

Storm Water Calculations**Project: CARSON IND., NAPOLEON, OHIO****Runoff flows & Coefficients, Pre & Post development**

By:RDS

Date: Junr, 2001

1) Existing (Pre-development) runoff:

Area(Ac.)	Land use description	"C"	"I" in/hr	"Q" cfs
3.385	Grassed/Agri area	0.35	2.60	3.080
0.000	Building roof	0.90	2.60	0.000
1.390	Asphalt pavement	0.85	2.60	3.072
0.000	x	0.00	2.60	0.000
Total Existing Runoff				<u>6.152</u>

2) Proposed (Post-development) runoff:

Project Description:

Calculations are based on an initial development with 30,075 s.f. of proposed building roof area, a total of 144,924 square feet of asphalt, gravel & concrete pavement area and the balance in agricultural use or lawn & landscape area.

Area(Ac.)	Land use description	"C"	"CA"
0.690	Building roof	0.90	0.621
3.327	Pavements	0.85	2.828
0.000	x	0.00	0.000
<u>0.758</u>	Grassed/Agri area	0.35	<u>0.265</u>
4.775	TOTAL AREA	TOTAL	3.714

$$\text{Weighted "C" = } \frac{\text{TOTAL "CA" } 3.714}{\text{TOTAL "A" } 4.775}$$

$$\text{Weighted "C" = } \boxed{0.778}$$

3) Proposed (Post-development) runoff:

Area(Ac.)	Land use description	"C"	"I" in/hr	"Q" cfs
4.775	See "2" Above	0.778	2.60	<u>9.657</u>
Total Proposed Runoff				<u>9.657</u>

4) Critical Storm Determination:

$$(9.657 - 6.152) / (9.657) = 0.363 \text{ or } 36.3\% \text{ therefore :}$$

Critical Storm = 5 Year

Storm Water Calculations

Project: CARSON IND., NAPOLEON, OHIO

Storm Water Detention Calculations

By:RDS

Date: June, 2003

Maximum discharge allowable per City of Napoleon @ Q2 = 6.152 cfs.

EXISTING STORM OUTLETS:

- 1) 12" P.E., N-12 outlet to drainage channel North = 2.43 cfs. (estimated)
- 2) Surface drainage to existing drainage channel NE = 1.00 cfs. (estimated)
- 3) Surface drainage to existing drainage channel NW = 0.50 cfs. (estimated)
- 4) 10" P.E., N-12 outlet to drainage channel North = 1.50 cfs. (estimated)

PROPOSED STORM OUTLETS:

PROPOSED STORM OUTLET CAPACITY: = 5.43 cfs. (estimated)

Site Area: 4.775

Weighted "C": 0.778

"T"(min.) Time of Concentration	"I"(in/hr) Intensity 5 Year Storm	"CA"	"Q" in (cfs)	"Q" out (cfs)	"Q" in-"Q" out (cfs)	Detention Volume(c.f.)
<u>20</u>	<u>3.15</u>	<u>3.7143</u>	<u>11.70</u>	<u>5.430</u>	<u>6.27</u>	<u>7524</u>
30	2.50	3.7143	9.29	5.430	3.86	6940
40	2.07	3.7143	7.69	5.430	2.26	5420
50	1.78	3.7143	6.61	5.430	1.18	3544
60	1.58	3.7143	5.87	5.430	0.44	1579
70	1.25	3.7143	4.64	5.430	-0.79	-3306
80	1.18	3.7143	4.38	5.430	-1.05	-5026
90	1.06	3.7143	3.94	5.430	-1.49	-8062
100	1.00	3.7143	3.71	5.430	-1.72	-10295
110	0.96	3.7143	3.57	5.430	-1.86	-12305
120	0.89	3.7143	3.31	5.430	-2.12	-15295

Minimum Detention Volume Required = 7524 Cubic Feet

- Area required for 1' depth of storage = 0.173 Acres
- Area required for 1.5' depth of storage = 0.115 Acres
- Area required for 2' depth of storage = 0.086 Acres
- Area required for 2.5' depth of storage = 0.069 Acres

Expected Detention Areas & Volumes =

- New truck loading dock, Aver. 24" depth = 1970.00 c.f.
- Flooding over paved & grassed areas (2,3&4),est. = 500.00 c.f.
- Misc. pipe & basin storage capacities = 425.00 c.f.
- Add'l. pipe & basin storage capacities = 284.00 c.f.
- Ponding in new paved areas = 3600.00 c.f.
- Retention in Industrial Drive road swale (area 1),est. = 1500.00 c.f.
- Total Detention Volume = 8279.00 c.f.**

Storm Water Calculations**Project: CARSON IND., NAPOLEON, OHIO****Drainage Area Flow Calculations**

R.D.S.

