User: CECS Date: 12/13/2016
Project: I-85 Improvement Proj DB Prep Units: English
SubTitle: OUTFALL 2114+87 LT (PRE) Areal Units: Acres
State: South Carolina
County: Cherokee_NOAA_B
Filename: S:\Proj\2014\6114 I-85 mm 96-106\Design\Project PIN Number\Drainage\Calculations\OUTFALL\Q50 AN

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
2114+87 LT		Outlet	239.96	61	0.683

Total area: 239.96 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
3.73	4.68	5.44	6.49	7.35	8.24	3.1

Storm Data Source: Cherokee_NOAA_B County, SC (NRCS)
Rainfall Distribution Type: Type NO_B
Dimensionless Unit Hydrograph: <standard>

I-85 Improvement Proj DB Prep
OUTFALL 2114+87 LT (PRE)
Cherokee_NOAA_B County, South Carolina

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
SUBAREAS				
2114+87 LT	245.68	362.85	465.37	577.09
REACHES				
OUTLET	245.68	362.85	465.37	577.09

SCS Analysis

HSG	Land Use	Acres	CN
B	Impervious	25.50	98.00
B	Streets and roads: Gravel	2.04	85.00
B	Pasture,grassland,or range: Good	74.41	61.00
B	Woods:Good	133.07	55.00
A	Pasture,grassland,or range: Good	1.52	39.00
A	Woods:Good	3.42	30.00
		239.96	

Area Weighted CN
62

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	4.76%	100	0.8				0.408
Shallow Concentrated	Unpaved	4.76%	2177					0.172
Shallow Concentrated	Paved	4.76%	545					0.034
Channel 1		4.00%	1025	0.04	1.5	3.65028	4.117809	0.069
Channel 2								
Total			3847				1.5649	0.683

Drainage Area *(acres)*	**239.96**

Curve Number	**62**
Time of Concentration *(minutes)*	**41**

WinTR-55 Current Data Description

--- Identification Data ---

User: CECS
Date: 12/13/2016
Project: I-85 Improvement Proj DB Prep
Units: English
SubTitle: OUTFALL 2114+87 LT (POST)
Areal Units: Acres
State: South Carolina
County: Cherokee_NOAA_B
Filename: S:\Proj\2014\6114 I-85 mm 96-106\Design\Project PIN Number\Drainage\Calculations\OUTFALL\Q50 AN

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
2114+87 LT		Outlet	239.96	62	0.683

Total area: 239.96 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
3.73	4.68	5.44	6.49	7.35	8.24	3.1

Storm Data Source: Cherokee_NOAA_B County, SC (NRCS)
Rainfall Distribution Type: Type NO_B
Dimensionless Unit Hydrograph: <standard>

OUTFALL 2114+87 LT (POST)
Cherokee_NOAA_B County, South Carolina

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
SUBAREAS				
2114+87 LT	259.71	379.14	484.20	597.12
REACHES				
OUTLET	259.71	379.14	484.20	597.12

Hydraulic Analysis Report

Project Data

Project Title: 6114 - 2114+87 Outfall Channel Analysis

Designer: DRH

Project Date: Friday, February 03, 2017

Project Units: U.S. Customary Units

Notes:

Channel Analysis: Channel Analysis-Pre

Notes:

Input Parameters

Channel Type: Custom Cross Section

Cross Section Data

Elevation (ft)	Elevation (ft)	Manning's n
0.00	766.00	0.0750
17.99	765.00	0.0750
38.92	764.00	0.0750
40.03	763.00	0.0750
40.88	762.00	0.0750
45.02	761.00	0.0750
48.98	760.00	0.0750
53.19	759.00	0.0400
54.00	758.00	0.0400
56.51	758.00	0.0400
59.09	759.00	0.0750
60.82	760.00	0.0750
62.62	761.00	0.0750
67.00	762.00	0.0750
76.34	763.00	0.0750
84.96	764.00	0.0750
93.45	765.00	0.0750
117.15	766.00	0.0750
135.50	767.00	-----

Longitudinal Slope: 0.0078 ft/ft

Flow: 465.3700 cfs

Result Parameters

Depth: 5.4465 ft

Area of Flow: 98.0565 ft^2

Wetted Perimeter: 43.0304 ft

Hydraulic Radius: 2.2788 ft

Average Velocity: 4.7459 ft/s

Top Width: 40.6565 ft

Froude Number: 0.5385

Critical Depth: 4.3072 ft

Critical Velocity: 8.0016 ft/s

Critical Slope: 0.0248 ft/ft

Critical Top Width: 29.25 ft

Calculated Max Shear Stress: 2.6509 lb/ft^2

Calculated Avg Shear Stress: 1.1091 lb/ft^2

Composite Manning's n Equation: Lotter method

Manning's n: 0.0479

Channel Analysis: Channel Analysis-Post

Notes:

Input Parameters

Channel Type: Custom Cross Section

Cross Section Data

Elevation (ft)	Elevation (ft)	Manning's n
0.00	766.00	0.0750
17.99	765.00	0.0750
38.92	764.00	0.0750
40.03	763.00	0.0750
40.88	762.00	0.0750
45.02	761.00	0.0750
48.98	760.00	0.0750
53.19	759.00	0.0400
54.00	758.00	0.0400
56.51	758.00	0.0400
59.09	759.00	0.0750
60.82	760.00	0.0750
62.62	761.00	0.0750
67.00	762.00	0.0750
76.34	763.00	0.0750
84.96	764.00	0.0750
93.45	765.00	0.0750
117.15	766.00	0.0750
135.50	767.00	-----

Longitudinal Slope: 0.0078 ft/ft

Flow: 484.2000 cfs

Result Parameters

Depth: 5.5330 ft

Area of Flow: 101.6105 ft^2

Wetted Perimeter: 43.9100 ft

Hydraulic Radius: 2.3141 ft

Average Velocity: 4.7653 ft/s

Top Width: 41.4977 ft

Froude Number: 0.5367

Critical Depth: 4.3758 ft

Critical Velocity: 8.0444 ft/s

Critical Slope: 0.0249 ft/ft

Critical Top Width: 29.95 ft

Calculated Max Shear Stress: 2.6930 lb/ft^2

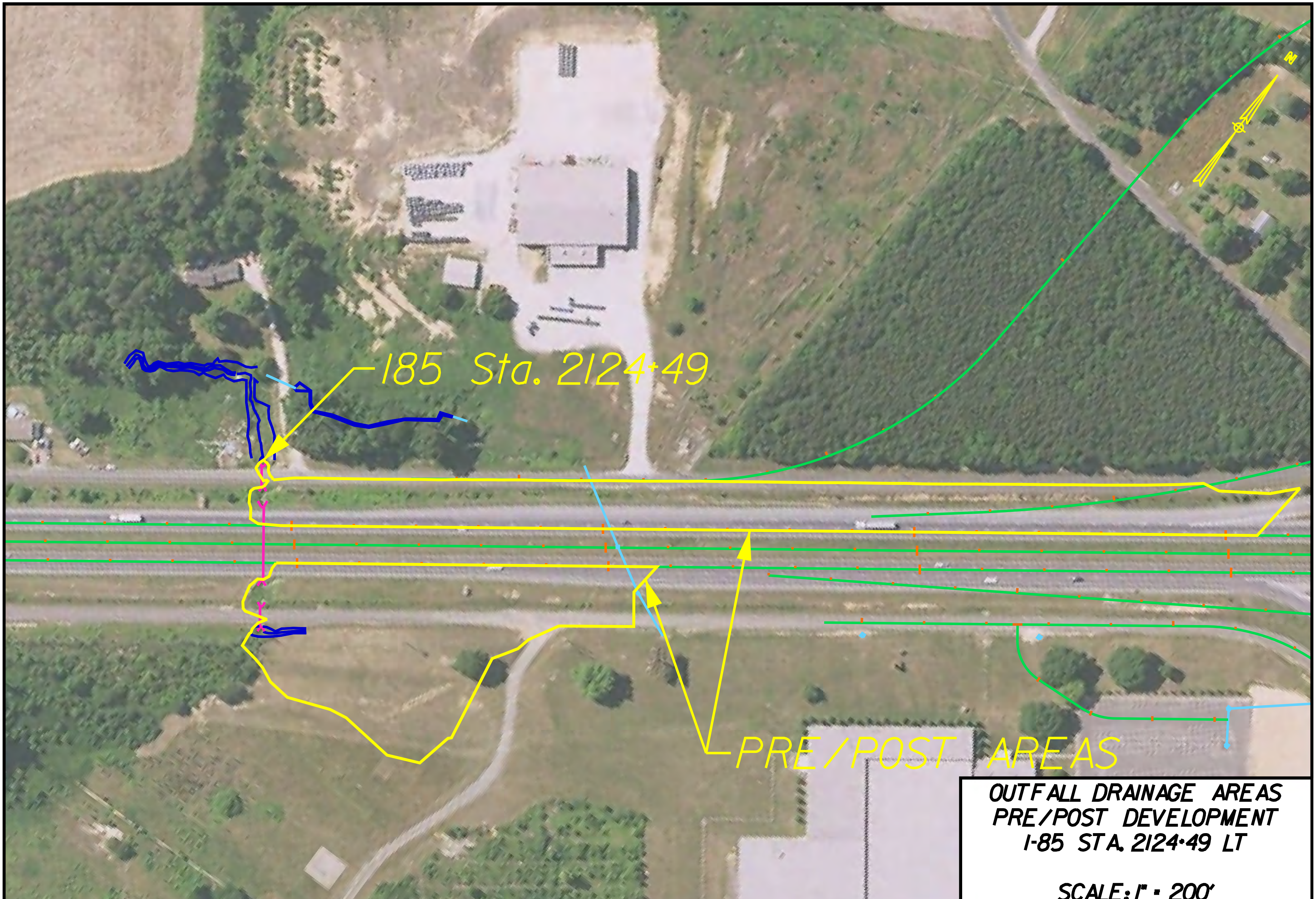
Calculated Avg Shear Stress: 1.1263 lb/ft^2

Composite Manning's n Equation: Lotter method

Manning's n: 0.0482

OUTFALL 2124+49 LT

This outfall primarily receives runoff from the Exit 104 interchange and the I-85 mainline from Sta. 2124+00 to Sta. 2140+00. The drainage area is approximately 6 acres and consists of paved and grassed areas only. Roadway discharge is routed under I-85 to the outfall through a series of 4’ x 6’ R.C. box culverts. Discharge from this outfall is released into a heavily wooded area and is then conveyed to an unnamed tributary that feeds into Bee Branch. There will be a decrease in discharge of 1 cfs from pre to post development conditions for the 10-year design storm. Therefore, the proposed I-85 improvements and reconfiguration of the Exit 104 Interchange will have no adverse downstream impact.



OUTFALL DRAINAGE AREAS
PRE/POST DEVELOPMENT
I-85 STA. 2124+49 LT

SCALE: 1" = 200'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	2.22	0.90	
Rolling, 2%-10%	Side Slopes, Turf	2.06	0.30	Area Weighted C
Rolling, 2%-10%	Grass Shoulders	1.42	0.25	0.52
		5.70		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	2.27%	100	0.41				0.322
Shallow Concentrated	Unpaved	2.27%	239					0.027
Shallow Concentrated								
Channel 1		12.85%	65	0.045	3.5	7.2854	7.27954	0.002
Channel 2								
Total			404				0.3193	0.351

Gaffney

Time of Concentration *(minutes)*	22

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.52	4.618	5.70	**14**
Q_{25}	1.1	0.52	5.284	5.70	**17**
Q_{50}	1.2	0.52	5.804	5.70	**21**
Q_{100}	1.25	0.52	6.311	5.70	**23**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	2.06	0.90	
Rolling, 2%-10%	Side Slopes, Turf	2.22	0.30	Area Weighted C
Rolling, 2%-10%	Grass Shoulders	1.42	0.25	0.50
		5.70		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	2.27%	100	0.41				0.322
Shallow Concentrated	Unpaved	2.27%	239					0.027
Shallow Concentrated								
Channel 1		12.85%	65	0.045	3.5	7.2854	7.27954	0.002
Channel 2								
Total			404				0.3193	0.351

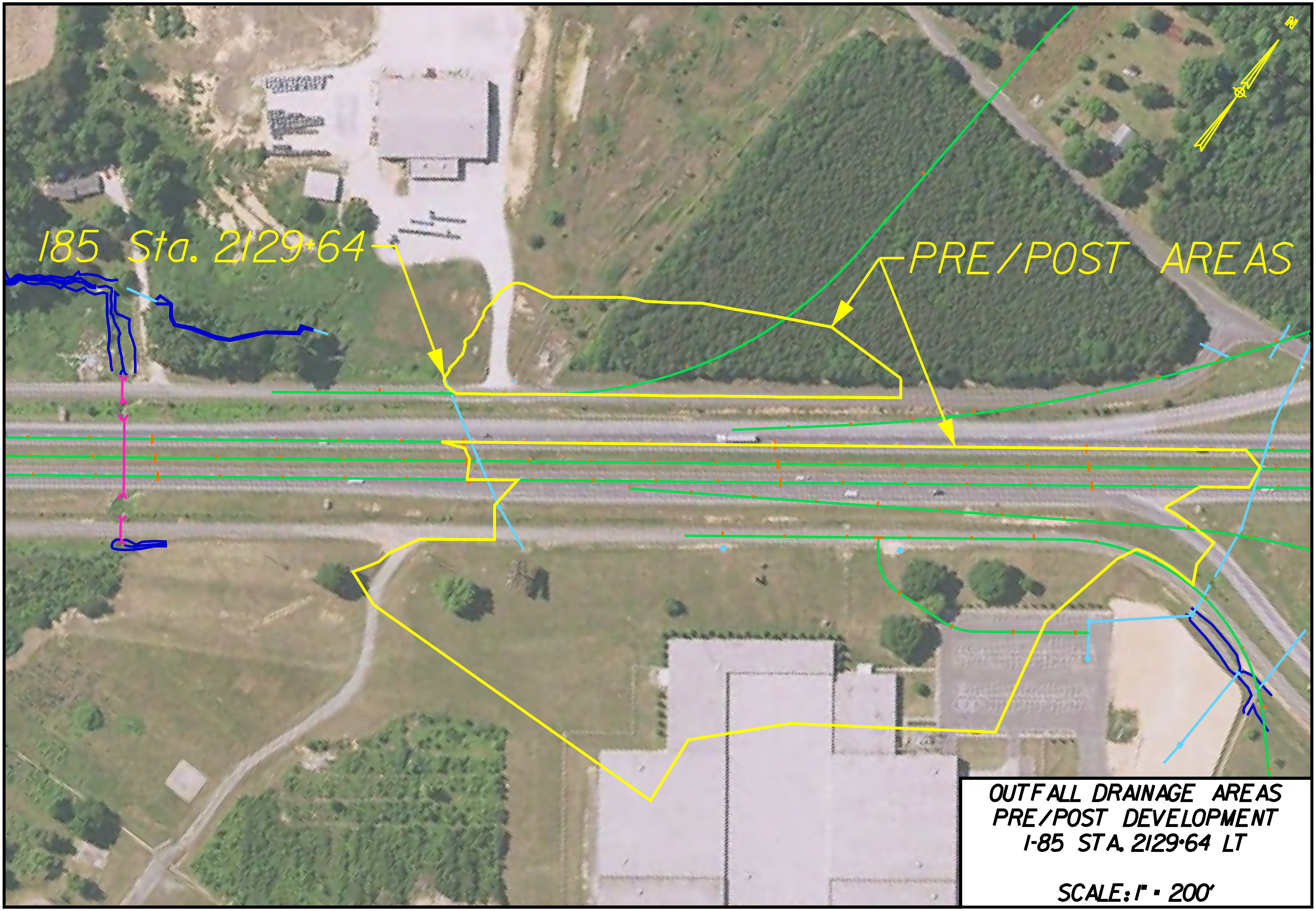
Gaffney

Time of Concentration *(minutes)*	22

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.50	4.618	5.70	**13**
Q_{25}	1.1	0.50	5.284	5.70	**17**
Q_{50}	1.2	0.50	5.804	5.70	**20**
Q_{100}	1.25	0.50	6.311	5.70	**23**

OUTFALL 2129+64 LT

This outfall receives runoff from offsite areas, the Exit 104 interchange, and the I-85 mainline from Sta. 2130+00 to Sta. 2143+00. The drainage area is approximately 14 acres and includes roadway pavement, grassed medians, commercial development, and wooded areas. Offsite and roadway runoff is routed under I-85 to the outfall via an existing storm sewer system. Discharge from this outfall is released into a heavily wooded area and is then conveyed to an unnamed tributary that feeds into Bee Branch. The I-85 improvements will increase imperviousness due to the proposed median paving along the mainline and the reconfiguration of the Exit 104 Interchange. As a result, there will be a negligible increase in discharge of 4 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.


I85 Sta. 2129+64
PRE/POST AREAS
OUTFALL DRAINAGE AREAS
PRE/POST DEVELOPMENT
I-85 STA. 2129+64 LT
SCALE: 1" = 200'
N

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	4.47	0.90	
Rolling, 2%-10%	Side Slopes, Turf	7.85	0.30	Area Weighted C
Rolling, 2%-10%	Woodland & Forest	1.26	0.15	0.48
		13.58		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	4.54%	100	0.8				0.416
Shallow Concentrated	Unpaved	4.54%	130					0.011
Shallow Concentrated								
Channel 1								
Channel 2								
Total			230				0.1499	0.426

Gaffney

Time of Concentration *(minutes)*	26

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.48	4.296	13.58	**28**
Q_{25}	1.1	0.48	4.907	13.58	**35**
Q_{50}	1.2	0.48	5.383	13.58	**42**
Q_{100}	1.25	0.48	5.846	13.58	**48**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	5.83	0.90	
Rolling, 2%-10%	Side Slopes, Turf	7.14	0.30	Area Weighted C
Rolling, 2%-10%	Woodland & Forest	0.61	0.15	0.55
		13.58		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusł	4.54%	100	0.8				0.416
Shallow Concentrated	Unpaved	4.54%	130					0.011
Shallow Concentrated								
Channel 1								
Channel 2								
Total			230				0.1499	0.426

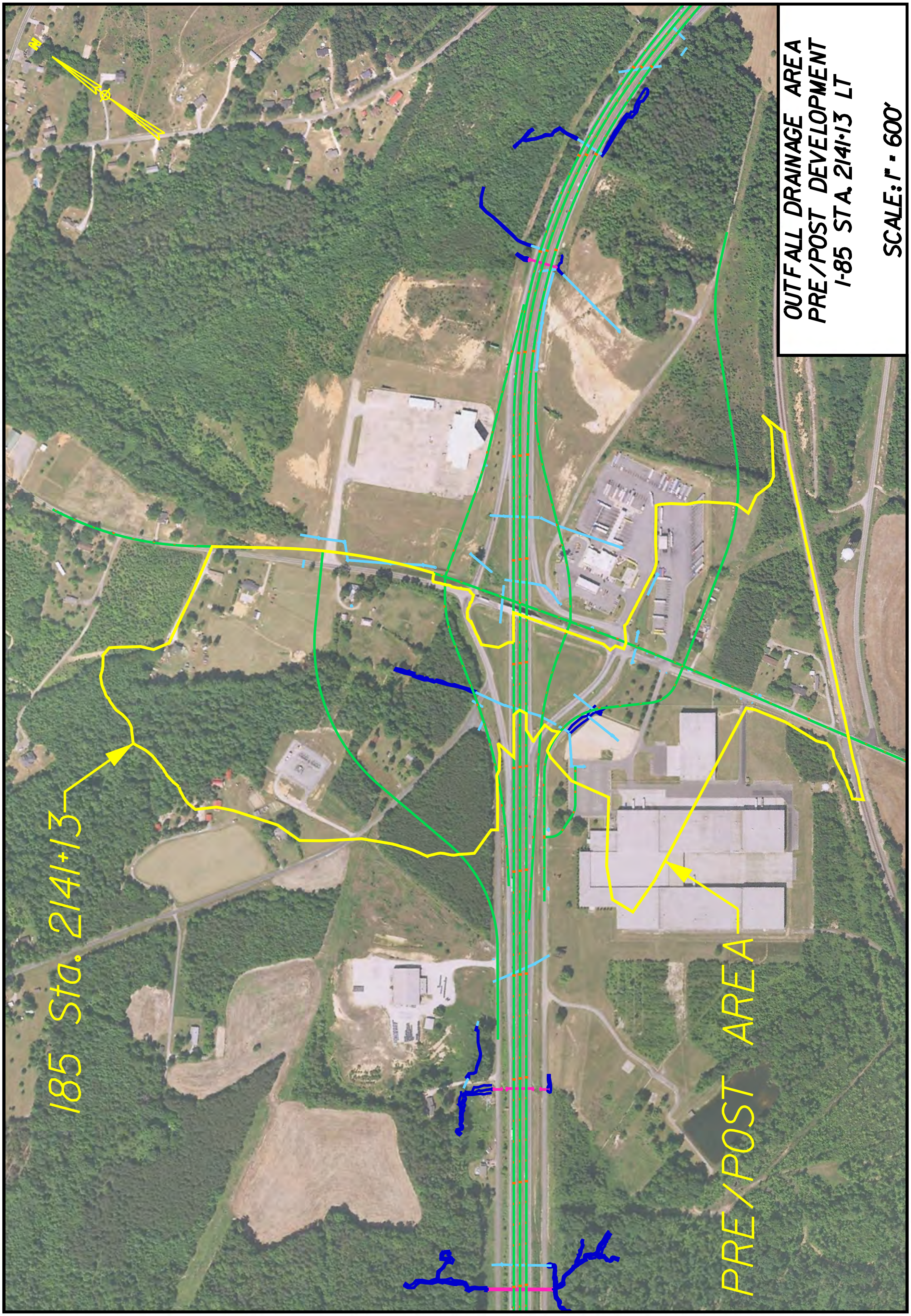
Gaffney

Time of Concentration *(minutes)*	26

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.55	4.296	13.58	**32**
Q_{25}	1.1	0.55	4.907	13.58	**40**
Q_{50}	1.2	0.55	5.383	13.58	**48**
Q_{100}	1.25	0.55	5.846	13.58	**55**

OUTFALL 2141+13 LT

This outfall receives cumulative discharge from Outfall 2143+72 LT, the Exit 104 Interchange, and limited offsite areas. The analysis point is offsite in order to capture the sheet flow impacts to the approximately 88-acre drainage area which encompasses roadway pavement, grassed medians, commercial development, sparse residential areas, wooded areas, and a portion of the Southern Railway. Offsite and roadway runoff is routed under I-85 to the outfall via an existing storm sewer system. Additionally, other storm sewers systems under the interchange access ramps, route runoff to the same outfall point. Discharge from this outfall is released into a heavily wooded area and is then conveyed to Bee Branch. The I-85 improvements will increase imperviousness due to the proposed median paving along the mainline and the reconfiguration of the Exit 104 Interchange. As a result, there will be a negligible increase in discharge of 8 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.


OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2141+13 LT
SCALE: 1" = 600'
I85 Sta. 2141+13
PRE/POST AREA

Rational Analysis

Land Slope	Land Use	Acres	C
Rolling, 2%-10%	Pavements & Roofs	19.02	0.90
Rolling, 2%-10%	Gravel Pavements	1.36	0.55
Rolling, 2%-10%	Side Slopes, Turf	13.63	0.30
Rolling, 2%-10%	Grass Shoulders	25.17	0.25
Hilly, Over 10%	Woodland & Forest	17.97	0.20
Rolling, 2%-10%	Woodland & Forest	10.83	0.15
		87.98	

Area Weighted C
0.38

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusl	2.68%	100	0.8				0.513
Shallow Concentrated	Unpaved	2.68%	292					0.031
Shallow Concentrated								
Channel 1								
Channel 2								
Total			392				0.2002	0.544

Gaffney

Time of Concentration *(minutes)*	33

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
$\mathbf{Q_{10}}$	1	0.38	3.828	87.98	**128**
$\mathbf{Q_{25}}$	1.1	0.38	4.363	87.98	**161**
$\mathbf{Q_{50}}$	1.2	0.38	4.777	87.98	**192**
$\mathbf{Q_{100}}$	1.25	0.38	5.180	87.98	**217**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	21.36	0.90	
Rolling, 2%-10%	Gravel Pavements	1.36	0.55	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	18.84	0.30	0.40
Rolling, 2%-10%	Grass Shoulders	22.23	0.25	
Hilly, Over 10%	Woodland & Forest	14.22	0.20	
Rolling, 2%-10%	Woodland & Forest	9.97	0.15	
		87.98		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	2.68%	100	0.8				0.513
Shallow Concentrated	Unpaved	2.68%	292					0.031
Shallow Concentrated								
Channel 1								
Channel 2								
Total			392				0.2002	0.544

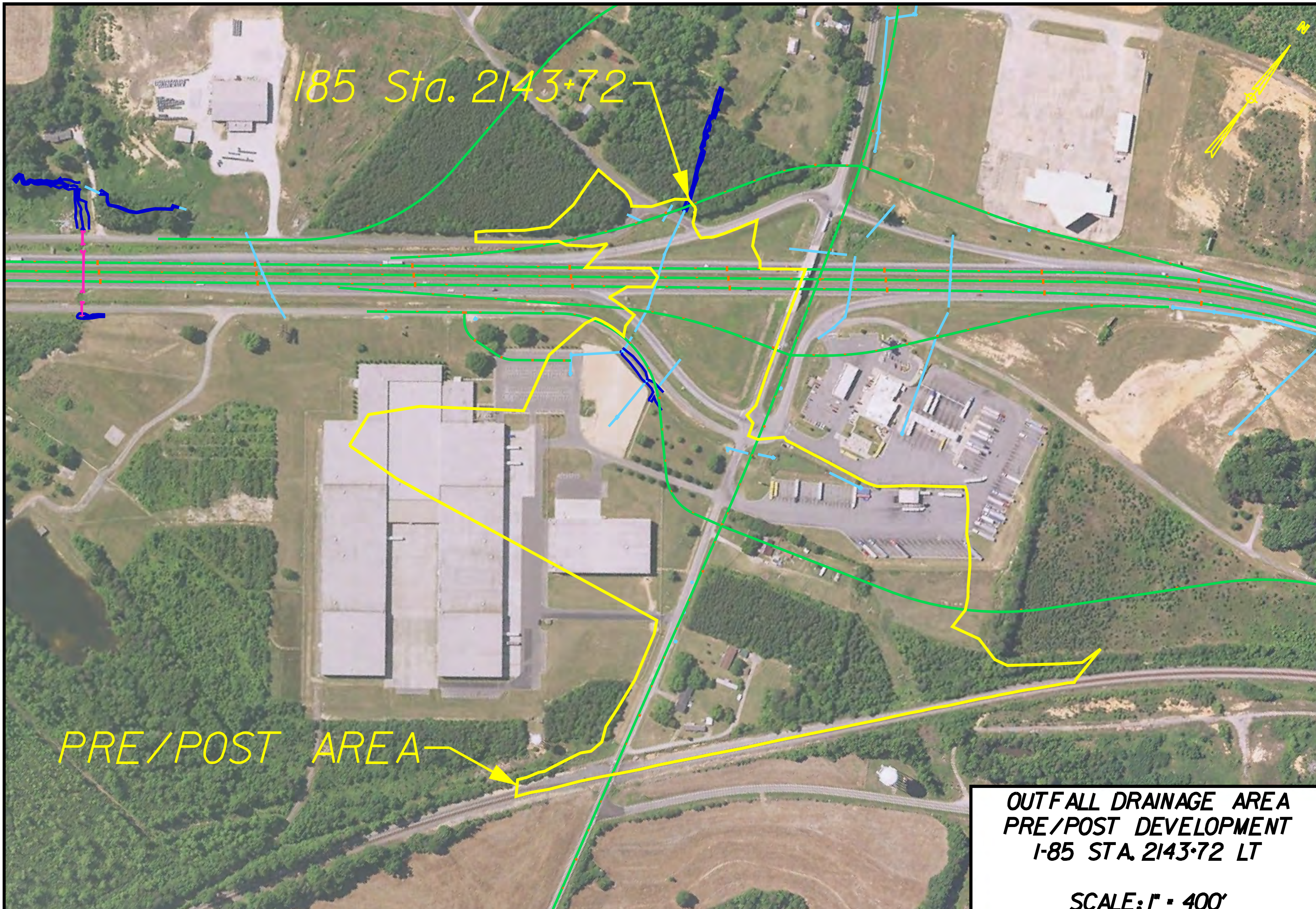
Gaffney

Time of Concentration *(minutes)*	33

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.40	3.828	87.98	**136**
Q_{25}	1.1	0.40	4.363	87.98	**170**
Q_{50}	1.2	0.40	4.777	87.98	**204**
Q_{100}	1.25	0.40	5.180	87.98	**230**

OUTFALL 2143+72 LT

This outfall receives runoff from offsite areas, the Exit 104 interchange, and the I-85 mainline from Sta. 2143+00 to Sta. 2147+00. The drainage area is approximately 41 acres and encompasses roadway pavement, grassed medians, commercial development, sparse residential areas, wooded areas, and a portion of the Southern Railway. Offsite and roadway runoff is routed under I-85 to the outfall via an existing storm sewer system. Additionally, other storm sewer systems under the interchange access ramps, route runoff to the same outfall point. Discharge from this outfall is released into a heavily wooded area and is then conveyed to Bee Branch. The I-85 improvements will increase imperviousness due to the proposed median paving along the mainline and the reconfiguration of the Exit 104 Interchange. As a result, there will be a negligible increase in discharge of 4 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2143+72 LT

SCALE: 1" = 400'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	15.18	0.90	
Rolling, 2%-10%	Gravel Pavements	1.36	0.55	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	10.46	0.30	0.50
Rolling, 2%-10%	Grass Shoulders	7.09	0.25	
Rolling, 2%-10%	Woodland & Forest	6.83	0.15	
		40.92		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusł	2.68%	100	0.8				0.513
Shallow Concentrated	Unpaved	2.68%	292					0.031
Shallow Concentrated								
Channel 1								
Channel 2								
Total			392				0.2002	0.544

Gaffney

Time of Concentration *(minutes)*	33

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.50	3.828	40.92	**78**
Q_{25}	1.1	0.50	4.363	40.92	**98**
Q_{50}	1.2	0.50	4.777	40.92	**117**
Q_{100}	1.25	0.50	5.180	40.92	**132**

Civil Engineering Consulting Services, Inc.

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	16.55	0.90	
Rolling, 2%-10%	Gravel Pavements	1.36	0.55	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	10.90	0.30	0.52
Rolling, 2%-10%	Grass Shoulders	6.15	0.25	
Rolling, 2%-10%	Woodland & Forest	5.96	0.15	
		40.92		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	2.68%	100	0.8				0.513
Shallow Concentrated	Unpaved	2.68%	292					0.031
Shallow Concentrated								
Channel 1								
Channel 2								
Total			392				0.2002	0.544

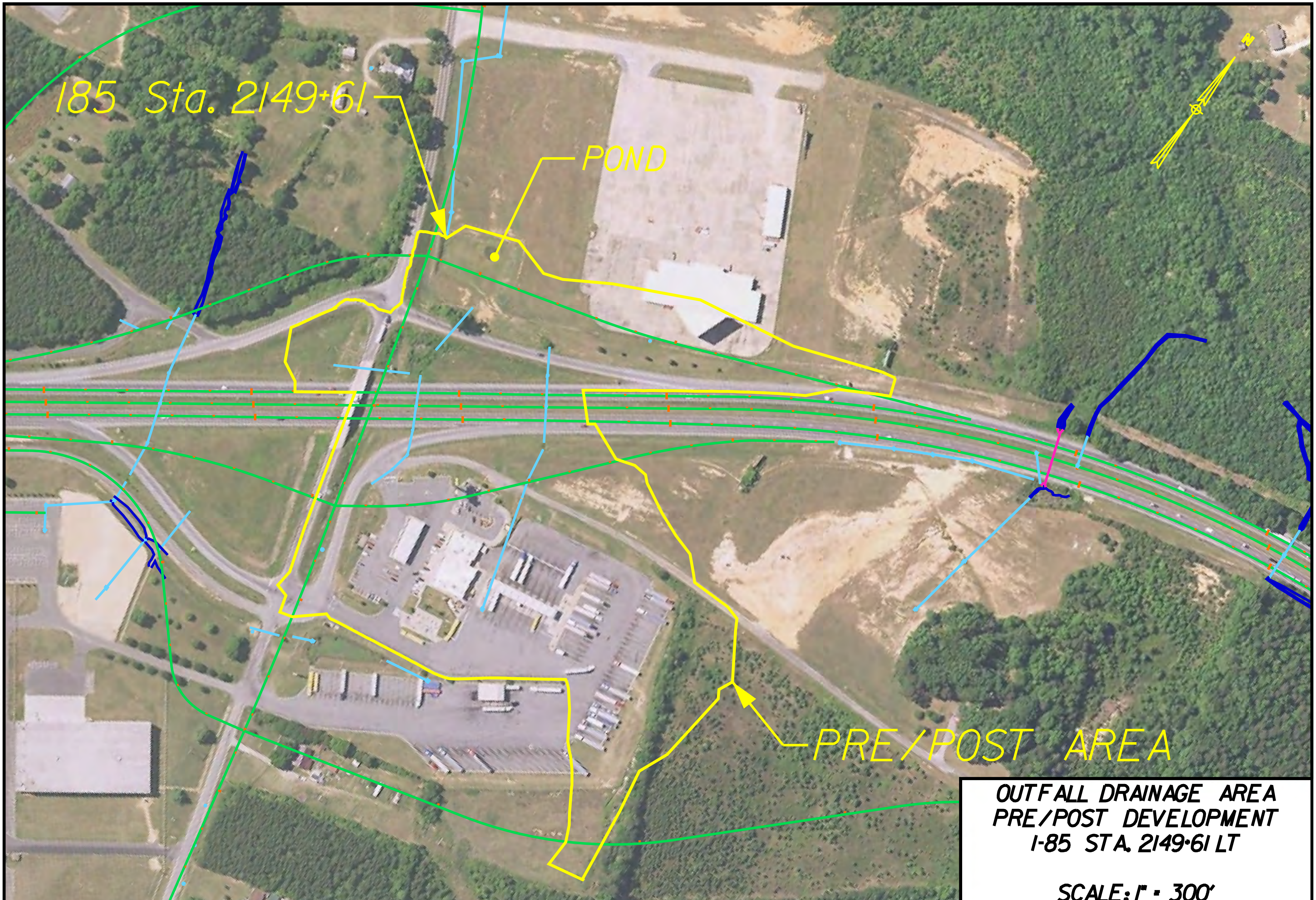
Gaffney

Time of Concentration *(minutes)*	33			
	C_f	C	I [in/hr]	**AREA (ac)**	CFS

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.52	3.828	40.92	**82**
Q_{25}	1.1	0.52	4.363	40.92	**102**
Q_{50}	1.2	0.52	4.777	40.92	**122**
Q_{100}	1.25	0.52	5.180	40.92	**138**

OUTFALL 2149+61 LT

An existing offsite detention pond receives discharge from offsite areas, the Exit 104 interchange, and the I-85 mainline from Sta. 2147+00 to Sta. 2153+00. The contributing drainage area was summed to the riser of the detention pond, located just outside the existing right-of-way, in order to determine the potential impact of the proposed I-85 improvements on the pond. The overall drainage area is approximately 23 acres. The pond discharges into an offsite storm sewer system that outfalls into an unnamed tributary to Bee Branch. The proposed interchange improvements will impact the detention pond. The pond will need to be reestablished unless the potential increase in discharge, resulting from the pond's removal, can be addressed with the proposed interchange improvements. The proposed I-85 improvements will decrease imperviousness to the overall watershed due to the reconfiguration of the Exit 104 Interchange; which will result in a decrease in discharge of 2 cfs for the 10-year design event when compared to the existing condition.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2149+61 LT

SCALE: 1" = 300'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	11.07	0.90	
Rolling, 2%-10%	Side Slopes, Turf	10.31	0.30	Area Weighted C
Rolling, 2%-10%	Unimproved Areas	1.33	0.20	0.59
		22.71		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	1.49%	100	0.41				0.381
Shallow Concentrated	Unpaved	1.49%	285					0.040
Shallow Concentrated								
Channel 1								
Channel 2								
Total			385				0.2540	0.421

Gaffney

Time of Concentration *(minutes)*	26

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.59	4.296	22.71	**57**
Q_{25}	1.1	0.59	4.907	22.71	**72**
Q_{50}	1.2	0.59	5.383	22.71	**86**
Q_{100}	1.25	0.59	5.846	22.71	**97**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	10.19	0.90	
Rolling, 2%-10%	Side Slopes, Turf	11.19	0.30	Area Weighted C
Rolling, 2%-10%	Unimproved Areas	1.33	0.20	0.56
		22.71		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	1.49%	100	0.41				0.381
Shallow Concentrated	Unpaved	1.49%	285					0.040
Shallow Concentrated								
Channel 1								
Channel 2								
Total			385				0.2540	0.421

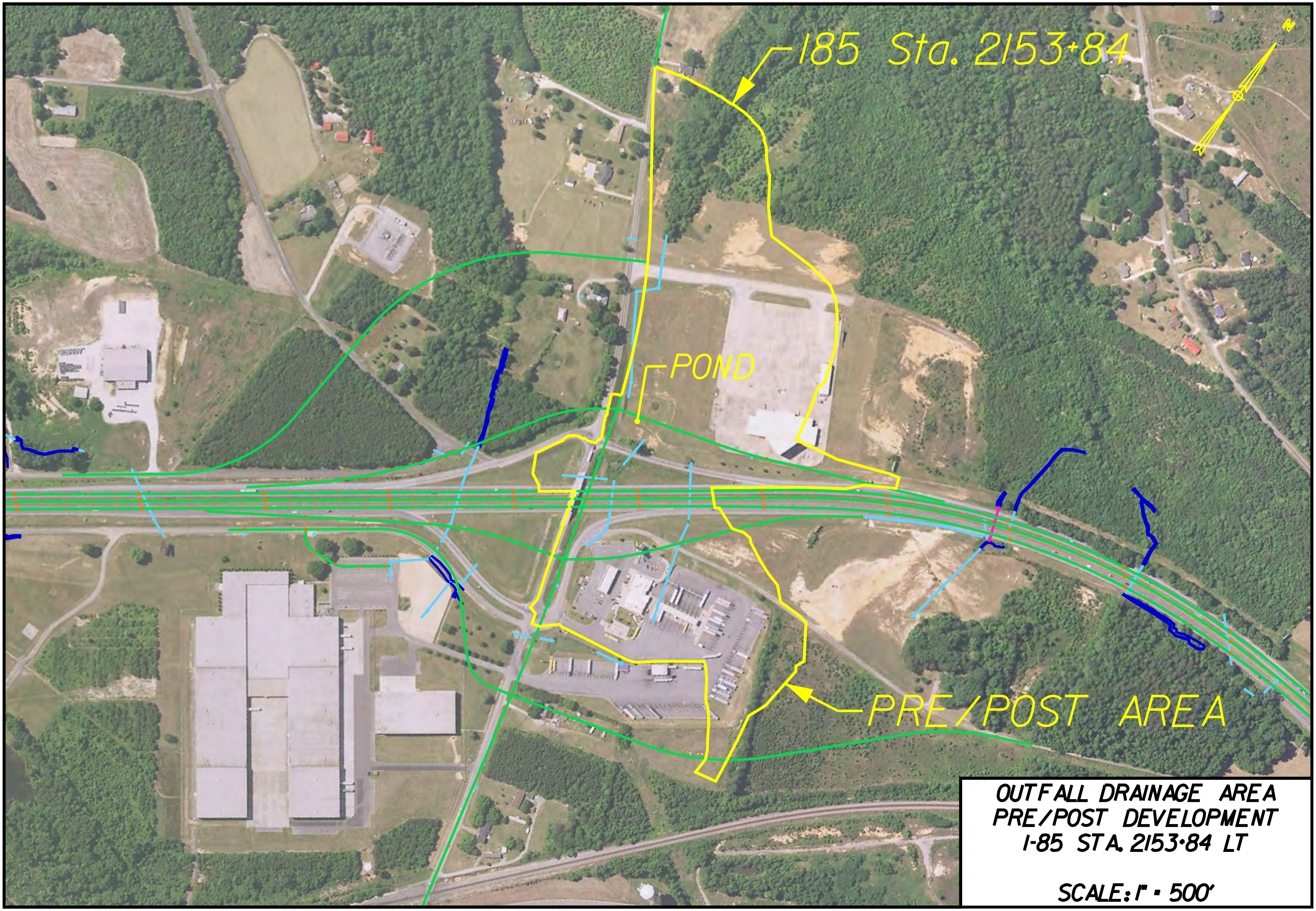
Gaffney

Time of Concentration *(minutes)*	26

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.56	4.296	22.71	**55**
Q_{25}	1.1	0.56	4.907	22.71	**69**
Q_{50}	1.2	0.56	5.383	22.71	**83**
Q_{100}	1.25	0.56	5.846	22.71	**93**

OUTFALL 2153+84 LT

This outfall receives cumulative discharge from Outfall 2149+61 LT, the Exit 104 interchange, State Road S-11-99 and limited offsite areas. The analysis point is offsite in order to capture the sheet flow impacts to the approximately 41-acre drainage area which includes roadway pavement, grassed medians, commercial development, and unimproved areas. Offsite and roadway discharge is routed under I-85 to the outfall via an existing storm sewer system. Discharge from this outfall is released into a heavily wooded area and is then conveyed to an unnamed tributary that feeds into Bee Branch. There will be no change in discharge from pre to post development conditions for the 10-year design storm. Therefore, the proposed I-85 improvements and reconfiguration of the Exit 104 Interchange will have no adverse downstream impact.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2153+84 LT

SCALE: 1" = 500'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	16.70	0.90	
Rolling, 2%-10%	Side Slopes, Turf	10.51	0.30	Area Weighted C
Rolling, 2%-10%	Grass Shoulders	8.89	0.25	0.52
Rolling, 2%-10%	Unimproved Areas	1.33	0.20	
Rolling, 2%-10%	Woodland & Forest	3.75	0.15	
		41.18		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	1.49%	100	0.41				0.381
Shallow Concentrated	Unpaved	1.49%	285					0.040
Shallow Concentrated								
Channel 1								
Channel 2								
Total			385				0.2540	0.421

Gaffney

Time of Concentration *(minutes)*	26

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.52	4.296	41.18	**91**
Q_{25}	1.1	0.52	4.907	41.18	**115**
Q_{50}	1.2	0.52	5.383	41.18	**137**
Q_{100}	1.25	0.52	5.846	41.18	**155**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	16.44	0.90	
Rolling, 2%-10%	Side Slopes, Turf	13.13	0.30	Area Weighted C
Rolling, 2%-10%	Grass Shoulders	6.69	0.25	0.52
Rolling, 2%-10%	Unimproved Areas	1.33	0.20	
Rolling, 2%-10%	Woodland & Forest	3.59	0.15	
		41.18		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	1.49%	100	0.41				0.381
Shallow Concentrated	Unpaved	1.49%	285					0.040
Shallow Concentrated								
Channel 1								
Channel 2								
Total			385				0.2540	0.421

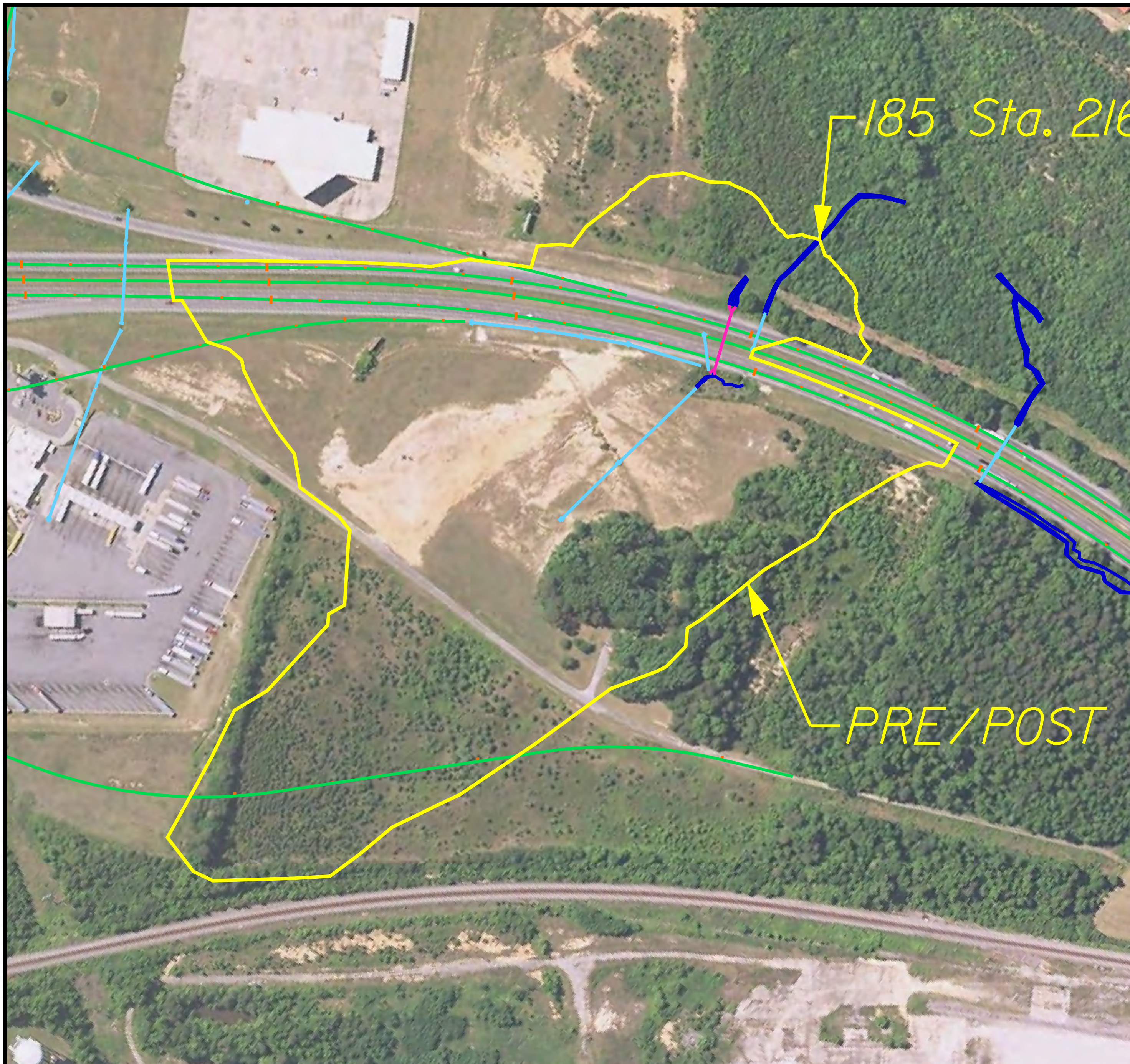
Gaffney

Time of Concentration *(minutes)*	26

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.52	4.296	41.18	**91**
Q_{25}	1.1	0.52	4.907	41.18	**115**
Q_{50}	1.2	0.52	5.383	41.18	**137**
Q_{100}	1.25	0.52	5.846	41.18	**155**

OUTFALL 2165+54 LT

This outfall receives runoff from offsite areas, the Exit 104 interchange, and the I-85 mainline from Sta. 2153+00 to Sta. 2165+00. The drainage area is approximately 28 acres and encompasses roadway pavement, grassed medians and fields, unimproved areas, and wooded areas. Offsite and roadway runoff is collected by existing storm sewer systems, which route runoff to the head of an existing 4' x 6' R.C. box culvert. The box culvert carries the water under I-85 to the outfall. Discharge from this outfall is released into a heavily wooded area and is then conveyed to an unnamed tributary that feeds into Bee Branch. The I-85 improvements will increase imperviousness due to the proposed median paving along the mainline and the reconfiguration of the Exit 104 Interchange. As a result, there will be a negligible increase in discharge of 5 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2165+54 LT

SCALE: 1" = 300'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	2.98	0.90	
Rolling, 2%-10%	Earth shoulders	2.14	0.50	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	10.52	0.30	0.33
Rolling, 2%-10%	Unimproved Areas	7.53	0.20	
Rolling, 2%-10%	Woodland & Forest	4.72	0.15	
		27.89		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods: light underbrush	2.84%	100	0.4				0.288
Shallow Concentrated	Unpaved	2.84%	1189					0.121
Shallow Concentrated								
Channel 1								
Channel 2								
Total			1289				0.8747	0.409

Gaffney

Time of Concentration *(minutes)*	25

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.33	4.372	27.89	**40**
Q_{25}	1.1	0.33	4.996	27.89	**50**
Q_{50}	1.2	0.33	5.482	27.89	**60**
Q_{100}	1.25	0.33	5.956	27.89	**68**

Civil Engineering Consulting Services, Inc.

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	4.63	0.90	
Rolling, 2%-10%	Earth shoulders	2.05	0.50	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	10.85	0.30	0.37
Rolling, 2%-10%	Unimproved Areas	5.69	0.20	
Rolling, 2%-10%	Woodland & Forest	4.67	0.15	
		27.89		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods: light underbrush	2.84%	100	0.4				0.288
Shallow Concentrated	Unpaved	2.84%	1189					0.121
Shallow Concentrated								
Channel 1								
Channel 2								
Total			1289				0.8747	0.409

Gaffney

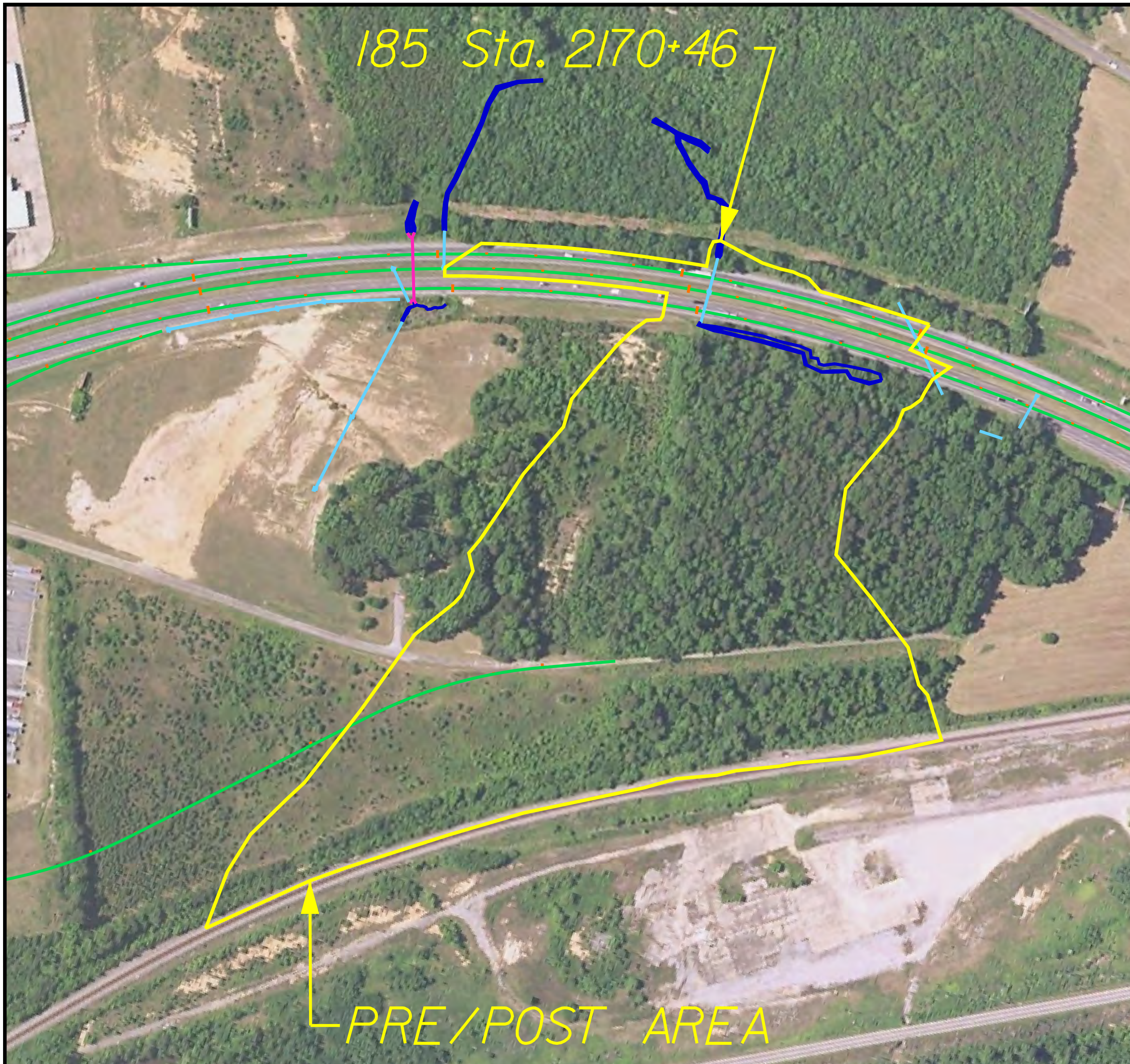
Time of Concentration *(minutes)*	25

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.37	4.372	27.89	**45**
Q_{25}	1.1	0.37	4.996	27.89	**57**
Q_{50}	1.2	0.37	5.482	27.89	**68**
Q_{100}	1.25	0.37	5.956	27.89	**77**

Civil Engineering Consulting Services, Inc.

OUTFALL 2170+46 LT

This outfall receives runoff from offsite areas, the Exit 104 interchange, and the I-85 mainline from Sta. 2165+00 to Sta. 2174+50. The drainage area is approximately 22 acres and includes roadway pavement, grassed medians, unimproved areas, and dense wooded areas. Offsite and roadway runoff is routed under I-85 to the outfall via an existing storm sewer system. Discharge from this outfall is released into a heavily wooded area and is then conveyed to an unnamed tributary that feeds into Bee Branch. The I-85 improvements will increase imperviousness due to the proposed median paving along the mainline and the reconfiguration of the Exit 104 Interchange. As a result, there will be a negligible increase in discharge of 3 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2170+46 LT

SCALE: 1" = 300'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	1.74	0.90	
Rolling, 2%-10%	Gravel Pavements	0.92	0.55	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	1.78	0.30	0.25
Rolling, 2%-10%	Unimproved Areas	3.51	0.20	
Rolling, 2%-10%	Woodland & Forest	13.94	0.15	
		21.89		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusł	2.60%	100	0.8				0.520
Shallow Concentrated	Unpaved	2.60%	908					0.097
Shallow Concentrated								
Channel 1								
Channel 2								
Total			1008				0.4540	0.617

Gaffney

Time of Concentration *(minutes)*	38

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.25	3.551	21.89	**19**
Q_{25}	1.1	0.25	4.042	21.89	**24**
Q_{50}	1.2	0.25	4.422	21.89	**29**
Q_{100}	1.25	0.25	4.791	21.89	**32**

Civil Engineering Consulting Services, Inc.

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	2.74	0.90	
Rolling, 2%-10%	Gravel Pavements	0.92	0.55	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	2.20	0.30	0.28
Rolling, 2%-10%	Unimproved Areas	2.59	0.20	
Rolling, 2%-10%	Woodland & Forest	13.44	0.15	
		21.89		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

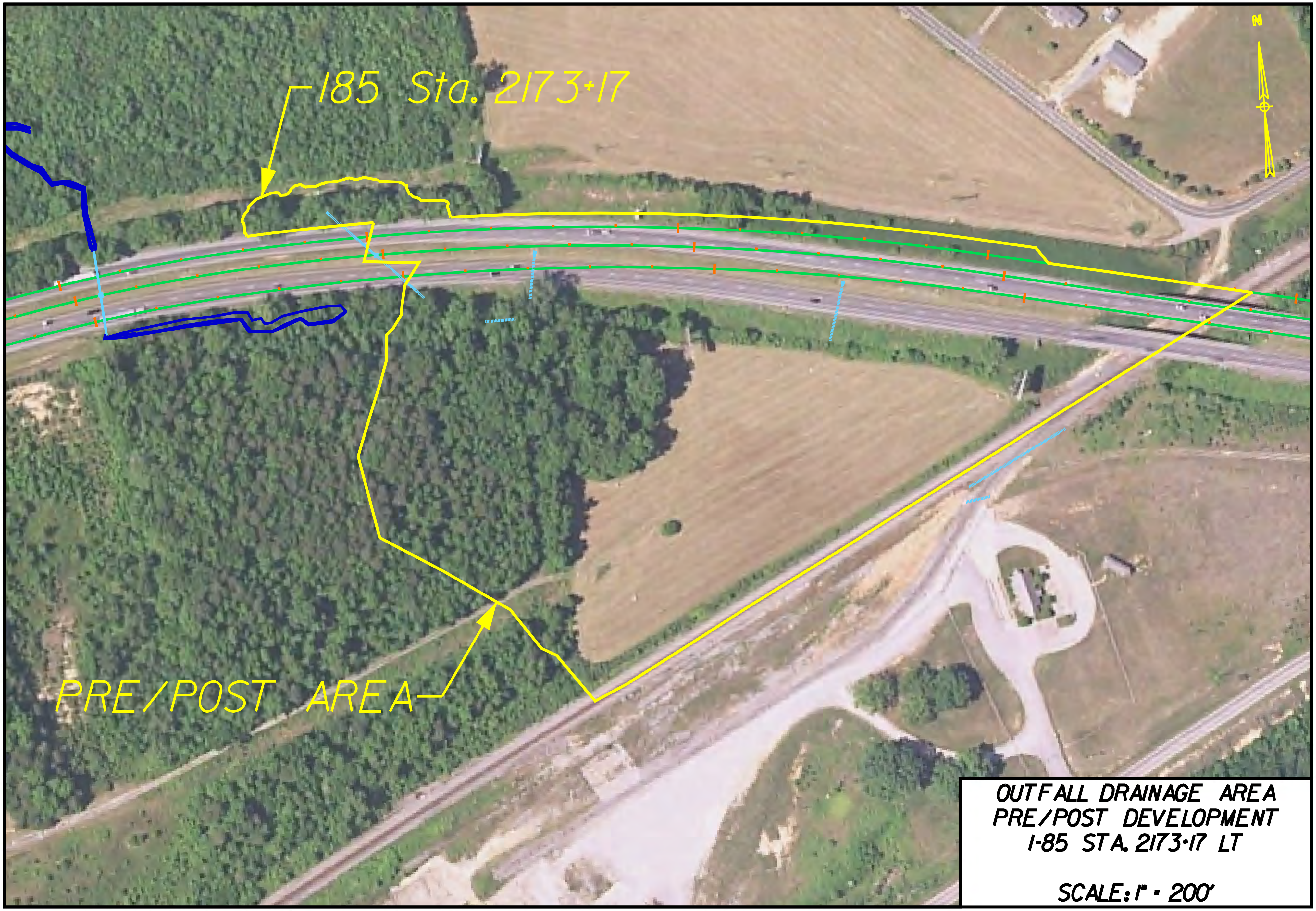
Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	2.60%	100	0.8				0.520
Shallow Concentrated	Unpaved	2.60%	908					0.097
Shallow Concentrated								
Channel 1								
Channel 2								
Total			1008				0.4540	0.617

Gaffney

Time of Concentration *(minutes)*	38				
	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.28	3.551	21.89	**22**
Q_{25}	1.1	0.28	4.042	21.89	**27**
Q_{50}	1.2	0.28	4.422	21.89	**33**
Q_{100}	1.25	0.28	4.791	21.89	**37**

OUTFALL 2173+17 LT

This outfall receives runoff from offsite areas as well as roadway discharge from Sta. 2174+50 to Sta. 2188+50. The drainage area is approximately 15 acres and consists of roadway pavement, grassed medians and fields, dense wooded areas, and a portion of the Southern Railway. Offsite and roadway runoff is routed under I-85 to the outfall via an existing storm sewer system. Discharge from this outfall is released into a heavily wooded area and is then conveyed to an unnamed tributary that feeds into Bee Branch. The I-85 improvements will increase imperviousness due to the proposed median paving. As a result, there will be a negligible increase in discharge of 3 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.


N
185 Sta. 2173+17
PRE/POST AREA
OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2173+17 LT
SCALE: 1" = 200'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	2.12	0.90	
Rolling, 2%-10%	Gravel Pavements	0.82	0.55	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	3.46	0.30	0.36
Rolling, 2%-10%	Meadows & Pasture Land	4.76	0.30	
Rolling, 2%-10%	Woodland & Forest	4.21	0.15	
		15.37		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	2.57%	100	0.41				0.306
Shallow Concentrated	Unpaved	2.57%	810					0.087
Shallow Concentrated								
Channel 1								
Channel 2								
Total			910				0.6435	0.393

Gaffney

Time of Concentration *(minutes)*	24

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.36	4.451	15.37	**24**
Q_{25}	1.1	0.36	5.089	15.37	**31**
Q_{50}	1.2	0.36	5.585	15.37	**37**
Q_{100}	1.25	0.36	6.069	15.37	**41**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	3.16	0.90	
Rolling, 2%-10%	Gravel Pavements	0.88	0.55	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	2.36	0.30	0.40
Rolling, 2%-10%	Meadows & Pasture Land	4.76	0.30	
Rolling, 2%-10%	Woodland & Forest	4.21	0.15	
		15.37		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	2.57%	100	0.41				0.306
Shallow Concentrated	Unpaved	2.57%	810					0.087
Shallow Concentrated								
Channel 1								
Channel 2								
Total			910				0.6435	0.393

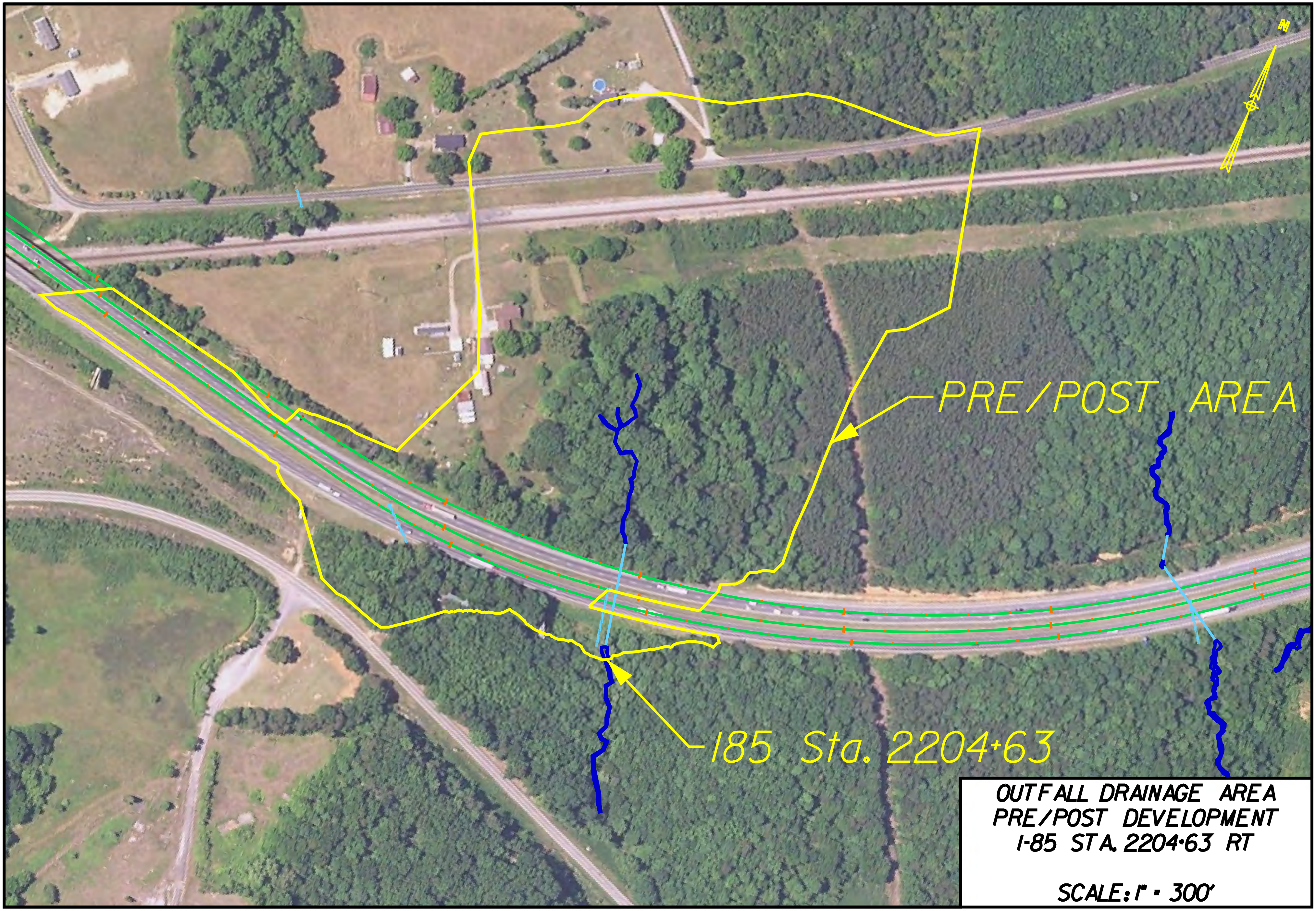
Gaffney

Time of Concentration *(minutes)*	24

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.40	4.451	15.37	**27**
Q_{25}	1.1	0.40	5.089	15.37	**34**
Q_{50}	1.2	0.40	5.585	15.37	**41**
Q_{100}	1.25	0.40	6.069	15.37	**46**

OUTFALL 2204+63 RT

This outfall receives runoff from offsite areas as well as roadway discharge from Sta. 2190+00 to Sta. 2204+00. The drainage area is approximately 33 acres and is characterized by roadway pavement, grassed medians, sparse residential tracts, dense wooded areas, and a portion of the Southern Railway. Roadway runoff is routed to the outfall through an existing storm sewer system; while offsite runoff is routed under I-85 via an existing 36" R.C. pipe. Discharge from this outfall is conveyed to an unnamed tributary that feeds into Jumping Branch. The I-85 improvements will increase imperviousness due to the proposed median paving. As a result, there will be a negligible increase in discharge of 3 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2204+63 RT

SCALE: 1" = 300'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	3.28	0.90	
Rolling, 2%-10%	Gravel Pavements	1.40	0.55	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	4.45	0.30	0.29
Rolling, 2%-10%	Grass Shoulders	7.25	0.25	
Hilly, Over 10%	Woodland & Forest	5.41	0.20	
Rolling, 2%-10%	Woodland & Forest	11.52	0.15	
		33.31		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	5.04%	100	0.8				0.399
Shallow Concentrated	Unpaved	5.04%	767					0.059
Shallow Concentrated								
Channel 1		1.11%	1480	0.04	2	4.5765	2.25813	0.182
Channel 2								
Total			2347				1.0195	0.639

Gaffney

Time of Concentration *(minutes)*	39			

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.29	3.500	33.31	**34**
Q_{25}	1.1	0.29	3.984	33.31	**42**
Q_{50}	1.2	0.29	4.358	33.31	**51**
Q_{100}	1.25	0.29	4.720	33.31	**57**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	4.77	0.90	
Rolling, 2%-10%	Gravel Pavements	1.40	0.55	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	2.96	0.30	0.32
Rolling, 2%-10%	Grass Shoulders	7.25	0.25	
Hilly, Over 10%	Woodland & Forest	5.41	0.20	
Rolling, 2%-10%	Woodland & Forest	11.52	0.15	
		33.31		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	5.04%	100	0.8				0.399
Shallow Concentrated	Unpaved	5.04%	767					0.059
Shallow Concentrated								
Channel 1		1.11%	1480	0.04	2	4.5765	2.25813	0.182
Channel 2								
Total			2347				1.0195	0.639

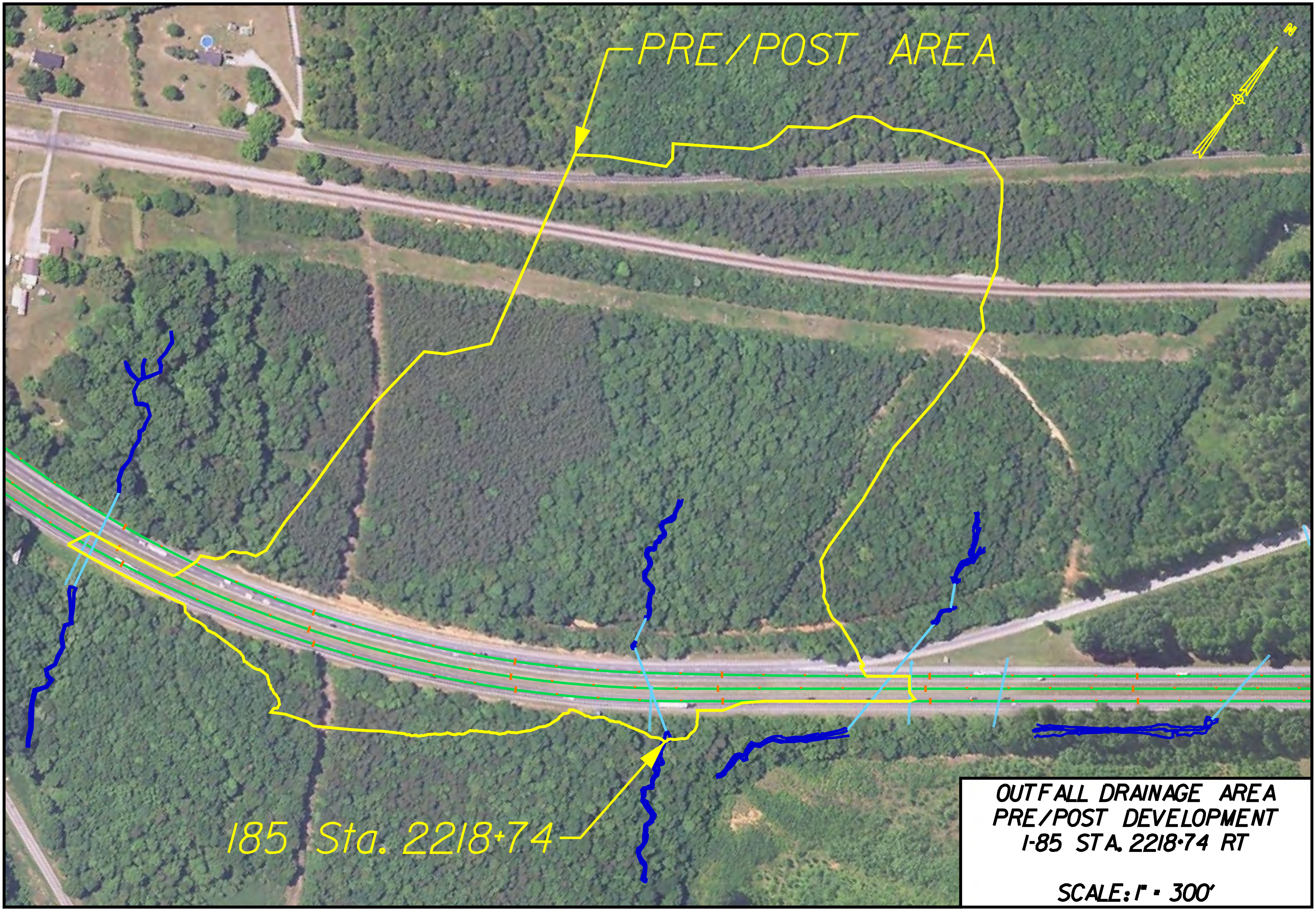
Gaffney

Time of Concentration *(minutes)*	39

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.32	3.500	33.31	**37**
Q_{25}	1.1	0.32	3.984	33.31	**46**
Q_{50}	1.2	0.32	4.358	33.31	**55**
Q_{100}	1.25	0.32	4.720	33.31	**62**

OUTFALL 2218+74 RT

This outfall receives runoff from offsite areas as well as roadway discharge from Sta. 2204+00 to Sta. 2224+50. The drainage area is approximately 42 acres and encompasses roadway pavement, grassed medians, dense wooded areas, and a portion of the Southern Railway. Roadway runoff is routed to the outfall through an existing storm sewer system; while offsite runoff is routed under I-85 via an existing 36” R.C. pipe. Discharge from this outfall is conveyed to an unnamed tributary that feeds into Jumping Branch. The I-85 improvements will increase imperviousness due to the proposed median paving. As a result, there will be a negligible increase in discharge of 4 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2218+74 RT

SCALE: 1" = 300'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	4.00	0.90	
Rolling, 2%-10%	Gravel Pavements	1.45	0.55	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	6.19	0.30	0.26
Hilly, Over 10%	Woodland & Forest	4.87	0.20	
Rolling, 2%-10%	Woodland & Forest	25.59	0.15	
		42.10		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	10.42%	100	0.8				0.298
Shallow Concentrated	Unpaved	10.42%	495					0.026
Shallow Concentrated								
Channel 1		2.21%	380	0.04	3	6.3246	3.36648	0.031
Channel 2								
Total			975				0.7608	0.356

Gaffney

Time of Concentration *(minutes)*	22

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.26	4.618	42.10	**51**
Q_{25}	1.1	0.26	5.284	42.10	**64**
Q_{50}	1.2	0.26	5.804	42.10	**77**
Q_{100}	1.25	0.26	6.311	42.10	**87**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	5.27	0.90	
Rolling, 2%-10%	Gravel Pavements	1.45	0.55	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	4.92	0.30	0.28
Hilly, Over 10%	Woodland & Forest	4.87	0.20	
Rolling, 2%-10%	Woodland & Forest	25.59	0.15	
		42.10		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	10.42%	100	0.8				0.298
Shallow Concentrated	Unpaved	10.42%	495					0.026
Shallow Concentrated								
Channel 1		2.21%	380	0.04	3	6.3246	3.36648	0.031
Channel 2								
Total			975				0.7608	0.356

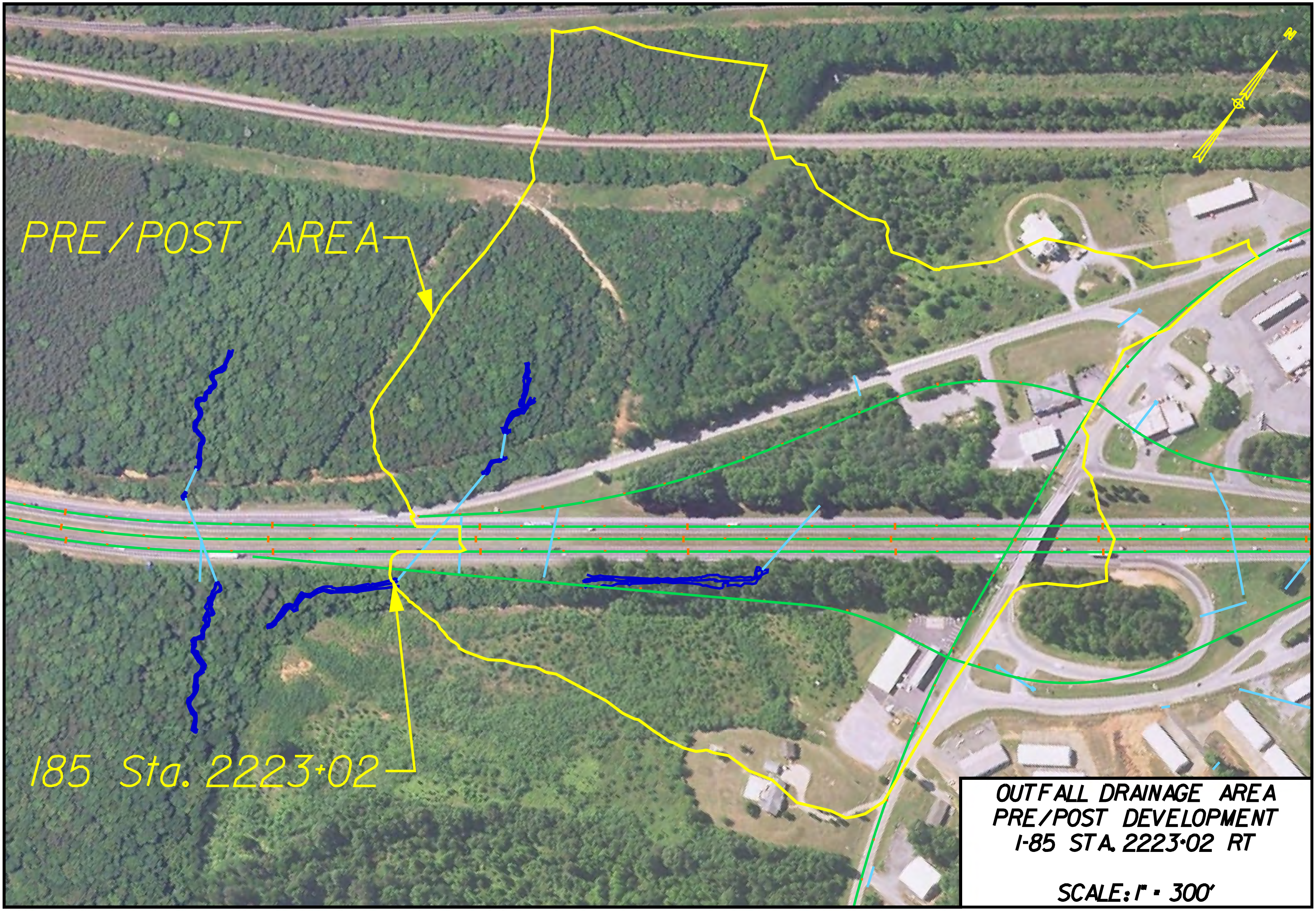
Gaffney

Time of Concentration *(minutes)*	22

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.28	4.618	42.10	**55**
Q_{25}	1.1	0.28	5.284	42.10	**69**
Q_{50}	1.2	0.28	5.804	42.10	**82**
Q_{100}	1.25	0.28	6.311	42.10	**93**

OUTFALL 2223+02 RT

This outfall receives runoff from offsite areas, the Exit 106 interchange, and the I-85 mainline from Sta. 2224+50 to Sta. 2240+00. The drainage area is approximately 50 acres and includes roadway pavement, grassed medians, dense wooded areas, business areas, and a portion of the Southern Railway. Offsite and roadway runoff reach the outfall via multiple cross-line pipes under I-85. Discharge from this outfall is conveyed to an unnamed tributary that feeds into Jumping Branch. The I-85 improvements will increase imperviousness due to the proposed median paving along the mainline and the reconfiguration of the Exit 106 interchange. As a result, there will be a negligible increase in discharge of 4 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.


