HAMILTON-MASON ROAD

Drainage Computations

Stage 3 Submittal
May, 2006

Resource International Inc.
6350 Presidential Gateway
Columbus, Ohio 43231
(614) 823-4949

Narrative

I. Project Overview

The purpose of this project is to widen Hamilton Mason Road between its overpass of Interstate 75 and Butler-Warren Road. The existing roadway will be resurfaced and new roadway will be constructed in both directions. The intersection with Cox Road will be reconstructed to provide a four-leg intersection in order to accommodate the extension of Cox Road. New drainage facilities will be provided for the entire roadway, consisting largely of curb and gutter. Some ditch sections will be constructed to assist with conveying pavement drainage to existing watercourses and to pick up drainage of small "pocket" areas outside the curb line. The new mainline roadway will consist of two travel lanes in each direction along with protected right and left turn lanes at the intersections with Cox Road and at Butler-Warren Road. The new roadway will also provide a center left turn lane for driveways along the entire length of the reconstruction of Hamilton-Mason Road.

The project's drainage basins generally flow to the north. Three primary drainage channels drain the project area. The western half of the project area (between Interstate 75 and the driveway to the park near Station 87+50) drains to a culvert near existing Station 82+00. This drainage area consists of area located on the southeast corner of the intersection of Hamilton-Mason and Cox Road (largely park land) and a small area in the southwest corner of the intersection of Hamilton-Mason and Cox Road (lightly developed commercial area). The primary drainage channel is a roadside ditch along the south side of Hamilton-Mason Road that crosses under Hamilton-Mason Road through the culvert and flows northeast. The remaining half of the project area is drained with three drainage channels, one flowing to the culvert at Station 94+40, one flowing to a culvert near Station 108+60, and a small drainage area draining to a culvert under Butler-Warren Road at the eastern end of the project area.

The drainage system consists largely of closed systems, with some open systems to convey drainage to receiving waters and to pick up isolated areas of low points outside the curb and gutter. Three culverts will either be extended or replaced. The design constraints of each are based on the Location and Design Manual, Volume 2.

II. Closed System Design

The closed system consists of several separate storm sewer lines. All but three flow to the three culverts in the project area. The westernmost system (near Interstate 75) captures drainage west of the Hamilton-Mason and Cox Road intersection, conveys it to the southwest corner of the intersection where it flows under Cox Road and into the ditch leading to the culvert at Station 82+00. A smaller system just east of the intersection drains the eastern and northern sides of the intersection, discharging the drainage into the ditch on the north side of Hamilton-Mason Road. One storm sewer system captures drainage between Stations 80+50 and 87+50, discharging near the culvert at Station 82+00. Two systems, one on each side of the culvert at Station 94+40, capture drainage

between Stations 87+50 and 102+50, discharging it immediately downstream of the culvert. Two more storm sewer systems, one on each side of the culver at Station 108+60, capture the drainage between Stations 102+50 and 115+00 and discharge it directly into the proposed 42" culvert at Station 108+60. The easternmost system, capturing drainage between Stations 115+00 and 121+00, discharges into an existing 15" culvert under Butler-Warren Road just north of the intersection between Butler-Warren Road and Hamilton Mason Road.

All closed systems were designed in accordance with the Location and Design Manual, Volume 2.

III. Culverts

Three culverts drain the project area. Three streams drain the project area. One, near Station 82+00, captures flow from the intersection area of Cox Road and Hamilton-Mason Road and some of the flow from the park. The second culvert, at Station 94+40, captures flow from the park area just west of the existing pond. The final culvert, near Station 108+60, drains park land just north (downstream) of the existing pond in the park.

The design flows were obtained by performing a PeakFlow analysis on the contributing watershed. The culvert alternatives were then analyzed using HY-8 to provide adequate hydraulic conveyance while minimizing cost and impact to the reconstructed and widened Hamilton-Mason Road. Where possible, the existing type of culvert was maintained (and upsized if required). The culvert at Station 82+00 was replaced with a proposed elliptical pipe because the elliptical pipe provides adequate capacity at lower cost.

IV. Water Quality Design

Each of the project's drainage areas was evaluated to determine whether the disturbance requires a post-construction BMP, in accordance with Section 1115 of the Location and Design Manual, Volume 2.

There are several distinct overall drainage areas within the project area. All involve the use of closed systems draining to roadway ditches or one of the three culverts passing under the roadway. With the exception of one closed system (at the westernmost edge of the project), the closed systems discharge drainage at or near the downstream end of the proposed culverts or into ditches that empty into receiving waters downstream of the culverts.

The only real alternatives for treatment in a closed system are the use of manufactured systems, use of exfiltration trenches, or the use of ponds at the system outlets. Of these alternatives, only exfiltration trenches are technologically and economically feasible for this project. Detention ponds will consume vast tracts of right-of-way, as four ponds will need to be constructed (one at each culvert and one near Butler-Warren Road). Any proposed pond will require detention of an existing stream. Manufactured systems are extremely costly to install and require specialized equipment to maintain. They are economically infeasible to install and maintain when only four will be required. Exfiltration trenches provide the best treatment option, as they treat individual small

drainage areas at each catch basin and are easily integrated into the construction of the curb and gutter of the roadway. No additional right-of-way or costly specialized maintenance equipment is required.

The design of the exfiltration trenches followed 2 L&D § 1118 and used the recommended strip method, which assumes a contributing area that is 150 feet wide (from the centerline of the roadway) and as long as the drainage area to the next catch basin. The required length of the exfiltration trench is based on the total area and the impervious percentage, rounded up to the nearest four foot increment. We have attached a design spreadsheet detailing the computation of the area, impervious percentage, and the required exfiltration trench length. The exfiltration trenches are shown on the plan and profile sheets.

TMDL Note

According to the Ohio Environmental Protection Agency, no Total Maximum Daily Loading (TMDL) regulations have been promulgated under Section 303(d) of the Federal Water Pollution Control Act for the Little Muddy Creek, the ultimate receiving waters for this project. The project watershed is located near the upper reaches of the East Fork of Mill Creek, for which the Ohio EPA promulgated a final TMDL regulation in 2004 (*see* "Total Maximum Daily Loads for the Mill Creek Basin – Final Report" *available at* http://www.epa.state.oh.us/dsw/tmdl/Mill_Creek_sep04_final.pdf) as approved by the US EPA on April 26, 2005, but none of the project drainage reaches this regulated watershed.

Form LD-34
Revised July 1999

STORM SEWER COMPUTATION SHEET

Calculated by ECH Date 5/19/2006 Just Full Capacity 10 Yr. Frequency Project
Checked by Date Hydraulic Gradient 25 Yr. Frequency Sheet 1 of 2
Interstate Sag Yr. Frequency

		RCP	CMP
Manning's 'n' for 10	Year Design Frequency	0.013	0.024
Manning's 'n' for 25	Year H.G. Frequency	0.013	0.024

HAMILTON-MASON ROAD

MH, CB, I	Station	Side	Drainage Area in Acres		Time of Concentration in Minutes		Rainfall in Inches/Hour		Runoff Coeff.	Column 7 x Column 4		Discharge in cfs		Size of Pipe in Inches	Length of Pipe in Feet	Slope of Pipe in ft./ft.	Inlet F/L of Pipe	Outlet F/L of Pipe	Mean Velocity in	Just Full Cap. (10	Friction Slope in ft./ft.	Head Loss in Feet	El. Of HG (for Q25)	Grate or Cover El.	Cover El. - HG El.
No.			ΔA	∑A	ΔT	∑T	i10	i25	C	ΔCA	∑CA	Q10	Q25	D	L	So	El	El	Vm	cfs	Sf	H	Elev.	Elev.	ΔH
1	70+00	L	0.36		10.0		5.4	6.7	0.80	0.29		1.6	1.9	15	96	0.0300	901.42	898.54	6.5	11.0	0.0008	0.08	902.75	905.82	3.07
@2	70+00	R	0.34	-	10.0	-	5.4	6.7	0.80	0.27	-	1.5	1.8												
3	70+00	R		0.70		10.2	5.3	6.6			0.56	3.0	3.7	15	197	0.0400	898.44	890.56	8.5	13.0	0.0031	0.61	900.30	905.39	5.09
4	72+00	R		0.70		10.6	5.3	6.6			0.56	3.0	3.7	15	166	0.0400	890.46	883.82	8.5	13.0	0.0031	0.51	892.22	896.24	4.02
5	73+75	L	0.27		10.0		5.4	6.7	0.80	0.22		1.2	1.4	15	92	0.0500	888.42	883.82	7.0	14.2	0.0005	0.05	889.72	893.30	3.58
@6	73+75	R	0.65	-	10.0	-	5.4	6.7	0.80	0.52	-	2.8	3.5												
7	73+75	R		1.62		11.0	5.3	6.6			1.30	6.9	8.6	15	157	0.0150	883.72	881.37	9.0	8.0	0.0170	2.67	887.64	888.59	0.95
@8	75+40	R	0.48	-	10.0	-	5.4	6.7	0.80	0.38	-	2.1	2.6												
9-10	75+40	R		2.10		11.2	5.2	6.5			1.68	8.7	10.9	18	21	0.0150	881.12	880.80	7.0	13.0	0.0110	0.23	882.62	885.94	3.33
11	CX15+75	L	0.40		10.0		5.4	6.7	0.80	0.32	-	1.7	2.1	15	140	0.0050	882.00	881.30	3.6	4.6	0.0011	0.15	882.70	885.85	3.15
@12	77+68	L	0.41	-	10.0	-	5.4	6.7	0.80	0.33	-	1.8	2.2												
13	77+68	L		0.81		10.6	5.3	6.6			0.65	3.4	4.3	15	282	0.0050	880.39	878.98	3.8	4.6	0.0044	1.24	881.62	885.27	3.65
14	80+50	R	0.33		10.0		5.4	6.7	0.80	0.26		1.4	1.8	15	80	0.0040	879.30	878.98	5.2	6.5	0.0008	0.06	880.44	882.83	2.39
@15	80+50	L	0.30	-	10.0	-	5.4	6.7	0.80	0.24	-	1.3	1.6												
16-17	80+50	L		1.44		11.9	5.1	6.4			1.15	5.9	7.4	18	42	0.0050	878.88	878.67	6.0	7.5	0.0050	0.21	880.38	883.24	2.86
23	85+00	R	0.21		10.0		5.4	6.7	0.80	0.17	-	0.9	1.1	15	68	0.0079	880.51	879.97	3.6	5.6	0.0004	0.03	881.25	884.01	2.76
@24	85+00	L	0.20	-	10.0	-	5.4	6.7	0.80	0.16	-	0.9	1.1												
25	85+00	L		0.41		10.3	5.3	6.6			0.33	1.7	2.2	15	126	0.0080	879.87	878.86	4.6	5.6	0.0015	0.19	880.30	883.79	3.49
22	83+75	L		0.41		10.8	5.4	6.7			0.33	1.8	2.2	15	126	0.0080	878.76	877.75	4.6	5.6	0.0015	0.19	879.30	883.22	3.92
18	82+26	R	0.39		10.0		5.4	6.7	0.80	0.31		1.7	2.1	15	80	0.0100	878.86	878.06	5.2	6.5	0.0014	0.11	879.42	882.38	2.96
@19	82+26	L	0.50	-	10.0	-	5.4	6.7	0.80	0.40	-	2.2	2.7												
19	82+26	L		0.89		10.3	5.4	6.7			0.71	3.8	4.8	15	21	0.0100	877.96	877.75	5.2	6.5	0.0070	0.15	879.26	882.19	2.93
20-21	82+47.20	L		1.30		11.2	5.1	6.4			1.04	5.3	6.7	18	40	0.0050	877.65	877.45	4.2	7.5	0.0040	0.16	879.11	882.78	3.67
26	90+00	R	0.24		10.0		5.4	6.7	0.80	0.19	-	1.0	1.3	15	68	0.0500	880.92	877.52	3.0	4.6	0.0004	0.03	878.80	884.99	6.19
@27	90+00	L	0.30	-	10.0	-	5.4	6.7	0.80	0.24	-	1.3	1.6												
28	90+00	L		0.54		10.4	5.3	6.6			0.43	2.3	2.9	15	197	0.0180	877.42	873.87	6.5	8.6	0.0020	0.39	875.51	881.74	6.23
29	92+00	R	0.17		10.0		5.4	6.7	0.80	0.14	-	0.7	0.9	15	68	0.0200	875.23	873.87	3.0	6.5	0.0004	0.03	875.15	878.95	3.80
@30	92+00	L	0.22	-	10.0	-	5.4	6.7	0.80	0.18	-	1.0	1.2												
31	92+00	L		0.93		10.9	5.3	6.6			0.74	3.9	4.9	15	210	0.0180	873.77	869.99	6.5	8.6	0.0072	1.51	872.75	878.51	5.76
32-33	93+87	L		0.93		11.4	5.2	6.5			0.74	3.9	4.8	15	32	0.0200	869.89	869.25	5.2	9.2	0.0070	0.22	870.72	874.80	4.08

Form LD-34
Revised July 1999

STORM SEWER COMPUTATION SHEET

Calculated by ECH Date 5/23/2006 Just Full Capacity 10 Yr. Frequency Project
Checked by Date Hydraulic Gradient 25 Yr. Frequency Sheet 2 of 2
Interstate Sag Yr. Frequency

Manning's 'n' for 10 Year Design Frequency RCP 0.013 CMP 0.024
Manning's 'n' for 25 Year H.G. Frequency RCP 0.013 CMP 0.024

HAMILTON-MASON ROAD

MH, CB, I	Station	Side	Drainage Area in Acres		Time of Concentration in Minutes		Rainfall in Inches/Hour		Runoff Coeff.	Column 7 x Column 4		Discharge in cfs		Size of Pipe in Inches	Length of Pipe in Feet	Slope of Pipe in ft./ft.	Inlet F/L of Pipe	Outlet F/L of Pipe	Mean Velocity in	Just Full Cap. (10	Friction Slope in ft./ft.	Head Loss in Feet	El. Of HG (for Q25)	Grate or Cover El.	Cover El. - HG El.
No.			ΔA	ΣA	ΔT	ΣT	i10	i25	C	ΔCA	ΣCA	Q10	Q25	D	L	So	El	El	Vm	cfs	Sf	H	Elev.	Elev.	ΔH
40	100+50	R	0.17		10.0		5.4	6.7	0.80	0.14	-	0.7	0.9	15	68	0.0100	879.02	878.34	3.0	6.5	0.0004	0.03	880.29	882.73	2.44
@41	100+50	L	0.23	-	10.0	-	5.4	6.7	0.80	0.18	-	1.0	1.2												
42	100+50	L		0.40		10.4	5.4	6.7			0.32	1.7	2.1	15	300	0.0200	878.24	872.24	6.0	9.0	0.0010	0.30	879.79	883.33	3.54
37	97+50	R	0.26		10.0		5.4	6.7	0.80	0.21		1.1	1.4	15	68	0.0075	872.75	872.24	4.4	5.6	0.0004	0.03	875.66	876.70	1.04
@38	97+50	L	0.34	-	10.0	-	5.4	6.7	0.80	0.27	-	1.5	1.8												
39	97+50	L		1.00		11.2	5.2	6.5			0.80	4.2	5.2	15	281	0.0075	872.14	870.03	4.0	5.6	0.0080	2.25	875.64	877.29	1.65
34	94+69	R	0.49		10.0		5.4	6.7	0.80	0.39		2.1	2.6	15	68	0.0100	870.71	870.03	3.0	6.5	0.0016	0.11	872.07	874.20	2.13
@35	94+69	L	0.63	-	10.0	-	5.4	6.7	0.80	0.50	-	2.7	3.4												
36-37	94+69	R		2.12		12.4	4.9	5.9			1.70	8.3	10.0	15	54	0.0200	869.93	868.85	7.5	9.0	0.0080	0.43	871.18	874.80	3.62
43	103+50	R	0.08		10.0		5.4	6.7	0.80	0.06	-	0.3	0.4	15	68	0.0100	880.07	879.39	3.0	6.5	0.0004	0.03	881.35	883.51	2.16
@44	103+50	L	0.11	-	10.0	-	5.4	6.7	0.80	0.09	-	0.5	0.6												
45	103+50	L		0.19		10.4	5.4	6.7			0.15	0.8	1.0	15	300	0.0100	879.29	876.29	3.4	6.5	0.0004	0.12	880.66	884.11	3.45
49	106+50	L	0.60		10.0		5.4	6.7	0.80	0.48	-	2.6	3.2	15	26	0.0050	876.42	876.29	4.0	4.6	0.0024	0.06	877.75	878.80	1.05
46	106+50	R	0.26		10.0		5.4	6.7	0.80	0.21	-	1.1	1.4	15	68	0.0100	876.97	876.29	3.5	6.5	0.0005	0.03	878.25	881.17	2.92
@47	106+50	L	0.34	-	10.0	-	5.4	6.7	0.80	0.27	-	1.5	1.8												
48-52	106+50	L		1.39		11.8	5.4	6.7			1.11	6.0	7.5	18	244	0.0100	876.19	873.75	5.0	10.2	0.0024	0.59	877.69	881.77	4.08
50	109+04	R	0.50		10.0		5.4	6.7	0.80	0.40	-	2.2	2.7	15	68	0.0100	874.63	873.95	3.0	6.5	0.0017	0.12	876.00	879.56	3.56
@51	109+04	L	0.65	-	10.0	-	5.4	6.7	0.80	0.52	-	2.8	3.5												
51-52	109+04	L		1.15		10.4	5.3	6.6			0.92	4.9	6.1	15	10	0.0100	873.85	873.75	3.0	6.5	0.0090	0.09	875.09	879.56	4.47
53	112+00	R	0.31		10.0		5.4	6.7	0.80	0.25	-	1.3	1.7	15	68	0.0100	877.83	877.15	3.4	6.5	0.0007	0.05	879.13	881.35	2.22
@54	112+00	L	0.41	-	10.0	-	5.4	6.7	0.80	0.33	-	1.8	2.2												
54-55	112+00	L		0.72		10.3	5.4	6.7			0.58	3.1	3.9	15	300	0.0045	877.05	875.70	4.0	4.4	0.0035	1.05	878.00	881.95	3.95
56	117+50	R	0.21		10.0		5.4	6.7	0.80	0.17	-	0.9	1.1	15	68	0.0100	878.03	877.35	3.0	4.6	0.0004	0.03	879.31	882.17	2.86
@57	117+50	L	0.16	-	10.0	-	5.4	6.7	0.80	0.13	-	0.7	0.9												
58	117+50	L		0.37		10.4	5.4	6.7			0.30	1.6	2.0	15	244	0.0150	877.25	873.59	4.0	8.0	0.0010	0.24	878.75	882.76	4.01
59	119+94.00	R	0.21		10.0		5.4	6.7	0.80	0.17		0.9	1.1	15	68	0.0025	873.76	873.59	3.0	4.6	0.0004	0.03	875.04	876.18	1.14
@60	119+94.00	L	0.16	-	10.0	-	5.4	6.7	0.80	0.13	-	0.7	0.9												
61	119+94.00	L		0.74		11.4	5.3	6.5			0.59	3.1	3.8	15	37	0.0025	873.49	873.40	5.0	3.2	0.0035	0.13	874.87	876.78	1.91
62	120+14.31	L	0.21		10.0		5.4	6.7	0.80	0.17		0.9	1.1	15	32	0.0025	873.48	873.40	3.0	3.2	0.0004	0.01	874.74	875.46	0.72
63	120+30.88	L		0.95		11.5	5.3	6.5			0.76	4.0	4.9	15	138	0.0198	873.30	870.57	5.5	9.0	0.0057	0.79	872.61	875.00	2.39
DW-1	106+30	R	0.45		10.0		5.4	6.7	0.80	0.36	-	1.9	2.4	12	21	0.0100	878.38	878.17	4.4	3.6	0.0045	0.09	879.26	880.13	0.87