Date: June, 2003

Time/Concentration "T" m **20**Design Storm "I" in./hr.= **3.15**

5 Yr. Storm

Area	Description	Area(Ac.)	Land use description	"C"	"I" in/hr	"Q" cfs
Area 1	Drainage to existing 12" Outlet					
		0.000	Building roof	0.90	3.15	0.000
		0.000	x	0.00	3.15	0.000
		1.374	Asphalt pavement	0.85	3.15	3.679
		0.256	Lawn-grassed area	0.35	3.15	0.282
						<u>3.961</u>
Area 2	Rear yard surface drainage, NW					
		0.000	Building roof	0.90	3.15	0.000
		0.000	Asphalt pavement	0.85	3.15	0.000
		0.000	x	0.00	3.15	0.000
		0.342	Lawn-grassed area	0.35	3.15	0.377
						<u>0.377</u>
Area 3	Front yard surface drainage, NE					
		0.000	Building roof	0.90	3.15	0.000
		0.071	Asphalt pavement	0.85	3.15	0.190
		1.364	NEW Asphalt pavement	0.85	3.15	3.652
		0.128	Lawn-grassed area	0.35	3.15	0.141
						<u>3.983</u>
Area 4	Building "B", docks & pavement					
		0.690	Building roof	0.90	3.15	1.956
		0.512	Pavements	0.85	3.15	1.371
		0.038	Lawn-grassed area	0.35	3.15	0.042
						<u>3.369</u>
Area 5	R/W-North 1/2 Street Pavement @ 25 yr. Storm					
		0.000	Building roof	0.90	4.20	0.000
		0.140	Pavements	0.90	4.20	0.529
		0.000	Lawn-grassed area	0.35	4.20	0.000
						<u>0.529</u>
Area 6	R/W-South 1/2 Street Right-of-Way @ 25 yr. Storm					
		0.000	Building roof	0.90	4.20	0.000
		0.140	Pavements	0.90	4.20	0.529
		0.180	Lawn-grassed area	0.35	4.20	0.265
						<u>0.794</u>

Storm Water Calculations**Project: CARSON IND., NAPOLEON, OHIO****Storm Water Detention Calculations by Drainage Area**

By:RDS

Date: June, 2003

DRAINAGE AREA #1**Site Area: 1.63 ac.****Weighted "C"= 0.772**

"T"(min.) Time of Concentration	"I"(in/hr) Intensity 5 Year Stm	"CA"	"Q" in (cfs)	"Q" out (cfs)	"Q"in-"Q"out (cfs)	Detention Volume(c.f.)
<u>20</u>	<u>3.15</u>	<u>1.2584</u>	<u>3.96</u>	<u>1.430</u>	<u>2.53</u>	<u>3041</u>
30	2.50	1.2584	3.15	1.430	1.72	3089
40	2.07	1.2584	2.60	1.430	1.17	2820
50	1.78	1.2584	2.24	1.430	0.81	2430
60	1.58	1.2584	1.99	1.430	0.56	2010
70	1.25	1.2584	1.57	1.430	0.14	601
80	1.18	1.2584	1.48	1.430	0.05	264
90	1.06	1.2584	1.33	1.430	-0.10	-519

DRAINAGE AREA #2**Site Area: 0.342 ac.****Weighted "C"= 0.350**

"T"(min.) Time of Concentration	"I"(in/hr) Intensity 5 Year Stm	"CA"	"Q" in (cfs)	"Q" out (cfs)	"Q"in-"Q"out (cfs)	Detention Volume(c.f.)
<u>20</u>	<u>3.15</u>	<u>0.1197</u>	<u>0.38</u>	<u>0.500</u>	<u>-0.12</u>	<u>-148</u>
30	2.50	0.1197	0.30	0.500	-0.20	-361
40	2.07	0.1197	0.25	0.500	-0.25	-605
50	1.78	0.1197	0.21	0.500	-0.29	-861
60	1.58	0.1197	0.19	0.500	-0.31	-1119
70	1.25	0.1197	0.15	0.500	-0.35	-1472
80	1.18	0.1197	0.14	0.500	-0.36	-1722
90	1.06	0.1197	0.13	0.500	-0.37	-2015

DRAINAGE AREA #3**Site Area: 1.563ac.****Weighted "C"= 0.809**

"T"(min.) Time of Concentration	"I"(in/hr) Intensity 5 Year Stm	"CA"	"Q" in (cfs)	"Q" out (cfs)	"Q"in-"Q"out (cfs)	Detention Volume(c.f.)
<u>20</u>	<u>3.15</u>	<u>1.2650</u>	<u>3.98</u>	<u>1.000</u>	<u>2.98</u>	<u>3582</u>
30	2.50	1.2650	3.16	1.000	2.16	3893
40	2.07	1.2650	2.62	1.000	1.62	3885
50	1.78	1.2650	2.25	1.000	1.25	3755
60	1.58	1.2650	2.00	1.000	1.00	3595
70	1.25	1.2650	1.58	1.000	0.58	2441
80	1.18	1.2650	1.49	1.000	0.49	2365
90	1.06	1.2650	1.34	1.000	0.34	1841

