

Source Contributions and Hydrology Assignment

Stormwater Management

Submitted by:

Margaret Zaice

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Source Contributions and Hydrology Assignment

The site studied for this assignment covers 23.4 acres and made up of two blocks in Madison, Alabama. The area was built over a 10 year period beginning in the mid 80's. The site is bounded by portions of Highland Drive, Cherry Drive, Wellington Drive, and Springwater Drive. Sanoma Drive is totally contained in the site area. The land use for the area is homogeneous medium density residential, with an average lot size of ½ acre. Most homes are 2 stories, 16% are one story. The land generally slopes from the north to the south with an average street and land slope varies from the medium range (2-5%) to the steep (>5%). Street slope ranges from flat to medium. Streets are lined on both sides with curbs. Street texture varies from medium rough to smooth, depending on how recently it was repaved. The soils are clayey.

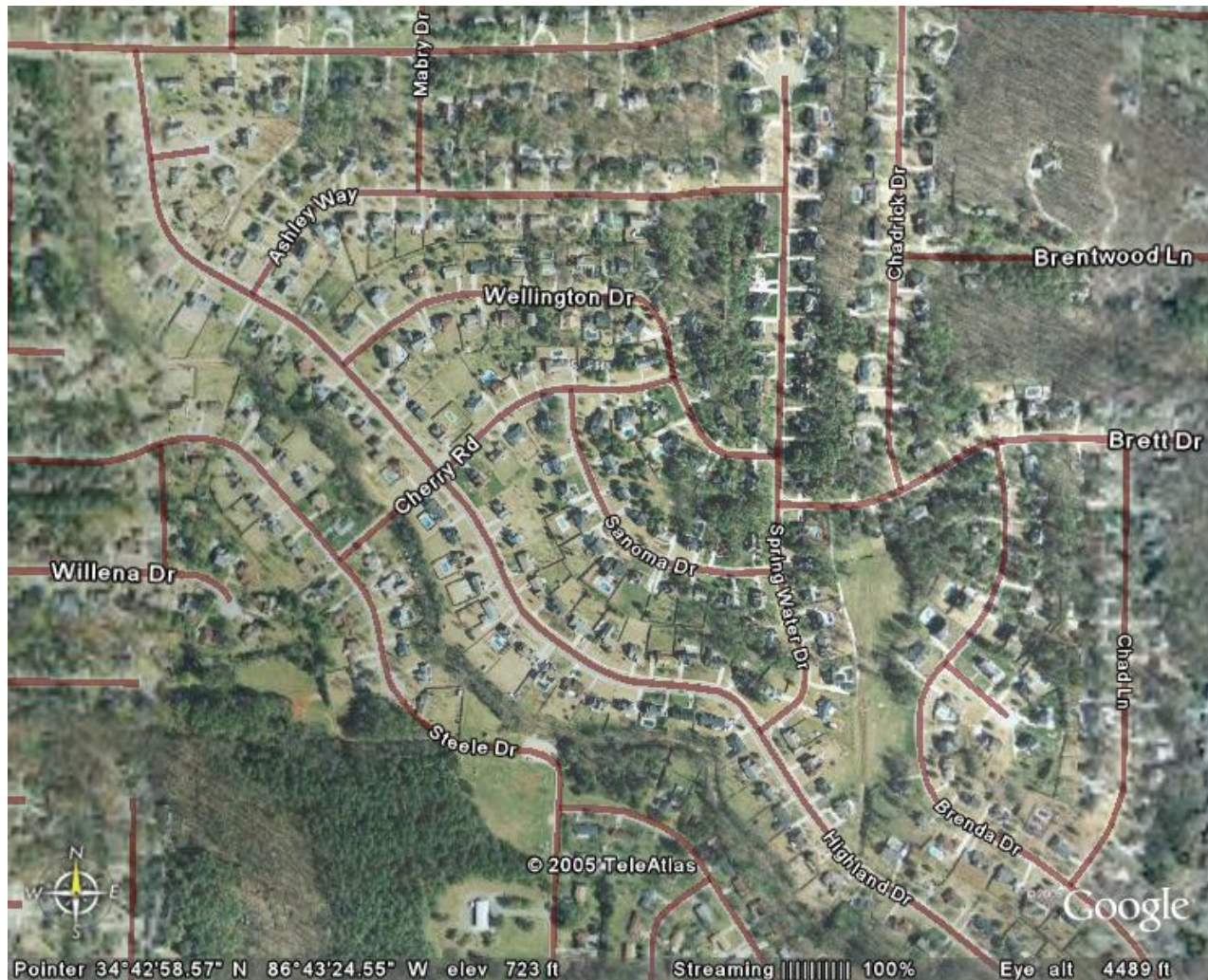


Figure 1 Site Map.