Rii	Ditch Design Parameters and Design Data - Ditch # 1 (Cross-Sections 80+50 to 82+50 Left)			
	Project:	TR-117 (H-M Road)	Date:	5/23/2006

DITCH DESIGN PARAMETERS			
ALLOWABLE SHEAR		FLOW INFORMATION	
Seed	0.40 psf	Watershed Area Code (Fig. 1101-3)	D
Sod	1.00 psf	Initial Time of Concentration	12 min
Type 1 Matting	2.00 psf	Depth Frequency	10-year
Type 2 Matting	3.00 psf	Shear Frequency	5-year
Type 3 Matting	5.00 psf		

DITCH DESIGN DATA							
Cross-Sections		Section Area	Section C-Value	Elevations		Slopes	
Start	End			Start	End	Grade	In/Back
80+50.00	81+00.00	1.440 ac	0.80	878.70 ft	878.10 ft	1.20%	4:1/3:1
81+00.00	81+50.00	0.040 ac	0.60	878.10 ft	877.80 ft	0.60%	4:1/3:1
81+50.00	82+00.00	0.040 ac	0.60	877.80 ft	877.30 ft	1.00%	4:1/3:1
82+00.00	82+50.00	0.040 ac	0.60	877.30 ft	876.80 ft	1.00%	4:1/3:1

NOTE: Cross-Sections are in order of decreasing elevation.

DITCH ANALYSIS

PID : **Date :** 05/17/2006 **Project :** TR117 Hamilton-Mason Road **Location :** Ditch #1

Description : Hamilton-Mason Road Sta. 80+50 LT. to Sta. 82+20 LT. **Designer :** RII

Rainfall Area : D

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If a shear value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
80+50	81+00	L	50.00	2.00	4.00	3.00	0.0120	1.44	1.44	0.80	1.15	Seed	4.26	5	0.035	12.36	2.33	0.41	4.90	0.54	5.79
												Jute Mat	4.25	5	0.040	12.39	2.11	0.43	4.90	0.58	6.04
												Jute Mat	4.98	10	0.040	12.38	2.20	0.47	5.74	0.62	6.36
81+00	81+50	L	50.00	2.00	4.00	3.00	0.0060	0.04	1.48	0.60	1.18	Seed	4.19	5	0.035	12.85	1.81	0.24	4.93	0.64	6.49
												Seed	4.92	10	0.035	12.82	1.89	0.26	5.78	0.69	6.85
81+50	82+00	L	50.00	2.00	4.00	3.00	0.0100	0.04	1.52	0.60	1.20	Seed	4.14	5	0.035	13.23	2.19	0.36	4.97	0.57	5.99
												Seed	4.86	10	0.035	13.18	2.28	0.38	5.83	0.62	6.31
82+00	82+50	L	50.00	2.00	4.00	3.00	0.0100	0.04	1.56	0.60	1.22	Seed	4.10	5	0.035	13.61	2.19	0.36	5.01	0.57	6.00
												Seed	4.81	10	0.035	13.54	2.29	0.39	5.88	0.62	6.33

Rii	Ditch Design Parameters and Design Data - Ditch # 2 (Cross-Sections 77+68 RT to 82+00 RT)			
	Project:	TR-117 (H-M Road)	Date:	5/23/2006

DITCH DESIGN PARAMETERS			
ALLOWABLE SHEAR		FLOW INFORMATION	
Seed	0.40 psf	Watershed Area Code (Fig. 1101-3)	D
Sod	1.00 psf	Initial Time of Concentration	10 Minutes
Type 1 Matting	2.00 psf	Depth Frequency	10-year
Type 2 Matting	3.00 psf	Shear Frequency	5-year
Type 3 Matting	5.00 psf		

DITCH DESIGN DATA

Cross-Sections		Section Area	Section C-Value	Elevations		Slopes	
Start	End			Start	End	Grade	In/Back
77+68.09	78+00.00	11.100 ac	0.65	878.80 ft	878.70 ft	0.31%	4:1/3:1
78+00.00	78+50.00	0.147 ac	0.60	878.70 ft	878.50 ft	0.40%	4:1/3:1
78+50.00	79+00.00	0.080 ac	0.60	878.50 ft	878.30 ft	0.40%	4:1/3:1
79+00.00	79+50.00	0.070 ac	0.60	878.30 ft	878.10 ft	0.40%	4:1/3:1
79+50.00	80+00.00	0.050 ac	0.60	878.10 ft	877.90 ft	0.40%	4:1/3:1
80+00.00	80+50.00	0.050 ac	0.60	877.90 ft	877.70 ft	0.40%	4:1/3:1
80+50.00	81+00.00	0.050 ac	0.60	877.70 ft	877.50 ft	0.40%	4:1/3:1
81+00.00	81+50.00	0.050 ac	0.60	877.50 ft	877.30 ft	0.40%	4:1/3:1
81+50.00	81+80.00	0.030 ac	0.60	877.30 ft	877.18 ft	0.40%	4:1/3:1

NOTE: Cross-Sections are in order of decreasing elevation.

DITCH ANALYSIS

PID : **Date :** 05/17/2006 **Project :** TR117 Hamilton-Mason Road **Location :** Ditch #2

Description : Station 77+68 RT to 81+80 RT **Designer :** RII

Rainfall Area : D

Allowable Shears

		Seed:	0.40	**Jute Mat:** 0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:** 3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00			

(*) Warning: Grade is steeper than allowable. If a shear value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
77+68	78+00	R	50.00	2.00	4.00	3.00	0.0031	11.10	11.10	0.65	7.22	Seed	3.41	5	0.035	20.39	2.14	0.30	24.57	1.55	12.82
												Seed	3.99	10	0.035	20.37	2.23	0.32	28.76	1.65	13.58
78+00	78+50	R	50.00	2.00	4.00	3.00	0.0040	0.15	11.25	0.60	7.30	Seed	3.38	5	0.035	20.74	2.36	0.37	24.66	1.47	12.26
												Seed	3.95	10	0.035	20.71	2.46	0.39	28.87	1.57	12.98
78+50	79+00	R	50.00	2.00	4.00	3.00	0.0040	0.08	11.33	0.60	7.35	Seed	3.35	5	0.035	21.09	2.36	0.37	24.61	1.46	12.25
												Seed	3.92	10	0.035	21.05	2.46	0.39	28.82	1.57	12.97
79+00	79+50	R	50.00	2.00	4.00	3.00	0.0040	0.07	11.40	0.60	7.39	Seed	3.32	5	0.035	21.45	2.36	0.37	24.54	1.46	12.24
												Seed	3.89	10	0.035	21.39	2.45	0.39	28.75	1.57	12.96
79+50	80+00	R	50.00	2.00	4.00	3.00	0.0040	0.05	11.45	0.60	7.42	Seed	3.29	5	0.035	21.80	2.35	0.36	24.43	1.46	12.22
												Seed	3.86	10	0.035	21.73	2.45	0.39	28.63	1.56	12.94
80+00	80+50	R	50.00	2.00	4.00	3.00	0.0040	0.05	11.50	0.60	7.45	Seed	3.26	5	0.035	22.15	2.35	0.36	24.32	1.46	12.20
												Seed	3.83	10	0.035	22.07	2.45	0.39	28.51	1.56	12.92
80+50	81+00	R	50.00	2.00	4.00	3.00	0.0040	0.05	11.55	0.60	7.48	Seed	3.24	5	0.035	22.51	2.35	0.36	24.22	1.45	12.18

DITCH ANALYSIS

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
												Seed	3.79	10	0.035	22.41	2.45	0.39	28.40	1.56	12.90
81+00	81+50	R	50.00	2.00	4.00	3.00	0.0040	0.05	11.60	0.60	7.51	Seed	3.21	5	0.035	22.86	2.35	0.36	24.11	1.45	12.16
												Seed	3.76	10	0.035	22.75	2.44	0.39	28.29	1.56	12.89
81+50	81+80	R	30.00	2.00	4.00	3.00	0.0040	0.03	11.63	0.60	7.53	Seed	3.19	5	0.035	23.07	2.35	0.36	24.05	1.45	12.15
												Seed	3.75	10	0.035	22.95	2.44	0.39	28.22	1.55	12.87

Rii	Ditch Design Parameters and Design Data - Ditch # 3 (Cross-Sections 85+50 RT to 82+20.50 RT)			
	Project:	TR-117 (H-M Road)	Date:	5/23/2006

DITCH DESIGN PARAMETERS			
ALLOWABLE SHEAR		FLOW INFORMATION	
Seed	0.40 psf	Watershed Area Code (Fig. 1101-3)	D
Sod	1.00 psf	Initial Time of Concentration	10 Minutes
Type 1 Matting	2.00 psf	Depth Frequency	10-year
Type 2 Matting	3.00 psf	Shear Frequency	5-year
Type 3 Matting	5.00 psf		

DITCH DESIGN DATA							
Cross-Sections		Section Area	Section C-Value	Elevations		Slopes	
Start	End			Start	End	Grade	In/Back
86+50.00	86+00.00	0.87 ac	0.60	883.20 ft	882.90 ft	0.60%	4:1/3:1
86+00.00	85+50.00	0.13 ac	0.60	882.90 ft	882.60 ft	0.60%	4:1/3:1
85+50.00	85+00.00	0.15 ac	0.60	882.60 ft	882.30 ft	0.60%	4:1/3:1
85+00.00	84+50.00	0.18 ac	0.60	882.30 ft	881.60 ft	1.40%	4:1/3:1
84+50.00	84+00.00	0.21 ac	0.60	881.60 ft	880.90 ft	1.40%	4:1/3:1
84+00.00	83+50.00	0.16 ac	0.60	880.90 ft	880.10 ft	1.60%	4:1/3:1
83+50.00	83+00.00	0.17 ac	0.60	880.10 ft	879.40 ft	1.40%	4:1/3:1
83+00.00	82+50.00	0.17 ac	0.60	879.40 ft	878.80 ft	1.20%	4:1/3:1
82+50.00	82+00.00	0.14 ac	0.60	878.80 ft	878.50 ft	0.60%	4:1/3:1
82+00.00	81+60.00	0.08 ac	0.60	878.50 ft	878.30 ft	0.50%	4:1/3:1

NOTE: Cross-Sections are in order of decreasing elevation.

DITCH ANALYSIS

PID : **Date :** 05/17/2006 **Project :** TR117 Hamilton-Mason Road **Location :** Ditch #3

Description : Station 86+50 LT to 81+60 RT **Designer :** RII

Rainfall Area : D

Allowable Shears

		Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If a shear value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
86+50	86+00	R	50.00	2.00	4.00	3.00	0.0060	0.87	0.87	0.60	0.52	Seed	4.51	5	0.035	10.56	1.49	0.17	2.35	0.45	5.12
												Seed	5.29	10	0.035	10.54	1.55	0.18	2.76	0.48	5.38
86+00	85+50	R	50.00	2.00	4.00	3.00	0.0060	0.13	1.00	0.60	0.60	Seed	4.43	5	0.035	11.10	1.53	0.18	2.66	0.47	5.32
												Seed	5.20	10	0.035	11.05	1.60	0.19	3.12	0.51	5.60
85+50	85+00	R	50.00	2.00	4.00	3.00	0.0060	0.15	1.15	0.60	0.69	Seed	4.36	5	0.035	11.62	1.58	0.19	3.01	0.50	5.53
												Seed	5.12	10	0.035	11.56	1.66	0.20	3.53	0.54	5.81
85+00	84+50	R	50.00	2.00	4.00	3.00	0.0140	0.18	1.33	0.60	0.80	Seed	4.30	5	0.035	12.00	2.24	0.38	3.43	0.44	5.05
												Seed	5.06	10	0.035	11.91	2.34	0.41	4.04	0.47	5.31
84+50	84+00	R	50.00	2.00	4.00	3.00	0.0140	0.21	1.54	0.60	0.92	Seed	4.26	5	0.035	12.35	2.32	0.41	3.93	0.47	5.27
												Jute Mat	4.25	5	0.040	12.39	2.11	0.44	3.93	0.50	5.49
												Jute Mat	5.00	10	0.040	12.29	2.20	0.47	4.62	0.54	5.78
84+00	83+50	R	50.00	2.00	4.00	3.00	0.0160	0.16	1.70	0.60	1.02	Seed	4.21	5	0.035	12.72	2.49	0.47	4.29	0.47	5.30
												Jute Mat	4.20	5	0.040	12.76	2.26	0.50	4.29	0.50	5.53

DITCH ANALYSIS

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
												Temp. Mat	4.20	5	0.040	12.76	2.26	0.50	4.29	0.50	5.53
												Temp. Mat	4.94	10	0.040	12.64	2.36	0.55	5.04	0.55	5.82
83+50	83+00	R	50.00	2.00	4.00	3.00	0.0140	0.17	1.87	0.60	1.12	Seed	4.16	5	0.035	13.10	2.43	0.44	4.67	0.51	5.55
												Jute Mat	4.16	5	0.040	13.13	2.21	0.47	4.66	0.54	5.79
												Temp. Mat	4.16	5	0.040	13.13	2.21	0.47	4.66	0.54	5.79
												Temp. Mat	4.89	10	0.040	13.00	2.31	0.51	5.48	0.59	6.11
83+00	82+50	R	50.00	2.00	4.00	3.00	0.0120	0.17	2.04	0.60	1.22	Seed	4.11	5	0.035	13.49	2.34	0.41	5.03	0.55	5.83
												Jute Mat	4.11	5	0.040	13.52	2.13	0.44	5.03	0.58	6.09
												Jute Mat	4.83	10	0.040	13.38	2.22	0.47	5.91	0.63	6.42
82+50	82+00	R	50.00	2.00	4.00	3.00	0.0060	0.01	2.05	0.60	1.23	Seed	4.05	5	0.035	13.98	1.82	0.24	4.99	0.65	6.52
												Seed	4.77	10	0.035	13.81	1.89	0.26	5.88	0.70	6.89
82+00	81+60	R	40.00	2.00	4.00	3.00	0.0050	0.08	2.13	0.60	1.28	Seed	4.00	5	0.035	14.37	1.71	0.21	5.13	0.68	6.79
												Seed	4.72	10	0.035	14.19	1.78	0.23	6.04	0.74	7.17

Rii	Ditch Design Parameters and Design Data - Ditch # 4 (Cross-Sections 97+00 RT to 94+13.77 RT)			
	Project:	TR-117 (H-M Road)	Date:	5/23/2006

DITCH DESIGN PARAMETERS			
ALLOWABLE SHEAR		FLOW INFORMATION	
Seed	0.40 psf	Watershed Area Code (Fig. 1101-3)	D
Sod	1.00 psf	Initial Time of Concentration	10 Minutes
Type 1 Matting	2.00 psf	Depth Frequency	10-year
Type 2 Matting	3.00 psf	Shear Frequency	5-year
Type 3 Matting	5.00 psf		

DITCH DESIGN DATA							
Cross-Sections		Section Area	Section C-Value	Elevations		Slopes	
Start	End			Start	End	Grade	In/Back
97+00.00	96+50.00	0.047 ac	0.60	875.54 ft	874.30 ft	2.48%	4:1/3:1
96+50.00	96+00.00	0.074 ac	0.60	874.30 ft	873.00 ft	2.60%	4:1/3:1
96+00.00	95+50.00	0.073 ac	0.60	873.00 ft	871.70 ft	2.60%	4:1/3:1
95+50.00	95+00.00	0.049 ac	0.60	871.70 ft	870.40 ft	2.60%	4:1/3:1
95+00.00	94+50.00	0.041 ac	0.60	870.40 ft	869.10 ft	2.60%	4:1/3:1
94+50.00	94+13.77	0.041 ac	0.60	869.10 ft	868.72 ft	1.05%	4:1/3:1

NOTE: Cross-Sections are in order of decreasing elevation.