Storm Water Calculations**Project: CARSON IND., NAPOLEON, OHIO****Storm Water Detention Calculations by Drainage Area**

By:RDS

Date: June, 2003

DRAINAGE AREA #4**Site Area: 1.240ac.****Weighted "C"= 0.862**

"T"(min.) Time of Concentration	"I"(in/hr) Intensity 5 Year Stm	"CA"	"Q" in (cfs)	"Q" out (cfs)	"Q"in-"Q"out (cfs)	Detention Volume(c.f.)
<u>20</u>	<u>3.15</u>	<u>1.0690</u>	<u>3.37</u>	<u>1.500</u>	<u>1.87</u>	<u>2241</u>
30	2.50	1.0690	2.67	1.500	1.17	2111
40	2.07	1.0690	2.21	1.500	0.71	1711
50	1.78	1.0690	1.90	1.500	0.40	1208
60	1.58	1.0690	1.69	1.500	0.19	680
70	1.25	1.0690	1.34	1.500	-0.16	-688
80	1.18	1.0690	1.26	1.500	-0.24	-1145
90	1.06	1.0690	1.13	1.500	-0.37	-1981

DRAINAGE AREA # Reserved**Site Area: 0.000ac.****Weighted "C"= 0.000**

"T"(min.) Time of Concentration	"I"(in/hr) Intensity 5 Year Stm	"CA"	"Q" in (cfs)	"Q" out (cfs)	"Q"in-"Q"out (cfs)	Detention Volume(c.f.)
<u>20</u>	<u>3.15</u>	<u>0.0000</u>	<u>0.00</u>	<u>0.000</u>	<u>0.00</u>	<u>0</u>
30	2.50	0.0000	0.00	0.000	0.00	0
40	2.07	0.0000	0.00	0.000	0.00	0
50	1.78	0.0000	0.00	0.000	0.00	0
60	1.58	0.0000	0.00	0.000	0.00	0
70	1.25	0.0000	0.00	0.000	0.00	0
80	1.18	0.0000	0.00	0.000	0.00	0
90	1.06	0.0000	0.00	0.000	0.00	0

DRAINAGE AREA # Reserved**Site Area: 0.000ac.****Weighted "C"= 0.000**

"T"(min.) Time of Concentration	"I"(in/hr) Intensity 5 Year Stm	"CA"	"Q" in (cfs)	"Q" out (cfs)	"Q"in-"Q"out (cfs)	Detention Volume(c.f.)
<u>20</u>	<u>3.15</u>	<u>0.0000</u>	<u>0.00</u>	<u>0.000</u>	<u>0.00</u>	<u>0</u>
30	2.50	0.0000	0.00	0.000	0.00	0
40	2.07	0.0000	0.00	0.000	0.00	0
50	1.78	0.0000	0.00	0.000	0.00	0
60	1.58	0.0000	0.00	0.000	0.00	0
70	1.25	0.0000	0.00	0.000	0.00	0
80	1.18	0.0000	0.00	0.000	0.00	0
90	1.06	0.0000	0.00	0.000	0.00	0

Storm Water Calculations						
Project: RDD Ltd.-VISION, NAPOLEON, OHIO						
Runoff flows & Coefficients, Pre & Post development						
By:RDS		Date: September, 2000				
1) Existing (Pre-development) runoff:						
	Area(Ac.)	Land use description	"C"	"I" in/hr	"Q" cfs	
	5.364	Grassed/Agri area	0.35	2.60	4.881	
	0.109	Building roof	0.90	2.60	0.255	
	0.972	Asphalt pavement	0.85	2.60	2.148	
	0.000	x	0.00	2.60	0.000	
			Total Existing Runoff			7.284
2) Proposed (Post-development) runoff:						
Project Description:						
Calculations are based on an initial development with 37,106.5 s.f. of proposed building roof area, 110,000 square feet of asphalt & concrete pavement area added since 1995 and the balance in agricultural use or lawn & landscape area.						
	Area(Ac.)	Land use description	"C"	"CA"		
	0.955	Building roof	0.90	0.860		
	2.090	Asphalt pavement	0.85	1.777		
	0.435	Concrete pavement	0.90	0.392		
	2.965	Grassed/Agri area	0.35	1.038		
	6.445	TOTAL AREA		TOTAL	4.065	
	Weighted "C" =		TOTAL "CA"	4.065		
			TOTAL "A"	6.445		
	Weighted "C" =			0.631		
3) Proposed (Post-development) runoff:						
	Area(Ac.)	Land use description	"C"	"I" in/hr	"Q" cfs	
	6.445	See "2" Above	0.631	2.60	10.570	
			Total Proposed Runoff			10.570
4) Critical Storm Determination:						
(10.570-7.284)/(7.284)=0.45 or 45% therefore :				Critical Storm = 5 Year		