Downspouts from each roof were evaluated during the site investigation. If the downspout drained within 5 feet of the driveway, the water from that spout was considered connected. All other roof water was added to the landscape category. The roof area that each down spout drained was estimated to determine the percentage of connected roof runoff. The connected roof areas ranged from 0.25 to 0.33, with one at 0.5. Each street contains a sidewalk on one side of the

street. Each sidewalk has an area of lawn between the sidewalk and the street varying from 1 to 3 feet. Sidewalks were treated as draining to landscaping.

The site analysis (see appendix) revealed the following percentages of contributing areas:

Impervious:	Driveway	6
	Streets	10
	Connected Roof Area	2
Pervious:	Landscaped*	82

*lawns and non-connected roof area

Site hydrology calculations for rainfall depths ranging from .04 in to 4.0 in yielded the results shown in table 1. The most significant changes are for landscaping. At the lowest intensity rainfalls, streets and driveways are the biggest contributors with none from landscaping. At .20 in and above, the landscaping contribution jumps to 45% increasing up to 67% for a 4.0 rain.

Table 1 Source contributions with varying rainfall depth.

Rainfall Depth	Runoff	Contributions (%)			
		Roof	Driveway	Landscaping	Street
0.04	0.002	11	32	0	57
0.12	0.011	16	30	0	54
0.20	0.037	9	16	45	30
0.39	0.092	8	14	53	26
0.59	0.162	7	13	57	23
0.79	0.227	7	13	57	23
1.20	0.377	6	13	58	23
2.00	0.728	5	13	59	23
3.2	1.379	5	11	63	21
4	1.960	4	10	67	19

Pollutants in the area originate from rooftops, accumulations in areas where cars park (driveways and streets), traffic on streets, sediment from landscaping, grass clippings from lawn maintenance, debris from trees and decorative landscaping, fecal matter from pets and urban wildlife (squirrels, birds), oil destined to be recycled that the recycler frequently spills, pesticides and fertilizers applied for lawn maintenance. (Fire ants are a frequent problem in the area and diazanon is applied often.)

The general management approach for this area should focus on areas where differences can actually be made. Although roofs are a relatively small percentage of contribution, some houses could simply turn their downspouts or use redirectors to disconnect their roof runoff. Streets are relatively low use and the only economically reasonable method (considering the ridiculously low taxes in the area) for managing pollutants from them is to encourage people to keep their cars in good condition and take care of leaking engines.

The area where major differences can be made is in the landscaping. The site is comprised of people who generally take excessive care of their lawns. Management that encourages rain gardens, less use of pesticide and fertilizers (or at least more environmentally friendly products), education to encourage mulching grass clippings back into the lawn (rather than dump in the storm

sewers (which some still do), prompt raking or mulching of leaves in the fall, will help control pollutants in landscaping runoff.

Images from Google Earth Pro were used to obtain information for the site analysis.

Appendix

- A. Results of Site Survey
- B. Contribution Calculations
- C. Percentage area Calculations
- D. Photos of Area