DITCH ANALYSIS

PID : **Date :** 06/30/2005 **Project :** TR117 Hamilton-Mason Road **Location :** Ditch #4

Description : Sta. 97+00 RT to Sta. 94+13.77 **Designer :** RII

Rainfall Area : D

Allowable Shears

		Seed:	0.40	**Jute Mat:** 0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:** 3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00			

(*) Warning: Grade is steeper than allowable. If a shear value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
97+00	96+50	R	50.00	2.00	4.00	3.00	0.0248	0.05	0.05	0.60	0.03	Seed	4.46	5	0.035	10.89	0.97	0.09	0.13	0.06	2.41
												Seed	5.24	10	0.035	10.81	1.00	0.10	0.15	0.07	2.46
96+50	96+00	R	50.00	2.00	4.00	3.00	0.0260	0.07	0.12	0.60	0.07	Seed	4.37	5	0.035	11.51	1.33	0.16	0.32	0.10	2.71
												Seed	5.14	10	0.035	11.41	1.43	0.18	0.37	0.11	2.77
96+00	95+50	R	50.00	2.00	4.00	3.00	0.0260	0.07	0.19	0.60	0.12	Seed	4.30	5	0.035	12.04	1.56	0.21	0.50	0.13	2.92
												Seed	5.06	10	0.035	11.91	1.63	0.23	0.59	0.14	3.01
95+50	95+00	R	50.00	2.00	4.00	3.00	0.0260	0.05	0.24	0.60	0.15	Seed	4.23	5	0.035	12.54	1.68	0.24	0.62	0.15	3.03
												Seed	4.98	10	0.035	12.38	1.77	0.26	0.73	0.16	3.12
95+00	94+50	R	50.00	2.00	4.00	3.00	0.0260	0.04	0.28	0.60	0.17	Seed	4.17	5	0.035	13.02	1.73	0.26	0.71	0.16	3.12
												Seed	4.91	10	0.035	12.83	1.85	0.28	0.84	0.17	3.22
94+50	94+14	R	34.23	2.00	4.00	3.00	0.0105	0.04	0.33	0.60	0.20	Seed	4.12	5	0.035	13.44	1.33	0.14	0.80	0.22	3.53
												Seed	4.85	10	0.035	13.24	1.40	0.16	0.95	0.24	3.67

Rii	Ditch Design Parameters and Design Data - Ditch # 5 (Cross-Sections 103+00 LT to 106+50 LT)			
	Project:	TR-117 (H-M Road)	Date:	5/23/2006

DITCH DESIGN PARAMETERS			
ALLOWABLE SHEAR		FLOW INFORMATION	
Seed	0.40 psf	Watershed Area Code (Fig. 1101-3)	D
Sod	1.00 psf	Initial Time of Concentration	10 Minutes
Type 1 Matting	2.00 psf	Depth Frequency	10-year
Type 2 Matting	3.00 psf	Shear Frequency	5-year
Type 3 Matting	5.00 psf		

DITCH DESIGN DATA

Cross-Sections		Section Area	Section C-Value	Elevations		Slopes	
Start	End			Start	End	Grade	In/Back
103+00.00	103+50.00	0.051 ac	0.60	881.41 ft	880.91 ft	1.00%	4:1/3:1
103+50.00	104+00.00	0.048 ac	0.60	880.91 ft	880.41 ft	1.00%	4:1/3:1
104+00.00	104+50.00	0.047 ac	0.60	880.41 ft	879.91 ft	1.00%	4:1/3:1
104+50.00	105+00.00	0.046 ac	0.60	879.91 ft	879.41 ft	1.00%	4:1/3:1
105+00.00	105+50.00	0.037 ac	0.60	879.41 ft	878.91 ft	1.00%	4:1/3:1
105+50.00	106+00.00	0.037 ac	0.60	878.91 ft	878.41 ft	1.00%	4:1/3:1
106+00.00	106+50.00	0.076 ac	0.60	878.41 ft	878.00 ft	0.82%	4:1/3:1

NOTE: Cross-Sections are in order of decreasing elevation.

DITCH ANALYSIS

PID : **Date :** 05/17/2006 **Project :** TR117 Hamilton Mason Road **Location :** Ditch #5

Description : Sta. 103+00 LT to Sta. 106+50 LT **Designer :** RII

Rainfall Area : D

Allowable Shears

	Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If a shear value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
103+00	103+50	L	50.00	2.00	4.00	3.00	0.0100	0.05	0.05	0.60	0.03	Seed	4.42	5	0.035	11.17	0.76	0.05	0.14	0.08	2.55
												Seed	5.19	10	0.035	11.10	0.80	0.05	0.16	0.09	2.60
103+50	104+00	L	50.00	2.00	4.00	3.00	0.0100	0.05	0.10	0.60	0.06	Seed	4.29	5	0.035	12.07	0.90	0.07	0.26	0.12	2.82
												Seed	5.05	10	0.035	11.96	0.95	0.08	0.30	0.13	2.90
104+00	104+50	L	50.00	2.00	4.00	3.00	0.0100	0.05	0.15	0.60	0.09	Seed	4.19	5	0.035	12.87	1.01	0.09	0.37	0.14	3.01
												Seed	4.93	10	0.035	12.73	1.09	0.10	0.43	0.16	3.09
104+50	105+00	L	50.00	2.00	4.00	3.00	0.0100	0.05	0.19	0.60	0.12	Seed	4.09	5	0.035	13.62	1.12	0.10	0.47	0.16	3.15
												Seed	4.82	10	0.035	13.44	1.18	0.11	0.56	0.18	3.26
105+00	105+50	L	50.00	2.00	4.00	3.00	0.0100	0.04	0.23	0.60	0.14	Seed	4.01	5	0.035	14.34	1.17	0.11	0.55	0.18	3.26
												Seed	4.73	10	0.035	14.12	1.22	0.12	0.65	0.20	3.38
105+50	106+00	L	50.00	2.00	4.00	3.00	0.0100	0.04	0.27	0.60	0.16	Seed	3.93	5	0.035	15.02	1.20	0.12	0.63	0.20	3.37
												Seed	4.64	10	0.035	14.77	1.28	0.13	0.74	0.21	3.48
106+00	106+50	L	50.00	2.00	4.00	3.00	0.0082	0.08	0.34	0.60	0.21	Seed	3.85	5	0.035	15.71	1.21	0.12	0.79	0.23	3.63

DITCH ANALYSIS

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
												Seed	4.55	10	0.035	15.42	1.27	0.13	0.93	0.25	3.78

	Ditch Design Parameters and Design Data - Ditch # 6 (Cross-Sections 118+00 LT to 120+00 LT)			
	Project:	TR-117 (H-M Road)	Date:	5/23/2006

DITCH DESIGN PARAMETERS

ALLOWABLE SHEAR		FLOW INFORMATION	
Seed	0.40 psf	Watershed Area Code (Fig. 1101-3)	D
Sod	1.00 psf	Initial Time of Concentration	10 Minutes
Type 1 Matting	2.00 psf	Depth Frequency	10-year
Type 2 Matting	3.00 psf	Shear Frequency	5-year
Type 3 Matting	5.00 psf		

DITCH DESIGN DATA

Cross-Sections		Section Area	Section C-Value	Elevations		Slopes	
Start	End			Start	End	Grade	In/Back
118+00.00	118+50.00	0.032 ac	0.60	881.13 ft	879.00 ft	4.26%	4:1/3:1
118+50.00	119+00.00	0.032 ac	0.60	879.00 ft	877.00 ft	4.00%	4:1/3:1
119+00.00	119+50.00	0.033 ac	0.60	877.00 ft	875.00 ft	4.00%	4:1/3:1
119+50.00	120+00.00	0.033 ac	0.60	875.00 ft	873.00 ft	4.00%	4:1/3:1

NOTE: Cross-Sections are in order of decreasing elevation.

DITCH ANALYSIS

PID : **Date :** 05/17/2006 **Project :** TR117 Hamilton-Mason Road **Location :** Ditch #6

Description : Sta. 118+00 LT to Sta. 120+00 LT **Designer :** RII

Rainfall Area : D

Allowable Shears

	Seed:	0.40	**Jute Mat:**	0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:**	3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00				

(*) Warning: Grade is steeper than allowable. If a shear value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (In./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
118+00	118+50	L	50.00	2.00	4.00	3.00	0.0426	0.03	0.03	0.60	0.02	Seed	4.48	5	0.035	10.79	1.03	0.10	0.09	0.04	2.27
												Seed	5.24	10	0.035	10.82	0.99	0.12	0.10	0.05	2.33
118+50	119+00	L	50.00	2.00	4.00	3.00	0.0400	0.03	0.06	0.60	0.04	Seed	4.38	5	0.035	11.46	1.21	0.16	0.17	0.06	2.44
												Seed	5.14	10	0.035	11.43	1.33	0.17	0.20	0.07	2.46
119+00	119+50	L	50.00	2.00	4.00	3.00	0.0400	0.03	0.10	0.60	0.06	Seed	4.30	5	0.035	12.04	1.41	0.20	0.25	0.08	2.55
												Seed	5.05	10	0.035	11.98	1.49	0.21	0.29	0.09	2.60
119+50	120+00	L	50.00	2.00	4.00	3.00	0.0400	0.03	0.13	0.60	0.08	Seed	4.23	5	0.035	12.57	1.59	0.22	0.33	0.09	2.63
												Seed	4.97	10	0.035	12.49	1.66	0.25	0.39	0.10	2.70

Project: H-M ROAD
Stream name: Tributary to Little Muddy Creek
Location: STATION 81+95.00

Date: 5/22/06

Geographic region = C

Contributing drainage area = 0.073 square miles (46.7 acres)
Main-channel slope = 91.3 feet per mile
Storage area = 0.50%

Recurrence Interval (Years)	Regression Estimate (cfs)
2	23
5	42
10	57
25	75
50	89
100	102

Recurrence Interval (Years)	Regression Estimate (cfs)	90% Confidence Limits for Regression Estimate	
		Upper (cfs)	Lower (cfs)
2	23	46	12
5	42	72	25
10	57	97	33
25	75	132	42
50	89	162	49
100	102	194	54

Warning: the value of one or more basin characteristics is outside the range of characteristics for sites in this region.

Warning: The regression equations used by this program tend to overestimate peak discharges for basins having approximately 30 percent or more surface-mined area. For more information, refer to page 15 of the reference report.

CURRENT DATE: 05-23-2006
CURRENT TIME: 12:57:24

FILE DATE: 5/23/2006
FILE NAME: HM82F3

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	877.69	877.30	126.00	1 RCPE	5.00	3.17	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: HM82F3 DATE: 5/23/2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
881.35	75.0	75.0	0.0	0.0	0.0	0.0	0.0	0.00	1
881.43	77.7	77.7	0.0	0.0	0.0	0.0	0.0	0.00	1
881.52	80.4	80.4	0.0	0.0	0.0	0.0	0.0	0.00	1
881.61	83.1	83.1	0.0	0.0	0.0	0.0	0.0	0.00	1
881.68	85.8	85.8	0.0	0.0	0.0	0.0	0.0	0.00	1
881.76	88.5	88.5	0.0	0.0	0.0	0.0	0.0	0.00	1
881.77	89.0	89.0	0.0	0.0	0.0	0.0	0.0	0.00	1
881.94	93.9	93.9	0.0	0.0	0.0	0.0	0.0	0.00	1
882.05	96.6	96.6	0.0	0.0	0.0	0.0	0.0	0.00	1
882.18	99.3	99.3	0.0	0.0	0.0	0.0	0.0	0.00	1
882.30	102.0	102.0	0.0	0.0	0.0	0.0	0.0	0.00	1
883.06	116.7	116.7	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: HM82F3 DATE: 5/23/2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
881.35	0.000	75.00	0.00	0.00
881.43	0.000	77.70	0.00	0.00
881.52	0.000	80.40	0.00	0.00
881.61	0.000	83.10	0.00	0.00
881.68	0.000	85.80	0.00	0.00
881.76	0.000	88.50	0.00	0.00
881.77	0.000	89.00	0.00	0.00
881.94	0.000	93.90	0.00	0.00
882.05	0.000	96.60	0.00	0.00
882.18	0.000	99.30	0.00	0.00
882.30	0.000	102.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 05-23-2006
CURRENT TIME: 12:57:24

FILE DATE: 5/23/2006
FILE NAME: HM82F3

PERFORMANCE CURVE FOR CULVERT 1 - 1(5.00 (ft) BY 3.17 (ft)) RCPE

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
75.00	881.35	3.47	3.66	2-M2c	2.25	2.19	2.19	1.65	8.03	3.94
77.70	881.43	3.57	3.74	2-M2c	2.31	2.23	2.23	1.68	8.15	3.97
80.40	881.52	3.68	3.83	2-M2c	2.38	2.27	2.27	1.70	8.29	4.01
83.10	881.61	3.79	3.92	2-M2c	2.44	2.30	2.30	1.73	8.42	4.04
85.80	881.68	3.89	3.99	2-M2c	2.50	2.34	2.34	1.76	8.55	4.07
88.50	881.76	4.01	4.07	2-M2c	2.59	2.38	2.38	1.79	8.67	4.11
89.00	881.77	4.03	4.08	2-M2c	2.60	2.39	2.39	1.81	8.70	4.14
93.90	881.94	4.24	4.25	2-M2c	2.79	2.46	2.46	1.84	8.91	4.16
96.60	882.05	4.36	4.34	2-M2c	3.17	2.49	2.49	1.86	9.03	4.20
99.30	882.18	4.49	4.43	2-M2c	3.17	2.53	2.53	1.89	9.13	4.22
102.00	882.30	4.61	4.51	2-M2c	3.17	2.56	2.56	1.91	9.28	4.25

El. inlet face invert 877.69 ft El. outlet invert 877.30 ft
El. inlet throat invert 0.00 ft El. inlet crest 877.69 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	0.00 ft
INLET ELEVATION	877.69 ft
OUTLET STATION	126.00 ft
OUTLET ELEVATION	877.30 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0031
CULVERT LENGTH ALONG SLOPE	126.00 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	ELLIPTICAL
BARREL SPAN	5.00 ft
BARREL RISE	3.17 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQ. EDGE WITH HEADWALL
INLET DEPRESSION	NONE

CURRENT DATE: 05-23-2006
CURRENT TIME: 12:57:24

FILE DATE: 5/23/2006
FILE NAME: HM82F3

TAILWATER

******* REGULAR CHANNEL CROSS SECTION **********

BOTTOM WIDTH	2.00 ft
SIDE SLOPE H/V (X:1)	4.0
CHANNEL SLOPE V/H (ft/ft)	0.008
MANNING'S n (.01-0.1)	0.035
CHANNEL INVERT ELEVATION	877.00 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	877.30 ft

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
75.00	878.95	0.666	1.95	3.94	0.97
77.70	878.98	0.668	1.98	3.97	0.99
80.40	879.00	0.669	2.00	4.01	1.00
83.10	879.03	0.670	2.03	4.04	1.01
85.80	879.06	0.672	2.06	4.07	1.03
88.50	879.09	0.673	2.09	4.11	1.04
89.00	879.11	0.674	2.11	4.14	1.05
93.90	879.14	0.676	2.14	4.16	1.07
96.60	879.16	0.677	2.16	4.20	1.08
99.30	879.19	0.678	2.19	4.22	1.09
102.00	879.21	0.679	2.21	4.25	1.10

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	105.00 ft
CREST LENGTH	200.00 ft
OVERTOPPING CREST ELEVATION	883.06 ft

Project: H-M ROAD
Date: 5/22/06
Stream name: Triutary to Little Muddy Creek
Location: STA. 94+14.00

Geographic region = C

Contributing drainage area = 0.160 square miles (102 acres)
Main-channel slope = 61.3 feet per mile
Storage area = 0.00%

Recurrence Interval (Years)	Regression Estimate (cfs)
2	45
5	81
10	107
25	141
50	166
100	191

Recurrence Interval (Years)	Regression Estimate (cfs)	90% Confidence Limits for Regression Estimate	
		Upper (cfs)	Lower (cfs)
2	45	89	23
5	81	138	47
10	107	183	63
25	141	247	80
50	166	301	92
100	191	358	102

Warning: the value of one or more basin characteristics is outside the range of characteristics for sites in this region.

Warning: The regression equations used by this program tend to overestimate peak discharges for basins having approximately 30 percent or more surface-mined area. For more information, refer to page 15 of the reference report.