PRE/POST AREA
185 Sta. 2223+02
N
OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2223+02 RT
SCALE: 1" = 300'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	7.69	0.90	
Rolling, 2%-10%	Gravel Pavements	0.96	0.55	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	10.20	0.30	0.31
Rolling, 2%-10%	Unimproved Areas	0.18	0.20	
Rolling, 2%-10%	Woodland & Forest	30.57	0.15	
		49.60		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	5.34%	100	0.8				0.390
Shallow Concentrated	Unpaved	5.34%	1132					0.084
Shallow Concentrated								
Channel 1								
Channel 2								
Total			1232				0.7222	0.474

Gaffney

Time of Concentration *(minutes)*		29			
	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.31	4.082	49.60	**62**
Q_{25}	1.1	0.31	4.658	49.60	**78**
Q_{50}	1.2	0.31	5.105	49.60	**93**
Q_{100}	1.25	0.31	5.541	49.60	**105**

Civil Engineering Consulting Services, Inc.

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	8.13	0.90	
Rolling, 2%-10%	Gravel Pavements	0.96	0.55	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	15.30	0.30	0.33
Rolling, 2%-10%	Unimproved Areas	0.25	0.20	
Rolling, 2%-10%	Woodland & Forest	24.96	0.15	
		49.60		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	5.34%	100	0.8				0.390
Shallow Concentrated	Unpaved	5.34%	1132					0.084
Shallow Concentrated								
Channel 1								
Channel 2								
Total			1232				0.7222	0.474

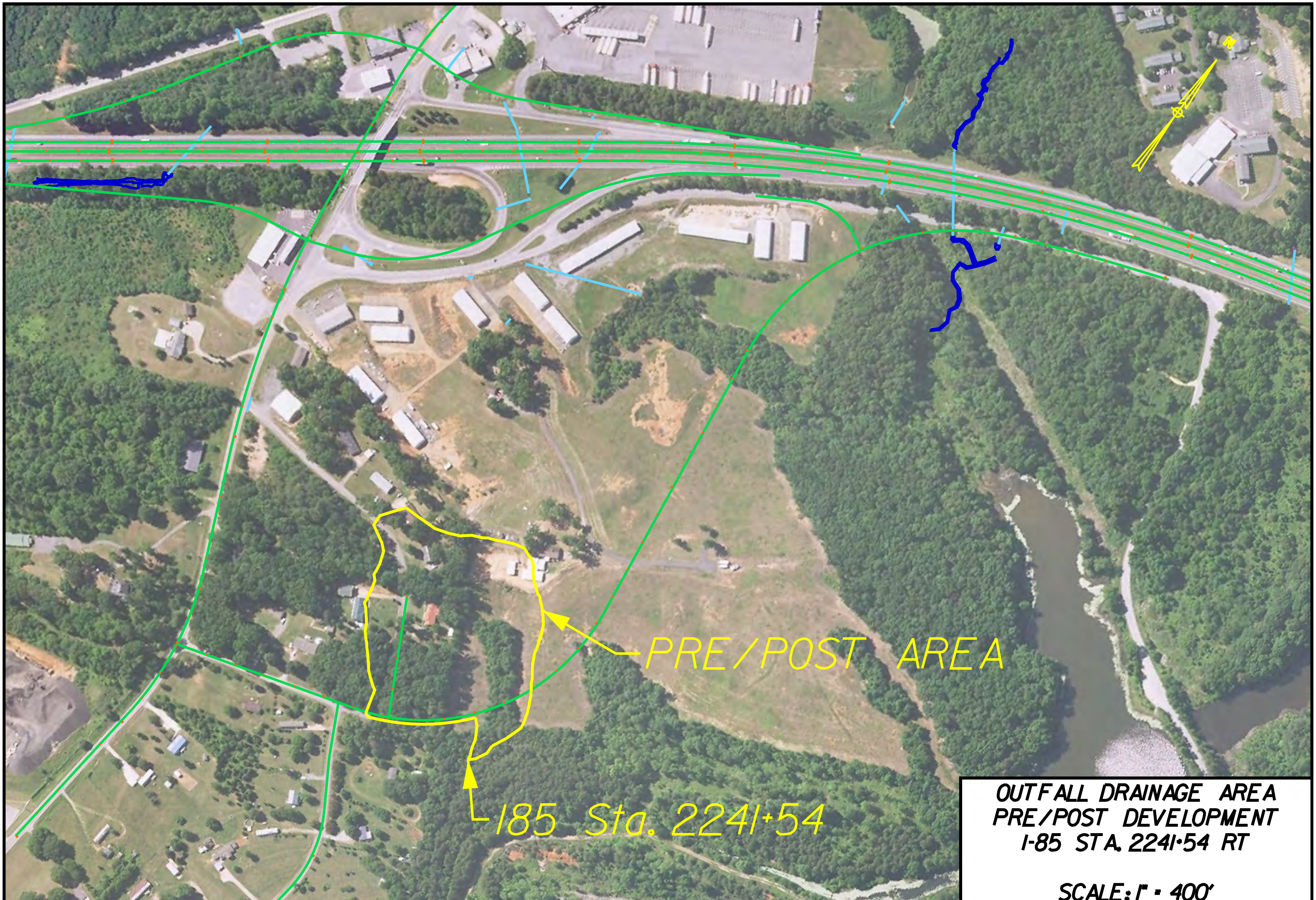
Gaffney

Time of Concentration *(minutes)*	29

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.33	4.082	49.60	**66**
Q_{25}	1.1	0.33	4.658	49.60	**83**
Q_{50}	1.2	0.33	5.105	49.60	**99**
Q_{100}	1.25	0.33	5.541	49.60	**112**

OUTFALL 2241+54 RT

This outfall is approximately 8 acres and primarily receives offsite discharge from a wooded residential area with minimal pavement and grass. Discharge from this outfall is released into a heavily wooded area and is then conveyed to Mill Creek. The proposed Lakeview Drive improvements will increase imperviousness which will result in a negligible increase in discharge of 1 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2241+54 RT

SCALE: 1" = 400'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	0.61	0.90	
Rolling, 2%-10%	Earth shoulders	0.36	0.50	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	0.31	0.30	0.26
Rolling, 2%-10%	Grass Shoulders	2.17	0.25	
Rolling, 2%-10%	Woodland & Forest	4.23	0.15	
		7.68		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	11.57%	100	0.8				0.286
Shallow Concentrated	Unpaved	11.57%	435					0.022
Shallow Concentrated								
Channel 1								
Channel 2								
Total			535				0.4824	0.308

Gaffney

Time of Concentration *(minutes)*	19

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.26	4.893	7.68	**10**
Q_{25}	1.1	0.26	5.607	7.68	**12**
Q_{50}	1.2	0.26	6.165	7.68	**15**
Q_{100}	1.25	0.26	6.711	7.68	**17**

Rational Analysis

Land Slope	Land Use	Acres	C
Rolling, 2%-10%	Pavements & Roofs	0.96	0.90
Rolling, 2%-10%	Earth shoulders	0.36	0.50
Rolling, 2%-10%	Side Slopes, Turf	1.17	0.30
Rolling, 2%-10%	Grass Shoulders	1.72	0.25
Rolling, 2%-10%	Woodland & Forest	3.47	0.15
		7.68	

Area Weighted C
0.31

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	11.57%	100	0.8				0.286
Shallow Concentrated	Unpaved	11.57%	435					0.022
Shallow Concentrated								
Channel 1								
Channel 2								
Total			535				0.4824	0.308

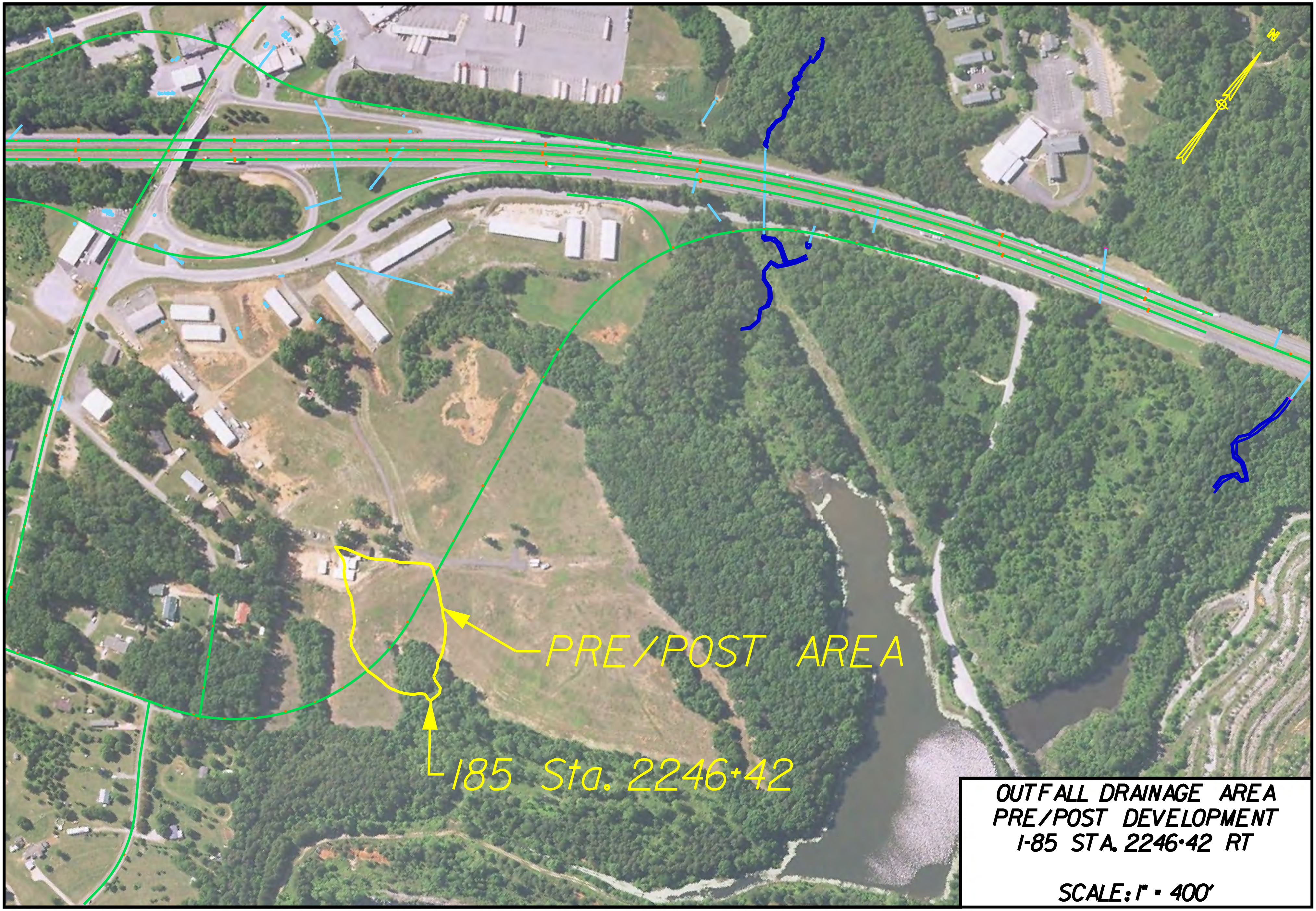
Gaffney

Time of Concentration *(minutes)*	19

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.31	4.893	7.68	**11**
Q_{25}	1.1	0.31	5.607	7.68	**14**
Q_{50}	1.2	0.31	6.165	7.68	**17**
Q_{100}	1.25	0.31	6.711	7.68	**20**

OUTFALL 2246+42 RT

This outfall is approximately 3 acres and primarily receives offsite discharge from a grassed field. Discharge from this outfall is released into a heavily wooded area and is then conveyed to Mill Creek. The proposed Lakeview Drive improvements will increase imperviousness which will result in a negligible increase in discharge of 1 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.


N
PRE/POST AREA
I85 Sta. 2246+42
OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2246+42 RT
SCALE: 1" = 400'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	0.07	0.90	
Rolling, 2%-10%	Grass Shoulders	2.05	0.25	Area Weighted C
Rolling, 2%-10%	Woodland & Forest	0.53	0.15	0.25
		2.65		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	14.34%	100	0.41				0.154
Shallow Concentrated	Unpaved	14.34%	467					0.021
Shallow Concentrated								
Channel 1								
Channel 2								
Total			567				0.9000	0.175

Gaffney

Time of Concentration *(minutes)*	11

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.25	5.815	2.65	**4**
Q_{25}	1.1	0.25	6.699	2.65	**5**
Q_{50}	1.2	0.25	7.395	2.65	**6**
Q_{100}	1.25	0.25	8.080	2.65	**7**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	0.29	0.90	
Rolling, 2%-10%	Side Slopes, Turf	1.38	0.30	Area Weighted C
Rolling, 2%-10%	Grass Shoulders	0.72	0.25	0.34
Rolling, 2%-10%	Woodland & Forest	0.26	0.15	
		2.65		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	14.34%	100	0.41				0.154
Shallow Concentrated	Unpaved	14.34%	467					0.021
Shallow Concentrated								
Channel 1								
Channel 2								
Total			567				0.9000	0.175

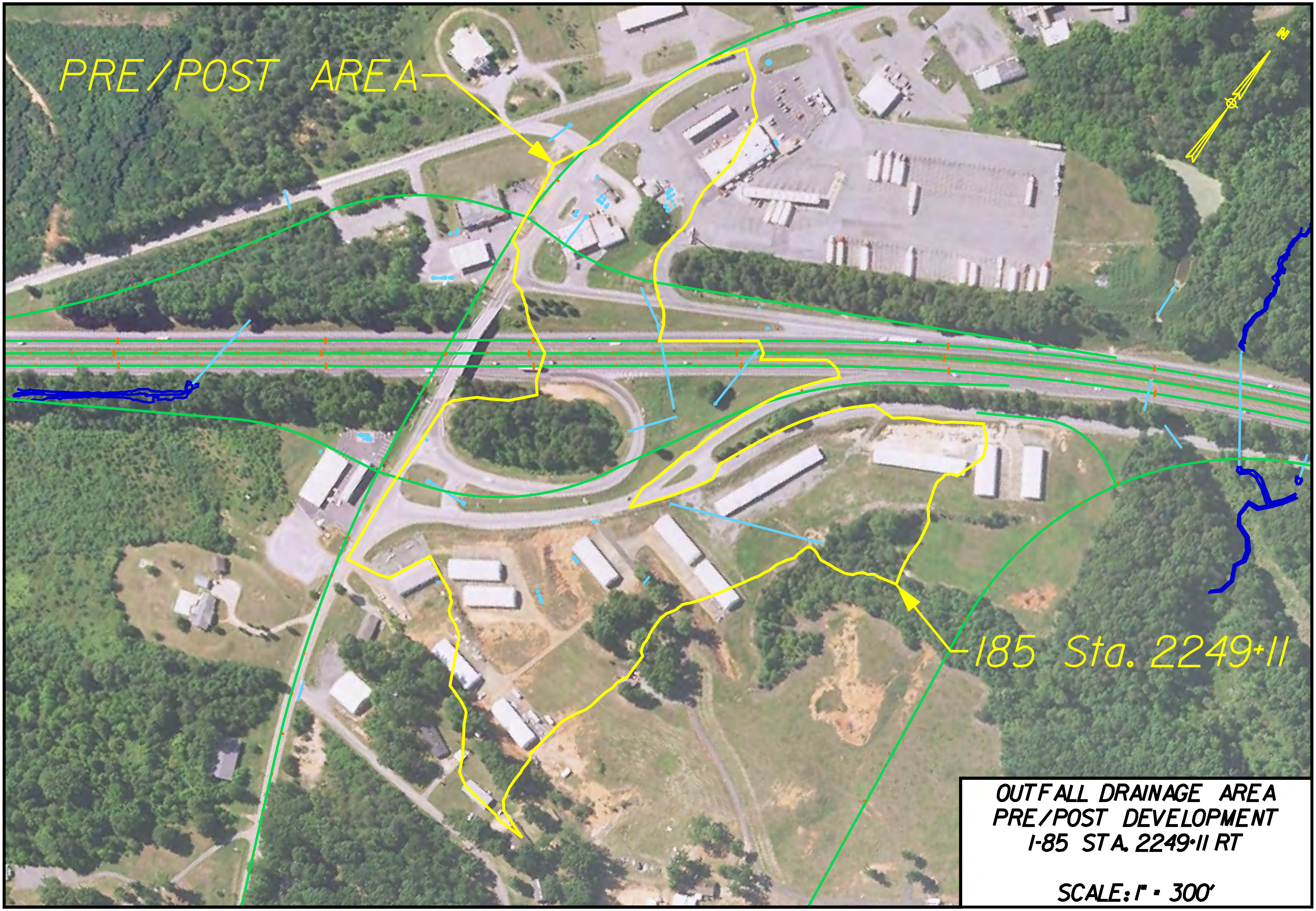
Gaffney

Time of Concentration *(minutes)*	11

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.34	5.815	2.65	**5**
Q_{25}	1.1	0.34	6.699	2.65	**7**
Q_{50}	1.2	0.34	7.395	2.65	**8**
Q_{100}	1.25	0.34	8.080	2.65	**9**

OUTFALL 2249+11 RT

This outfall receives runoff from offsite areas, the Exit 106 interchange, and the I-85 mainline from Sta. 2240+00 to Sta. 2245+00. The drainage area is approximately 23 acres and consists of roadway pavement, grassed medians, unimproved sections, and business areas. Offsite and roadway runoff is routed to the outfall via multiple existing storm sewer systems crossing under I-85 and systems crossing under the interchange access ramps. Discharge from this outfall is released into a heavily wooded area and is then conveyed to Mill Creek. The proposed I-85 improvements will decrease imperviousness due to the realignment of the Exit 106 interchange access ramps. As a result, there will be a decrease in discharge of 3 cfs from pre to post development conditions for the 10-year design storm. Therefore, the proposed I-85 improvements and reconfiguration of the Exit 106 Interchange will have no adverse downstream impact.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2249+11 RT

SCALE: 1" = 300'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	5.92	0.90	
Rolling, 2%-10%	Industrial Areas, Light	4.70	0.70	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	3.97	0.30	0.50
Rolling, 2%-10%	Grass Shoulders	5.24	0.25	
Rolling, 2%-10%	Unimproved Areas	2.73	0.20	
Rolling, 2%-10%	Woodland & Forest	0.79	0.15	
		23.35		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Gaffney

Time of Concentration *(minutes)*	5

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.50	6.770	23.35	**80**
Q_{25}	1.1	0.50	7.845	23.35	**102**
Q_{50}	1.2	0.50	8.698	23.35	**123**
Q_{100}	1.25	0.50	9.546	23.35	**141**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	5.20	0.90	
Rolling, 2%-10%	Industrial Areas, Light	4.23	0.70	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	8.39	0.30	0.49
Rolling, 2%-10%	Grass Shoulders	3.89	0.25	
Rolling, 2%-10%	Unimproved Areas	0.85	0.20	
Rolling, 2%-10%	Woodland & Forest	0.79	0.15	
		23.35		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

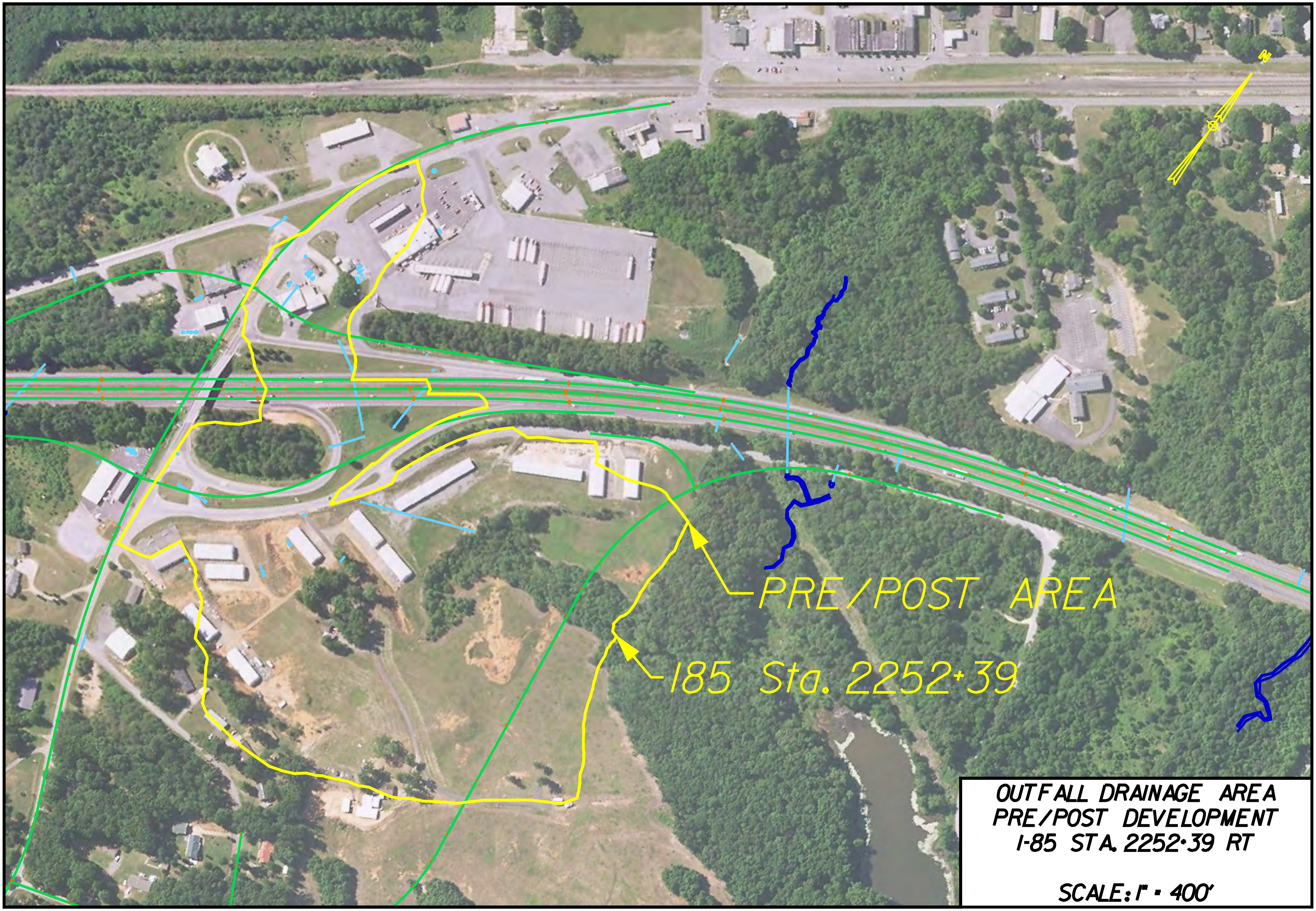
Gaffney

Time of Concentration *(minutes)*	5

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
$\mathbf{Q_{10}}$	1	0.49	6.770	23.35	**77**
$\mathbf{Q_{25}}$	1.1	0.49	7.845	23.35	**99**
$\mathbf{Q_{50}}$	1.2	0.49	8.698	23.35	**119**
$\mathbf{Q_{100}}$	1.25	0.49	9.546	23.35	**136**

OUTFALL 2252+39 RT

This outfall receives cumulative discharge from Outfall 2249+11 RT, the Exit 106 Interchange, the proposed roadway for Lakeview Drive, and limited offsite areas. The drainage area is approximately 43 acres and consists of roadway pavement, grassed areas, unimproved sections, and business areas. Offsite and roadway runoff is routed to the outfall via multiple existing storm sewer systems crossing under I-85 and systems crossing under the interchange access ramps. Discharge from this outfall is released into a heavily wooded area and is then conveyed to Mill Creek. The I-85 improvements will increase imperviousness due to the proposed median paving and Exit 106 interchange realignment. As a result, there will be a negligible increase in discharge of 1 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2252+39 RT

SCALE: 1" = 400'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	6.53	0.90	
Rolling, 2%-10%	Industrial Areas, Light	4.70	0.70	Area Weighted C
Rolling, 2%-10%	Earth shoulders	0.58	0.50	0.40
Rolling, 2%-10%	Side Slopes, Turf	5.85	0.30	
Rolling, 2%-10%	Grass Shoulders	21.87	0.25	
Rolling, 2%-10%	Unimproved Areas	0.85	0.20	
Rolling, 2%-10%	Woodland & Forest	2.84	0.15	
		43.22		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	10.12%	100	0.41				0.177
Shallow Concentrated	Unpaved	10.12%	1012					0.055
Shallow Concentrated								
Channel 1								
Channel 2								
Total			1112				1.3342	0.232

Gaffney

Time of Concentration *(minutes)*	14

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.40	5.432	43.22	**94**
Q_{25}	1.1	0.40	6.243	43.22	**119**
Q_{50}	1.2	0.40	6.880	43.22	**143**
Q_{100}	1.25	0.40	7.505	43.22	**162**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	6.62	0.90	
Rolling, 2%-10%	Industrial Areas, Light	4.23	0.70	Area Weighted C
Rolling, 2%-10%	Earth shoulders	0.48	0.50	0.41
Rolling, 2%-10%	Side Slopes, Turf	13.25	0.30	
Rolling, 2%-10%	Grass Shoulders	15.75	0.25	
Rolling, 2%-10%	Unimproved Areas	0.85	0.20	
Rolling, 2%-10%	Woodland & Forest	2.04	0.15	
		43.22		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	10.12%	100	0.41				0.177
Shallow Concentrated	Unpaved	10.12%	1012					0.055
Shallow Concentrated								
Channel 1								
Channel 2								
Total			1112				1.3342	0.232

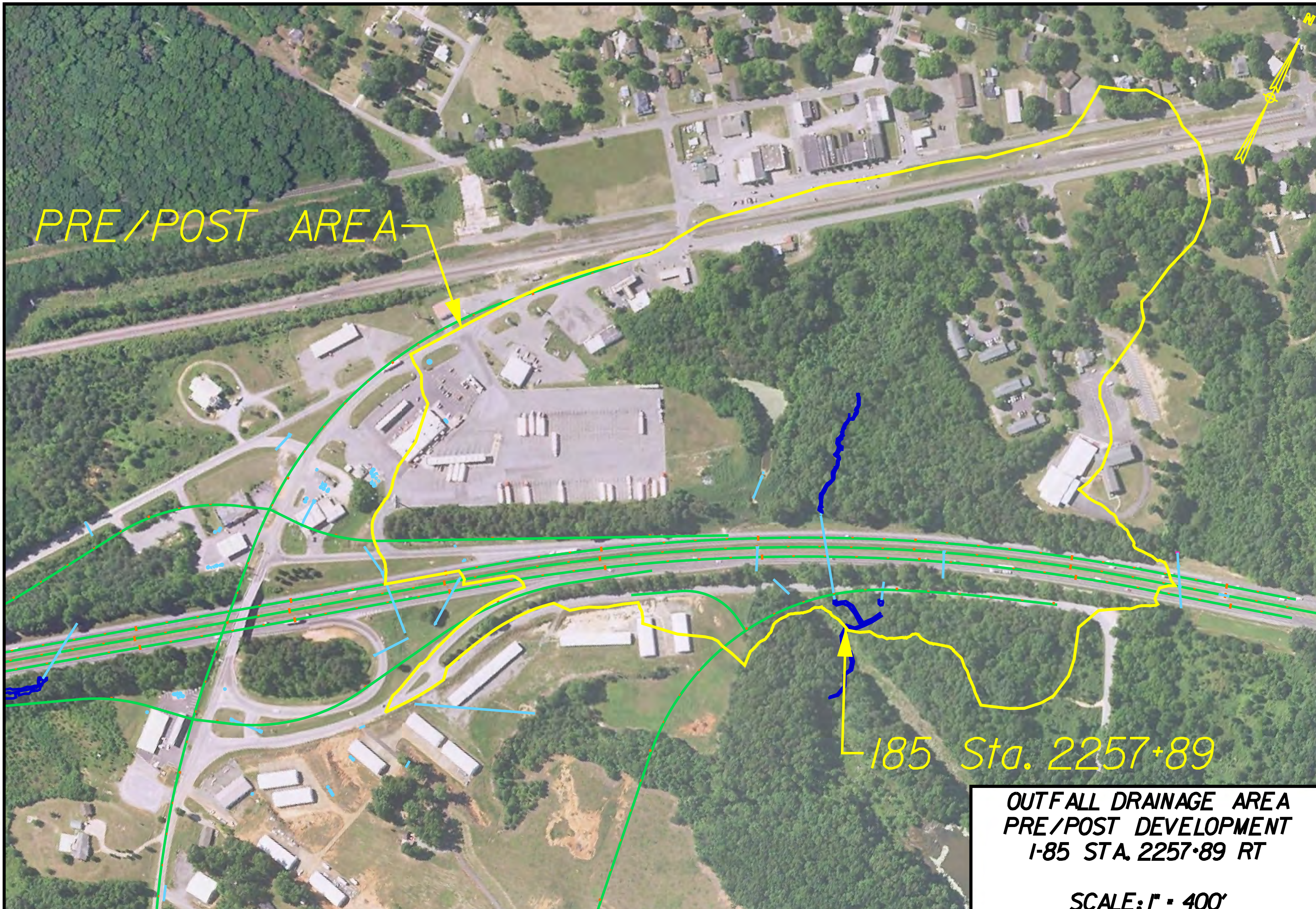
Gaffney

Time of Concentration *(minutes)*	14

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.41	5.432	43.22	**95**
Q_{25}	1.1	0.41	6.243	43.22	**121**
Q_{50}	1.2	0.41	6.880	43.22	**145**
Q_{100}	1.25	0.41	7.505	43.22	**165**

OUTFALL 2257+89 RT

This outfall receives runoff from offsite areas, the Exit 106 interchange, and the I-85 mainline from Sta. 2245+00 to Sta. 2268+00. The drainage area is approximately 73 acres and is characterized by roadway pavement, grassed medians, sparse residential tracts, business areas, and dense wooded areas. The area also includes a 0.5-acre impoundment. Roadway runoff is routed to the outfall through multiple existing storm sewer systems; while offsite runoff is routed under I-85 via an existing 48” R.C pipe. Discharge from this outfall is released into a heavily wooded area and is then conveyed to Mill Creek. The I-85 improvements will increase imperviousness due to the proposed median paving along the mainline and the reconfiguration of the Exit 106 interchange. As a result, there will be a negligible increase in discharge of 7 cfs from pre to post development conditions for the 10-year design storm. The increased runoff to the undeveloped area will have no adverse downstream impact and detention is not recommended.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2257+89 RT

SCALE: 1" = 400'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	21.20	0.90	
Rolling, 2%-10%	Gravel Pavements	2.69	0.55	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	7.36	0.30	0.41
Rolling, 2%-10%	Grass Shoulders	0.81	0.25	
Rolling, 2%-10%	Unimproved Areas	10.98	0.20	
Rolling, 2%-10%	Woodland & Forest	29.75	0.15	
		72.79		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusl	6.33%	100	0.8				0.364
Shallow Concentrated	Unpaved	6.33%	642					0.044
Shallow Concentrated								
Channel 1								
Channel 2								
Total			742				0.5053	0.408

Gaffney

Time of Concentration *(minutes)*	25

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.41	4.372	72.79	**130**
Q_{25}	1.1	0.41	4.996	72.79	**163**
Q_{50}	1.2	0.41	5.482	72.79	**195**
Q_{100}	1.25	0.41	5.956	72.79	**221**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	22.82	0.90	
Rolling, 2%-10%	Gravel Pavements	2.69	0.55	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	12.16	0.30	0.43
Rolling, 2%-10%	Grass Shoulders	0.52	0.25	
Rolling, 2%-10%	Unimproved Areas	9.23	0.20	
Rolling, 2%-10%	Woodland & Forest	25.37	0.15	
		72.79		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusl	6.33%	100	0.8				0.364
Shallow Concentrated	Unpaved	6.33%	642					0.044
Shallow Concentrated								
Channel 1								
Channel 2								
Total			742				0.5053	0.408

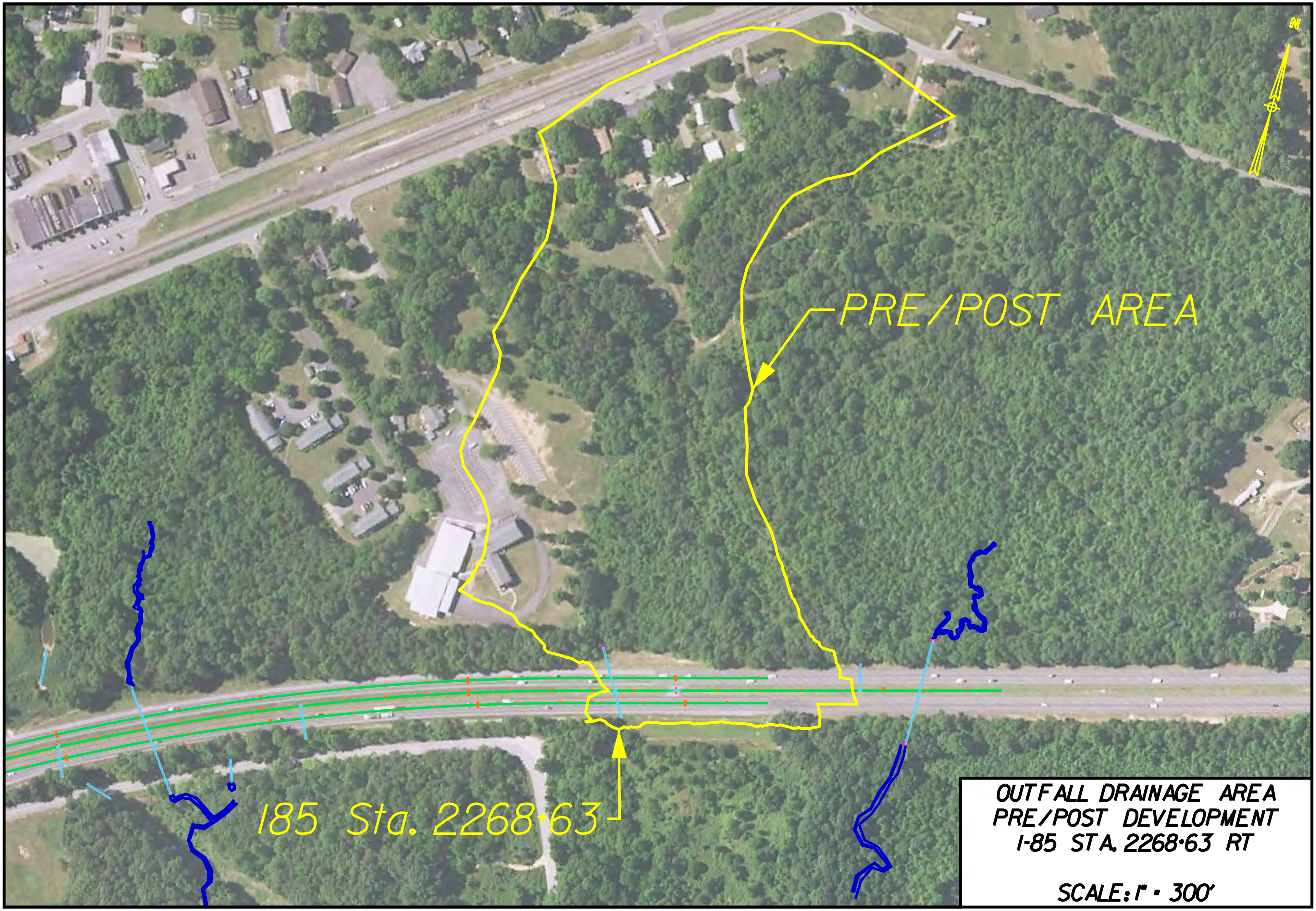
Gaffney

Time of Concentration *(minutes)*	25

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.43	4.372	72.79	**137**
Q_{25}	1.1	0.43	4.996	72.79	**173**
Q_{50}	1.2	0.43	5.482	72.79	**207**
Q_{100}	1.25	0.43	5.956	72.79	**234**

OUTFALL 2268+63 RT

This outfall receives runoff from offsite areas as well as roadway discharge Sta. 2268+00 to Sta. 2274+50. The drainage area is approximately 25 acres and encompasses roadway pavement, grassed medians, sparse residential tracts, business areas, and dense wooded areas. Offsite and roadway runoff is routed under I-85 to the outfall via an existing storm sewer system. Discharge from this outfall is released into a heavily wooded area and is then conveyed to Mill Creek. There will be no change in discharge from pre to post development conditions for the 10-year design storm. Therefore, the proposed I-85 improvements will have no adverse downstream impact.



OUTFALL DRAINAGE AREA
PRE/POST DEVELOPMENT
I-85 STA. 2268+63 RT

SCALE: 1" = 300'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	2.54	0.90	
Rolling, 2%-10%	Gravel Pavements	0.08	0.55	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	1.49	0.30	0.28
Rolling, 2%-10%	Meadows & Pasture Land	4.94	0.30	
Rolling, 2%-10%	Grass Shoulders	2.21	0.25	
Rolling, 2%-10%	Woodland & Forest	13.48	0.15	
		24.74		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	3.58%	100	0.8				0.457
Shallow Concentrated	Unpaved	3.58%	1658					0.151
Shallow Concentrated								
Channel 1								
Channel 2								
Total			1758				0.8034	0.608

Gaffney

Time of Concentration *(minutes)*	37

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.28	3.603	24.74	**25**
Q_{25}	1.1	0.28	4.102	24.74	**31**
Q_{50}	1.2	0.28	4.489	24.74	**37**
Q_{100}	1.25	0.28	4.864	24.74	**42**

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	2.92	0.90	
Rolling, 2%-10%	Gravel Pavements	0.08	0.55	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	1.11	0.30	0.29
Rolling, 2%-10%	Meadows & Pasture Land	4.94	0.30	
Rolling, 2%-10%	Grass Shoulders	2.21	0.25	
Rolling, 2%-10%	Woodland & Forest	13.48	0.15	
		24.74		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	3.58%	100	0.8				0.457
Shallow Concentrated	Unpaved	3.58%	1658					0.151
Shallow Concentrated								
Channel 1								
Channel 2								
Total			1758				0.8034	0.608

Gaffney

Time of Concentration *(minutes)*	37

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.29	3.603	24.74	**25**
Q_{25}	1.1	0.29	4.102	24.74	**32**
Q_{50}	1.2	0.29	4.489	24.74	**38**
Q_{100}	1.25	0.29	4.864	24.74	**43**

4.2 Cross-Line Analysis

Cross-lines were analyzed according to the SCDOT's *Requirements for Hydraulic Design Studies*, dated May 26, 2009. All existing cross-lines along I-85 were analyzed for the 50-year design storms. Frontage road cross-lines were analyzed for 25-year design storms. All cross-lines were analyzed for performance during 100-year design storms. The Federal Highway Administration's HY-8 program was used to evaluate the performance of the existing cross-lines, and GEOPAK Drainage was used to analyze existing cross-line drainage systems. No indications of median drainage surcharging were identified. The hydrologic and hydraulic analysis for the project cross-lines are found in this section, and is summarized in *Table 4.2* - The Culvert Assessment Summary Table.

<u>HY-8 Analysis</u>

Tailwater (TW) conditions for the culverts were established within HY-8 by inputting the receiving channel characteristics (cross-sectional geometry, *n*-value, and grade).

Within the project area existing roadway culverts are frequently constructed in series with short ditch sections connecting the upstream and downstream culverts. In order to model the impact of the downstream (DS) structure on the upstream (US) culvert's performance the downstream culvert was analyzed first to establish headwater (HW) elevations for the design events. The calculated HW depths were assumed, due to the short length of connecting channel, to be constant through the channel. Therefore, US TW elevations were able to be estimated by simply adding the DS HW depth to the US culvert's outlet elevation thereby establishing a TW rating curve for the US culvert.

<u>GEOPAK Analysis</u>

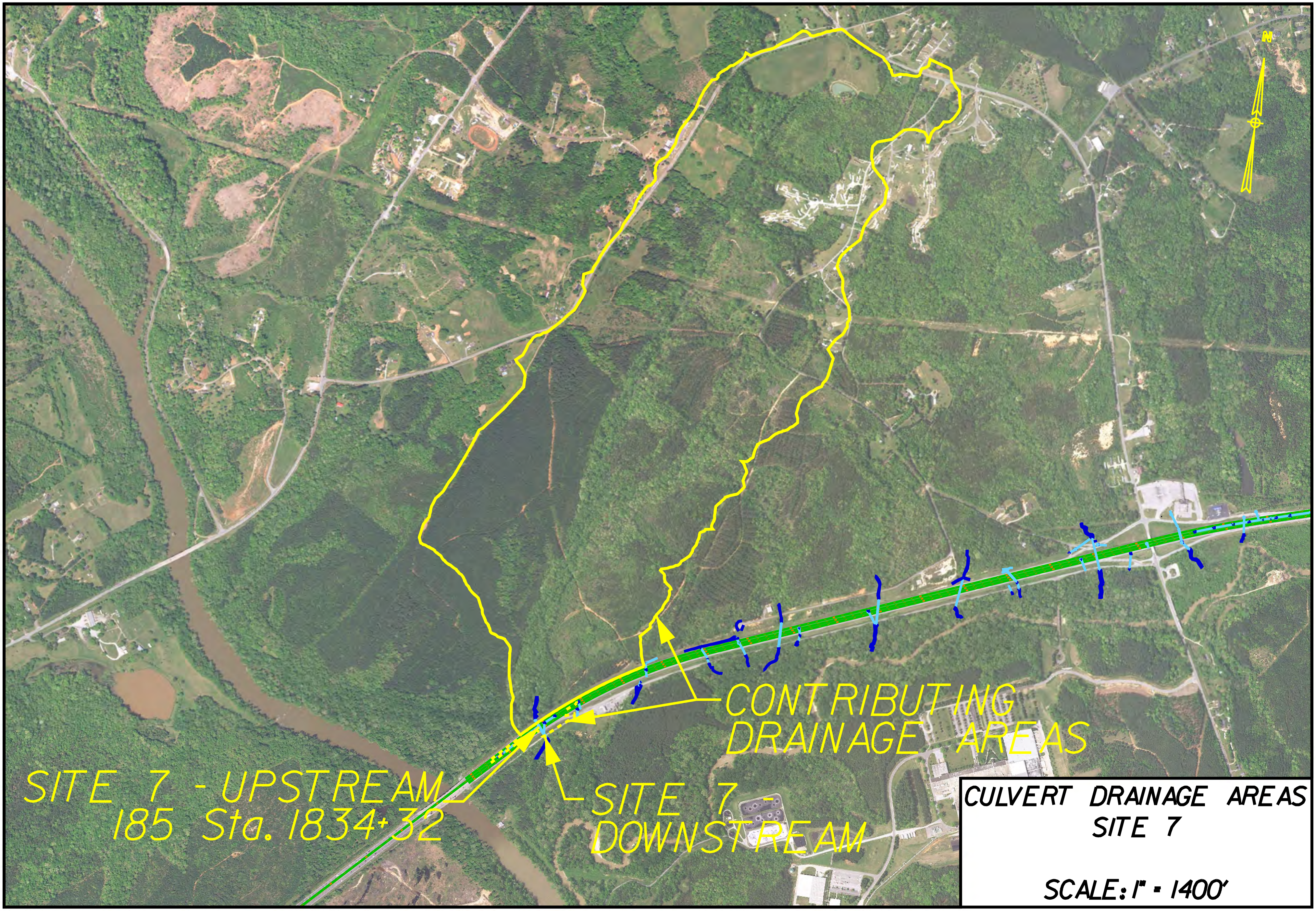
Tailwater conditions for cross-lines that are part of a larger closed storm sewer system were established by modeling the downstream receiving channel as a ditch section within GEOPAK drainage. The receiving channel's characteristics (cross-sectional geometry, *n*-value, and grade) taken into account when modeling the receiving channel.

Table 4.2 - Culvert Assessment Summary Table

Site ID	Location	Video Pipe Inspection Pipe ID	Road/ Classification	Design Year (25-Year/50-Year)	Stream Name	Drainage Structure	Structure Height (Ft)	Existing Invert (Inlet)	Existing Invert (Outlet)	Cross-Line Drainage Area (Acre)	Design Flow (cfs)	100-Year Flow (cfs)	Design Storm			100-Year Storm			Recommended Outlet Protection Pad Dimensions (L x W)	Hydraulic Analysis Notes	Visual Inspection Notes	Recommendation
													Calculated Headwater	Headwater Depth (From Inlet)	Hw/D	Calculated Headwater	Headwater Depth (From Inlet)	Hw/D				
Site 7	1834+32		I-85 / Primary	50-Year Storm	Unnamed tributary to Buffalo Creek	8' x 8' RCBC	8.0	558.33	557.79	458.11	637	811	573.80	15.47	1.9	575.98	17.65	2.2	NA		Sedimentation inside of culvert. Erosion along slopes of infall.	Clean culvert and stabilize infall channel. Undersized frontage road downstream culvert; 8' x 8' will perform adequately with enlargement of downstream culvert. Improve downstream culvert. See calculations for *Site 7 - Improved Downstream Culvert* .
Site 8	1839+52		I-85 / Primary			18" RCP	1.5	581.11	578.15										NA		Pipe outlet/outfall 60% blocked with sediment and debris.	Clean pipe. Clean outfall.
Site 9	1847+93		I-85 / Primary			30" RCP	2.5	605.48	602.46										NA		Pipe outlet/outfall 70% blocked with sediment, debris, and vegetation.	Clean pipe. Clean outfall.
Site 10	1854+69		I-85 / Primary			18" RCP	1.5	608.67	590.70										NA		U/S heavily vegetated with erosion. D/S outlet joint separated.	Clean and stabilize U/S. Stabilize outfall and repair joint separation.
Site 11	1854+58		I-85 / Primary			NA	NA	NA	NA										NA		Not surveyed, unable to locate.	NA
Site 12	1858+83		I-85 / Primary			24" RCP	2.0	591.68	559.93										NA		US/ heavily vegetated. D/S scour hole with joint separation.	Clean and stabilize U/S. Stabilize outfall and repair joint separation.
Site 13	1863+58		I-85 / Primary	50-Year Storm	Buffalo Creek	4' x 6' RCBC	6.0	567.36	565.35	57.24	62	70	570.68	3.32	0.6	570.95	3.59	0.6	25' x 29'		Upstream heavily vegetated but channel is clear. Scour at culvert exit; and slight erosion along downstream channel.	Repair downstream scour hole and construct energy dissipator.
Site 14	1865+79		I-85 / Primary			18" RCP	1.5	590.84	560.18										NA			None.
Site 15	1873+79		I-85 / Primary			18" RCP	1.5	581.80	557.78										NA		D/S joint separation and scour.	Stabilize outfall and repair joint separation.
Site 16	1874+88		I-85 / Primary	50-Year Storm	Buffalo Creek	4' x 6' RCBC	6.0	562.81	557.97	64.57	98	111	566.85	4.04	0.7	567.21	4.40	0.7	25' x 29'		Slight scour at culvert exit; otherwise stable outfall.	Repair downstream scour hole and construct energy dissipator.
Site 17	1884+43		I-85 / Primary			30" RCP	2.5	590.79	570.76										NA		U/S vegetated. D/S blocked by debris.	Clean U/S. Clear D/S debris.
Site 18	1890+37		I-85 / Primary	50-Year Storm	Buffalo Creek	72" RCP TO 4' x 6' RCBC	6.0	603.69	596.80	2.37	4	5	604.29	0.60	0.10	604.39	0.70	0.1	NA	Culvert analyzed as 72" RCP and 4' x 6' RCBC. 72" RCP produced the highest headwater elevation and is listed in the table. Hw/D compares the listed headwater elevation to 72" inlet height.	D/S vegetated.	Clear D/S vegetation.
Site 19	1898+40		I-85 / Primary			18" RCP	1.5	588.39	NA										NA		D/S scour hole, channel erosion, and joint separation.	Stabilize outfall channel, construct energy dissipator, and repair joint separation.
Site 20	1900+14		I-85 / Primary	50-Year Storm	Unnamed tributary to Buffalo Creek	7' x 7' RCBC	7.0	563.34	560.24	320.65	606	758	573.92	10.58	1.5	577.35	14.01	2.0	NA		Upstream channel not aligned with culvert; large tree located in front of headwall. Erosion down slopes from roadway runoff draining to inlet and slight scour around inlet headwall.	Clear infall; Stabilize roadway side slopes and protect with riprap. Retain culvert with no increase in discharge to the culvert.
Site 21	1909+86		I-85 / Primary	50-Year Storm	Buffalo Creek	4' x 6' RCBC	6.0	571.13	562.51	94.14	119	135	575.70	4.57	0.8	576.11	4.98	0.8	25' x 29'		Upstream heavily vegetated. Large scour hole at culvert exit.	Clear upstream vegetation. Repair downstream scour hole and construct energy dissipator.
Site 22	1916+38		I-85 / Primary	50-Year Storm	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not surveyed. Analysis not completed.	NA	NA
Site 23	1917+16		I-85 / Primary			18" RCP	1.5	578.05	564.45										NA	Survey is inconsistent with field observation.	D/S outlet not surveyed, unable to locate.	NA
Site 24	1945+56		I-85 / Primary	50-Year Storm	Unnamed tributary to Buffalo Creek	12' x 10' RCBC	10.0	569.62	557.36	955	839	984	577.35	7.73	0.8	578.31	8.69	0.9	77' x 88'		Downstream channel eroded along first outer curve of creek.	Stabilize outfall channel and construct energy dissipator.
Site 25	1958+06		I-85 / Primary			18" RCP	1.5	577.12	574.97										NA		Not surveyed, unable to locate.	NA
Site 26	1966+55		I-85 / Primary	50-Year Storm	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not surveyed. Analysis not completed.	NA	NA
Site 27	1969+45		I-85 / Primary	50-Year Storm	Unnamed tributary to Buffalo Creek	4' x 6' RCBC	6.0	589.22	585.40	0.96	4.5	5.1	589.79	0.57	0.1	589.84	0.62	0.1	NA	Very little flow to culvert.	Upstream heavily vegetated.	None.
Site 28	1973+13		I-85 / Primary			18" RCP	1.5	608.69	607.51										NA		D/S scour hole with debris and vegetation.	Clear D/S vegetation and debris, stabilize channel.
Site 29	1976+02		I-85 / Primary			24" RCP	2.0	618.55	611.54										NA		U/S heavily vegetated, Type 9 CB within apparent Clear Zone. D/S scour hole and debris filled channel.	Clear U/S vegetation, Convert Type 9 to DI Type 112. Repair D/S scour hole, clear and stabilize outfall.
Site 30	1982+48		I-85 / Primary			18" RCP	1.5	646.47	634.16										NA		D/S outfall overgrown.	Clean outfall.
Site 31	1989+06		I-85 / Primary			24" RCP	2.0	665.67	660.36										NA		D/S scour hole and joint separation.	Stabilize outfall and repair joint separation.
Site 32	1998+61		I-85 / Primary			18" RCP	1.5	692.63	684.18										NA		Outfall overgrown.	Clear overgrowth.
Site 33	2006+38		I-85 / Primary			18" RCP	1.5	714.50	709.03										NA		D/S scour hole and joint separation.	Stabilize outfall and repair joint separation.
Site 34	2010+43		I-85 / Primary			18" RCP	1.5	726.27	709.03										NA		D/S pipe end 20% blocked, outfall overgrown.	Clear pipe and clean outfall.
Site 35	2015+03		I-85 / Primary			18" RCP	1.5	737.12	735.43										NA		D/S pipe end 40% blocked.	Clear pipe and clean outfall.
Site 36	2018+40		I-85 / Primary	50-Year Storm	Unnamed tributary to Buffalo Creek	36" RCP	3.0	NA	715.35	73.97	134	151	NA	NA	NA	NA	NA	NA	NA	Insufficient survey. Analysis not completed.	NA	NA
Site 37	2022+99		I-85 / Primary			18" RCP	1.5	758.93	758.11										NA			None.
Site 38A	2029+09		S-11-352 / Secondary	25-Year Storm	Unnamed tributary to Buffalo Creek	42" RCP	3.5	766.94	764.62	11.09	25	34	769.08	2.14	0.6	769.81	2.87	0.8	NA	Site 38A is upstream to Site 38B.	Wooded but stable. Downstream heavily vegetated.	Clear vegetation; Stabilize channel.
Site 38B	2029+09		I-85 / Primary	50-Year Storm	Unnamed tributary to Buffalo Creek	42" RCP	3.5	758.28	740.11	23.62	76	86	762.56	4.28	1.2	763.10	4.82	1.4	NA		Upstream heavily vegetated. Very large erosion downstream; downstream paved channel has failed (~500 yards away) due to channel overtopping.	Clean infall and stabilize outfall channel. Retain culvert with no increase in discharge to the culvert.
Site 39	2034+99		I-85 / Primary			NA	NA	NA	NA										NA		Not surveyed, unable to locate.	NA
Site 40	2040+58		I-85 / Primary			30" RCP	2.5	809.07	802.61										NA		See Site 41.	None.

Table 4.2 - Culvert Assessment Summary Table

													Design Storm			100-Year Storm						
Site ID	Location	Video Pipe Inspection Pipe ID	Road/ Classification	Design Year (25-Year/50-Year)	Stream Name	Drainage Structure	Structure Height (Ft)	Existing Invert (Inlet)	Existing Invert (Outlet)	Cross-Line Drainage Area (Acre)	Design Flow (cfs)	100-Year Flow (cfs)	Calculated Headwater	Headwater Depth (From Inlet)	Hw/D	Calculated Headwater	Headwater Depth (From Inlet)	Hw/D	Recommended Outlet Protection Pad Dimensions (L x W)	Hydraulic Analysis Notes	Visual Inspection Notes	Recommendation
Site 41	2040+58		I-85 / Primary			36" RCP	3.0	802.41	801.27										NA		D/S scour hole.	Stabilize outfall.
Site 42	2042+00		I-85 / Primary			NA	NA	NA	NA										NA		U/S overgrown. D/S pipe blocked with sediment.	Clean infall. Clear D/S pipe and outfall.
Site 43	2045+19		I-85 / Primary			NA	NA	NA	NA										NA		Not surveyed, unable to locate.	NA
Site 44	2055+19		I-85 / Primary			24" RCP	2.0	842.63	839.36										NA		Median inlet is heavily silted and has tree growing in it. D/S pipe is 80% blocked with no evident outfall channel.	Clean system and reestablish outfall.
Site 45	2058+62		I-85 / Primary			18" RCP	1.5	834.00	831.51										NA		D/S pipe blocked with sediment and debris. Poorly defined outfall channel.	Clean pipe and outfall.
Site 46	2064+48		I-85 / Primary	50-Year Storm	Unnamed tributary to Bee Branch	60" RCP TO 4' x 6' RCBC	5.0	779.33	766.72	91.24	179	203	786.00	6.67	1.3	786.71	7.38	1.5	NA	Culvert analyzed as 60" RCP and 4' x 6' RCBC. 4' x 6' RCBC produced the highest headwater elevation and is listed in the table. Hw/D compares the listed headwater elevation to 60" inlet height.	Downstream culvert is 50% filled with sediment. Sediment build up along outfall.	Clean downstream culvert and outfall. Stabilize downstream channel. Remove 60" RCP and extend 4' x 6' RCBC. 4' x 6' RCBC Hw/D = 1.10; which will then meet design standards.
Site 47	2066+16		I-85 / Primary			18" RCP	1.5	802.82	799.06										NA		Outfall is vegetated.	Clear outfall.
Site 48	2075+51		I-85 / Primary			18" RCP	1.5	776.14	771.31										NA		Outfall heavily eroded with joint separation.	Stabilize outfall and repair joint separation.
Site 49	2076+39		I-85 / Primary	50-Year Storm	Unnamed tributary to Bee Branch	4' x 6' RCBC	6.0	751.18	744.32	97.43	172	195	757.12	5.94	1.0	757.73	6.55	1.1	25' x 29'		Slight scour around culvert exit; but stable outfall channel.	Repair scour hole and construct energy dissipator.
Site 50	2082+58		I-85 / Primary	50-Year Storm	Unnamed tributary to Bee Branch	4' x 4' RCBC	4.0	771.72	770.57	47.20	103	116	776.03	4.31	1.1	776.47	4.75	1.2	21' x 26'		U/S large ponding area. Heavily vegetated. Side slope erosion. D/S scour hole, heavily vegetated.	Remove vegetation from upstream and downstream channels. Stabilize upstream culvert entrance with riprap. Repair downstream scour hole and construct energy dissipator.
Site 51	2095+08		I-85 / Primary	50-Year Storm	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not surveyed. Analysis not completed.	NA	NA
Site 52	2097+13		I-85 / Primary	50-Year Storm	Unnamed tributary to Bee Branch	36" RCP	3.0	821.15	787.08	23.18	62	70	823.79	2.64	0.9	824.00	2.85	1.0	18' x 21'	Analyzed with geopak drainage.	Ponded water downstream of pipe from scour. Heavy vegetation along downstream channel.	Clean outfall. Stabilize downstream outlet and construct energy dissipator.
Site 53	2114+83		I-85 / Primary	50-Year Storm	Unnamed tributary to Bee Branch	6' x 6' RCBC	6.0	763.05	759.61	235.68	477	588	773.74	10.69	1.8	777.17	14.12	2.4	NA		No obvious signs of erosion upstream. Heavy vegetation along edges of channels.	Clear main channel downstream. Retain culvert with no additional discharge to the culvert.
Site 54	2116+00		I-85 / Primary			18" RCP	1.5	795.35	770.13										NA		Outfall heavily vegetated.	Clear outfall.
Site 55	2124+50		I-85 / Primary	50-Year Storm	Unnamed tributary to Bee Branch	4' x 6' RCBC	6.0	805.78	802.24	2.78	8	9	806.53	0.75	0.1	806.59	0.81	0.1	NA		3 culverts; 2 under frontage roads. Paved channels in between culverts; and paved channels draining down from roadway ditches.	Clear vegetation between culverts upstream and downstream.
Site 56	2130+20		I-85 / Primary			30" RCP	2.5	818.09	804.85										NA		D/S heavily vegetated with scour hole.	Clear outfall and stabilize channel.
Site 57	2142+75		I-85 / Primary			24" RCP	2.0	827.64	817.79										NA		D/S pipe end half submerged.	Clear outfall for positive drainage.
Site 58	2147+84		S-11-99 / Secondary			30" RCP	2.5	826.91	824.99										NA	Survey incomplete.	D/S heavily vegetated and blocked.	Clear D/S pipe and outfall.
Site 59	2148+92		I-85 / Primary			18" RCP	1.5	836.00	828.29										NA		D/S heavily vegetated.	Clear outfall.
Site 60	2152+05		I-85 / Primary			30" RCP	2.5	828.59	824.62										NA		D/S vegetated.	None.
Site 61	2163+97		I-85 / Primary			15" RCP	1.3	822.39	816.76										NA		D/S overgrown.	Clear outfall.
Site 62	2164+36		I-85 / Primary	50-Year Storm	Unnamed tributary to Bee Branch	4' x 6' RCBC	6.0	814.29	818.92	24.85	63	72	820.44	6.15	1.0	820.49	6.20	1.0	NA	Culvert inverted. However, culvert does meet Hw/D requirements.	Sediment buildup [~ 6" to 1'] on inside of culvert. Tree growing through headwall weep hole.	Retain culvert with no additional discharge to the culvert. Clean culvert; Clean infall and outfall.
Site 63	2170+41		I-85 / Primary	50-Year Storm	Unnamed tributary to Bee Branch	36" RCP	3.0	818.60	817.38	21.67	32	36	821.27	2.67	0.9	821.47	2.87	1.0	NA		Downstream surrounded with heavy vegetation.	Clear outfall to R/W.
Site 64	2174+88		I-85 / Primary			30" RCP	2.5	820.46	820.76										NA	Survey shows inverted inlet and outlet elevations.	Slight D/S erosion and joint separation.	Stabilize outfall and repair joint separation.
Site 65	2204+44		I-85 / Primary	50-Year Storm	Unnamed tributary to Jumping Branch	36" RCP	3.0	811.53	804.97	27.18	40	45	814.58	3.05	1.0	814.85	3.32	1.1	15' x 19'		Excessive downstream scour resulting in joint separation.	Stabilize upstream channel. Repair scour hole and joint separation downstream. Construct energy dissipator.
Site 66	2218+37		I-85 / Primary	50-Year Storm	Unnamed tributary to Jumping Branch	36" RCP	3.0	797.19	789.14	36.69	59	67	801.41	4.22	1.4	802.04	4.85	1.6	18' x 21'		36" RCP entrance filled with debris. Large scour hole downstream of pipe.	Clean infall and stabilize pipe entrance with riprap. Clean existing pipe; retain pipe with no additional discharge to inlet of culvert. Repair scour hole, construct energy dissipator, and stabilize downstream channel.
Site 67	2218+40		I-85 / Primary			18" RCP	1.5	808.75	793.70										NA		Paved oufall channel eroding behind top of channel.	Stabilize outfall channel.
Site 68	2223+93		I-85 / Primary	50-Year Storm	Unnamed tributary to Jumping Branch	36" RCP	3.0	804.82	796.57	19.61	23	26	807.00	2.18	0.7	807.16	2.34	0.8	15' x 19'		Pipe entrance partially blocked by sediment. Downstream channel eroded.	Clean infall to R/W. Repair downstream scour hole and construct energy dissipator.
Site 69	2226+83		I-85 / Primary			18" RCP	1.5	821.31	809.50										NA		D/S channel eroded, joint separation.	Stabilize outfall and repair joint separation.
Site 70	2232+55		I-85 / Primary			24" RCP	2.0	833.50	827.34										NA		D/S scour hole and channel erosion.	Stabilize outfall.
Site 71	2243+23		I-85 / Primary			30" RCP	2.5	849.32	835.81										NA		Survey inconsistent with field observation.	None.



CULVERT DRAINAGE AREAS
SITE 7

SCALE: 1" = 1400'

SCS Analysis

HSG	Land Use	Acres	CN
B	Streets and roads: Paved open ditches	4.71	89.00
B	Streets and roads: Dirt	3.73	82.00
B	Residential: 1/3 acre	9.86	72.00
B	Pasture,grassland,or range: Good	66.14	61.00
B	Woods:Good	352.42	55.00
A	Pasture,grassland,or range: Good	0.12	39.00
A	Woods:Good	21.13	30.00
		458.11	

Area Weighted CN
56

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	7.38%	100	0.8				0.342
Shallow Concentrated	Unpaved	7.38%	1472					0.093
Shallow Concentrated								
Channel 1		1.53%	7849	0.04	18	13.7295	5.512184	0.396
Channel 2								
Total			9421				3.1483	0.831

Drainage Area (acres)	458.11

Curve Number	**56**
Time of Concentration *(minutes)*	**50**

WinTR-55 Current Data Description

--- Identification Data ---

User:	CECS	Date:	12/14/2016
Project:	I-85 Improvement Proj DB Prep	Units:	English
SubTitle:	SITE 7 - UPSTREAM	Areal Units:	Acres
State:	South Carolina		
County:	Cherokee_NOAA_B		

Filename: S:\Proj\2014\6114 I-85 mm 96-106\Design\Project PIN Number\Drainage\Calculations\CULVERT - POST

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
SITE 7		Outlet	458.11	56	0.833

Total area: 458.11 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
3.73	4.68	5.44	6.49	7.35	8.24	3.1

Storm Data Source: Cherokee_NOAA_B County, SC (NRCS)
Rainfall Distribution Type: Type NO_B
Dimensionless Unit Hydrograph: <standard>

SITE 7 - UPSTREAM

Cherokee_NOAA_B County, South Carolina

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
SUBAREAS				
SITE 7	303.95	479.04	636.48	810.64
REACHES				
OUTLET	303.95	479.04	636.48	810.64

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 7 - EXISTING UPSTREAM

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 7 - EXISTING UPSTREAM Discharge (cfs)	Roadway Discharge (cfs)	Iterations
573.80	50 year	637.00	637.00	0.00	1
575.98	100 year	811.00	811.00	0.00	1
581.86	Overtopping	1161.28	1161.28	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 7 - EXISTING UPSTREAM

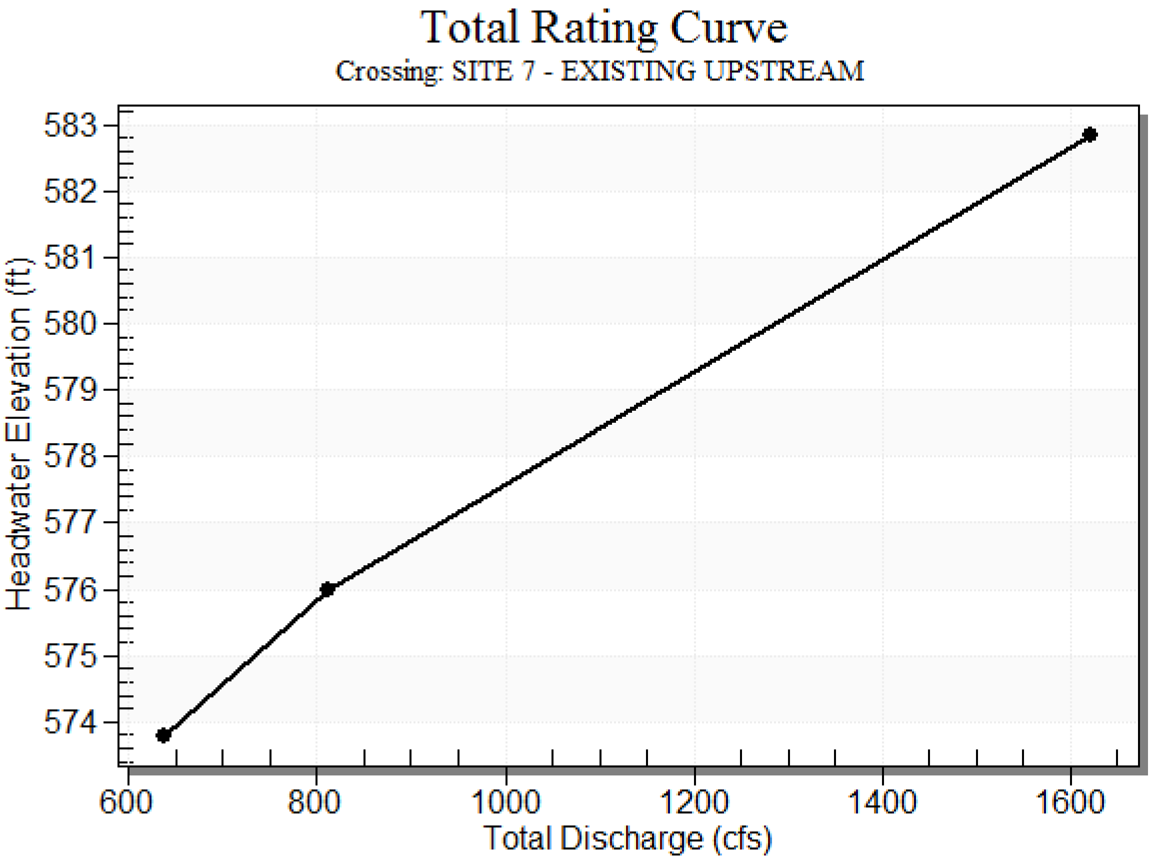


Table 2 - Culvert Summary Table: SITE 7 - EXISTING UPSTREAM

Discharge Names	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)
50 year	637.00	637.00	573.80	9.270	15.469	4-FFf	6.111	5.818	8.000	13.450	9.953
100 year	811.00	811.00	575.98	11.575	17.648	4-FFf	8.000	6.834	8.000	14.040	12.672

****

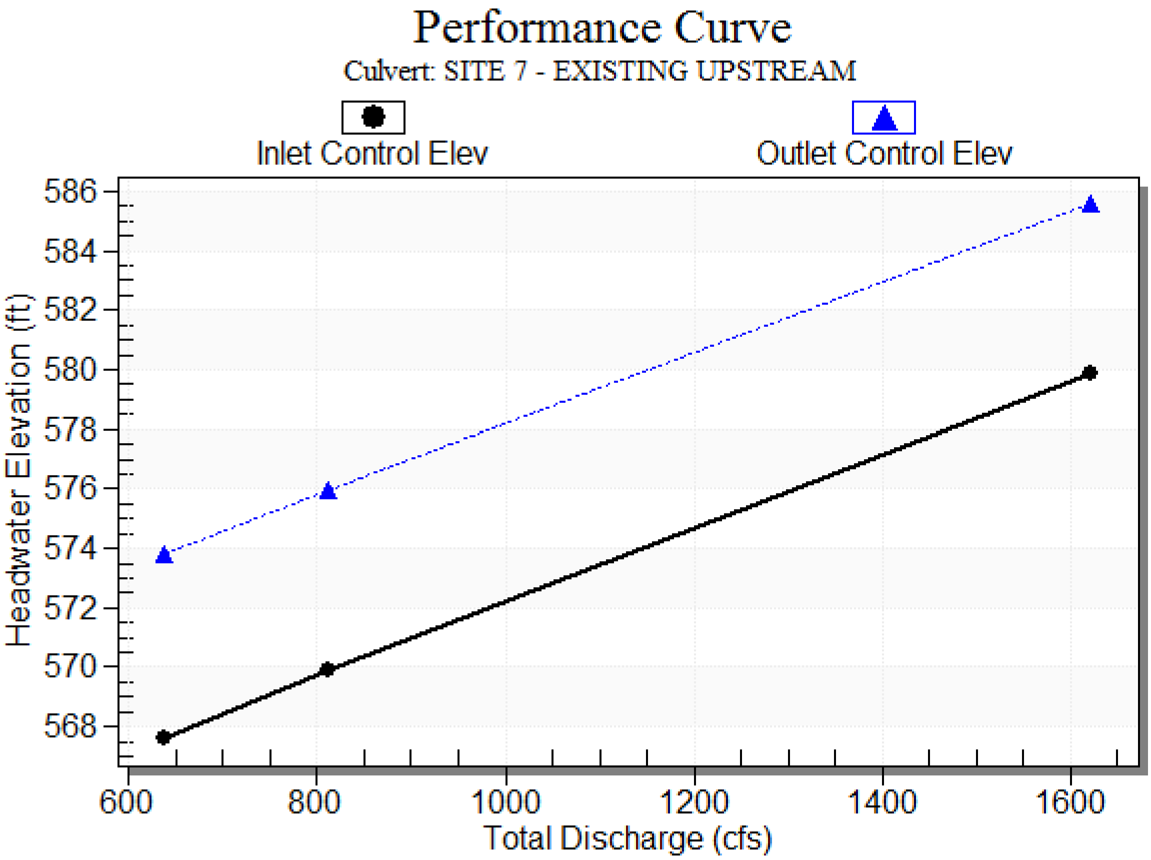
Straight Culvert

Inlet Elevation (invert): 558.33 ft,   Outlet Elevation (invert): 557.79 ft

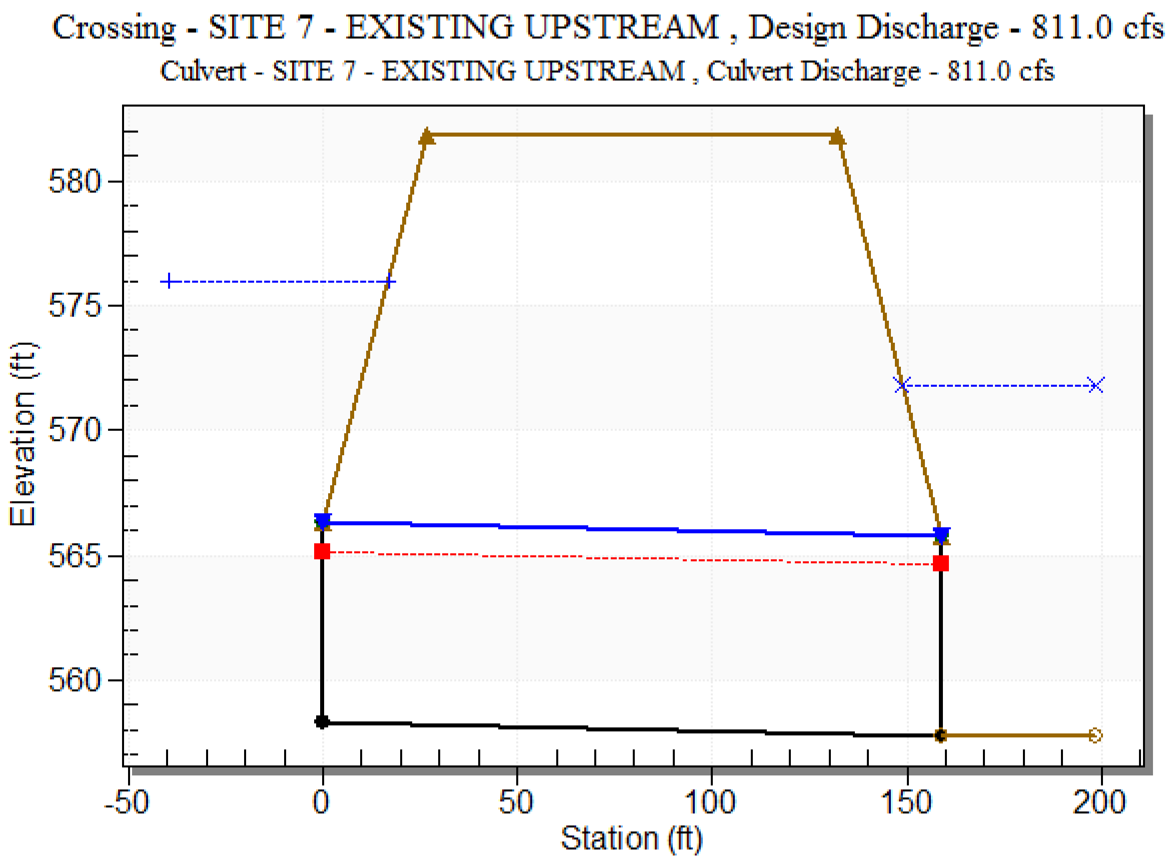
Culvert Length: 159.00 ft,   Culvert Slope: 0.0034

****

Culvert Performance Curve Plot: SITE 7 - EXISTING UPSTREAM



Water Surface Profile Plot for Culvert: SITE 7 - EXISTING UPSTREAM



Site Data - SITE 7 - EXISTING UPSTREAM

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 558.33 ft

Outlet Station: 159.00 ft

Outlet Elevation: 557.79 ft

Number of Barrels: 1

Culvert Data Summary - SITE 7 - EXISTING UPSTREAM

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: Square Edge (30-75º flare) Wingwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: SITE 7 - EXISTING UPSTREAM)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)
637.00	571.24	13.45	0.00
811.00	571.83	14.04	0.00

Tailwater Channel Data - SITE 7 - EXISTING UPSTREAM

Tailwater Channel Option: Enter Rating Curve

Channel Invert Elevation: 557.79 ft

Roadway Data for Crossing: SITE 7 - EXISTING UPSTREAM

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 581.86 ft

Roadway Surface: Paved

Roadway Top Width: 105.00 ft

SITE 7 – Existing Upstream Culvert Tailwater Rating Curve

Return Event	Downstream (DS) Culvert			Upstream (US) Culvert		
	Inlet Elevation	558.01		Outlet Elevation	557.79	
		Headwater			Tailwater	
		Elevation	Depth		Elevation	Depth
50-Year		571.24	13.23		571.02	13.23
100-Year		571.83	13.82		571.61	13.82

* All elevations and depths are in feet.