Appendix A: Site Survey

Location:	Ashley Estates Subdivision, Madison, AL Streets Highland-partial, Cherry-partial, Sanoma-all, Springwater-partial
Date:	11/06/05
Photo Numbers:	Google Earth Pro
Land Use: -density -type	Residential- Medium Single Family
Income level:	Medium
Age of Development:	>1980
Maintenance of Buildings:	Excellent
Heights of buildings: -1 -2	16% 84%
Roof Drains: -Connected -Unconnected	20% 80%
Roof Types:	Composition shingle
Sediment Source Nearby:	Yes, Landscaping
Treated Wood near Street:	Telephone poles
Landscaping Near Road: -quantity: -type: -Maintenance -Leaves on street	much lawn Excessive some
Topography -street slopes -land slopes	Medium (2-5%) Medium (2-5%)
Traffic speed	25-40 mph
Traffic density	light
Width of street Highland All others	40 feet 30 feet
Condition of street:	Good
Texture of street:	Generally intermediate
Pavement Material -streets -sidewalks, driveways, walkways:	asphalt concrete
Driveways: -condition: -texture:	Paved Good smooth
Gutter material: -condition: Street/gutter interface	Concrete Good smooth
Litter loadings near street:	clean
Parking/storage areas:	none
Other paved areas:	none

Appendix B: Contribution Calculations

Rainfall Depth	Roof				Driveways				Landscaping (clayey soils)			
	%	Rv _{Roof}	Weighted Rv _{Roof} % x Rv _{Roof}	Roof Contrib. WRv _{Roof} /ΣWRv x 100	%	Rv _{Dways}	Weighted Rv _{Dway} % x Rv _{Dways}	Driveway Contrib. WRv _{Driveway} /ΣWRv x 100	% Lscpg	Rv _{Lscpg}	Weighted Rv _{Landscaping} % x Rv _{Lscpg}	Landscaping Contrib. WRv _{Landscaping} /ΣWRv x 100
0.04	0.02	0.25	0.005	11	0.055	0.26	0.014	32	0.823	0.00	0.000	0
0.12	0.02	0.75	0.015	16	0.055	0.49	0.027	30	0.823	0.00	0.000	0
0.20	0.02	0.85	0.017	9	0.055	0.55	0.030	16	0.823	0.10	0.082	45
0.39	0.02	0.93	0.0186	8	0.055	0.60	0.033	14	0.823	0.15	0.123	53
0.59	0.02	0.95	0.019	7	0.055	0.64	0.035	13	0.823	0.19	0.156	57
0.79	0.02	0.96	0.0192	7	0.055	0.67	0.037	13	0.823	0.20	0.165	57
1.20	0.02	0.98	0.0196	6	0.055	0.73	0.040	13	0.823	0.22	0.181	58
2.00	0.02	0.99	0.0198	5	0.055	0.84	0.046	13	0.823	0.26	0.214	59
3.2	0.02	0.99	0.0198	5	0.055	0.90	0.050	11	0.823	0.33	0.272	63
4	0.02	0.99	0.0198	4	0.055	0.91	0.050	10	0.823	0.40	0.329	67
			0.1728				0.362				1.523	

Rainfall Depth	Streets					
	%	Rv _{streets}	Weighted Rv _{Streets} % x Rv _{Streets}	Street Contrib. WRv _{Street} /ΣWRv x 100	Vol. Coef.= ΣWRv	Runoff Rainfall Depth x Vol. Coef.
0.04	0.1	0.26	0.026	57	0.05	0.002
0.12	0.1	0.49	0.049	54	0.09	0.011
0.20	0.1	0.55	0.055	30	0.18	0.037
0.39	0.1	0.60	0.06	26	0.24	0.092
0.59	0.1	0.64	0.064	23	0.27	0.162
0.79	0.1	0.67	0.067	23	0.29	0.227
1.20	0.1	0.73	0.073	23	0.31	0.377
2.00	0.1	0.84	0.084	23	0.36	0.728
3.2	0.1	0.90	0.09	21	0.43	1.379
4	0.1	0.91	0.091	19	0.49	1.960
			0.659			

Rainfall Depth	Runoff	Contributions (%)			
		Roof	Driveway	Land scaping	Street
0.04	0.002	11	32	0	57
0.12	0.011	16	30	0	54
0.20	0.037	9	16	45	30
0.39	0.092	8	14	53	26
0.59	0.162	7	13	57	23
0.79	0.227	7	13	57	23
1.20	0.377	6	13	58	23
2.00	0.728	5	13	59	23
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4	1.960	4	10	67	19