CURRENT DATE: 05-22-2006
CURRENT TIME: 16:37:08

FILE DATE: 5/22/2006
FILE NAME: HM94F

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	868.88	868.62	98.00	1 RCB	8.00	4.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: HM94F DATE: 5/22/2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
872.55	141.0	141.0	0.0	0.0	0.0	0.0	0.0	0.00	1
872.63	146.0	146.0	0.0	0.0	0.0	0.0	0.0	0.00	1
872.71	151.0	151.0	0.0	0.0	0.0	0.0	0.0	0.00	1
872.80	156.0	156.0	0.0	0.0	0.0	0.0	0.0	0.00	1
872.84	159.0	159.0	0.0	0.0	0.0	0.0	0.0	0.00	1
872.96	166.0	166.0	0.0	0.0	0.0	0.0	0.0	0.00	1
873.04	171.0	171.0	0.0	0.0	0.0	0.0	0.0	0.00	1
873.12	176.0	176.0	0.0	0.0	0.0	0.0	0.0	0.00	1
873.20	181.0	181.0	0.0	0.0	0.0	0.0	0.0	0.00	1
873.28	186.0	186.0	0.0	0.0	0.0	0.0	0.0	0.00	1
873.36	191.0	191.0	0.0	0.0	0.0	0.0	0.0	0.00	1
875.02	277.3	277.3	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: HM94F DATE: 5/22/2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
872.55	0.000	141.00	0.00	0.00
872.63	0.000	146.00	0.00	0.00
872.71	0.000	151.00	0.00	0.00
872.80	0.000	156.00	0.00	0.00
872.84	0.000	159.00	0.00	0.00
872.96	0.000	166.00	0.00	0.00
873.04	0.000	171.00	0.00	0.00
873.12	0.000	176.00	0.00	0.00
873.20	0.000	181.00	0.00	0.00
873.28	0.000	186.00	0.00	0.00
873.36	0.000	191.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 05-22-2006
CURRENT TIME: 16:37:08

FILE DATE: 5/22/2006
FILE NAME: HM94F

PERFORMANCE CURVE FOR CULVERT 1 - 1(8.00 (ft) BY 4.00 (ft)) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
141.00	872.55	3.60	3.67	3-M1t	2.17	2.13	2.80	2.80	6.28	4.61
146.00	872.63	3.68	3.75	3-M1t	2.23	2.18	2.84	2.84	6.42	4.65
151.00	872.71	3.77	3.83	3-M1t	2.28	2.23	2.88	2.88	6.56	4.69
156.00	872.80	3.85	3.92	3-M1t	2.33	2.28	2.91	2.91	6.70	4.73
159.00	872.84	3.90	3.96	3-M1t	2.37	2.31	2.93	2.93	6.78	4.75
166.00	872.96	4.02	4.08	3-M1t	2.44	2.38	2.98	2.98	6.97	4.81
171.00	873.04	4.11	4.16	3-M1t	2.49	2.43	3.01	3.01	7.10	4.84
176.00	873.12	4.20	4.24	3-M1t	2.54	2.47	3.04	3.04	7.23	4.88
181.00	873.20	4.28	4.32	3-M1t	2.59	2.52	3.08	3.08	7.36	4.91
186.00	873.28	4.37	4.40	3-M1t	2.64	2.57	3.11	3.11	7.48	4.95
191.00	873.36	4.46	4.48	3-M1t	2.69	2.61	3.14	3.14	7.61	4.98

El. inlet face invert 868.88 ft El. outlet invert 868.62 ft
El. inlet throat invert 0.00 ft El. inlet crest 868.88 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	0.00 ft
INLET ELEVATION	868.88 ft
OUTLET STATION	98.00 ft
OUTLET ELEVATION	868.62 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0027
CULVERT LENGTH ALONG SLOPE	98.00 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	8.00 ft
BARREL RISE	4.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (90-45 DEG.)
INLET DEPRESSION	NONE

CURRENT DATE: 05-22-2006
CURRENT TIME: 16:37:08

FILE DATE: 5/22/2006
FILE NAME: HM94F

TAILWATER

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH	2.00 ft
SIDE SLOPE H/V (X:1)	4.0
CHANNEL SLOPE V/H (ft/ft)	0.008
MANNING'S n (.01-0.1)	0.035
CHANNEL INVERT ELEVATION	868.90 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	868.62 ft

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
141.00	871.42	0.693	2.52	4.61	1.26
146.00	871.46	0.694	2.56	4.65	1.28
151.00	871.50	0.696	2.60	4.69	1.30
156.00	871.53	0.697	2.63	4.73	1.31
159.00	871.55	0.698	2.65	4.75	1.32
166.00	871.60	0.700	2.70	4.81	1.35
171.00	871.63	0.701	2.73	4.84	1.36
176.00	871.66	0.703	2.76	4.88	1.38
181.00	871.70	0.704	2.80	4.91	1.40
186.00	871.73	0.705	2.83	4.95	1.41
191.00	871.76	0.706	2.86	4.98	1.43

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	68.00 ft
CREST LENGTH	200.00 ft
OVERTOPPING CREST ELEVATION	875.02 ft

Project: H-M ROAD Date: 5/22/06
Stream name: Tributary to Little Muddy Creek
Location: STA. 108+85.46

Geographic region = C

Contributing drainage area = 0.050 square miles (32.0 acres)
Main-channel slope = 104 feet per mile
Storage area = 0.00%

Recurrence Interval (Years)	Regression Estimate (cfs)
2	20
5	37
10	50
25	67
50	80
100	92

Recurrence Interval (Years)	Regression Estimate (cfs)	90% Confidence Limits for Regression Estimate	
		Upper (cfs)	Lower (cfs)
2	20	39	10
5	37	63	22
10	50	86	29
25	67	118	38
50	80	146	44
100	92	176	48

Warning: the value of one or more basin characteristics is outside the range of characteristics for sites in this region.

Warning: the combination of basin characteristics for this site yields extrapolated estimates of peak discharge. Because the accuracy of the predictive equations is questionable under these conditions, the peak discharge estimates should be used only with extreme caution.

Warning: The regression equations used by this program tend to overestimate peak discharges for basins having approximately 30 percent or more surface-mined area. For more information, refer to page 15 of the reference report.

CURRENT DATE: 05-18-2006
CURRENT TIME: 10:23:57

FILE DATE: 5/18/2006
FILE NAME: HM109F

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	872.49	871.61	125.00	1 RCP	3.50	3.50	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: HM109F DATE: 5/18/2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
876.77	67.0	67.0	0.0	0.0	0.0	0.0	0.0	0.00	1
876.91	69.5	69.5	0.0	0.0	0.0	0.0	0.0	0.00	1
877.05	72.0	72.0	0.0	0.0	0.0	0.0	0.0	0.00	1
877.21	74.5	74.5	0.0	0.0	0.0	0.0	0.0	0.00	1
877.24	75.0	75.0	0.0	0.0	0.0	0.0	0.0	0.00	1
877.53	79.5	79.5	0.0	0.0	0.0	0.0	0.0	0.00	1
877.70	82.0	82.0	0.0	0.0	0.0	0.0	0.0	0.00	1
877.87	84.5	84.5	0.0	0.0	0.0	0.0	0.0	0.00	1
878.05	87.0	87.0	0.0	0.0	0.0	0.0	0.0	0.00	1
878.24	89.5	89.5	0.0	0.0	0.0	0.0	0.0	0.00	1
878.43	92.0	92.0	0.0	0.0	0.0	0.0	0.0	0.00	1
880.25	112.7	112.7	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: HM109F DATE: 5/18/2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
876.77	0.000	67.00	0.00	0.00
876.91	0.000	69.50	0.00	0.00
877.05	0.000	72.00	0.00	0.00
877.21	0.000	74.50	0.00	0.00
877.24	0.000	75.00	0.00	0.00
877.53	0.000	79.50	0.00	0.00
877.70	0.000	82.00	0.00	0.00
877.87	0.000	84.50	0.00	0.00
878.05	0.000	87.00	0.00	0.00
878.24	0.000	89.50	0.00	0.00
878.43	0.000	92.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 05-18-2006
CURRENT TIME: 10:23:57

FILE DATE: 5/18/2006
FILE NAME: HM109F

PERFORMANCE CURVE FOR CULVERT 1 - 1(3.50 (ft) BY 3.50 (ft)) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
67.00	876.77	4.28	4.28	5-S2n	2.23	2.56	2.16	1.65	10.78	2.91
69.50	876.91	4.42	4.42	5-S2n	2.29	2.60	2.32	1.68	10.28	2.94
72.00	877.05	4.56	4.56	5-S2n	2.35	2.65	2.37	1.71	10.37	2.96
74.50	877.21	4.72	4.72	5-S2n	2.40	2.69	2.43	1.74	10.46	2.99
75.00	877.24	4.75	4.75	5-S2n	2.42	2.70	2.44	1.76	10.48	3.02
79.50	877.53	5.04	5.04	5-S2n	2.53	2.78	2.55	1.78	10.59	3.04
82.00	877.70	5.21	5.21	5-S2n	2.60	2.82	2.52	1.80	11.07	3.06
84.50	877.87	5.38	5.38	5-S2n	2.67	2.85	2.68	1.83	10.70	3.09
87.00	878.05	5.56	5.56	5-S2n	2.74	2.88	2.68	1.85	11.01	3.11
89.50	878.24	5.75	5.75	5-S2n	2.81	2.92	2.72	1.87	11.19	3.13
92.00	878.43	5.94	5.94	5-S2n	2.92	2.95	2.85	1.90	10.96	3.15

El. inlet face invert 872.49 ft El. outlet invert 871.61 ft
El. inlet throat invert 0.00 ft El. inlet crest 872.49 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	0.00 ft
INLET ELEVATION	872.49 ft
OUTLET STATION	125.00 ft
OUTLET ELEVATION	871.61 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0070
CULVERT LENGTH ALONG SLOPE	125.00 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	3.50 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

CURRENT DATE: 05-18-2006
CURRENT TIME: 10:23:57

FILE DATE: 5/18/2006
FILE NAME: HM109F

TAILWATER

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH	4.00 ft
SIDE SLOPE H/V (X:1)	6.0
CHANNEL SLOPE V/H (ft/ft)	0.005
MANNING'S n (.01-0.1)	0.035
CHANNEL INVERT ELEVATION	871.61 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	871.61 ft

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
67.00	873.26	0.522	1.65	2.91	0.52
69.50	873.29	0.523	1.68	2.94	0.52
72.00	873.32	0.524	1.71	2.96	0.53
74.50	873.35	0.526	1.74	2.99	0.54
75.00	873.37	0.527	1.76	3.02	0.55
79.50	873.39	0.528	1.78	3.04	0.56
82.00	873.41	0.529	1.80	3.06	0.56
84.50	873.44	0.530	1.83	3.09	0.57
87.00	873.46	0.531	1.85	3.11	0.58
89.50	873.48	0.532	1.87	3.13	0.58
92.00	873.51	0.533	1.90	3.15	0.59

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	68.00 ft
CREST LENGTH	200.00 ft
OVERTOPPING CREST ELEVATION	880.25 ft

EXFILTRATION TRENCH DESIGN

Ex T	Station	Offset	Side	Drainage Limits		Road Width	i	Cq	Length	Total Area	Lt = (A*Cq)/689	Length
				Start	End							
1	69+66.90	46.50	R	67+10	70+00	50.5	0.337	0.245	290	43500	15.4625	16
2	73+41.67	46.50	R	70+00	73+75	50.5	0.337	0.245	375	56250	19.9946	20
3	75+14.68	46.50	R	73+75	75+50	50.5	0.337	0.245	175	26250	9.3308	12
4	80+22.17	46.00	L	77+00	80+50	46	0.347	0.250	350	52500	19.0743	20
5	80+23.87	32.00	R	77+00	80+50	34	0.227	0.185	350	52500	14.1237	16
6	82+02.85	46.00	L	80+50	82+26	46	0.347	0.250	176	26400	9.5916	12
7	82+04.81	32.00	R	80+50	82+26	34	0.227	0.185	176	26400	7.1022	8
8	82+52.85	46.00	L	85+00	82+26	46	0.347	0.250	274	41100	14.9324	16
9	82+50.81	32.00	R	85+00	82+26	34	0.227	0.185	274	41100	11.0569	12
10	85+23.94	32.00	L	87+50	85+00	34	0.267	0.207	250	37500	11.2774	12
11	85+23.94	32.00	R	87+50	85+00	34	0.227	0.185	250	37500	10.0884	12
12	89+73.67	32.00	L	87+50	90+00	66	0.480	0.327	250	37500	17.7810	20
13	91+76.00	32.00	L	90+00	92+00	34	0.267	0.207	200	30000	9.0219	12
14	91+76.00	32.00	R	90+00	92+00	34	0.227	0.185	200	30000	8.0707	12
15	94+45.15	32.00	L	92+00	94+69	34	0.227	0.185	269	40350	10.8551	12
16	94+45.15	32.00	R	92+00	94+69	34	0.227	0.185	269	40350	10.8551	12
17	94+93.15	32.00	L	97+50	94+69	34	0.227	0.185	281	42150	11.3393	12
18	94+93.15	32.00	R	97+50	94+69	34	0.227	0.185	281	42150	11.3393	12
19	97+76.00	32.00	L	100+50	97+50	34	0.267	0.207	300	45000	13.5329	16
20	97+76.00	32.00	R	100+50	97+50	34	0.227	0.185	300	45000	12.1061	16
21	100+72.00	32.00	L	102+50	100+50	34	0.267	0.207	200	30000	9.0219	12
22	100+72.00	32.00	R	102+50	100+50	34	0.227	0.185	200	30000	8.0707	12
23	103+28.32	32.00	L	102+50	103+50	34	0.267	0.207	100	15000	4.5110	8
24	103+28.32	32.00	R	102+50	103+50	34	0.227	0.185	100	15000	4.0354	8
25	105+89.75	32.00	L	103+50	106+50	34	0.267	0.207	300	45000	13.5329	16
26	106+23.93	32.00	R	103+50	106+50	34	0.227	0.185	300	45000	12.1061	16
27	108+79.60	32.00	L	106+50	109+06	34	0.267	0.207	256	38400	11.5481	12
28	108+79.60	32.00	R	106+50	109+06	34	0.227	0.185	256	38400	10.3305	12
29	109+29.60	32.00	L	111+94	109+06	34	0.267	0.207	288	43200	12.9916	16
30	109+29.60	32.00	R	111+94	109+06	34	0.227	0.185	288	43200	11.6218	12
31	112+20.09	32.00	L	115+00	111+94	34	0.267	0.207	306	45900	13.8035	16
32	112+20.09	32.00	R	115+00	111+94	34	0.227	0.185	306	45900	12.3482	16
33	117+26.15	32.00	L	115+00	117+50	34	0.267	0.207	250	37500	11.2774	12
34	117+26.15	32.00	R	115+00	117+50	34	0.227	0.185	250	37500	10.0884	12
35	119+69.89	32.00	L	117+50	119+94	34	0.267	0.207	244	36600	11.0067	12
36	119+69.89	32.00	R	117+50	119+94	34	0.227	0.185	244	36600	9.8463	12

NOTE: Calculations for I, Cq, and area all use the "strip method" as required by 2 L&D 1118-1 (assumes 150 ft width of R/W off of the centerline). Of this 150 ft, the impervious area is the roadway width plus 4 feet for a sidewalk (if applicable).

DRANAGE AREA MAP

T.R. 21 (H-M RD.)
BUTLER COUNTY, OHIO

CALCULATED ECH
CHECKED SSK

HORIZONTAL SCALE IN FEET
0 200 400

LEGEND

- PROPOSED CATCH BASIN
- PROPOSED MANHOLE
- DIRECTION OF RUNOFF FLOW
- DRAINAGE DIVIDE

NOTE: CONTOURS AT FIVE FOOT INTERVALS

BEGIN WORK STA. 69+98.00

BEGIN PROJECT STA. 73+89.09 S.L.M. 9.58

END WORK STA. 16+09.30

BEGIN WORK STA. 6+62.80

END WORK STA. 121+00

END PROJECT STA. 120+51.02 S.L.M. 10.46

A = 0.27 AC. C = 0.80
A = 0.40 AC. C = 0.80
A = 0.41 AC. C = 0.80
A = 0.65 AC. C = 0.80
A = 0.48 AC. C = 0.80
A = 0.30 AC. C = 0.80
A = 0.50 AC. C = 0.80
A = 0.20 AC. C = 0.80
A = 0.33 AC. C = 0.80
A = 0.39 AC. C = 0.80
A = 0.30 AC. C = 0.80
A = 0.22 AC. C = 0.80
A = 0.63 AC. C = 0.80
A = 0.21 AC. C = 0.80
A = 0.24 AC. C = 0.80
A = 0.49 AC. C = 0.80
A = 0.26 AC. C = 0.80
A = 0.17 AC. C = 0.80
A = 0.34 AC. C = 0.80
A = 0.23 AC. C = 0.80
A = 0.11 AC. C = 0.80
A = 0.34 AC. C = 0.80
A = 0.60 AC. C = 0.80
A = 0.65 AC. C = 0.80
A = 0.41 AC. C = 0.80
A = 0.21 AC. C = 0.80
A = 0.21 AC. C = 0.80
A = 0.21 AC. C = 0.80
A = 0.17 AC. C = 0.80
A = 0.08 AC. C = 0.80
A = 0.26 AC. C = 0.80
A = 0.50 AC. C = 0.80
A = 0.31 AC. C = 0.80
A = 0.16 AC. C = 0.80
A = 0.16 AC. C = 0.80

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117

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HAMILTON-MASON ROAD

Drainage Computations

Stage 3 Submittal
May, 2006

Resource International Inc.
6350 Presidential Gateway
Columbus, Ohio 43231
(614) 823-4949

Narrative

I. Project Overview

The purpose of this project is to widen Hamilton Mason Road between its overpass of Interstate 75 and Butler-Warren Road. The existing roadway will be resurfaced and new roadway will be constructed in both directions. The intersection with Cox Road will be reconstructed to provide a four-leg intersection in order to accommodate the extension of Cox Road. New drainage facilities will be provided for the entire roadway, consisting largely of curb and gutter. Some ditch sections will be constructed to assist with conveying pavement drainage to existing watercourses and to pick up drainage of small "pocket" areas outside the curb line. The new mainline roadway will consist of two travel lanes in each direction along with protected right and left turn lanes at the intersections with Cox Road and at Butler-Warren Road. The new roadway will also provide a center left turn lane for driveways along the entire length of the reconstruction of Hamilton-Mason Road.

The project's drainage basins generally flow to the north. Three primary drainage channels drain the project area. The western half of the project area (between Interstate 75 and the driveway to the park near Station 87+50) drains to a culvert near existing Station 82+00. This drainage area consists of area located on the southeast corner of the intersection of Hamilton-Mason and Cox Road (largely park land) and a small area in the southwest corner of the intersection of Hamilton-Mason and Cox Road (lightly developed commercial area). The primary drainage channel is a roadside ditch along the south side of Hamilton-Mason Road that crosses under Hamilton-Mason Road through the culvert and flows northeast. The remaining half of the project area is drained with three drainage channels, one flowing to the culvert at Station 94+40, one flowing to a culvert near Station 108+60, and a small drainage area draining to a culvert under Butler-Warren Road at the eastern end of the project area.

The drainage system consists largely of closed systems, with some open systems to convey drainage to receiving waters and to pick up isolated areas of low points outside the curb and gutter. Three culverts will either be extended or replaced. The design constraints of each are based on the Location and Design Manual, Volume 2.

II. Closed System Design

The closed system consists of several separate storm sewer lines. All but three flow to the three culverts in the project area. The westernmost system (near Interstate 75) captures drainage west of the Hamilton-Mason and Cox Road intersection, conveys it to the southwest corner of the intersection where it flows under Cox Road and into the ditch leading to the culvert at Station 82+00. A smaller system just east of the intersection drains the eastern and northern sides of the intersection, discharging the drainage into the ditch on the north side of Hamilton-Mason Road. One storm sewer system captures drainage between Stations 80+50 and 87+50, discharging near the culvert at Station 82+00. Two systems, one on each side of the culvert at Station 94+40, capture drainage

between Stations 87+50 and 102+50, discharging it immediately downstream of the culvert. Two more storm sewer systems, one on each side of the culver at Station 108+60, capture the drainage between Stations 102+50 and 115+00 and discharge it directly into the proposed 42" culvert at Station 108+60. The easternmost system, capturing drainage between Stations 115+00 and 121+00, discharges into an existing 15" culvert under Butler-Warren Road just north of the intersection between Butler-Warren Road and Hamilton Mason Road.