Note

Due to the lower US outlet elevation, calculated tailwater elevations are below the DS headwater elevation. For this crossing, US tailwater elevations will be held to the same elevations as the DS headwater.

SCS Analysis

HSG	Land Use	Acres	CN
B	Impervious	1.85	98.00
B	Streets and roads: Paved open ditches	4.90	89.00
B	Streets and roads: Dirt	3.73	82.00
B	Residential: 1/3 acre	9.86	72.00
B	Pasture,grassland,or range: Good	66.14	61.00
B	Woods:Good	352.42	55.00
A	Pasture,grassland,or range: Good	0.34	39.00
A	Woods:Good	21.13	30.00
		460.37	

Area Weighted CN
56

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	7.38%	100	0.8				0.342
Shallow Concentrated	Unpaved	7.38%	1472					0.093
Shallow Concentrated								
Channel 1		1.53%	7849	0.04	18	13.7295	5.512184	0.396
Channel 2								
Total			9421				3.1483	0.831

Drainage Area *(acres)*	**460.37**

Curve Number	**56**
Time of Concentration *(minutes)*	**50**

WinTR-55 Current Data Description

--- Identification Data ---

User: CECS Date: 12/14/2016
Project: I-85 Improvement Proj DB Prep Units: English
SubTitle: SITE 7 - DOWNSTREAM Areal Units: Acres
State: South Carolina
County: Cherokee_NOAA_B
Filename: S:\Proj\2014\6114 I-85 mm 96-106\Design\Project PIN Number\Drainage\Calculations\CULVERT - POST

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
SITE 7		Outlet	460.37	56	0.830

Total area: 460.37 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
3.73	4.68	5.44	6.49	7.35	8.24	3.1

Storm Data Source: Cherokee_NOAA_B County, SC (NRCS)
Rainfall Distribution Type: Type NO_B
Dimensionless Unit Hydrograph: <standard>

CECS I-85 Improvement Proj DB Prep

SITE 7 - DOWNSTREAM

Cherokee_NOAA_B County, South Carolina

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
SUBAREAS				
SITE 7	306.18	482.30	640.64	815.97
REACHES				
OUTLET	306.18	482.30	640.64	815.97

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 7 - EXISTING DOWNSTREAM

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 7 - EXISTING DOWNSTREAM Discharge (cfs)	Roadway Discharge (cfs)	Iterations
571.24	50 year	641.00	606.42	34.27	10
571.83	100 year	816.00	585.45	230.05	4
571.00	Overtopping	592.11	592.11	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 7 - EXISTING DOWNSTREAM

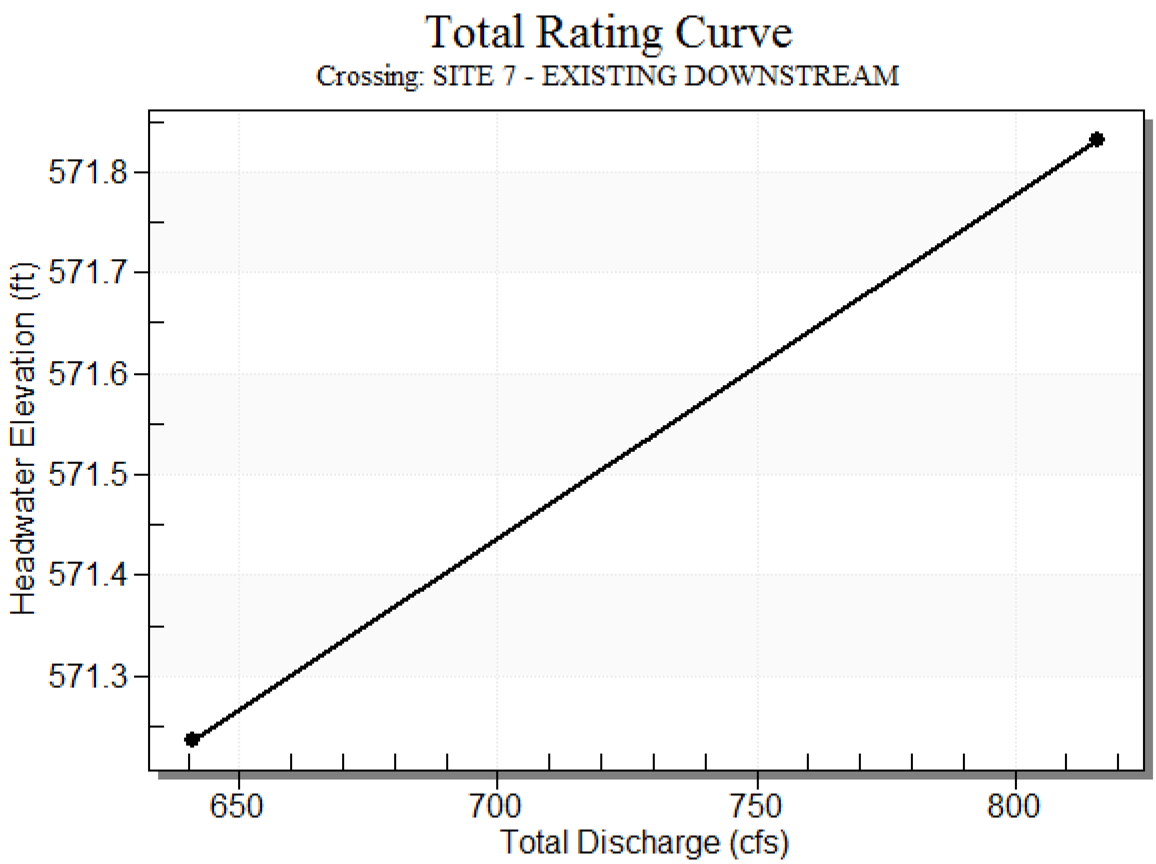


Table 2 - Culvert Summary Table: SITE 7 - EXISTING DOWNSTREAM

Discharge Names	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)
50 year	641.00	606.42	571.24	12.930	13.227	4-FFf	8.000	6.263	8.000	8.315	12.064
100 year	816.00	585.45	571.83	12.417	13.823	4-FFf	8.000	6.159	8.000	9.256	11.647

****

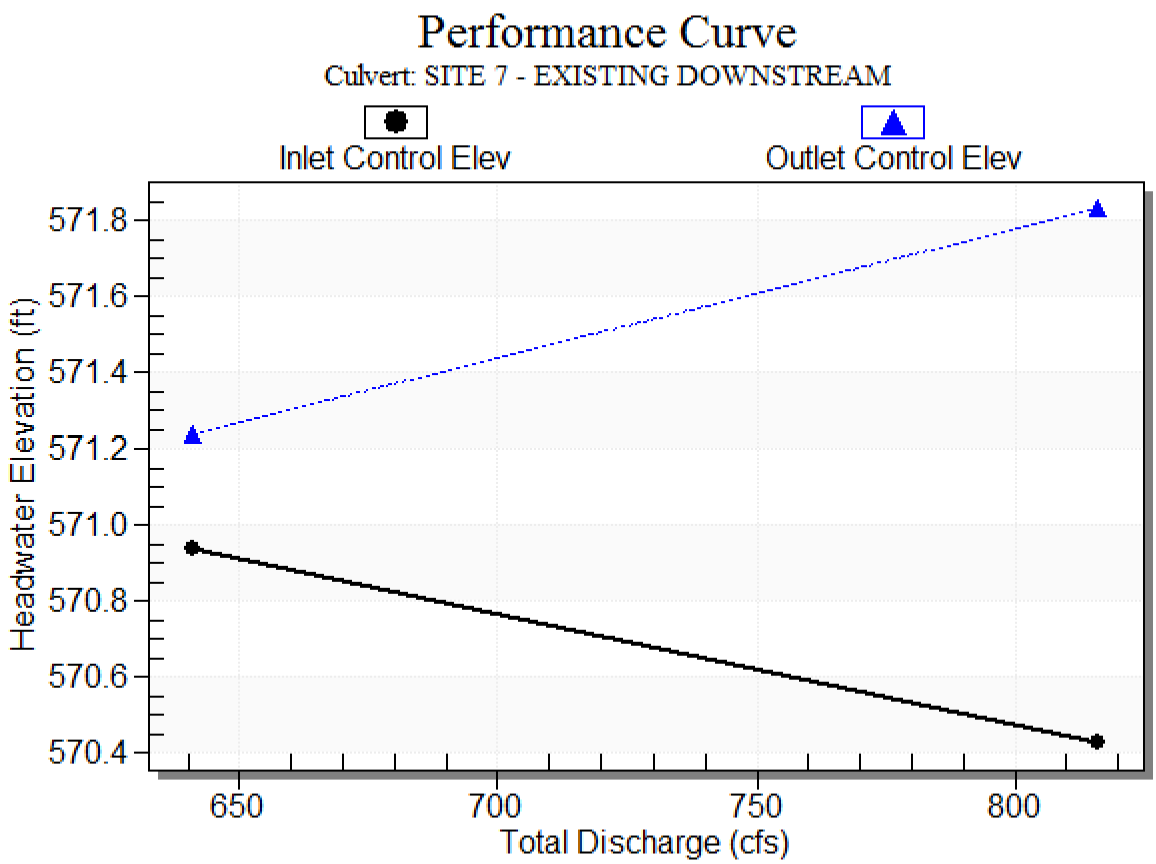
Straight Culvert

Inlet Elevation (invert): 558.01 ft,   Outlet Elevation (invert): 557.85 ft

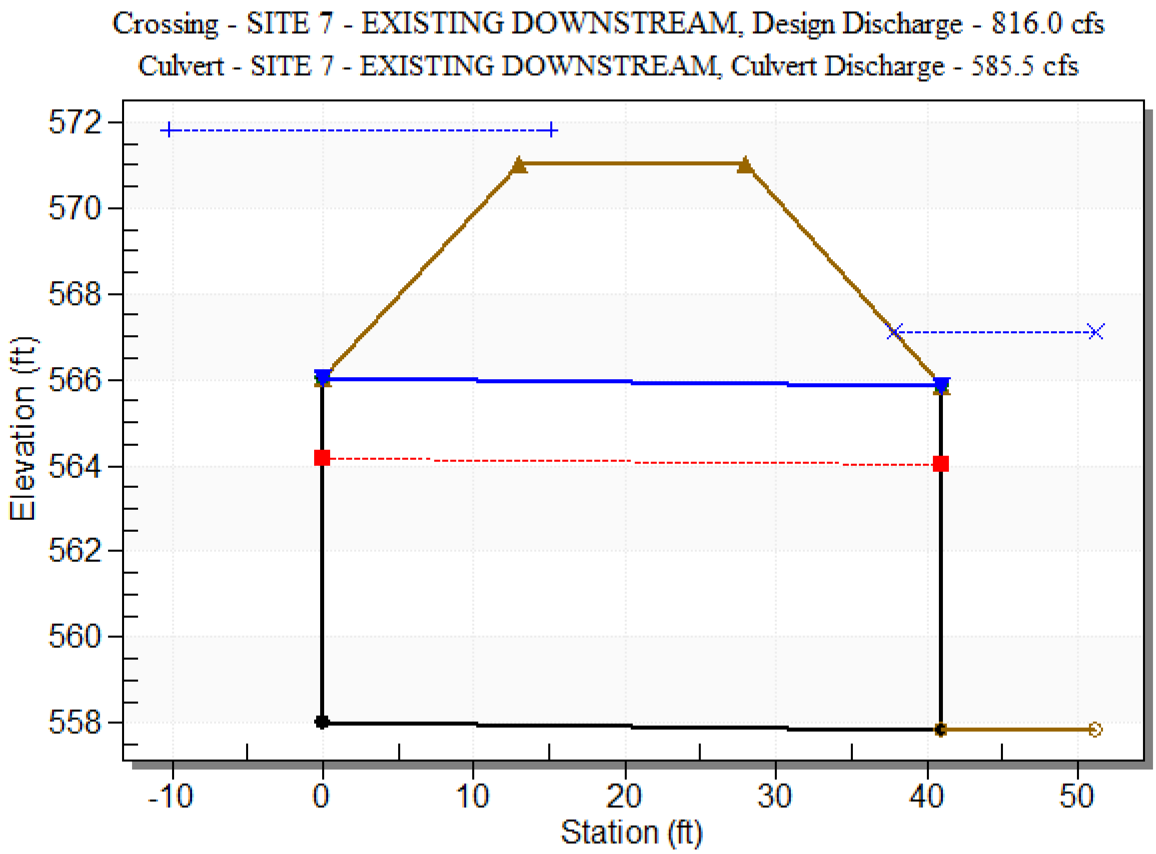
Culvert Length: 41.00 ft,   Culvert Slope: 0.0039

****

Culvert Performance Curve Plot: SITE 7 - EXISTING DOWNSTREAM



Water Surface Profile Plot for Culvert: SITE 7 - EXISTING DOWNSTREAM



Site Data - SITE 7 - EXISTING DOWNSTREAM

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 558.01 ft

Outlet Station: 41.00 ft

Outlet Elevation: 557.85 ft

Number of Barrels: 1

Culvert Data Summary - SITE 7 - EXISTING DOWNSTREAM

Barrel Shape: Circular

Barrel Diameter: 8.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0270

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: SITE 7 - EXISTING DOWNSTREAM)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
641.00	566.16	8.31	4.17	2.13	0.33
816.00	567.11	9.26	4.43	2.37	0.33

Tailwater Channel Data - SITE 7 - EXISTING DOWNSTREAM

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 6.00 ft

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

Channel Slope: 0.0041

Channel Manning's n: 0.0600

Channel Invert Elevation: 557.85 ft

Roadway Data for Crossing: SITE 7 - EXISTING DOWNSTREAM

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 571.00 ft

Roadway Surface: Paved

Roadway Top Width: 15.00 ft

SITE 7 – Improved Downstream Culvert

The existing downstream culvert, located under the frontage road, was found to be undersized. With improvement of the downstream culvert, the upstream 8' x 8' R.C. Box will perform adequately. Improvement of the downstream culvert to an 8'(H) x 10'(W) R.C. Box will provide a Hw/D ratio of 1.2 and is recommended. Supporting documentation for this recommendation can be found in the following pages.

	Culvert Size	Invert Elevation	50 - Year Hw Elev.	Hw/D	100 – Year Hw Elev.	Hw/D
Upstream (With Improved Downstream)	8' x 8' RCBC	558.33	568.19	1.2	571.40	1.6
Improved Downstream	8' x 10' RCBC	557.74	565.58	1.0	567.20	1.2

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 7 - UPSTREAM (DOWNSTREAM IMPROVED)

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 7 - UPSTREAM (DOWNSTREAM IMPROVED) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
568.19	50 year	637.00	637.00	0.00	1
571.40	100 year	811.00	811.00	0.00	1
581.86	Overtopping	1203.56	1203.56	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 7 - UPSTREAM (DOWNSTREAM IMPROVED)

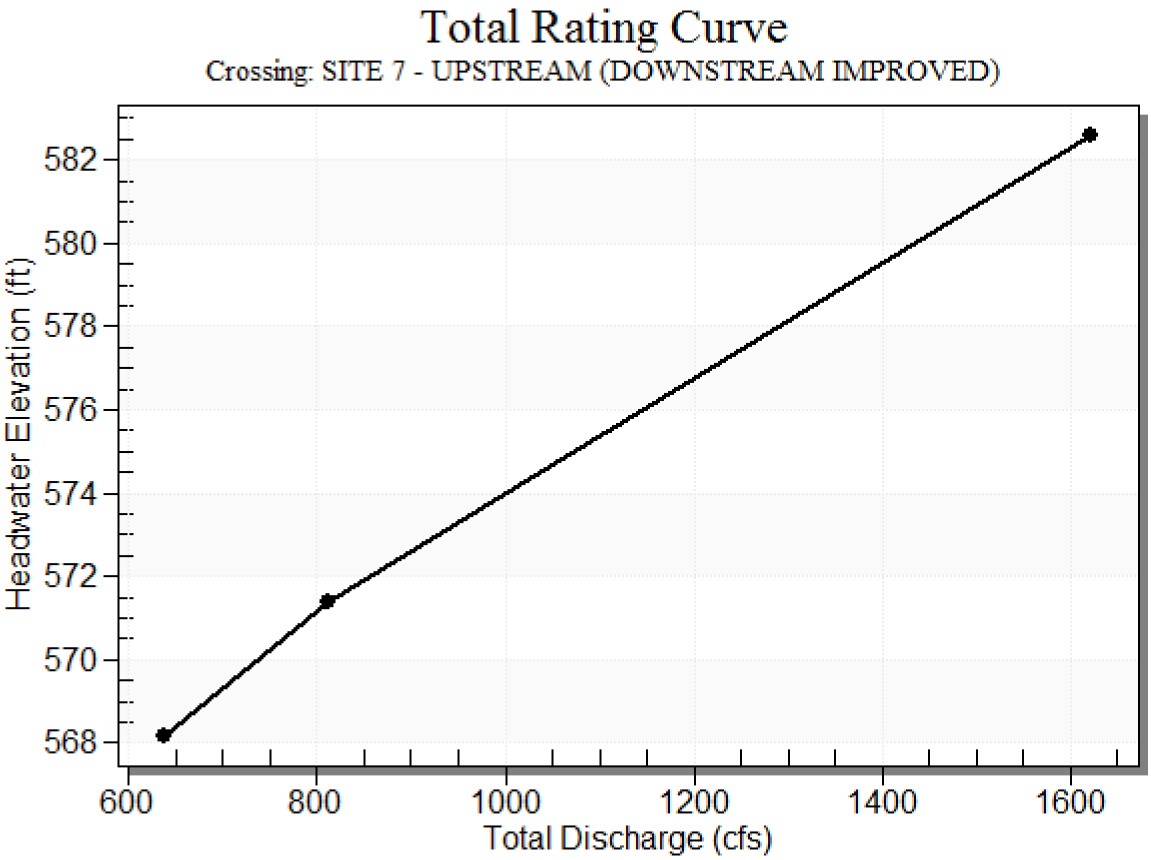


Table 2 - Culvert Summary Table: SITE 7 - UPSTREAM (DOWNSTREAM IMPROVED)

Discharge Names	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)
50 year	637.00	637.00	568.19	9.270	9.859	6-FFt	6.111	5.818	7.840	7.840	10.156
100 year	811.00	811.00	571.40	11.575	13.068	4-FFf	8.000	6.834	8.000	9.460	12.672

****

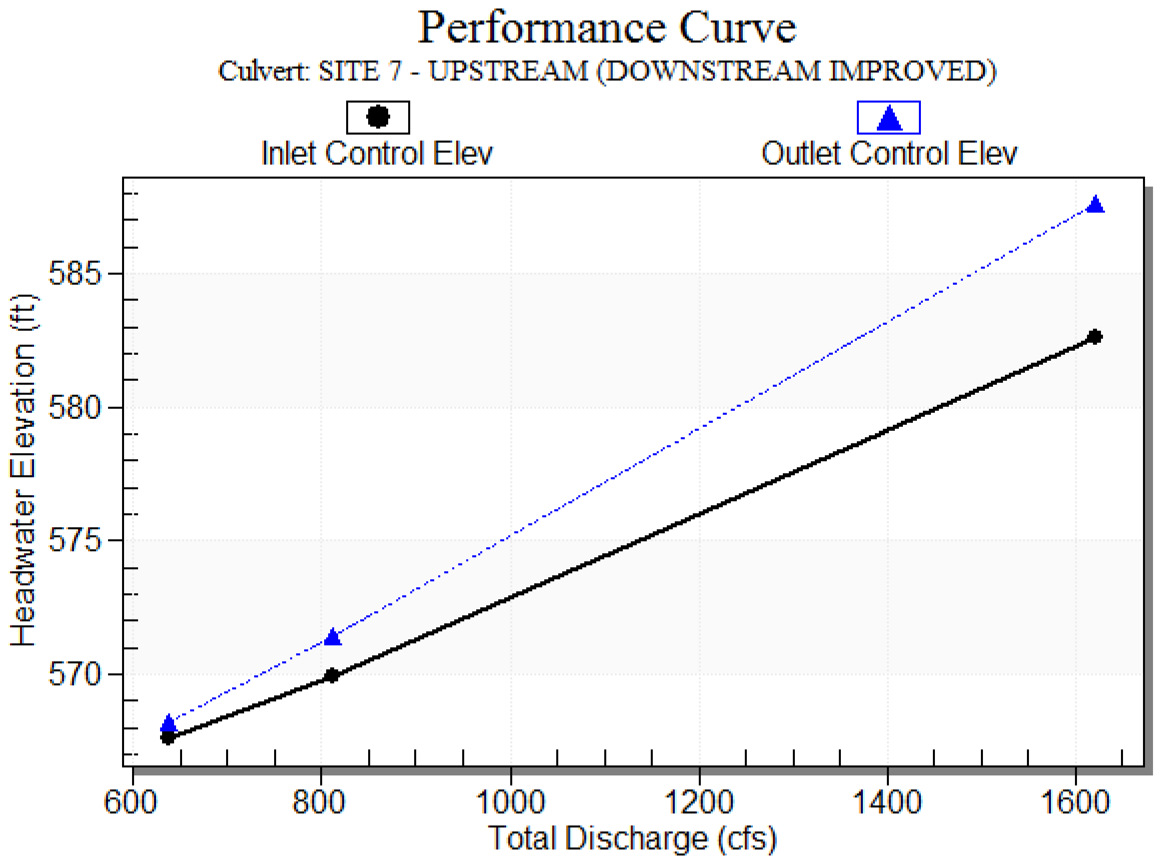
Straight Culvert

Inlet Elevation (invert): 558.33 ft,   Outlet Elevation (invert): 557.79 ft

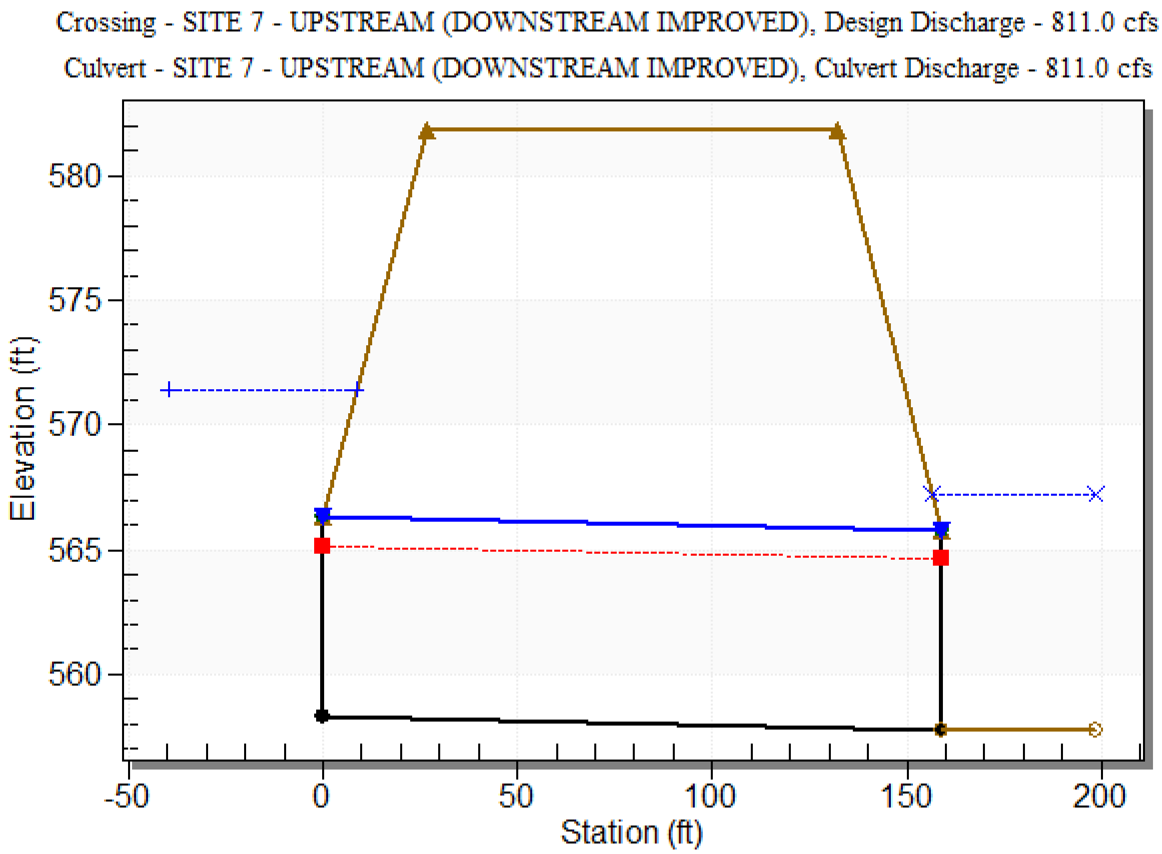
Culvert Length: 159.00 ft,   Culvert Slope: 0.0034

****

Culvert Performance Curve Plot: SITE 7 - UPSTREAM (DOWNSTREAM IMPROVED)



Water Surface Profile Plot for Culvert: SITE 7 - UPSTREAM (DOWNSTREAM IMPROVED)



Site Data - SITE 7 - UPSTREAM (DOWNSTREAM IMPROVED)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 558.33 ft

Outlet Station: 159.00 ft

Outlet Elevation: 557.79 ft

Number of Barrels: 1

Culvert Data Summary - SITE 7 - UPSTREAM (DOWNSTREAM IMPROVED)

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: Square Edge (30-75º flare) Wingwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve   Crossing: SITE 7 - UPSTREAM (DOWNSTREAM IMPROVED)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)
637.00	565.63	7.84	0.00
811.00	567.25	9.46	0.00

Tailwater Channel Data - SITE 7 - UPSTREAM (DOWNSTREAM IMPROVED)

Tailwater Channel Option: Enter Rating Curve

Channel Invert Elevation: 557.79 ft

Roadway Data for Crossing: SITE 7 - UPSTREAM (DOWNSTREAM IMPROVED)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 581.86 ft

Roadway Surface: Paved

Roadway Top Width: 105.00 ft

SITE 7 – Upstream (With Improved Downstream) Culvert Tailwater Rating Curve

<table>
<tr><th rowspan="4">Return Event</th><th colspan="3">Downstream (DS) Culvert</th><th colspan="3">Upstream (US) Culvert</th></tr>
<tr><th>Inlet Elevation</th><th colspan="2">557.74</th><th>Outlet Elevation</th><th colspan="2">557.79</th></tr>
<tr><th rowspan="2"></th><th colspan="2">Headwater</th><th rowspan="2"></th><th colspan="2">Tailwater</th></tr>
<tr><th>Elevation</th><th>Depth</th><th>Elevation</th><th>Depth</th></tr>
<tr><td>50-Year</td><td></td><td>565.58</td><td>7.84</td><td></td><td>565.63</td><td>7.84</td></tr>
<tr><td>100-Year</td><td></td><td>567.20</td><td>9.46</td><td></td><td>567.25</td><td>9.46</td></tr>
<tr><td colspan="7">* All elevations and depths are in feet.</td></tr>
<tr><td colspan="7">Note</td></tr>
<tr><td colspan="7">Improved downstream culvert elevations were calculated based upon the slope of the existing upstream culvert.</td></tr>
</table>

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 7 - IMPROVED DOWNSTREAM

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 7 - IMPROVED DOWNSTREAM Discharge (cfs)	Roadway Discharge (cfs)	Iterations
565.58	50 year	641.00	641.00	0.00	1
567.20	100 year	816.00	816.00	0.00	1
571.00	Overtopping	1149.12	1149.12	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 7 - IMPROVED DOWNSTREAM

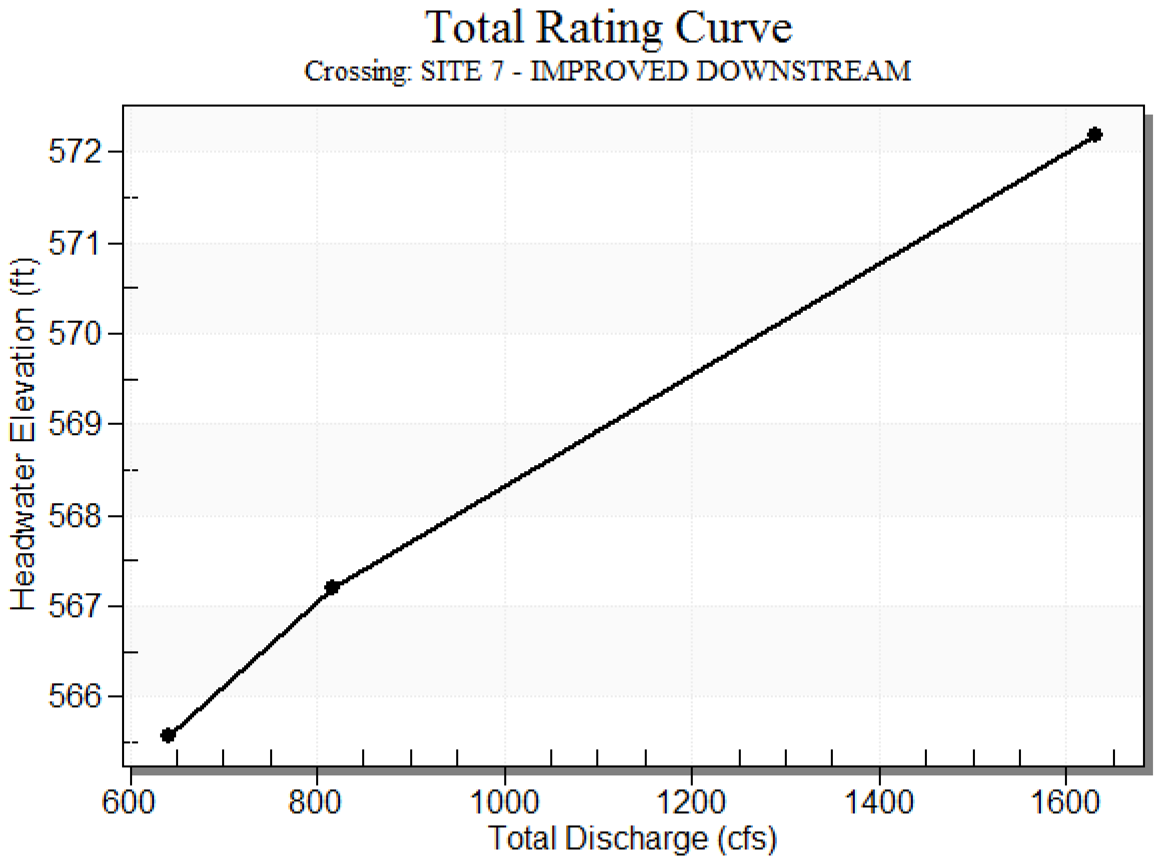


Table 2 - Culvert Summary Table: SITE 7 - IMPROVED DOWNSTREAM

Discharge Names	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)
50 year	641.00	641.00	565.58	7.836	6.339	6-FFc	4.722	5.034	4.722	4.758	13.575
100 year	816.00	816.00	567.20	9.461	8.121	6-FFc	5.665	5.913	5.665	4.987	14.404

****

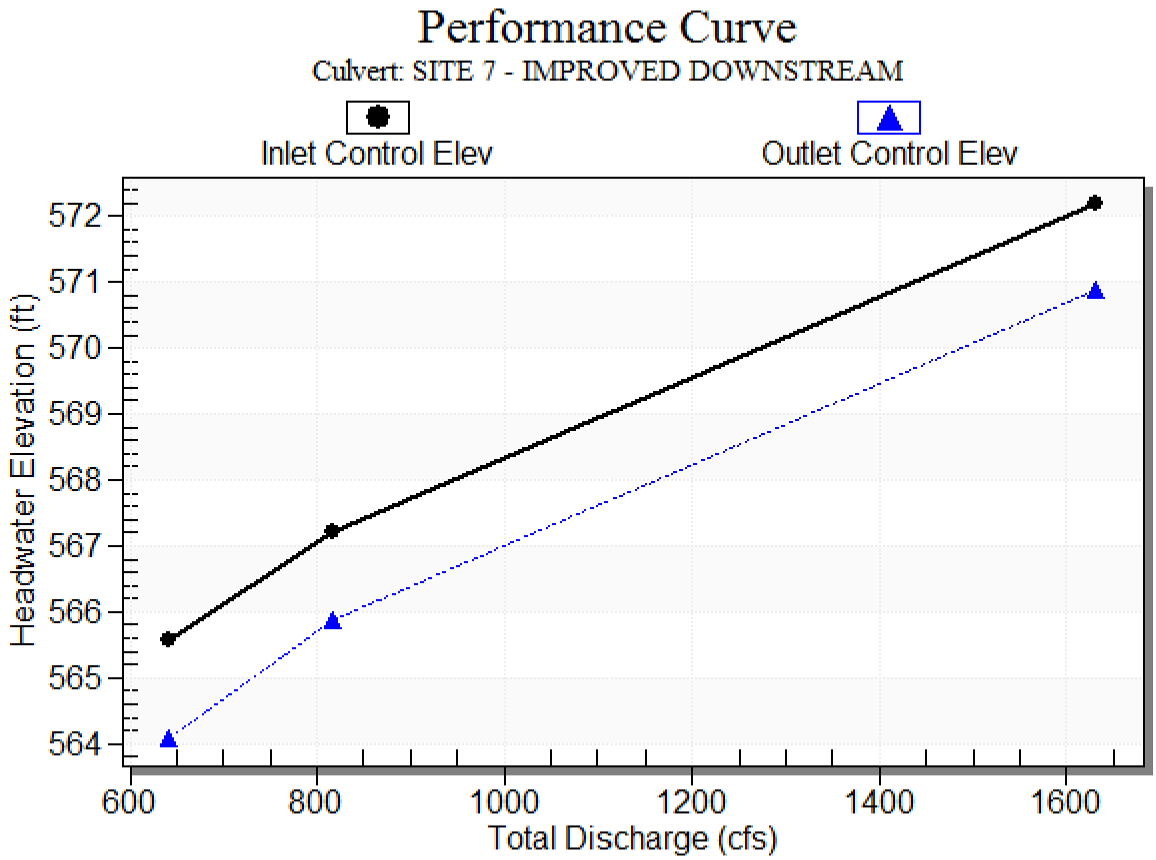
Straight Culvert

Inlet Elevation (invert): 557.74 ft,   Outlet Elevation (invert): 557.59 ft

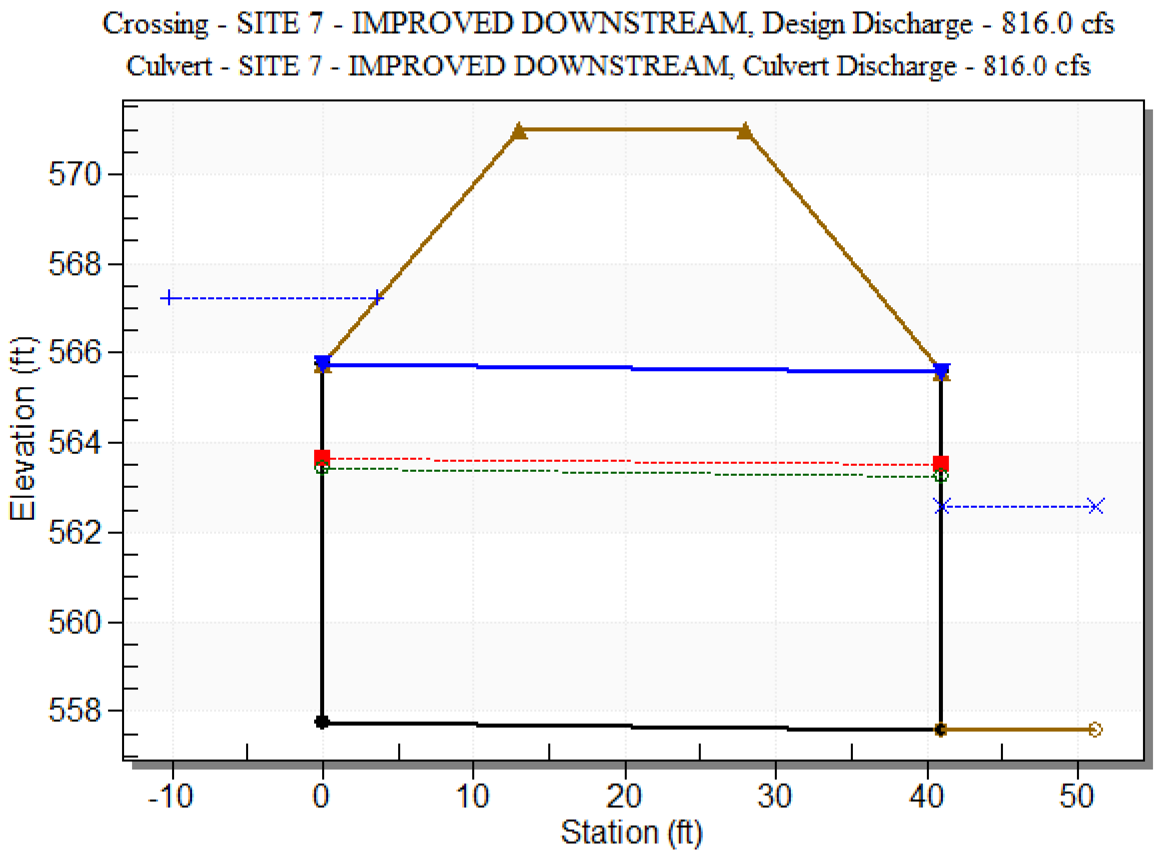
Culvert Length: 41.00 ft,   Culvert Slope: 0.0037

****

Culvert Performance Curve Plot: SITE 7 - IMPROVED DOWNSTREAM



Water Surface Profile Plot for Culvert: SITE 7 - IMPROVED DOWNSTREAM



Site Data - SITE 7 - IMPROVED DOWNSTREAM

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 557.74 ft

Outlet Station: 41.00 ft

Outlet Elevation: 557.59 ft

Number of Barrels: 1

Culvert Data Summary - SITE 7 - IMPROVED DOWNSTREAM

Barrel Shape: Concrete Box

Barrel Span: 10.00 ft

Barrel Rise: 8.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

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

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: SITE 7 - IMPROVED DOWNSTREAM)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
641.00	562.35	4.76	2.43	1.22	0.41
816.00	562.58	4.99	2.55	1.28	0.39

Tailwater Channel Data - SITE 7 - IMPROVED DOWNSTREAM

Tailwater Channel Option: Irregular Channel

Roadway Data for Crossing: SITE 7 - IMPROVED DOWNSTREAM

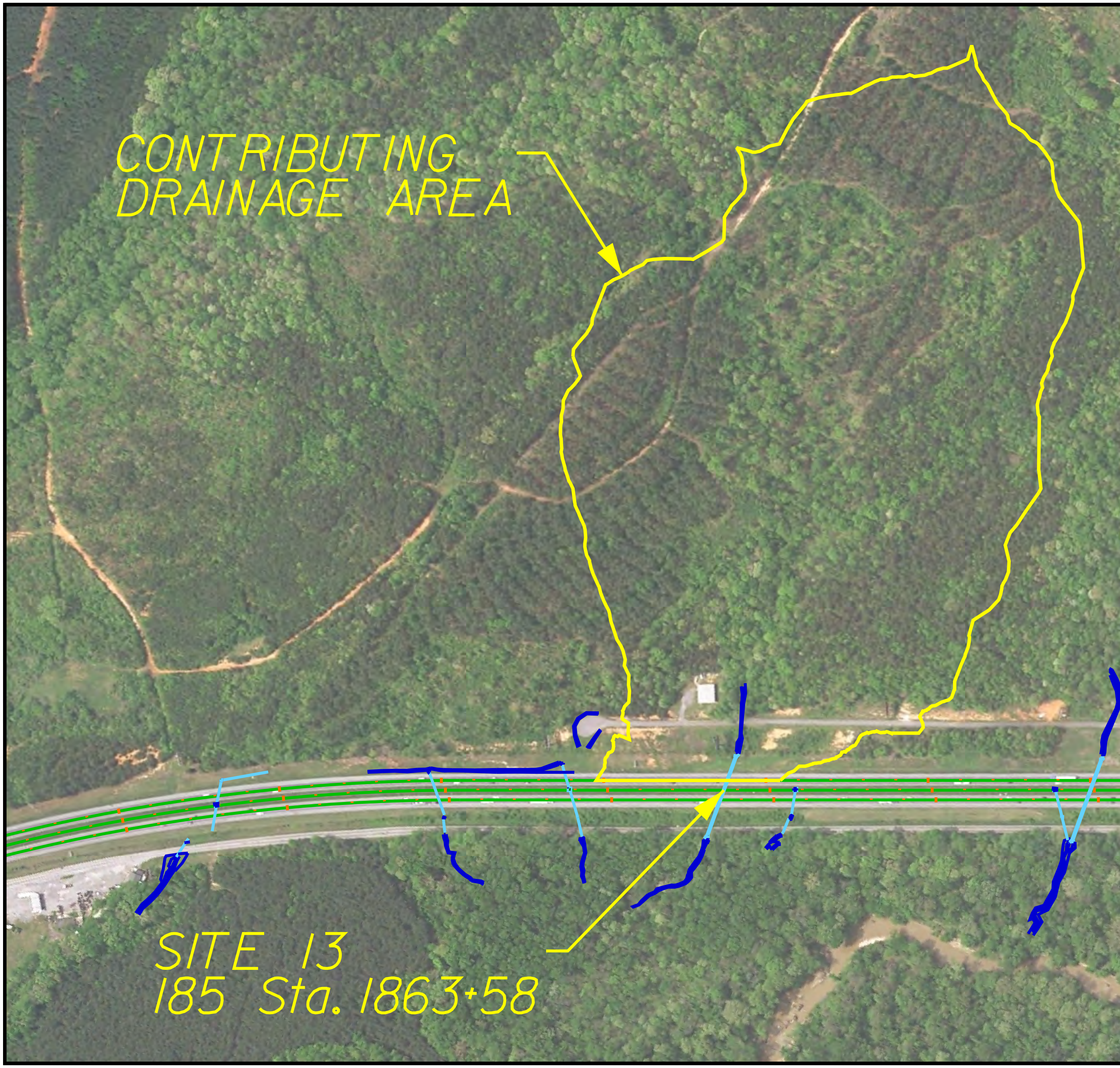
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 571.00 ft

Roadway Surface: Paved

Roadway Top Width: 15.00 ft



CULVERT DRAINAGE AREA
SITE 13

SCALE: 1" = 450'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	0.75	0.90	
Rolling, 2%-10%	Side Slopes, Earth	0.22	0.60	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	2.69	0.30	0.18
Hilly, Over 10%	Woodland & Forest	7.85	0.20	
Rolling, 2%-10%	Woodland & Forest	45.73	0.15	
		57.24		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusl	8.21%	100	0.8				0.328
Shallow Concentrated	Unpaved	8.21%	1434					0.086
Shallow Concentrated								
Channel 1		3.88%	1011	0.045	11.5	18.178	4.80901	0.058
Channel 2								
Total			2545				1.4960	0.473

Gaffney

Time of Concentration *(minutes)*	29			

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.18	4.082	57.24	**41**
Q_{25}	1.1	0.18	4.658	57.24	**51**
Q_{50}	1.2	0.18	5.105	57.24	**62**
Q_{100}	1.25	0.18	5.541	57.24	**70**

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 13

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 13 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
570.68	50 year	62.00	62.00	0.00	1
570.95	100 year	70.00	70.00	0.00	1
598.87	Overtopping	543.42	543.42	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 13

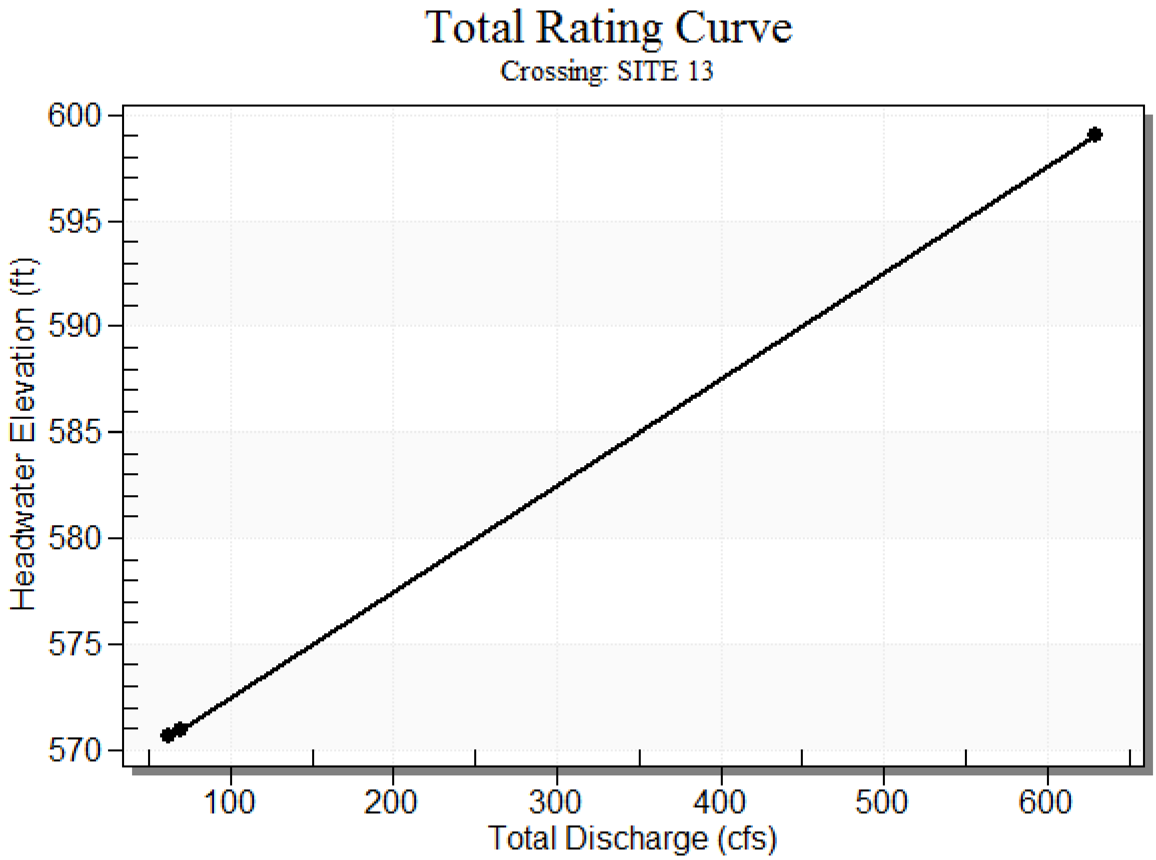


Table 2 - Culvert Summary Table: SITE 13

Discharge Names	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)
50 year	62.00	62.00	570.68	3.319	1.106	6-FFt	1.540	1.954	1.540	2.873	10.067
100 year	70.00	70.00	570.95	3.591	1.351	6-FFt	1.683	2.119	1.683	3.052	10.401

****

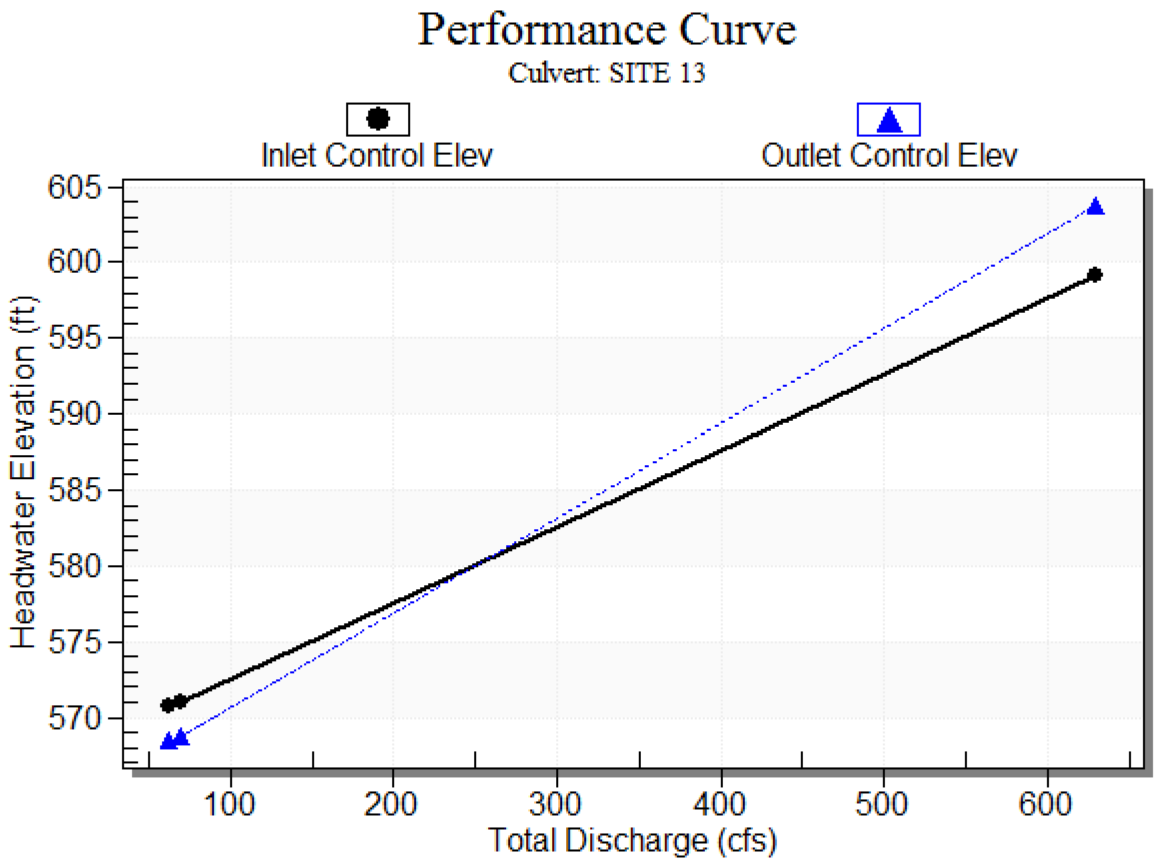
Straight Culvert

Inlet Elevation (invert): 567.36 ft,   Outlet Elevation (invert): 565.35 ft

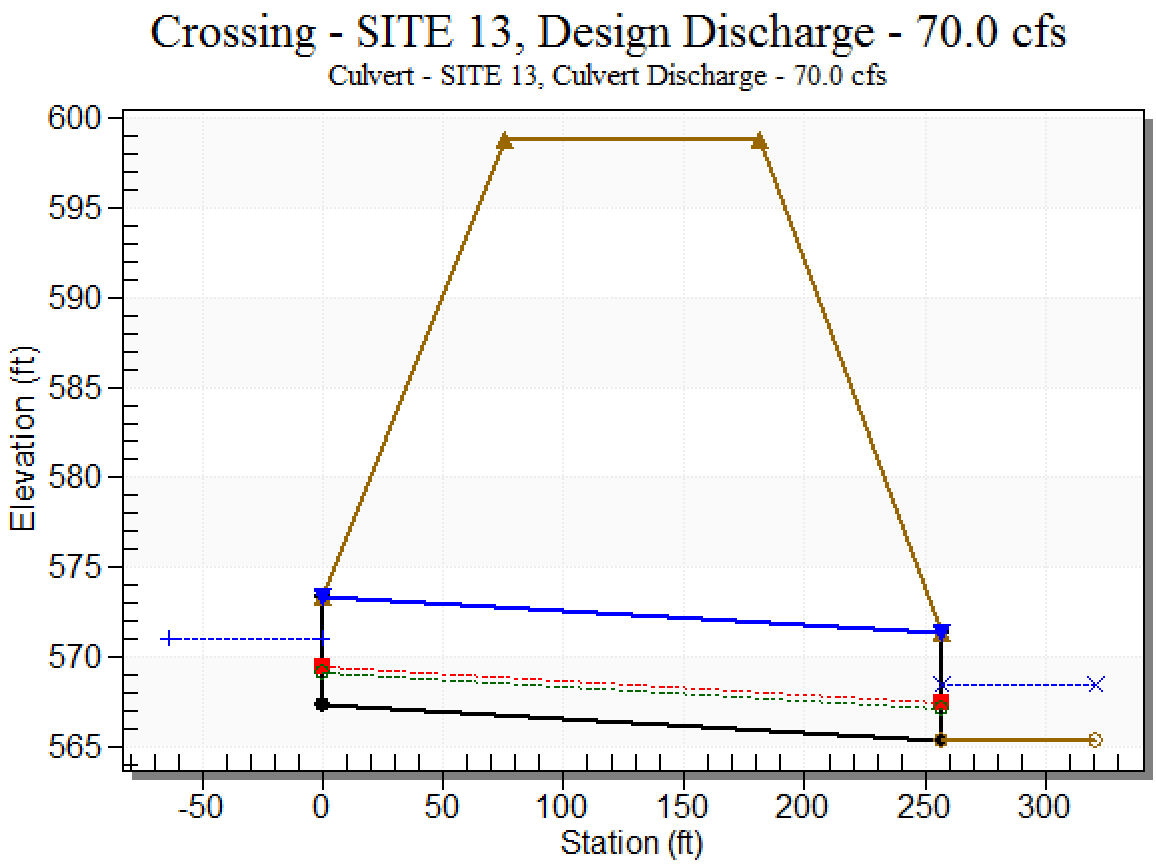
Culvert Length: 257.01 ft,   Culvert Slope: 0.0078

****

Culvert Performance Curve Plot: SITE 13



Water Surface Profile Plot for Culvert: SITE 13



Site Data - SITE 13

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 567.36 ft

Outlet Station: 257.00 ft

Outlet Elevation: 565.35 ft

Number of Barrels: 1

Culvert Data Summary - SITE 13

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: Square Edge (90º) Headwall

Inlet Depression: NONE

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

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
62.00	568.22	2.87	2.79	0.81	0.35
70.00	568.40	3.05	2.88	0.86	0.36

Tailwater Channel Data - SITE 13

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 1.30 (_:1)

Channel Slope: 0.0045

Channel Manning's n: 0.0500

Channel Invert Elevation: 565.35 ft

Roadway Data for Crossing: SITE 13

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 598.87 ft

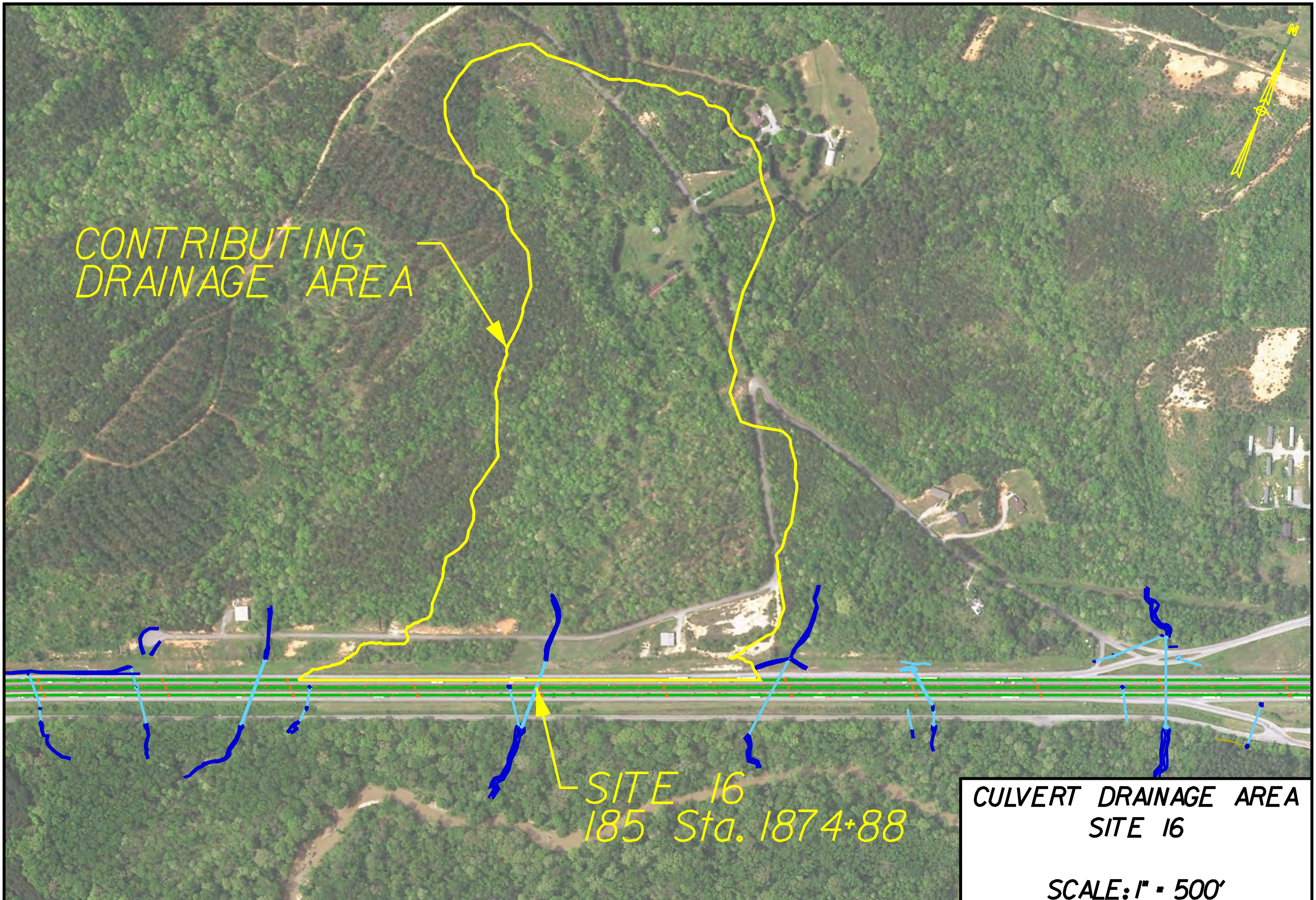
Roadway Surface: Paved

Roadway Top Width: 105.00 ft

Pipe/Box Dimensions				Flow
		(inch)		(cfs)
Pipe Diameter				62
Box Dimension				
Span (ft)	4	48		
Height (ft)	6	72		

Length	Width	Riprap		GeoText
(FHWA HEC-14 - Calculated)		Quantity	Class[2]	
(ft)	(ft)	(Tons)		(SqYd)
25	29	55	B	82

** Energy Disipator only, still add quantities for slope protection.
** Apron length as per HEC-14 Table 10.1, Fig. 10.4; width as per HEC-14 Fig. 10.4.
** Riprap Class (D50) as per HEC-14 Eq. 10.4; Tailwater condition assumed (TW=0.4D)



CULVERT DRAINAGE AREA
SITE 16

SCALE: 1" = 500'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	2.43	0.90	
Rolling, 2%-10%	Side Slopes, Earth	1.12	0.60	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	9.06	0.30	0.25
Hilly, Over 10%	Woodland & Forest	51.96	0.20	
		64.57		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusl	8.04%	100	0.8				0.331
Shallow Concentrated	Unpaved	8.04%	1864					0.113
Shallow Concentrated								
Channel 1		2.50%	711	0.04	24	16.301	7.62365	0.026
Channel 2								
Total			2675				1.5816	0.470

Gaffney

Time of Concentration *(minutes)*	29

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.25	4.082	64.57	**65**
Q_{25}	1.1	0.25	4.658	64.57	**82**
Q_{50}	1.2	0.25	5.105	64.57	**98**
Q_{100}	1.25	0.25	5.541	64.57	**111**

Civil Engineering Consulting Services, Inc.

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 16

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 16 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
566.85	50 year	98.00	98.00	0.00	1
567.21	100 year	111.00	111.00	0.00	1
588.68	Overtopping	548.81	548.81	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 16

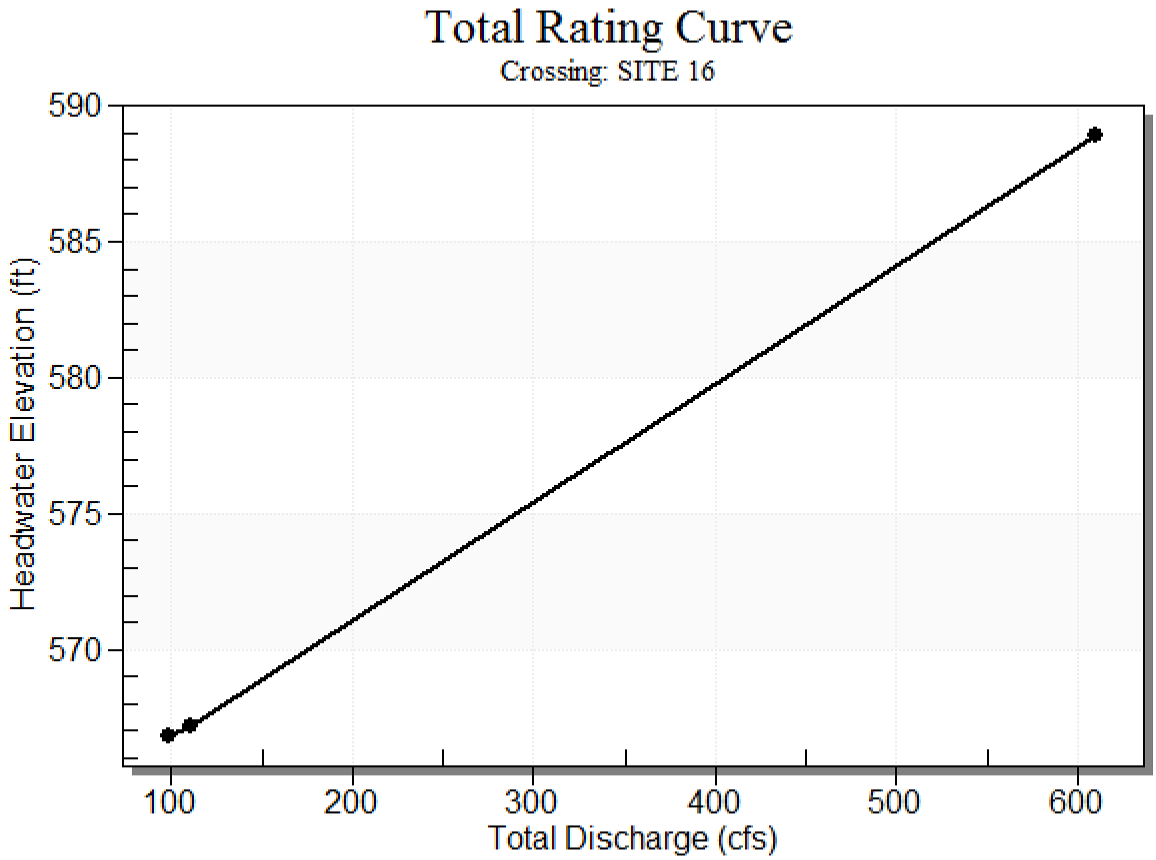


Table 2 - Culvert Summary Table: SITE 16

Discharge Names	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)
50 year	98.00	98.00	566.85	4.042	0.0*	6-FFt	1.567	2.652	1.567	3.727	15.636
100 year	111.00	111.00	567.21	4.398	0.0*	6-FFt	1.717	2.881	1.717	3.967	16.159

* Full Flow Headwater elevation is below inlet invert.

****

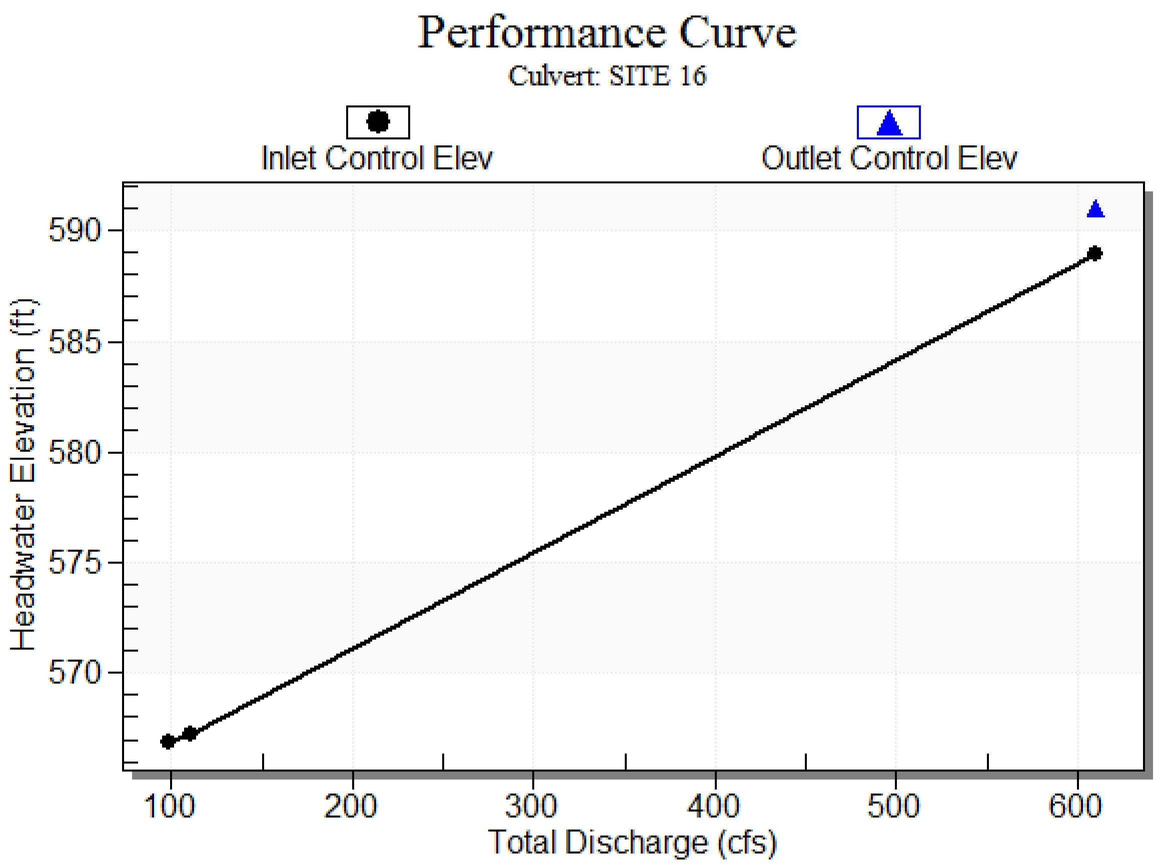
Straight Culvert

Inlet Elevation (invert): 562.81 ft,   Outlet Elevation (invert): 557.97 ft

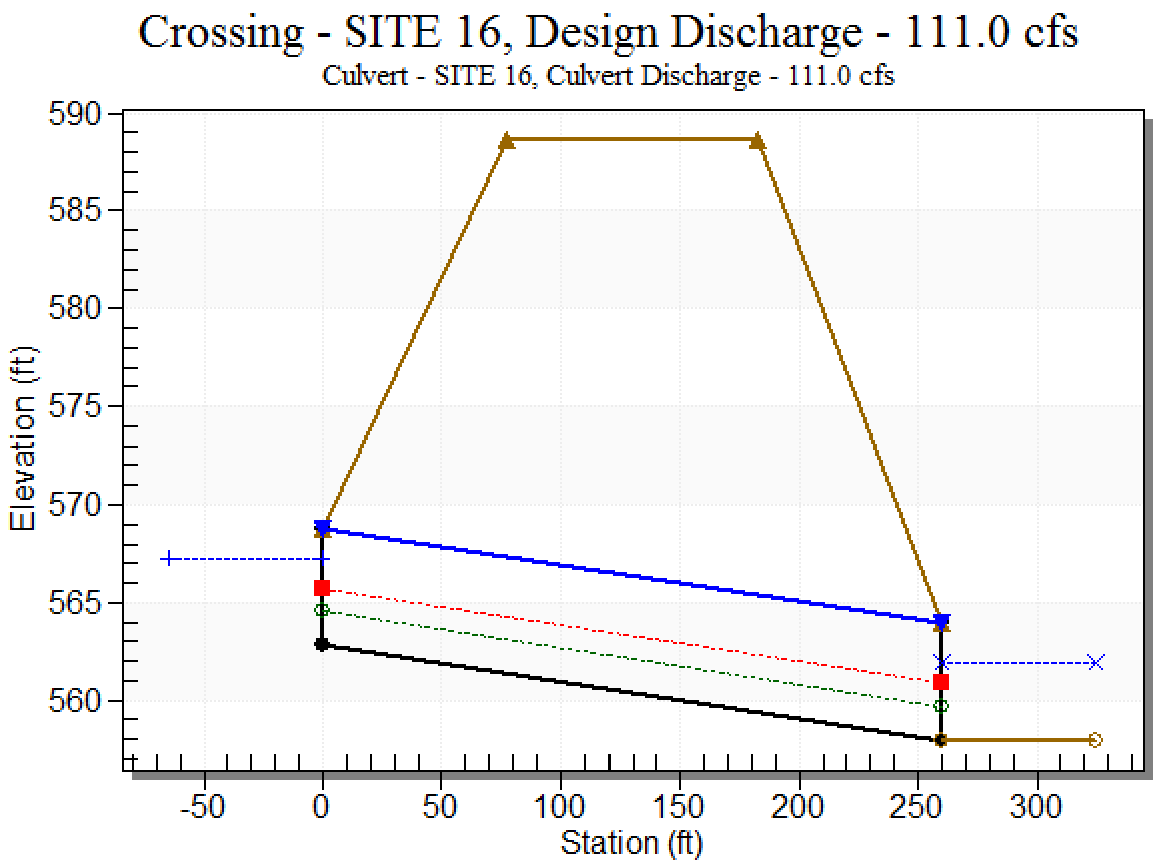
Culvert Length: 260.05 ft,   Culvert Slope: 0.0186

****

Culvert Performance Curve Plot: SITE 16



Water Surface Profile Plot for Culvert: SITE 16



Site Data - SITE 16

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 562.81 ft

Outlet Station: 260.00 ft

Outlet Elevation: 557.97 ft

Number of Barrels: 1

Culvert Data Summary - SITE 16

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: Square Edge (30-75º flare) Wingwall

Inlet Depression: NONE

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

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
98.00	561.70	3.73	2.78	0.74	0.31
111.00	561.94	3.97	2.87	0.79	0.31

Tailwater Channel Data - SITE 16

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft

Side Slope (H:V): 1.20 (_:1)

Channel Slope: 0.0032

Channel Manning's n: 0.0500

Channel Invert Elevation: 557.97 ft

Roadway Data for Crossing: SITE 16

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 588.68 ft

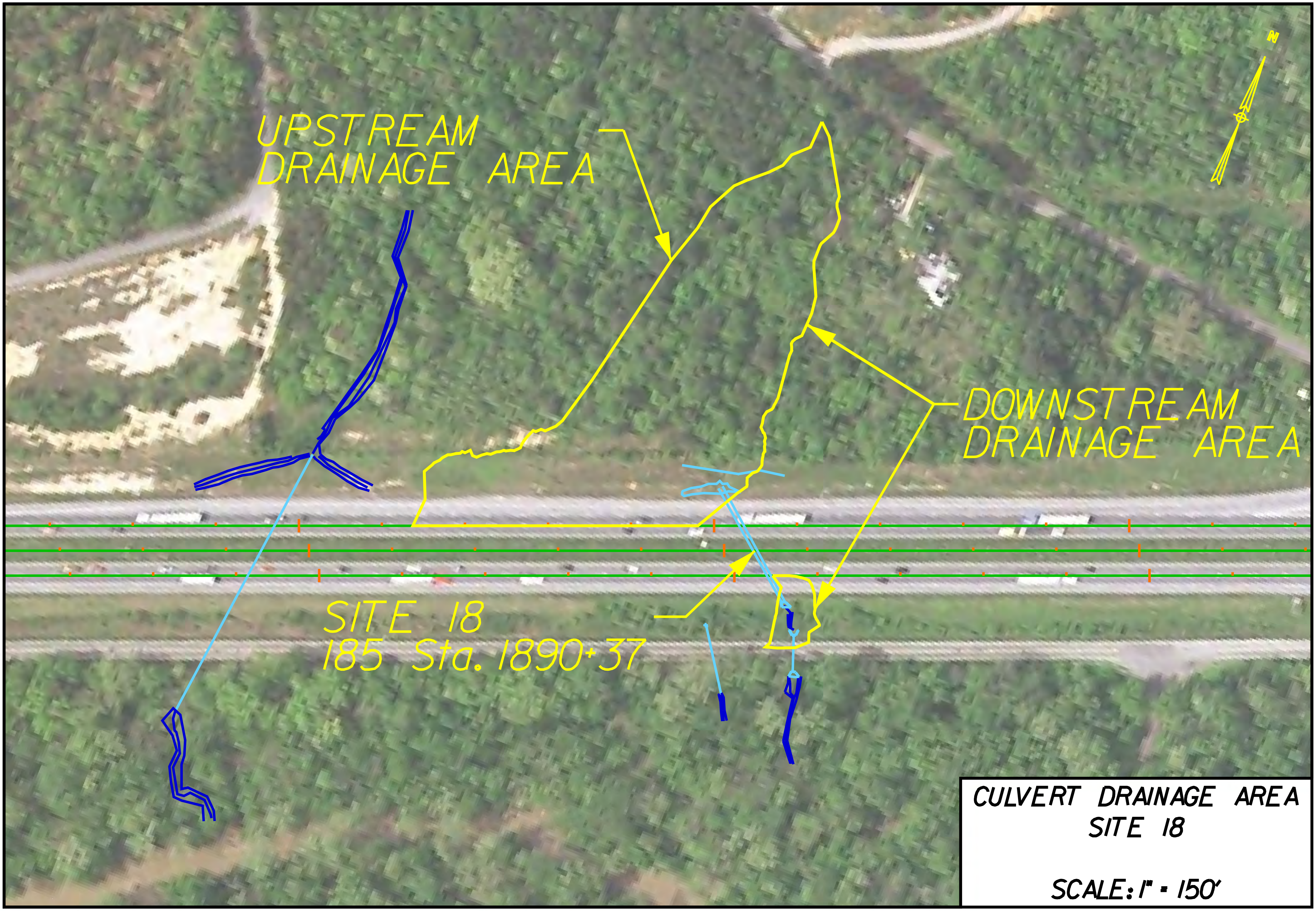
Roadway Surface: Paved

Roadway Top Width: 105.00 ft

Pipe/Box Dimensions				Flow
		(inch)		(cfs)
Pipe Diameter				98
Box Dimension				
Span (ft)	4	48		
Height (ft)	6	72		

Length	Width	Riprap		GeoText
(FHWA HEC-14 - Calculated)		Quantity	Class[2]	
(ft)	(ft)	(Tons)		(SqYd)
25	29	55	B	82

** Energy Disipator only, still add quantities for slope protection.
** Apron length as per HEC-14 Table 10.1, Fig. 10.4; width as per HEC-14 Fig. 10.4.
** Riprap Class (D50) as per HEC-14 Eq. 10.4; Tailwater condition assumed (TW=0.4D)


UPSTREAM
DRAINAGE AREA
DOWNSTREAM
DRAINAGE AREA
SITE 18
I85 Sta. 1890+37
N
CULVERT DRAINAGE AREA
SITE 18
SCALE: 1" = 150'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	0.25	0.90	
Hilly, Over 10%	Side Slopes, Turf	0.66	0.30	Area Weighted C
Rolling, 2%-10%	Woodland & Forest	1.46	0.15	0.27
		2.37		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrus	7.15%	100	0.8				0.347
Shallow Concentrated	Unpaved	7.15%	201					0.013
Shallow Concentrated								
Channel 1		17.39%	150	0.045	22.5	16.195	17.1903	0.002
Channel 2								
Total			451				0.3460	0.362

Gaffney

Time of Concentration *(minutes)*	22

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.27	4.618	2.37	**3**
Q_{25}	1.1	0.27	5.284	2.37	**4**
Q_{50}	1.2	0.27	5.804	2.37	**4**
Q_{100}	1.25	0.27	6.311	2.37	**5**

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 4 - Summary of Culvert Flows at Crossing: SITE 18 - UPSTREAM - 72" RCP

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 18 - UPSTREAM - 72" RCP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
604.29	50 year	4.00	4.00	0.00	1
604.39	100 year	5.00	5.00	0.00	1
612.21	Overtopping	305.73	305.73	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 18 - UPSTREAM - 72" RCP

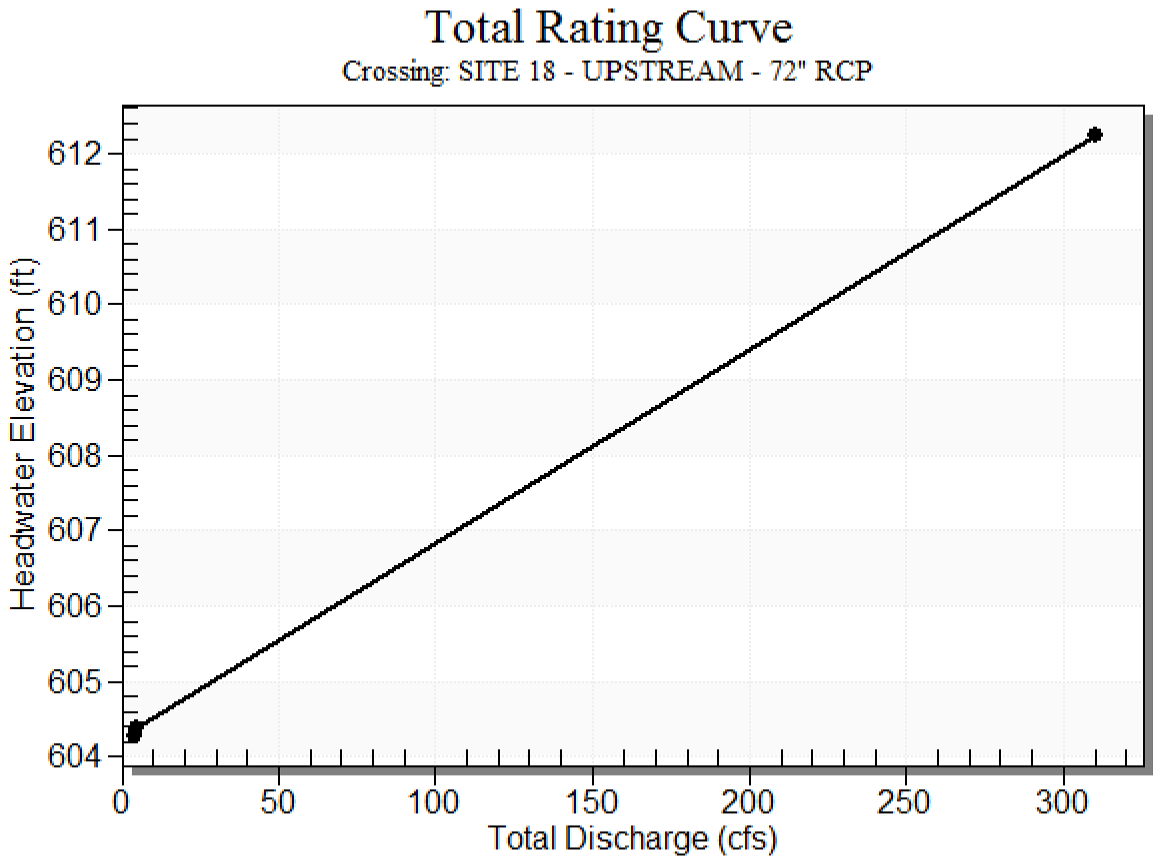


Table 5 - Culvert Summary Table: SITE 18 - UPSTREAM - 72" RCP

Discharge Names	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)
50 year	4.00	4.00	604.29	0.599	0.0*	6-FFt	0.107	0.513	0.560	0.560	2.390
100 year	5.00	5.00	604.39	0.701	0.0*	6-FFc	0.133	0.576	0.576	0.560	2.966

* Full Flow Headwater elevation is below inlet invert.

