CE 585

Construction Site Erosion Control

The University of Alabama

Tuscaloosa, AL

New Chevrolet and Cadillac Dealership

Jasper, AL

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July 10, 2007

Table of Contents

List of Tables

List of Figures

1.0 Introduction

This document is for a class exercise. The new Chevrolet and Cadillac dealership in Jasper, AL was chosen by the author to use for a class project in Construction Site Erosion, CE 585. The site is located in the southwest corner of the I-22 exit onto Industrial Blvd in Jasper, AL. This document contains a description of the site, the hydrologic characteristics of the site, hydrology calculation results, and preliminary suggestions for an erosion control plan.

2.0 Objective

This homework assignment is intended to gather needed information and to conduct the basic hydrologic analyses. The results of these analyses will be used at a later time to design erosion and sediment controls. The following items are included in this report:

1) Drainage area delineation including upslope contributing areas, on-site sub-drainage areas, and downslope areas.
2) Determination and organization of the site information needed for a hydrologic analysis for each sub area as designated in 1).
3) Use WinTR-55 to calculate the peak runoff rates, and plot the hydrographs for each sub area. Select an appropriate design storm for each area based on the likely control being used for each area.

3.0 Watershed Description

The new dealership has four watersheds (I, II, III, and IV) totaling approximately 30 acres. There are three up-slope watersheds (U1, U2, and U3). The locations of each watershed is shown in figure 3a. Up-slope watershed U1 will be diverted around the site while watersheds U2 and U3 will flow through a portion of the site. There are no down-slope areas beyond the outfall locations (Outlet 1, Outlet 2, and Outlet 3). Outlets 1 and 2 both flow into unnamed creeks which ultimately connect with Cane Creek to the South while Outlet 3 overflows into Bates Creek to the West. The project is bordered to the North by I-22, to the East by Industrial Blvd, and a portion of the South is bordered by Whitehouse Rd. Due to the nature of these borders U2 and U3 are each concentrated at the locations in which they will cross the project. Culverts will be utilized in each location. For drainage area U1, the runoff is already routed just beyond the southern border of the project and along Whitehouse Rd. U1 converges with drainage area I, II, and U2 at Outlet 1.