All closed systems were designed in accordance with the Location and Design Manual, Volume 2.

III. Culverts

Three culverts drain the project area. Three streams drain the project area. One, near Station 82+00, captures flow from the intersection area of Cox Road and Hamilton-Mason Road and some of the flow from the park. The second culvert, at Station 94+40, captures flow from the park area just west of the existing pond. The final culvert, near Station 108+60, drains park land just north (downstream) of the existing pond in the park.

The design flows were obtained by performing a PeakFlow analysis on the contributing watershed. The culvert alternatives were then analyzed using HY-8 to provide adequate hydraulic conveyance while minimizing cost and impact to the reconstructed and widened Hamilton-Mason Road. Where possible, the existing type of culvert was maintained (and upsized if required). The culvert at Station 82+00 was replaced with a proposed elliptical pipe because the elliptical pipe provides adequate capacity at lower cost.

IV. Water Quality Design

Each of the project's drainage areas was evaluated to determine whether the disturbance requires a post-construction BMP, in accordance with Section 1115 of the Location and Design Manual, Volume 2.

There are several distinct overall drainage areas within the project area. All involve the use of closed systems draining to roadway ditches or one of the three culverts passing under the roadway. With the exception of one closed system (at the westernmost edge of the project), the closed systems discharge drainage at or near the downstream end of the proposed culverts or into ditches that empty into receiving waters downstream of the culverts.

The only real alternatives for treatment in a closed system are the use of manufactured systems, use of exfiltration trenches, or the use of ponds at the system outlets. Of these alternatives, only exfiltration trenches are technologically and economically feasible for this project. Detention ponds will consume vast tracts of right-of-way, as four ponds will need to be constructed (one at each culvert and one near Butler-Warren Road). Any proposed pond will require detention of an existing stream. Manufactured systems are extremely costly to install and require specialized equipment to maintain. They are economically infeasible to install and maintain when only four will be required. Exfiltration trenches provide the best treatment option, as they treat individual small

drainage areas at each catch basin and are easily integrated into the construction of the curb and gutter of the roadway. No additional right-of-way or costly specialized maintenance equipment is required.

The design of the exfiltration trenches followed 2 L&D § 1118 and used the recommended strip method, which assumes a contributing area that is 150 feet wide (from the centerline of the roadway) and as long as the drainage area to the next catch basin. The required length of the exfiltration trench is based on the total area and the impervious percentage, rounded up to the nearest four foot increment. We have attached a design spreadsheet detailing the computation of the area, impervious percentage, and the required exfiltration trench length. The exfiltration trenches are shown on the plan and profile sheets.

TMDL Note

According to the Ohio Environmental Protection Agency, no Total Maximum Daily Loading (TMDL) regulations have been promulgated under Section 303(d) of the Federal Water Pollution Control Act for the Little Muddy Creek, the ultimate receiving waters for this project. The project watershed is located near the upper reaches of the East Fork of Mill Creek, for which the Ohio EPA promulgated a final TMDL regulation in 2004 (*see* "Total Maximum Daily Loads for the Mill Creek Basin – Final Report" *available at* http://www.epa.state.oh.us/dsw/tmdl/Mill_Creek_sep04_final.pdf) as approved by the US EPA on April 26, 2005, but none of the project drainage reaches this regulated watershed.

Rii	Ditch Design Parameters and Design Data - Ditch # 1 (Cross-Sections 80+50 to 82+50 Left)			
	Project:	TR-117 (H-M Road)	Date:	5/23/2006

DITCH DESIGN PARAMETERS			
ALLOWABLE SHEAR		FLOW INFORMATION	
Seed	0.40 psf	Watershed Area Code (Fig. 1101-3)	D
Sod	1.00 psf	Initial Time of Concentration	12 min
Type 1 Matting	2.00 psf	Depth Frequency	10-year
Type 2 Matting	3.00 psf	Shear Frequency	5-year
Type 3 Matting	5.00 psf		

DITCH DESIGN DATA

Cross-Sections		Section Area	Section C-Value	Elevations		Slopes	
Start	End			Start	End	Grade	In/Back
80+50.00	81+00.00	1.440 ac	0.80	878.70 ft	878.10 ft	1.20%	4:1/3:1
81+00.00	81+50.00	0.040 ac	0.60	878.10 ft	877.80 ft	0.60%	4:1/3:1
81+50.00	82+00.00	0.040 ac	0.60	877.80 ft	877.30 ft	1.00%	4:1/3:1
82+00.00	82+50.00	0.040 ac	0.60	877.30 ft	876.80 ft	1.00%	4:1/3:1

DITCH ANALYSIS

PID : **Date :** 05/17/2006 **Project :** TR117 Hamilton-Mason Road **Location :** Ditch #1

Description : Hamilton-Mason Road Sta. 80+50 LT. to Sta. 82+20 LT.

Designer : RII

Rainfall Area : D

Allowable Shears

	Seed:	0.40	**Jute Mat:** 0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:** 3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00			

(*) Warning: Grade is steeper than allowable. If a shear value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
80+50	81+00	L	50.00	2.00	4.00	3.00	0.0120	1.44	1.44	0.80	1.15	Seed	4.26	5	0.035	12.36	2.33	0.41	4.90	0.54	5.79
												Jute Mat	4.25	5	0.040	12.39	2.11	0.43	4.90	0.58	6.04
												Jute Mat	4.98	10	0.040	12.38	2.20	0.47	5.74	0.62	6.36
81+00	81+50	L	50.00	2.00	4.00	3.00	0.0060	0.04	1.48	0.60	1.18	Seed	4.19	5	0.035	12.85	1.81	0.24	4.93	0.64	6.49
												Seed	4.92	10	0.035	12.82	1.89	0.26	5.78	0.69	6.85
81+50	82+00	L	50.00	2.00	4.00	3.00	0.0100	0.04	1.52	0.60	1.20	Seed	4.14	5	0.035	13.23	2.19	0.36	4.97	0.57	5.99
												Seed	4.86	10	0.035	13.18	2.28	0.38	5.83	0.62	6.31
82+00	82+50	L	50.00	2.00	4.00	3.00	0.0100	0.04	1.56	0.60	1.22	Seed	4.10	5	0.035	13.61	2.19	0.36	5.01	0.57	6.00
												Seed	4.81	10	0.035	13.54	2.29	0.39	5.88	0.62	6.33

Rii	Ditch Design Parameters and Design Data - Ditch # 2 (Cross-Sections 77+68 RT to 82+00 RT)			
	Project:	TR-117 (H-M Road)	Date:	5/23/2006

DITCH DESIGN PARAMETERS			
ALLOWABLE SHEAR		FLOW INFORMATION	
Seed	0.40 psf	Watershed Area Code (Fig. 1101-3)	D
Sod	1.00 psf	Initial Time of Concentration	10 Minutes
Type 1 Matting	2.00 psf	Depth Frequency	10-year
Type 2 Matting	3.00 psf	Shear Frequency	5-year
Type 3 Matting	5.00 psf		

DITCH DESIGN DATA							
Cross-Sections		Section Area	Section C-Value	Elevations		Slopes	
Start	End			Start	End	Grade	In/Back
77+68.09	78+00.00	11.100 ac	0.65	878.80 ft	878.70 ft	0.31%	4:1/3:1
78+00.00	78+50.00	0.147 ac	0.60	878.70 ft	878.50 ft	0.40%	4:1/3:1
78+50.00	79+00.00	0.080 ac	0.60	878.50 ft	878.30 ft	0.40%	4:1/3:1
79+00.00	79+50.00	0.070 ac	0.60	878.30 ft	878.10 ft	0.40%	4:1/3:1
79+50.00	80+00.00	0.050 ac	0.60	878.10 ft	877.90 ft	0.40%	4:1/3:1
80+00.00	80+50.00	0.050 ac	0.60	877.90 ft	877.70 ft	0.40%	4:1/3:1
80+50.00	81+00.00	0.050 ac	0.60	877.70 ft	877.50 ft	0.40%	4:1/3:1
81+00.00	81+50.00	0.050 ac	0.60	877.50 ft	877.30 ft	0.40%	4:1/3:1
81+50.00	81+80.00	0.030 ac	0.60	877.30 ft	877.18 ft	0.40%	4:1/3:1

DITCH ANALYSIS

PID : **Date :** 05/17/2006 **Project :** TR117 Hamilton-Mason Road **Location :** Ditch #2

Description : Station 77+68 RT to 81+80 RT

Designer : RII

Rainfall Area : D

Allowable Shears

	Seed:	0.40	**Jute Mat:** 0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:** 3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00			

(*) Warning: Grade is steeper than allowable. If a shear value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
77+68	78+00	R	50.00	2.00	4.00	3.00	0.0031	11.10	11.10	0.65	7.22	Seed	3.41	5	0.035	20.39	2.14	0.30	24.57	1.55	12.82
												Seed	3.99	10	0.035	20.37	2.23	0.32	28.76	1.65	13.58
78+00	78+50	R	50.00	2.00	4.00	3.00	0.0040	0.15	11.25	0.60	7.30	Seed	3.38	5	0.035	20.74	2.36	0.37	24.66	1.47	12.26
												Seed	3.95	10	0.035	20.71	2.46	0.39	28.87	1.57	12.98
78+50	79+00	R	50.00	2.00	4.00	3.00	0.0040	0.08	11.33	0.60	7.35	Seed	3.35	5	0.035	21.09	2.36	0.37	24.61	1.46	12.25
												Seed	3.92	10	0.035	21.05	2.46	0.39	28.82	1.57	12.97
79+00	79+50	R	50.00	2.00	4.00	3.00	0.0040	0.07	11.40	0.60	7.39	Seed	3.32	5	0.035	21.45	2.36	0.37	24.54	1.46	12.24
												Seed	3.89	10	0.035	21.39	2.45	0.39	28.75	1.57	12.96
79+50	80+00	R	50.00	2.00	4.00	3.00	0.0040	0.05	11.45	0.60	7.42	Seed	3.29	5	0.035	21.80	2.35	0.36	24.43	1.46	12.22
												Seed	3.86	10	0.035	21.73	2.45	0.39	28.63	1.56	12.94
80+00	80+50	R	50.00	2.00	4.00	3.00	0.0040	0.05	11.50	0.60	7.45	Seed	3.26	5	0.035	22.15	2.35	0.36	24.32	1.46	12.20
												Seed	3.83	10	0.035	22.07	2.45	0.39	28.51	1.56	12.92
80+50	81+00	R	50.00	2.00	4.00	3.00	0.0040	0.05	11.55	0.60	7.48	Seed	3.24	5	0.035	22.51	2.35	0.36	24.22	1.45	12.18

DITCH ANALYSIS

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
												Seed	3.79	10	0.035	22.41	2.45	0.39	28.40	1.56	12.90
81+00	81+50	R	50.00	2.00	4.00	3.00	0.0040	0.05	11.60	0.60	7.51	Seed	3.21	5	0.035	22.86	2.35	0.36	24.11	1.45	12.16
												Seed	3.76	10	0.035	22.75	2.44	0.39	28.29	1.56	12.89
81+50	81+80	R	30.00	2.00	4.00	3.00	0.0040	0.03	11.63	0.60	7.53	Seed	3.19	5	0.035	23.07	2.35	0.36	24.05	1.45	12.15
												Seed	3.75	10	0.035	22.95	2.44	0.39	28.22	1.55	12.87

Rii	Ditch Design Parameters and Design Data - Ditch # 3 (Cross-Sections 85+50 RT to 82+20.50 RT)			
	Project:	TR-117 (H-M Road)	Date:	5/23/2006

DITCH DESIGN PARAMETERS			
ALLOWABLE SHEAR		FLOW INFORMATION	
Seed	0.40 psf	Watershed Area Code (Fig. 1101-3)	D
Sod	1.00 psf	Initial Time of Concentration	10 Minutes
Type 1 Matting	2.00 psf	Depth Frequency	10-year
Type 2 Matting	3.00 psf	Shear Frequency	5-year
Type 3 Matting	5.00 psf		

DITCH DESIGN DATA							
Cross-Sections		Section Area	Section C-Value	Elevations		Slopes	
Start	End			Start	End	Grade	In/Back
86+50.00	86+00.00	0.87 ac	0.60	883.20 ft	882.90 ft	0.60%	4:1/3:1
86+00.00	85+50.00	0.13 ac	0.60	882.90 ft	882.60 ft	0.60%	4:1/3:1
85+50.00	85+00.00	0.15 ac	0.60	882.60 ft	882.30 ft	0.60%	4:1/3:1
85+00.00	84+50.00	0.18 ac	0.60	882.30 ft	881.60 ft	1.40%	4:1/3:1
84+50.00	84+00.00	0.21 ac	0.60	881.60 ft	880.90 ft	1.40%	4:1/3:1
84+00.00	83+50.00	0.16 ac	0.60	880.90 ft	880.10 ft	1.60%	4:1/3:1
83+50.00	83+00.00	0.17 ac	0.60	880.10 ft	879.40 ft	1.40%	4:1/3:1
83+00.00	82+50.00	0.17 ac	0.60	879.40 ft	878.80 ft	1.20%	4:1/3:1
82+50.00	82+00.00	0.14 ac	0.60	878.80 ft	878.50 ft	0.60%	4:1/3:1
82+00.00	81+60.00	0.08 ac	0.60	878.50 ft	878.30 ft	0.50%	4:1/3:1

DITCH ANALYSIS

PID : **Date :** 05/17/2006 **Project :** TR117 Hamilton-Mason Road **Location :** Ditch #3

Description : Station 86+50 LT to 81+60 RT **Designer :** RII

Rainfall Area : D

Allowable Shears

	Seed:	0.40	**Jute Mat:** 0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:** 3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00			

(*) Warning: Grade is steeper than allowable. If a shear value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
86+50	86+00	R	50.00	2.00	4.00	3.00	0.0060	0.87	0.87	0.60	0.52	Seed	4.51	5	0.035	10.56	1.49	0.17	2.35	0.45	5.12
												Seed	5.29	10	0.035	10.54	1.55	0.18	2.76	0.48	5.38
86+00	85+50	R	50.00	2.00	4.00	3.00	0.0060	0.13	1.00	0.60	0.60	Seed	4.43	5	0.035	11.10	1.53	0.18	2.66	0.47	5.32
												Seed	5.20	10	0.035	11.05	1.60	0.19	3.12	0.51	5.60
85+50	85+00	R	50.00	2.00	4.00	3.00	0.0060	0.15	1.15	0.60	0.69	Seed	4.36	5	0.035	11.62	1.58	0.19	3.01	0.50	5.53
												Seed	5.12	10	0.035	11.56	1.66	0.20	3.53	0.54	5.81
85+00	84+50	R	50.00	2.00	4.00	3.00	0.0140	0.18	1.33	0.60	0.80	Seed	4.30	5	0.035	12.00	2.24	0.38	3.43	0.44	5.05
												Seed	5.06	10	0.035	11.91	2.34	0.41	4.04	0.47	5.31
84+50	84+00	R	50.00	2.00	4.00	3.00	0.0140	0.21	1.54	0.60	0.92	Seed	4.26	5	0.035	12.35	2.32	0.41	3.93	0.47	5.27
												Jute Mat	4.25	5	0.040	12.39	2.11	0.44	3.93	0.50	5.49
												Jute Mat	5.00	10	0.040	12.29	2.20	0.47	4.62	0.54	5.78
84+00	83+50	R	50.00	2.00	4.00	3.00	0.0160	0.16	1.70	0.60	1.02	Seed	4.21	5	0.035	12.72	2.49	0.47	4.29	0.47	5.30
												Jute Mat	4.20	5	0.040	12.76	2.26	0.50	4.29	0.50	5.53

DITCH ANALYSIS

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
												Temp. Mat	4.20	5	0.040	12.76	2.26	0.50	4.29	0.50	5.53
												Temp. Mat	4.94	10	0.040	12.64	2.36	0.55	5.04	0.55	5.82
83+50	83+00	R	50.00	2.00	4.00	3.00	0.0140	0.17	1.87	0.60	1.12	Seed	4.16	5	0.035	13.10	2.43	0.44	4.67	0.51	5.55
												Jute Mat	4.16	5	0.040	13.13	2.21	0.47	4.66	0.54	5.79
												Temp. Mat	4.16	5	0.040	13.13	2.21	0.47	4.66	0.54	5.79
												Temp. Mat	4.89	10	0.040	13.00	2.31	0.51	5.48	0.59	6.11
83+00	82+50	R	50.00	2.00	4.00	3.00	0.0120	0.17	2.04	0.60	1.22	Seed	4.11	5	0.035	13.49	2.34	0.41	5.03	0.55	5.83
												Jute Mat	4.11	5	0.040	13.52	2.13	0.44	5.03	0.58	6.09
												Jute Mat	4.83	10	0.040	13.38	2.22	0.47	5.91	0.63	6.42
82+50	82+00	R	50.00	2.00	4.00	3.00	0.0060	0.01	2.05	0.60	1.23	Seed	4.05	5	0.035	13.98	1.82	0.24	4.99	0.65	6.52
												Seed	4.77	10	0.035	13.81	1.89	0.26	5.88	0.70	6.89
82+00	81+60	R	40.00	2.00	4.00	3.00	0.0050	0.08	2.13	0.60	1.28	Seed	4.00	5	0.035	14.37	1.71	0.21	5.13	0.68	6.79
												Seed	4.72	10	0.035	14.19	1.78	0.23	6.04	0.74	7.17

Rii	Ditch Design Parameters and Design Data - Ditch # 4 (Cross-Sections 97+00 RT to 94+13.77 RT)			
	Project:	TR-117 (H-M Road)	Date:	5/23/2006