****

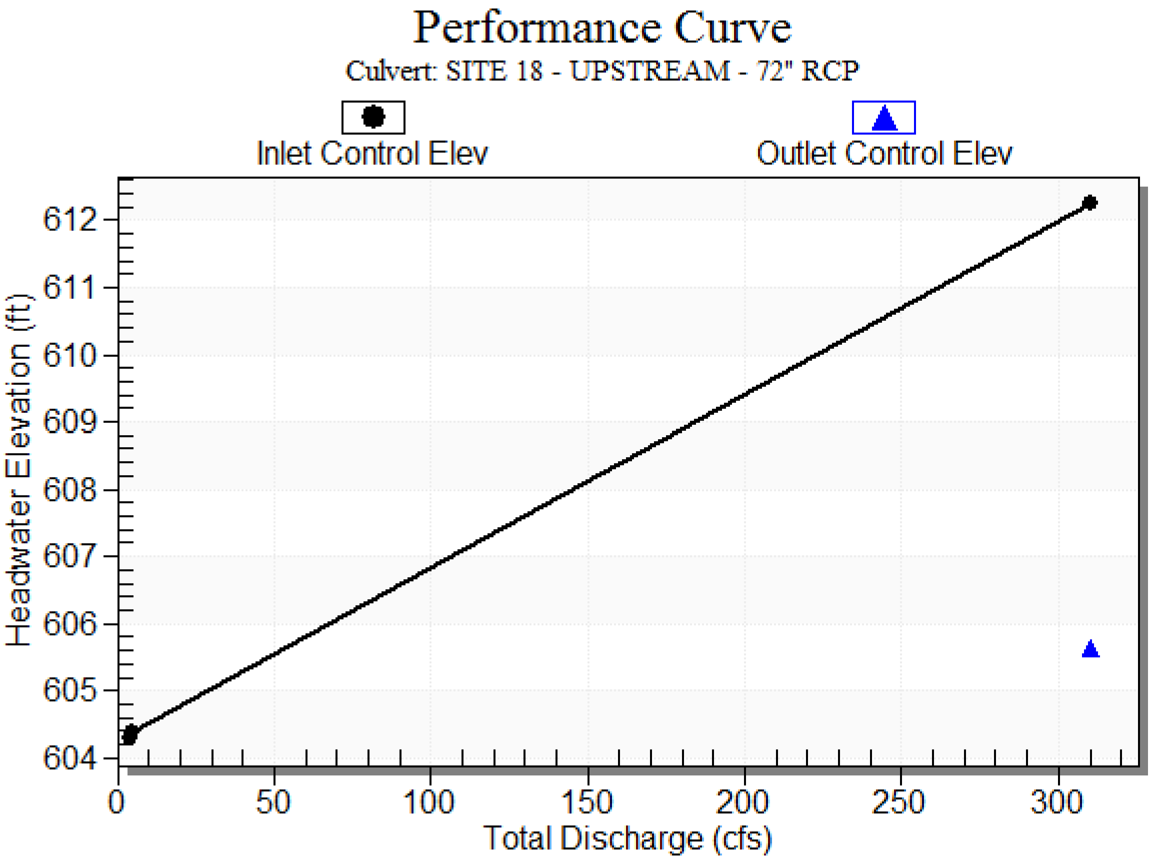
Straight Culvert

Inlet Elevation (invert): 603.69 ft,   Outlet Elevation (invert): 596.80 ft

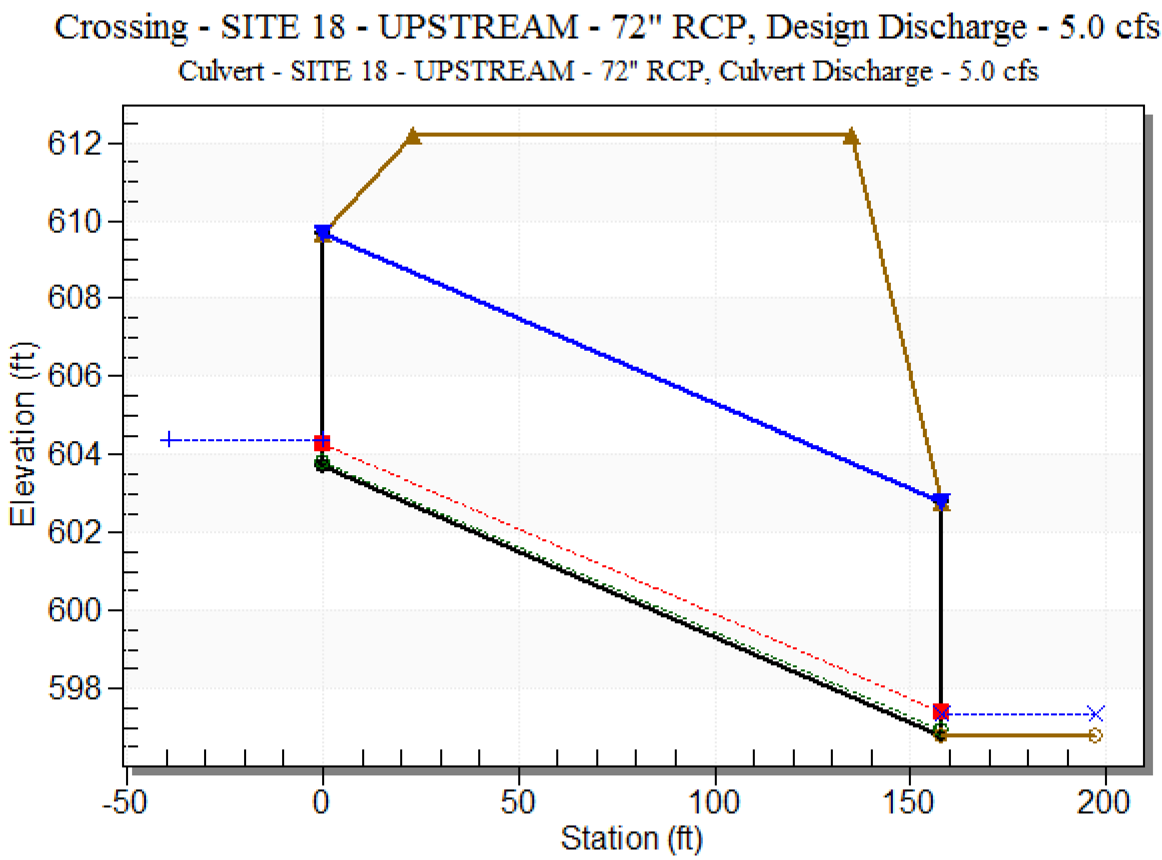
Culvert Length: 158.15 ft,   Culvert Slope: 0.0436

****

Culvert Performance Curve Plot: SITE 18 - UPSTREAM - 72" RCP



Water Surface Profile Plot for Culvert: SITE 18 - UPSTREAM - 72" RCP



Site Data - SITE 18 - UPSTREAM - 72" RCP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 603.69 ft

Outlet Station: 158.00 ft

Outlet Elevation: 596.80 ft

Number of Barrels: 1

Culvert Data Summary - SITE 18 - UPSTREAM - 72" RCP

Barrel Shape: Circular

Barrel Diameter: 6.00 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: SITE 18 - UPSTREAM - 72" RCP)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)
4.00	597.36	0.56	0.00
5.00	597.36	0.56	0.00

Tailwater Channel Data - SITE 18 - UPSTREAM - 72" RCP

Tailwater Channel Option: Enter Rating Curve

Channel Invert Elevation: 596.80 ft

Roadway Data for Crossing: SITE 18 - UPSTREAM - 72" RCP

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 612.21 ft

Roadway Surface: Paved

Roadway Top Width: 112.00 ft

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 7 - Summary of Culvert Flows at Crossing: SITE 18 - UPSTREAM - 4' x 6' RCBC

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 18 - UPSTREAM - 4' x 6' RCBC Discharge (cfs)	Roadway Discharge (cfs)	Iterations
604.21	50 year	4.00	4.00	0.00	1
604.29	100 year	5.00	5.00	0.00	1
612.21	Overtopping	238.62	238.62	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 18 - UPSTREAM - 4' x 6' RCBC

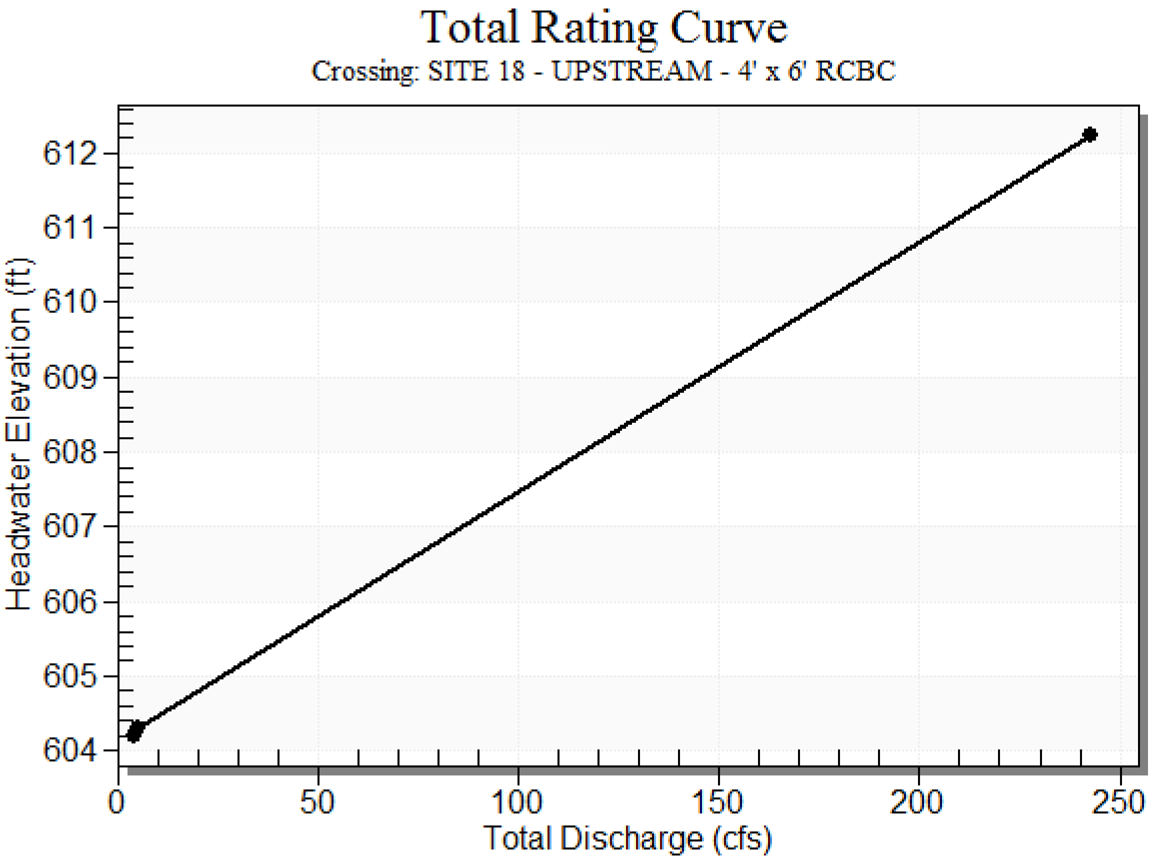


Table 8 - Culvert Summary Table: SITE 18 - UPSTREAM - 4' x 6' RCBC

Discharge Names	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)
50 year	4.00	4.00	604.21	0.516	0.0*	6-FFt	0.061	0.314	0.061	0.560	16.323
100 year	5.00	5.00	604.29	0.599	0.0*	6-FFt	0.077	0.365	0.077	0.560	16.323

* Full Flow Headwater elevation is below inlet invert.

****

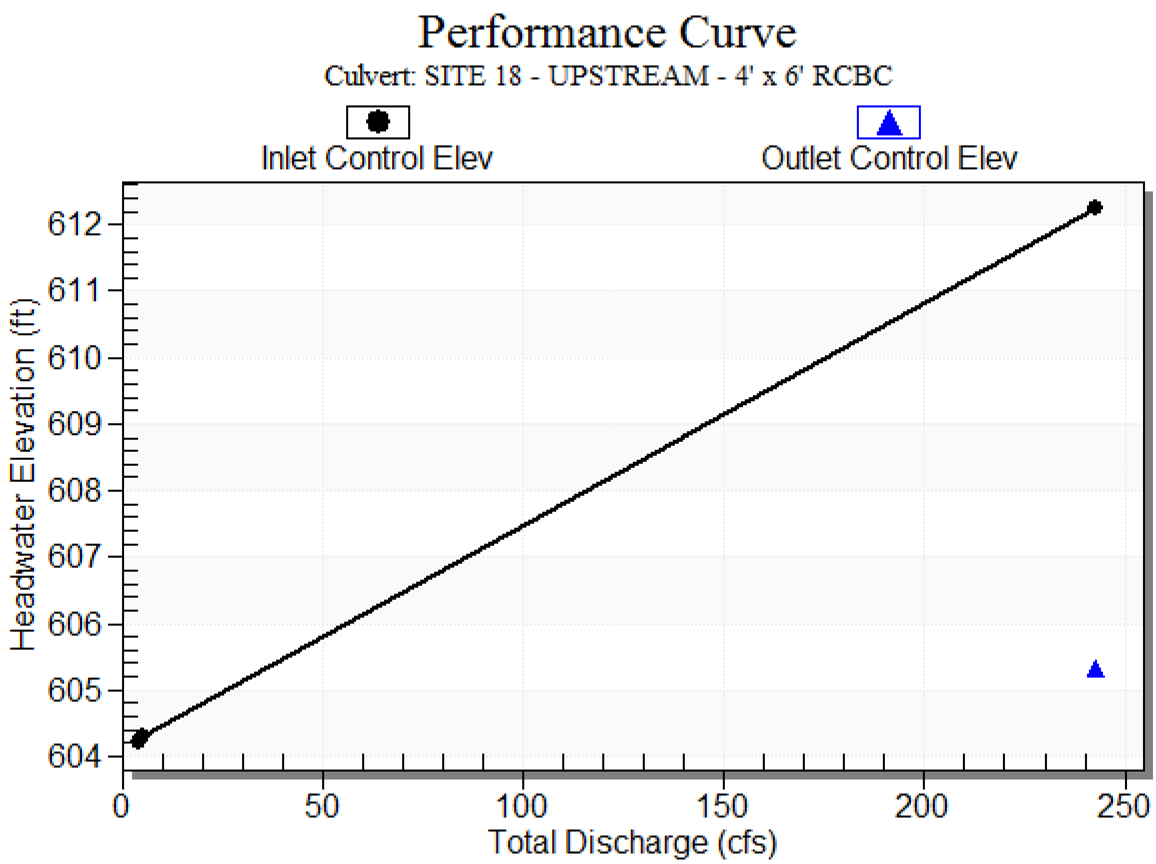
Straight Culvert

Inlet Elevation (invert): 603.69 ft,   Outlet Elevation (invert): 596.80 ft

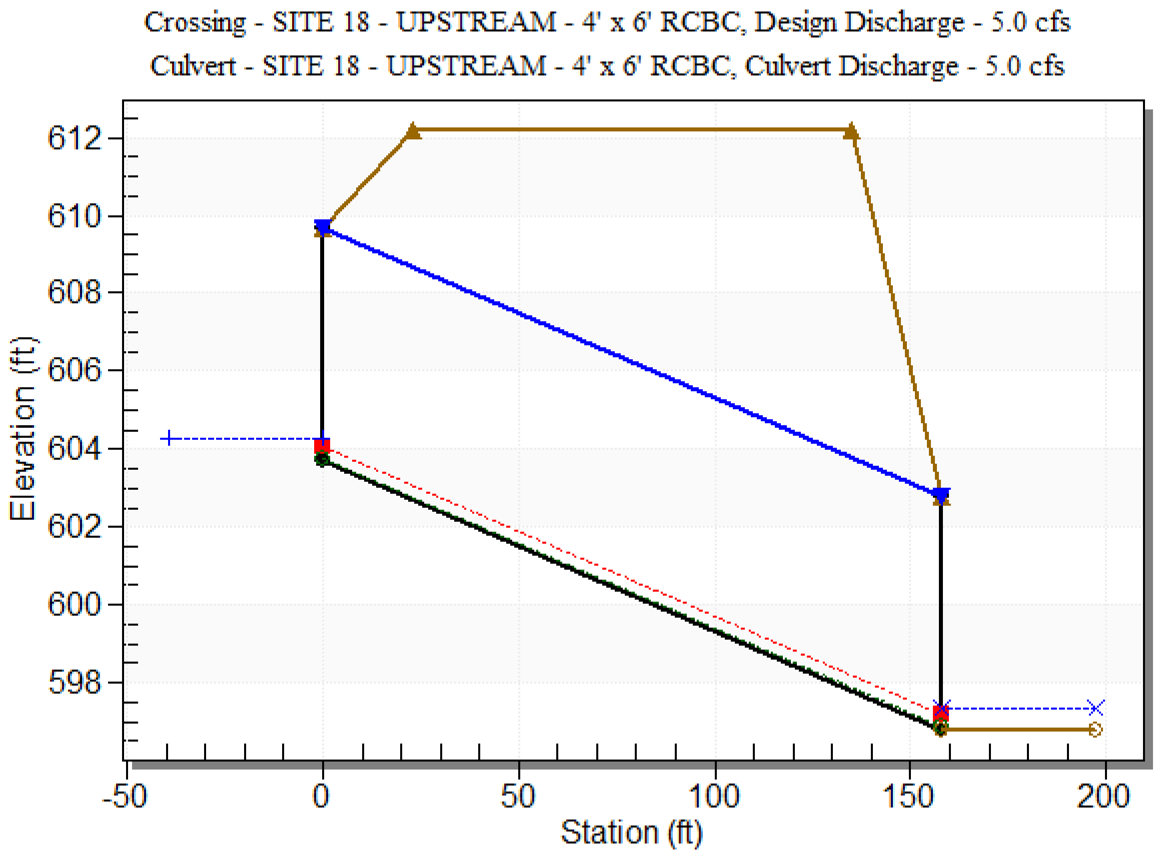
Culvert Length: 158.15 ft,   Culvert Slope: 0.0436

****

Culvert Performance Curve Plot: SITE 18 - UPSTREAM - 4' x 6' RCBC



Water Surface Profile Plot for Culvert: SITE 18 - UPSTREAM - 4' x 6' RCBC



Site Data - SITE 18 - UPSTREAM - 4' x 6' RCBC

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 603.69 ft

Outlet Station: 158.00 ft

Outlet Elevation: 596.80 ft

Number of Barrels: 1

Culvert Data Summary - SITE 18 - UPSTREAM - 4' x 6' RCBC

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: Square Edge (90º) Headwall

Inlet Depression: NONE

Table 9 - Downstream Channel Rating Curve (Crossing: SITE 18 - UPSTREAM - 4' x 6' RCBC)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)
4.00	597.36	0.56	0.00
5.00	597.36	0.56	0.00

Tailwater Channel Data - SITE 18 - UPSTREAM - 4' x 6' RCBC

Tailwater Channel Option: Enter Rating Curve

Channel Invert Elevation: 596.80 ft

Roadway Data for Crossing: SITE 18 - UPSTREAM - 4' x 6' RCBC

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 612.21 ft

Roadway Surface: Paved

Roadway Top Width: 112.00 ft

SITE 18 – Upstream Culvert Tailwater Rating Curve

Return Event	Downstream (DS) Culvert			Upstream (US) Culvert		
	Inlet Elevation	584.10		Outlet Elevation	596.80	
		Headwater			Tailwater	
		Elevation	Depth		Elevation	Depth
50-Year		584.66	0.56		597.36	0.56
100-Year		584.66	0.56		597.36	0.56

* All elevations and depths are in feet.

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	0.28	0.90	
Hilly, Over 10%	Side Slopes, Turf	0.71	0.30	Area Weighted C
Rolling, 2%-10%	Woodland & Forest	1.46	0.15	0.28
		2.45		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrus	7.15%	100	0.8				0.347
Shallow Concentrated	Unpaved	7.15%	201					0.013
Shallow Concentrated								
Channel 1		17.39%	150	0.045	22.5	16.195	17.1903	0.002
Channel 2								
Total			451				0.3460	0.362

Gaffney

Time of Concentration *(minutes)*	22

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.28	4.618	2.45	**3**
Q_{25}	1.1	0.28	5.284	2.45	**4**
Q_{50}	1.2	0.28	5.804	2.45	**5**
Q_{100}	1.25	0.28	6.311	2.45	**5**

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 18 - DOWNSTREAM

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 18 - DOWNSTREAM Discharge (cfs)	Roadway Discharge (cfs)	Iterations
584.66	50 year	5.00	5.00	0.00	1
584.66	100 year	5.00	5.00	0.00	1
598.07	Overtopping	109.27	109.27	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 18 - DOWNSTREAM

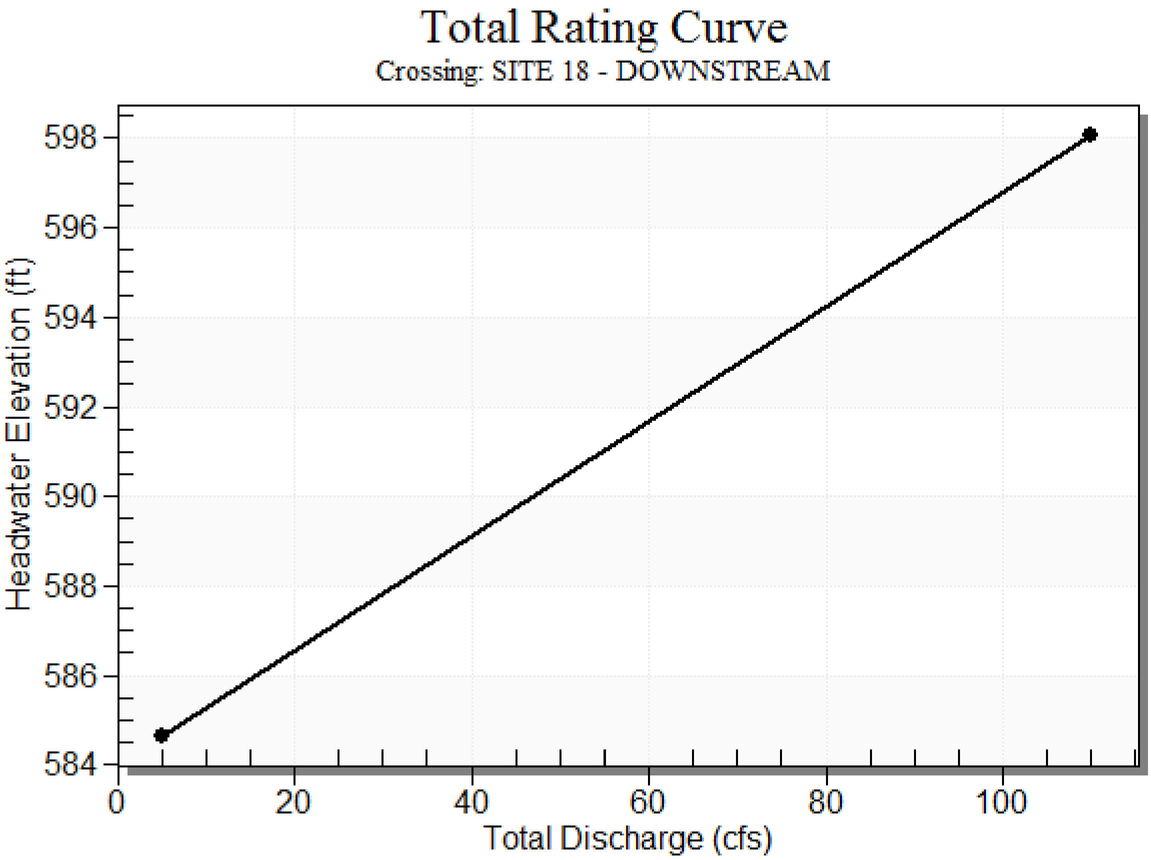


Table 2 - Culvert Summary Table: SITE 18 - DOWNSTREAM

Discharge Names	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)
50 year	5.00	5.00	584.66	0.564	0.0*	6-FFc	0.088	0.442	0.088	0.400	18.978
100 year	5.00	5.00	584.66	0.564	0.0*	6-FFc	0.088	0.442	0.088	0.400	18.978

* Full Flow Headwater elevation is below inlet invert.

****

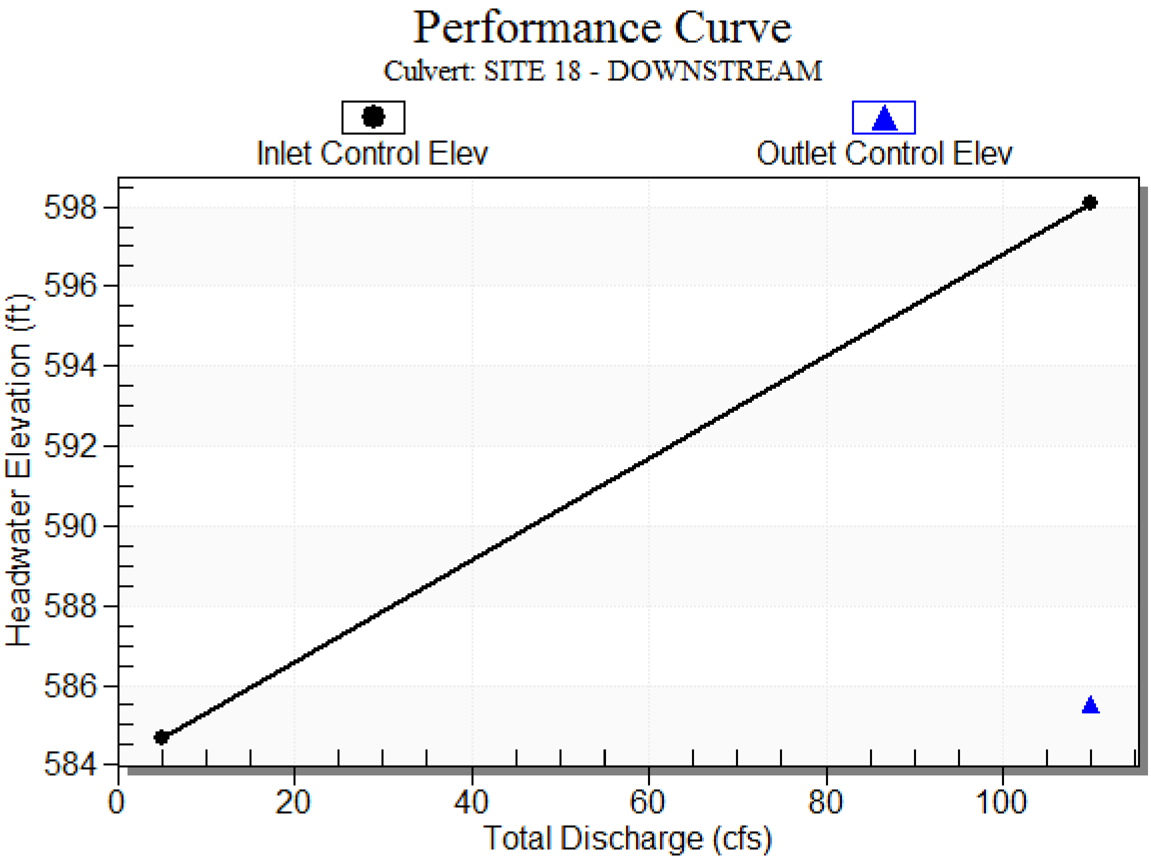
Straight Culvert

Inlet Elevation (invert): 584.10 ft,   Outlet Elevation (invert): 574.28 ft

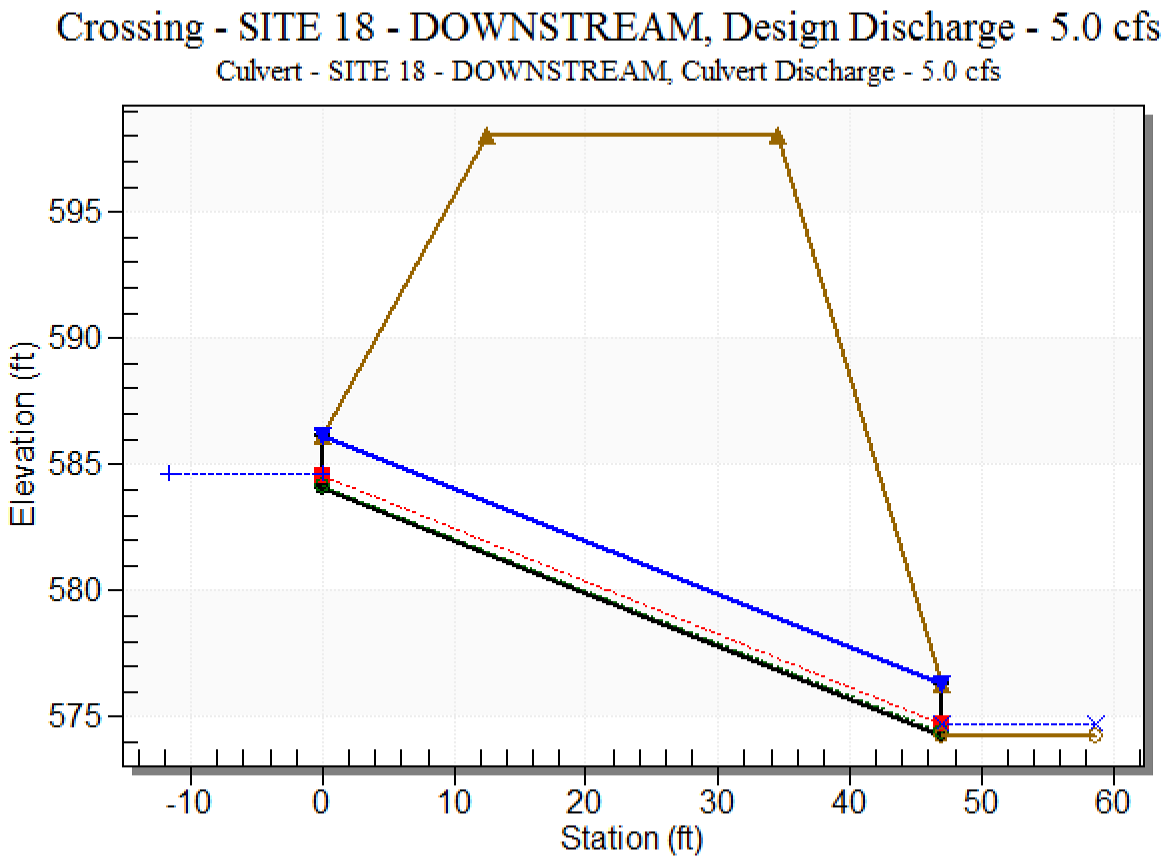
Culvert Length: 48.01 ft,   Culvert Slope: 0.2089

****

Culvert Performance Curve Plot: SITE 18 - DOWNSTREAM



Water Surface Profile Plot for Culvert: SITE 18 - DOWNSTREAM



Site Data - SITE 18 - DOWNSTREAM

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 584.10 ft

Outlet Station: 47.00 ft

Outlet Elevation: 574.28 ft

Number of Barrels: 1

Culvert Data Summary - SITE 18 - DOWNSTREAM

Barrel Shape: Concrete Box

Barrel Span: 3.00 ft

Barrel Rise: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

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

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: SITE 18 - DOWNSTREAM)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
5.00	574.68	0.40	1.73	1.42	0.68
5.00	574.68	0.40	1.73	1.42	0.68

Tailwater Channel Data - SITE 18 - DOWNSTREAM

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 18.00 (_:1)

Channel Slope: 0.0570

Channel Manning's n: 0.0700

Channel Invert Elevation: 574.28 ft

Roadway Data for Crossing: SITE 18 - DOWNSTREAM

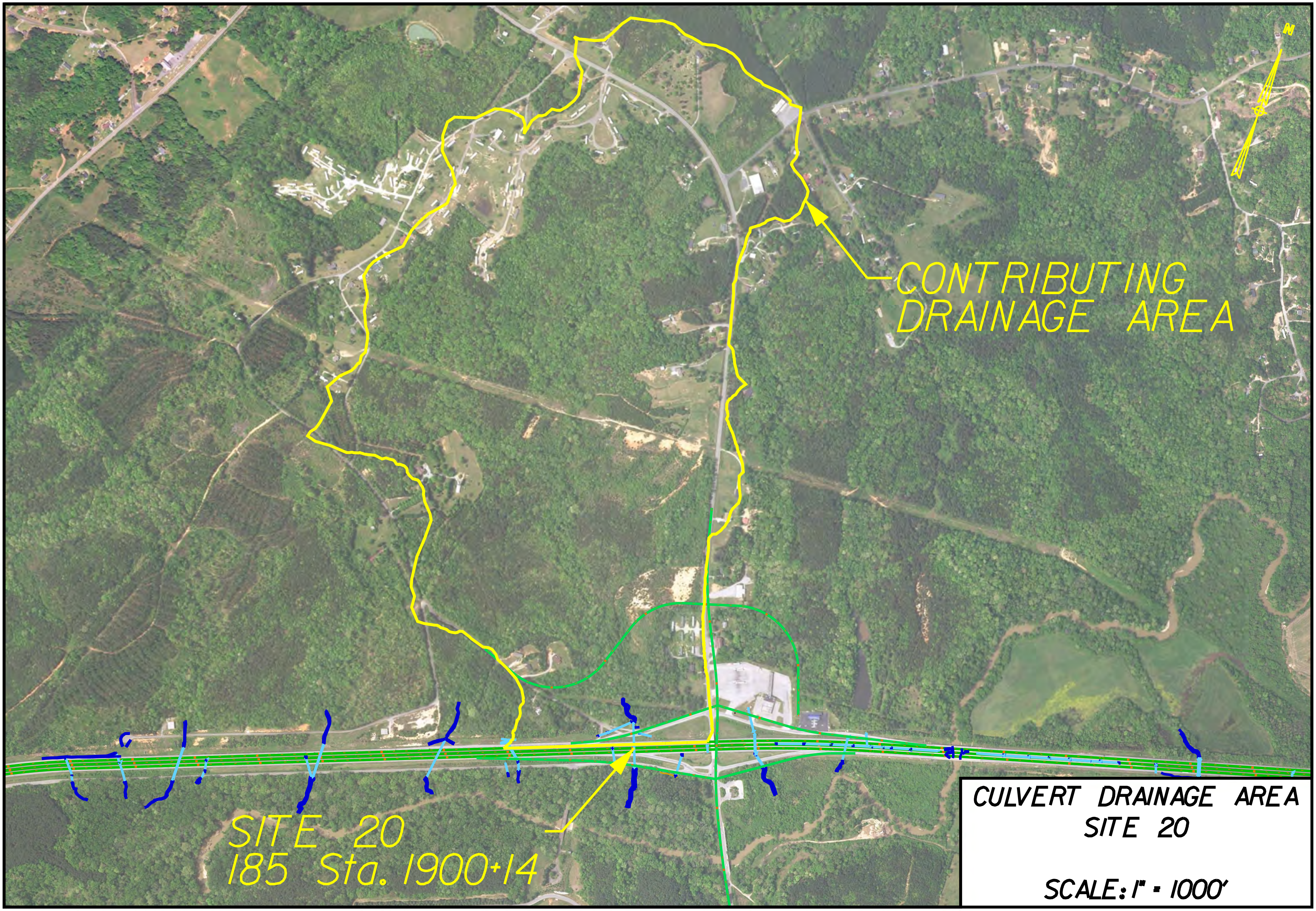
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 598.07 ft

Roadway Surface: Paved

Roadway Top Width: 22.00 ft


CONTRIBUTING
DRAINAGE AREA
SITE 20
I85 Sta. 1900+14
CULVERT DRAINAGE AREA
SITE 20
SCALE: 1" = 1000'

SCS Analysis

HSG	Land Use	Acres	CN
B	Impervious	10.42	98.00
B	Fallow: Bare Soil	4.54	86.00
B	Residential: 1 acre	31.86	68.00
B	Pasture,grassland,or range: Good	27.32	61.00
B	Meadow	22.57	58.00
B	Woods:Good	220.78	55.00
A	Pasture,grassland,or range: Good	0.67	39.00
A	Woods:Good	2.49	30.00
		320.65	

Area Weighted CN
59

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	6.92%	100	0.8				0.351
Shallow Concentrated	Unpaved	6.92%	1226					0.080
Shallow Concentrated								
Channel 1		2.88%	3675	0.045	9.45	8.9069	5.849718	0.175
Channel 2								
Total			5001				2.2919	0.606

Drainage Area *(acres)*	**320.65**

Curve Number	**59**
Time of Concentration *(minutes)*	**37**

WinTR-55 Current Data Description

--- Identification Data ---

User:	CECS	Date:	12/13/2016
Project:	I-85 Improvement Proj DB Prep	Units:	English
SubTitle:	SITE 20	Areal Units:	Acres
State:	South Carolina		
County:	Cherokee_NOAA_B		

Filename: S:\Proj\2014\6114 I-85 mm 96-106\Design\Project PIN Number\Drainage\Calculations\CULVERT - POST

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
SITE 20		Outlet	320.65	59	0.620

Total area: 320.65 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
3.73	4.68	5.44	6.49	7.35	8.24	3.1

Storm Data Source: Cherokee_NOAA_B County, SC (NRCS)
Rainfall Distribution Type: Type NO_B
Dimensionless Unit Hydrograph: <standard>

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
SUBAREAS				
SITE 20	307.78	466.00	605.59	757.86
REACHES				
OUTLET	307.78	466.00	605.59	757.86

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 20

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 20 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
573.92	50 year	606.00	606.00	0.00	1
577.35	100 year	758.00	758.00	0.00	1
594.50	Overtopping	1233.28	1233.28	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 20

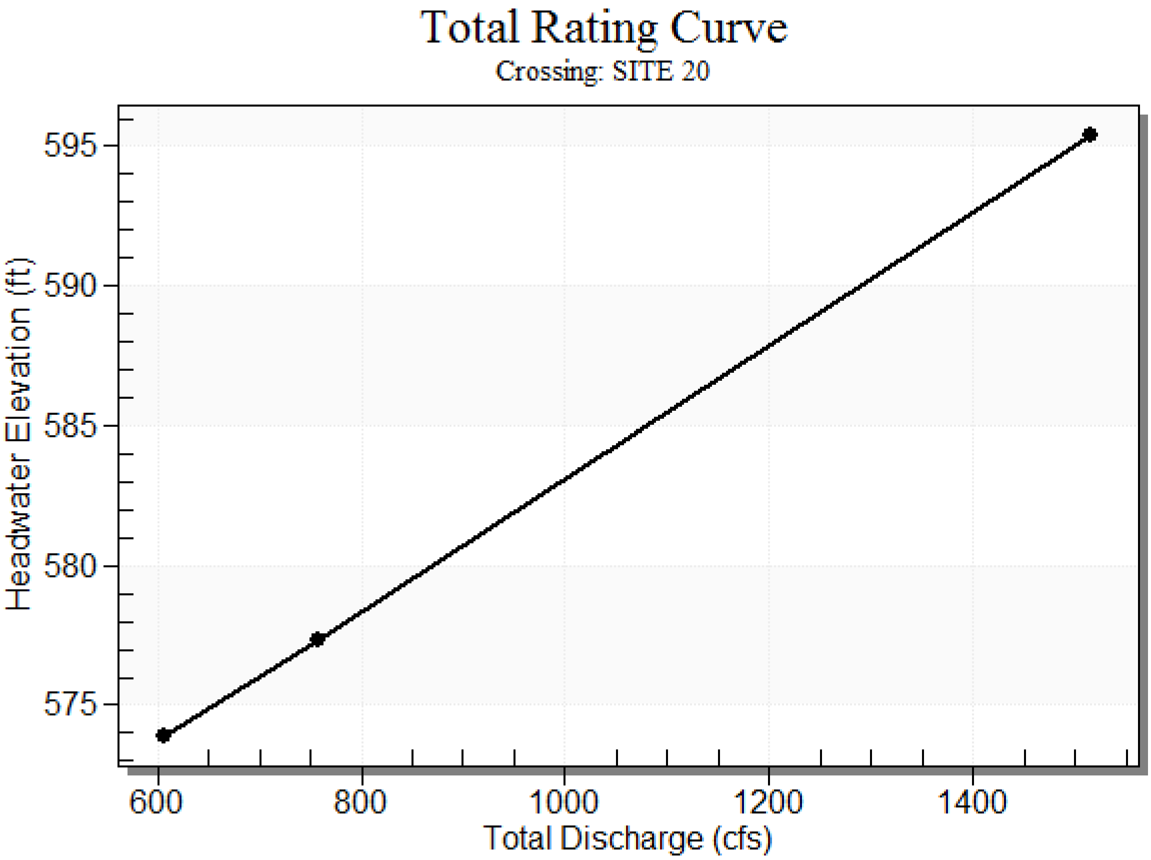


Table 2 - Culvert Summary Table: SITE 20

Discharge Names	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)
50 year	606.00	606.00	573.92	10.582	9.938	6-FFc	6.024	6.151	6.024	5.050	14.372
100 year	758.00	758.00	577.35	13.785	14.010	6-FFc	7.000	7.000	7.000	5.645	15.469

****

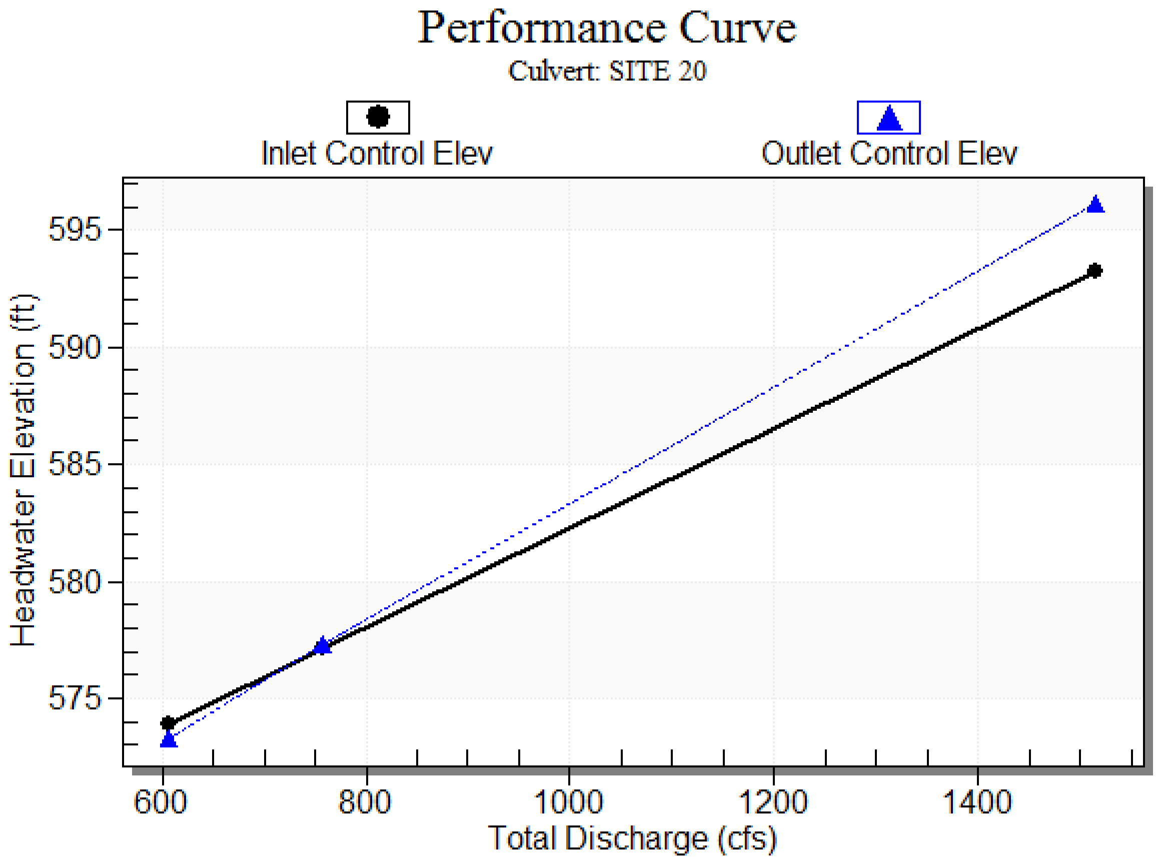
Straight Culvert

Inlet Elevation (invert): 563.34 ft,   Outlet Elevation (invert): 560.24 ft

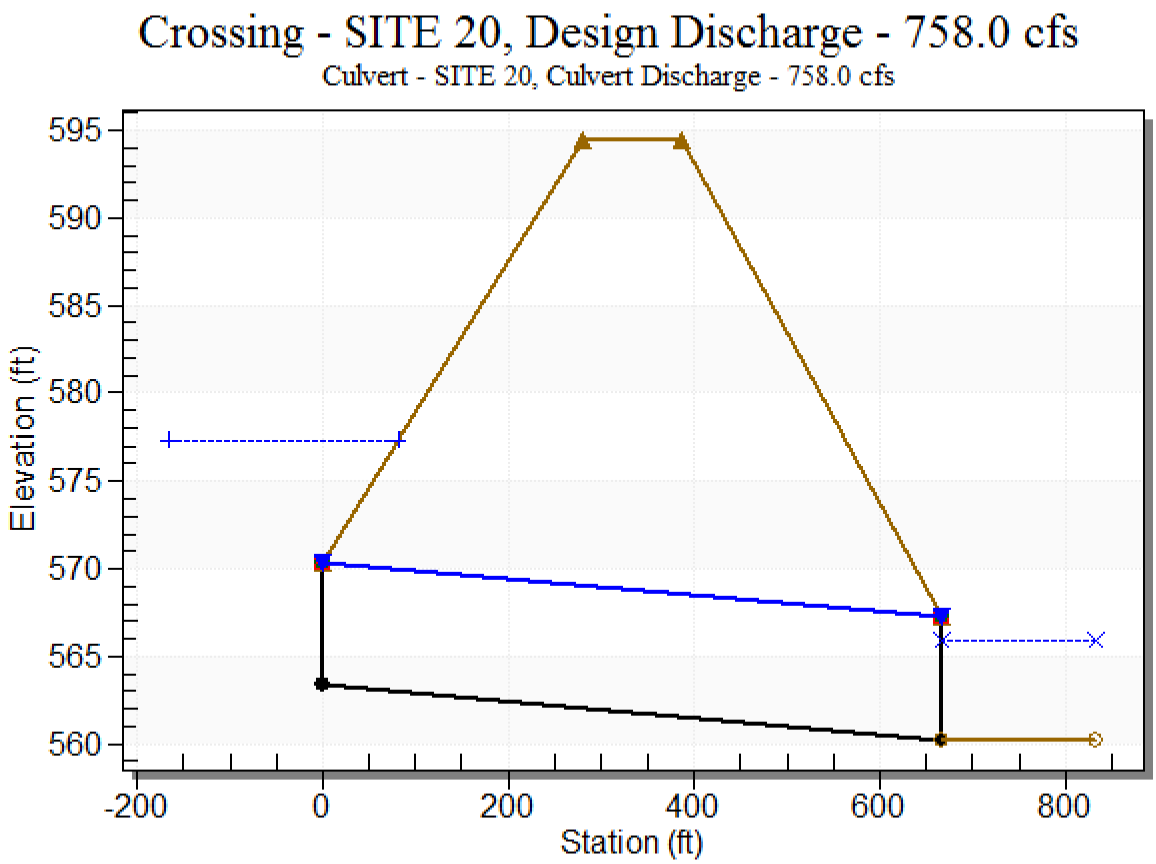
Culvert Length: 667.01 ft,   Culvert Slope: 0.0046

****

Culvert Performance Curve Plot: SITE 20



Water Surface Profile Plot for Culvert: SITE 20



Site Data - SITE 20

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 563.34 ft

Outlet Station: 667.00 ft

Outlet Elevation: 560.24 ft

Number of Barrels: 1

Culvert Data Summary - SITE 20

Barrel Shape: Concrete Box

Barrel Span: 7.00 ft

Barrel Rise: 7.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

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

Inlet Depression: NONE

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

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
606.00	565.29	5.05	5.43	2.21	0.51
758.00	565.89	5.65	5.76	2.47	0.52

Tailwater Channel Data - SITE 20

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 12.00 ft

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

Channel Slope: 0.0070

Channel Manning's n: 0.0500

Channel Invert Elevation: 560.24 ft

Roadway Data for Crossing: SITE 20

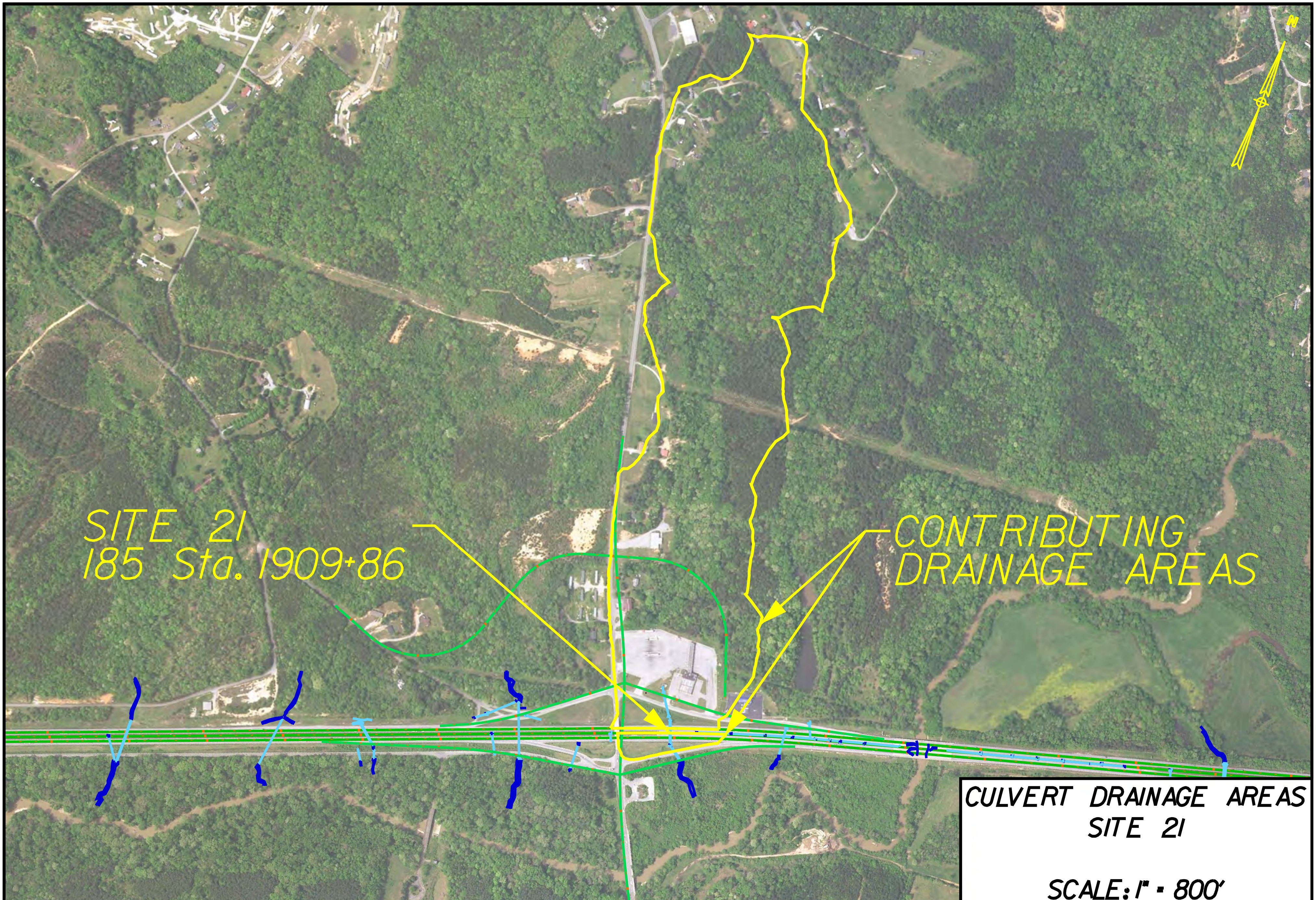
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 594.50 ft

Roadway Surface: Paved

Roadway Top Width: 105.00 ft



CULVERT DRAINAGE AREAS
SITE 21

SCALE: 1" = 800'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	9.15	0.90	
Rolling, 2%-10%	Gravel Pavements	0.44	0.55	Area Weighted C
Rolling, 2%-10%	Meadows & Pasture Land	3.10	0.30	0.25
Rolling, 2%-10%	Side Slopes, Turf	11.52	0.30	
Rolling, 2%-10%	Grass Shoulders	1.14	0.25	
Rolling, 2%-10%	Unimproved Areas	0.58	0.20	
Rolling, 2%-10%	Woodland & Forest	68.21	0.15	
		94.14		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	4.91%	100	0.8				0.403
Shallow Concentrated	Unpaved	4.91%	3481					0.271
Shallow Concentrated								
Channel 1								
Channel 2								
Total			3581				1.4764	0.674

Gaffney

Time of Concentration *(minutes)*	41			

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.25	3.403	94.14	**80**
Q_{25}	1.1	0.25	3.872	94.14	**100**
Q_{50}	1.2	0.25	4.234	94.14	**119**
Q_{100}	1.25	0.25	4.584	94.14	**135**

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 21

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 21 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
575.70	50 year	119.00	119.00	0.00	1
576.11	100 year	135.00	135.00	0.00	1
588.69	Overtopping	454.38	454.38	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 21

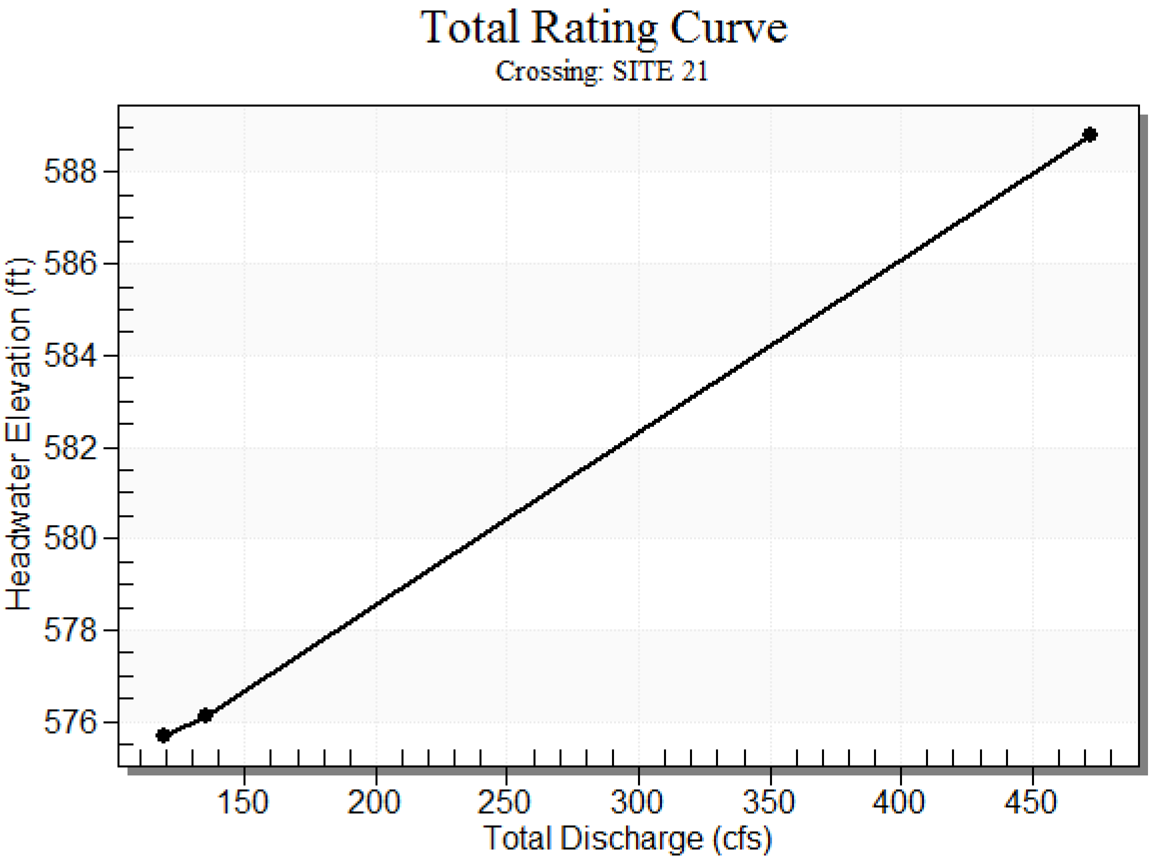


Table 2 - Culvert Summary Table: SITE 21

Discharge Names	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)
50 year	119.00	119.00	575.70	4.569	0.0*	1-S2n	0.000	2.013	2.319	2.319	20.985
100 year	135.00	135.00	576.11	4.984	0.054	1-S2n	0.000	2.013	2.490	2.490	21.497

* Full Flow Headwater elevation is below inlet invert.

****

Single Broken-back Culvert

Inlet Elevation (invert): 571.13 ft

Break Elevation (invert): 568.26 ft

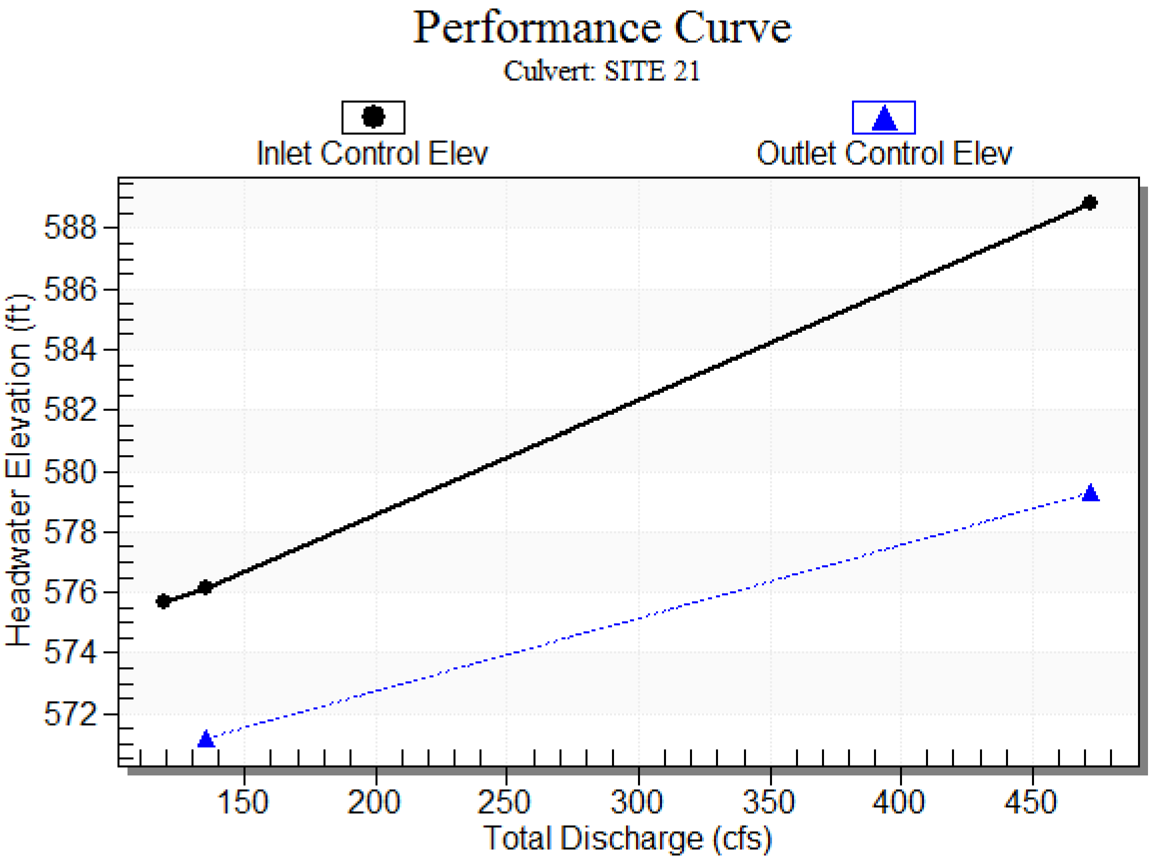
Culvert Length: 265.14 ft

Upper Culvert Section Slope: 0.0185

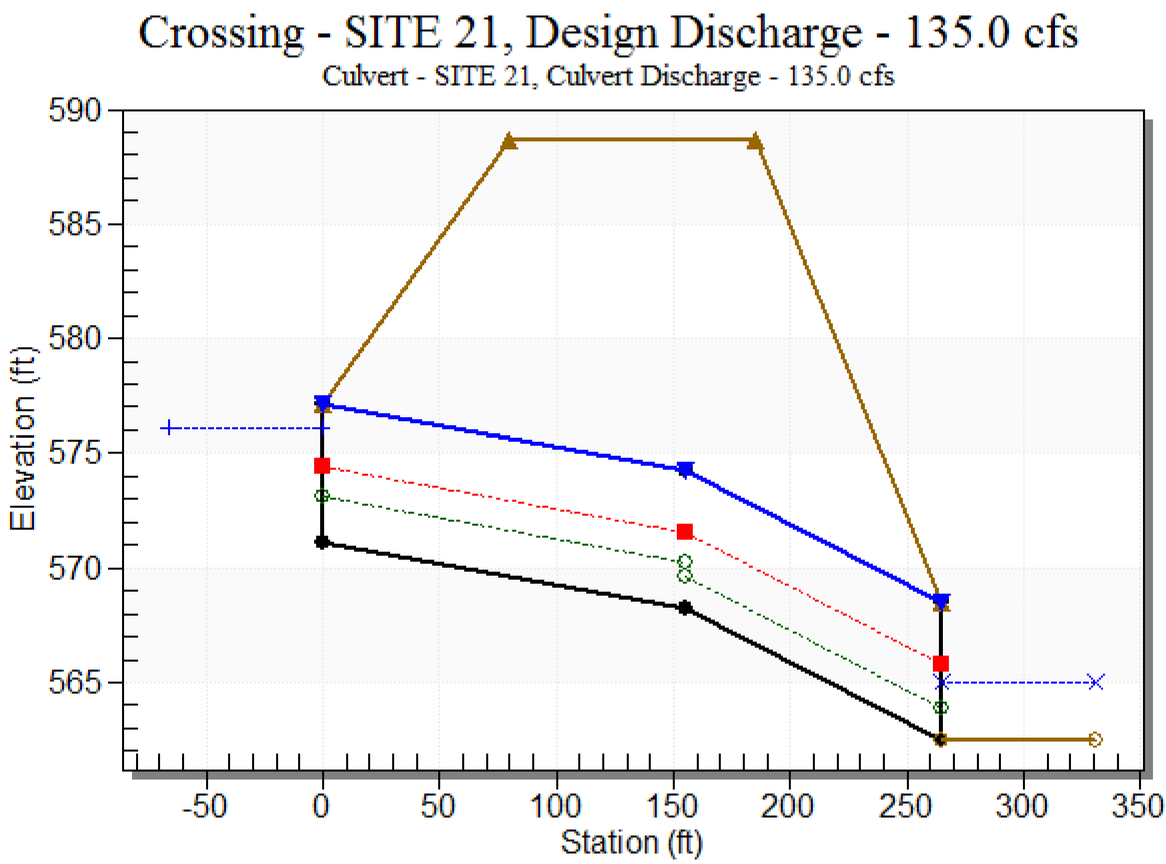
Steep Culvert Section Slope: 0.0523

****

Culvert Performance Curve Plot: SITE 21



Water Surface Profile Plot for Culvert: SITE 21



Site Data - SITE 21

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 571.13 ft

Break Station: 155.00 ft

Break Elevation: 568.26 ft

Outlet Station: 265.00 ft

Outlet Elevation: 562.51 ft

Number of Barrels: 1

Culvert Data Summary - SITE 21

Barrel Shape: Concrete Box

Barrel Span: 4.00 ft

Barrel Rise: 6.00 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 (30-75º flare) Wingwall

Inlet Depression: NONE

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

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
119.00	564.83	2.32	4.36	1.26	0.56
135.00	565.00	2.49	4.52	1.35	0.56

Tailwater Channel Data - SITE 21

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 9.00 ft

Side Slope (H:V): 1.20 (_:1)

Channel Slope: 0.0087

Channel Manning's n: 0.0450

Channel Invert Elevation: 562.51 ft

Roadway Data for Crossing: SITE 21

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 588.69 ft

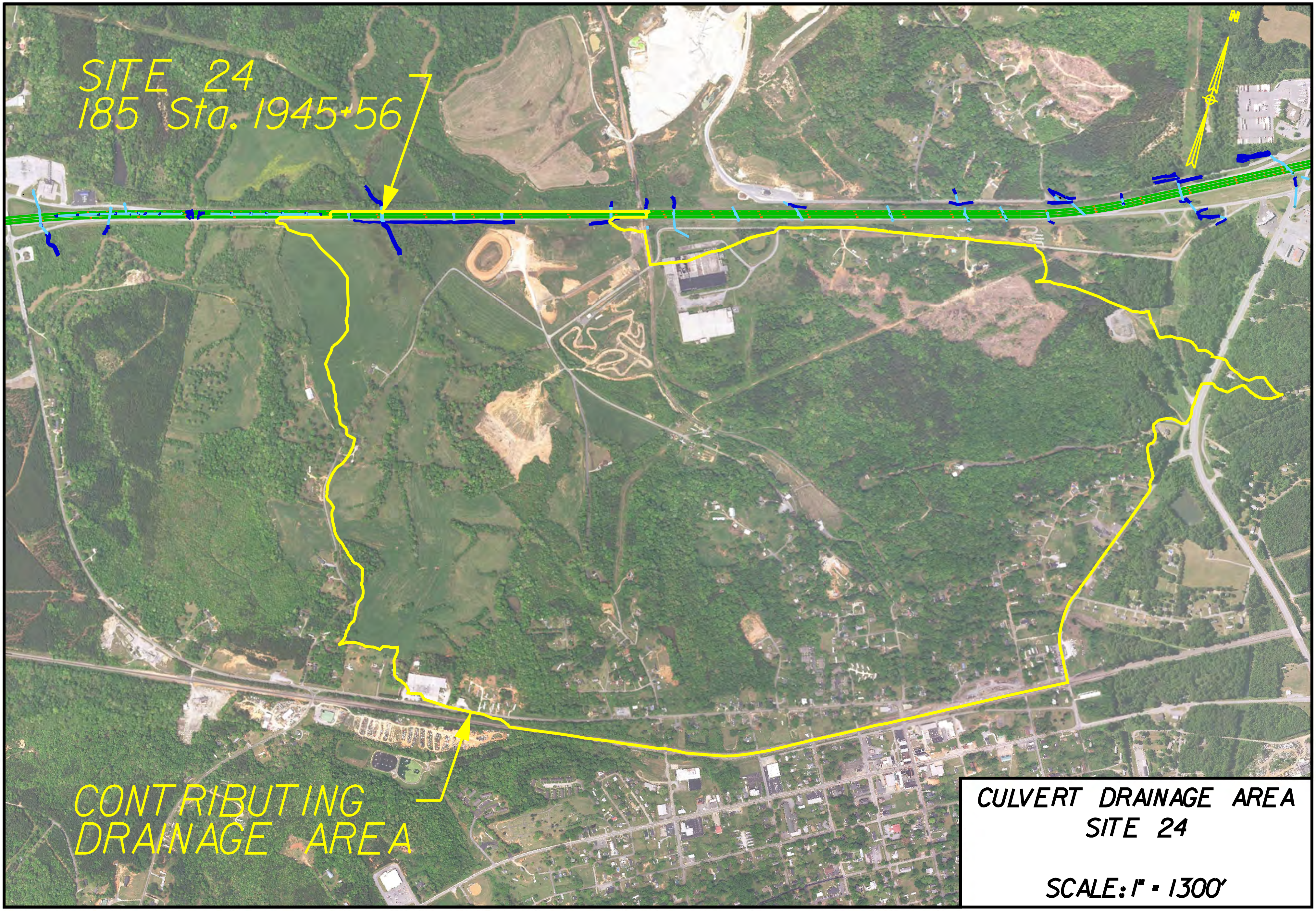
Roadway Surface: Paved

Roadway Top Width: 105.00 ft

<table>
<tr><td colspan="3">Pipe/Box Dimensions</td><td rowspan="6"></td><td>Flow</td></tr>
<tr><td colspan="2"></td><td>(inch)</td><td>(cfs)</td></tr>
<tr><td colspan="2">Pipe Diameter</td><td></td><td rowspan="4">119</td></tr>
<tr><td colspan="3">Box Dimension</td></tr>
<tr><td>Span (ft)</td><td>4</td><td>48</td></tr>
<tr><td>Height (ft)</td><td>6</td><td>72</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td>Length</td><td>Width</td><td colspan="2">Riprap</td><td>GeoText</td></tr>
<tr><td colspan="2">(FHWA HEC-14 - Calculated)</td><td>Quantity</td><td>Class[2]</td><td></td></tr>
<tr><td>(ft)</td><td>(ft)</td><td>(Tons)</td><td></td><td>(SqYd)</td></tr>
<tr><td>25</td><td>29</td><td>55</td><td>B</td><td>82</td></tr>
<tr><td colspan="5"></td></tr>
<tr><td colspan="5">** Energy Disipator only, still add quantities for slope protection.
** Apron length as per HEC-14 Table 10.1, Fig. 10.4; width as per HEC-14 Fig. 10.4.
** Riprap Class (D50) as per HEC-14 Eq. 10.4; Tailwater condition assumed (TW=0.4D)</td></tr>
</table>

SITE 22

Analysis on the culvert located at Site 22 could not be performed because the crossing was not surveyed. The upstream inlet was not found during the culvert assessment field inspection; while the downstream was located and found to be 80% filled.


SITE 24
185 Sta. 1945+56
CONTRIBUTING
DRAINAGE AREA
N
CULVERT DRAINAGE AREA
SITE 24
SCALE: 1" = 1300'

RURAL REGRESSION ANALYSIS

This spreadsheet computes the 50-, 20-, 10-, 4-, 2-, 1-, 0.5-, and 0.2-percent chance exceedance flows for an ungaged site in Georgia, South Carolina, and North Carolina. The spreasheet also includes the 95-percent prediction intervals, the minus and plus standard error of prediction intervals, and the average standard error of prediction. To use the spreadsheet, enter requested information in the yellow cells below.

Enter a site-description name: SITE 24

Enter the explanatory variables:

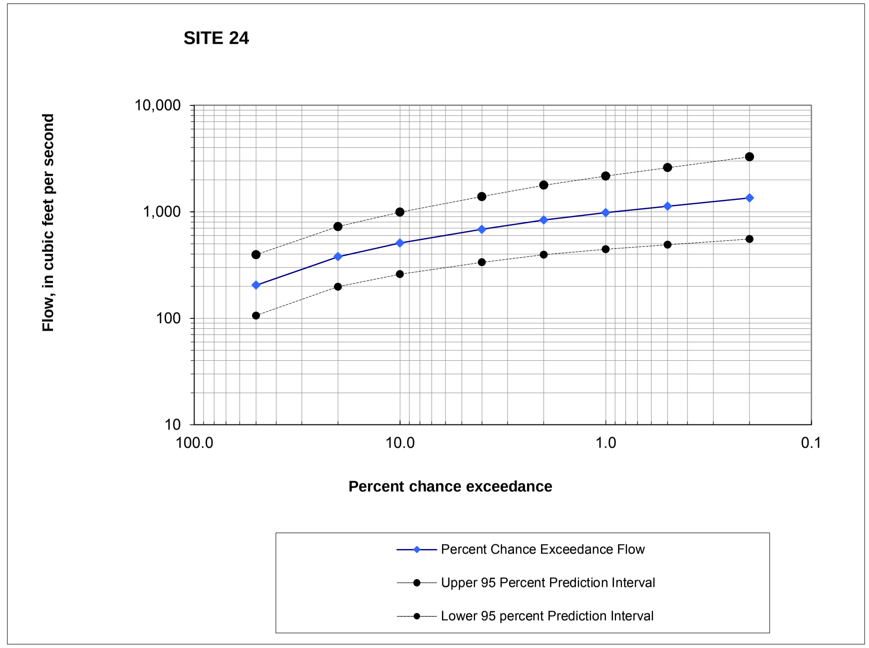
Drainage area, in square miles	1.49
Percent of basin in Hydrologic Region 1	100
Percent of basin in Hydrologic Region 2	0
Percent of basin in Hydrologic Region 3	0
Percent of basin in Hydrologic Region 4	0
Percent of basin in Hydrologic Region 5	0

Applicable range of draingage area is 1 to 9,000 square miles.
Hydrologic Region 1 corresponds to the USEPA Level III Ridge and Valley and Piedmont ecoregions
Hydrologic Region 2 corresponds to the USEPA Level III Blue Ridge ecoregion
Hydrologic Region 3 corresponds to the USEPA Level IV Sand Hills ecoregion
Hydrologic Region 4 corresponds to the USEPA Level III Southeastern, Middle Atlantic Coastal, and Southern Coastal Plain ecoregions
Hydrologic Region 5 corresponds to the lower portion of the USEPA Level IV Tifton Uplands ecoregion.