BLOCK 1	Roof Area ft²	% Roof Connected	% Roof Area Connected ft²	Driveway	Lot	Levels	Landscaped Area Lot- Connected Roof- Driveway
600 Highland	1,790	0	0	775	27,160	2	26,385
107 Springwater	2,410	0.25	603	1,417	21,150	2	19,131
120 Sanoma	2,240	0	0	1,030	21,380	2	20,350
118 Sanoma	2,000	0	0	1,550	24,810	2	23,260
116 Sanoma	1,960	0	0	800	19,000	2	18,200
114 Sanoma	2,225	0	0	1,850	20,230	2	18,380
112 Sanoma	1,765	0	0	1,494	22,860	2	21,366
110 Sanoma	3,520	0	0	1,485	21,410	2	19,925
108 Sanoma	2,670	0	0	2,785	23,743	2	20,958
106 Sanoma	2,825	0.33	932	1,565	18,244	2	15,747
104 Sanoma	2,440	0.25	610	1,585	20,306	2	18,111
102 Sanoma	1,770	0.33	584	905	18,049	2	16,560
100 Sanoma	1,890	0.00	0	995	23,500	2	22,505
108 Cherry	3,120	0.25	780	1,010	20,249	1	18,459
106 Cherry	3,005	0.25	751	960	19,986	1	18,275
104 Cherry	2,039	0.25	510	1,085	24,714	2	23,119
862 Highland	2,530	0.25	633	973	21,470	2	19,865
842 Highland	2,144	0.25	536	1,745	22,280	2	19,999
822 Highland	3,020	0.25	755	1,080	20,815	1	18,980
802 Highland	3,280	0.25	820	960	19,205	1	17,425
782 Highland	1,790	0.25	448	1,707	19,096	2	16,942
762 Highland	2,730	0.25	683	975	22,032	1	20,375
742 Highland	3,540	0.25	885	2,250	20,192	2	17,057
722 Highland	2,590	0.00	0	910	22,050	2	21,140
682 Highland	2,205	0.25	551	970	21,230	2	19,709
662 Highland	2,420	0.25	605	1,150	20,335	2	18,580
642 Highland	3,670	0.33	1211	1,260	20,336	1	17,865
622 Highland	2,220	0.33	733	1,150	20,100	2	18,217
BLOCK 2							
132 Wellington	2,500	0.25	625	1,440	17,820	2	15,755
130 Wellington	1,850	0.25	463	1,960	24,725	2	22,303
128 Wellington	3,880	0.33	1280	2,440	21,740	2	18,020
120 Cherry	1,730	0.25	433	1,615	18,410	2	16,363
118 Cherry	3,525	0.25	881	1,170	17,470	1	15,419
116 Cherry	3,330	0.25	833	940	27,330	1	25,558
103 Sanoma	3,100	0.33	1023	1,220	18,875	2	16,632
105 Sanoma	2,530	0.33	835	1,225	21,400	2	19,340
109 Sanoma	2,000	0	0	2,580	24,400	2	21,820
113 Sanoma	2,100	0	0	1,550	24,100	2	22,550
115 Sanoma	2,400	0	0	1,000	23,170	2	22,170
117 Sanoma	2,790	0.33	921	950	28,140	2	26,269
119 Sanoma	2,800	0.25	700	1,170	24,168	2	22,298
136 Wellington	2,015	0	0	830	29,640	2	28,810
			20,621	56,511	917,320		840,188
			Connected Roof	Driveway	Lot		Landscaped

STREET	Center	Width	Texture	Street Area
Highland	1590	40	Med	31,800
Sanoma	1135	30	Med	34,050
Cherry	916	30	Med	13,740
Springwater	1080	30	Med	16,200
Wellington	520	30	Med	7,800
			Total	103,590

Area Calculations

Contributor	Area	%
Roof Area	20,621	2
Driveway	56,511	6
Landscaped	840,188	82
Streets	<u>103,590</u>	<u>10</u>
	1,020,910	100

APPENDIX D: Photos of Area



Photo 1: An upslope house with no connected roof drainage, sidewalk example, and telephone pole.



Photo 2. Totally flat yard.



Photo 3. Wellington Rd. General neighborhood view.



Photo 4. Texture of asphalt.