DITCH DESIGN PARAMETERS			
ALLOWABLE SHEAR		FLOW INFORMATION	
Seed	0.40 psf	Watershed Area Code (Fig. 1101-3)	D
Sod	1.00 psf	Initial Time of Concentration	10 Minutes
Type 1 Matting	2.00 psf	Depth Frequency	10-year
Type 2 Matting	3.00 psf	Shear Frequency	5-year
Type 3 Matting	5.00 psf		

DITCH DESIGN DATA							
Cross-Sections		Section Area	Section C-Value	Elevations		Slopes	
Start	End			Start	End	Grade	In/Back
97+00.00	96+50.00	0.047 ac	0.60	875.54 ft	874.30 ft	2.48%	4:1/3:1
96+50.00	96+00.00	0.074 ac	0.60	874.30 ft	873.00 ft	2.60%	4:1/3:1
96+00.00	95+50.00	0.073 ac	0.60	873.00 ft	871.70 ft	2.60%	4:1/3:1
95+50.00	95+00.00	0.049 ac	0.60	871.70 ft	870.40 ft	2.60%	4:1/3:1
95+00.00	94+50.00	0.041 ac	0.60	870.40 ft	869.10 ft	2.60%	4:1/3:1
94+50.00	94+13.77	0.041 ac	0.60	869.10 ft	868.72 ft	1.05%	4:1/3:1

DITCH ANALYSIS

PID : **Date :** 06/30/2005 **Project :** TR117 Hamilton-Mason Road **Location :** Ditch #4

Description : Sta. 97+00 RT to Sta. 94+13.77 **Designer :** RII

Rainfall Area : D

Allowable Shears

		Seed:	0.40	**Jute Mat:** 0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:** 3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00			

(*) Warning: Grade is steeper than allowable. If a shear value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
97+00	96+50	R	50.00	2.00	4.00	3.00	0.0248	0.05	0.05	0.60	0.03	Seed	4.46	5	0.035	10.89	0.97	0.09	0.13	0.06	2.41
												Seed	5.24	10	0.035	10.81	1.00	0.10	0.15	0.07	2.46
96+50	96+00	R	50.00	2.00	4.00	3.00	0.0260	0.07	0.12	0.60	0.07	Seed	4.37	5	0.035	11.51	1.33	0.16	0.32	0.10	2.71
												Seed	5.14	10	0.035	11.41	1.43	0.18	0.37	0.11	2.77
96+00	95+50	R	50.00	2.00	4.00	3.00	0.0260	0.07	0.19	0.60	0.12	Seed	4.30	5	0.035	12.04	1.56	0.21	0.50	0.13	2.92
												Seed	5.06	10	0.035	11.91	1.63	0.23	0.59	0.14	3.01
95+50	95+00	R	50.00	2.00	4.00	3.00	0.0260	0.05	0.24	0.60	0.15	Seed	4.23	5	0.035	12.54	1.68	0.24	0.62	0.15	3.03
												Seed	4.98	10	0.035	12.38	1.77	0.26	0.73	0.16	3.12
95+00	94+50	R	50.00	2.00	4.00	3.00	0.0260	0.04	0.28	0.60	0.17	Seed	4.17	5	0.035	13.02	1.73	0.26	0.71	0.16	3.12
												Seed	4.91	10	0.035	12.83	1.85	0.28	0.84	0.17	3.22
94+50	94+14	R	34.23	2.00	4.00	3.00	0.0105	0.04	0.33	0.60	0.20	Seed	4.12	5	0.035	13.44	1.33	0.14	0.80	0.22	3.53
												Seed	4.85	10	0.035	13.24	1.40	0.16	0.95	0.24	3.67

Rii	Ditch Design Parameters and Design Data - Ditch # 5 (Cross-Sections 103+00 LT to 106+50 LT)			
	Project:	TR-117 (H-M Road)	Date:	5/23/2006

DITCH DESIGN PARAMETERS			
ALLOWABLE SHEAR		FLOW INFORMATION	
Seed	0.40 psf	Watershed Area Code (Fig. 1101-3)	D
Sod	1.00 psf	Initial Time of Concentration	10 Minutes
Type 1 Matting	2.00 psf	Depth Frequency	10-year
Type 2 Matting	3.00 psf	Shear Frequency	5-year
Type 3 Matting	5.00 psf		

DITCH DESIGN DATA							
Cross-Sections		Section Area	Section C-Value	Elevations		Slopes	
Start	End			Start	End	Grade	In/Back
103+00.00	103+50.00	0.051 ac	0.60	881.41 ft	880.91 ft	1.00%	4:1/3:1
103+50.00	104+00.00	0.048 ac	0.60	880.91 ft	880.41 ft	1.00%	4:1/3:1
104+00.00	104+50.00	0.047 ac	0.60	880.41 ft	879.91 ft	1.00%	4:1/3:1
104+50.00	105+00.00	0.046 ac	0.60	879.91 ft	879.41 ft	1.00%	4:1/3:1
105+00.00	105+50.00	0.037 ac	0.60	879.41 ft	878.91 ft	1.00%	4:1/3:1
105+50.00	106+00.00	0.037 ac	0.60	878.91 ft	878.41 ft	1.00%	4:1/3:1
106+00.00	106+50.00	0.076 ac	0.60	878.41 ft	878.00 ft	0.82%	4:1/3:1

DITCH ANALYSIS

PID : **Date :** 05/17/2006 **Project :** TR117 Hamilton Mason Road **Location :** Ditch #5

Description : Sta. 103+00 LT to Sta. 106+50 LT **Designer :** RII

Rainfall Area : D

Allowable Shears

		Seed:	0.40	**Jute Mat:** 0.45	**Temporary Mat:**	1.00
	Permanent Mat	**Type 1:**	2.00	**Type 2:** 3.00	**Type 3:**	5.00
	RCP	**Type B:**	6.00			

(*) Warning: Grade is steeper than allowable. If a shear value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
103+00	103+50	L	50.00	2.00	4.00	3.00	0.0100	0.05	0.05	0.60	0.03	Seed	4.42	5	0.035	11.17	0.76	0.05	0.14	0.08	2.55
												Seed	5.19	10	0.035	11.10	0.80	0.05	0.16	0.09	2.60
103+50	104+00	L	50.00	2.00	4.00	3.00	0.0100	0.05	0.10	0.60	0.06	Seed	4.29	5	0.035	12.07	0.90	0.07	0.26	0.12	2.82
												Seed	5.05	10	0.035	11.96	0.95	0.08	0.30	0.13	2.90
104+00	104+50	L	50.00	2.00	4.00	3.00	0.0100	0.05	0.15	0.60	0.09	Seed	4.19	5	0.035	12.87	1.01	0.09	0.37	0.14	3.01
												Seed	4.93	10	0.035	12.73	1.09	0.10	0.43	0.16	3.09
104+50	105+00	L	50.00	2.00	4.00	3.00	0.0100	0.05	0.19	0.60	0.12	Seed	4.09	5	0.035	13.62	1.12	0.10	0.47	0.16	3.15
												Seed	4.82	10	0.035	13.44	1.18	0.11	0.56	0.18	3.26
105+00	105+50	L	50.00	2.00	4.00	3.00	0.0100	0.04	0.23	0.60	0.14	Seed	4.01	5	0.035	14.34	1.17	0.11	0.55	0.18	3.26
												Seed	4.73	10	0.035	14.12	1.22	0.12	0.65	0.20	3.38
105+50	106+00	L	50.00	2.00	4.00	3.00	0.0100	0.04	0.27	0.60	0.16	Seed	3.93	5	0.035	15.02	1.20	0.12	0.63	0.20	3.37
												Seed	4.64	10	0.035	14.77	1.28	0.13	0.74	0.21	3.48
106+00	106+50	L	50.00	2.00	4.00	3.00	0.0082	0.08	0.34	0.60	0.21	Seed	3.85	5	0.035	15.71	1.21	0.12	0.79	0.23	3.63

DITCH ANALYSIS

STATION BEGIN	STATION END	SIDE LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
											Seed	4.55	10	0.035	15.42	1.27	0.13	0.93	0.25	3.78

Rii	Ditch Design Parameters and Design Data - Ditch # 6 (Cross-Sections 118+00 LT to 120+00 LT)			
	Project:	TR-117 (H-M Road)	Date:	5/23/2006

DITCH DESIGN PARAMETERS			
ALLOWABLE SHEAR		FLOW INFORMATION	
Seed	0.40 psf	Watershed Area Code (Fig. 1101-3)	D
Sod	1.00 psf	Initial Time of Concentration	10 Minutes
Type 1 Matting	2.00 psf	Depth Frequency	10-year
Type 2 Matting	3.00 psf	Shear Frequency	5-year
Type 3 Matting	5.00 psf		

DITCH DESIGN DATA							
Cross-Sections		Section Area	Section C-Value	Elevations		Slopes	
Start	End			Start	End	Grade	In/Back
118+00.00	118+50.00	0.032 ac	0.60	881.13 ft	879.00 ft	4.26%	4:1/3:1
118+50.00	119+00.00	0.032 ac	0.60	879.00 ft	877.00 ft	4.00%	4:1/3:1
119+00.00	119+50.00	0.033 ac	0.60	877.00 ft	875.00 ft	4.00%	4:1/3:1
119+50.00	120+00.00	0.033 ac	0.60	875.00 ft	873.00 ft	4.00%	4:1/3:1

DITCH ANALYSIS

PID : **Date :** 05/17/2006 **Project :** TR117 Hamilton-Mason Road **Location :** Ditch #6

Description : Sta. 118+00 LT to Sta. 120+00 LT **Designer :** RII

Rainfall Area : D

Allowable Shears

	Seed:	0.40	**Jute Mat:** 0.45	**Temporary Mat:**	1.00
Permanent Mat	**Type 1:**	2.00	**Type 2:** 3.00	**Type 3:**	5.00
RCP	**Type B:**	6.00			

(*) Warning: Grade is steeper than allowable. If a shear value is parantheses, design parameters have been exceeded. - See user manual.

STATION BEGIN	STATION END	SIDE	LENGTH (ft.)	RADIUS WIDTH (ft.)	IN SLOPE (ft./ft.)	BACK SLOPE (ft./ft.)	GRADE (ft./ft.)	AREA (acres)	AREA SUM (acres)	RUNOFF COEFF.	CA (Sum)	PROTECT TYPE	RAIN INT. (in./hr.)	STORM FREQ. (yrs.)	MANN. COEFF.	TIME FLOW (min.)	VEL. FLOW (fps.)	SHEAR (lbs./ sq.ft.)	DESIGN FLOW (cfs.)	DEPTH FLOW (ft.)	WIDTH FLOW (ft.)
118+00	118+50	L	50.00	2.00	4.00	3.00	0.0426	0.03	0.03	0.60	0.02	Seed	4.48	5	0.035	10.79	1.03	0.10	0.09	0.04	2.27
												Seed	5.24	10	0.035	10.82	0.99	0.12	0.10	0.05	2.33
118+50	119+00	L	50.00	2.00	4.00	3.00	0.0400	0.03	0.06	0.60	0.04	Seed	4.38	5	0.035	11.46	1.21	0.16	0.17	0.06	2.44
												Seed	5.14	10	0.035	11.43	1.33	0.17	0.20	0.07	2.46
119+00	119+50	L	50.00	2.00	4.00	3.00	0.0400	0.03	0.10	0.60	0.06	Seed	4.30	5	0.035	12.04	1.41	0.20	0.25	0.08	2.55
												Seed	5.05	10	0.035	11.98	1.49	0.21	0.29	0.09	2.60
119+50	120+00	L	50.00	2.00	4.00	3.00	0.0400	0.03	0.13	0.60	0.08	Seed	4.23	5	0.035	12.57	1.59	0.22	0.33	0.09	2.63
												Seed	4.97	10	0.035	12.49	1.66	0.25	0.39	0.10	2.70

Project: H-M ROAD
Stream name: Tributary to Little Muddy Creek
Location: STATION 81+95.00

Date: 5/22/06

Geographic region = C

Contributing drainage area = 0.073 square miles (46.7 acres)
Main-channel slope = 91.3 feet per mile
Storage area = 0.50%

Recurrence Interval (Years)	Regression Estimate (cfs)
2	23
5	42
10	57
25	75
50	89
100	102

Recurrence Interval (Years)	Regression Estimate (cfs)	90% Confidence Limits for Regression Estimate	
		Upper (cfs)	Lower (cfs)
2	23	46	12
5	42	72	25
10	57	97	33
25	75	132	42
50	89	162	49
100	102	194	54

Warning: the value of one or more basin characteristics is outside the range of characteristics for sites in this region.

Warning: The regression equations used by this program tend to overestimate peak discharges for basins having approximately 30 percent or more surface-mined area. For more information, refer to page 15 of the reference report.

CURRENT DATE: 05-23-2006
CURRENT TIME: 12:57:24

FILE DATE: 5/23/2006
FILE NAME: HM82F3

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	877.69	877.30	126.00	1 RCPE	5.00	3.17	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: HM82F3 DATE: 5/23/2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
881.35	75.0	75.0	0.0	0.0	0.0	0.0	0.0	0.00	1
881.43	77.7	77.7	0.0	0.0	0.0	0.0	0.0	0.00	1
881.52	80.4	80.4	0.0	0.0	0.0	0.0	0.0	0.00	1
881.61	83.1	83.1	0.0	0.0	0.0	0.0	0.0	0.00	1
881.68	85.8	85.8	0.0	0.0	0.0	0.0	0.0	0.00	1
881.76	88.5	88.5	0.0	0.0	0.0	0.0	0.0	0.00	1
881.77	89.0	89.0	0.0	0.0	0.0	0.0	0.0	0.00	1
881.94	93.9	93.9	0.0	0.0	0.0	0.0	0.0	0.00	1
882.05	96.6	96.6	0.0	0.0	0.0	0.0	0.0	0.00	1
882.18	99.3	99.3	0.0	0.0	0.0	0.0	0.0	0.00	1
882.30	102.0	102.0	0.0	0.0	0.0	0.0	0.0	0.00	1
883.06	116.7	116.7	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: HM82F3 DATE: 5/23/2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
881.35	0.000	75.00	0.00	0.00
881.43	0.000	77.70	0.00	0.00
881.52	0.000	80.40	0.00	0.00
881.61	0.000	83.10	0.00	0.00
881.68	0.000	85.80	0.00	0.00
881.76	0.000	88.50	0.00	0.00
881.77	0.000	89.00	0.00	0.00
881.94	0.000	93.90	0.00	0.00
882.05	0.000	96.60	0.00	0.00
882.18	0.000	99.30	0.00	0.00
882.30	0.000	102.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 05-23-2006
CURRENT TIME: 12:57:24

FILE DATE: 5/23/2006
FILE NAME: HM82F3

PERFORMANCE CURVE FOR CULVERT 1 - 1(5.00 (ft) BY 3.17 (ft)) RCPE

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
75.00	881.35	3.47	3.66	2-M2c	2.25	2.19	2.19	1.65	8.03	3.94
77.70	881.43	3.57	3.74	2-M2c	2.31	2.23	2.23	1.68	8.15	3.97
80.40	881.52	3.68	3.83	2-M2c	2.38	2.27	2.27	1.70	8.29	4.01
83.10	881.61	3.79	3.92	2-M2c	2.44	2.30	2.30	1.73	8.42	4.04
85.80	881.68	3.89	3.99	2-M2c	2.50	2.34	2.34	1.76	8.55	4.07
88.50	881.76	4.01	4.07	2-M2c	2.59	2.38	2.38	1.79	8.67	4.11
89.00	881.77	4.03	4.08	2-M2c	2.60	2.39	2.39	1.81	8.70	4.14
93.90	881.94	4.24	4.25	2-M2c	2.79	2.46	2.46	1.84	8.91	4.16
96.60	882.05	4.36	4.34	2-M2c	3.17	2.49	2.49	1.86	9.03	4.20
99.30	882.18	4.49	4.43	2-M2c	3.17	2.53	2.53	1.89	9.13	4.22
102.00	882.30	4.61	4.51	2-M2c	3.17	2.56	2.56	1.91	9.28	4.25

El. inlet face invert 877.69 ft El. outlet invert 877.30 ft
El. inlet throat invert 0.00 ft El. inlet crest 877.69 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	0.00 ft
INLET ELEVATION	877.69 ft
OUTLET STATION	126.00 ft
OUTLET ELEVATION	877.30 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0031
CULVERT LENGTH ALONG SLOPE	126.00 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	ELLIPTICAL
BARREL SPAN	5.00 ft
BARREL RISE	3.17 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQ. EDGE WITH HEADWALL
INLET DEPRESSION	NONE

CURRENT DATE: 05-23-2006
CURRENT TIME: 12:57:24

FILE DATE: 5/23/2006
FILE NAME: HM82F3

TAILWATER

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH	2.00 ft
SIDE SLOPE H/V (X:1)	4.0
CHANNEL SLOPE V/H (ft/ft)	0.008
MANNING'S n (.01-0.1)	0.035
CHANNEL INVERT ELEVATION	877.00 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	877.30 ft

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
75.00	878.95	0.666	1.95	3.94	0.97
77.70	878.98	0.668	1.98	3.97	0.99
80.40	879.00	0.669	2.00	4.01	1.00
83.10	879.03	0.670	2.03	4.04	1.01
85.80	879.06	0.672	2.06	4.07	1.03
88.50	879.09	0.673	2.09	4.11	1.04
89.00	879.11	0.674	2.11	4.14	1.05
93.90	879.14	0.676	2.14	4.16	1.07
96.60	879.16	0.677	2.16	4.20	1.08
99.30	879.19	0.678	2.19	4.22	1.09
102.00	879.21	0.679	2.21	4.25	1.10

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	105.00 ft
CREST LENGTH	200.00 ft
OVERTOPPING CREST ELEVATION	883.06 ft

Project: H-M ROAD
Stream name: Triutary to Little Muddy Creek
Location: STA. 94+14.00

Date: 5/22/06

Geographic region = C

Contributing drainage area = 0.160 square miles (102 acres)
Main-channel slope = 61.3 feet per mile
Storage area = 0.00%

Recurrence Interval (Years)	Regression Estimate (cfs)
2	45
5	81
10	107
25	141
50	166
100	191

Recurrence Interval (Years)	Regression Estimate (cfs)	90% Confidence Limits for Regression Estimate	
		Upper (cfs)	Lower (cfs)
2	45	89	23
5	81	138	47
10	107	183	63
25	141	247	80
50	166	301	92
100	191	358	102

Warning: the value of one or more basin characteristics is outside the range of characteristics for sites in this region.