Sum of region percentages	100

Drainage area check
DRAINAGE AREA WITHIN APPLICABLE LIMITS.

Percent chance exceedance	Percent chance exceedance flow, in ft^3/s	Lower 95 percent prediction interval flow, in ft^3/s	Upper 95 percent prediction interval flow, in ft^3/s	$-S_{P,i}$ (percent)	$+S_{P,i}$ (percent)	Average $S_{p,i}$ (percent)
50	205	106	396	-28.5	39.9	34.6
20	379	198	726	-28.2	39.3	34.1
10	509	260	995	-29.0	40.8	35.2
4	684	336	1,390	-30.5	43.8	37.6
2	839	396	1,780	-31.8	46.6	39.7
1	984	446	2,170	-33.2	49.7	42.0
0.5	1,130	491	2,600	-34.6	52.9	44.5
0.2	1,350	554	3,290	-36.5	57.5	47.9



UNITS	TOTAL AREA		IMPERVIOUS AREA	% IMPERVIOUS
SQ. METERS	3867300		267230	6.91%
SQ. MILES	1.49		0.10	6.91%

Note: Data derived from NLCD 2006 Impervious Surface, 30-meter resolution

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 24

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 24 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
577.35	50 year	839.00	839.00	0.00	1
578.31	100 year	984.00	984.00	0.00	1
582.31	Overtopping	1547.63	1547.63	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 24

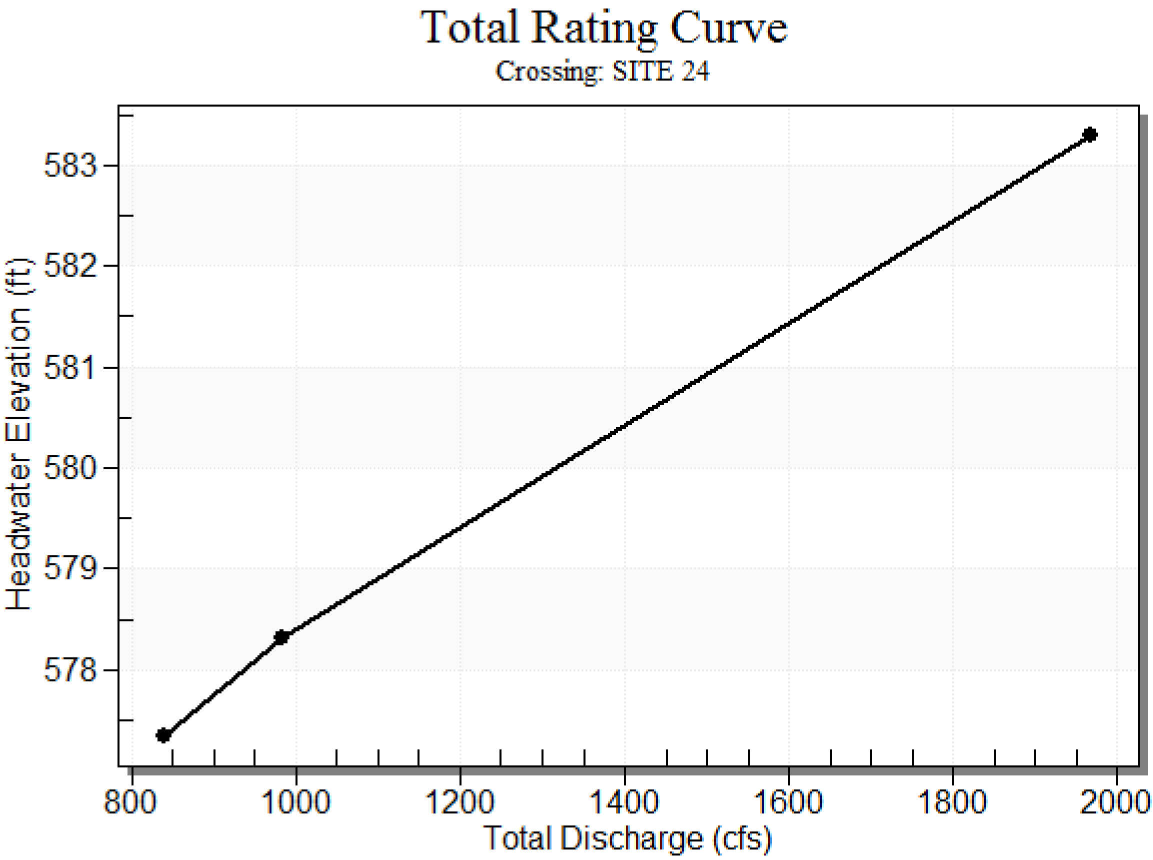


Table 2 - Culvert Summary Table: SITE 24

Discharge Names	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)
50 year	839.00	839.00	577.35	7.730	0.0*	6-FFt	1.486	5.335	1.486	7.200	47.041
100 year	984.00	984.00	578.31	8.688	0.0*	6-FFt	1.653	5.933	1.653	7.718	49.601

* Full Flow Headwater elevation is below inlet invert.

****

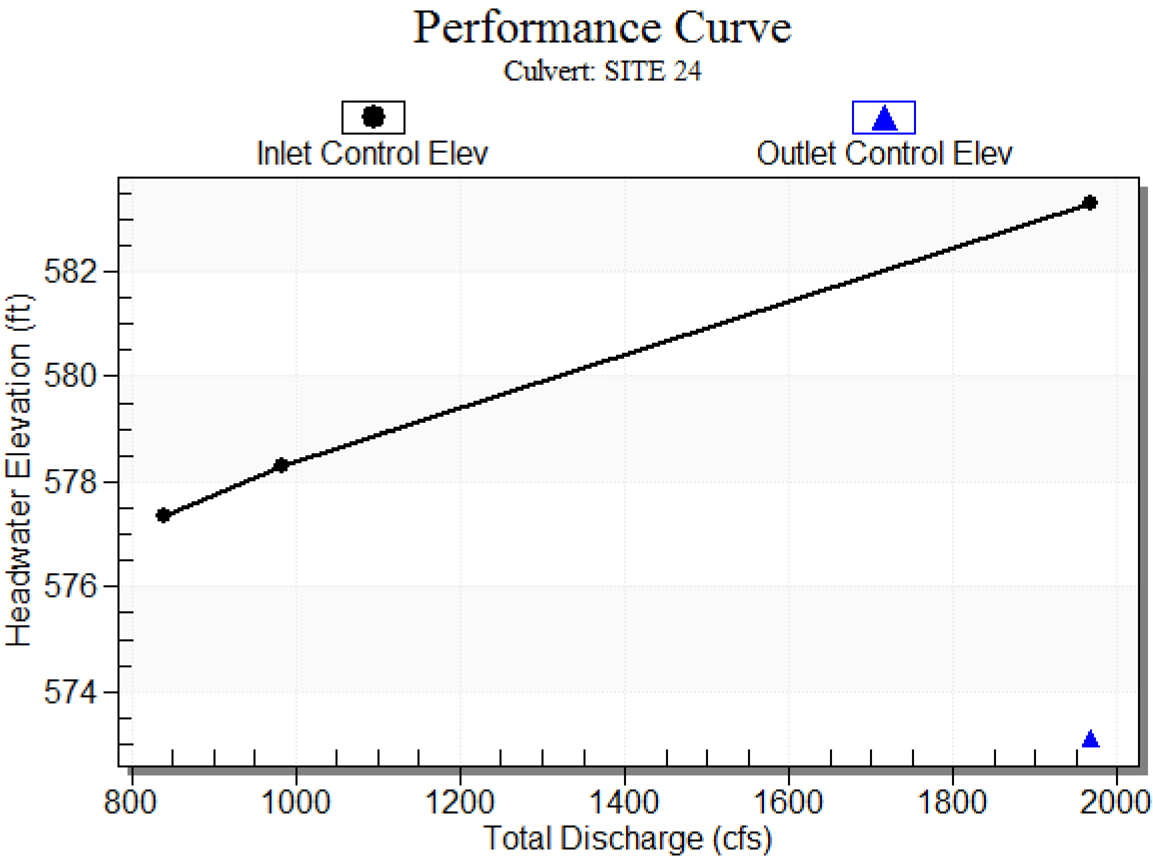
Straight Culvert

Inlet Elevation (invert): 569.62 ft,   Outlet Elevation (invert): 557.36 ft

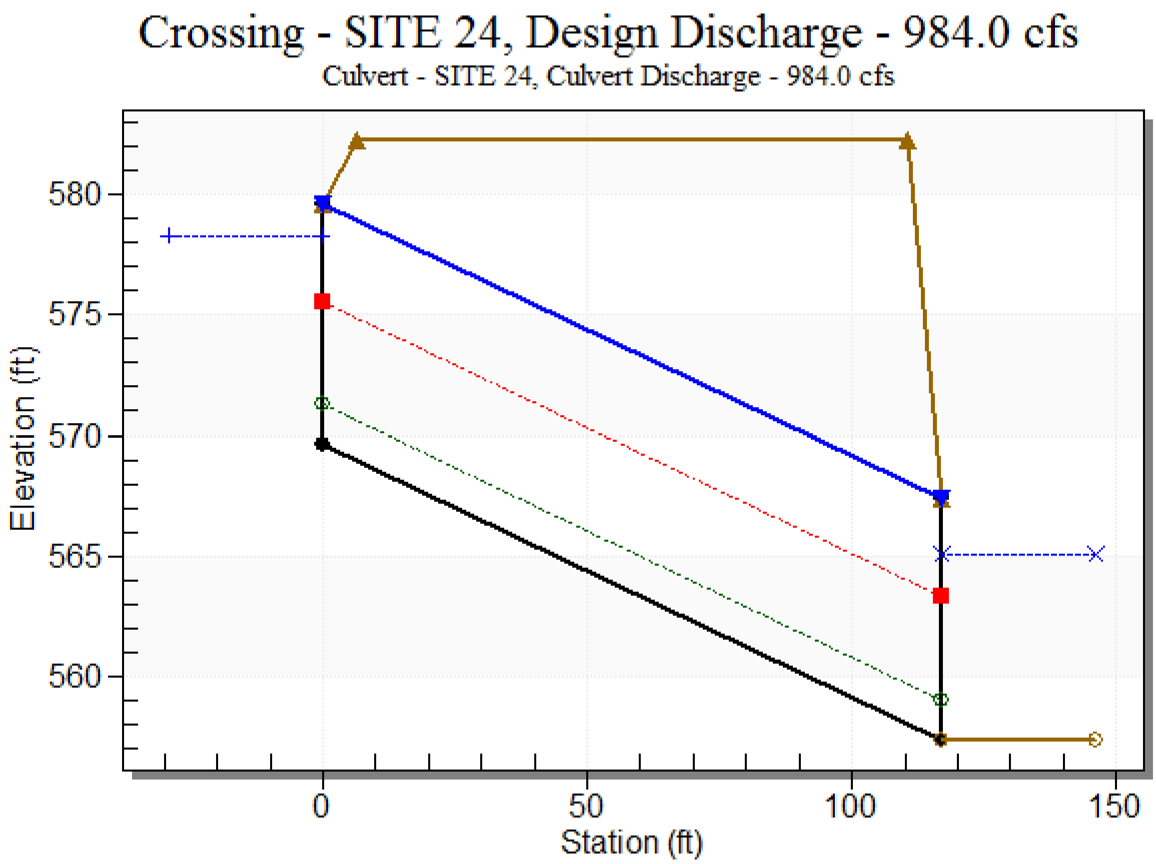
Culvert Length: 117.64 ft,   Culvert Slope: 0.1048

****

Culvert Performance Curve Plot: SITE 24



Water Surface Profile Plot for Culvert: SITE 24



Site Data - SITE 24

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 569.62 ft

Outlet Station: 117.00 ft

Outlet Elevation: 557.36 ft

Number of Barrels: 1

Culvert Data Summary - SITE 24

Barrel Shape: Concrete Box

Barrel Span: 12.00 ft

Barrel Rise: 10.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

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

Inlet Depression: NONE

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

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
839.00	564.56	7.20	3.81	2.25	0.33
984.00	565.08	7.72	3.96	2.41	0.33

Tailwater Channel Data - SITE 24

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 9.00 ft

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

Channel Slope: 0.0050

Channel Manning's n: 0.0700

Channel Invert Elevation: 557.36 ft

Roadway Data for Crossing: SITE 24

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 582.31 ft

Roadway Surface: Paved

Roadway Top Width: 104.00 ft

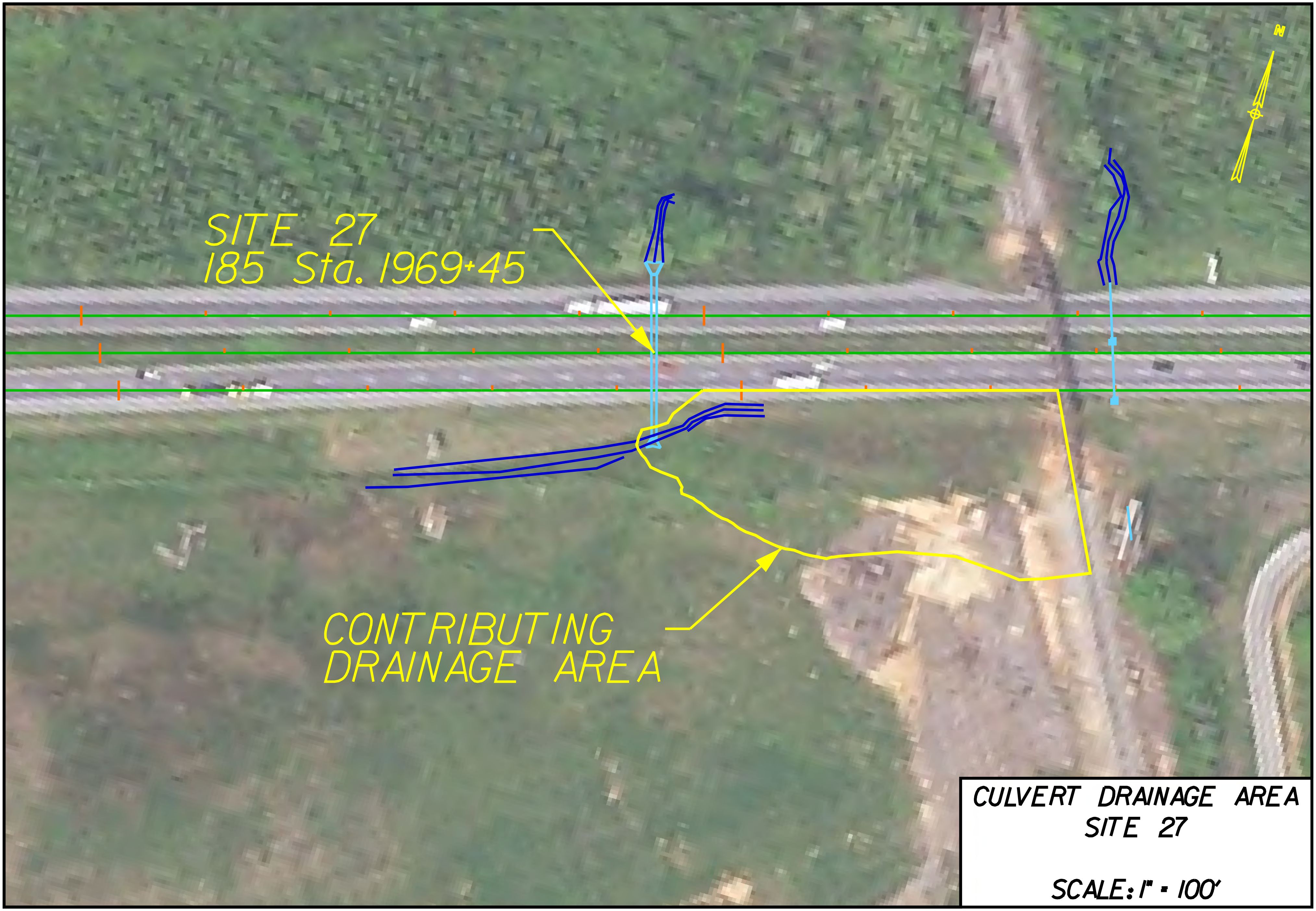
Pipe/Box Dimensions				Flow
		(inch)		(cfs)
Pipe Diameter				839
Box Dimension				
Span (ft)	12	144		
Height (ft)	10	120		

Length	Width	Riprap		GeoText
(FHWA HEC-14 - Calculated)		Quantity	Class[2]	
(ft)	(ft)	(Tons)		(SqYd)
77	88	1222	D	754

** Energy Disipator only, still add quantities for slope protection.
** Apron length as per HEC-14 Table 10.1, Fig. 10.4; width as per HEC-14 Fig. 10.4.
** Riprap Class (D50) as per HEC-14 Eq. 10.4; Tailwater condition assumed (TW=0.4D)

SITE 26

Analysis on the culvert located at Site 26 could not be performed because the crossing was not surveyed. Additionally, the site could not be located during the culvert assessment field inspection.



CULVERT DRAINAGE AREA
SITE 27

SCALE: 1" = 100'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	0.15	0.90	
Flat, 0%-2%	Earth shoulders	0.62	0.50	Area Weighted C
Hilly, Over 10%	Gravel Pavements	0.02	0.60	0.53
Hilly, Over 10%	Side Slopes, Turf	0.17	0.30	
		0.96		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	11.90%	100	0.41				0.166
Shallow Concentrated	Unpaved	11.90%	211					0.011
Shallow Concentrated								
Channel 1		10.82%	100	0.045	4.5	9.2221	6.75059	0.004
Channel 2								
Total			411				0.6331	0.180

Gaffney

Time of Concentration *(minutes)*	11

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.53	5.815	0.96	**3**
Q_{25}	1.1	0.53	6.699	0.96	**4**
Q_{50}	1.2	0.53	7.395	0.96	**5**
Q_{100}	1.25	0.53	8.080	0.96	**5**

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 27

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 27 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
589.79	50 year	4.50	4.50	0.00	1
589.84	100 year	5.10	5.10	0.00	1
596.56	Overtopping	5.10	5.10	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 27

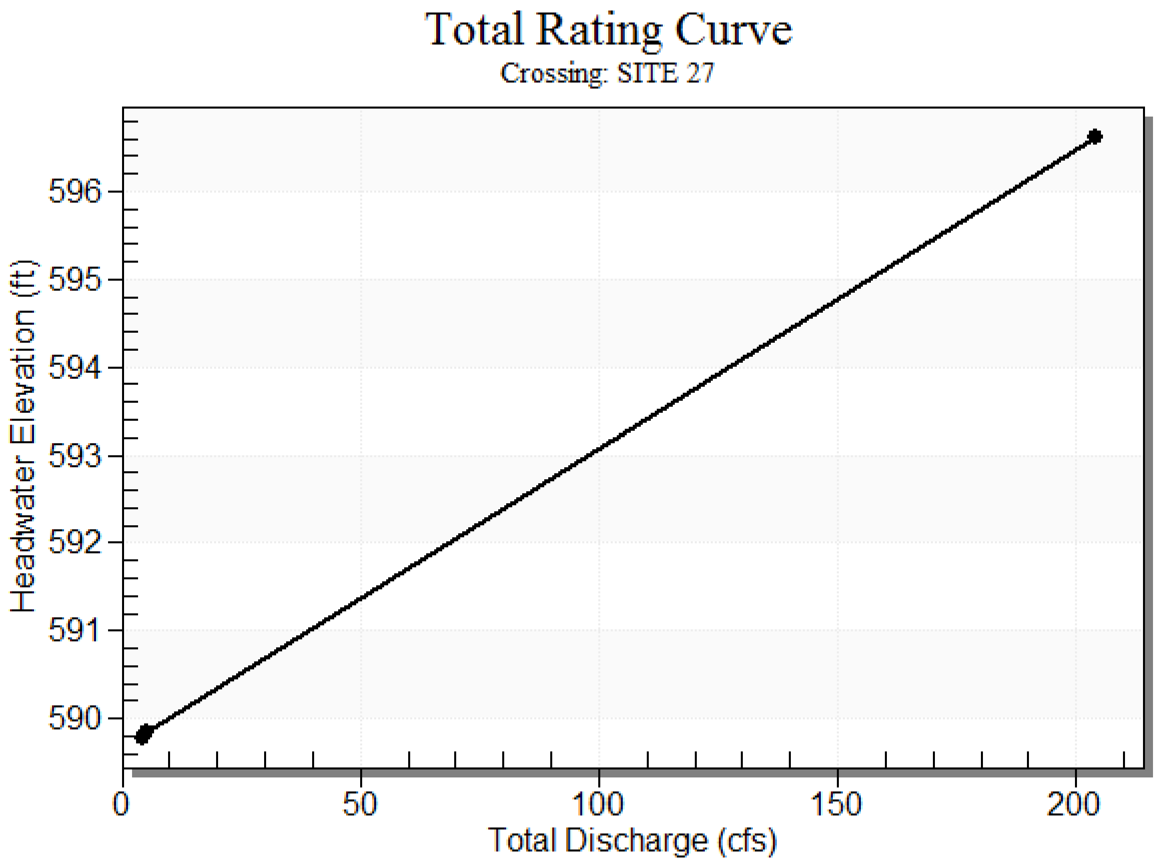


Table 2 - Culvert Summary Table: SITE 27

Discharge Names	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)
50 year	4.50	4.50	589.79	0.567	0.0*	6-FFt	0.085	0.340	0.085	1.196	13.298
100 year	5.10	5.10	589.84	0.616	0.0*	6-FFt	0.096	0.370	0.096	1.254	13.298

* Full Flow Headwater elevation is below inlet invert.

****

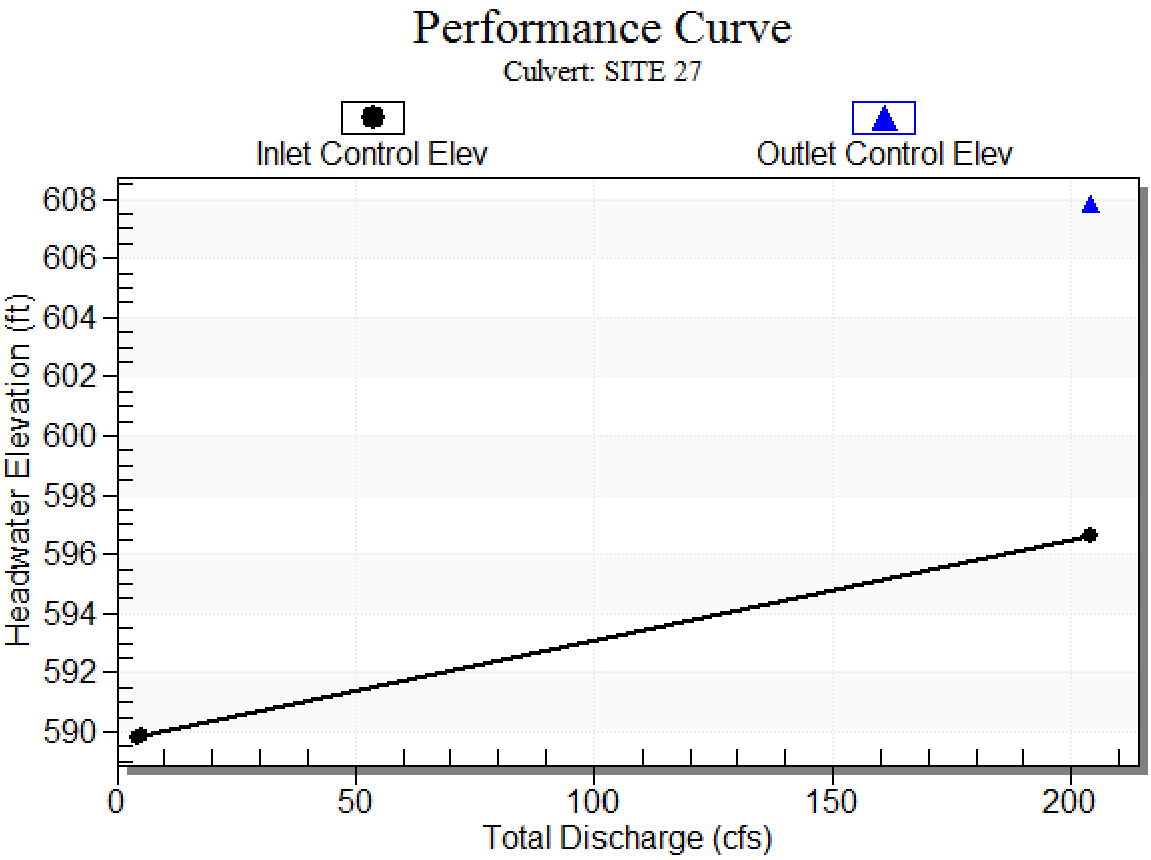
Straight Culvert

Inlet Elevation (invert): 589.22 ft,   Outlet Elevation (invert): 585.40 ft

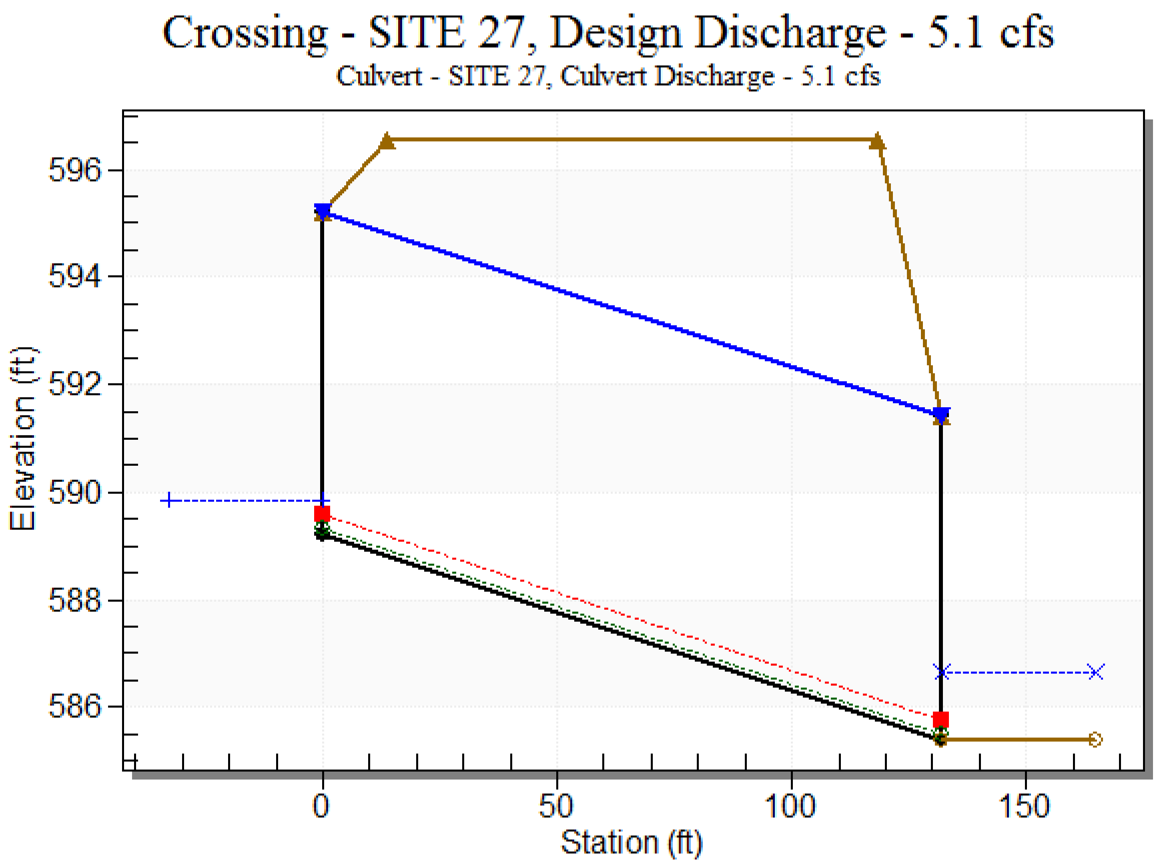
Culvert Length: 132.06 ft,   Culvert Slope: 0.0289

****

Culvert Performance Curve Plot: SITE 27



Water Surface Profile Plot for Culvert: SITE 27



Site Data - SITE 27

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 589.22 ft

Outlet Station: 132.00 ft

Outlet Elevation: 585.40 ft

Number of Barrels: 1

Culvert Data Summary - SITE 27

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: Square Edge (90º) Headwall

Inlet Depression: NONE

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

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
4.50	586.60	1.20	1.75	1.57	0.40
5.10	586.65	1.25	1.80	1.64	0.40

Tailwater Channel Data - SITE 27

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 1.80 (_:1)

Channel Slope: 0.0210

Channel Manning's n: 0.0800

Channel Invert Elevation: 585.40 ft

Roadway Data for Crossing: SITE 27

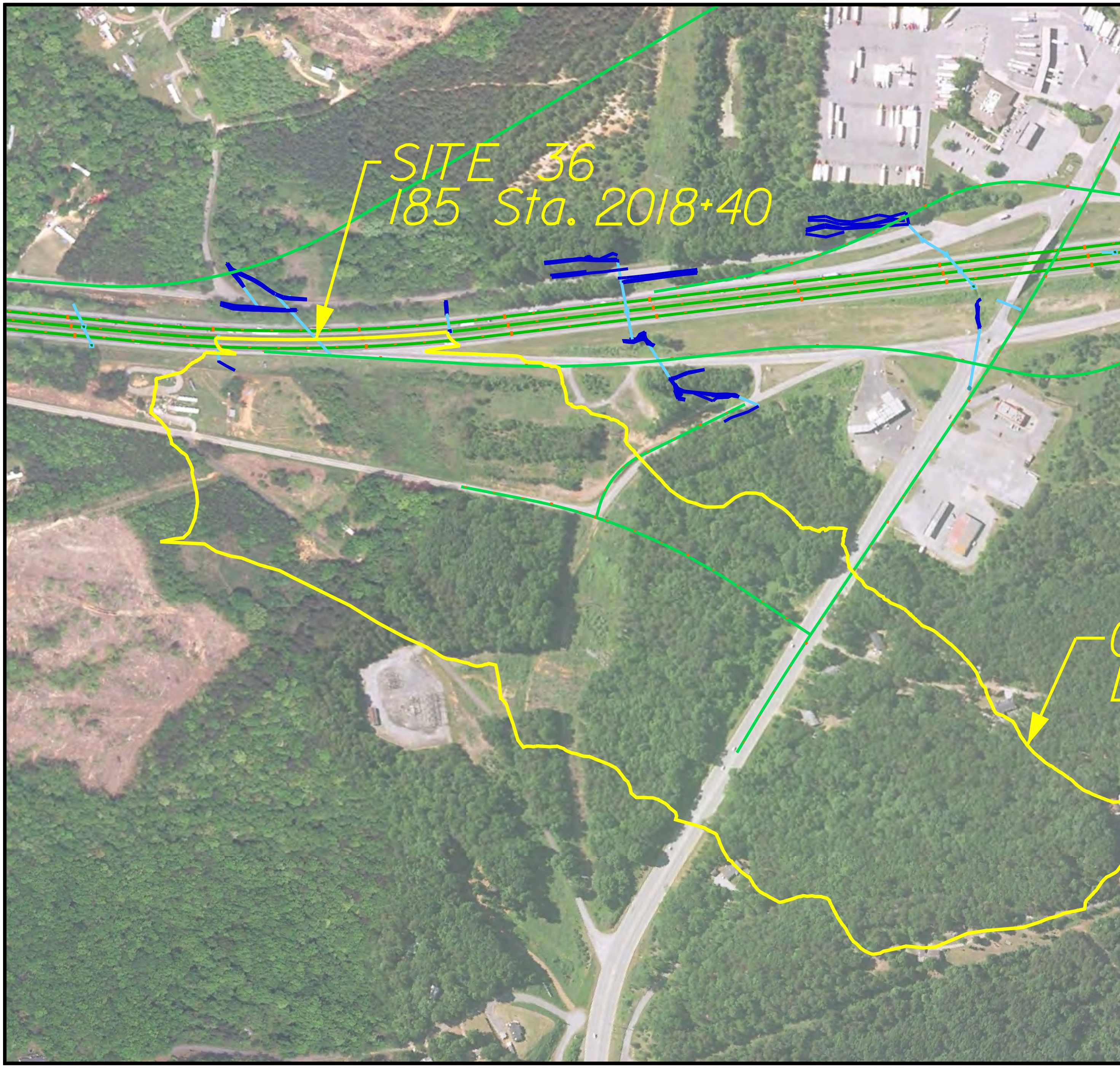
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 596.56 ft

Roadway Surface: Paved

Roadway Top Width: 105.00 ft



CULVERT DRAINAGE AREA
SITE 36

SCALE: 1" = 500'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	5.85	0.90	
Rolling, 2%-10%	Earth shoulders	0.19	0.50	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	15.29	0.30	0.27
Rolling, 2%-10%	Unimproved Areas	7.49	0.20	
Hilly, Over 10%	Woodland & Forest	41.82	0.20	
Rolling, 2%-10%	Woodland & Forest	3.33	0.15	
		73.97		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrus	6.15%	100	0.8				0.368
Shallow Concentrated	Unpaved	6.15%	634					0.044
Shallow Concentrated								
Channel 1								
Channel 2								
Total			734				0.4946	0.412

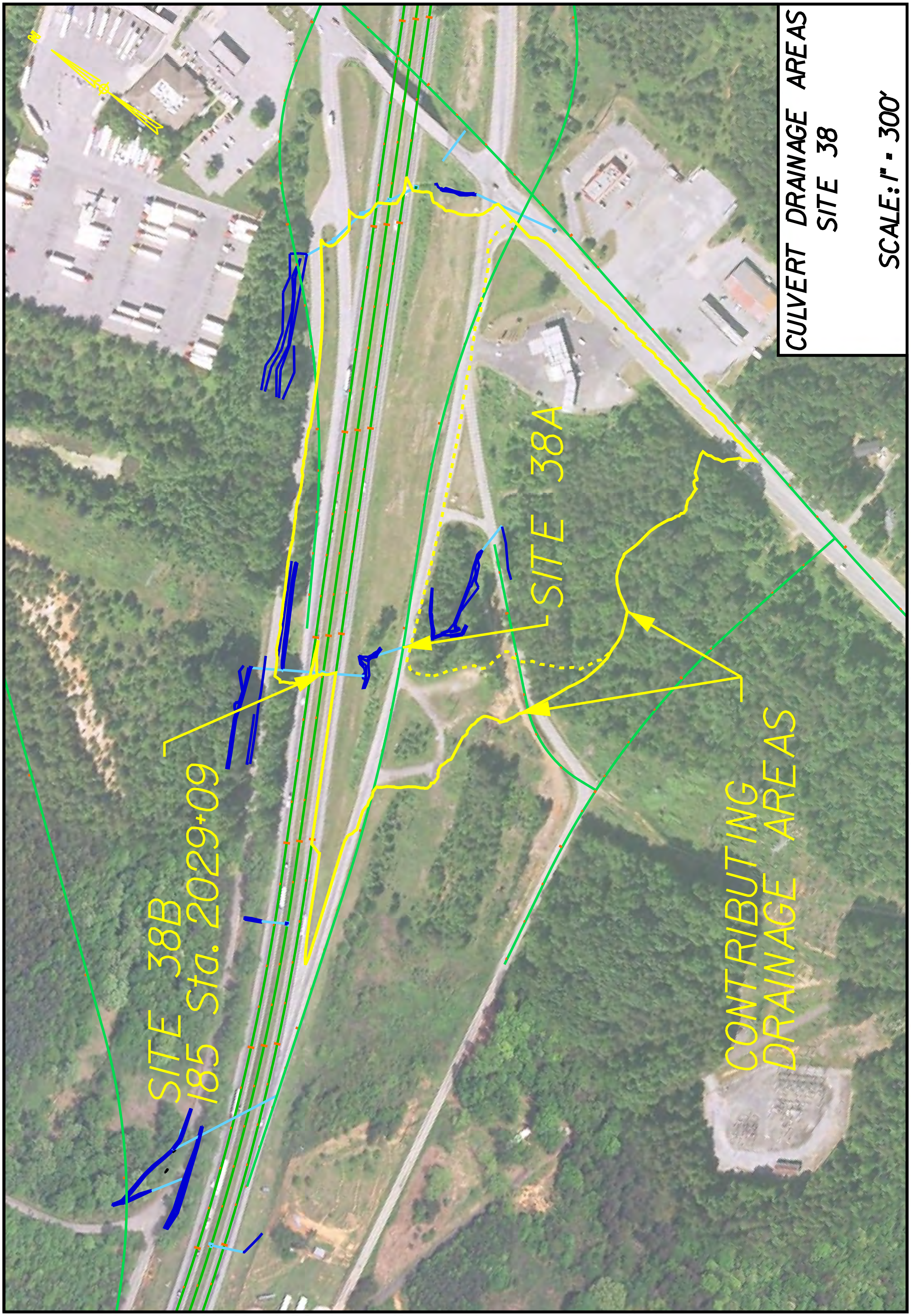
Gaffney

Time of Concentration *(minutes)*	25

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.27	4.372	73.97	**89**
Q_{25}	1.1	0.27	4.996	73.97	**112**
Q_{50}	1.2	0.27	5.482	73.97	**134**
Q_{100}	1.25	0.27	5.956	73.97	**151**

SITE 36

Analysis of the 36” R.C pipe located at Site 36 (Approx. Station 2018+40) could not be completed because the inlet of the crossing was not surveyed. However, the inlet of the crossing was located during the culvert assessment field inspection.


CULVERT DRAINAGE AREAS
SITE 38
SCALE: 1" = 300'
SITE 38A
SITE 38B
I85 Sta. 2029+09
CONTRIBUTING
DRAINAGE AREAS

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	1.95	0.90	
Rolling, 2%-10%	Side Slopes, Turf	4.11	0.30	Area Weighted C
Hilly, Over 10%	Woodland & Forest	5.03	0.20	0.36
		11.09		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusl	12.65%	100	0.8				0.276
Shallow Concentrated	Unpaved	12.65%	523					0.025
Shallow Concentrated								
Channel 1								
Channel 2								
Total			623				0.5743	0.301

Gaffney

Time of Concentration *(minutes)*	19

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.36	4.893	11.09	**20**
Q_{25}	1.1	0.36	5.607	11.09	**25**
Q_{50}	1.2	0.36	6.165	11.09	**30**
Q_{100}	1.25	0.36	6.711	11.09	**34**

Civil Engineering Consulting Services, Inc.

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 38A - UPSTREAM

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 38A - UPSTREAM Discharge (cfs)	Roadway Discharge (cfs)	Iterations
769.08	25 year	25.00	25.00	0.00	1
769.32	50 year	30.00	30.00	0.00	1
769.81	100 year	34.00	34.01	0.00	6
787.61	Overtopping	30.00	30.00	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 38A - UPSTREAM

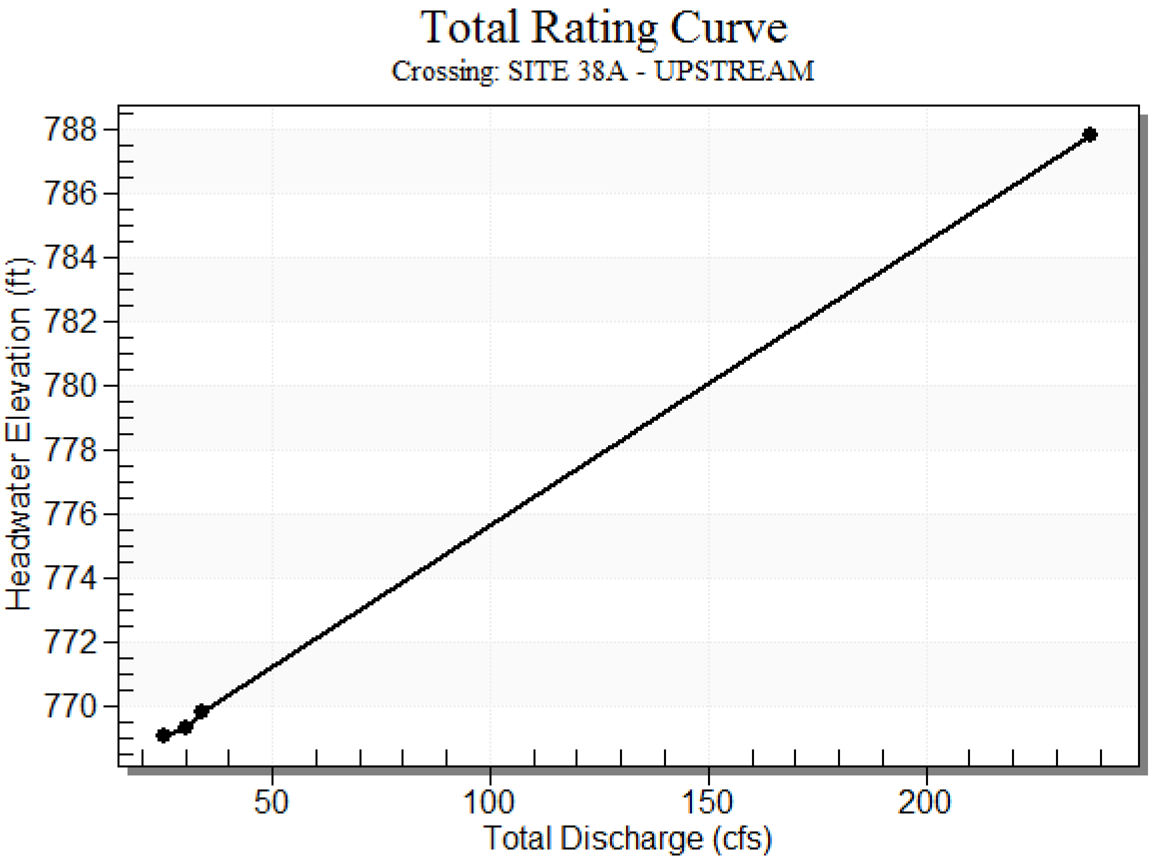


Table 2 - Culvert Summary Table: SITE 38A - UPSTREAM

Discharge Names	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)
25 year	25.00	25.00	769.08	2.143	1.548	4-FFf	0.980	1.537	0.980	3.670	11.246
50 year	30.00	30.00	769.32	2.384	2.245	4-FFf	1.084	1.692	1.084	4.280	11.767
100 year	34.00	34.01	769.81	2.563	2.866	4-FFf	1.168	1.805	3.500	4.820	3.535

****

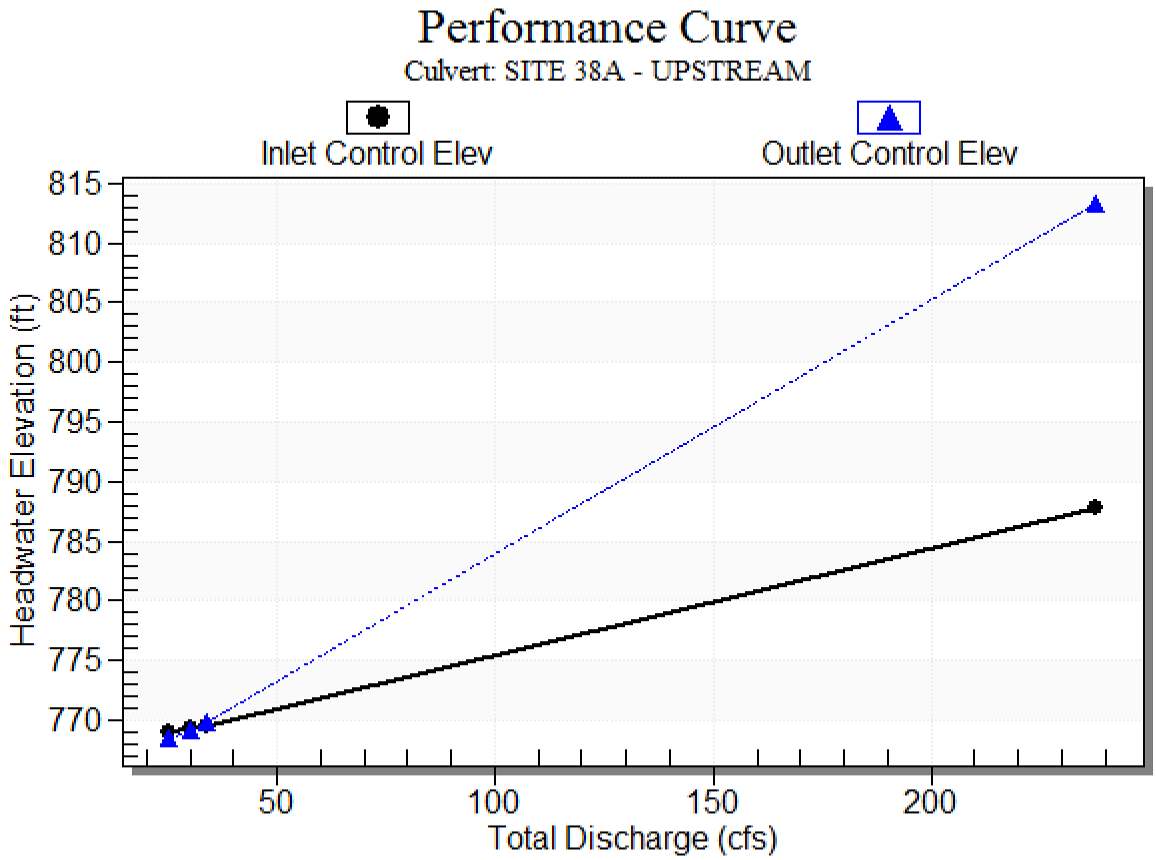
Straight Culvert

Inlet Elevation (invert): 766.94 ft,   Outlet Elevation (invert): 764.62 ft

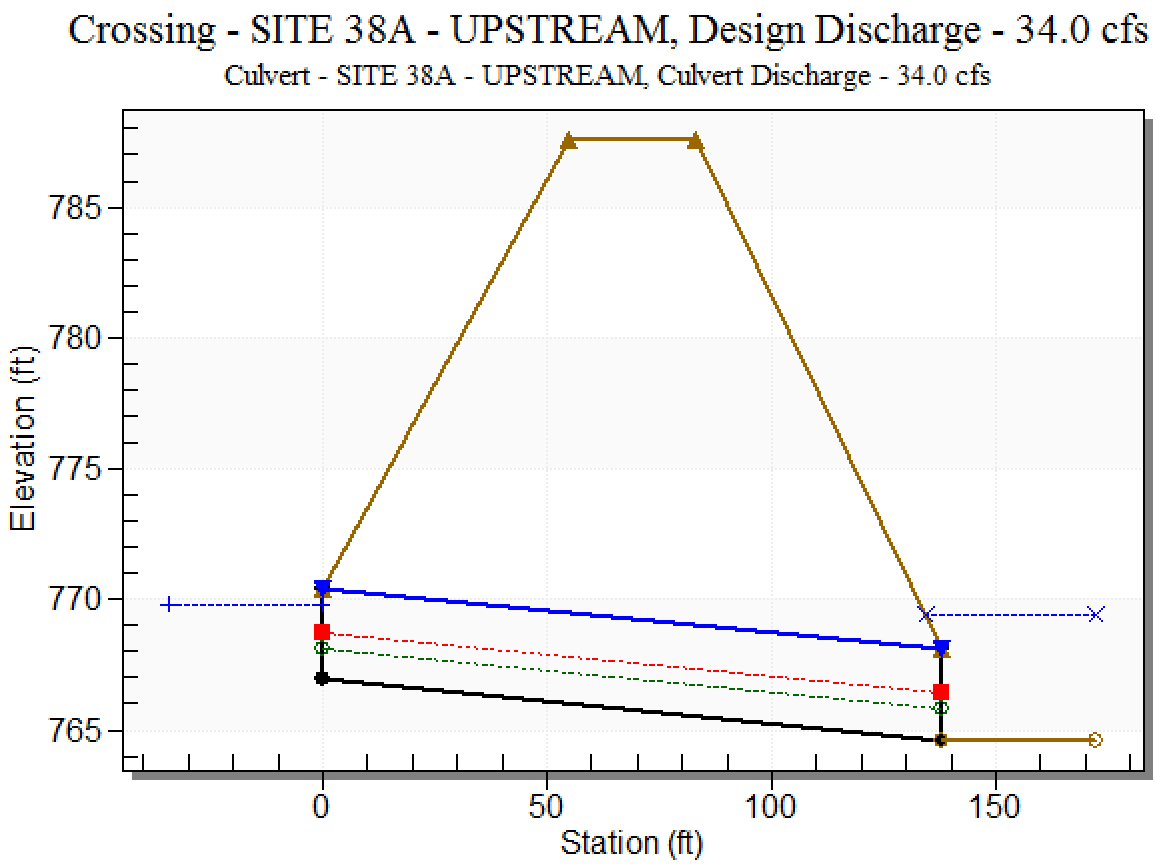
Culvert Length: 138.02 ft,   Culvert Slope: 0.0168

****

Culvert Performance Curve Plot: SITE 38A - UPSTREAM



Water Surface Profile Plot for Culvert: SITE 38A - UPSTREAM



Site Data - SITE 38A - UPSTREAM

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 766.94 ft

Outlet Station: 138.00 ft

Outlet Elevation: 764.62 ft

Number of Barrels: 1

Culvert Data Summary - SITE 38A - UPSTREAM

Barrel Shape: Circular

Barrel Diameter: 3.50 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: SITE 38A - UPSTREAM)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)
25.00	768.29	3.67	0.00
30.00	768.90	4.28	0.00
34.00	769.44	4.82	0.00

Tailwater Channel Data - SITE 38A - UPSTREAM

Tailwater Channel Option: Enter Rating Curve

Channel Invert Elevation: 764.62 ft

Roadway Data for Crossing: SITE 38A - UPSTREAM

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 787.61 ft

Roadway Surface: Paved

Roadway Top Width: 28.00 ft

SITE 38 – Upstream Culvert Tailwater Rating Curve

Return Event	Downstream (DS) Culvert			Upstream (US) Culvert		
	Inlet Elevation	758.28		Outlet Elevation	764.62	
		Headwater			Tailwater	
		Elevation	Depth		Elevation	Depth
25-Year		761.95	3.67		768.29	3.67
50-Year		762.56	4.28		768.90	4.28
100-Year		763.10	4.82		769.44	4.82

* All elevations and depths are in feet.

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	6.13	0.90	
Rolling, 2%-10%	Side Slopes, Turf	12.35	0.30	Area Weighted C
Hilly, Over 10%	Woodland & Forest	5.14	0.20	0.43
		23.62		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrus	12.65%	100	0.8				0.276
Shallow Concentrated	Unpaved	12.65%	523					0.025
Shallow Concentrated								
Channel 1								
Channel 2								
Total			623				0.5743	0.301

Gaffney

Time of Concentration *(minutes)*	19			

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.43	4.893	23.62	**50**
Q_{25}	1.1	0.43	5.607	23.62	**63**
Q_{50}	1.2	0.43	6.165	23.62	**76**
Q_{100}	1.25	0.43	6.711	23.62	**86**

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 38B - DOWNSTREAM

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 38B - DOWNSTREAM Discharge (cfs)	Roadway Discharge (cfs)	Iterations
761.95	25 year	63.00	63.00	0.00	1
762.56	50 year	76.00	76.00	0.00	1
763.10	100 year	86.00	86.00	0.00	1
780.56	Overtopping	236.33	236.33	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 38B - DOWNSTREAM

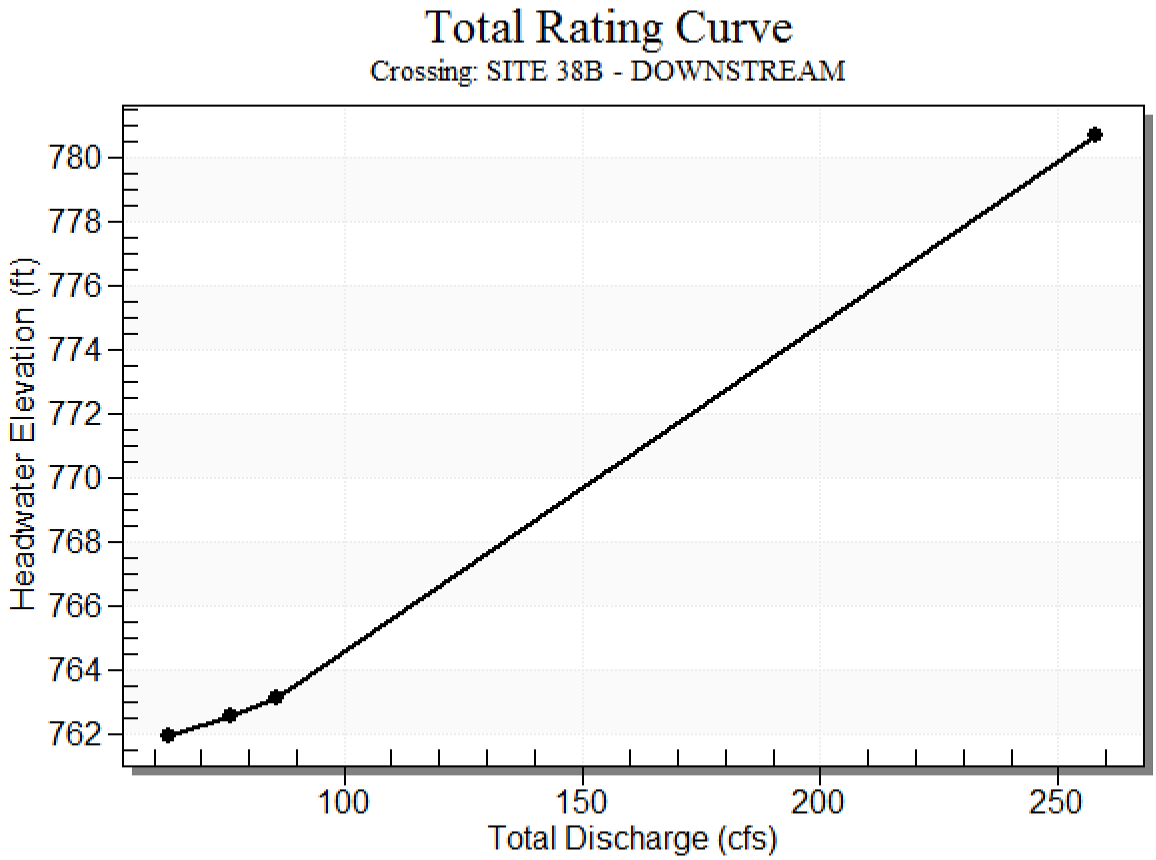


Table 2 - Culvert Summary Table: SITE 38B - DOWNSTREAM

Discharge Names	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)
25 year	63.00	63.00	761.95	3.666	0.0*	6-FFc	1.121	2.485	2.485	1.365	8.645
50 year	76.00	76.00	762.56	4.278	0.0*	6-FFc	1.239	2.725	2.725	1.497	9.457
100 year	86.00	86.00	763.10	4.823	0.0*	6-FFc	1.321	2.884	2.884	1.589	10.179

* Full Flow Headwater elevation is below inlet invert.

****

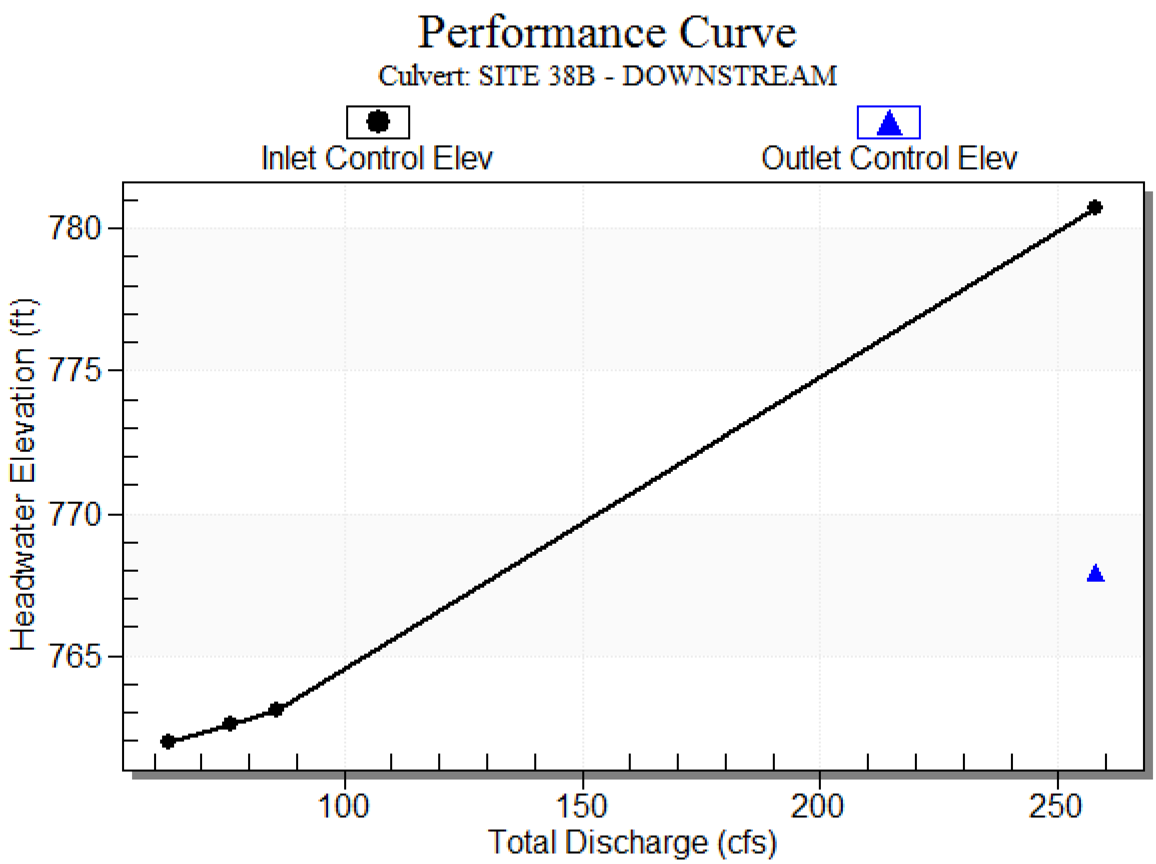
Straight Culvert

Inlet Elevation (invert): 758.28 ft,   Outlet Elevation (invert): 740.11 ft

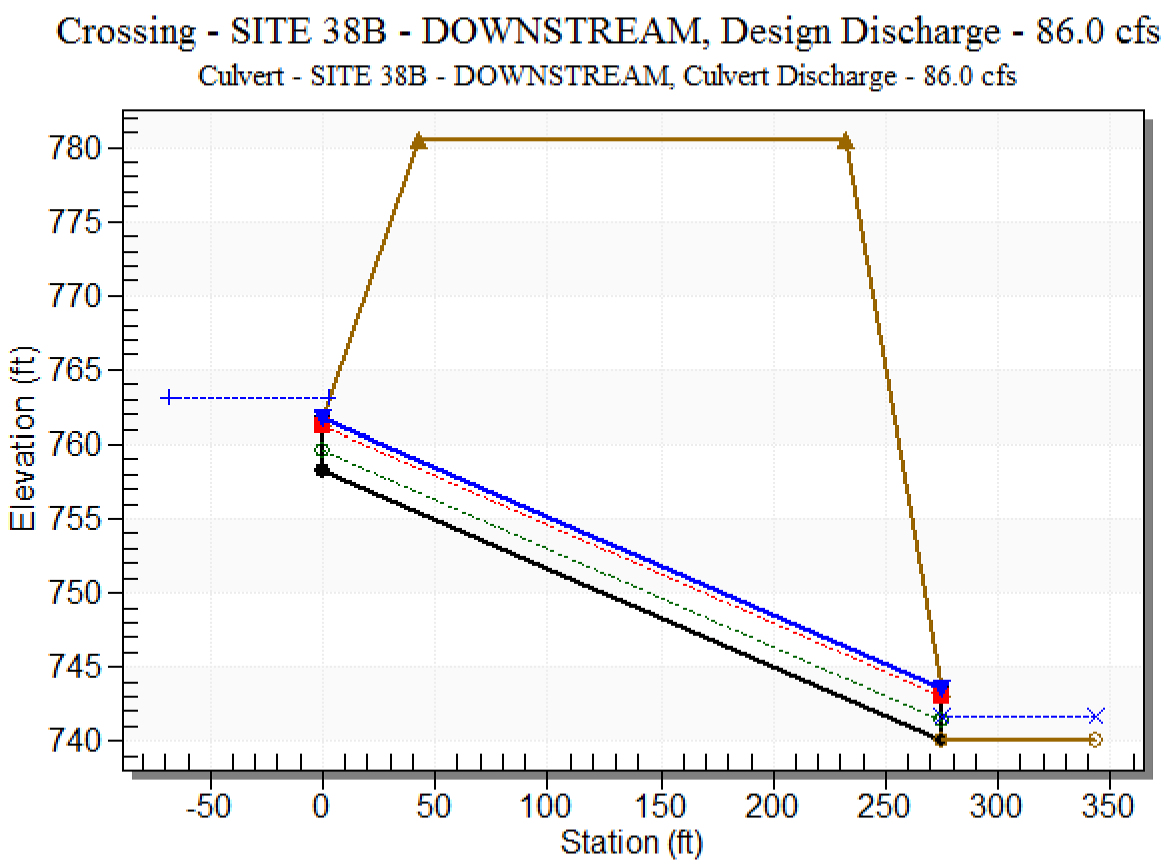
Culvert Length: 275.60 ft,   Culvert Slope: 0.0661

****

Culvert Performance Curve Plot: SITE 38B - DOWNSTREAM



Water Surface Profile Plot for Culvert: SITE 38B - DOWNSTREAM



Site Data - SITE 38B - DOWNSTREAM

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 758.28 ft

Outlet Station: 275.00 ft

Outlet Elevation: 740.11 ft

Number of Barrels: 1

Culvert Data Summary - SITE 38B - DOWNSTREAM

Barrel Shape: Circular

Barrel Diameter: 3.50 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: SITE 38B - DOWNSTREAM)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
63.00	741.48	1.37	9.31	1.70	1.72
76.00	741.61	1.50	9.78	1.87	1.74
86.00	741.70	1.59	10.10	1.98	1.75

Tailwater Channel Data - SITE 38B - DOWNSTREAM

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 2.50 ft

Side Slope (H:V): 1.80 (_:1)

Channel Slope: 0.0200

Channel Manning's n: 0.0200

Channel Invert Elevation: 740.11 ft

Roadway Data for Crossing: SITE 38B - DOWNSTREAM

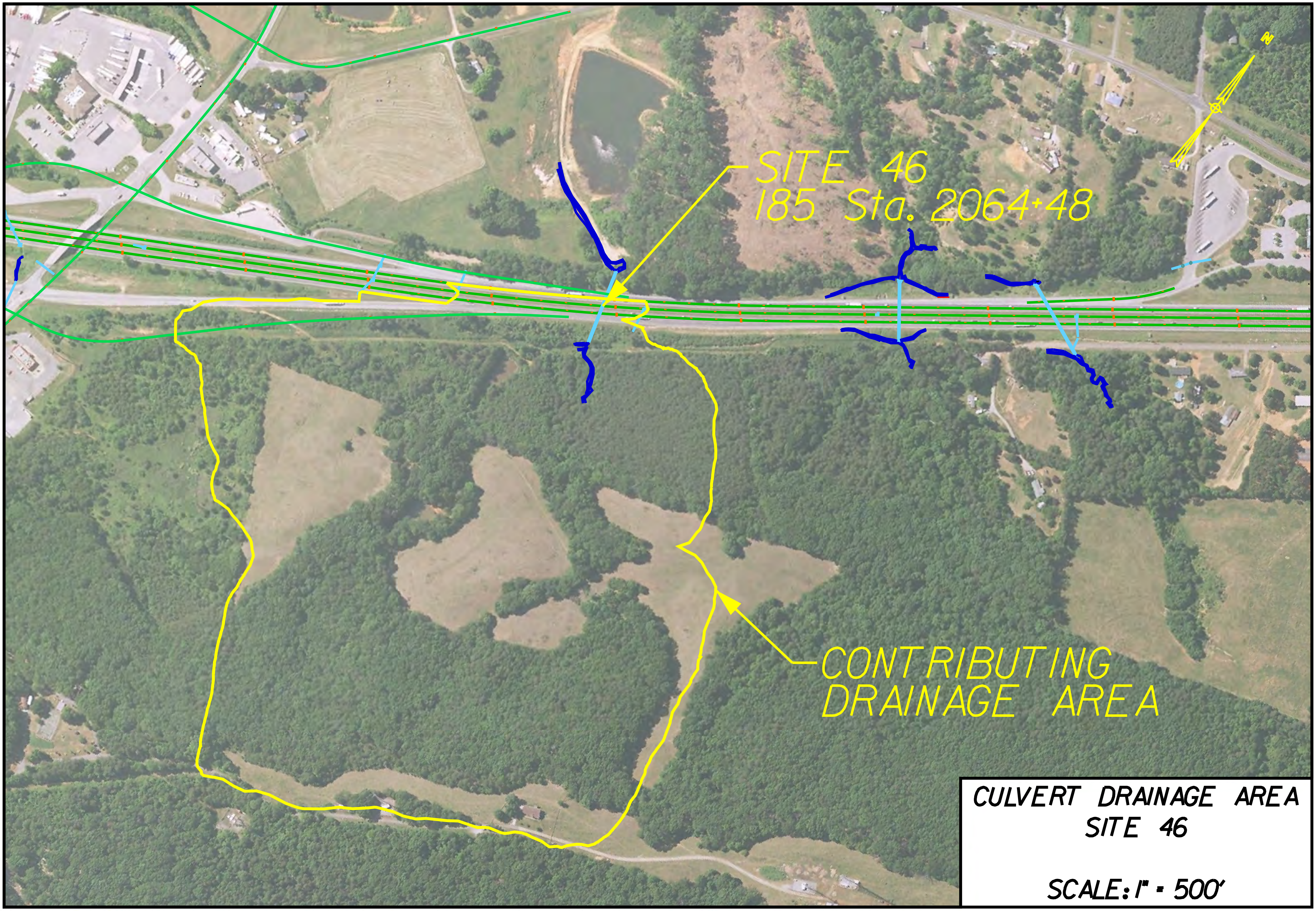
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 780.56 ft

Roadway Surface: Paved

Roadway Top Width: 190.00 ft


SITE 46
I85 Sta. 2064+48
CONTRIBUTING
DRAINAGE AREA
CULVERT DRAINAGE AREA
SITE 46
SCALE: 1" = 500'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	3.18	0.90	
Rolling, 2%-10%	Side Slopes, Turf	5.26	0.30	Area Weighted C
Rolling, 2%-10%	Meadows & Pasture Land	7.50	0.30	0.27
Hilly, Over 10%	Meadows & Pasture Land	19.86	0.35	
Hilly, Over 10%	Woodland & Forest	55.44	0.20	
		91.24		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	18.93%	100	0.8				0.235
Shallow Concentrated	Unpaved	18.93%	1485					0.059
Shallow Concentrated								
Channel 1		5.72%	1268	0.04	27	19.078	11.2286	0.031
Channel 2								
Total			2853				2.4382	0.325

Gaffney

Time of Concentration *(minutes)*	20

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.27	4.798	91.24	**119**
Q_{25}	1.1	0.27	5.495	91.24	**149**
Q_{50}	1.2	0.27	6.040	91.24	**179**
Q_{100}	1.25	0.27	6.572	91.24	**203**

Civil Engineering Consulting Services, Inc.

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 46 - 4' x 6' RCBC

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 46 - 4' x 6' RCBC Discharge (cfs)	Roadway Discharge (cfs)	Iterations
786.00	50 year	179.00	179.00	0.00	1
786.71	100 year	203.00	203.00	0.00	1
817.28	Overtopping	666.43	666.43	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 46 - 4' x 6' RCBC

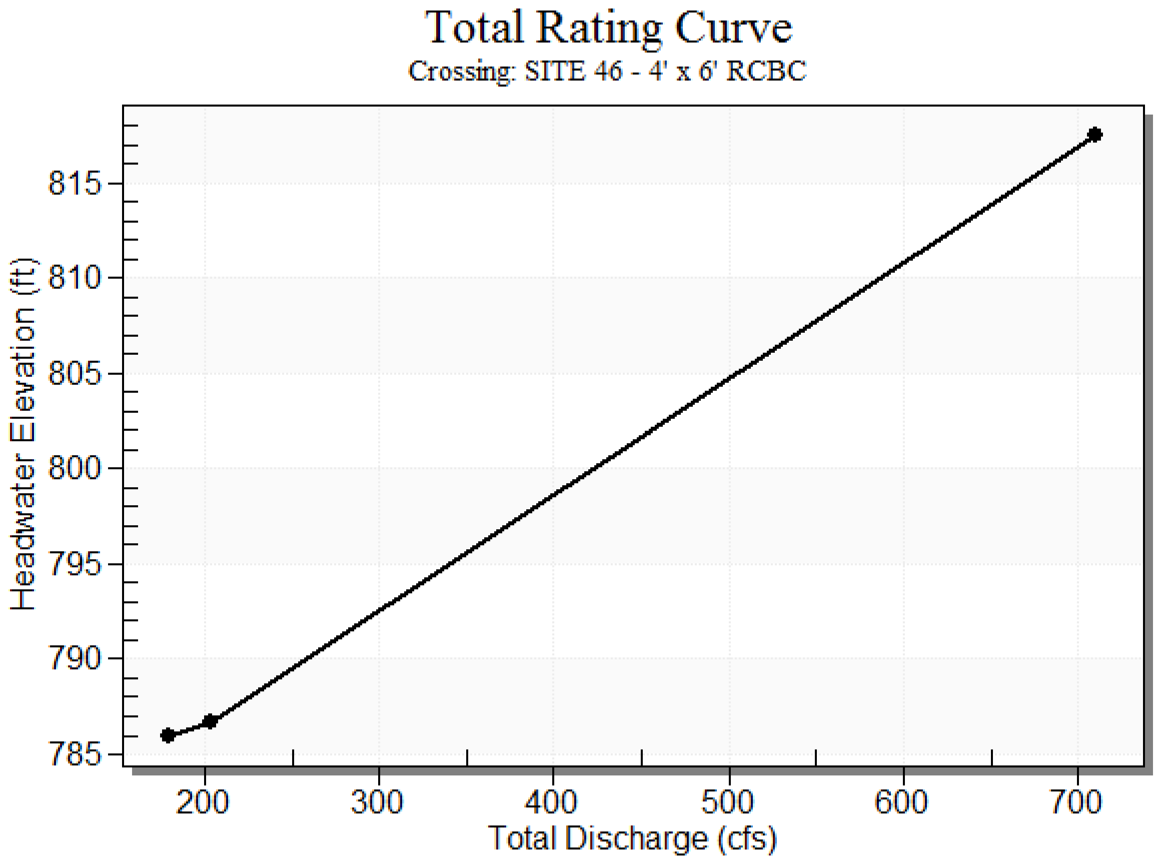


Table 2 - Culvert Summary Table: SITE 46 - 4' x 6' RCBC

Discharge Names	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)
50 year	179.00	179.00	786.00	6.670	0.0*	6-FFc	1.811	3.962	1.811	3.057	24.707
100 year	203.00	203.00	786.71	7.381	0.0*	6-FFc	1.996	4.309	1.996	3.240	25.426

* Full Flow Headwater elevation is below inlet invert.