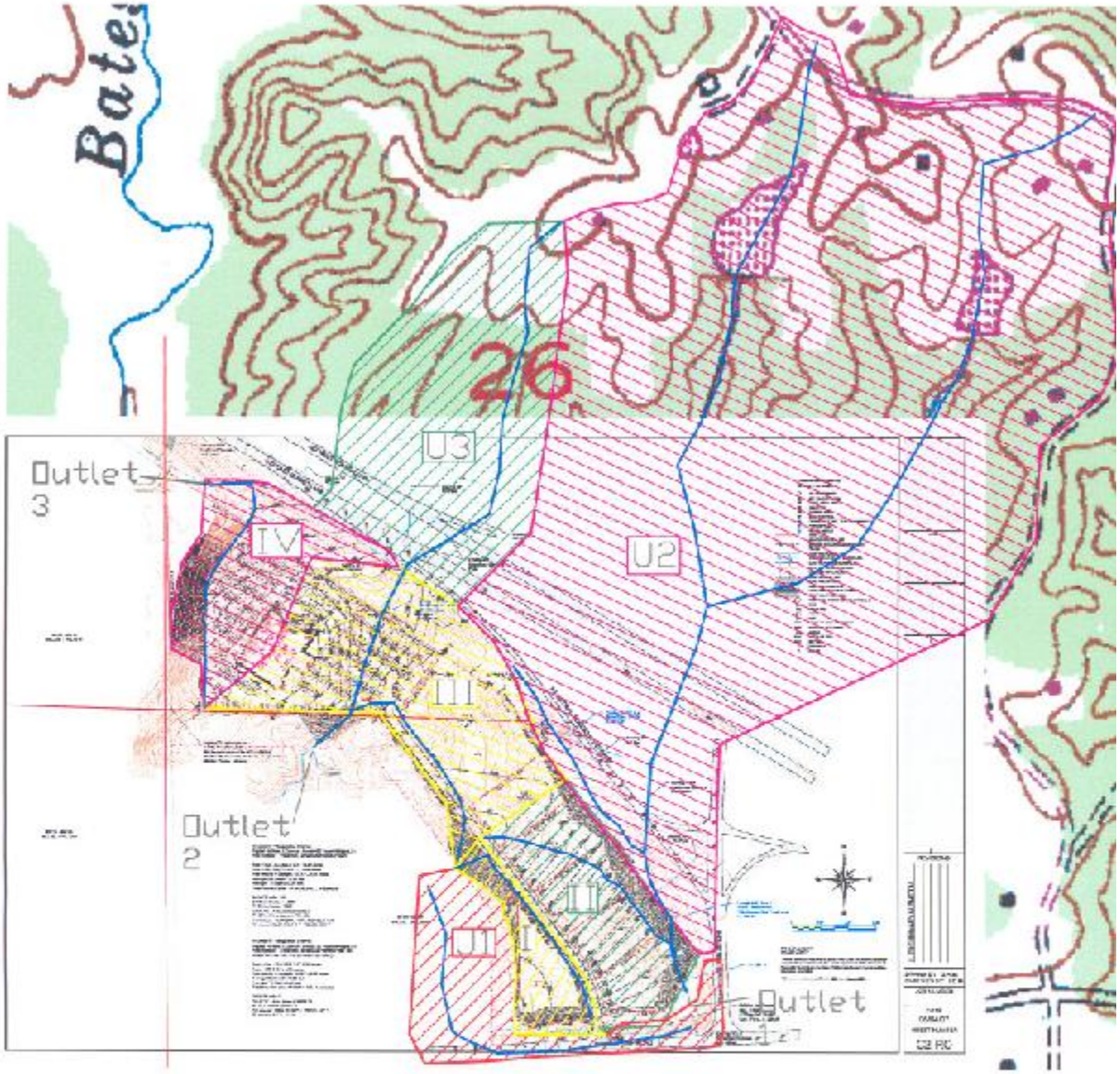

Figure 3a: Division of Watersheds (Internal and Up-slope)

The characteristics of the watersheds on this site are listed in Table 3a. Table 3a includes the discharge point, the area, the curve number, and the time of concentration. Curve numbers were determined considering soil type and land use. The soil type used is group D for all areas. It was determined that the soils were type D by comparing the geotech report with the table on page 119 of the textbook. The geotech report gives the soil as being silty clay which corresponds with group D in the table. Land use types were considered to be fair woods and grass for up-slope areas and newly graded areas for drainage areas I, II, III, and IV. The time of concentration was calculated using WinTR55. Sheet flow, shallow concentrated flow, and channel flow were each considered. For on-site areas with sheet flow were considered to have a smooth surface, shallow concentrated flows were considered to be unpaved, For areas which the time of concentration was calculated to be less than six minutes (0.1 hr) the value of 0.1 hr was used for the time of concentration.

Name	Reach	Area (ac)	RCN	Tc(hr)
U1	Outlet 1	7.04	82	0.417
I	Outlet 1	2.9	94	0.1
II	Outlet 1	7.45	94	0.1
U2	Outlet 1	97.28	82	0.481
U3	Outlet 2	13.28	94	0.1
III	Outlet 2	17.95	77	0.309
IV	Outlet 3	6.94	94	0.1
Total Const Area (ac)		35.24		
Total Downslope Area (ac)		0		
Total Upslope Area (ac)		117.6		
Total Area (ac)		152.84		

Table 3a: Watershed Data

4.0 Rainfall Information

Type III rainfall distribution was used for this site.

5.0 WinTR-55 Results

The hydrologic information for this site was input into the WinTR-55 program. Each drainage sub-area was simulated for each return period (1, 2, 5, 10, 25, 50, 100 years). The results are given below in Table 5a:

Outlet 1

	Walker	County,	Alabama				
	Watershed	Peak	Table				
	Peak	Flow	by	Rainfall	Return	Period	
Sub-Area	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	1-Yr
Identifier	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
U1	11.26	16.18	19.81	23.91	27.13	30.34	9.1
I	9.15	11.92	13.91	16.15	17.88	19.62	7.88
II	23.52	30.62	35.74	41.49	45.96	50.4	20.26
U2	146.69	210.64	257.75	311.74	353.62	394.69	118.51
OUTLET	171.55	244.7	298.62	359.31	407.29	454.94	139.27

Outlet 2

	Walker	County,	Alabama				
Watershed	Peak	Table					
	Peak	Flow	by	Rainfall	Return	Period	
Sub-Area	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	1-Yr
Identifier	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
III	41.93	54.58	63.72	73.97	81.92	89.85	36.11
U3	26.17	39.47	49.42	60.99	69.9	79.05	20.44
OUTLET	62.82	86.84	104.67	124.89	140.68	156.56	52.13
□							

Outlet 3

	Walker	County,	Alabama				
	Watershed	Peak	Table				
	Peak	Flow	by	Rainfall	Return	Period	
Sub-Area	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	1-Yr
Identifier	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)	(cfs)
IV	21.91	28.51	33.29	38.64	42.8	46.94	18.87
OUTLET	21.91	28.51	33.29	38.64	42.8	46.94	18.87

Table 5a: Peak Rainfall Data

6.0 Selection of Design Return Periods

The selection of the design return period was based on the McGhee equation found in the text book on page 109. Figure 3.16 on page 109 was used to select the design return period. Based on a 90% or less chance of failure of sediment ponds and fill slopes and a 50% or less chance for the failure of the filter fence and diversion channels combined with the 1.5 year construction period, the actual design period for the erosion control structures should be five year return period and 20 year return period as shown in table 6a below:

Table 6a: Design return period for tentative erosion control practices

Site Activity	Acceptable Failure (%)	Design Return Period (yr)	Selected Design Return Period (yr)	Real Failure Probability (%)
Diversion channels	50	3	5	28
Filter Fence	50	3	5	28
Slope Protection	10	15	25	6
Sediment Ponds	10	15	25	6

7.0 Diversion Channels

In consideration of the site, it is expected that there will be no areas which will have a run of over 200 feet left unpaved once construction is completed. Therefore the only diversion channels will be the one which will be constructed for drainage area U1 at the southernmost portion of the project.

8.0 Conclusions

The results of this report will be used to design the erosion control practices for this site. There will be a need for three sediment ponds, one diversion channel, and many feet of filter fence. During the construction phase as well as at the end of construction while vegetation is being established on the slopes.