Warning: The regression equations used by this program tend to overestimate peak discharges for basins having approximately 30 percent or more surface-mined area. For more information, refer to page 15 of the reference report.

CURRENT DATE: 05-22-2006
CURRENT TIME: 16:37:08

FILE DATE: 5/22/2006
FILE NAME: HM94F

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
	INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	868.88	868.62	98.00	1 RCB	8.00	4.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: HM94F DATE: 5/22/2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
872.55	141.0	141.0	0.0	0.0	0.0	0.0	0.0	0.00	1
872.63	146.0	146.0	0.0	0.0	0.0	0.0	0.0	0.00	1
872.71	151.0	151.0	0.0	0.0	0.0	0.0	0.0	0.00	1
872.80	156.0	156.0	0.0	0.0	0.0	0.0	0.0	0.00	1
872.84	159.0	159.0	0.0	0.0	0.0	0.0	0.0	0.00	1
872.96	166.0	166.0	0.0	0.0	0.0	0.0	0.0	0.00	1
873.04	171.0	171.0	0.0	0.0	0.0	0.0	0.0	0.00	1
873.12	176.0	176.0	0.0	0.0	0.0	0.0	0.0	0.00	1
873.20	181.0	181.0	0.0	0.0	0.0	0.0	0.0	0.00	1
873.28	186.0	186.0	0.0	0.0	0.0	0.0	0.0	0.00	1
873.36	191.0	191.0	0.0	0.0	0.0	0.0	0.0	0.00	1
875.02	277.3	277.3	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: HM94F DATE: 5/22/2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
872.55	0.000	141.00	0.00	0.00
872.63	0.000	146.00	0.00	0.00
872.71	0.000	151.00	0.00	0.00
872.80	0.000	156.00	0.00	0.00
872.84	0.000	159.00	0.00	0.00
872.96	0.000	166.00	0.00	0.00
873.04	0.000	171.00	0.00	0.00
873.12	0.000	176.00	0.00	0.00
873.20	0.000	181.00	0.00	0.00
873.28	0.000	186.00	0.00	0.00
873.36	0.000	191.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 05-22-2006
CURRENT TIME: 16:37:08

FILE DATE: 5/22/2006
FILE NAME: HM94F

PERFORMANCE CURVE FOR CULVERT 1 - 1(8.00 (ft) BY 4.00 (ft)) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
141.00	872.55	3.60	3.67	3-M1t	2.17	2.13	2.80	2.80	6.28	4.61
146.00	872.63	3.68	3.75	3-M1t	2.23	2.18	2.84	2.84	6.42	4.65
151.00	872.71	3.77	3.83	3-M1t	2.28	2.23	2.88	2.88	6.56	4.69
156.00	872.80	3.85	3.92	3-M1t	2.33	2.28	2.91	2.91	6.70	4.73
159.00	872.84	3.90	3.96	3-M1t	2.37	2.31	2.93	2.93	6.78	4.75
166.00	872.96	4.02	4.08	3-M1t	2.44	2.38	2.98	2.98	6.97	4.81
171.00	873.04	4.11	4.16	3-M1t	2.49	2.43	3.01	3.01	7.10	4.84
176.00	873.12	4.20	4.24	3-M1t	2.54	2.47	3.04	3.04	7.23	4.88
181.00	873.20	4.28	4.32	3-M1t	2.59	2.52	3.08	3.08	7.36	4.91
186.00	873.28	4.37	4.40	3-M1t	2.64	2.57	3.11	3.11	7.48	4.95
191.00	873.36	4.46	4.48	3-M1t	2.69	2.61	3.14	3.14	7.61	4.98

El. inlet face invert 868.88 ft El. outlet invert 868.62 ft
El. inlet throat invert 0.00 ft El. inlet crest 868.88 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	0.00 ft
INLET ELEVATION	868.88 ft
OUTLET STATION	98.00 ft
OUTLET ELEVATION	868.62 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0027
CULVERT LENGTH ALONG SLOPE	98.00 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	8.00 ft
BARREL RISE	4.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (90-45 DEG.)
INLET DEPRESSION	NONE

CURRENT DATE: 05-22-2006
CURRENT TIME: 16:37:08

FILE DATE: 5/22/2006
FILE NAME: HM94F

TAILWATER

******* REGULAR CHANNEL CROSS SECTION ***************

BOTTOM WIDTH	2.00 ft
SIDE SLOPE H/V (X:1)	4.0
CHANNEL SLOPE V/H (ft/ft)	0.008
MANNING'S n (.01-0.1)	0.035
CHANNEL INVERT ELEVATION	868.90 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	868.62 ft

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
141.00	871.42	0.693	2.52	4.61	1.26
146.00	871.46	0.694	2.56	4.65	1.28
151.00	871.50	0.696	2.60	4.69	1.30
156.00	871.53	0.697	2.63	4.73	1.31
159.00	871.55	0.698	2.65	4.75	1.32
166.00	871.60	0.700	2.70	4.81	1.35
171.00	871.63	0.701	2.73	4.84	1.36
176.00	871.66	0.703	2.76	4.88	1.38
181.00	871.70	0.704	2.80	4.91	1.40
186.00	871.73	0.705	2.83	4.95	1.41
191.00	871.76	0.706	2.86	4.98	1.43

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	68.00 ft
CREST LENGTH	200.00 ft
OVERTOPPING CREST ELEVATION	875.02 ft

Project: H-M ROAD
Stream name: Tributary to Little Muddy Creek
Location: STA. 108+85.46

Date: 5/22/06

Geographic region = C

Contributing drainage area = 0.050 square miles (32.0 acres)
Main-channel slope = 104 feet per mile
Storage area = 0.00%

Recurrence Interval (Years)	Regression Estimate (cfs)
2	20
5	37
10	50
25	67
50	80
100	92

Recurrence Interval (Years)	Regression Estimate (cfs)	90% Confidence Limits for Regression Estimate	
		Upper (cfs)	Lower (cfs)
2	20	39	10
5	37	63	22
10	50	86	29
25	67	118	38
50	80	146	44
100	92	176	48

Warning: the value of one or more basin characteristics is outside the range of characteristics for sites in this region.

Warning: the combination of basin characteristics for this site yields extrapolated estimates of peak discharge. Because the accuracy of the predictive equations is questionable under these conditions, the peak discharge estimates should be used only with extreme caution.

Warning: The regression equations used by this program tend to overestimate peak discharges for basins having approximately 30 percent or more surface-mined area. For more information, refer to page 15 of the reference report.

CURRENT DATE: 05-18-2006
CURRENT TIME: 10:23:57

FILE DATE: 5/18/2006
FILE NAME: HM109F

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

CULV NO.	SITE DATA: INLET ELEV. (ft)	SITE DATA: OUTLET ELEV. (ft)	SITE DATA: CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	872.49	871.61	125.00	1 RCP	3.50	3.50	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: HM109F DATE: 5/18/2006

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
876.77	67.0	67.0	0.0	0.0	0.0	0.0	0.0	0.00	1
876.91	69.5	69.5	0.0	0.0	0.0	0.0	0.0	0.00	1
877.05	72.0	72.0	0.0	0.0	0.0	0.0	0.0	0.00	1
877.21	74.5	74.5	0.0	0.0	0.0	0.0	0.0	0.00	1
877.24	75.0	75.0	0.0	0.0	0.0	0.0	0.0	0.00	1
877.53	79.5	79.5	0.0	0.0	0.0	0.0	0.0	0.00	1
877.70	82.0	82.0	0.0	0.0	0.0	0.0	0.0	0.00	1
877.87	84.5	84.5	0.0	0.0	0.0	0.0	0.0	0.00	1
878.05	87.0	87.0	0.0	0.0	0.0	0.0	0.0	0.00	1
878.24	89.5	89.5	0.0	0.0	0.0	0.0	0.0	0.00	1
878.43	92.0	92.0	0.0	0.0	0.0	0.0	0.0	0.00	1
880.25	112.7	112.7	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: HM109F DATE: 5/18/2006

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
876.77	0.000	67.00	0.00	0.00
876.91	0.000	69.50	0.00	0.00
877.05	0.000	72.00	0.00	0.00
877.21	0.000	74.50	0.00	0.00
877.24	0.000	75.00	0.00	0.00
877.53	0.000	79.50	0.00	0.00
877.70	0.000	82.00	0.00	0.00
877.87	0.000	84.50	0.00	0.00
878.05	0.000	87.00	0.00	0.00
878.24	0.000	89.50	0.00	0.00
878.43	0.000	92.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 05-18-2006
CURRENT TIME: 10:23:57

FILE DATE: 5/18/2006
FILE NAME: HM109F

PERFORMANCE CURVE FOR CULVERT 1 - 1(3.50 (ft) BY 3.50 (ft)) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
67.00	876.77	4.28	4.28	5-S2n	2.23	2.56	2.16	1.65	10.78	2.91
69.50	876.91	4.42	4.42	5-S2n	2.29	2.60	2.32	1.68	10.28	2.94
72.00	877.05	4.56	4.56	5-S2n	2.35	2.65	2.37	1.71	10.37	2.96
74.50	877.21	4.72	4.72	5-S2n	2.40	2.69	2.43	1.74	10.46	2.99
75.00	877.24	4.75	4.75	5-S2n	2.42	2.70	2.44	1.76	10.48	3.02
79.50	877.53	5.04	5.04	5-S2n	2.53	2.78	2.55	1.78	10.59	3.04
82.00	877.70	5.21	5.21	5-S2n	2.60	2.82	2.52	1.80	11.07	3.06
84.50	877.87	5.38	5.38	5-S2n	2.67	2.85	2.68	1.83	10.70	3.09
87.00	878.05	5.56	5.56	5-S2n	2.74	2.88	2.68	1.85	11.01	3.11
89.50	878.24	5.75	5.75	5-S2n	2.81	2.92	2.72	1.87	11.19	3.13
92.00	878.43	5.94	5.94	5-S2n	2.92	2.95	2.85	1.90	10.96	3.15

El. inlet face invert 872.49 ft El. outlet invert 871.61 ft
El. inlet throat invert 0.00 ft El. inlet crest 872.49 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	0.00 ft
INLET ELEVATION	872.49 ft
OUTLET STATION	125.00 ft
OUTLET ELEVATION	871.61 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0070
CULVERT LENGTH ALONG SLOPE	125.00 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	3.50 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE WITH HEADWALL
INLET DEPRESSION	NONE

CURRENT DATE: 05-18-2006
CURRENT TIME: 10:23:57

FILE DATE: 5/18/2006
FILE NAME: HM109F

TAILWATER

******* REGULAR CHANNEL CROSS SECTION ****************

BOTTOM WIDTH	4.00 ft
SIDE SLOPE H/V (X:1)	6.0
CHANNEL SLOPE V/H (ft/ft)	0.005
MANNING'S n (.01-0.1)	0.035
CHANNEL INVERT ELEVATION	871.61 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	871.61 ft

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
67.00	873.26	0.522	1.65	2.91	0.52
69.50	873.29	0.523	1.68	2.94	0.52
72.00	873.32	0.524	1.71	2.96	0.53
74.50	873.35	0.526	1.74	2.99	0.54
75.00	873.37	0.527	1.76	3.02	0.55
79.50	873.39	0.528	1.78	3.04	0.56
82.00	873.41	0.529	1.80	3.06	0.56
84.50	873.44	0.530	1.83	3.09	0.57
87.00	873.46	0.531	1.85	3.11	0.58
89.50	873.48	0.532	1.87	3.13	0.58
92.00	873.51	0.533	1.90	3.15	0.59

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	68.00 ft
CREST LENGTH	200.00 ft
OVERTOPPING CREST ELEVATION	880.25 ft

Form LD-34
Revised July 1999

STORM SEWER COMPUTATION SHEET

6/4/06

Calculated by ECH Date 5/19/2006 Just Full Capacity 10 Yr. Frequency Project
Checked by Date Hydraulic Gradient 25 Yr. Frequency Sheet 1 of 2
Interstate Sag Yr. Frequency

Manning's 'n' for 10 Year Design Frequency RCP 0.013 CMP 0.024
Manning's 'n' for 25 Year H.G. Frequency RCP 0.013 CMP 0.024

HAMILTON-MASON ROAD

MH, CB, I	Station	Side	Drainage Area in Acres		Time of Concentration in Minutes		Rainfall in Inches/Hour		Runoff Coeff.	Column 7 x Column 4		Discharge in cfs		Size of Pipe in Inches	Length of Pipe in Feet	Slope of Pipe in ft./ft.	Inlet F/L of Pipe	Outlet F/L of Pipe	Mean Velocity in	Just Full Cap. (10	Friction Slope in ft./ft.	Head Loss in Feet	El. Of HG (for Q25)	Grate or Cover El.	Cover El. - HG El.
No.			ΔA	∑A	ΔT	∑T	i10	i25	C	ΔCA	∑CA	Q10	Q25	D	L	So	El	El	Vm	cfs	Sf	H	Elev.	Elev.	ΔH
1	70+00	L	0.36		10.0		5.4	6.7	0.80	0.29		1.6	1.9	15	96	0.0300	901.42	898.54	6.5	11.0	0.0008	0.08	902.75	905.82	3.07
@2	70+00	R	0.34	-	10.0	-	5.4	6.7	0.80	0.27	-	1.5	1.8												
3	70+00	R		0.70		10.2	5.3	6.6			0.56	3.0	3.7	15	197	0.0400	898.44	890.56	8.5	13.0	0.0031	0.61	900.30	905.39	5.09
4	72+00	R		0.70		10.6	5.3	6.6			0.56	3.0	3.7	15	166	0.0400	890.46	883.82	8.5	13.0	0.0031	0.51	892.22	896.24	4.02
5	73+75	L	0.27		10.0		5.4	6.7	0.80	0.22		1.2	1.4	15	92	0.0500	888.42	883.82	7.0	14.2	0.0005	0.05	889.72	893.30	3.58
@6	73+75	R	0.65	-	10.0	-	5.4	6.7	0.80	0.52	-	2.8	3.5												
7	73+75	R		1.62		11.0	5.3	6.6			1.30	6.9	8.6	15	157	0.0150	883.72	881.37	9.0	8.0	0.0170	2.67	887.64	888.59	0.95
@8	75+40	R	0.48	-	10.0	-	5.4	6.7	0.80	0.38	-	2.1	2.6												
9-10	75+40	R		2.10		11.2	5.2	6.5			1.68	8.7	10.9	18	21	0.0150	881.12	880.80	7.0	13.0	0.0110	0.23	882.62	885.94	3.33
11	CX15+75	L	0.40		10.0		5.4	6.7	0.80	0.32	-	1.7	2.1	15	140	0.0050	882.00	881.30	3.6	4.6	0.0011	0.15	882.70	885.85	3.15
@12	77+68	L	0.41	-	10.0	-	5.4	6.7	0.80	0.33	-	1.8	2.2												
13	77+68	L		0.81		10.6	5.3	6.6			0.65	3.4	4.3	15	282	0.0050	880.39	878.98	3.8	4.6	0.0044	1.24	881.62	885.27	3.65
14	80+50	R	0.33		10.0		5.4	6.7	0.80	0.26		1.4	1.8	15	80	0.0040	879.30	878.98	5.2	6.5	0.0008	0.06	880.44	882.83	2.39
@15	80+50	L	0.30	-	10.0	-	5.4	6.7	0.80	0.24	-	1.3	1.6												
16-17	80+50	L		1.44		11.9	5.1	6.4			1.15	5.9	7.4	18	42	0.0050	878.88	878.67	6.0	7.5	0.0050	0.21	880.38	883.24	2.86
23	85+00	R	0.21		10.0		5.4	6.7	0.80	0.17	-	0.9	1.1	15	68	0.0079	880.51	879.97	3.6	5.6	0.0004	0.03	881.25	884.01	2.76
@24	85+00	L	0.20	-	10.0	-	5.4	6.7	0.80	0.16	-	0.9	1.1												
25	85+00	L		0.41		10.3	5.3	6.6			0.33	1.7	2.2	15	126	0.0080	879.87	878.86	4.6	5.6	0.0015	0.19	880.30	883.79	3.49
22	83+75	L		0.41		10.8	5.4	6.7			0.33	1.8	2.2	15	126	0.0080	878.76	877.75	4.6	5.6	0.0015	0.19	879.30	883.22	3.92
18	82+26	R	0.39		10.0		5.4	6.7	0.80	0.31		1.7	2.1	15	80	0.0100	878.86	878.06	5.2	6.5	0.0014	0.11	879.42	882.38	2.96
@19	82+26	L	0.50	-	10.0	-	5.4	6.7	0.80	0.40	-	2.2	2.7												
19	82+26	L		0.89		10.3	5.4	6.7			0.71	3.8	4.8	15	21	0.0100	877.96	877.75	5.2	6.5	0.0070	0.15	879.26	882.19	2.93
20-21	82+47.20	L		1.30		11.2	5.1	6.4			1.04	5.3	6.7	18	40	0.0050	877.65	877.45	4.2	7.5	0.0040	0.16	879.11	882.78	3.67
26	90+00	R	0.24		10.0		5.4	6.7	0.80	0.19	-	1.0	1.3	15	68	0.0500	880.92	877.52	3.0	4.6	0.0004	0.03	878.80	884.99	6.19
@27	90+00	L	0.30	-	10.0	-	5.4	6.7	0.80	0.24	-	1.3	1.6												
28	90+00	L		0.54		10.4	5.3	6.6			0.43	2.3	2.9	15	197	0.0180	877.42	873.87	6.5	8.6	0.0020	0.39	875.51	881.74	6.23
29	92+00	R	0.17		10.0		5.4	6.7	0.80	0.14	-	0.7	0.9	15	68	0.0200	875.23	873.87	3.0	6.5	0.0004	0.03	875.15	878.95	3.80
@30	92+00	L	0.22	-	10.0	-	5.4	6.7	0.80	0.18	-	1.0	1.2												
31	92+00	L		0.93		10.9	5.3	6.6			0.74	3.9	4.9	15	210	0.0180	873.77	869.99	6.5	8.6	0.0072	1.51	872.75	878.51	5.76
32-33	93+87	L		0.93		11.4	5.2	6.5			0.74	3.9	4.8	15	32	0.0200	869.89	869.25	5.2	9.2	0.0070	0.22	870.72	874.80	4.08