****

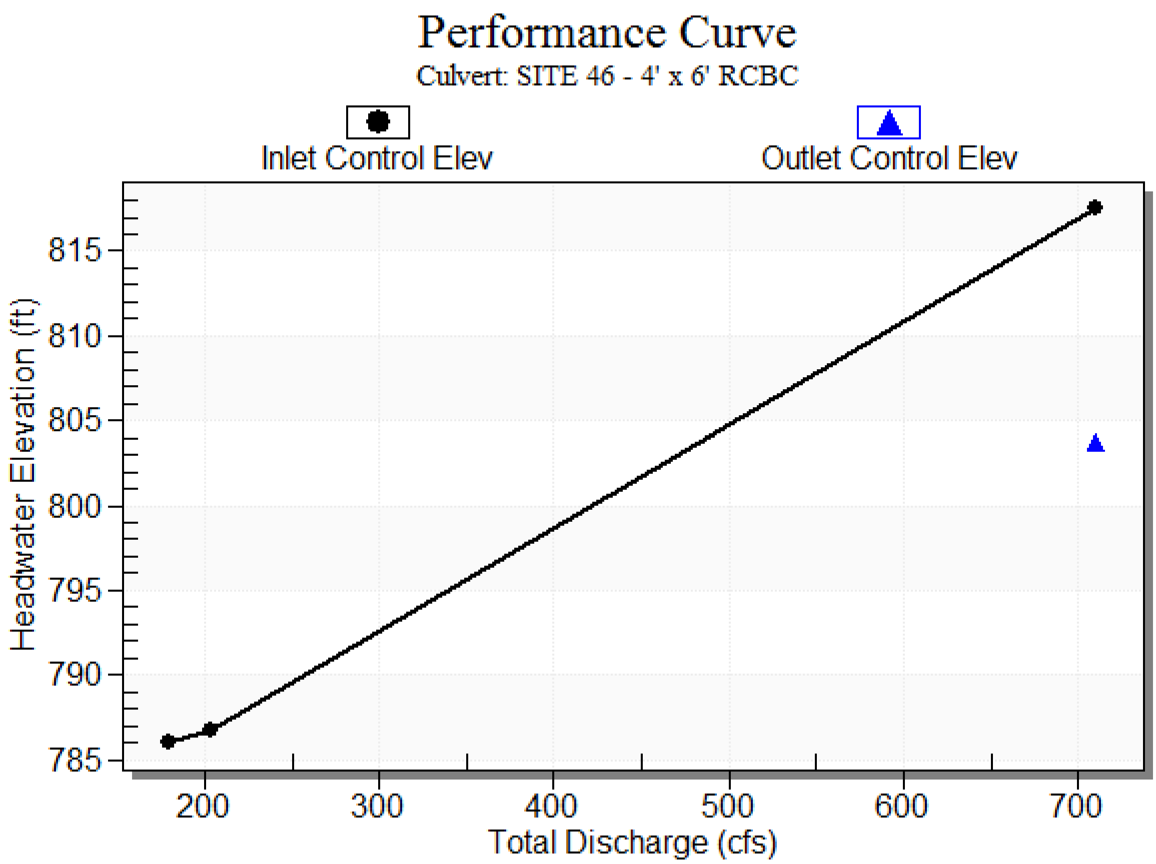
Straight Culvert

Inlet Elevation (invert): 779.33 ft,   Outlet Elevation (invert): 766.72 ft

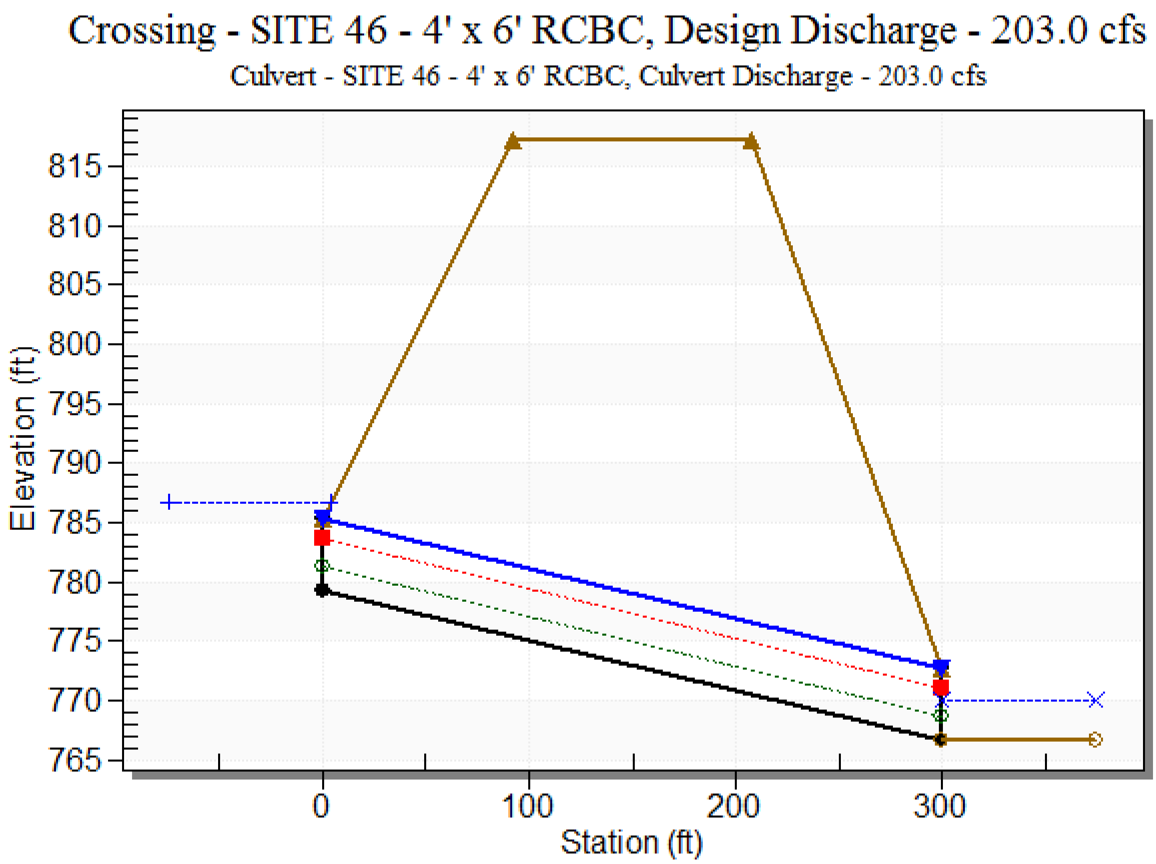
Culvert Length: 300.26 ft,   Culvert Slope: 0.0420

****

Culvert Performance Curve Plot: SITE 46 - 4' x 6' RCBC



Water Surface Profile Plot for Culvert: SITE 46 - 4' x 6' RCBC



Site Data - SITE 46 - 4' x 6' RCBC

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 779.33 ft

Outlet Station: 300.00 ft

Outlet Elevation: 766.72 ft

Number of Barrels: 1

Culvert Data Summary - SITE 46 - 4' x 6' RCBC

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: Square Edge (90º) Headwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: SITE 46 - 4' x 6' RCBC)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
179.00	769.78	3.06	5.79	3.43	0.74
203.00	769.96	3.24	5.98	3.64	0.74

Tailwater Channel Data - SITE 46 - 4' x 6' RCBC

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

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

Channel Slope: 0.0180

Channel Manning's n: 0.0500

Channel Invert Elevation: 766.72 ft

Roadway Data for Crossing: SITE 46 - 4' x 6' RCBC

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 817.28 ft

Roadway Surface: Paved

Roadway Top Width: 115.00 ft

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 46 - 60" RCP

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 46 - 60" RCP Discharge (cfs)	Roadway Discharge (cfs)	Iterations
785.23	50 year	176.00	176.00	0.00	1
785.96	100 year	200.00	200.00	0.00	1
817.28	Overtopping	632.10	632.10	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 46 - 60" RCP

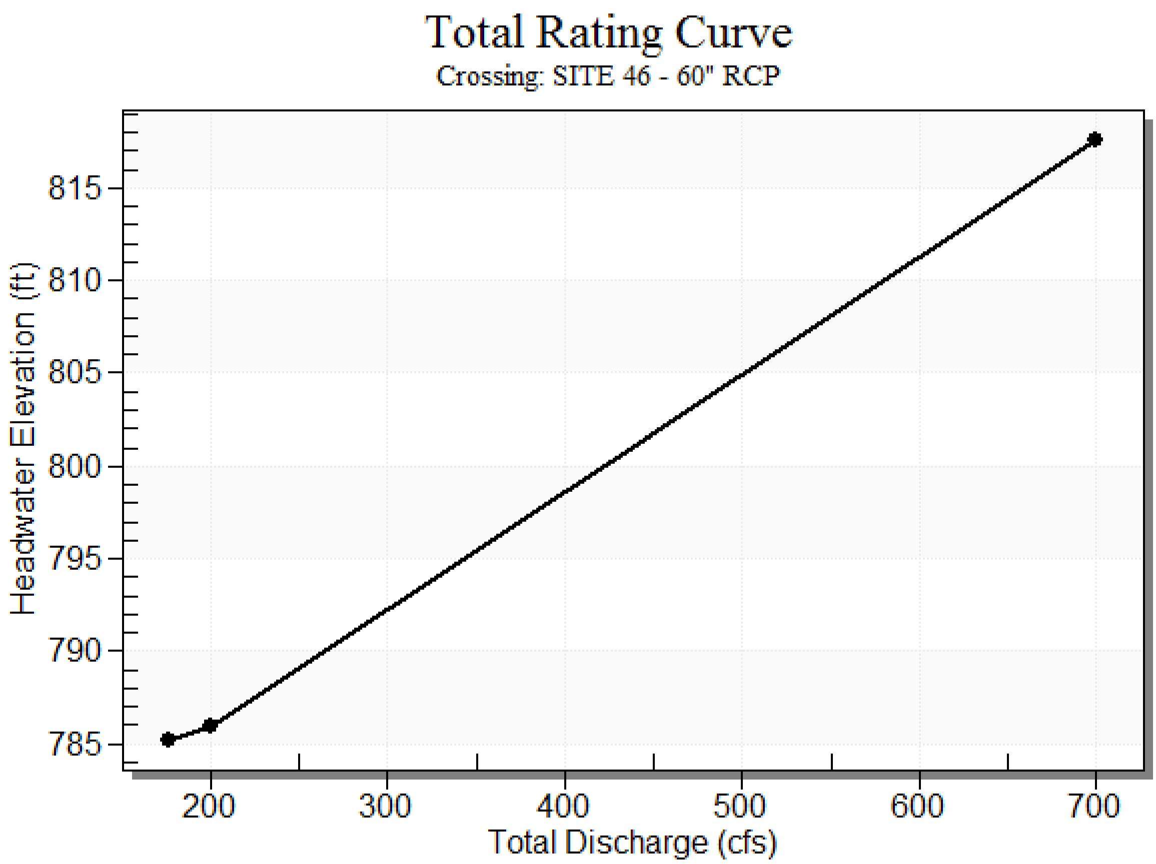


Table 2 - Culvert Summary Table: SITE 46 - 60" RCP

Discharge Names	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)
50 year	176.00	176.00	785.23	5.899	0.0*	6-FFc	1.878	3.796	3.796	3.033	11.019
100 year	200.00	200.00	785.96	6.626	0.0*	6-FFc	2.015	4.036	4.036	3.218	11.814

* Full Flow Headwater elevation is below inlet invert.

****

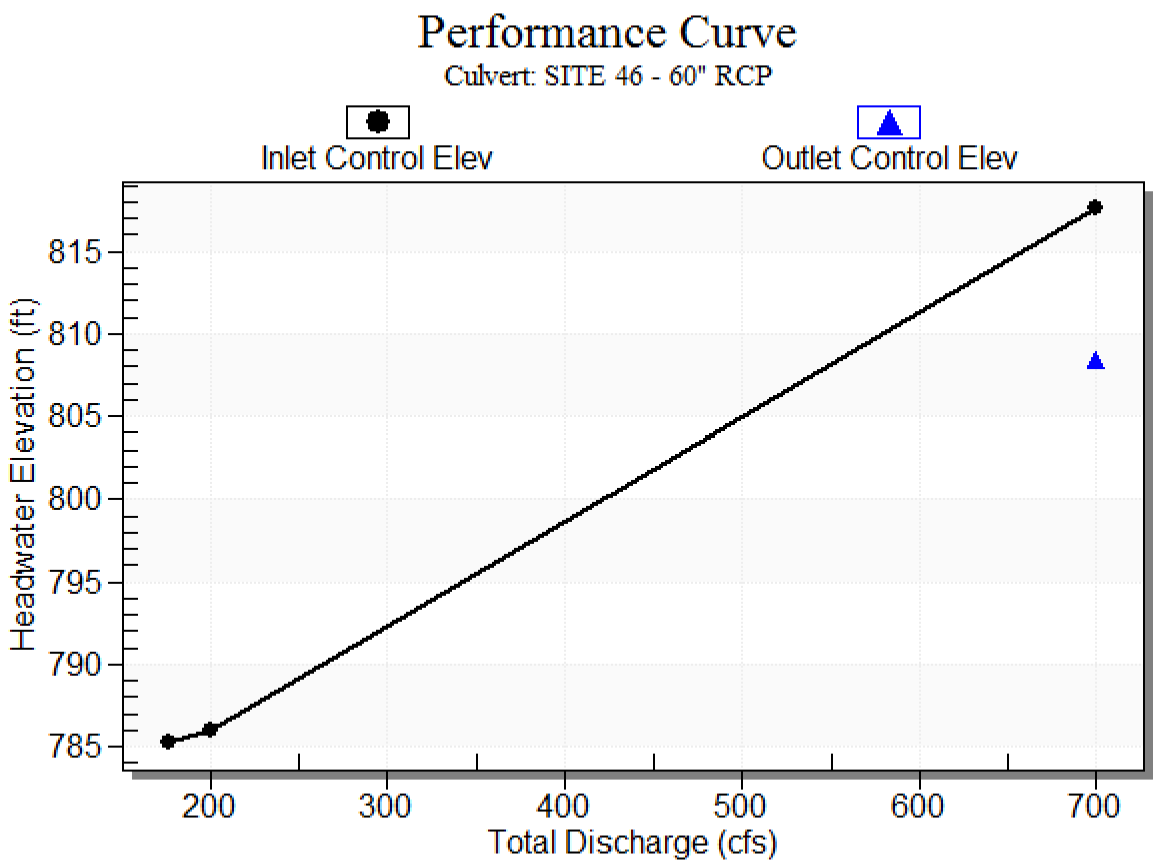
Straight Culvert

Inlet Elevation (invert): 779.33 ft,   Outlet Elevation (invert): 766.72 ft

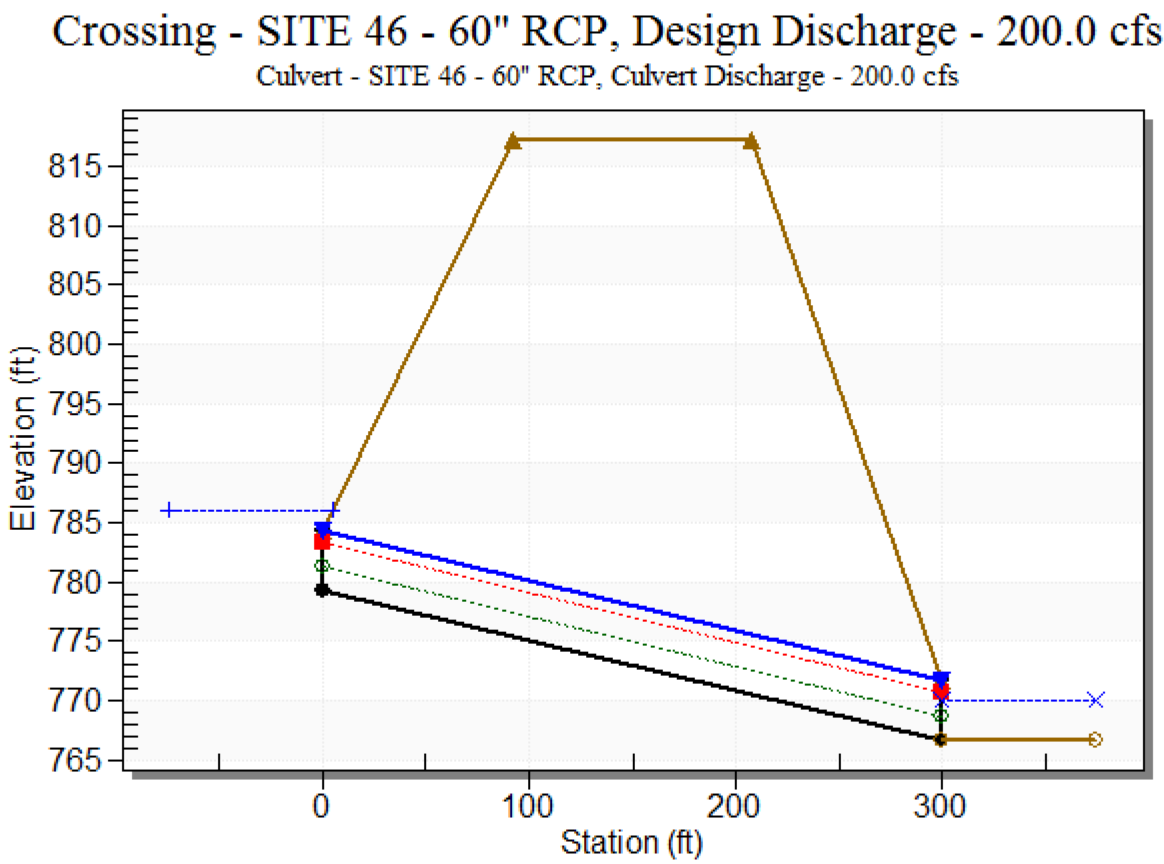
Culvert Length: 300.26 ft,   Culvert Slope: 0.0420

****

Culvert Performance Curve Plot: SITE 46 - 60" RCP



Water Surface Profile Plot for Culvert: SITE 46 - 60" RCP



Site Data - SITE 46 - 60" RCP

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 779.33 ft

Outlet Station: 300.00 ft

Outlet Elevation: 766.72 ft

Number of Barrels: 1

Culvert Data Summary - SITE 46 - 60" RCP

Barrel Shape: Circular

Barrel Diameter: 5.00 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 3 - Downstream Channel Rating Curve (Crossing: SITE 46 - 60" RCP)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
176.00	769.75	3.03	5.76	3.41	0.74
200.00	769.94	3.22	5.96	3.61	0.74

Tailwater Channel Data - SITE 46 - 60" RCP

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

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

Channel Slope: 0.0180

Channel Manning's n: 0.0500

Channel Invert Elevation: 766.72 ft

Roadway Data for Crossing: SITE 46 - 60" RCP

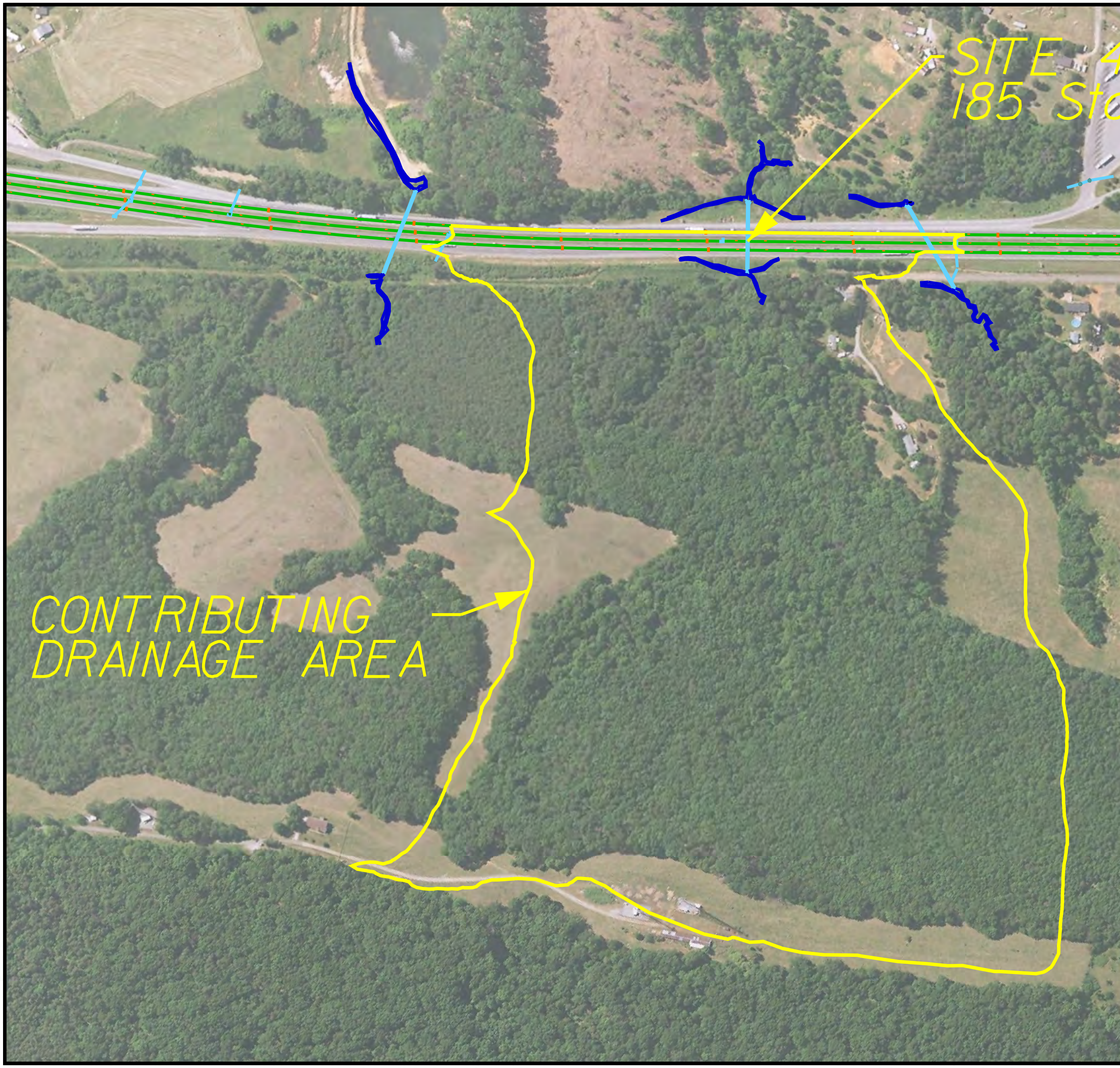
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 817.28 ft

Roadway Surface: Paved

Roadway Top Width: 115.00 ft



CULVERT DRAINAGE AREA
SITE 49

SCALE: 1" = 500'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	3.35	0.90	
Hilly, Over 10%	Side Slopes, Turf	2.69	0.30	Area Weighted C
Rolling, 2%-10%	Meadows & Pasture Land	7.20	0.30	0.25
Hilly, Over 10%	Meadows & Pasture Land	12.25	0.35	
Hilly, Over 10%	Woodland & Forest	71.94	0.20	
		97.43		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	17.41%	100	0.8				0.243
Shallow Concentrated	Unpaved	17.41%	1451					0.060
Shallow Concentrated								
Channel 1		3.97%	1724	0.04	12.8	9.9825	8.76106	0.055
Channel 2								
Total			3275				2.5455	0.357

Gaffney

Time of Concentration *(minutes)*	22

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.25	4.618	97.43	**114**
Q_{25}	1.1	0.25	5.284	97.43	**143**
Q_{50}	1.2	0.25	5.804	97.43	**172**
Q_{100}	1.25	0.25	6.311	97.43	**195**

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 49

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 49 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
757.12	50 year	172.00	172.00	0.00	1
757.73	100 year	195.00	195.00	0.00	1
784.11	Overtopping	651.76	651.76	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 49

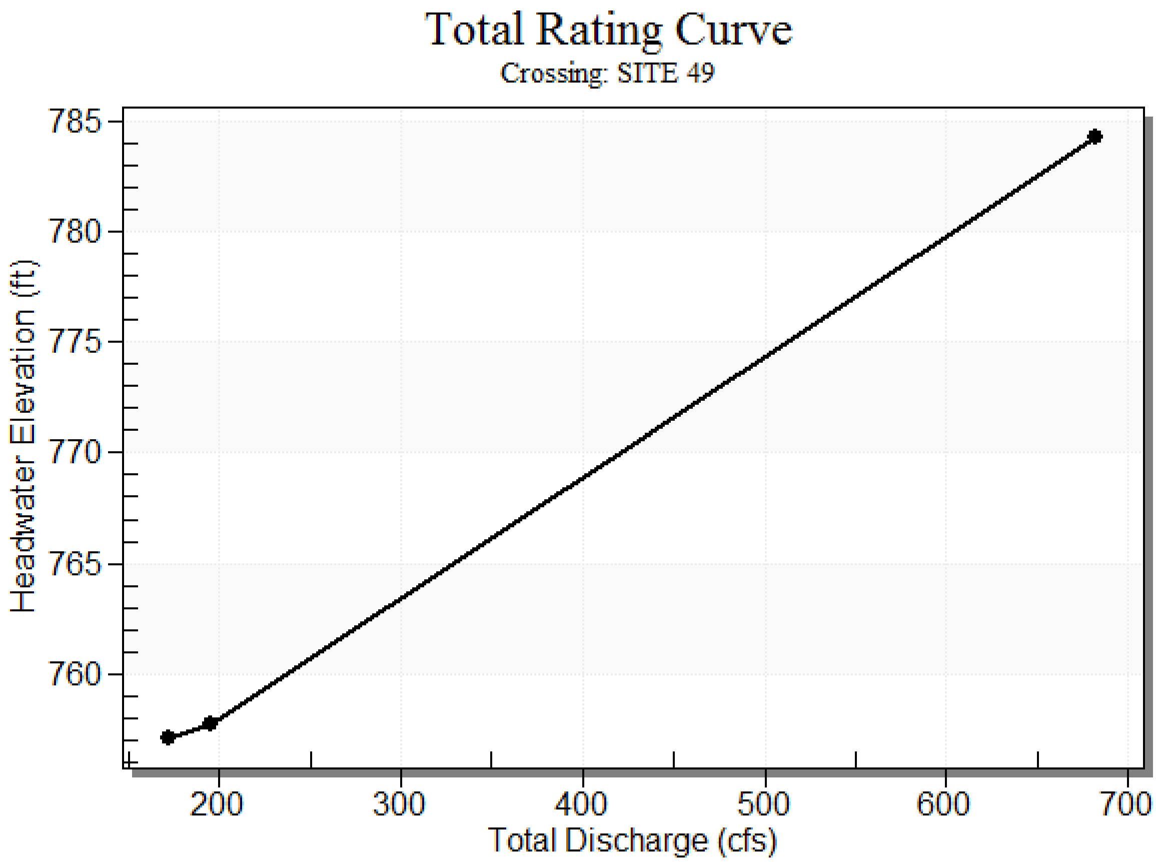


Table 2 - Culvert Summary Table: SITE 49

Discharge Names	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)
50 year	172.00	172.00	757.12	5.939	0.0*	6-FFc	2.005	3.858	2.005	3.713	21.449
100 year	195.00	195.00	757.73	6.547	0.0*	6-FFc	2.200	4.195	2.200	3.947	22.156

* Full Flow Headwater elevation is below inlet invert.

****

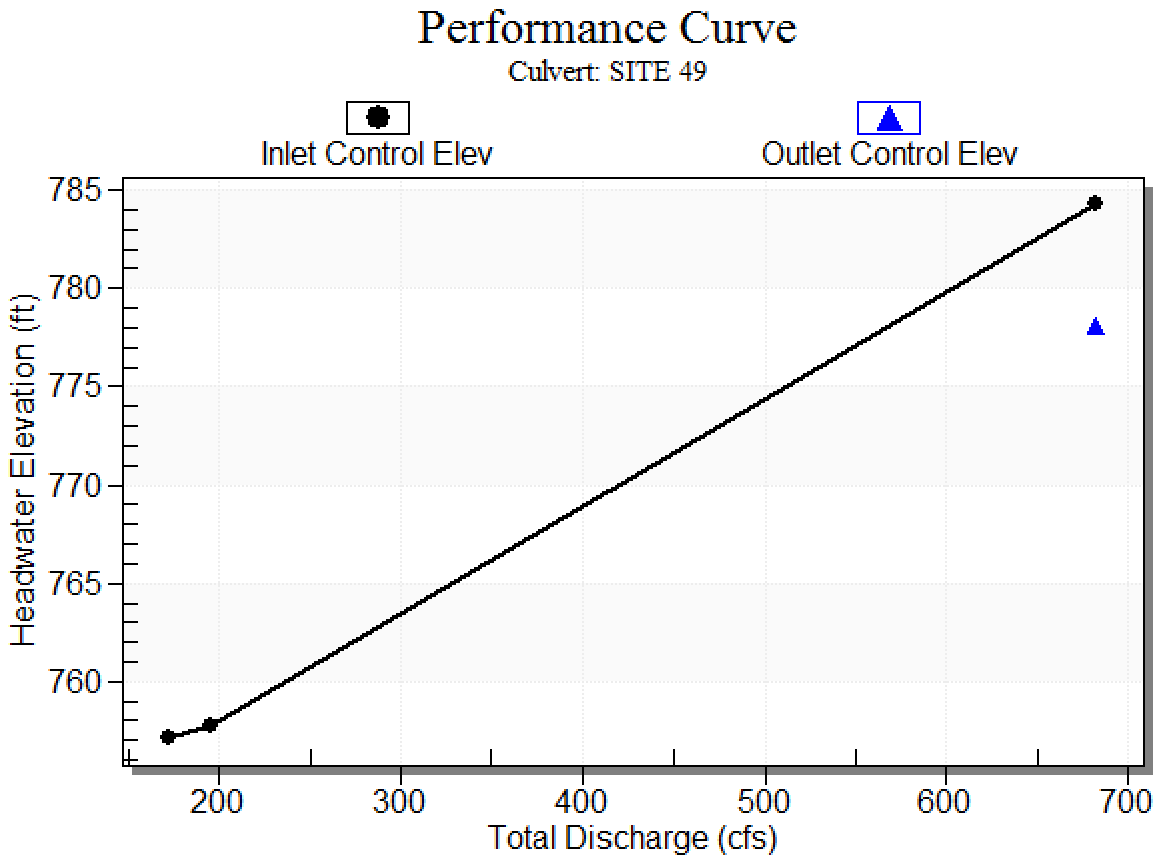
Straight Culvert

Inlet Elevation (invert): 751.18 ft,   Outlet Elevation (invert): 744.32 ft

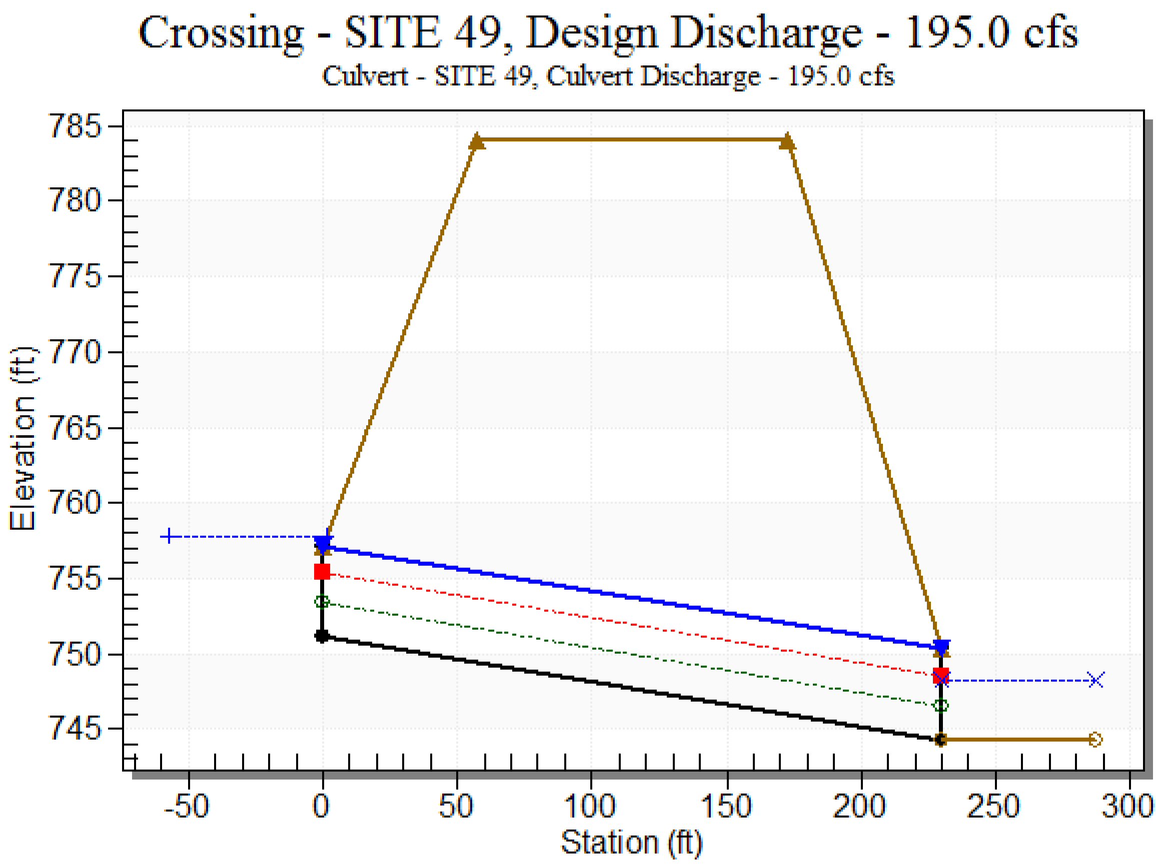
Culvert Length: 230.10 ft,   Culvert Slope: 0.0298

****

Culvert Performance Curve Plot: SITE 49



Water Surface Profile Plot for Culvert: SITE 49



Site Data - SITE 49

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 751.18 ft

Outlet Station: 230.00 ft

Outlet Elevation: 744.32 ft

Number of Barrels: 1

Culvert Data Summary - SITE 49

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: Square Edge (30-75º flare) Wingwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: SITE 49)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
172.00	748.03	3.71	4.97	6.26	0.56
195.00	748.27	3.95	5.13	6.65	0.56

Tailwater Channel Data - SITE 49

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.50 ft

Side Slope (H:V): 1.30 (_:1)

Channel Slope: 0.0270

Channel Manning's n: 0.0800

Channel Invert Elevation: 744.32 ft

Roadway Data for Crossing: SITE 49

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 784.11 ft

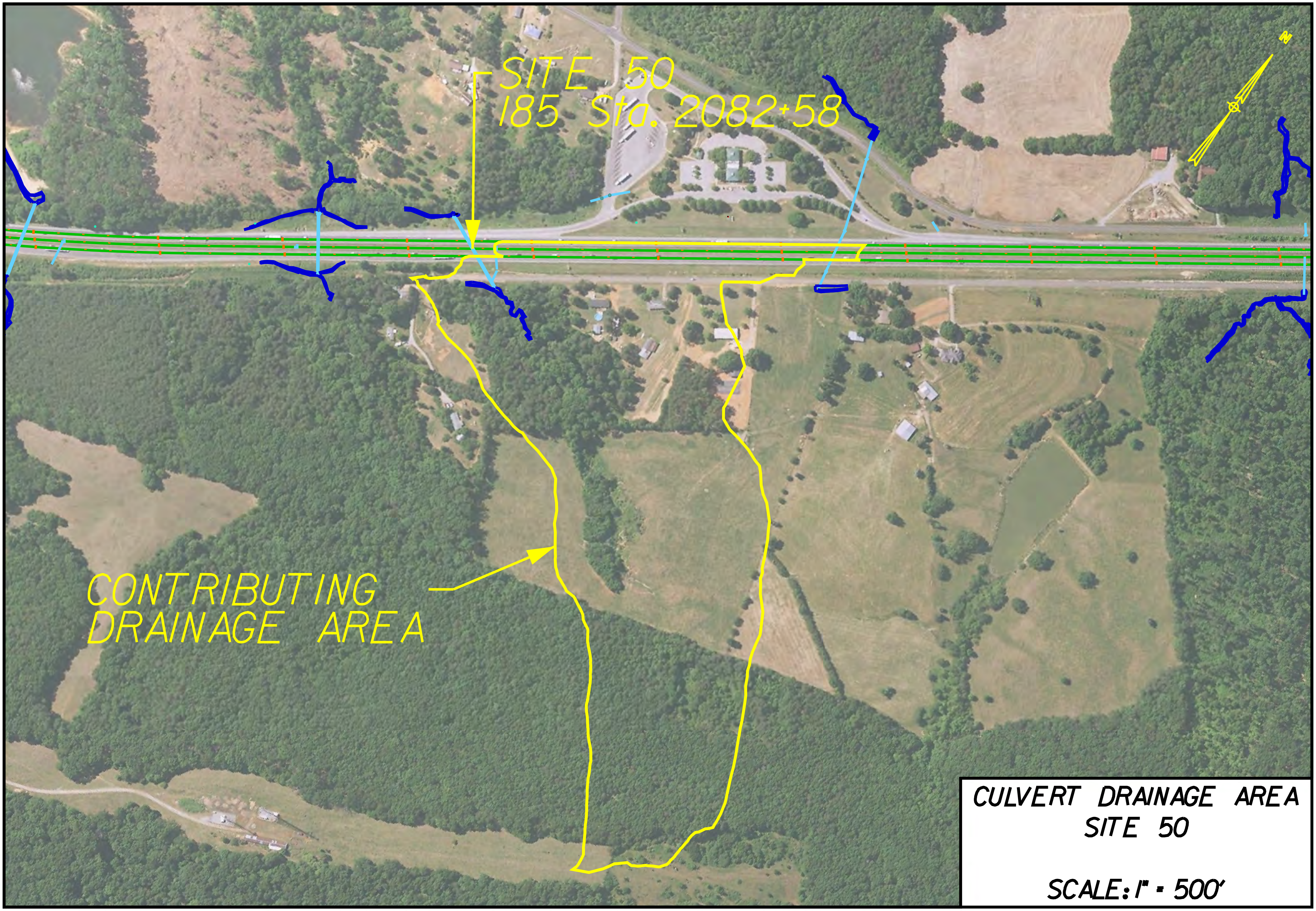
Roadway Surface: Paved

Roadway Top Width: 115.00 ft

Pipe/Box Dimensions				Flow
		(inch)		(cfs)
Pipe Diameter				172
Box Dimension				
Span (ft)	4	48		
Height (ft)	6	72		

Length	Width	Riprap		GeoText
(FHWA HEC-14 - Calculated)		Quantity	Class[2]	
(ft)	(ft)	(Tons)		(SqYd)
25	29	95	C	82

** Energy Disipator only, still add quantities for slope protection.
** Apron length as per HEC-14 Table 10.1, Fig. 10.4; width as per HEC-14 Fig. 10.4.
** Riprap Class (D50) as per HEC-14 Eq. 10.4; Tailwater condition assumed (TW=0.4D)



CULVERT DRAINAGE AREA
SITE 50

SCALE: 1" = 500'

Rational Analysis

Land Slope	Land Use	Acres	C
Rolling, 2%-10%	Pavements & Roofs	3.46	0.90
Rolling, 2%-10%	Gravel Pavements	0.03	0.55
Rolling, 2%-10%	Side Slopes, Turf	1.92	0.30
Rolling, 2%-10%	Meadows & Pasture Land	19.01	0.30
Hilly, Over 10%	Woodland & Forest	21.19	0.20
Rolling, 2%-10%	Woodland & Forest	1.59	0.15
		47.20	

Area Weighted C
0.29

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	18.77%	100	0.8				0.236
Shallow Concentrated	Unpaved	18.77%	1145					0.046
Shallow Concentrated								
Channel 1		4.85%	1536	0.04	132.5	45.427	16.7428	0.025
Channel 2								
Total			2781				2.5190	0.307

Gaffney

Time of Concentration *(minutes)*	19

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.29	4.893	47.20	**68**
Q_{25}	1.1	0.29	5.607	47.20	**86**
Q_{50}	1.2	0.29	6.165	47.20	**103**
Q_{100}	1.25	0.29	6.711	47.20	**116**

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 50

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 50 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
776.03	50 year	103.00	103.00	0.00	1
776.47	100 year	116.00	116.00	0.00	1
792.81	Overtopping	314.66	314.66	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 50

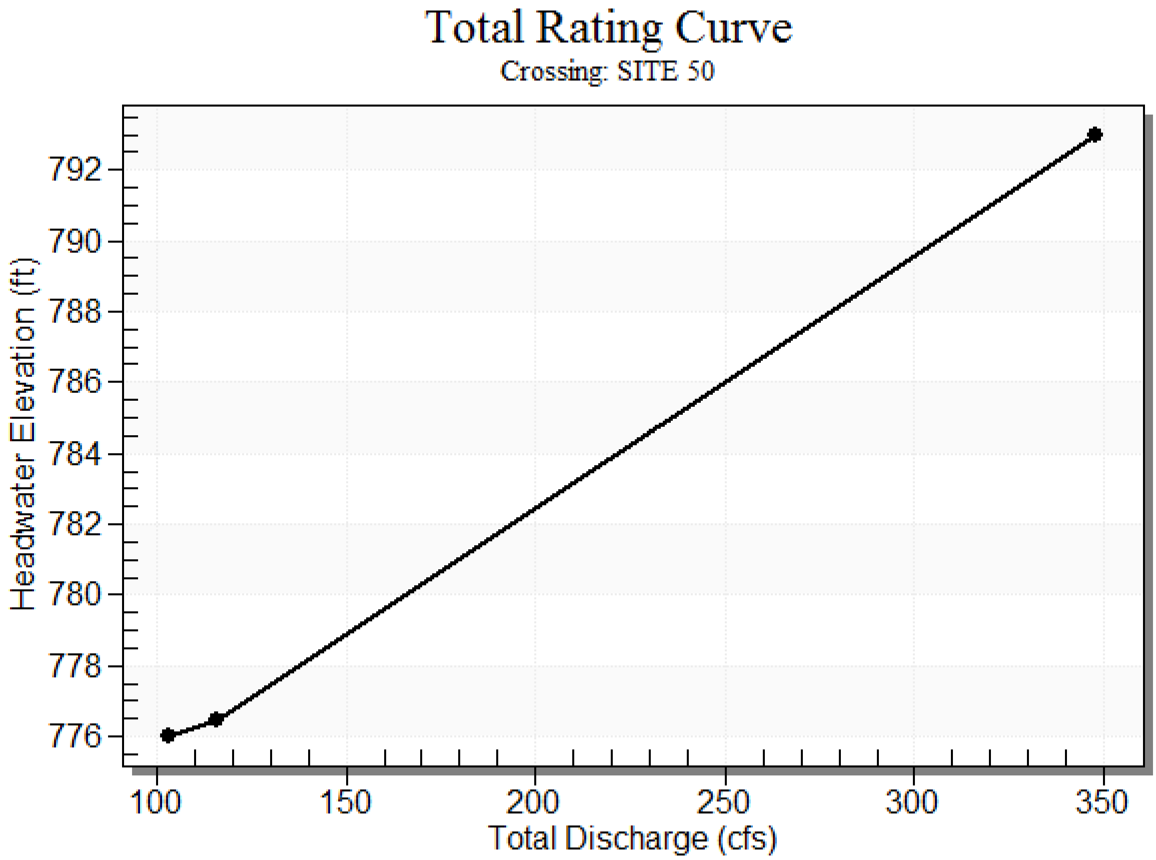


Table 2 - Culvert Summary Table: SITE 50

Discharge Names	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)
50 year	103.00	103.00	776.03	4.314	3.515	6-FFt	3.062	2.741	3.062	2.896	8.408
100 year	116.00	116.00	776.47	4.751	4.159	6-FFt	3.366	2.967	3.366	3.065	8.615

****

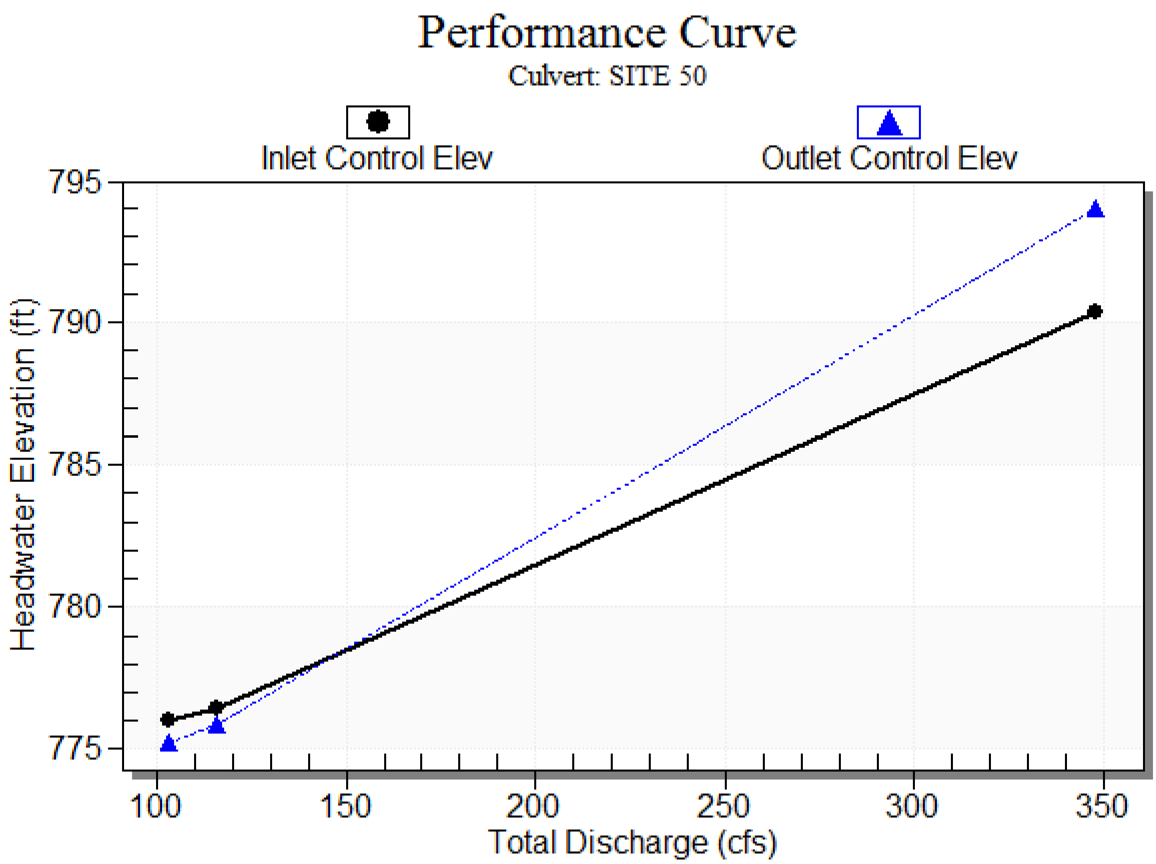
Straight Culvert

Inlet Elevation (invert): 771.72 ft,   Outlet Elevation (invert): 770.57 ft

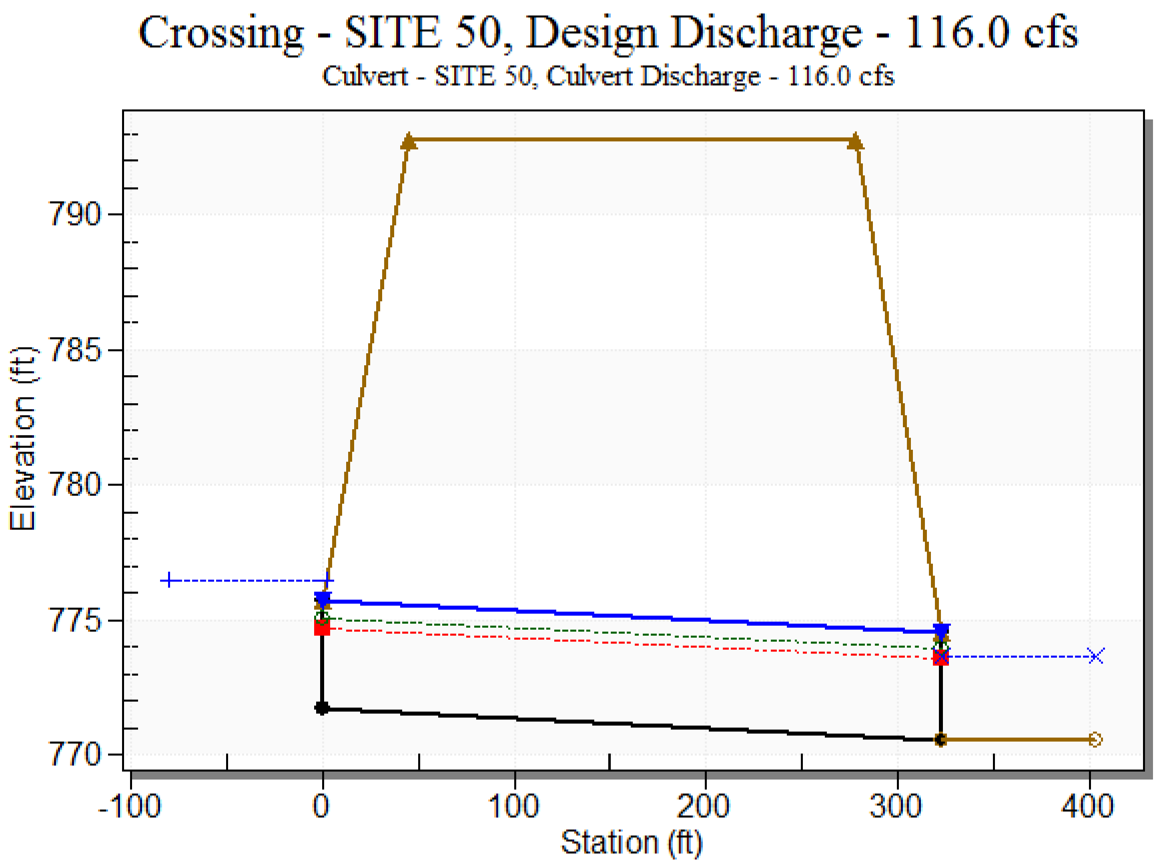
Culvert Length: 323.00 ft,   Culvert Slope: 0.0036

****

Culvert Performance Curve Plot: SITE 50



Water Surface Profile Plot for Culvert: SITE 50



Site Data - SITE 50

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 771.72 ft

Outlet Station: 323.00 ft

Outlet Elevation: 770.57 ft

Number of Barrels: 1

Culvert Data Summary - SITE 50

Barrel Shape: Concrete Box

Barrel Span: 4.00 ft

Barrel Rise: 4.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

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

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: SITE 50)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
103.00	773.47	2.90	5.26	7.95	0.68
116.00	773.64	3.07	5.42	8.42	0.68

Tailwater Channel Data - SITE 50

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 3.00 ft

Side Slope (H:V): 1.30 (_:1)

Channel Slope: 0.0440

Channel Manning's n: 0.0800

Channel Invert Elevation: 770.57 ft

Roadway Data for Crossing: SITE 50

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 792.81 ft

Roadway Surface: Paved

Roadway Top Width: 233.00 ft

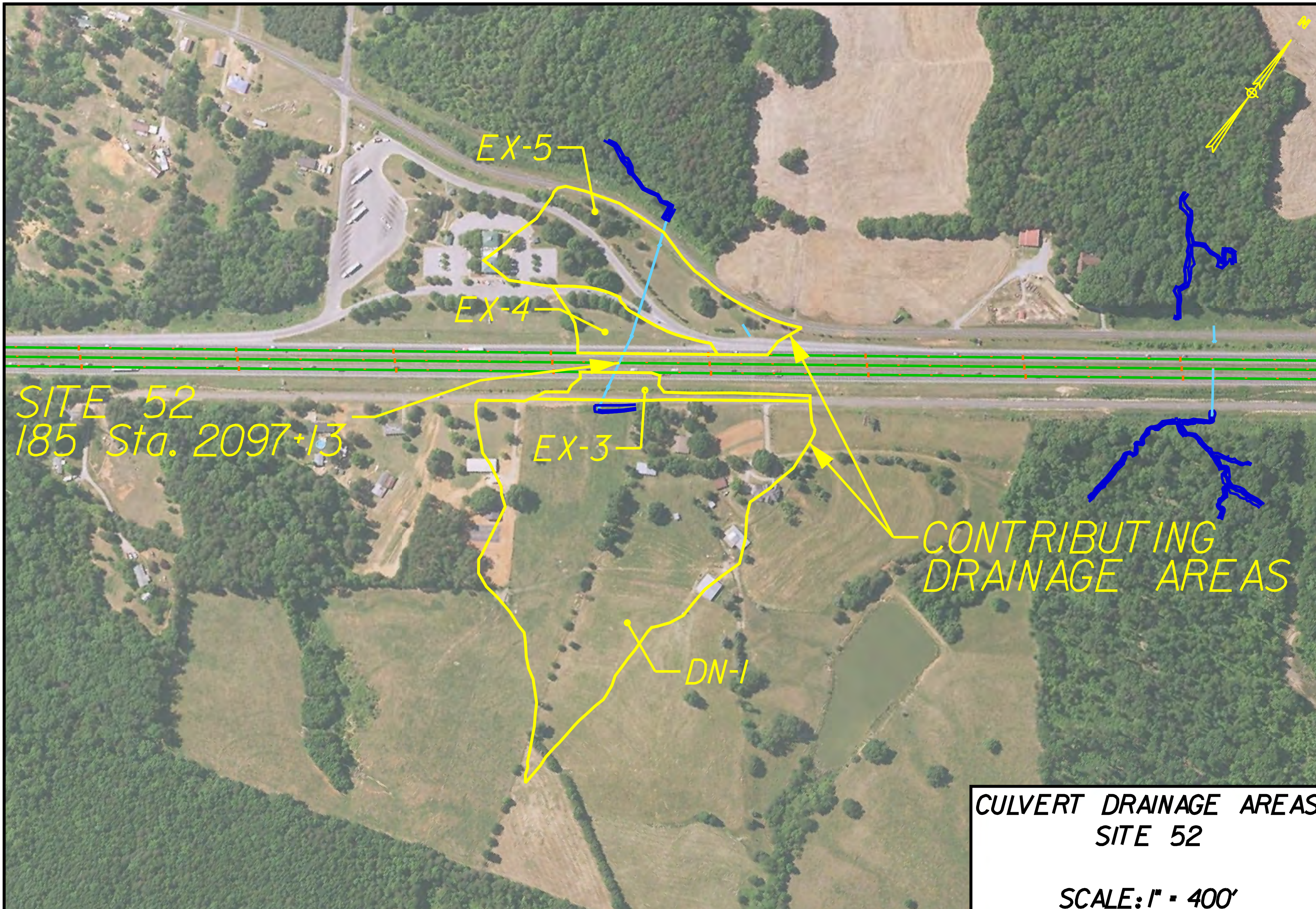
Pipe/Box Dimensions				Flow
		(inch)		(cfs)
Pipe Diameter				103
Box Dimension				
Span (ft)	4	48		
Height (ft)	4	48		

Length	Width	Riprap		GeoText
(FHWA HEC-14 - Calculated)		Quantity	Class[2]	
(ft)	(ft)	(Tons)		(SqYd)
21	26	73	C	62

** Energy Disipator only, still add quantities for slope protection.
** Apron length as per HEC-14 Table 10.1, Fig. 10.4; width as per HEC-14 Fig. 10.4.
** Riprap Class (D50) as per HEC-14 Eq. 10.4; Tailwater condition assumed (TW=0.4D)

SITE 51

Analysis on the culvert located at Site 51 could not be performed because the crossing was not surveyed. Additionally, the site could not be located during the culvert assessment field inspection.



CULVERT DRAINAGE AREAS
SITE 52

SCALE: 1" = 400'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	1.51	0.90	
Hilly, Over 10%	Side Slopes, Turf	3.38	0.30	Area Weighted C
				0.49
		4.89		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	11.21%	100	0.41				0.170
Shallow Concentrated	Unpaved	11.21%	137					0.007
Shallow Concentrated								
Channel 1								
Channel 2								
Total			237				0.3725	0.177

Gaffney

Time of Concentration *(minutes)*	11

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.49	5.815	4.89	**14**
Q_{25}	1.1	0.49	6.699	4.89	**17**
Q_{50}	1.2	0.49	7.395	4.89	**21**
Q_{100}	1.25	0.49	8.080	4.89	**24**

CECS Civil Engineering Consulting Services, Inc.

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	0.38	0.90	
Rolling, 2%-10%	Side Slopes, Turf	0.92	0.30	Area Weighted C
				0.48
		1.30		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	4.03%	100	0.41				0.255
Shallow Concentrated	Unpaved	4.03%	83					0.007
Shallow Concentrated								
Channel 1								
Channel 2								
Total			183				0.1936	0.263

Gaffney

Time of Concentration *(minutes)*	16

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.48	5.203	1.30	**3**
Q_{25}	1.1	0.48	5.972	1.30	**4**
Q_{50}	1.2	0.48	6.575	1.30	**5**
Q_{100}	1.25	0.48	7.166	1.30	**6**

Civil Engineering Consulting Services, Inc.

Rational Analysis

Land Slope	Land Use	Acres	C
Rolling, 2%-10%	Pavements & Roofs	0.31	0.90
Rolling, 2%-10%	Side Slopes, Turf	0.53	0.30
		0.84	

Area Weighted C
0.52

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Gaffney

Time of Concentration *(minutes)*	5

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.52	6.770	0.84	**3**
Q_{25}	1.1	0.52	7.845	0.84	**4**
Q_{50}	1.2	0.52	8.698	0.84	**5**
Q_{100}	1.25	0.52	9.546	0.84	**5**

Rational Analysis

Land Slope	Land Use	Acres	C
Rolling, 2%-10%	Pavements & Roofs	0.64	0.90
Rolling, 2%-10%	Meadows & Pasture Land	15.51	0.30
		16.15	

Area Weighted C
0.32

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	5.27%	100	0.41				0.229
Shallow Concentrated	Unpaved	5.27%	1212					0.091
Shallow Concentrated								
Channel 1								
Channel 2								
Total			1312				1.1377	0.320

Gaffney

Time of Concentration *(minutes)*	20

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.32	4.798	16.15	**25**
Q_{25}	1.1	0.32	5.495	16.15	**32**
Q_{50}	1.2	0.32	6.040	16.15	**38**
Q_{100}	1.25	0.32	6.572	16.15	**43**

Civil Engineering Consulting Services, Inc.

AREA DATA (50 YR)									
Area - ID	Tc Used	Discharge	Intensity	Composite		Total		Remainder	
				C Value	Area	C Value	Subarea	C Value	Area
EX-5	11	21.25	7.39	0.49	4.89	0.00	0.00	0.49	4.89
EX-4	16	4.92	6.57	0.48	1.30	0.00	0.00	0.48	1.30
EX-3	5	4.60	8.70	0.52	0.84	0.30	0.53	0.90	0.31
DN-1	20	37.45	6.04	0.32	16.15	0.00	0.00	0.32	16.15

NODE DATA (50 YR)

Node - ID	Node					Reference	Node		Junction	Tc		Cumulative			
	Type	Library Item Name	Reference PGL	Station	Offset	Elevation	Elevation	Depth	Loss	Used	Cumulative	Discharge	Area	C Value	Intensity
OP-52	Outlet	OP	I85_NB_PGL_CG	2096+69.00	-707.00	778.16	778.16	2.33	0.00	0.00	21.00	0.00	23.18	0.37	0.00
DN-6	Other	DUMMY JOINT	I85_NB_PGL_CG	2098+58.50	-453.50	793.56	793.56	6.48	1.14	20.61	20.66	61.76	23.18	0.37	5.96
EX-5	Other	C.B. TYPE 9	I85_NB_PGL_CG	2098+38.00	-376.75	802.44	802.44	9.32	0.08	20.61	20.61	61.76	23.18	0.37	5.96
EX-4	Other	EXISTING D.I.	I85_NB_PGL_CG	2097+51.00	-85.00	828.35	828.35	17.00	0.11	20.37	20.37	44.83	18.29	0.34	5.99
EX-3	Other	EXISTING D.I.	I85_NB_PGL_CG	2096+77.50	78.00	828.58	828.58	11.86	0.03	20.18	20.18	40.50	16.99	0.33	6.02
DN-2	Other	DUMMY JOINT	I85_NB_PGL_CG	2096+48.00	147.00	825.00	825.00	3.85	0.65	20.00	20.12	37.45	16.15	0.32	6.04
DN-1	Other	DUMMY JOINT	I85_NB_PGL_CG	2097+68.00	143.00	830.50	830.50	3.54	0.00	20.00	20.00	37.45	16.15	0.32	6.04

LINK DATA (50 YR)

Link - ID	Node		Shape	Material	No.	Rise	Actual	Slope	Q	Capacity	Uniform		US		DS		Invert		Actual Velocity		Actual Depth	
	US	DS			Barrels		Length		(cfs)		Depth	Velocity	Soffit	HGL	Soffit	HGL	US	DS	US	DS	US	DS
DL-6	DN-6	OP-52	n/a	n/a	1.00	1.50	316.50	3.55	61.76	232.32	0.71	15.92	788.58	789.72	777.33	776.54	787.08	775.83	6.31	15.83	1.50	0.71
EP-5	EX-5	DN-6	Circular	Concrete	1.00	3.00	79.91	7.56	61.76	213.70	1.15	24.82	796.12	795.89	790.08	788.41	793.12	787.08	9.06	20.46	2.77	1.33
EP-4	EX-4	EX-5	Circular	Concrete	1.00	3.00	300.21	6.07	44.83	191.54	1.03	20.99	814.35	813.76	796.12	794.15	811.35	793.12	7.36	20.80	2.41	1.03
EP-3	EX-3	EX-4	Circular	Concrete	1.00	3.00	178.81	3.00	40.50	134.70	1.17	15.79	819.72	818.82	814.35	812.56	816.72	811.35	7.66	15.21	2.10	1.21
EP-2	DN-2	EX-3	Circular	Concrete	1.00	3.00	75.04	5.90	37.45	188.85	0.94	19.76	824.15	823.79	819.72	817.78	821.15	816.72	5.68	16.85	2.64	1.06
DL-1	DN-1	DN-2	n/a	n/a	1.00	3.00	120.07	4.84	37.45	460.38	1.17	17.09	829.96	828.99	824.15	822.36	826.96	821.15	5.71	15.91	2.03	1.21

LEGEND	
	HW ELEVATION
	SYSTEM DISCHARGE

AREA DATA (100 YR)									
Area - ID	Tc Used	Discharge	Intensity	Composite		Total		Remainder	
				C Value	Area	C Value	Subarea	C Value	Area
EX-5	11	24.20	8.08	0.49	4.89	0.00	0.00	0.49	4.89
EX-4	16	5.59	7.17	0.48	1.30	0.00	0.00	0.48	1.30
EX-3	5	5.26	9.55	0.52	0.84	0.30	0.53	0.90	0.31
DN-1	20	42.46	6.57	0.32	16.15	0.00	0.00	0.32	16.15

NODE DATA (100 YR)

Node - ID	Node					Reference	Node		Junction	Tc		Cumulative			
	Type	Library Item Name	Reference PGL	Station	Offset	Elevation	Elevation	Depth	Loss	Used	Cumulative	Discharge	Area	C Value	Intensity
OP-52	Outlet	OP	I85_NB_PGL_CG	2096+69.00	-707.00	778.16	778.16	2.33	0.00	0.00	20.96	0.00	23.18	0.37	0.00
DN-6	Other	DUMMY JOINT	I85_NB_PGL_CG	2098+58.50	-453.50	793.56	793.56	6.48	1.47	20.59	20.64	70.04	23.18	0.37	6.49
EX-5	Other	C.B. TYPE 9	I85_NB_PGL_CG	2098+38.00	-376.75	802.44	802.44	9.32	0.10	20.59	20.59	70.04	23.18	0.37	6.49
EX-4	Other	EXISTING D.I.	I85_NB_PGL_CG	2097+51.00	-85.00	828.35	828.35	17.00	0.13	20.36	20.36	50.84	18.29	0.34	6.52
EX-3	Other	EXISTING D.I.	I85_NB_PGL_CG	2096+77.50	78.00	828.58	828.58	11.86	0.03	20.17	20.17	45.92	16.99	0.33	6.55
DN-2	Other	DUMMY JOINT	I85_NB_PGL_CG	2096+48.00	147.00	825.00	825.00	3.85	0.73	20.00	20.11	42.46	16.15	0.32	6.57
DN-1	Other	DUMMY JOINT	I85_NB_PGL_CG	2097+68.00	143.00	830.50	830.50	3.54	0.00	20.00	20.00	42.46	16.15	0.32	6.57

LINK DATA (100 YR)

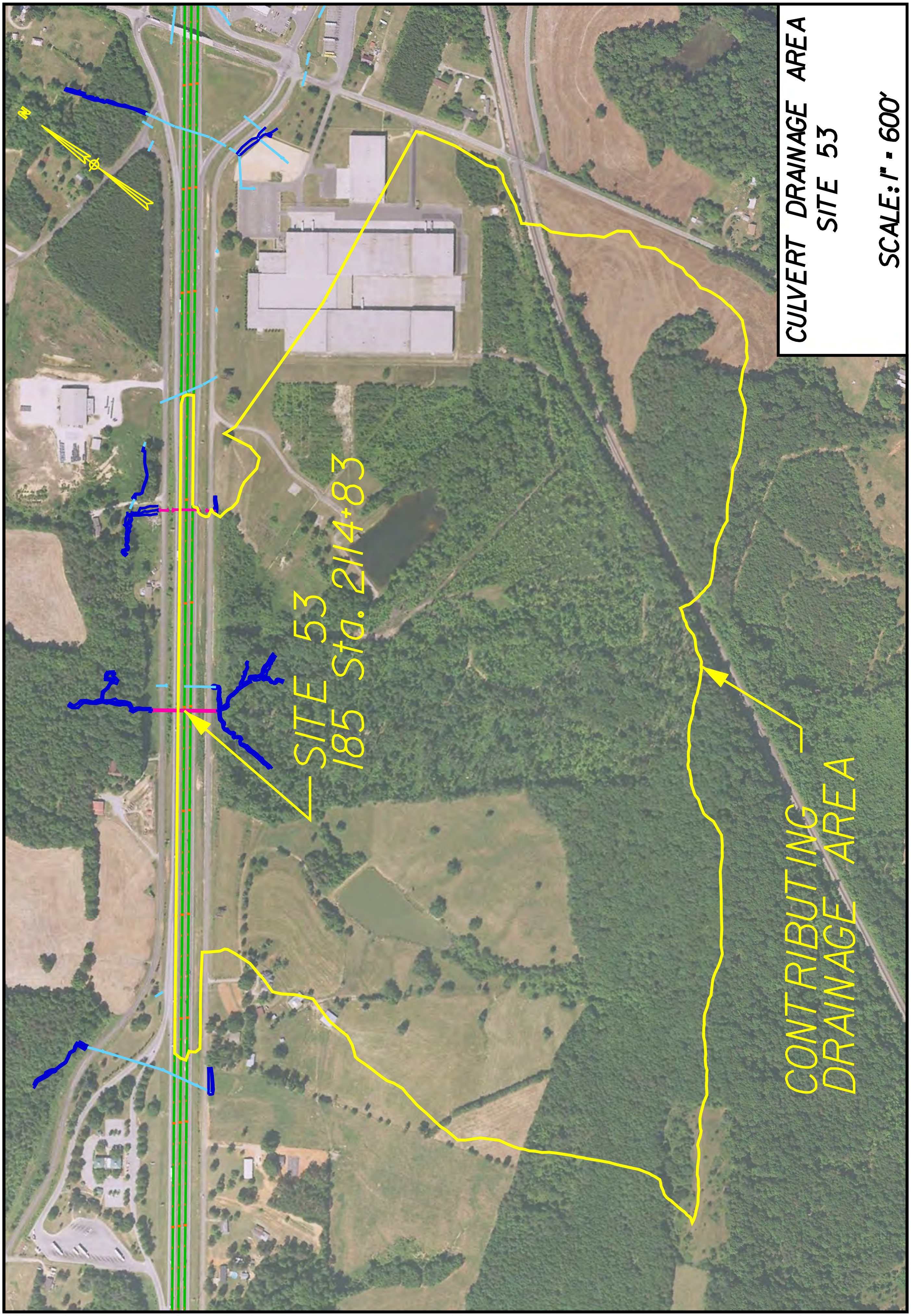
Link - ID	Node		Shape	Material	No. Barrels	Rise	Actual Length	Slope	Q (cfs)	Capacity	Uniform		US		DS		Invert		Actual Velocity		Actual Depth	
	US	DS									Depth	Velocity	Soffit	HGL	Soffit	HGL	US	DS	US	DS	US	DS
DL-6	DN-6	OP-52	n/a	n/a	1.00	1.50	316.50	3.55	70.04	232.32	0.76	16.56	788.58	790.05	777.33	776.60	787.08	775.83	7.16	16.45	1.50	0.77
EP-5	EX-5	DN-6	Circular	Concrete	1.00	3.00	79.91	7.56	70.04	213.70	1.23	25.67	796.12	796.03	790.08	788.52	793.12	787.08	10.00	20.95	2.91	1.44
EP-4	EX-4	EX-5	Circular	Concrete	1.00	3.00	300.21	6.07	50.84	191.54	1.10	21.72	814.35	813.92	796.12	794.23	811.35	793.12	7.89	21.49	2.57	1.11
EP-3	EX-3	EX-4	Circular	Concrete	1.00	3.00	178.81	3.00	45.92	134.70	1.26	16.35	819.72	818.96	814.35	812.65	816.72	811.35	8.12	15.64	2.24	1.30
EP-2	DN-2	EX-3	Circular	Concrete	1.00	3.00	75.04	5.90	42.46	188.85	1.00	20.46	824.15	824.00	819.72	817.86	821.15	816.72	6.12	17.23	2.85	1.14
DL-1	DN-1	DN-2	n/a	n/a	1.00	3.00	120.07	4.84	42.46	460.38	1.23	17.61	829.96	829.09	824.15	822.43	826.96	821.15	5.85	16.26	2.13	1.28

LEGEND	
	HW ELEVATION
	SYSTEM DISCHARGE

Pipe/Box Dimensions				Flow
		(inch)		(cfs)
Pipe Diameter		36		62
Box Dimension				
Span (ft)		0		
Height (ft)		0		

Length	Width	Riprap		GeoText
(FHWA HEC-14 - Calculated)		Quantity	Class[2]	
(ft)	(ft)	(Tons)		(SqYd)
18	21	50	C	43

** Energy Disipator only, still add quantities for slope protection.
** Apron length as per HEC-14 Table 10.1, Fig. 10.4; width as per HEC-14 Fig. 10.4.
** Riprap Class (D50) as per HEC-14 Eq. 10.4; Tailwater condition assumed (TW=0.4D)


CULVERT DRAINAGE AREA
SITE 53
SCALE: 1" = 600'
SITE 53
I85 Sta. 2114+83
CONTRIBUTING
DRAINAGE AREA

SCS Analysis

HSG	Land Use	Acres	CN	
B	Impervious	23.68	98.00	
B	Streets and roads: Gravel	2.27	85.00	Area Weighted CN
B	Pasture,grassland,or range: Good	72.90	61.00	62
B	Woods:Good	131.89	55.00	
A	Pasture,grassland,or range: Good	1.55	39.00	
A	Woods:Good	3.39	30.00	
		235.68		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	4.76%	100	0.8				0.408
Shallow Concentrated	Unpaved	4.76%	2177					0.172
Shallow Concentrated	Paved	4.76%	545					0.034
Channel 1		4.00%	1025	0.04	1.5	3.65028	4.11781	0.069
Channel 2								
Total			3847				1.5649	0.683

Drainage Area *(acres)*	**235.68**

Curve Number	**62**
Time of Concentration *(minutes)*	**41**

WinTR-55 Current Data Description

--- Identification Data ---

User:	CECS	Date:	12/13/2016
Project:	I-85 Improvement Proj DB Prep	Units:	English
SubTitle:	SITE 53	Areal Units:	Acres
State:	South Carolina		
County:	Cherokee_NOAA_B		

Filename: S:\Proj\2014\6114 I-85 mm 96-106\Design\Project PIN Number\Drainage\Calculations\CULVERT - POST

--- Sub-Area Data ---

Name	Description	Reach	Area(ac)	RCN	Tc
SITE 53		Outlet	235.68	62	0.680

Total area: 235.68 (ac)

--- Storm Data --

Rainfall Depth by Rainfall Return Period

2-Yr (in)	5-Yr (in)	10-Yr (in)	25-Yr (in)	50-Yr (in)	100-Yr (in)	1-Yr (in)
3.73	4.68	5.44	6.49	7.35	8.24	3.1

Storm Data Source: Cherokee_NOAA_B County, SC (NRCS)
Rainfall Distribution Type: Type NO_B
Dimensionless Unit Hydrograph: <standard>

SITE 53

Cherokee_NOAA_B County, South Carolina

Watershed Peak Table

Sub-Area or Reach Identifier	Peak Flow by Rainfall Return Period 10-Yr (cfs)	25-Yr (cfs)	50-Yr (cfs)	100-Yr (cfs)
SUBAREAS				
SITE 53	255.84	373.62	476.59	587.77
REACHES				
OUTLET	255.84	373.62	476.59	587.77

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 53

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 53 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
773.74	50 year	477.00	477.00	0.00	1
777.17	100 year	588.00	588.00	0.00	1
783.80	Overtopping	751.41	751.41	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 53

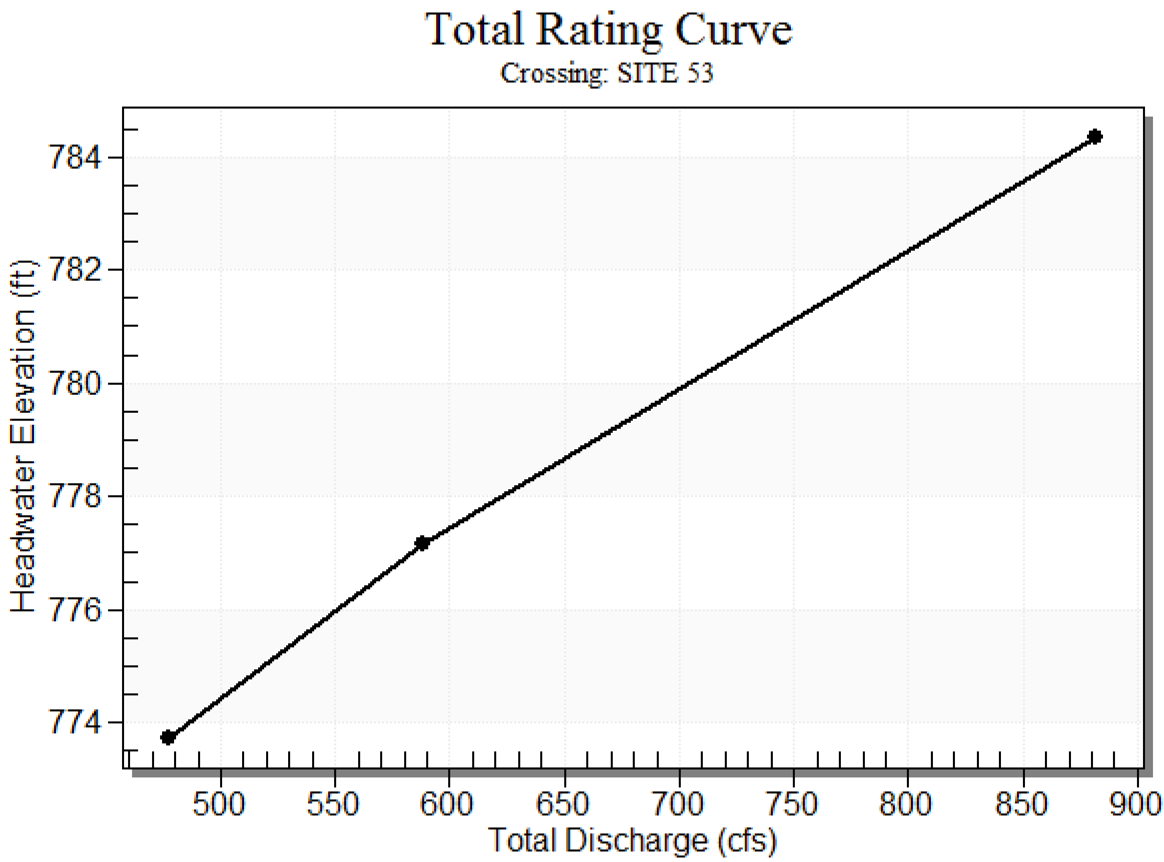


Table 2 - Culvert Summary Table: SITE 53

Discharge Names	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)
50 year	477.00	477.00	773.74	10.693	10.245	4-FFf	4.147	5.812	4.147	7.866	19.171
100 year	588.00	588.00	777.17	14.124	14.005	4-FFf	4.892	6.000	4.892	8.602	20.033

****

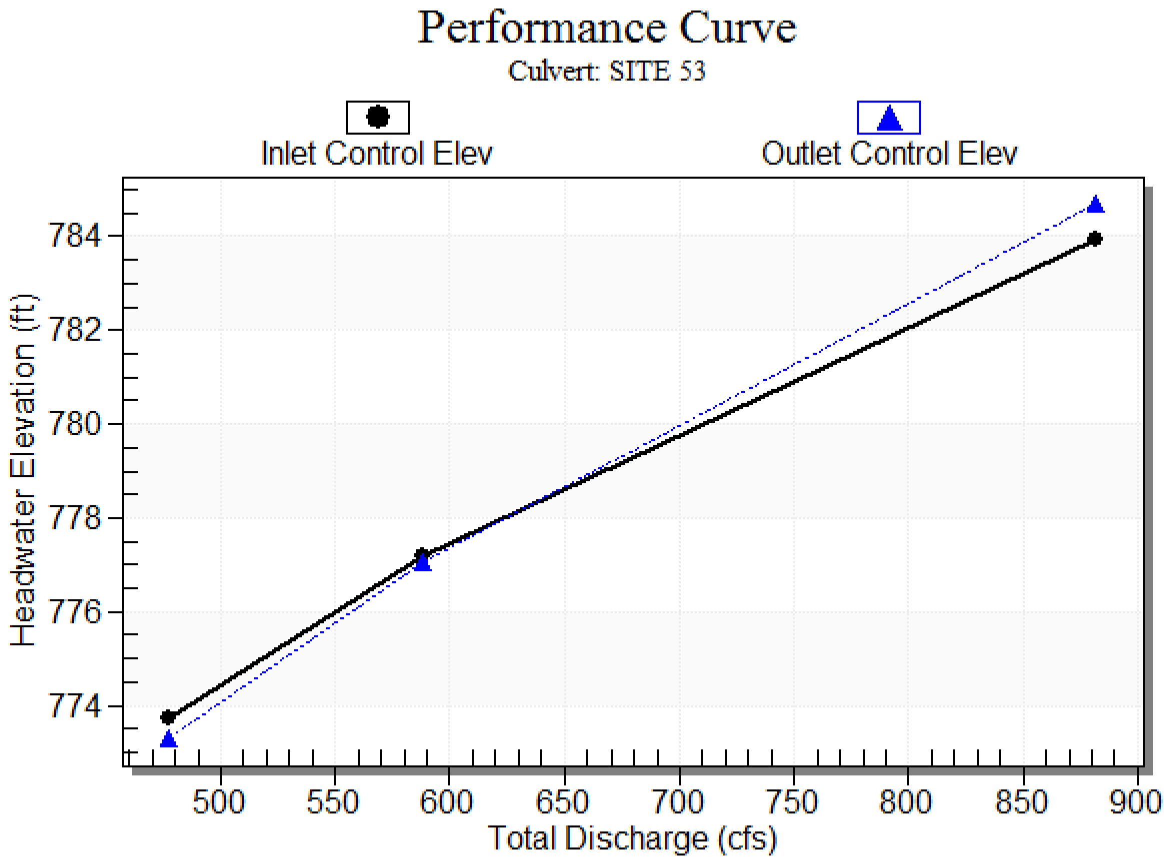
Straight Culvert

Inlet Elevation (invert): 763.05 ft,   Outlet Elevation (invert): 759.61 ft

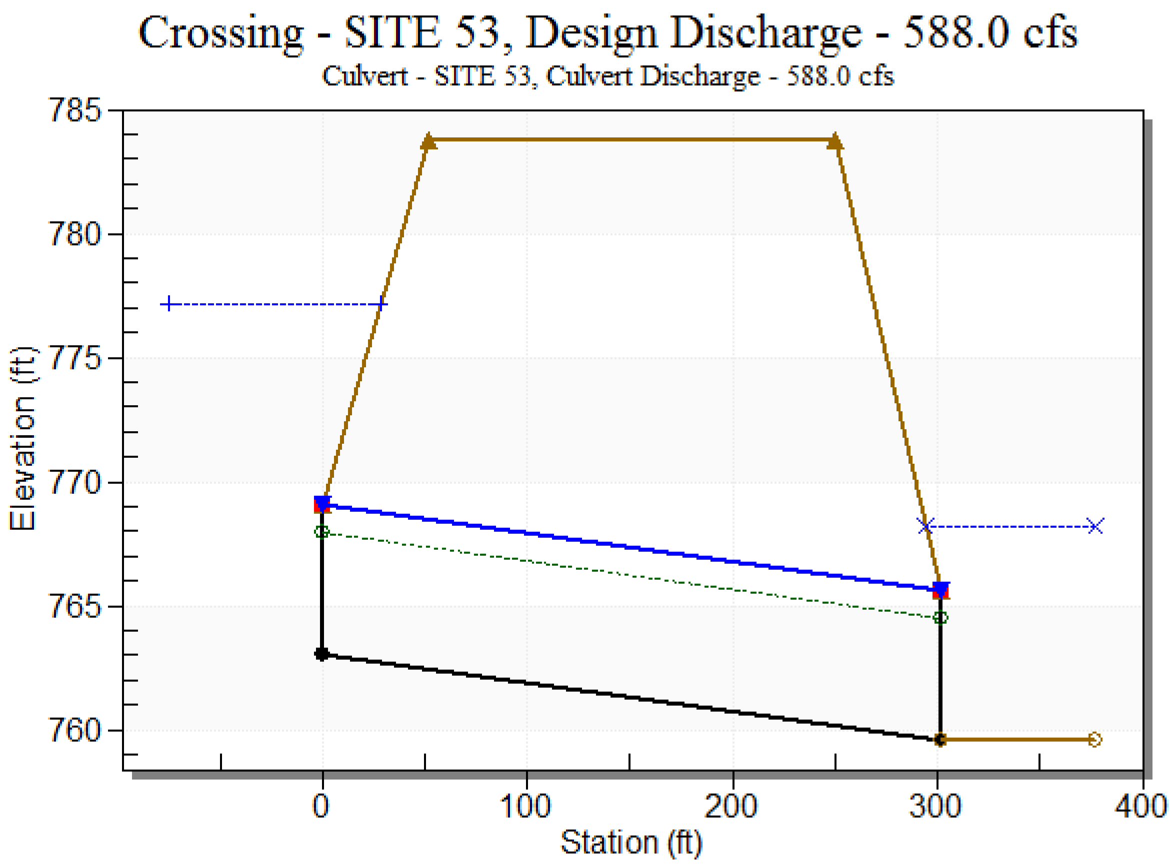
Culvert Length: 302.02 ft,   Culvert Slope: 0.0114