Storm Water Calculations						
Project: RDD Ltd.-VISION, NAPOLEON, OHIO						
Storm Water Detention Calculations						
By:RDS		Date: September, 2000				
Maximum discharge allowable per City of Napoleon @ Q2 = 7.284 cfs.						
EXISTING STORM OUTLETS:						
1) 12" P.E., N-12 outlet to open drainage channel North =		2.5 cfs. (estimated)				
2) Surface runoff to open drainage channels N. & E. =		3.3 cfs. (estimated)				
PROPOSED STORM OUTLETS:						
1) 8" P.E., N-12 outlet to open drainage channel North =		0.5 cfs. (estimated)				
PROPOSED STORM OUTLET CAPACITY:				=		6.3 cfs. (estimated)
Site Area:		6.445				
Weighted "C"		0.631				
"T"(min.)	"I"(in/hr)	"CA"	"Q" in	"Q" out	"Q" in-"Q" out	Detention
Time of	Intensity		(cfs)	(cfs)	(cfs)	Volume(c.f.)
Concentration	5 Year Storm					
<u>20</u>	<u>3.15</u>	<u>4.0653</u>	<u>12.81</u>	<u>6.300</u>	<u>6.51</u>	<u>7807</u>
30	2.50	4.0653	10.16	6.300	3.86	6954
40	2.07	4.0653	8.42	6.300	2.12	5076
50	1.78	4.0653	7.24	6.300	0.94	2808
60	1.58	4.0653	6.42	6.300	0.12	443
70	1.25	4.0653	5.08	6.300	-1.22	-5117
80	1.18	4.0653	4.80	6.300	-1.50	-7214
90	1.06	4.0653	4.31	6.300	-1.99	-10751
100	1.00	4.0653	4.07	6.300	-2.23	-13409
110	0.96	4.0653	3.90	6.300	-2.40	-15823
120	0.89	4.0653	3.62	6.300	-2.68	-19310
Minimum Detention Volume Required =					7807	Cubic Feet
Area required for 1' depth of storage =					0.179	Acres
Area required for 1.5' depth of storage =					0.119	Acres
Area required for 2' depth of storage =					0.090	Acres
Area required for 2.5' depth of storage =					0.072	Acres
Expected Detention Areas & Volumes =						
New truck loading dock, Aver. 24" depth				=	2250.00	c.f.
Aver. 2/10" Flooding over exist. & prop. asph.				=	1900.00	c.f.
Misc. pipe & basin storage capacities				=	450.00	c.f.
3/10" Flooding over agri/grassed areas				=	3230.00	c.f.
Total Detention Volume				=	7830.00	c.f.

Storm Water Calculations						
Project: RDD Ltd.-VISION, NAPOLEON, OHIO						
Drainage Area Flow Calculations						
R.D.S.	Date: September, 2000					
				Design Storm "I" in./hr.=	3.15	
				Time/Concentration "T" m	20	
Area 1	Description:					
	30,106.5 s.f. new roof & loading docks					
				5 Yr. Stm.		
	Area(Ac.)	Land use description	"C"	"I" in/hr	"Q" cfs	
	0.691	Building roof	0.9	3.15	1.959	
	0.051	Concrete pavement	0.90	3.15	0.145	
	0.000	Gravel pavement	0.45	3.15	0.000	
	0.000	Lawn-grassed area	0.35	3.15	0.000	
			Total Flow ~ Area 1			2.104
Area 2	Description:					
	Drainage to existing 12" outlet					
				5 Yr. Stm.		
	Area(Ac.)	Land use description	"C"	"I" in/hr	"Q" cfs	
	0.264	Building roof	0.90	3.15	0.748	
	2.090	Asphalt pavement	0.85	3.15	5.596	
	0.384	Concrete pavement	0.90	3.15	1.089	
	0.000	Lawn-grassed area	0.35	3.15	0.000	
			Total Flow ~ Area 2			7.433
Area 3	Description:					
	Surface Drainage of Agri/Grassed areas					
				5 Yr. Stm.		
	Area(Ac.)	Land use description	"C"	"I" in/hr	"Q" cfs	
	0.000	Building roof	0.90	3.15	0.000	
	0.000	Asphalt pavement	0.85	3.15	0.000	
	0.000	Concrete pavement	0.90	3.15	0.000	
	2.965	Lawn-grassed area	0.35	3.15	3.269	
			Total Flow ~ Area 3			3.269