6/6/06

Form LD-34
Revised July 1999

STORM SEWER COMPUTATION SHEET

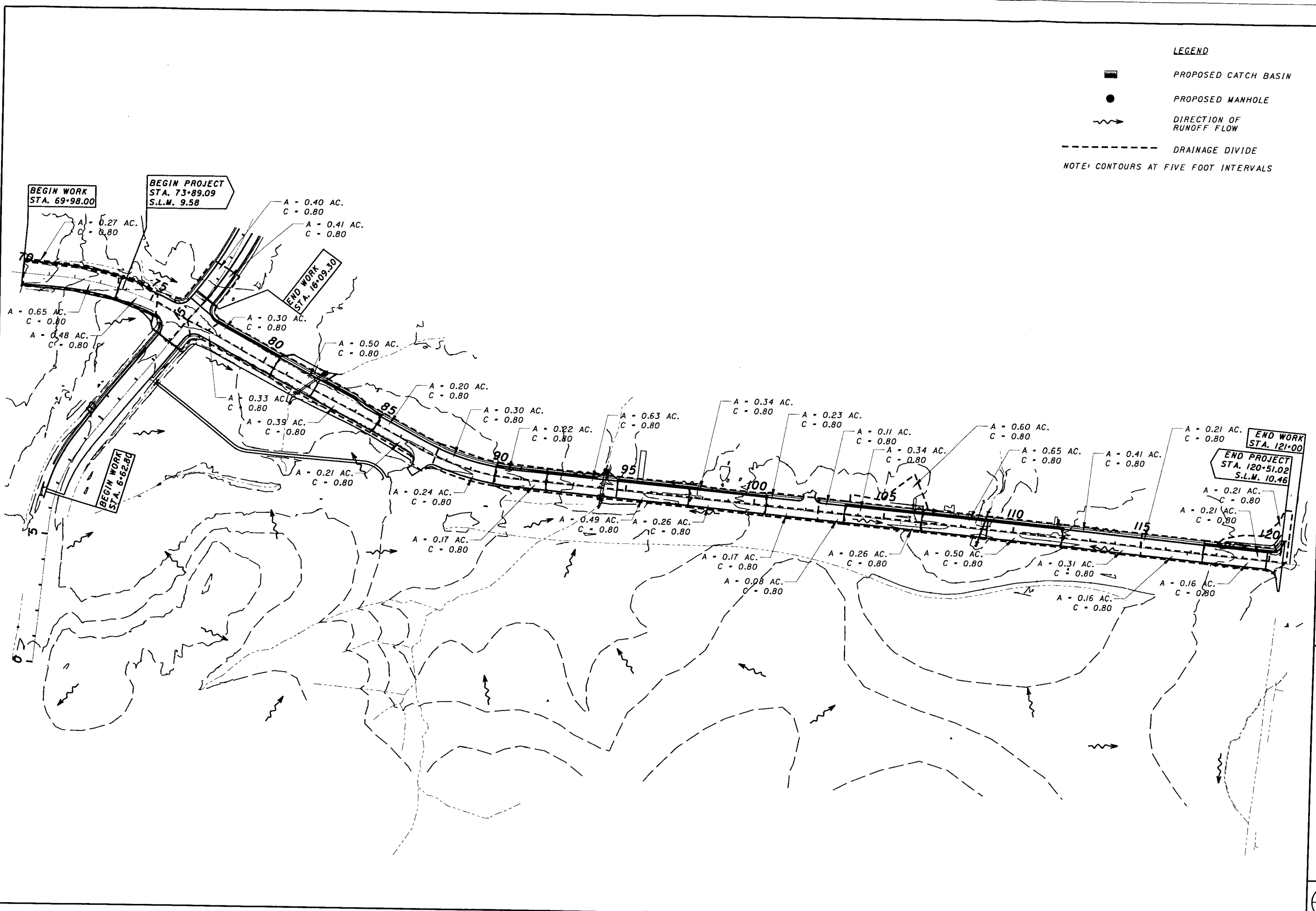
Calculated by ECH Date 5/23/2006 Just Full Capacity 10 Yr. Frequency Project
Checked by Date Hydraulic Gradient 25 Yr. Frequency Sheet 2 of 2
Interstate Sag Yr. Frequency

Manning's 'n' for 10 Year Design Frequency RCP 0.013 CMP 0.024
Manning's 'n' for 25 Year H.G. Frequency RCP 0.013 CMP 0.024

HAMILTON-MASON ROAD

MH, CB, I	Station	Side	Drainage Area in Acres		Time of Concentration in Minutes		Rainfall in Inches/Hour		Runoff Coeff.	Column 7 x Column 4		Discharge in cfs		Size of Pipe in Inches	Length of Pipe in Feet	Slope of Pipe in ft./ft.	Inlet F/L of Pipe	Outlet F/L of Pipe	Mean Velocity in	Just Full Cap. (10	Friction Slope in ft./ft.	Head Loss in Feet	El. Of HG (for Q25)	Grate or Cover El.	Cover El. - HG El.
No.			ΔA	ΣA	ΔT	ΣT	i10	i25	C	ΔCA	ΣCA	Q10	Q25	D	L	So	El	El	Vm	cfs	Sf	H	Elev.	Elev.	ΔH
40	100+50	R	0.17		10.0		5.4	6.7	0.80	0.14	-	0.7	0.9	15	68	0.0100	879.02	878.34	3.0	6.5	0.0004	0.03	880.29	882.73	2.44
@41	100+50	L	0.23	-	10.0	-	5.4	6.7	0.80	0.18	-	1.0	1.2												
42	100+50	L		0.40		10.4	5.4	6.7			0.32	1.7	2.1	15	300	0.0200	878.24	872.24	6.0	9.0	0.0010	0.30	879.79	883.33	3.54
37	97+50	R	0.26		10.0		5.4	6.7	0.80	0.21		1.1	1.4	15	68	0.0075	872.75	872.24	4.4	5.6	0.0004	0.03	875.66	876.70	1.04
@38	97+50	L	0.34	-	10.0	-	5.4	6.7	0.80	0.27	-	1.5	1.8												
39	97+50	L		1.00		11.2	5.2	6.5			0.80	4.2	5.2	15	281	0.0075	872.14	870.03	4.0	5.6	0.0080	2.25	875.64	877.29	1.65
34	94+69	R	0.49		10.0		5.4	6.7	0.80	0.39		2.1	2.6	15	68	0.0100	870.71	870.03	3.0	6.5	0.0016	0.11	872.07	874.20	2.13
@35	94+69	L	0.63	-	10.0	-	5.4	6.7	0.80	0.50	-	2.7	3.4												
36-37	94+69	R		2.12		12.4	4.9	5.9			1.70	8.3	10.0	15	54	0.0200	869.93	868.85	7.5	9.0	0.0080	0.43	871.18	874.80	3.62
43	103+50	R	0.08		10.0		5.4	6.7	0.80	0.06	-	0.3	0.4	15	68	0.0100	880.07	879.39	3.0	6.5	0.0004	0.03	881.35	883.51	2.16
@44	103+50	L	0.11	-	10.0	-	5.4	6.7	0.80	0.09	-	0.5	0.6												
45	103+50	L		0.19		10.4	5.4	6.7			0.15	0.8	1.0	15	300	0.0100	879.29	876.29	3.4	6.5	0.0004	0.12	880.66	884.11	3.45
49	106+50	L	0.60		10.0		5.4	6.7	0.80	0.48	-	2.6	3.2	15	26	0.0050	876.42	876.29	4.0	4.6	0.0024	0.06	877.75	878.80	1.05
46	106+50	R	0.26		10.0		5.4	6.7	0.80	0.21	-	1.1	1.4	15	68	0.0100	876.97	876.29	3.5	6.5	0.0005	0.03	878.25	881.17	2.92
@47	106+50	L	0.34	-	10.0	-	5.4	6.7	0.80	0.27	-	1.5	1.8												
48-52	106+50	L		1.39		11.8	5.4	6.7			1.11	6.0	7.5	18	244	0.0100	876.19	873.75	5.0	10.2	0.0024	0.59	877.69	881.77	4.08
50	109+04	R	0.50		10.0		5.4	6.7	0.80	0.40	-	2.2	2.7	15	68	0.0100	874.63	873.95	3.0	6.5	0.0017	0.12	876.00	879.56	3.56
@51	109+04	L	0.65	-	10.0	-	5.4	6.7	0.80	0.52	-	2.8	3.5												
51-52	109+04	L		1.15		10.4	5.3	6.6			0.92	4.9	6.1	15	10	0.0100	873.85	873.75	3.0	6.5	0.0090	0.09	875.09	879.56	4.47
53	112+00	R	0.31		10.0		5.4	6.7	0.80	0.25	-	1.3	1.7	15	68	0.0100	877.83	877.15	3.4	6.5	0.0007	0.05	879.13	881.35	2.22
@54	112+00	L	0.41	-	10.0	-	5.4	6.7	0.80	0.33	-	1.8	2.2												
54-55	112+00	L		0.72		10.3	5.4	6.7			0.58	3.1	3.9	15	300	0.0045	877.05	875.70	4.0	4.4	0.0035	1.05	878.00	881.95	3.95
56	117+50	R	0.21		10.0		5.4	6.7	0.80	0.17	-	0.9	1.1	15	68	0.0100	878.03	877.35	3.0	4.6	0.0004	0.03	879.31	882.17	2.86
@57	117+50	L	0.16	-	10.0	-	5.4	6.7	0.80	0.13	-	0.7	0.9												
58	117+50	L		0.37		10.4	5.4	6.7			0.30	1.6	2.0	15	244	0.0150	877.25	873.59	4.0	8.0	0.0010	0.24	878.75	882.76	4.01
59	119+94.00	R	0.21		10.0		5.4	6.7	0.80	0.17		0.9	1.1	15	68	0.0025	873.76	873.59	3.0	4.6	0.0004	0.03	875.04	876.18	1.14
@60	119+94.00	L	0.16	-	10.0	-	5.4	6.7	0.80	0.13	-	0.7	0.9												
61	119+94.00	L		0.74		11.4	5.3	6.5			0.59	3.1	3.8	15	37	0.0025	873.49	873.40	5.0	3.2	0.0035	0.13	874.87	876.78	1.91
62	120+14.31	L	0.21		10.0		5.4	6.7	0.80	0.17		0.9	1.1	15	32	0.0025	873.48	873.40	3.0	3.2	0.0004	0.01	874.74	875.46	0.72
63	120+30.88	L		0.95		11.5	5.3	6.5			0.76	4.0	4.9	15	138	0.0198	873.30	870.57	5.5	9.0	0.0057	0.79	872.61	875.00	2.39
DW-1	106+30	R	0.45		10.0		5.4	6.7	0.80	0.36	-	1.9	2.4	12	21	0.0100	878.38	878.17	4.4	3.6	0.0045	0.09	879.26	880.13	0.87

- Culvert For both path.


LEGEND
PROPOSED CATCH BASIN
PROPOSED MANHOLE
DIRECTION OF RUNOFF FLOW
DRAINAGE DIVIDE
NOTE: CONTOURS AT FIVE FOOT INTERVALS
BEGIN WORK STA. 69+98.00
BEGIN PROJECT STA. 73+89.09 S.L.M. 9.58
END WORK STA. 16+09.30
BEGIN WORK STA. 6+62.80
END WORK STA. 121+00
END PROJECT STA. 120+51.02 S.L.M. 10.46
A = 0.27 AC. C = 0.80
A = 0.40 AC. C = 0.80
A = 0.41 AC. C = 0.80
A = 0.65 AC. C = 0.80
A = 0.48 AC. C = 0.80
A = 0.30 AC. C = 0.80
A = 0.50 AC. C = 0.80
A = 0.33 AC. C = 0.80
A = 0.39 AC. C = 0.80
A = 0.20 AC. C = 0.80
A = 0.30 AC. C = 0.80
A = 0.22 AC. C = 0.80
A = 0.63 AC. C = 0.80
A = 0.21 AC. C = 0.80
A = 0.24 AC. C = 0.80
A = 0.49 AC. C = 0.80
A = 0.26 AC. C = 0.80
A = 0.17 AC. C = 0.80
A = 0.34 AC. C = 0.80
A = 0.23 AC. C = 0.80
A = 0.11 AC. C = 0.80
A = 0.34 AC. C = 0.80
A = 0.60 AC. C = 0.80
A = 0.65 AC. C = 0.80
A = 0.41 AC. C = 0.80
A = 0.21 AC. C = 0.80
A = 0.21 AC. C = 0.80
A = 0.21 AC. C = 0.80
A = 0.17 AC. C = 0.80
A = 0.08 AC. C = 0.80
A = 0.26 AC. C = 0.80
A = 0.50 AC. C = 0.80
A = 0.31 AC. C = 0.80
A = 0.16 AC. C = 0.80
A = 0.16 AC. C = 0.80
75
80
85
90
95
100
105
110
115
120
0
5
HORIZONTAL SCALE IN FEET
0
200
400
CALCULATED ECH
CHECKED SSK
DRANAGE AREA MAP
T.R. 21 (H-M RD.)
BUTLER COUNTY, OHIO
37
117
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EXFILTRATION TRENCH DESIGN

Ex T	Station	Offset	Side	Drainage Limits		Road Width	i	Cq	Length	Total Area	Lt = (A*Cq)/689	Length
				Start	End							
1	69+66.90	46.50	R	67+10	70+00	50.5	0.337	0.245	290	43500	15.4625	16
2	73+41.67	46.50	R	70+00	73+75	50.5	0.337	0.245	375	56250	19.9946	20
3	75+14.68	46.50	R	73+75	75+50	50.5	0.337	0.245	175	26250	9.3308	12
4	80+22.17	46.00	L	77+00	80+50	46	0.347	0.250	350	52500	19.0743	20
5	80+23.87	32.00	R	77+00	80+50	34	0.227	0.185	350	52500	14.1237	16
6	82+02.85	46.00	L	80+50	82+26	46	0.347	0.250	176	26400	9.5916	12
7	82+04.81	32.00	R	80+50	82+26	34	0.227	0.185	176	26400	7.1022	8
8	82+52.85	46.00	L	85+00	82+26	46	0.347	0.250	274	41100	14.9324	16
9	82+50.81	32.00	R	85+00	82+26	34	0.227	0.185	274	41100	11.0569	12
10	85+23.94	32.00	L	87+50	85+00	34	0.267	0.207	250	37500	11.2774	12
11	85+23.94	32.00	R	87+50	85+00	34	0.227	0.185	250	37500	10.0884	12
12	89+73.67	32.00	L	87+50	90+00	66	0.480	0.327	250	37500	17.7810	20
13	91+76.00	32.00	L	90+00	92+00	34	0.267	0.207	200	30000	9.0219	12
14	91+76.00	32.00	R	90+00	92+00	34	0.227	0.185	200	30000	8.0707	12
15	94+45.15	32.00	L	92+00	94+69	34	0.227	0.185	269	40350	10.8551	12
16	94+45.15	32.00	R	92+00	94+69	34	0.227	0.185	269	40350	10.8551	12
17	94+93.15	32.00	L	97+50	94+69	34	0.227	0.185	281	42150	11.3393	12
18	94+93.15	32.00	R	97+50	94+69	34	0.227	0.185	281	42150	11.3393	12
19	97+76.00	32.00	L	100+50	97+50	34	0.267	0.207	300	45000	13.5329	16
20	97+76.00	32.00	R	100+50	97+50	34	0.227	0.185	300	45000	12.1061	16
21	100+72.00	32.00	L	102+50	100+50	34	0.267	0.207	200	30000	9.0219	12
22	100+72.00	32.00	R	102+50	100+50	34	0.227	0.185	200	30000	8.0707	12
23	103+28.32	32.00	L	102+50	103+50	34	0.267	0.207	100	15000	4.5110	8
24	103+28.32	32.00	R	102+50	103+50	34	0.227	0.185	100	15000	4.0354	8
25	105+89.75	32.00	L	103+50	106+50	34	0.267	0.207	300	45000	13.5329	16
26	106+23.93	32.00	R	103+50	106+50	34	0.227	0.185	300	45000	12.1061	16
27	108+79.60	32.00	L	106+50	109+06	34	0.267	0.207	256	38400	11.5481	12
28	108+79.60	32.00	R	106+50	109+06	34	0.227	0.185	256	38400	10.3305	12
29	109+29.60	32.00	L	111+94	109+06	34	0.267	0.207	288	43200	12.9916	16
30	109+29.60	32.00	R	111+94	109+06	34	0.227	0.185	288	43200	11.6218	12
31	112+20.09	32.00	L	115+00	111+94	34	0.267	0.207	306	45900	13.8035	16
32	112+20.09	32.00	R	115+00	111+94	34	0.227	0.185	306	45900	12.3482	16
33	117+26.15	32.00	L	115+00	117+50	34	0.267	0.207	250	37500	11.2774	12
34	117+26.15	32.00	R	115+00	117+50	34	0.227	0.185	250	37500	10.0884	12
35	119+69.89	32.00	L	117+50	119+94	34	0.267	0.207	244	36600	11.0067	12
36	119+69.89	32.00	R	117+50	119+94	34	0.227	0.185	244	36600	9.8463	12

NOTE: Calculations for I, Cq, and area all use the "strip method" as required by 2 L&D 1118-1 (assumes 150 ft width of R/W off of the centerline). Of this 150 ft, the impervious area is the roadway width plus 4 feet for a sidewalk (if applicable).