****

Culvert Performance Curve Plot: SITE 53



Water Surface Profile Plot for Culvert: SITE 53



Site Data - SITE 53

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 763.05 ft

Outlet Station: 302.00 ft

Outlet Elevation: 759.61 ft

Number of Barrels: 1

Culvert Data Summary - SITE 53

Barrel Shape: Concrete Box

Barrel Span: 6.00 ft

Barrel Rise: 6.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

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

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: SITE 53)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
477.00	767.48	7.87	3.84	3.48	0.32
588.00	768.21	8.60	4.04	3.81	0.32

Tailwater Channel Data - SITE 53

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

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

Channel Slope: 0.0071

Channel Manning's n: 0.0800

Channel Invert Elevation: 759.61 ft

Roadway Data for Crossing: SITE 53

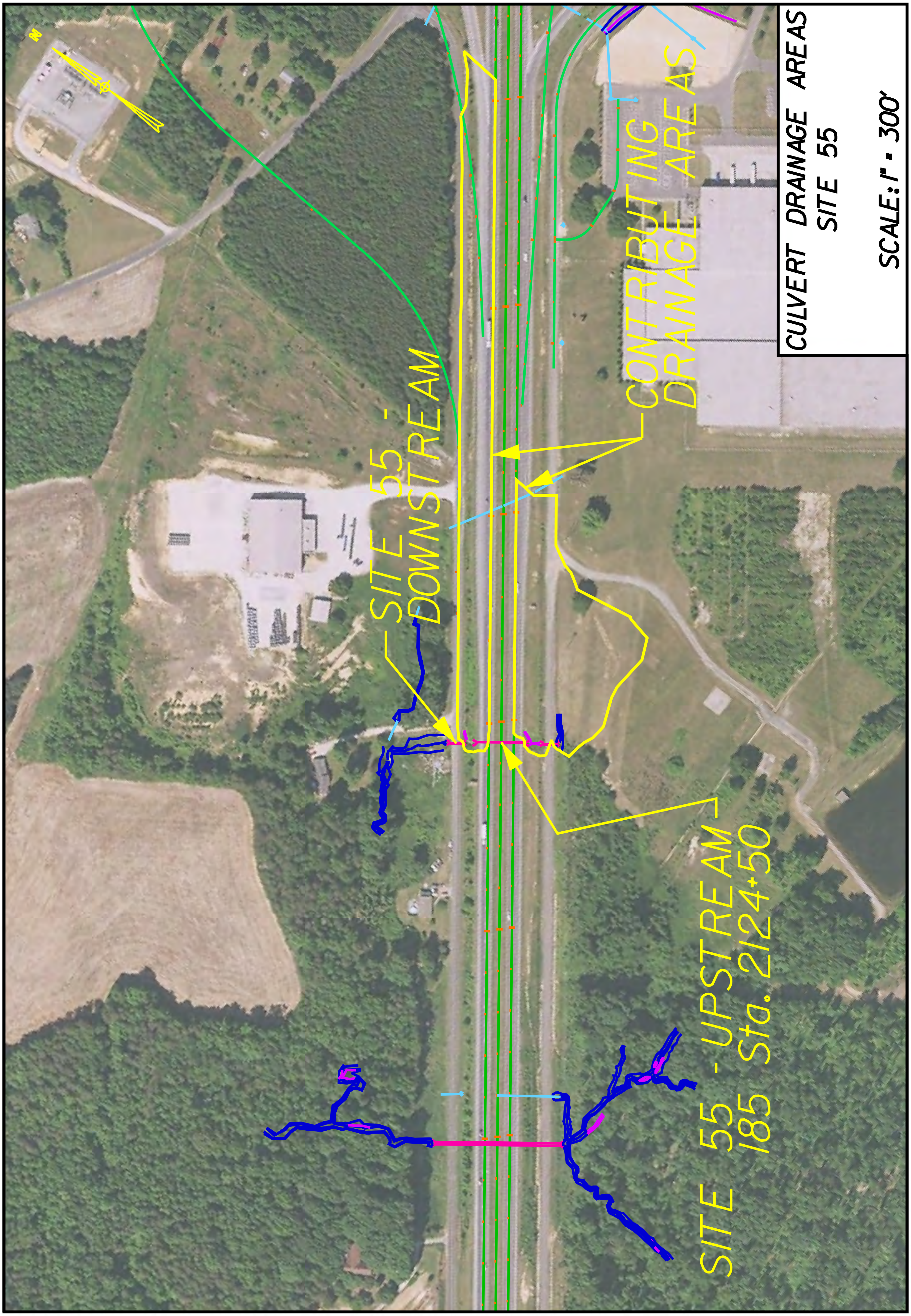
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 783.80 ft

Roadway Surface: Paved

Roadway Top Width: 198.00 ft


CULVERT DRAINAGE AREAS
SITE 55
SCALE: 1" = 300'
CONTRIBUTING DRAINAGE AREAS
SITE 55 - DOWNSTREAM
SITE 55 - UPSTREAM
185 Sta. 2124+50

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	0.57	0.90	
Rolling, 2%-10%	Side Slopes, Turf	2.21	0.30	Area Weighted C
				0.42
		2.78		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	2.27%	100	0.41				0.322
Shallow Concentrated	Unpaved	2.27%	239					0.027
Shallow Concentrated								
Channel 1		12.85%	65	0.045	3.5	7.2854	7.27954	0.002
Channel 2								
Total			404				0.3193	0.351

Gaffney

Time of Concentration *(minutes)*	22

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
$\mathbf{Q_{10}}$	1	0.42	4.618	2.78	**5**
$\mathbf{Q_{25}}$	1.1	0.42	5.284	2.78	**7**
$\mathbf{Q_{50}}$	1.2	0.42	5.804	2.78	**8**
$\mathbf{Q_{100}}$	1.25	0.42	6.311	2.78	**9**

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 55 - UPSTREAM

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 55 - UPSTREAM Discharge (cfs)	Roadway Discharge (cfs)	Iterations
806.53	50 year	8.00	8.00	0.00	1
806.59	100 year	9.00	9.00	0.00	1
812.63	Overtopping	9.00	9.00	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 55 - UPSTREAM

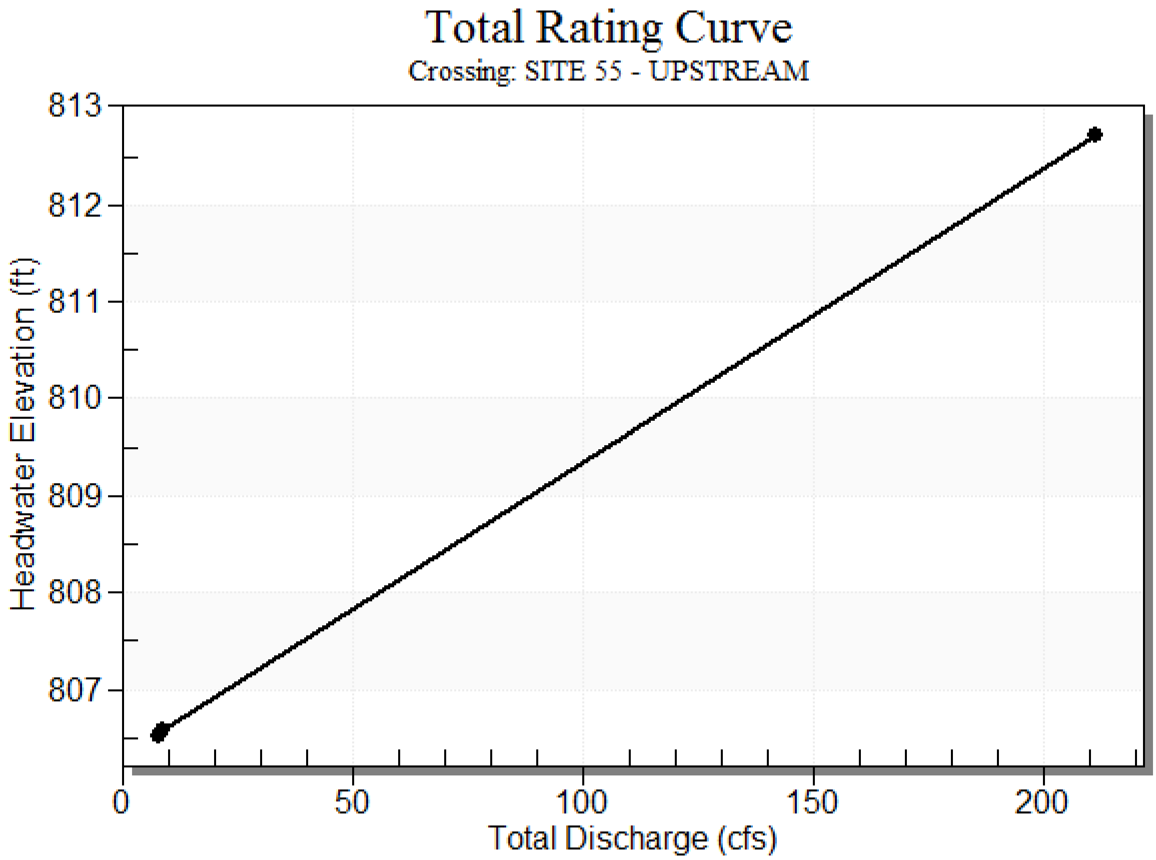


Table 2 - Culvert Summary Table: SITE 55 - UPSTREAM

Discharge Names	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)
50 year	8.00	8.00	806.53	0.745	0.0*	1-JS1t	0.148	0.499	1.370	1.370	1.460
100 year	9.00	9.00	806.59	0.806	0.0*	1-JS1t	0.167	0.540	1.500	1.500	1.500

* Full Flow Headwater elevation is below inlet invert.

****

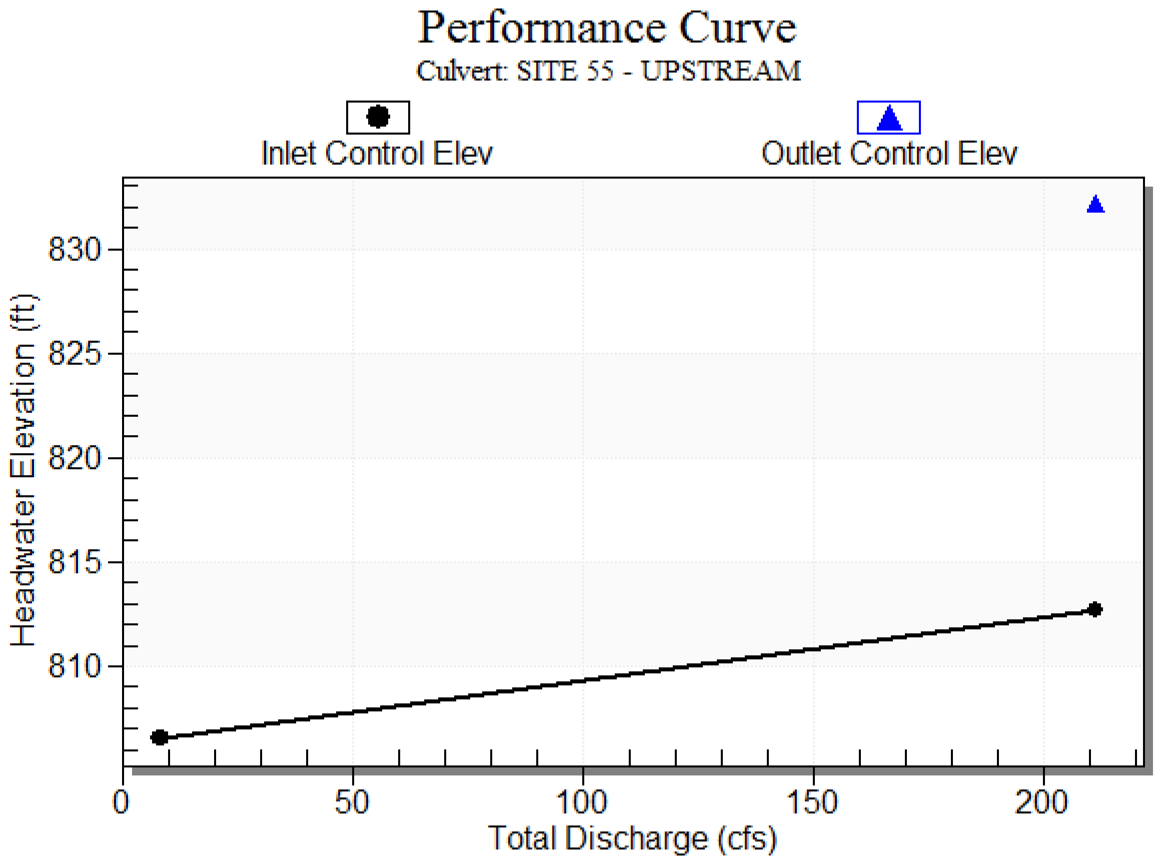
Straight Culvert

Inlet Elevation (invert): 805.78 ft,   Outlet Elevation (invert): 802.24 ft

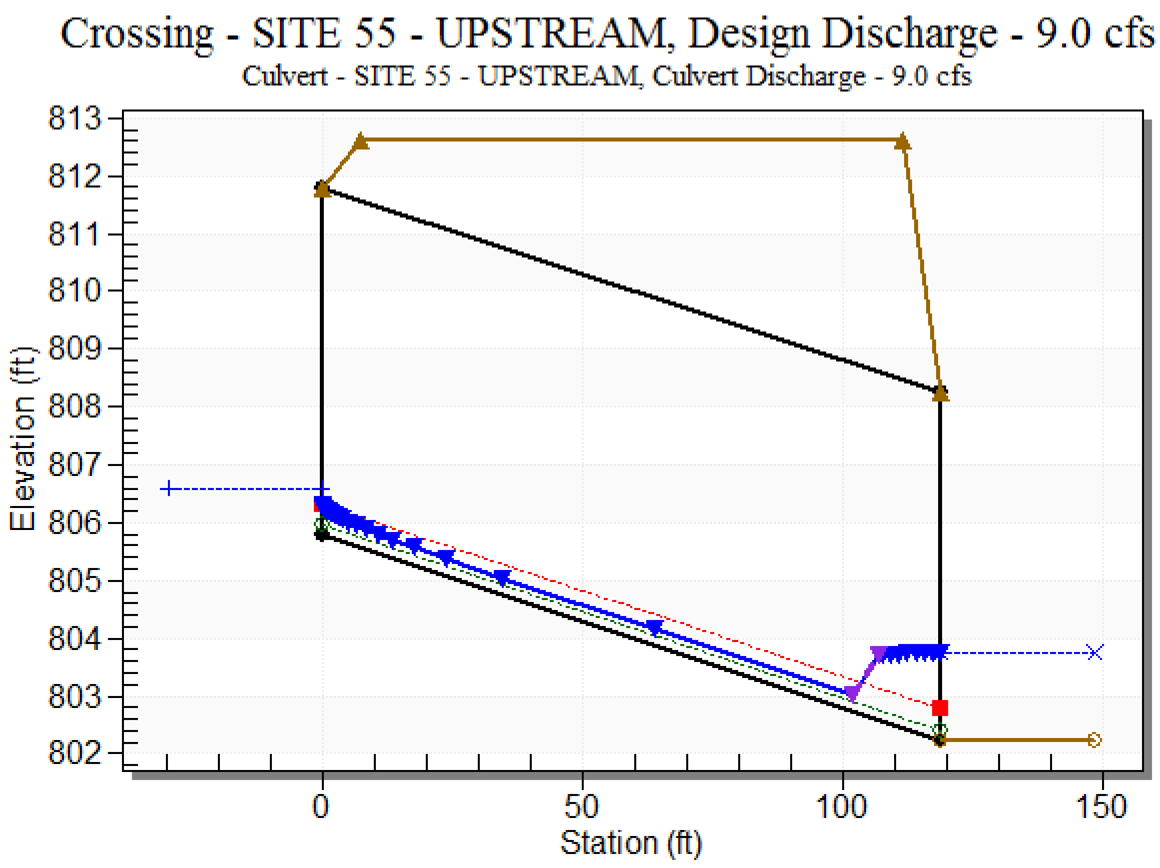
Culvert Length: 119.05 ft,   Culvert Slope: 0.0297

****

Culvert Performance Curve Plot: SITE 55 - UPSTREAM



Water Surface Profile Plot for Culvert: SITE 55 - UPSTREAM



Site Data - SITE 55 - UPSTREAM

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 805.78 ft

Outlet Station: 119.00 ft

Outlet Elevation: 802.24 ft

Number of Barrels: 1

Culvert Data Summary - SITE 55 - UPSTREAM

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: Square Edge (30-75º flare) Wingwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: SITE 55 - UPSTREAM)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)
8.00	803.61	1.37	0.00
9.00	803.74	1.50	0.00

Tailwater Channel Data - SITE 55 - UPSTREAM

Tailwater Channel Option: Enter Rating Curve

Channel Invert Elevation: 802.24 ft

Roadway Data for Crossing: SITE 55 - UPSTREAM

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 812.63 ft

Roadway Surface: Paved

Roadway Top Width: 104.00 ft

SITE 55 – Upstream Culvert Tailwater Rating Curve

<table>
<tr><td rowspan="4">Return Event</td><td colspan="3">Downstream (DS) Culvert</td><td colspan="3">Upstream (US) Culvert</td></tr>
<tr><td>Inlet Elevation</td><td colspan="2">797.82</td><td>Outlet Elevation</td><td colspan="2">802.24</td></tr>
<tr><td rowspan="2"></td><td colspan="2">Headwater</td><td rowspan="2"></td><td colspan="2">Tailwater</td></tr>
<tr><td>Elevation</td><td>Depth</td><td>Elevation</td><td>Depth</td></tr>
<tr><td>50-Year</td><td></td><td>799.19</td><td>1.37</td><td></td><td>803.61</td><td>1.37</td></tr>
<tr><td>100-Year</td><td></td><td>799.32</td><td>1.50</td><td></td><td>803.74</td><td>1.50</td></tr>
<tr><td colspan="7">* All elevations and depths are in feet.</td></tr>
</table>

Rational Analysis

Land Slope	Land Use	Acres	C
Rolling, 2%-10%	Pavements & Roofs	2.05	0.90
Rolling, 2%-10%	Side Slopes, Turf	3.64	0.30
		5.69	

Area Weighted C
0.52

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Grass:bermudagrass	2.27%	100	0.41				0.322
Shallow Concentrated	Unpaved	2.27%	239					0.027
Shallow Concentrated								
Channel 1		12.85%	65	0.045	3.5	7.2854	7.27954	0.002
Channel 2								
Total			404				0.3193	0.351

Gaffney

Time of Concentration *(minutes)*	22

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.52	4.618	5.69	**14**
Q_{25}	1.1	0.52	5.284	5.69	**17**
Q_{50}	1.2	0.52	5.804	5.69	**20**
Q_{100}	1.25	0.52	6.311	5.69	**23**

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 55 - DOWNSTREAM

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 55 - DOWNSTREAM Discharge (cfs)	Roadway Discharge (cfs)	Iterations
799.19	50 year	20.00	20.00	0.00	1
799.32	100 year	23.00	23.00	0.00	1
805.51	Overtopping	23.00	23.00	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 55 - DOWNSTREAM

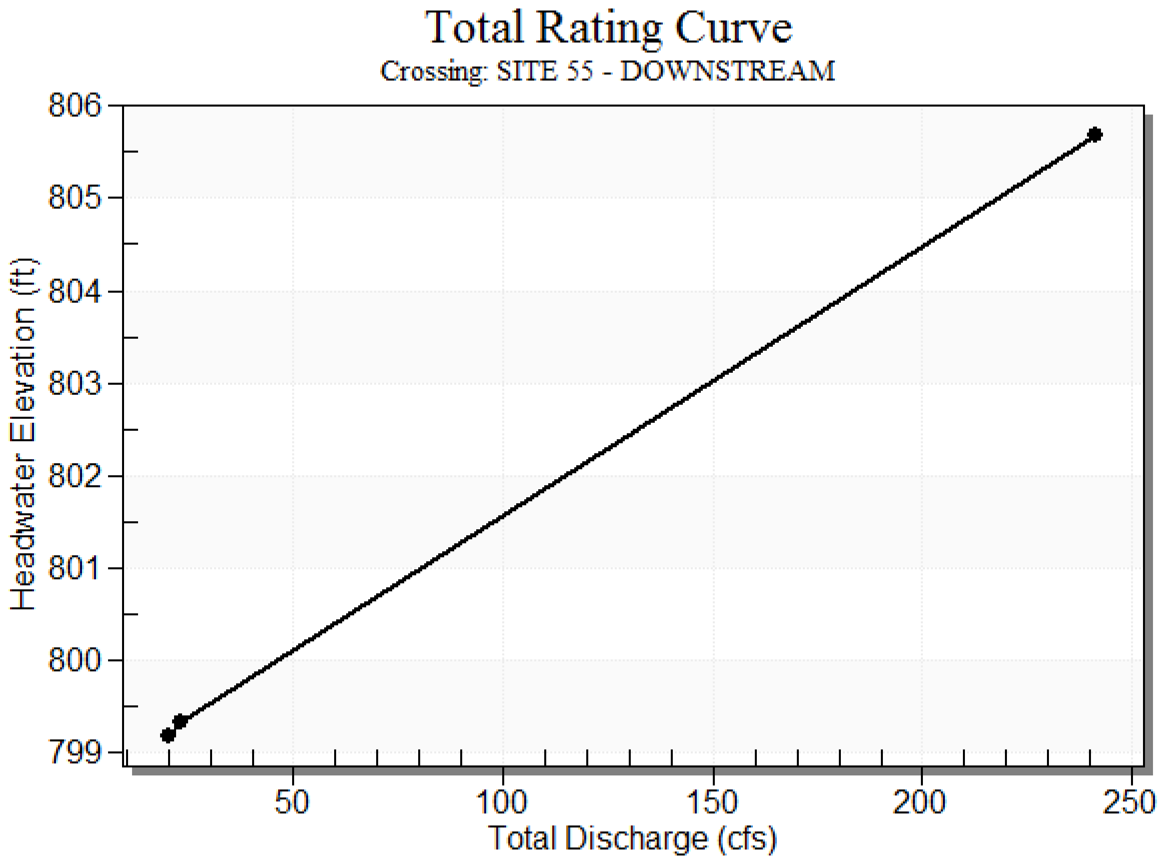


Table 2 - Culvert Summary Table: SITE 55 - DOWNSTREAM

Discharge Names	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)
50 year	20.00	20.00	799.19	1.370	1.238	1-JS1t	0.357	0.919	2.312	2.312	2.163
100 year	23.00	23.00	799.32	1.504	1.368	1-JS1t	0.411	1.009	2.436	2.436	2.360

****

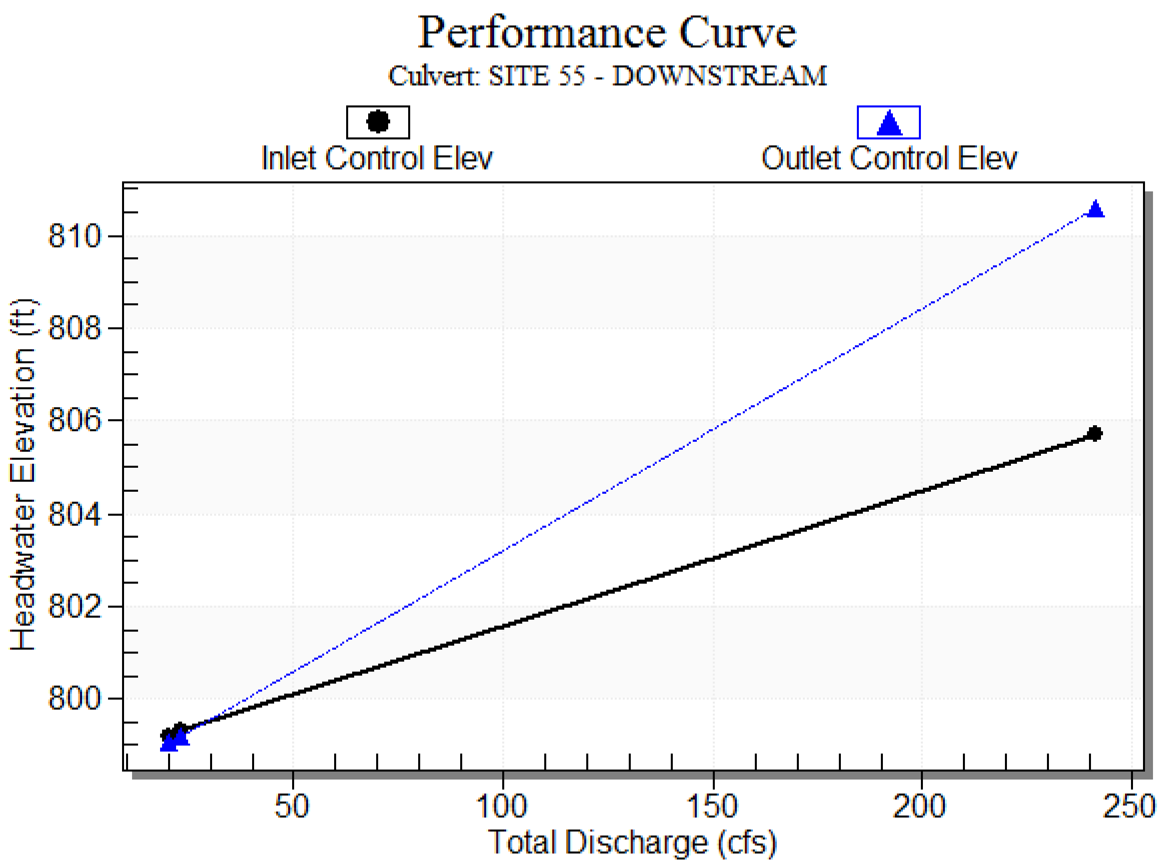
Straight Culvert

Inlet Elevation (invert): 797.82 ft,   Outlet Elevation (invert): 796.73 ft

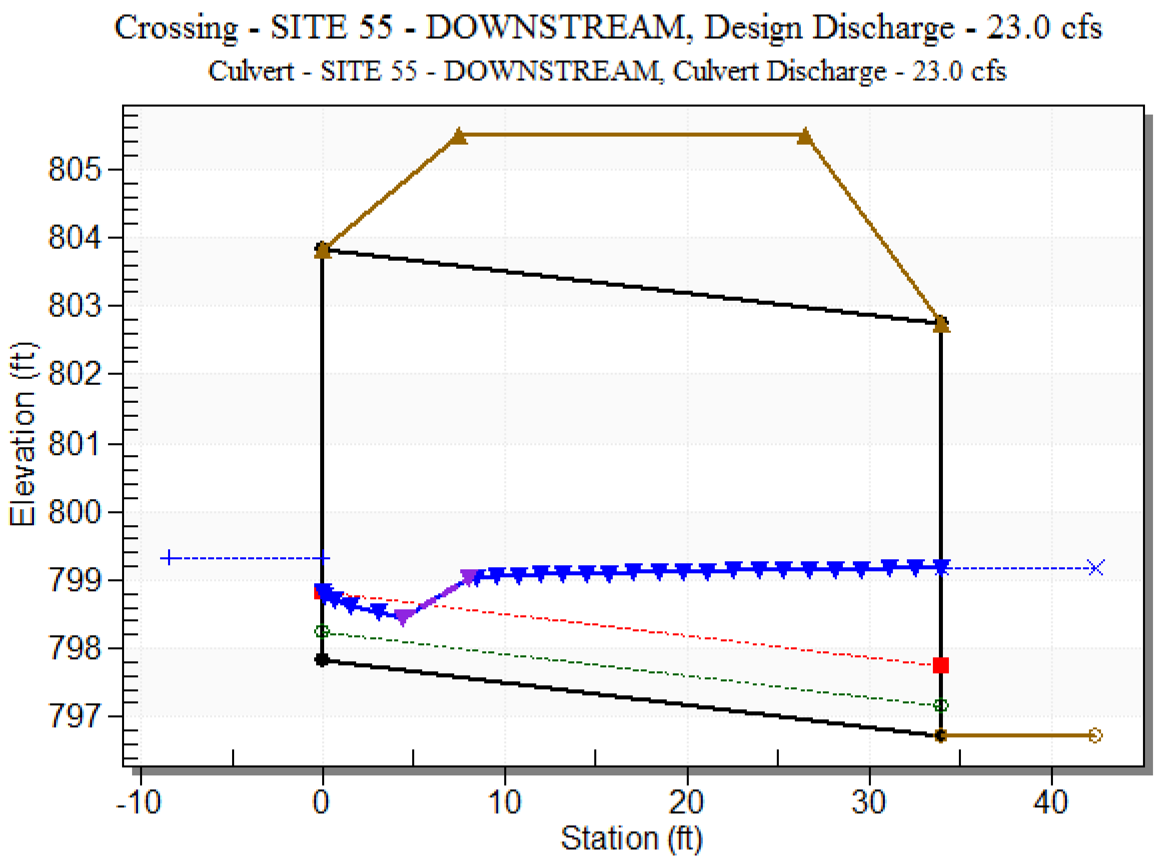
Culvert Length: 34.02 ft,   Culvert Slope: 0.0321

****

Culvert Performance Curve Plot: SITE 55 - DOWNSTREAM



Water Surface Profile Plot for Culvert: SITE 55 - DOWNSTREAM



Site Data - SITE 55 - DOWNSTREAM

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 797.82 ft

Outlet Station: 34.00 ft

Outlet Elevation: 796.73 ft

Number of Barrels: 1

Culvert Data Summary - SITE 55 - DOWNSTREAM

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: Square Edge (30-75º flare) Wingwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: SITE 55 - DOWNSTREAM)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
20.00	799.04	2.31	2.88	3.89	0.47
23.00	799.17	2.44	2.98	4.10	0.48

Tailwater Channel Data - SITE 55 - DOWNSTREAM

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 1.30 (_:1)

Channel Slope: 0.0270

Channel Manning's n: 0.0800

Channel Invert Elevation: 796.73 ft

Roadway Data for Crossing: SITE 55 - DOWNSTREAM

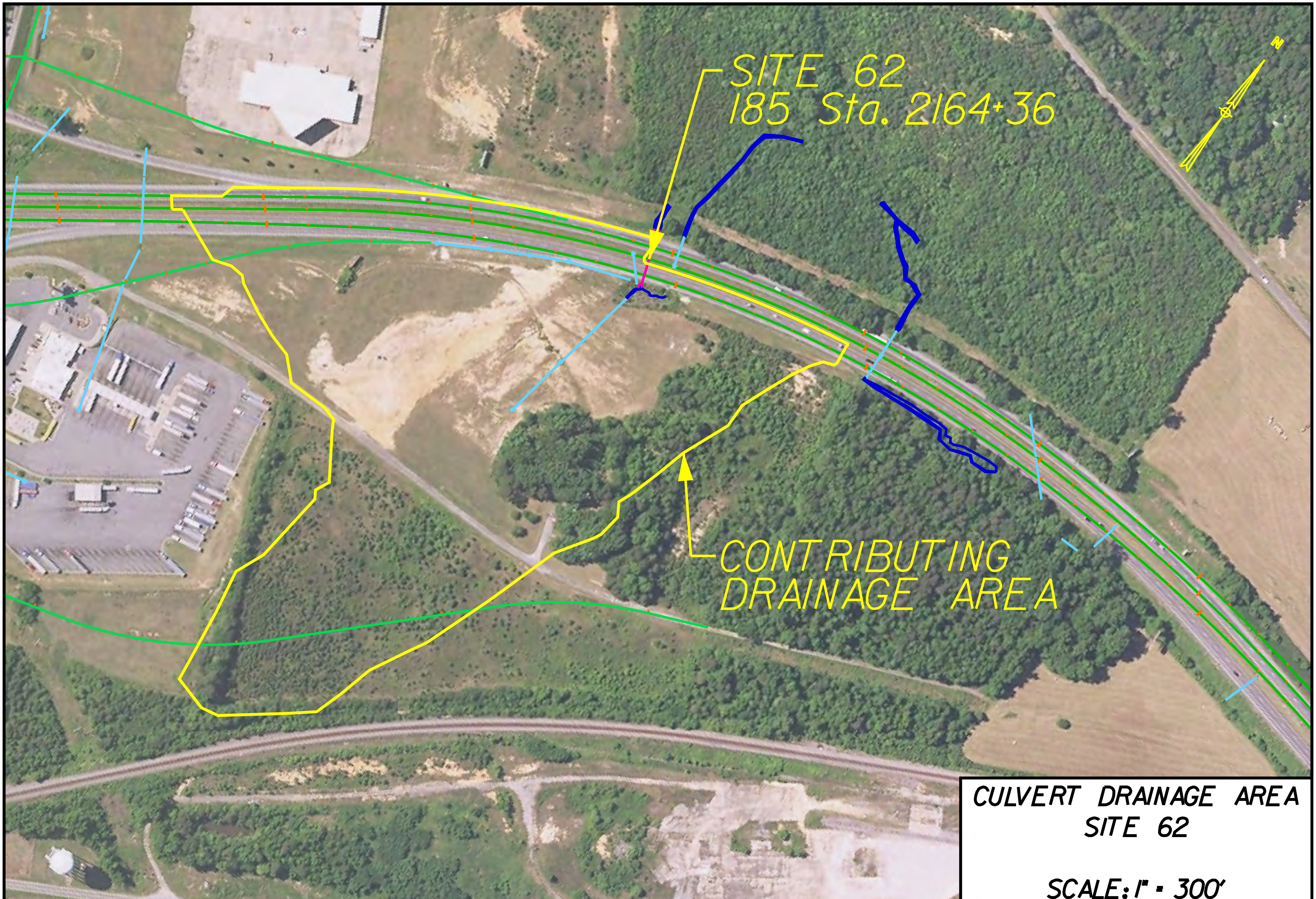
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 805.51 ft

Roadway Surface: Paved

Roadway Top Width: 19.00 ft



CULVERT DRAINAGE AREA
SITE 62

SCALE: 1" = 300'

Rational Analysis

Land Slope	Land Use	Acres	C	Area Weighted C
Rolling, 2%-10%	Pavements & Roofs	4.57	0.90	
Rolling, 2%-10%	Earth shoulders	2.05	0.50	
Rolling, 2%-10%	Side Slopes, Turf	9.98	0.30	0.39
Rolling, 2%-10%	Unimproved Areas	4.80	0.20	
Rolling, 2%-10%	Woodland & Forest	3.45	0.15	
		24.85		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods: light underbrush	2.84%	100	0.4				0.288
Shallow Concentrated	Unpaved	2.84%	1189					0.121
Shallow Concentrated								
Channel 1								
Channel 2								
Total			1289				0.8747	0.409

Gaffney

Time of Concentration *(minutes)*	25

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.39	4.372	24.85	**42**
Q_{25}	1.1	0.39	4.996	24.85	**53**
Q_{50}	1.2	0.39	5.482	24.85	**63**
Q_{100}	1.25	0.39	5.956	24.85	**72**

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 62

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 62 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
820.44	50 year	63.00	63.00	0.00	1
820.49	100 year	72.00	72.00	0.00	1
828.33	Overtopping	234.75	234.75	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 62

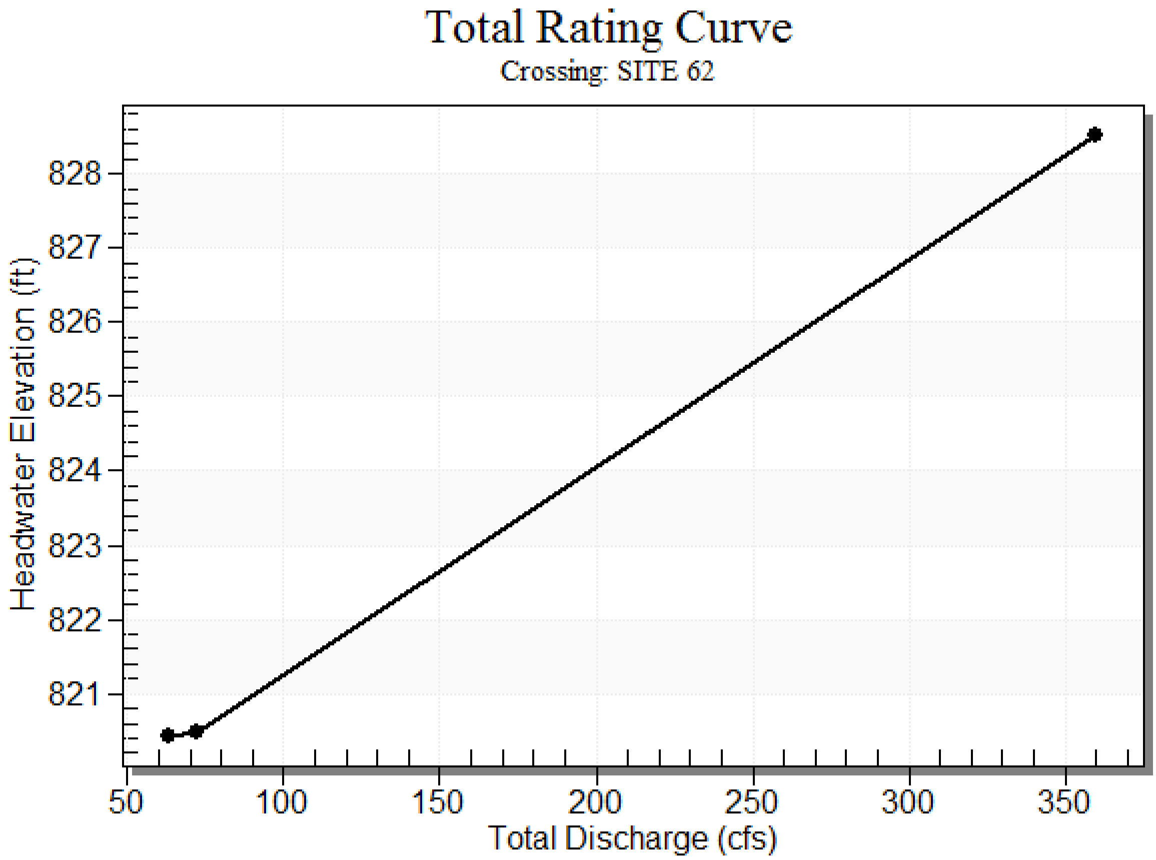


Table 2 - Culvert Summary Table: SITE 62

Discharge Names	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)
50 year	63.00	63.00	820.44	3.140	6.150	9-A2t	-1.000	1.975	2.344	2.344	6.718
100 year	72.00	72.00	820.49	3.431	6.196	9-A2t	-1.000	2.159	2.488	2.488	7.235

****

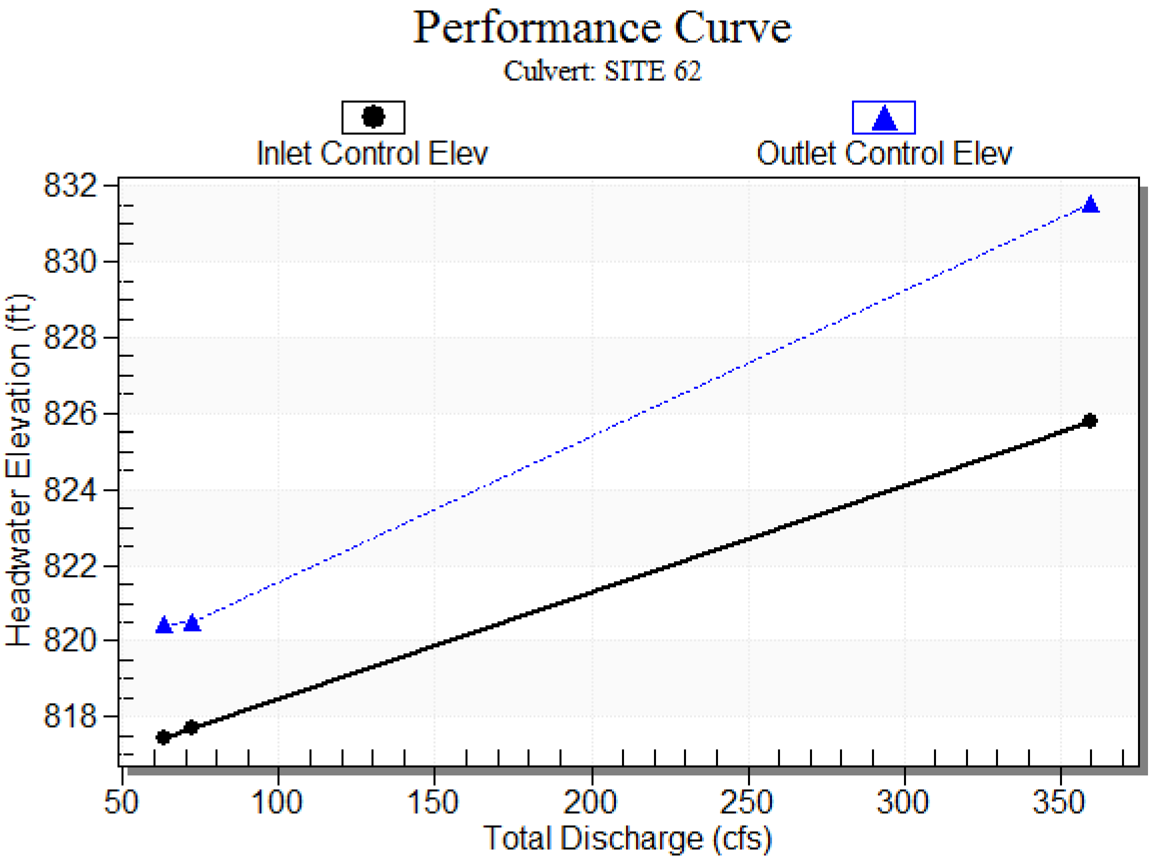
Straight Culvert

Inlet Elevation (invert): 814.29 ft,   Outlet Elevation (invert): 818.92 ft

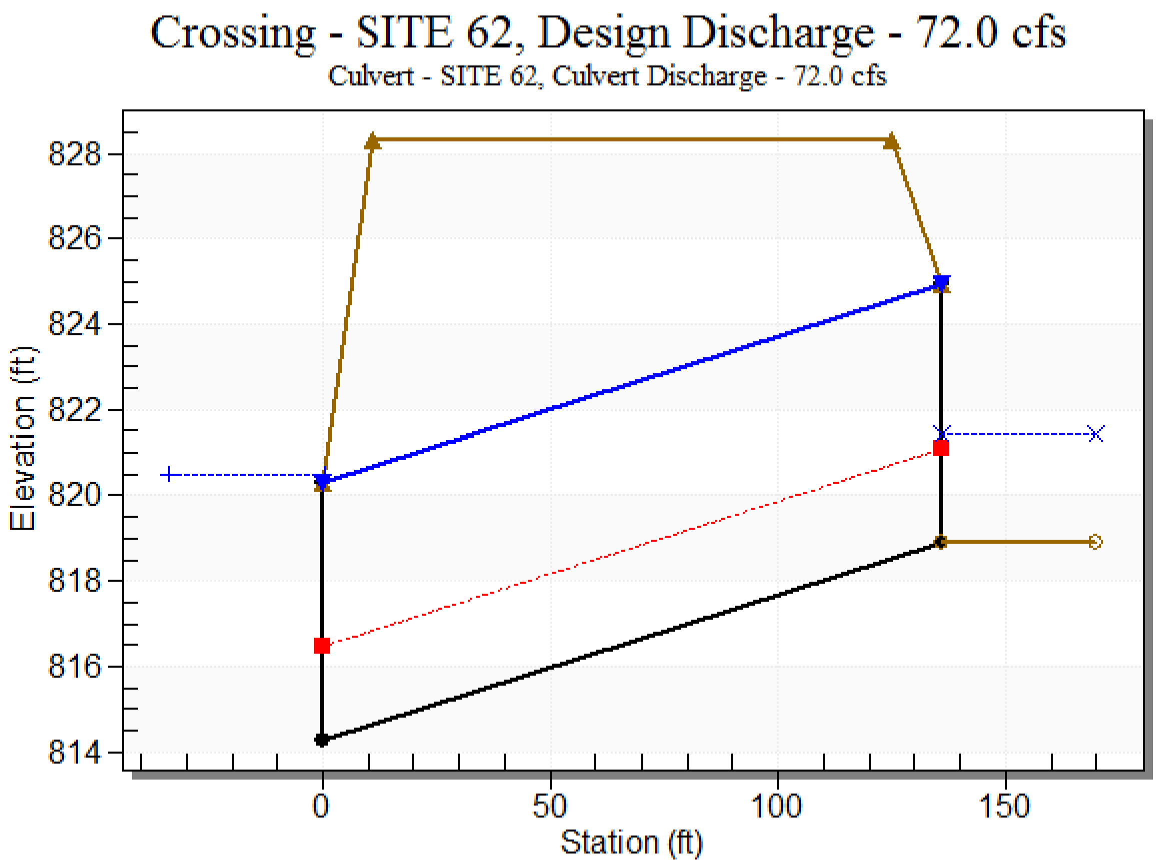
Culvert Length: 136.08 ft,   Culvert Slope: -0.0340

****

Culvert Performance Curve Plot: SITE 62



Water Surface Profile Plot for Culvert: SITE 62



Site Data - SITE 62

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 814.29 ft

Outlet Station: 136.00 ft

Outlet Elevation: 818.92 ft

Number of Barrels: 1

Culvert Data Summary - SITE 62

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: Square Edge (30-75º flare) Wingwall

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: SITE 62)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
63.00	821.26	2.34	1.52	0.63	0.22
72.00	821.41	2.49	1.57	0.67	0.23

Tailwater Channel Data - SITE 62

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 6.00 ft

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

Channel Slope: 0.0043

Channel Manning's n: 0.0800

Channel Invert Elevation: 818.92 ft

Roadway Data for Crossing: SITE 62

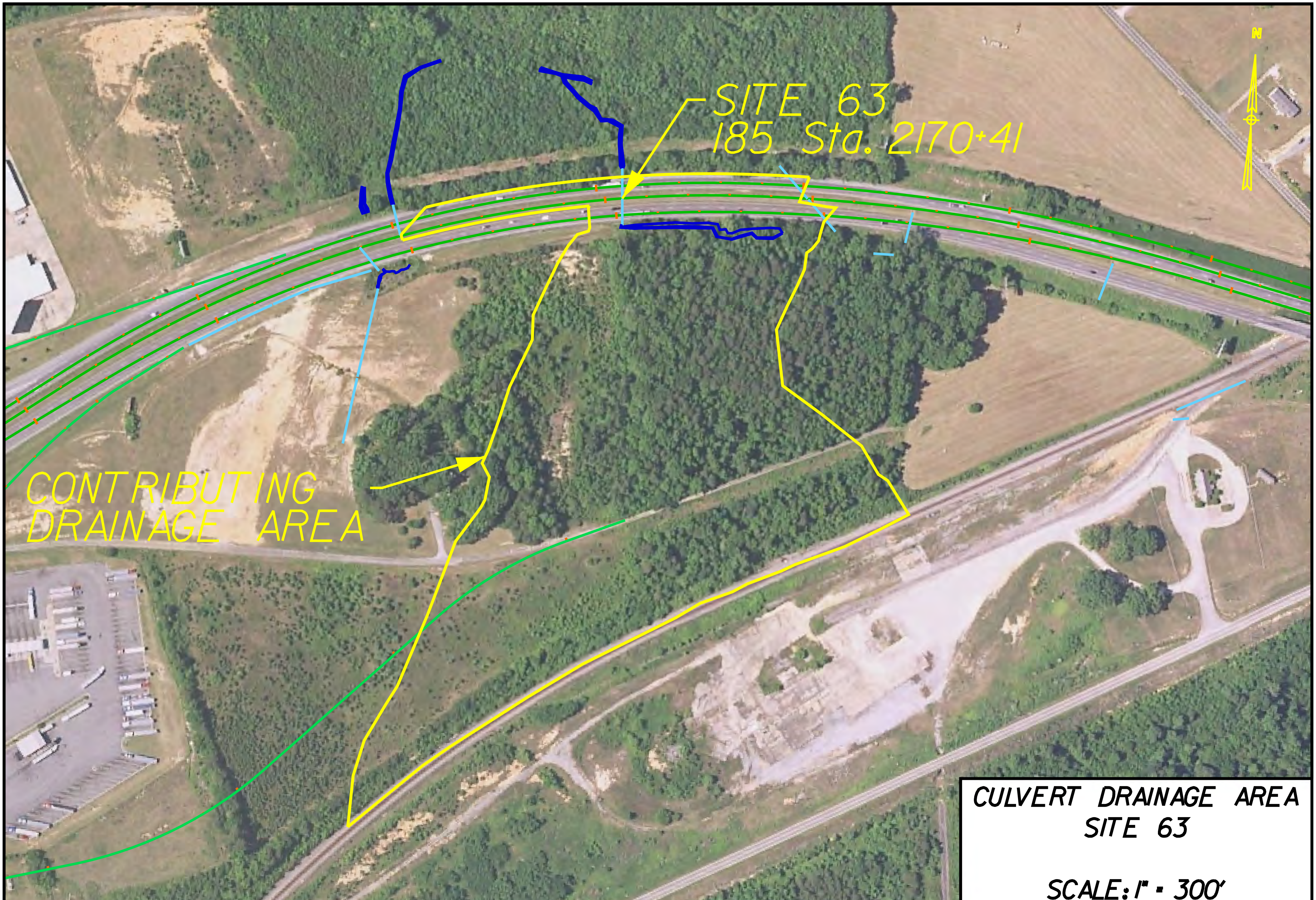
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 828.33 ft

Roadway Surface: Paved

Roadway Top Width: 114.00 ft



CULVERT DRAINAGE AREA
SITE 63

SCALE: 1" = 300'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	2.70	0.90	
Rolling, 2%-10%	Gravel Pavements	0.92	0.55	Area Weighted C
Rolling, 2%-10%	Side Slopes, Turf	2.02	0.30	0.28
Rolling, 2%-10%	Unimproved Areas	2.59	0.20	
Rolling, 2%-10%	Woodland & Forest	13.44	0.15	
		21.67		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusl	2.60%	100	0.8				0.520
Shallow Concentrated	Unpaved	2.60%	908					0.097
Shallow Concentrated								
Channel 1								
Channel 2								
Total			1008				0.4540	0.617

Gaffney

Time of Concentration *(minutes)*	38

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.28	3.551	21.67	**22**
Q_{25}	1.1	0.28	4.042	21.67	**27**
Q_{50}	1.2	0.28	4.422	21.67	**32**
Q_{100}	1.25	0.28	4.791	21.67	**36**

Civil Engineering Consulting Services, Inc.

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 63

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 63 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
821.27	50 year	32.00	32.00	0.00	1
821.47	100 year	36.00	36.00	0.00	1
822.37	Overtopping	51.85	51.85	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 63

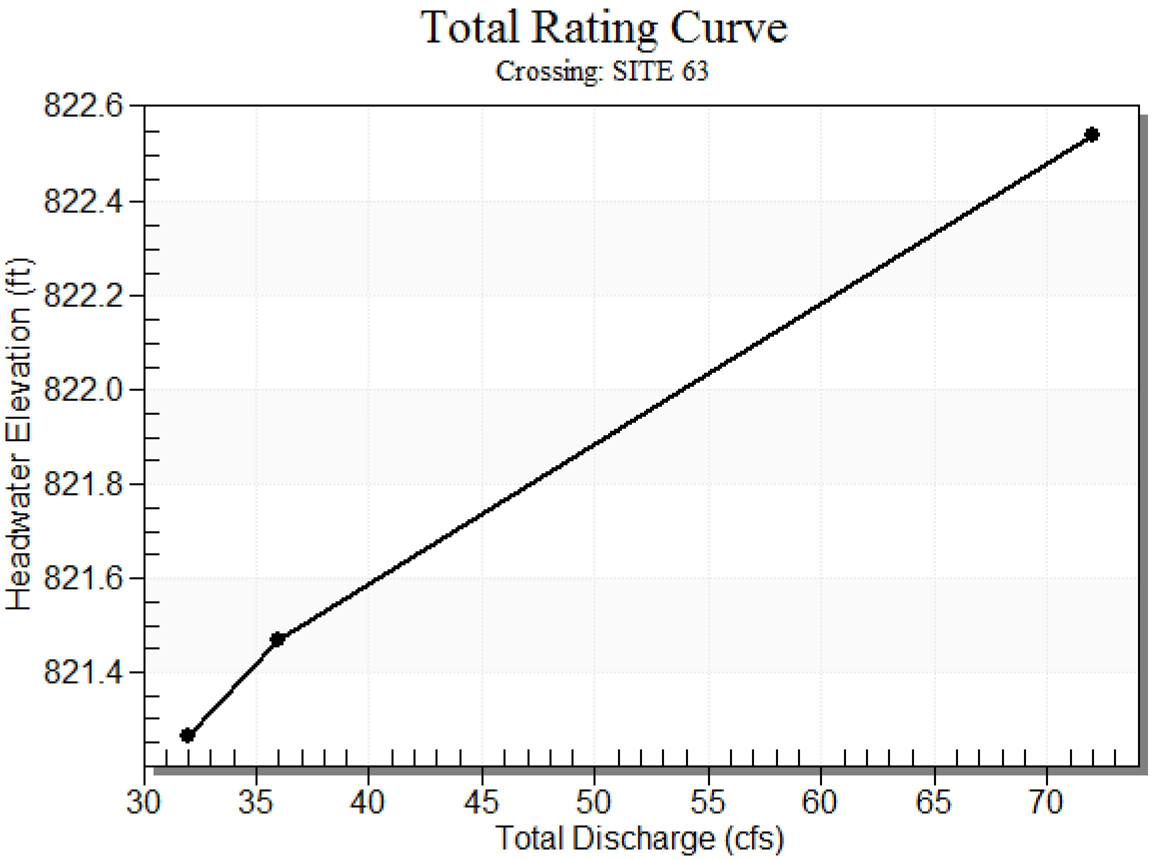


Table 2 - Culvert Summary Table: SITE 63

Discharge Names	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)
50 year	32.00	32.00	821.27	2.666	1.860	1-S2n	0.000	1.095	2.571	2.571	10.015
100 year	36.00	36.00	821.47	2.867	2.128	1-S2n	0.000	1.095	2.704	2.704	10.267

****

Single Broken-back Culvert

Inlet Elevation (invert): 818.60 ft

Break Elevation (invert): 818.30 ft

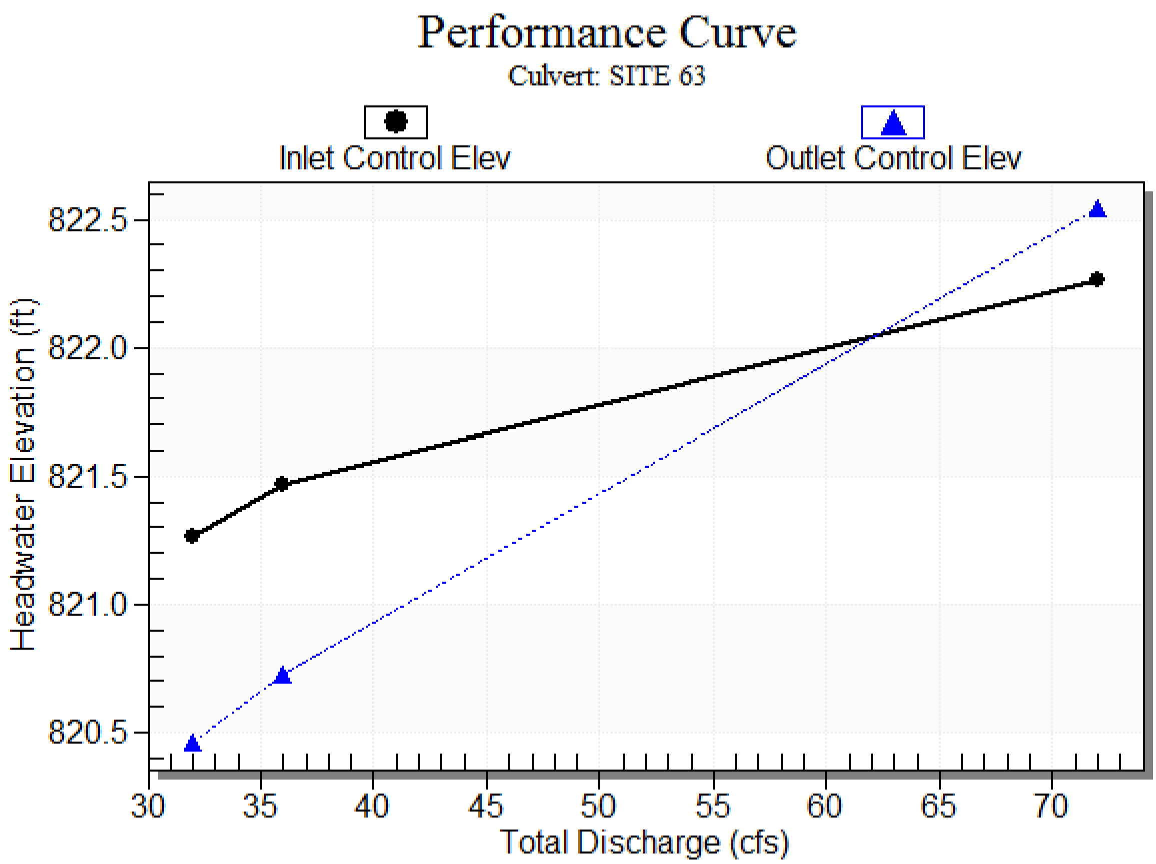
Culvert Length: 136.01 ft

Upper Culvert Section Slope: 0.0046

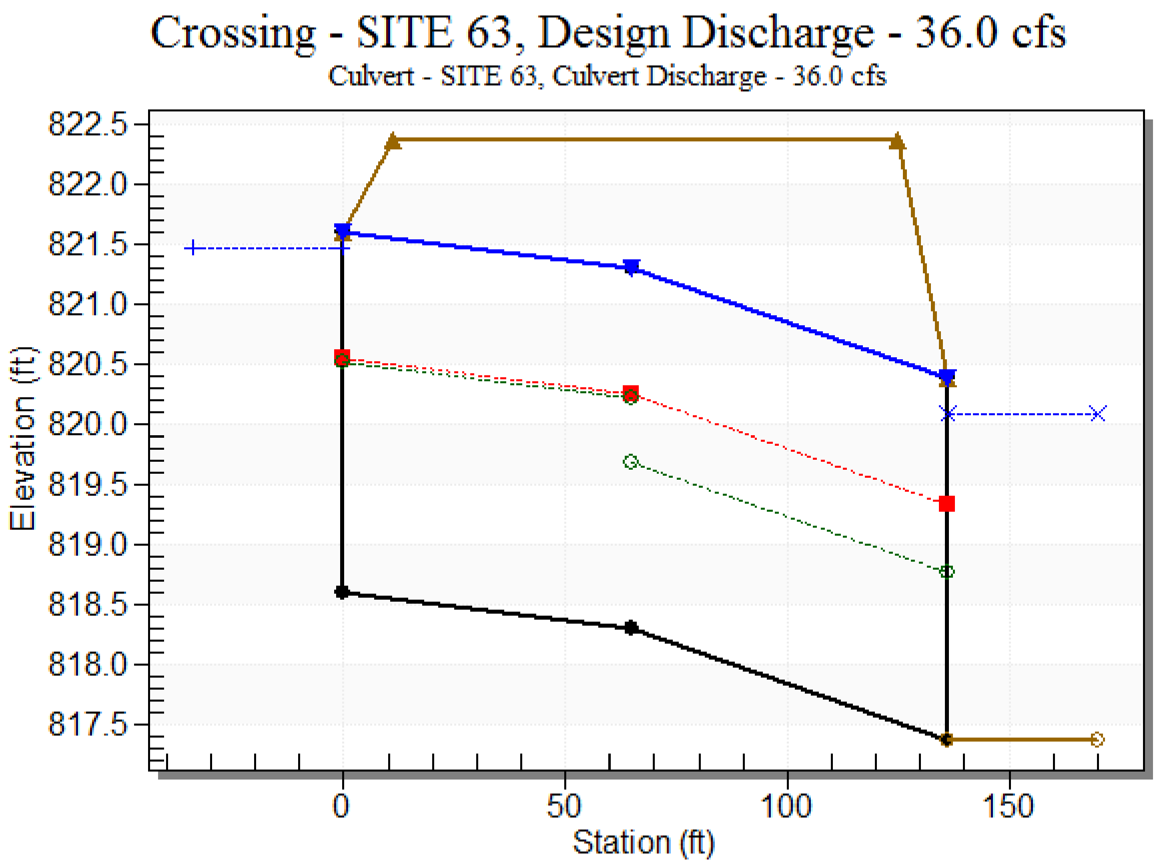
Steep Culvert Section Slope: 0.0130

****

Culvert Performance Curve Plot: SITE 63



Water Surface Profile Plot for Culvert: SITE 63



Site Data - SITE 63

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 818.60 ft

Break Station: 65.00 ft

Break Elevation: 818.30 ft

Outlet Station: 136.00 ft

Outlet Elevation: 817.38 ft

Number of Barrels: 1

Culvert Data Summary - SITE 63

Barrel Shape: Circular

Barrel Diameter: 3.00 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: SITE 63)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
32.00	819.95	2.57	3.05	3.53	0.44
36.00	820.08	2.70	3.14	3.71	0.45

Tailwater Channel Data - SITE 63

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 1.00 ft

Side Slope (H:V): 1.20 (_:1)

Channel Slope: 0.0220

Channel Manning's n: 0.0800

Channel Invert Elevation: 817.38 ft

Roadway Data for Crossing: SITE 63

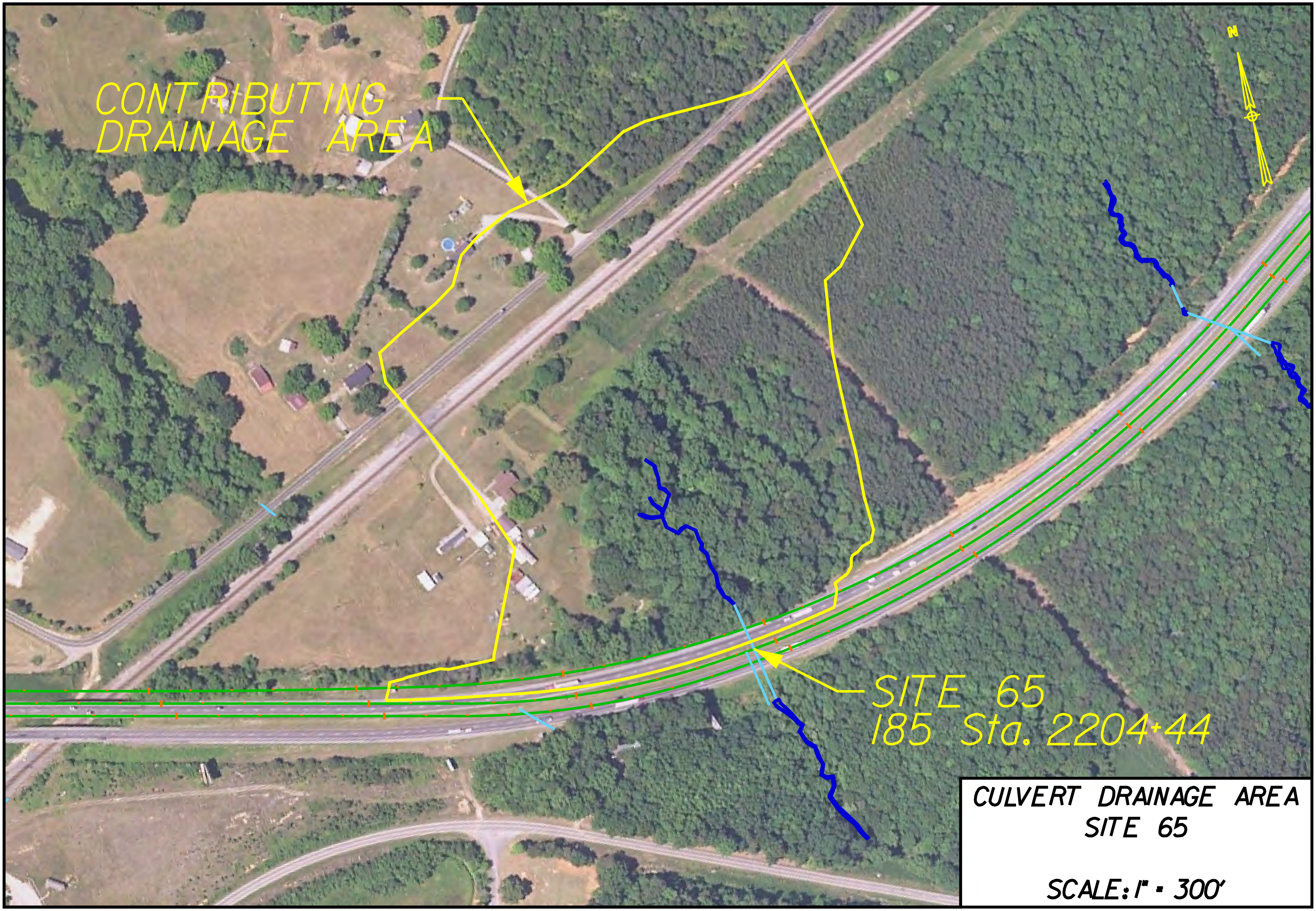
Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 822.37 ft

Roadway Surface: Paved

Roadway Top Width: 114.00 ft



CULVERT DRAINAGE AREA
SITE 65

SCALE: 1" = 300'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	2.21	0.90	
Rolling, 2%-10%	Side Slopes, Turf	9.23	0.30	Area Weighted C
Rolling, 2%-10%	Rail Yards	1.40	0.30	0.28
Hilly, Over 10%	Woodland & Forest	5.09	0.20	
Rolling, 2%-10%	Woodland & Forest	9.25	0.15	
		27.18		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	5.04%	100	0.8				0.399
Shallow Concentrated	Unpaved	5.04%	767					0.059
Shallow Concentrated								
Channel 1		1.11%	1480	0.04	2	4.5765	2.25813	0.182
Channel 2								
Total			2347				1.0195	0.639

Gaffney

Time of Concentration *(minutes)*	39

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.28	3.500	27.18	**27**
Q_{25}	1.1	0.28	3.984	27.18	**33**
Q_{50}	1.2	0.28	4.358	27.18	**40**
Q_{100}	1.25	0.28	4.720	27.18	**45**

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 65

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 65 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
814.58	50 year	40.00	40.00	0.00	1
814.85	100 year	45.00	45.00	0.00	1
834.86	Overtopping	172.32	172.32	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 65

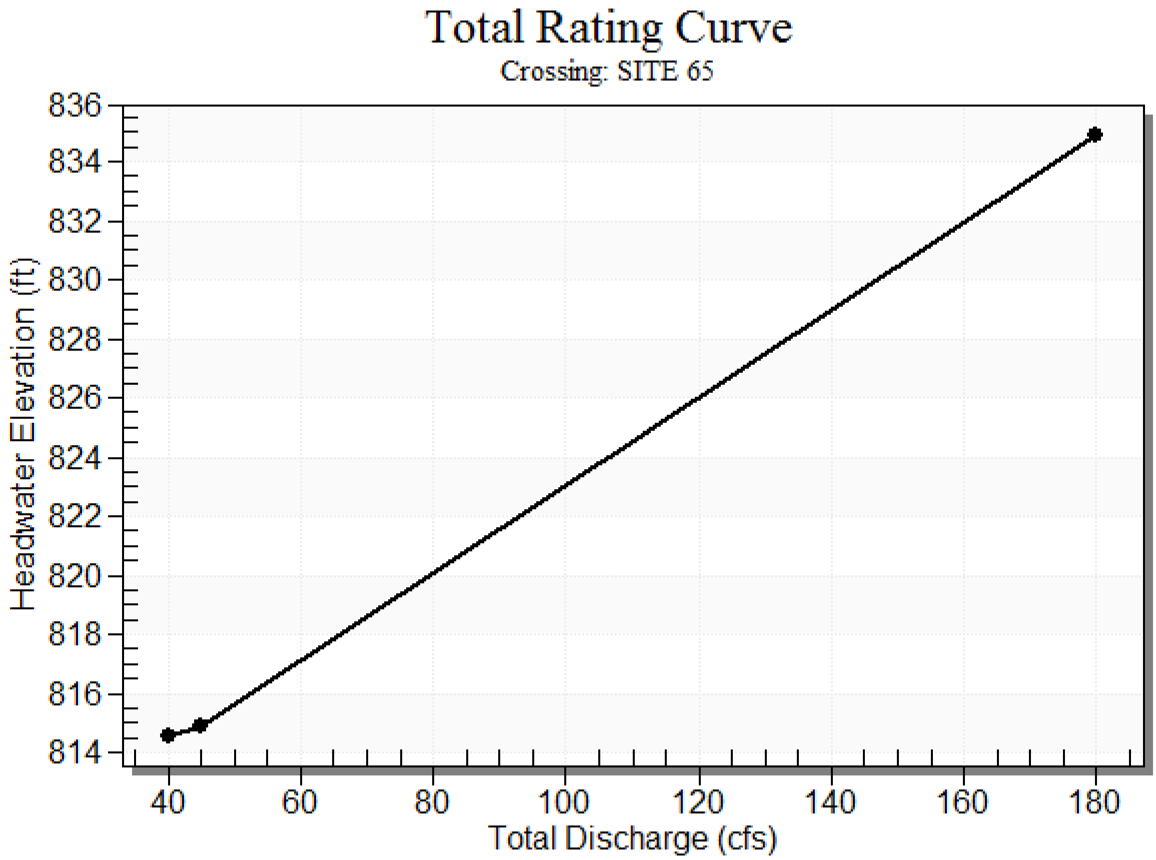


Table 2 - Culvert Summary Table: SITE 65

Discharge Names	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)
50 year	40.00	40.00	814.58	3.048	0.0*	6-FFc	1.200	2.057	2.057	1.650	7.754
100 year	45.00	45.00	814.85	3.322	0.0*	6-FFc	1.285	2.183	2.183	1.764	8.189

* Full Flow Headwater elevation is below inlet invert.

****

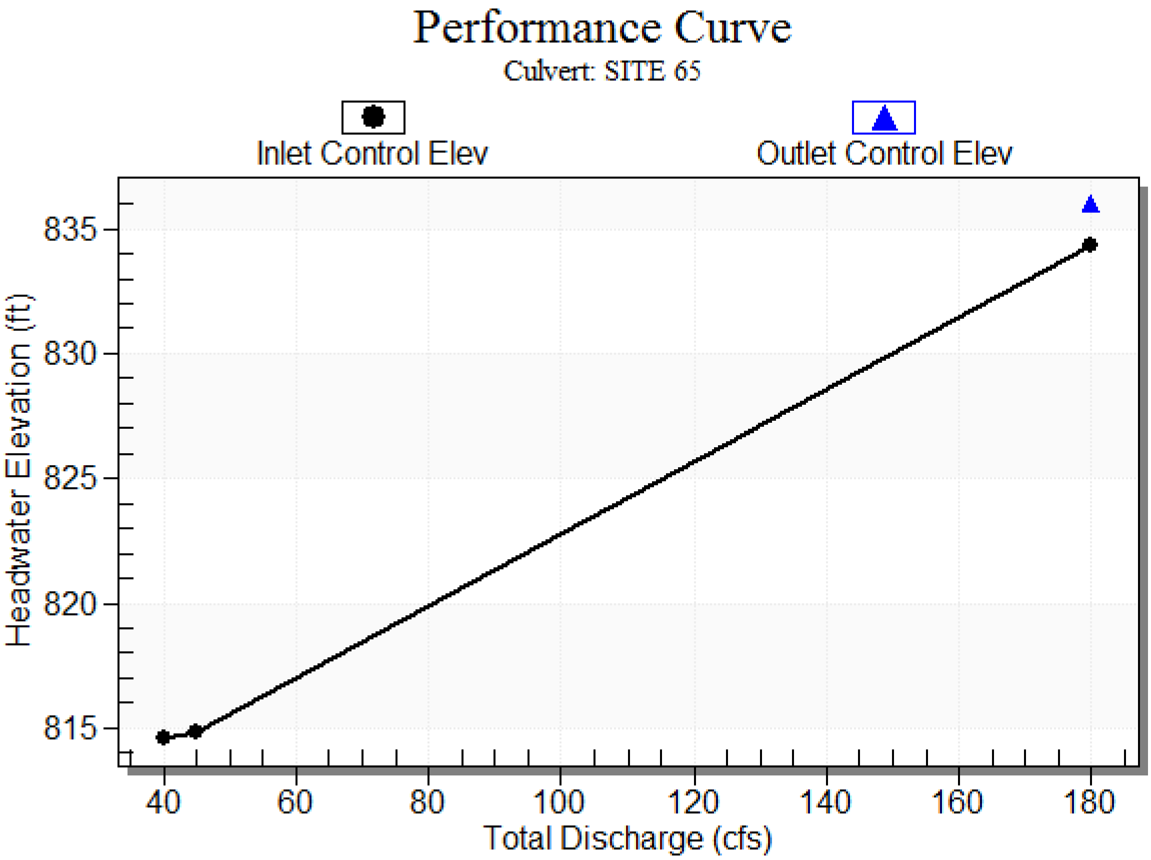
Straight Culvert

Inlet Elevation (invert): 811.53 ft,   Outlet Elevation (invert): 804.97 ft

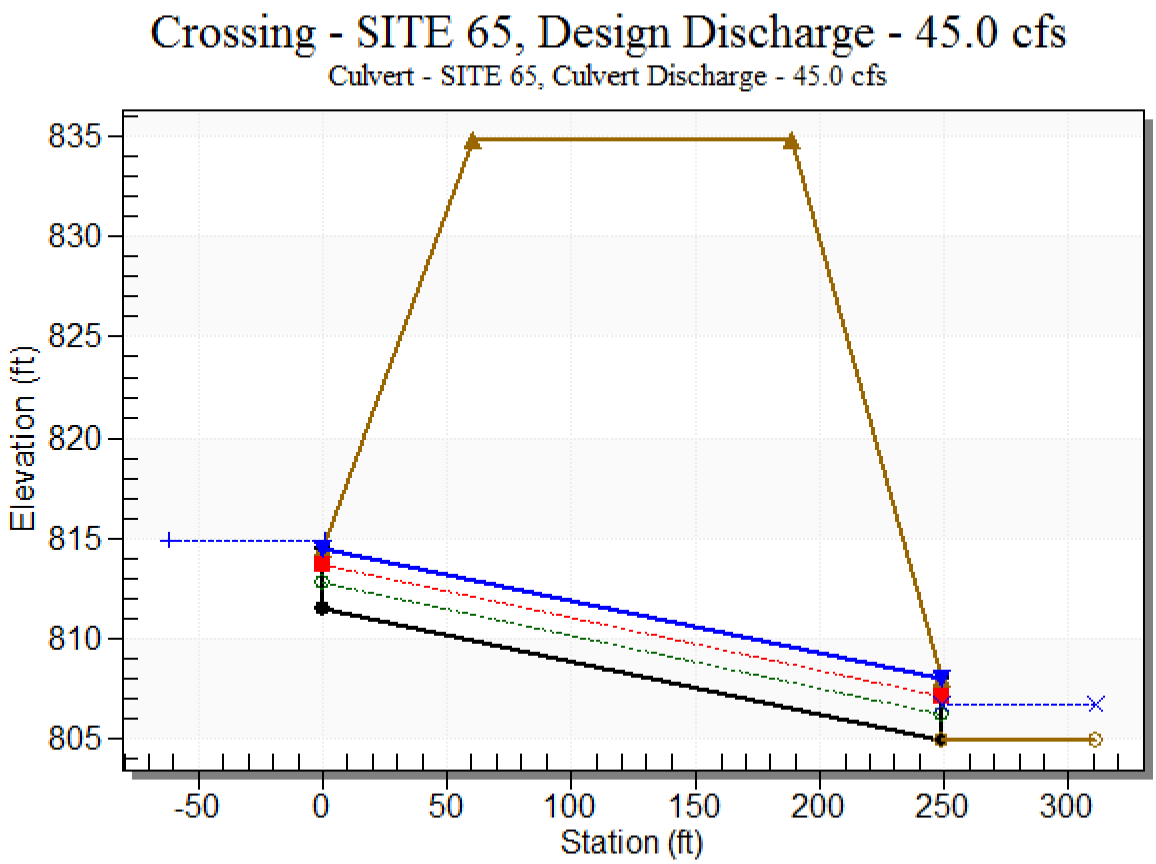
Culvert Length: 249.09 ft,   Culvert Slope: 0.0263

****

Culvert Performance Curve Plot: SITE 65



Water Surface Profile Plot for Culvert: SITE 65



Site Data - SITE 65

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 811.53 ft

Outlet Station: 249.00 ft

Outlet Elevation: 804.97 ft

Number of Barrels: 1

Culvert Data Summary - SITE 65

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: Grooved End Projecting

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: SITE 65)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
40.00	806.62	1.65	4.42	2.99	0.68
45.00	806.73	1.76	4.57	3.19	0.69

Tailwater Channel Data - SITE 65

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 0.90 (_:1)

Channel Slope: 0.0290

Channel Manning's n: 0.0600

Channel Invert Elevation: 804.97 ft

Roadway Data for Crossing: SITE 65

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 834.86 ft

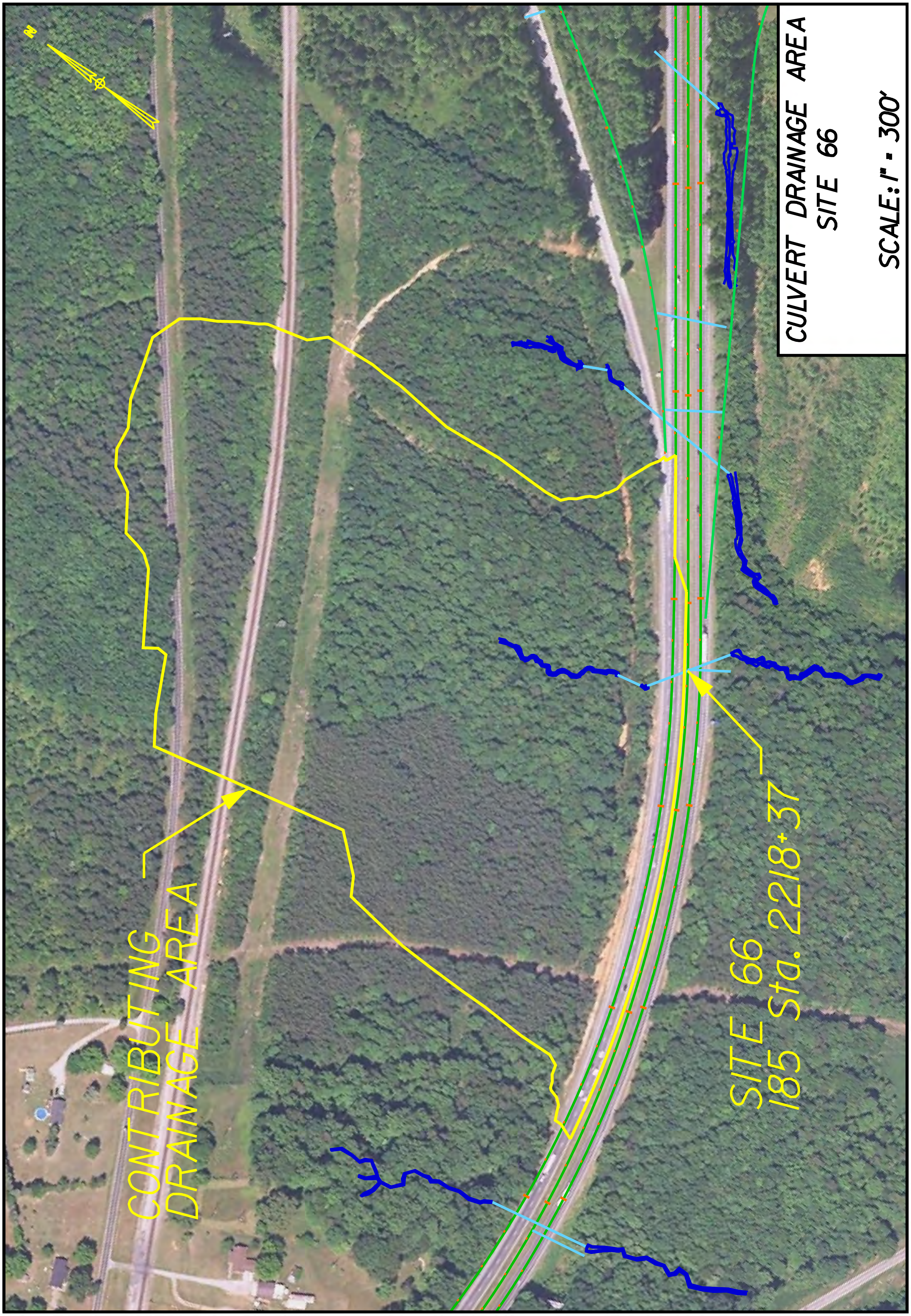
Roadway Surface: Paved

Roadway Top Width: 128.00 ft

Pipe/Box Dimensions				Flow
		(inch)		(cfs)
Pipe Diameter		36		40
Box Dimension				
Span (ft)		0		
Height (ft)		0		

Length	Width	Riprap		GeoText
(FHWA HEC-14 - Calculated)		Quantity	Class²	
(ft)	(ft)	(Tons)		(SqYd)
15	19	22	B	33

** Energy Disipator only, still add quantities for slope protection.
** Apron length as per HEC-14 Table 10.1, Fig. 10.4; width as per HEC-14 Fig. 10.4.
** Riprap Class (D50) as per HEC-14 Eq. 10.4; Tailwater condition assumed (TW=0.4D)


CULVERT DRAINAGE AREA
SITE 66
SCALE: 1" = 300'
CONTRIBUTING
DRAINAGE AREA
SITE 66
I85 Sta. 2218+37
N

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Pavements & Roofs	2.45	0.90	
Rolling, 2%-10%	Side Slopes, Turf	4.68	0.30	Area Weighted C
Rolling, 2%-10%	Rail Yards	1.45	0.30	0.23
Hilly, Over 10%	Woodland & Forest	4.93	0.20	
Rolling, 2%-10%	Woodland & Forest	23.18	0.15	
		36.69		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrusl	10.42%	100	0.8				0.298
Shallow Concentrated	Unpaved	10.42%	495					0.026
Shallow Concentrated								
Channel 1		2.21%	380	0.04	3	6.3246	3.36648	0.031
Channel 2								
Total			975				0.7608	0.356

Gaffney

Time of Concentration *(minutes)*	22

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.23	4.618	36.69	**39**
Q_{25}	1.1	0.23	5.284	36.69	**49**
Q_{50}	1.2	0.23	5.804	36.69	**59**
Q_{100}	1.25	0.23	6.311	36.69	**67**

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 66

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 66 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
801.41	50 year	59.00	59.00	0.00	1
802.04	100 year	67.00	67.00	0.00	1
813.74	Overtopping	148.18	148.18	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 66

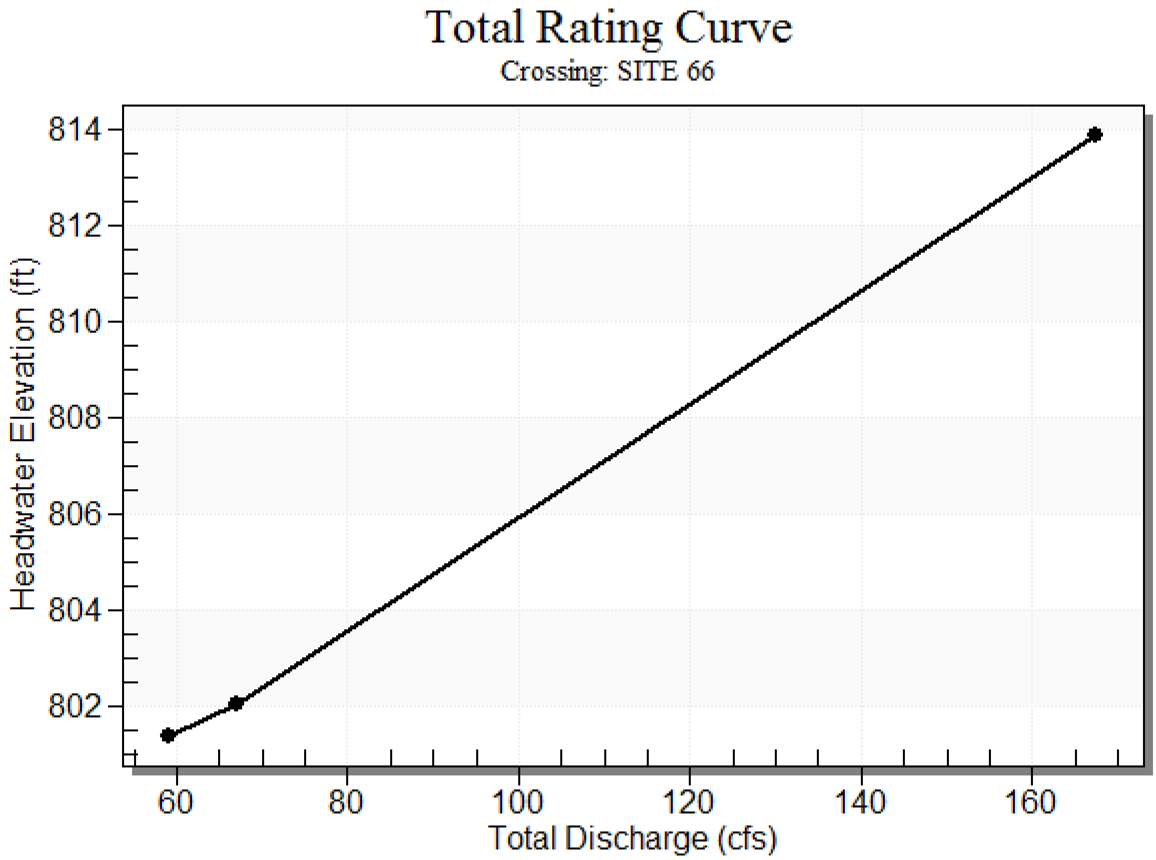


Table 2 - Culvert Summary Table: SITE 66

Discharge Names	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)
50 year	59.00	59.00	801.41	4.215	0.0*	6-FFc	1.366	2.481	2.481	1.495	9.474
100 year	67.00	67.00	802.04	4.851	0.0*	6-FFc	1.469	2.615	2.615	1.608	10.269

* Full Flow Headwater elevation is below inlet invert.

****

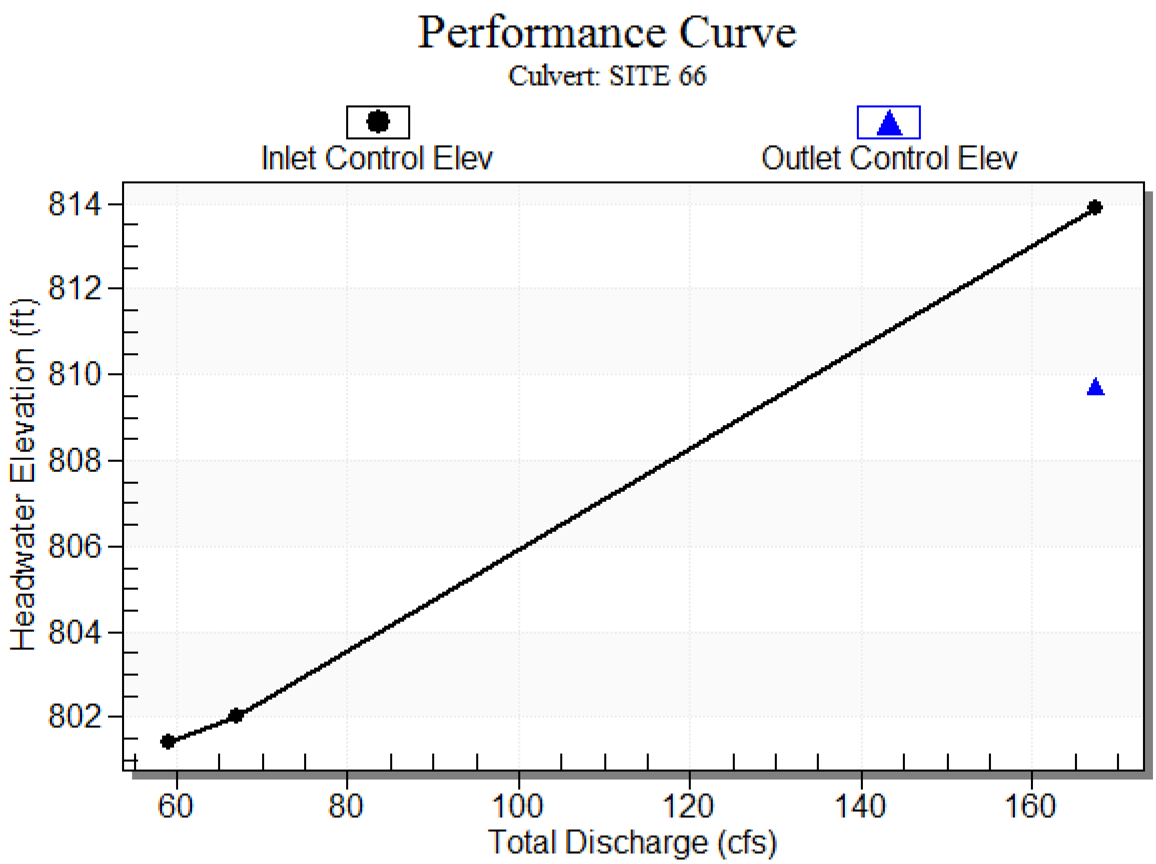
Straight Culvert

Inlet Elevation (invert): 797.19 ft,   Outlet Elevation (invert): 789.14 ft

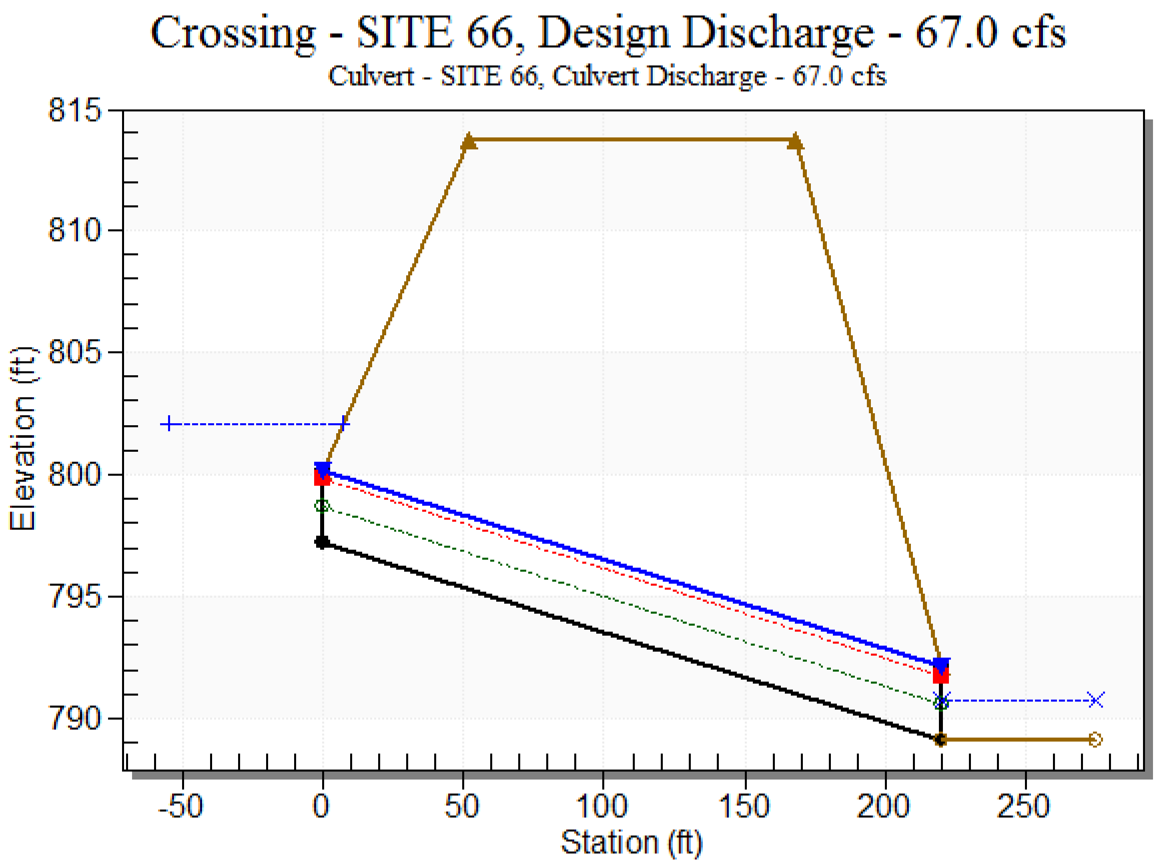
Culvert Length: 220.15 ft,   Culvert Slope: 0.0366

****

Culvert Performance Curve Plot: SITE 66



Water Surface Profile Plot for Culvert: SITE 66



Site Data - SITE 66

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 797.19 ft

Outlet Station: 220.00 ft

Outlet Elevation: 789.14 ft

Number of Barrels: 1

Culvert Data Summary - SITE 66

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: Grooved End Projecting

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: SITE 66)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
59.00	790.64	1.50	4.49	2.61	0.71
67.00	790.75	1.61	4.67	2.81	0.71

Tailwater Channel Data - SITE 66

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 7.00 ft

Side Slope (H:V): 1.20 (_:1)

Channel Slope: 0.0280

Channel Manning's n: 0.0600

Channel Invert Elevation: 789.14 ft

Roadway Data for Crossing: SITE 66

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 813.74 ft

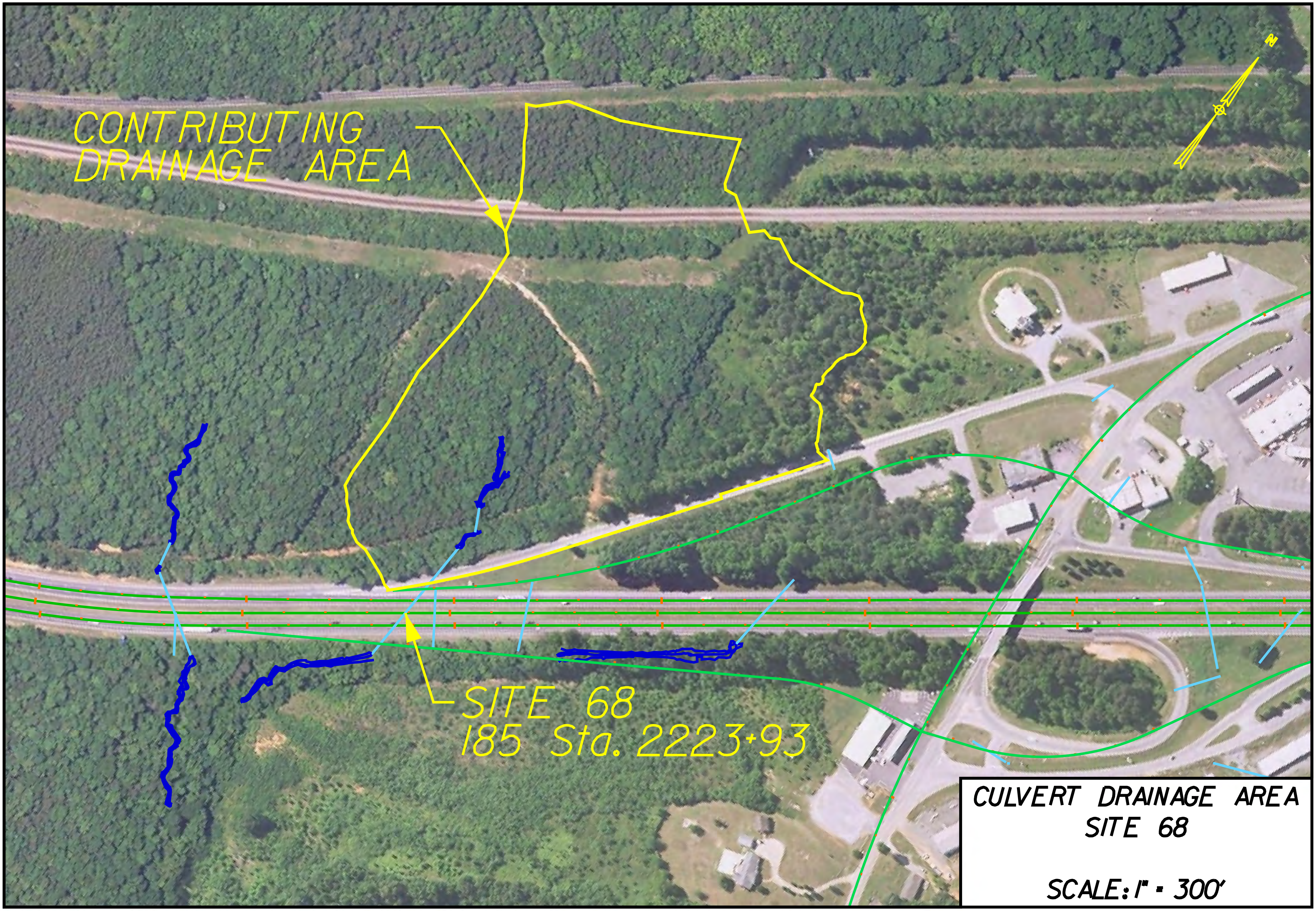
Roadway Surface: Paved

Roadway Top Width: 116.00 ft

Pipe/Box Dimensions				Flow
		(inch)		(cfs)
Pipe Diameter		36		59
Box Dimension				
Span (ft)		0		
Height (ft)		0		

Length	Width	Riprap		GeoText
(FHWA HEC-14 - Calculated)		Quantity	Class²	
(ft)	(ft)	(Tons)		(SqYd)
18	21	50	C	43

** Energy Disipator only, still add quantities for slope protection.
** Apron length as per HEC-14 Table 10.1, Fig. 10.4; width as per HEC-14 Fig. 10.4.
** Riprap Class (D50) as per HEC-14 Eq. 10.4; Tailwater condition assumed (TW=0.4D)


CONTRIBUTING
DRAINAGE AREA
SITE 68
I85 Sta. 2223+93
CULVERT DRAINAGE AREA
SITE 68
SCALE: 1" = 300'

Rational Analysis

Land Slope	Land Use	Acres	C	
Rolling, 2%-10%	Gravel Pavements	0.96	0.55	
Rolling, 2%-10%	Side Slopes, Turf	3.24	0.30	Area Weighted C
Rolling, 2%-10%	Woodland & Forest	15.41	0.15	0.19
		19.61		

County (NOAA-14)	2-year 24 Hour rainfall [in]
Cherokee	3.73

Flow Type	Surface	Slope	Length [ft]	Manning's n	Area [ft^2]	WP [ft]	Velocity [ft/s]	Time [hr]
Sheet	Woods:dense underbrush	5.34%	100	0.8				0.390
Shallow Concentrated	Unpaved	5.34%	1132					0.084
Shallow Concentrated								
Channel 1								
Channel 2								
Total			1232				0.7222	0.474

Gaffney

Time of Concentration *(minutes)*	29

	C_f	C	I [in/hr]	**AREA (ac)**	CFS
Q_{10}	1	0.19	4.082	19.61	**16**
Q_{25}	1.1	0.19	4.658	19.61	**20**
Q_{50}	1.2	0.19	5.105	19.61	**23**
Q_{100}	1.25	0.19	5.541	19.61	**26**

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Recurrence

Table 1 - Summary of Culvert Flows at Crossing: SITE 68

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	SITE 68 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
807.00	50 year	23.00	23.00	0.00	1
807.16	100 year	26.00	26.00	0.00	1
826.65	Overtopping	158.14	158.14	0.00	Overtopping

Rating Curve Plot for Crossing: SITE 68

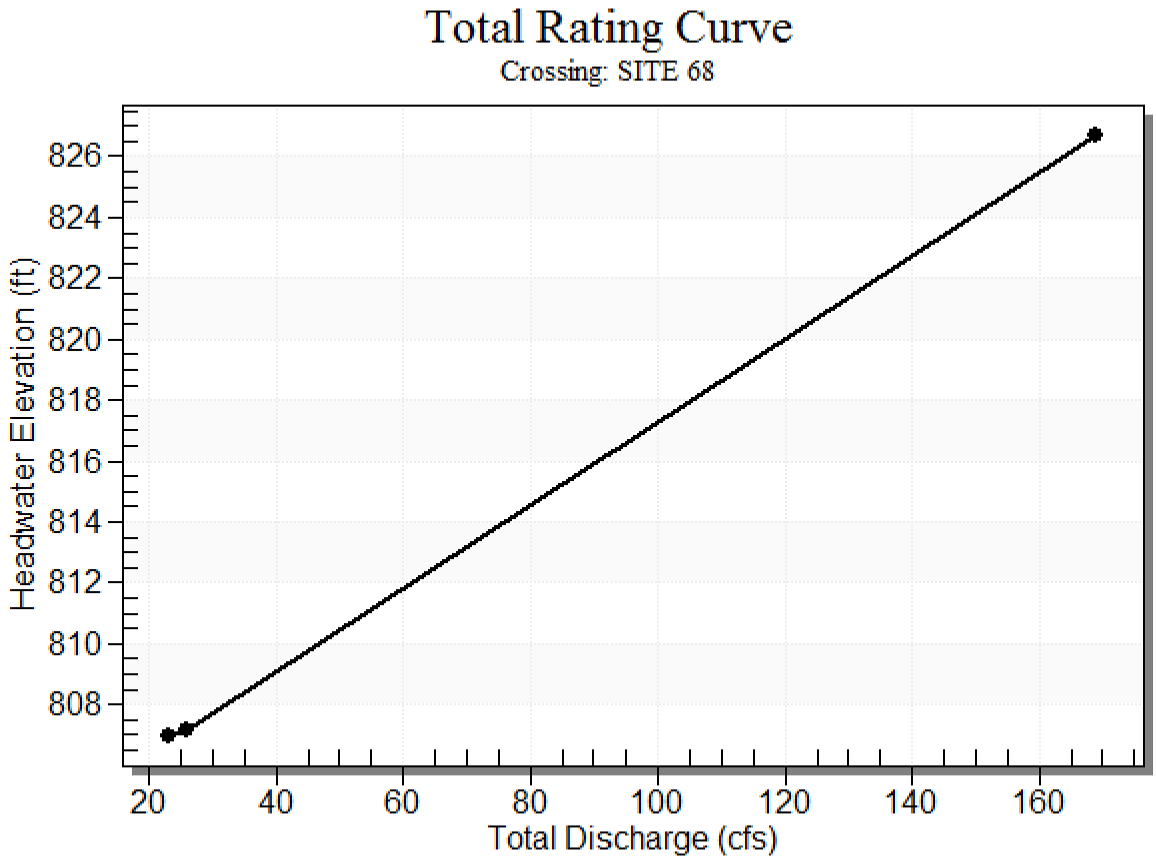


Table 2 - Culvert Summary Table: SITE 68

Discharge Names	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)
50 year	23.00	23.00	807.00	2.178	0.0*	6-FFc	0.905	1.543	1.543	1.088	6.279
100 year	26.00	26.00	807.16	2.338	0.0*	6-FFc	0.972	1.641	1.641	1.168	6.570

* Full Flow Headwater elevation is below inlet invert.

****

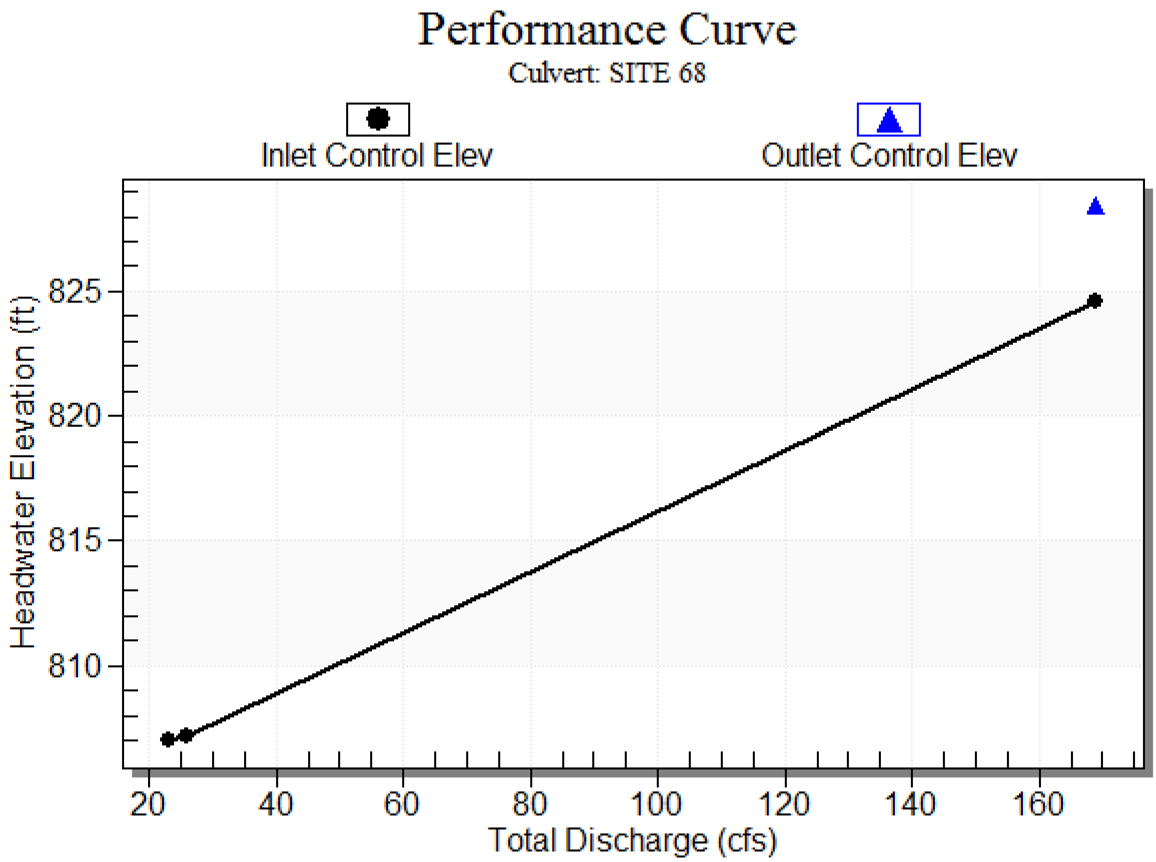
Straight Culvert

Inlet Elevation (invert): 804.82 ft,   Outlet Elevation (invert): 796.57 ft

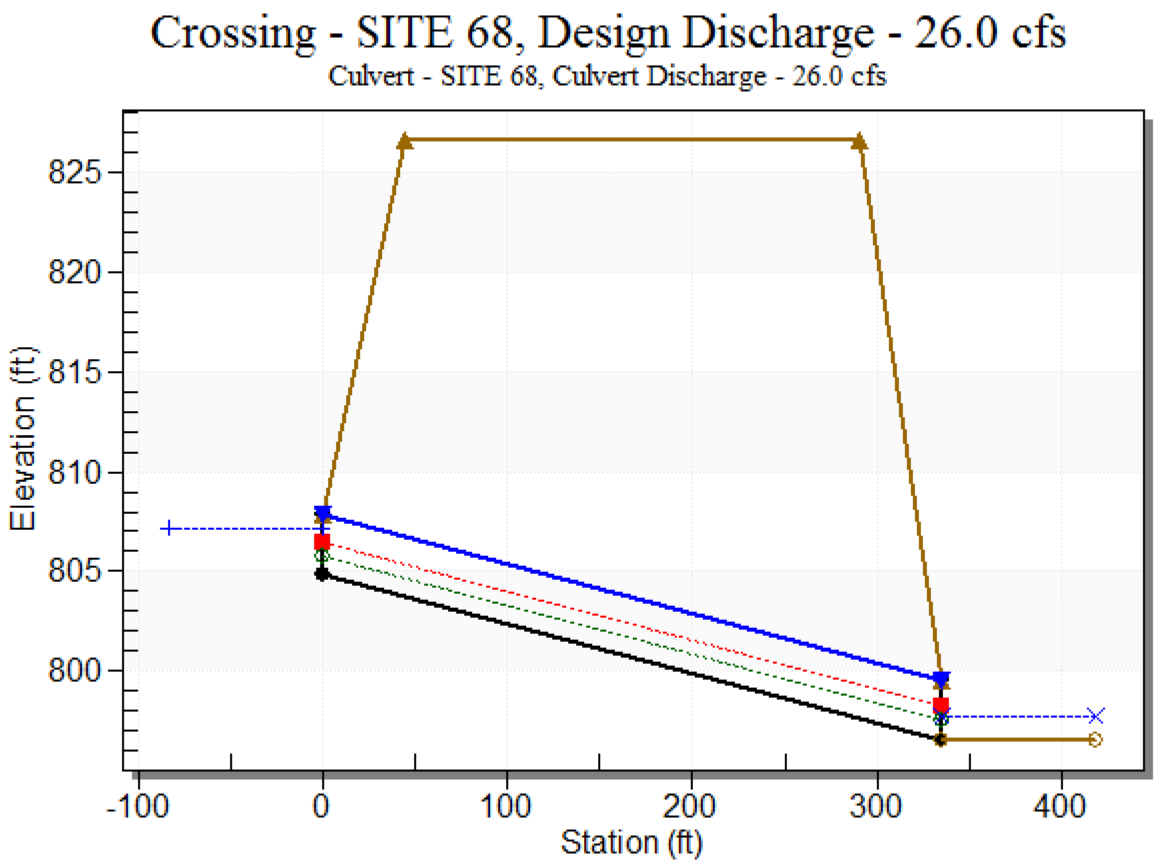
Culvert Length: 335.10 ft,   Culvert Slope: 0.0246

****

Culvert Performance Curve Plot: SITE 68



Water Surface Profile Plot for Culvert: SITE 68



Site Data - SITE 68

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 804.82 ft

Outlet Station: 335.00 ft

Outlet Elevation: 796.57 ft

Number of Barrels: 1

Culvert Data Summary - SITE 68

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: Grooved End Projecting

Inlet Depression: NONE

Table 3 - Downstream Channel Rating Curve (Crossing: SITE 68)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
23.00	797.66	1.09	5.38	2.17	1.01
26.00	797.74	1.17	5.58	2.33	1.02

Tailwater Channel Data - SITE 68

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 3.00 ft

Side Slope (H:V): 0.85 (_:1)

Channel Slope: 0.0320

Channel Manning's n: 0.0400

Channel Invert Elevation: 796.57 ft

Roadway Data for Crossing: SITE 68

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 826.65 ft

Roadway Surface: Paved

Roadway Top Width: 246.00 ft

<table>
<tr><th colspan="3">Pipe/Box Dimensions</th><th rowspan="6"></th><th>Flow</th></tr>
<tr><td colspan="2"></td><td>(inch)</td><td>(cfs)</td></tr>
<tr><td colspan="2">Pipe Diameter</td><td>36</td><td rowspan="4">23</td></tr>
<tr><td colspan="3">Box Dimension</td></tr>
<tr><td>Span (ft)</td><td></td><td>0</td></tr>
<tr><td>Height (ft)</td><td></td><td>0</td></tr>
<tr><td>Length</td><td>Width</td><td colspan="2">Riprap</td><td>GeoText</td></tr>
<tr><td colspan="2">(FHWA HEC-14 - Calculated)</td><td>Quantity</td><td>Class[2]</td><td></td></tr>
<tr><td>(ft)</td><td>(ft)</td><td>(Tons)</td><td></td><td>(SqYd)</td></tr>
<tr><td>15</td><td>19</td><td>22</td><td>B</td><td>33</td></tr>
</table>

** Energy Disipator only, still add quantities for slope protection.
** Apron length as per HEC-14 Table 10.1, Fig. 10.4; width as per HEC-14 Fig. 10.4.
** Riprap Class (D50) as per HEC-14 Eq. 10.4; Tailwater condition assumed (TW=0.4D)

5. Appendix

5.1 Miscellaneous Outfall Analysis Notes

OUTFALL 1830+64 RT
The survey did not establish how the median drainage inlets (DI 15 to DI 10) from station 1828+00 to station 1834+00 drain to an outfall, and was included in this outfall's drainage area.

OUTFALL 1910+64 RT
Survey information was not provided for the upstream headwall of the culvert under the Exit 100 ramp; there is only survey information for the downstream headwall (HW11). Based on the topography, it was assumed the headwall entrance was located behind the Speedway gas station. Therefore, the outfall drainage area includes all water draining to this point, in addition to all water draining to the downstream culvert.

OUTFALL 1916+80 RT
Based on topography and As-Built drawings 11.530.1, it was assumed there is an existing upstream pipe that goes under the Exit 100 ramp.

OUTFALL 1975+08 LT
All roadway drainage systems lead to a common channel, and were combined to one drainage outfall area to determine the overall impact at the outfall point.

OUTFALL 1997+27 LT
No outlet point was picked up for this drainage system. Based on topography, it was assumed that an outlet for the median drainage exists behind the Frontage Road.

OUTFALL 2038+46 LT
Survey does not indicate where the median drainage from station 2044+00 to station 2054+00 outfalls to. As-built drawing 11.530 suggests the median drop inlet at station 2046+00 (DI 57) drains to the left side of I-85 and flows down to the drop inlet at station 2040+00 (DI 55C); ultimately reaching the common outlet point.

OUTFALL 2249+11 RT
The 30" RCP that carries the median drainage to the outlet point only had a surveyed invert elevation. An outlet point was assumed based upon the topography and as-built drawing 11.352.

5.2 Miscellaneous Cross-Line Analysis Notes

GENERAL NOTES:

- Surveyor provided a spreadsheet with revisions to surveyed pipe elevations. A math error (units) pertaining to the conversion between feet and inches for the pipe thickness was found throughout the document. Therefore, SCDOT's published pipe thicknesses were used to calculate pipe inverts.

- A constant water depth through channels was assumed for culverts placed in series. Any drainage structures downstream from the drainage structure of interest were analyzed for capacity. The downstream structures' headwater elevations were used to set the tail water conditions for the upstream culvert.

- Any drainage structures upstream from the drainage structure of interest were not considered during the analysis. In other words, it was assumed that all water from the drainage area entered the culvert of interest; ignoring all upstream pipes. This produces more conservative results because it ignores any upstream restrictions to the flow of water.

SITE 7 CULVERT

- The survey did not establish how the median drainage inlets (DI 15 to DI 10) from station 1828+00 to station 1834+00 drain to an outfall. However, field inspection pictures indicated that the system does not feed into the culvert's structure. Therefore, it was assumed this median drainage system feeds into the outfall of Site 7 and not the infall of Site 7.

- The headwater of the downstream 96" corrugated metal pipe was used to set the tail water condition for the upstream culvert.

- The 96" C.M. pipe adversely impacts the performance of the 8' x 8' R.C. box culvert. With improvement of the 96" C.M.P pipe the upstream 8' x 8' R.C. box culvert will perform adequately.

SITE 13 CULVERT

The analysis for Site 13 does not consider the restriction or ponding caused by the existing 60" corrugated metal pipe upstream of the culvert.

SITE 16 CULVERT

The analysis for Site 16 does not consider the restriction or ponding caused by the existing 36" corrugated metal pipe upstream of the culvert.

SITE 20 CULVERT

The survey did not indicate where the median drainage inlets (DI 18C to STMP 18D) drain to. For a more conservative analysis, it was assumed that the system drains to the infall of the culvert.

SITE 21 CULVERT

Survey information was not provided for the upstream headwall of the culvert under the Exit 100 ramp; there is only survey information for the downstream headwall (HW11). Therefore, all water from the drainage area was summed to the culvert under I-85 (HW 10 to HW 9).

SITE 38 CULVERT

- Site 38A (STMP 54C to STMP 54B) - Survey points label the pipe under the Frontage Road as 36” R.C. pipe. It is believed the pipe was mismeasured due to record drawing 11.347 As-Builts, which show an in place 42” R.C. pipe. Analysis assumes a 42” R.C. pipe.

- Site 38B (STMP 54A to STMP 54F) - A straight grade was assumed for pipe breaks because 11.347 As-Builts specify two T-joints.

- The headwater for Site 38B was used to set the tail water conditions for Site 38A.

- Roadway drainage on the East side of North Mountain Street was assumed to tie to CB-55.

SITE 46 CULVERT

- As-Built 11.347 states the drainage structure is a 4’ x 6’ R.C. box culvert; while as-built 11.530 states the drainage structure is a 4’ x 4’ R.C. box culvert. It is believed the 11.530 As-Built label was a copy over error, and therefore a 4’ x 6’ R.C. box culvert was used for the analysis.

- There is a 60” R.C. pipe connected at the entrance of the 4’ x 6’ box from the field investigation. As a result, the system was analyzed as both a 60” R.C. pipe and a 4’ x 6’ R.C. box culvert. The 4’ x 6’ R.C. box culvert produced more conservative results as it yielded a higher headwater elevation. Note that due to the structures’ size difference, a structure height of five feet was used when calculating Hw/D because the pipe at the entrance of the box creates a restriction in the flow of water.

SITE 62 CULVERT

Survey points indicated the culvert flows from the left side of I-85 to the right side of I-85; although previous as-built plans as well as Stream Stats suggested the culvert outfalls to the left side of I-85. The surveyed points shots were used with the assumption the culvert outfalls to the left side of the highway. In other words, it was assumed the culvert is inverted.

5.3 Culvert Assessment Forms With Site Pictures

Culvert Assessment Form — **Site No.** 7

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/12/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

Sedimentation inside of culvert. Erosion along slopes of infall.

RECOMMENDATIONS

Clean culvert and stabilize infall channel.

U/S

U/S

D/S

D/S

Civil Engineering Consulting Services, Inc.

Culvert Assessment Form Site No. 8

Project ID	Work County	Route	Date
	Cherokee	I-85	9/12/2016

INLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked	x	Erosion	x
Scour		Corrosion			

COMMENTS

D/S 60% filled with sediment and debris.

RECOMMENDATIONS

Clean pipe and outfall.

Site No. 8 PHOTO

D/S

D/S

Civil Engineering Consulting Services, Inc.

Culvert Assessment Form | **Site No.** 9

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/12/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked	x	Erosion	
Scour		Corrosion			

COMMENTS

Pipe outlet blocked 70% with sediment, debris and vegetation.

RECOMMENDATIONS

Clean Pipe, Clean Outfall.

Site No. 9 PHOTO

D/S

D/S

Civil Engineering
Consulting Services, Inc.

Culvert Assessment Form **Site No.** 10

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/12/2016

INLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	x
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated	x	Blocked		Erosion	
Scour	x	Corrosion			

COMMENTS

U/S heavily vegetated with erosion. D/S outlet joint separated.

RECOMMENDATIONS

Clear vegetation U/S and stabilize incoming channel U/S. Repair joint separation in pipe D/S and stabilize outfall.

U/S

U/S

D/S

D/S

Culvert Assessment Form

				Site No.	11
Project ID	**Work County**	**Route**			**Date**
	Cherokee	I-85			9/12/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

Not surveyed. Could not locate.

RECOMMENDATIONS

Culvert Assessment Form Site No. 12

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/12/2016

INLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated	x	Blocked		Erosion	
Scour	x	Corrosion			

COMMENTS

U/S heavy vegetation. D/S scour hole with joint separation.

RECOMMENDATIONS

Clean and stabilize U/S. Stabilize outfall and repair joint separation.

U/S

U/S

D/S

D/S

Civil Engineering Consulting Services, Inc.

Culvert Assessment Form | **Site No.** 13

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/12/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	x
Scour		Corrosion			

COMMENTS

U/S heavily obstructed by vegetation but channel was clear. Scour at culvert exit; and slight erosion along downstream channel

RECOMMENDATIONS

Repair downstream scour hole and construct energy dissipator.

Civil Engineering Consulting Services, Inc.

Site No. 13 PHOTO

U/S

U/S

D/S

D/S

Culvert Assessment Form Site No. 14

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/12/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

U/S has evidence of buried paved channel.

RECOMMENDATIONS

Site No. 14 PHOTO

U/S

D/S

D/S

Civil Engineering
Consulting Services, Inc.

Culvert Assessment Form **Site No.** 15

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/12/2016

INLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	x
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated	x	Blocked		Erosion	x
Scour		Corrosion			

COMMENTS

D/S joint separation and scour.

RECOMMENDATIONS

Stabilize outfall and repair joint separation.

Site No. 15 PHOTO

U/S

D/S

D/S

Civil Engineering
Consulting Services, Inc.

Culvert Assessment Form Site No. 16

Project ID	Work County	Route	Date
	Cherokee	I-85	9/12/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

Slight scour downstream, otherwise stable creek and culvert.

RECOMMENDATIONS

Repair downstream scour hole and construct energy dissipator

Site No. 16 PHOTO

U/S

U/S

D/S

D/S

Culvert Assessment Form Site No. 17

Project ID	Work County	Route	Date
	Cherokee	I-85	9/12/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

Rip Rap channel down to U/S inlet. U/S vegetated. Debris in channel D/S

RECOMMENDATIONS

Clean U/S. Clear D/S debris.

U/S

U/S

D/S

D/S

Civil Engineering Consulting Services, Inc.

Culvert Assessment Form

Site No. 18

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/12/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

Pipe goes from 72" RCP-> 4'x6' box culvert-> frontage rd. 3'x2' box culvert. D/S heavily vegetated.

RECOMMENDATIONS

Clear D/S outfall.

U/S

U/S

D/S

D/S

Culvert Assessment Form | **Site No.** 19

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/12/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	x
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated	x	Blocked		Erosion	x
Scour	x	Corrosion			

COMMENTS

Scour hole right at inlet (median drainage)

D/S scour hole, channel erosion, and join separation.

RECOMMENDATIONS

Stabilize D/S and U/S channel. Stabilize D/S outfall. Repair separated pipe.

Site No. 19 PHOTO

U/S

U/S

D/S

D/S

Culvert Assessment Form Site No. 20

Project ID	Work County	Route	Date
	Cherokee	I-85	9/12/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	x
Scour	x	Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

Upstream channel not aligned with culvert; large tree located in front of headwall. Erosion down slopes from roadway runoff draining to inlet and slight scour around inlet headwall.

RECOMMENDATIONS

Clear infall; stabilize roadway side slopes and protect with riprap.

Site No. 20 PHOTO

U/S

U/S

D/S

D/S

Culvert Assessment Form **Site No.** 21

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	x
Scour	x	Corrosion			

COMMENTS

U/S receives inflow from another box culvert. Heavily vegetated U/S.

D/S large scour hole. Broken PVC pipe crossing just below outlet.

RECOMMENDATIONS

Clear vegetation U/S of culvert. Repair downstream scour hole and construct energy dissipator.

U/S

U/S

D/S

D/S

Civil Engineering Consulting Services, Inc.

Culvert Assessment Form **Site No.** 22

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated	x	Blocked	x	Erosion	x
Scour	x	Corrosion			

COMMENTS

Difficult to find or distinguish between Site 22 and 23. U/S 22 was not found but D/S 22 was located as 80% filled 48".

RECOMMENDATIONS

D/S

Civil Engineering Consulting Services, Inc.

Culvert Assessment Form **Site No.** 23

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

Difficult to find (and rate above). Survey had outfall (of 18" Site 23) at location of Site 22 (48" pipe). And 18" outfall was not located in the area. U/S inlet found, D/S outlet not located.

RECOMMENDATIONS

U/S

Culvert Assessment Form | **Site No.** 24

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	x
Scour		Corrosion			

COMMENTS

Downstream channel of D/s eroded along first outer curve of creek.

RECOMMENDATIONS

Stabilize outfall channel and construct energy dissipator.

U/S

U/S

D/S

D/S

Civil Engineering Consulting Services, Inc.

Culvert Assessment Form Site No. 25

Project ID	Work County	Route	Date
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

Not surveyed. Could not locate U/S or D/S.

RECOMMENDATIONS

Culvert Assessment Form Site No. 26

Project ID	Work County	Route	Date
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

Not surveyed. Could not locate U/S or D/S

RECOMMENDATIONS

Culvert Assessment Form **Site No.** 27

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

Heavy vegetation in upstream channel but clear at inlet.

RECOMMENDATIONS

U/S

U/S

D/S

D/S

Culvert Assessment Form Site No. 28

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	
Scour	x	Corrosion			

COMMENTS

D/S scour hole with debris and vegetation.

RECOMMENDATIONS

Clear D/S vegetation and debris, stabilize channel.

Site No. 28 PHOTO

U/S

D/S

D/S

Civil Engineering
Consulting Services, Inc.

Culvert Assessment Form | **Site No.** 29

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	x
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	x
Scour		Corrosion			

COMMENTS

U/S heavily vegetated, Type 9 CB within apparent Clear Zone.

D/S scour hole and debris filled channel.

RECOMMENDATIONS

Clear U/S vegetation, convert Type 9 to DI type 112. Repair D/S scour hole, clear and stabilize outfall.

U/S

U/S

D/S

D/S

Civil Engineering Consulting Services, Inc.

Culvert Assessment Form Site No. 30

Project ID	Work County	Route	Date
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	x
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS
D/S outfall overgrown.

RECOMMENDATIONS
Clean outfall.


U/S


D/S


D/S


D/S

Culvert Assessment Form | Site No. 31

Project ID	Work County	Route	Date
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	x
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated	x	Blocked		Erosion	x
Scour	s	Corrosion			

COMMENTS

Eroded ditch channel coming into U/S inlet.

D/S scour hole and joint separation.

RECOMMENDATIONS

Stabilize outfall and repair joint separation.

U/S

U/S

D/S

D/S

Civil Engineering Consulting Services, Inc.

Culvert Assessment Form Site No. 32

Project ID	Work County	Route	Date
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	x
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	x
Scour		Corrosion			

COMMENTS

U/S had erosion along incoming channel.

Outfall overgrown.

RECOMMENDATIONS

Clear overgrowth.

Site No. 32 PHOTO

U/S

D/S

D/S

Civil Engineering
Consulting Services, Inc.

Culvert Assessment Form Site No. 33

Project ID	Work County	Route	Date
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated	x	Blocked		Erosion	
Scour	x	Corrosion			

COMMENTS

D/S is separated at last section. Scour hole at outfall.

RECOMMENDATIONS

Stabilize outfall and repair joint separation.

Site No. 33 PHOTO

U/S

D/S

D/S

Civil Engineering
Consulting Services, Inc.

Culvert Assessment Form

Site No.	34

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked	x	Erosion	
Scour		Corrosion			

COMMENTS

D/S 20% filled with sediment. Outfall overgrown

RECOMMENDATIONS

Clear pipe and clean outfall.

U/S

D/S

D/S

D/S

Culvert Assessment Form Site No. 35

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked	x	Erosion	
Scour		Corrosion			

COMMENTS

D/S 40% blocked and heavy vegetation

RECOMMENDATIONS

Clear Pipe and clean outfall.

U/S

D/S

D/S

D/S

Culvert Assessment Form | **Site No.** 36

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	x
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated	x	Blocked		Erosion	
Scour		Corrosion			

COMMENTS

D/S has a paved ditch outfall, joint separation. Erosion D/S. Adjacent driveway pipes outfall at same location.

U/S is difficult to locate. Survey does not show true pipe end.

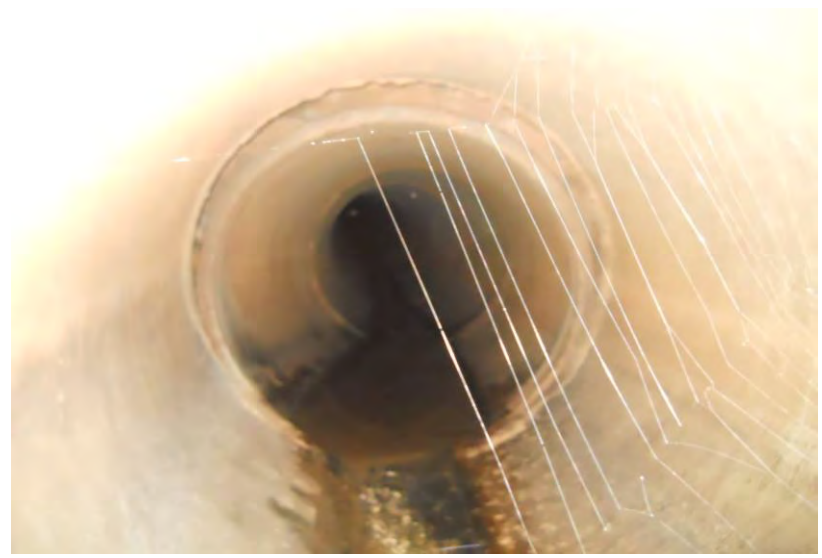
RECOMMENDATIONS

Stabilize U/S and D/S channels. Repair joint separation.

U/S

U/S

D/S



D/S

Culvert Assessment Form Site No. 37

Project ID	Work County	Route	Date
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

D/S outfall has a paved flume towards frontage road.

RECOMMENDATIONS

Site No. 37 PHOTO

U/S

U/S

D/S

D/S

Civil Engineering Consulting Services, Inc.

Culvert Assessment Form | | | Site No. | 38A

Project ID	Work County	Route	Date
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

Wooded but stable. Downstream heavily vegetated.

RECOMMENDATIONS

Clear vegetation; stabilize channel

U/S

U/S

D/S

Civil Engineering
Consulting Services, Inc.

Culvert Assessment Form | **Site No.** 38B

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

D/S has a long paved channel outfall. Very large erosion and paved channel failure ~500 yards D/S resulting in ponded water.

U/S heavily vegetated

RECOMMENDATIONS

Clean infall and stabilize outfall channel.

Site No. 38B PHOTO

U/S

U/S

D/S

D/S

Civil Engineering Consulting Services, Inc.

Culvert Assessment Form Site No. 39

Project ID	Work County	Route	Date
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	x
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	x
Scour		Corrosion			

COMMENTS

Was not located in survey and could not locate U/S or D/S

RECOMMENDATIONS

Culvert Assessment Form **Site No.** 40

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	x
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

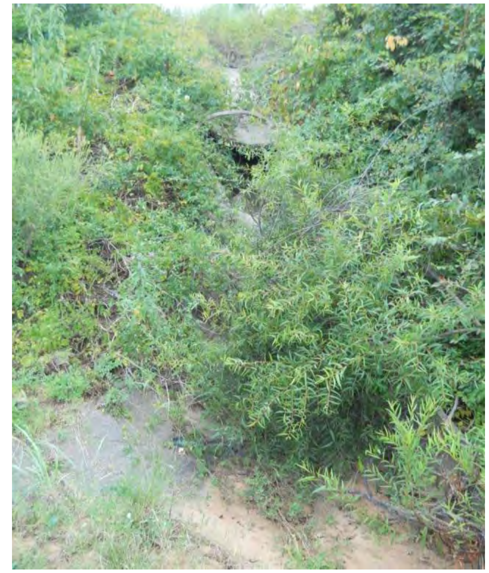
An upstream concrete spillway (from site 42) is damaged. Site 41 and 40 are the same system just different sized pipe that changes at a box.

RECOMMENDATIONS

Repair U/S spillway if necessary. Stabilize inlet.

Site No. 40 PHOTO

U/S



U/S

Civil Engineering Consulting Services, Inc.

Culvert Assessment Form **Site No.** 41

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated	x	Blocked		Erosion	xxx
Scour	x	Corrosion			

COMMENTS

Massive scour and erosion D/S. Some riprap has been placed and has failed. D/S pipes outfall into this eroded channel. A paved channel may have existed at some time.

RECOMMENDATIONS

D/S energy dissipation needed. Stabilize D/S channel.

Site No. 41 PHOTO

D/S

D/S

D/S

D/S

Culvert Assessment Form Site No. 42

Project ID	Work County	Route	Date
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation	xx	Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation	xx	Alignment	
Separated		Blocked	x	Erosion	x
Scour		Corrosion			

COMMENTS

U/S overgrown. D/S pipe blocked with sediment.

RECOMMENDATIONS

Clean infall. Clear D/S pipe and outfall.

U/S

U/S

D/S

D/S

Civil Engineering Consulting Services, Inc.

Culvert Assessment Form **Site No.** 43

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

Not surveyed and no inlet/outfall found U/S or D/S.

RECOMMENDATIONS

Culvert Assessment Form **Site No.** 44

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked	x	Erosion	x
Scour		Corrosion			

COMMENTS

U/S has paved channel upstream. 1/2 of grade is overgrown with grass.

Median has a tree growing in it. Exit pipe is 10% blocked

D/S is 80% filled. Outfall channel is not evident beyond pipe.

RECOMMENDATIONS

Clean system and reestablish outfall.

Site No. 44 PHOTO

U/S

U/S

D/S

D/S

Culvert Assessment Form Site No. 45

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked	x	Vegetation	x	Alignment	
Separated		Blocked	x	Erosion	
Scour		Corrosion			

COMMENTS

D/S pipe blocked with sediment and debris. Outfall channel is not well defined.

RECOMMENDATIONS

Clean pipe and outfall.

U/S

D/S

D/S

D/S

Culvert Assessment Form **Site No.** 46

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked	x	Erosion	x
Scour		Corrosion			

COMMENTS

U/S is a 60" pipe. D/S is a 4'x6' box. D/s is 50% filled with sediment and has a large eroded ditch (from roadway ditch drainage) intersection. Sediment build up along outfall.

RECOMMENDATIONS

Clean downstream culvert and outfall. Stabilize downstream channel.

Site No. 46 PHOTO

U/S

U/S

D/S

D/S

Culvert Assessment Form **Site No.** 47

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

U/S in median.

D/S has lots of rip rap with collection of debris. Outfall is vegetated.

RECOMMENDATIONS

Clear Outfall.

Site No. 47 PHOTO

U/S

D/S

D/S

Civil Engineering Consulting Services, Inc.

Culvert Assessment Form Site No. 48

Project ID	Work County	Route	Date
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated	x	Blocked		Erosion	x
Scour	x	Corrosion			

COMMENTS

Median Inlet. D/S heavily eroded with joint separation.

RECOMMENDATIONS

Stabilize outfall and repair joint separation.

U/S

D/S

D/S

D/S

Civil Engineering Consulting Services, Inc.

Culvert Assessment Form Site No. 49

Project ID	Work County	Route	Date
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

Slight scour around culvert exit; but stable outfall channel.

RECOMMENDATIONS

Repair scour hole and construct energy dissipator.

U/S

U/S

D/S

D/S

Civil Engineering Consulting Services, Inc.

Culvert Assessment Form Site No. 50

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/13/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

U/S large ponding area. Heavily vegetated. Side slope erosion.

D/S scour hole, heavily vegetated.

RECOMMENDATIONS

Remove vegetation from upstream and downstream channels. Stabilize upstream culvert entrance with riprap. Repair downstream scour hole and construct energy dissipator.

U/S

U/S

D/S

D/S

Civil Engineering Consulting Services, Inc.

Culvert Assessment Form Site No. 51

Project ID	Work County	Route	Date
	Cherokee	I-85	9/14/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

Not surveyed. Could not Locate U/S or D/S

RECOMMENDATIONS

Culvert Assessment Form — **Site No.** 52

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/14/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated	x	Blocked		Erosion	
Scour	x	Corrosion			

COMMENTS

Two intermediate CBs photographed.

D/S ponded water with scour., could not see very far downstream to comment on downstream conditions due to heavy vegetation. D/S pipe separation.

RECOMMENDATIONS

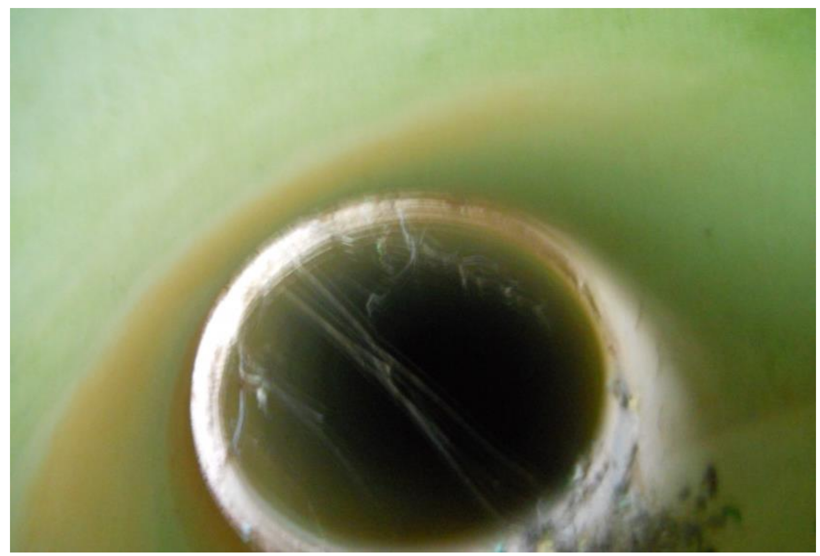
Clean outfall. Stabilize downstream outlet and construct energy dissipator. Repair joint separation.

Site No. 52 PHOTO

U/S

D/S

D/S



D/S

Culvert Assessment Form **Site No.** 53

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/14/2016

INLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

Clear main channel U/S and D/S, heavy vegetation along edges of channels

RECOMMENDATIONS

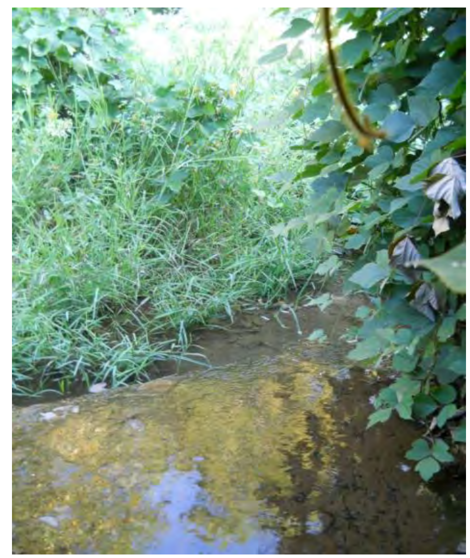
Clear main channel downstream.

Site No. 53 PHOTO

U/S

U/S

D/S



D/S

Culvert Assessment Form **Site No.** 54

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/14/2016

INLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	x
Scour	x	Corrosion			

COMMENTS

Outfall heavily vegetated.

RECOMMENDATIONS

Clear outfall.

Site No. 54 PHOTO

U/S

D/S

D/S

Culvert Assessment Form **Site No.** 55

Project ID	Work County	Route	Date
	Cherokee	I-85	9/14/2016

INLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	x
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

3 culverts, 2 under frontage roads. Paved channels in between culverts with paved channels coming down from roadway ditches.

Infall and outfall vegetated. Utility pipe running through culvert.

RECOMMENDATIONS

Clear vegetation between culverts upstream and downstream.

U/S

U/S

D/S

D/S

Civil Engineering
Consulting Services, Inc.

Culvert Assessment Form — **Site No.** 56

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/14/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	
Scour	x	Corrosion			

COMMENTS

Type 9 U/S, two junction boxes

D/S scour & heavy vegetation. Some type of broken concrete at pipe end, assuming not part of drainage system

RECOMMENDATIONS

Clear outfall and stabilize channel.

U/S

U/S

D/S

D/S

Culvert Assessment Form

Site No.	57			
Project ID	**Work County**	**Route**		**Date**
	Cherokee	I-85		9/14/2016

INLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	x
Scour	x	Corrosion			

COMMENTS

3 pipe sections, started U/S at outfall beneath frontage road.

D/S half submerged outlet

RECOMMENDATIONS

Clear outfall for positive drainage

U/S

U/S

D/S

D/S

Civil Engineering
Consulting Services, Inc.

Culvert Assessment Form Site No. 58

Project ID	Work County	Route	Date
	Cherokee	I-85	9/14/2016

INLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked	x	Erosion	
Scour		Corrosion			

COMMENTS

D/S has heavy vegetation and blocked

RECOMMENDATIONS

Clear D/S outlet pipe and outfall.

U/S

D/S

D/S

Civil Engineering Consulting Services, Inc.

Culvert Assessment Form | **Site No.** 59

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/14/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	x
Scour		Corrosion			

COMMENTS

U/S near gas station. 3 Junction boxes. Junction box inlet needs clearing.

D/S heavily vegetated.

RECOMMENDATIONS

Clear junction box median drains. Clear D/S pipe and outfall.

Site No. 59 PHOTO

U/S

U/S

D/S

D/S

Civil Engineering Consulting Services, Inc.

Culvert Assessment Form **Site No.** 60

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/14/2016

INLET

End Section					
Cracked	x	Vegetation	x	Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked	x	Vegetation		Alignment	
Separated		Blocked	x	Erosion	
Scour		Corrosion			

COMMENTS

Part of a system from Love's gas station. Pipes between inlets are 18"->24"->24"->30" (site 60). Site 60 begins after a short grass channel on road side. U/S edge is damaged, most likely from mower.

D/S has damaged edge

RECOMMENDATIONS

Check location of open end pipe, confirm clear zone. Clean U/S channel, above site 60 pipe. Clean D/S outfall channel.

Site No. 60 PHOTO

U/S

U/S

D/S

D/S

Culvert Assessment Form **Site No.** 61

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/14/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	x
Scour		Corrosion			

COMMENTS

D/S rip rap placed and overgrown. Sideline drainage converges at this outfall just upstream of Site 62 outfall.

RECOMMENDATIONS

Clear or replace outfall riprap. Clear outfall.

Civil Engineering Consulting Services, Inc.

Site No. 61 PHOTO

U/S

D/S

D/S

Civil Engineering Consulting Services, Inc.

Culvert Assessment Form Site No. 62

Project ID	Work County	Route	Date
	Cherokee	I-85	9/14/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour	x	Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

D/S 6 inches - 1 foot of sediment deposition inside culvert. Tree growing through headwall weep hole.

RECOMMENDATIONS

Clean culvert; Clean infall and outfall.

D/S

D/S

D/S

Culvert Assessment Form | **Site No.** 63

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/14/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	x
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

Downstream surrounded with heavy vegetation.

RECOMMENDATIONS

Clear outfall to R/W.

U/S

D/S

D/S

D/S

Civil Engineering Consulting Services, Inc.

Culvert Assessment Form **Site No.** 64

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/14/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated	x	Blocked		Erosion	x
Scour		Corrosion			

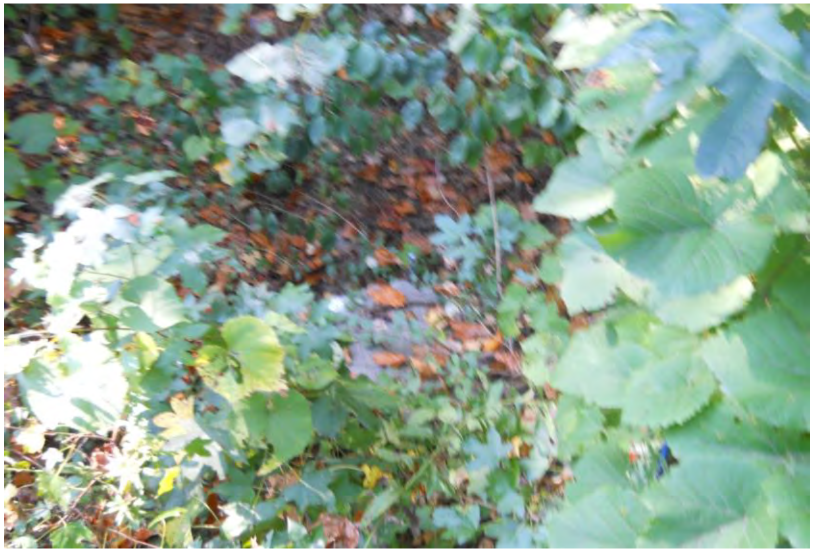
COMMENTS

D/S slight erosion, and joint separation.

RECOMMENDATIONS

Stabilize outfall and repair joint separation.

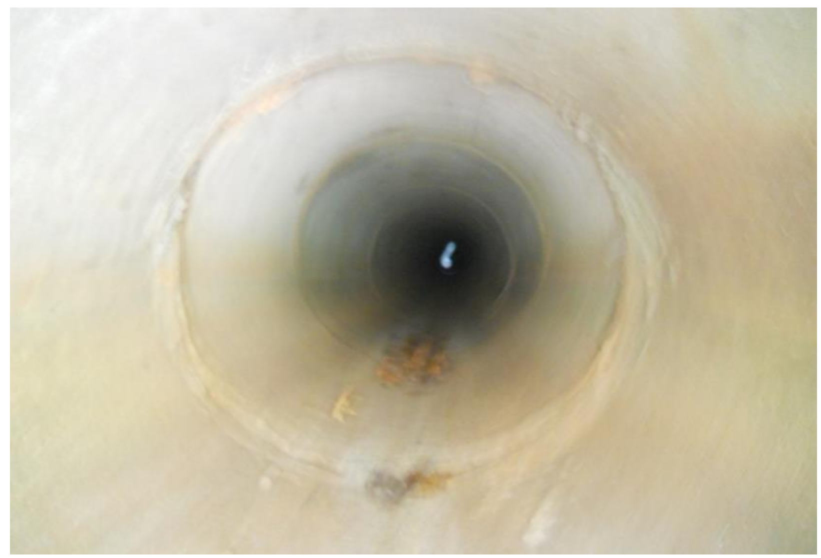
Site No. 64 PHOTO



U/S

U/S

D/S



D/S

Civil Engineering Consulting Services, Inc.

<u>Culvert Assessment Form</u> **Site No.** 65

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/14/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

D/S in a pool of water w/ excessive scour and last section separated

RECOMMENDATIONS

Stabilize upstream channel. Repair scour hole and joint separation downstream. Construct energy dissipator.

Site No. 65 PHOTO

U/S

U/S

D/S

D/S

Civil Engineering Consulting Services, Inc.

Culvert Assessment Form — **Site No.** 66

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/14/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked	x	Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	x
Scour	x	Corrosion			

COMMENTS

D/S outfalls to same scour pool as paved channel from Site 67. Large Scour pool and eroded channel

U/S has a rip rap ditch channel from interstate. Channel has a CMP ~60% buried upstream of Site 66

RECOMMENDATIONS

Clean infall and stabilize pipe entrance with riprap. Clean existing pipe; Repair scour hole, construct energy dissipator, and stabilize downstream channel.

Site No. 66 PHOTO

U/S

U/S

D/S

D/S

Culvert Assessment Form | **Site No.** 67

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/14/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	x
Scour		Corrosion			

COMMENTS

U/S is a median inlet with a paved channel ditch section upstream

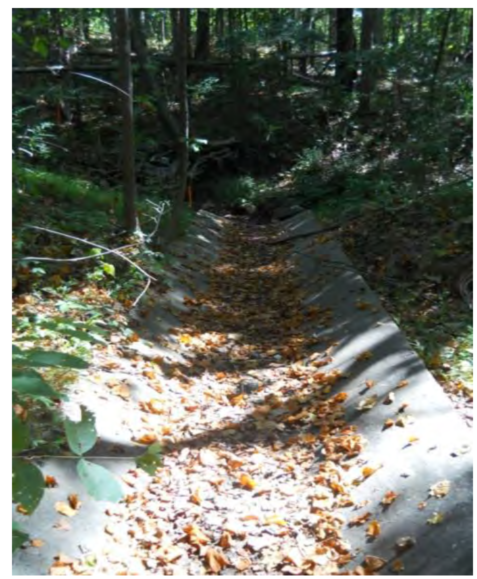
D/S outfalls onto a paved channel (which outfalls to site 66) which has erosion around edges.

RECOMMENDATIONS

Check capacity of D/S paved channel and potentially increasing size to prevent overtopping and erosion.
Stabilize outfall channel.

U/S

D/S



D/S

Civil Engineering
Consulting Services, Inc.

Culvert Assessment Form Site No. 68

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/14/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	
Scour	x	Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	x
Scour		Corrosion			

COMMENTS

Pipe entrance partially blocked by sediment.

D/S outfalls into eroded channel.

RECOMMENDATIONS

Clear infall to R/W. Repair downstream scour hole and construct energy dissipator.

Site No. 68 PHOTO

U/S

U/S

D/S

D/S

Culvert Assessment Form Site No. 69

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/14/2016

INLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated	x	Blocked		Erosion	x
Scour	x	Corrosion			

COMMENTS

D/S joint separation. Discharges into already heavily eroded channel.

RECOMMENDATIONS

Stabilize outfall and repair joint separation.

Site No. 69 PHOTO

U/S

D/S

D/S

Culvert Assessment Form **Site No.** 70

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/14/2016

INLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked	x	Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked		Erosion	x
Scour	x	Corrosion			

COMMENTS

D/S has very large scour hole. Plus eroded channel coming in. Starts the eroded channel through 69, 68, 67

U/S has multiple inflows and a collection of debris.

RECOMMENDATIONS

Clear U/S channel.

Repair and stabilize outfall channel.

U/S

U/S

D/S

D/S

Civil Engineering Consulting Services, Inc.

Culvert Assessment Form | **Site No.** 71

Project ID	**Work County**	**Route**	**Date**
	Cherokee	I-85	9/14/2016

INLET

End Section					
Cracked		Vegetation		Alignment	
Separated		Blocked	x	Erosion	
Scour		Corrosion			

OUTLET

End Section					
Cracked		Vegetation	x	Alignment	
Separated		Blocked		Erosion	
Scour		Corrosion			

COMMENTS

D/S alignment did not agree with survey or upstream junction out-pipe. Assuming a buried junction box of unknown location. Took a photo with expected alignment (photo shown with knife). Survey did show an 18" cross pipe beneath the ramp which was located and photographed to ensure outfall was not being mistaken.

RECOMMENDATIONS

Clear debris and sediment from U/S. Clear vegetation at outlet

U/S

U/S

D/S

D/S

SCDOT

HDR | ICA

CECS Civil Engineering Consulting Services, Inc.