NAPOLEON ENGINEERING & SURVEYING, INC.

Marc S. Gerken, P.E.
President

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June 7, 1994

City of Napoleon
255 Riverview Avenue
Napoleon, Ohio 43545

Attn: Marc Gerken
City Engineer

Re: F. & M. Bank-N. Scott St.
Drainage Calculations

2255 Scott St.

Dear Marc:

Please find attached the drainage calculations for the above referenced project.

As you can see from the percent increase in impervious area, we were required to design for a five (5) year storm frequency event.

We elected to obtain the required storage volume by oversizing the underground storm piping (See sheet 5 of 5). This volume of storm runoff will then be metered through an eight (8") inch outlet pipe which will discharge approximately 2.67± cfs under head conditions. Where the normal free-flowing capacity of an eight (8") pipe is approximately 1 cfs (Depending upon the "n" value of the pipe material).

Should you have any questions, please call.

Respectfully,

Douglas M. Shumaker

Douglas M. Shumaker
Engineer

Encl.

UNIT HYDROGRAPH REPORT

RECORD NUMBER : 1
TYPE : RATIONAL UH
DESCRIPTION : EXISTING RUNOFF-TWO YEAR STORM

[UNIT HYDROGRAPH INFORMATION]

Peak Discharge	=	2.33	(cfs)
Time Interval	=	1	(min)
Time to Peak	=	11.26	(min)
Time of Base	=	22.53	(min)
Rainfall Excess	=	1.00	(in)
Basin Lag Time	=	0.00	(min)
Shape Factor	=	484.00	

[BASIN DESCRIPTION]

[WEIGHTED WATERSHED AREA/RUNOFF]

DESCRIPTION	AREA	CN#	RUNOFF CO
BUILDING	0.04	98	0.9500
CONC. S.W.	0.01	98	0.9500
STONE DRIVEWAY	0.40	76	0.5000
GRASS	1.29	50	0.1500
Overall Approximation	1.73	57	0.2520

[TIME CONCENTRATION -- SCS LAG]

Channel Slope (S)	=	0.00700	
Flow Length (L)	=	100.00	(ft)
Time of Concentration	=	11.26	(min)

[Unit Hydrograph Flow Values Time vs. Flow]
(The time interval is 1 min)

TIME INTV	TIME (min)	FLOW (cfs)
1	1	0.21
2	2	0.41
3	3	0.62
4	4	0.83
5	5	1.03
6	6	1.24
7	7	1.44
8	8	1.65
9	9	1.86
10	10	2.06
11	11	2.27
12	12	2.17
13	13	1.97
14	14	1.76
15	15	1.55
16	16	1.35
17	17	1.14
18	18	0.94
19	19	0.73

HYDROGRAPH REPORT

RECORD NUMBER : 1
TYPE : MOD. RATIONAL
DESCRIPTION : PROPOSED RUNOFF-TWO YEAR STORM

[HYDROGRAPH INFORMATION]

Peak Discharge	=	3.31	(cfs)
Volume	=	0.03	(acft)
Time Interval	=	1	(min)
Time to Peak	=	7.00	(min)
Time of Base	=	13.99	(min)
Multiplication factor	=	1.00	

[RATIONAL HYDROGRAPH INFORMATION]

Runoff Coeficient	=	0.46472
Receding limb factor	=	1.00000

[RESERVOIR STORAGE]

Maximum Outflow	=	0.00000	(cfs)
Maximum Storage	=	0.00000	(acft)

[BASIN DESCRIPTION]

[WEIGHTED WATERSHED AREA]

DESCRIPTION	AREA	CN#	RUNOFF COEF
ASPHALT PARKING	0.50	98	0.95000
CONC. S.W.	0.06	98	0.95000
BUILDING	0.11	98	0.95000
GRASS	1.05	50	0.15000
Overall Approximation	1.73	69	0.46472

[TIME CONCENTRATION -- SCS LAG]

Channel Slope (S)	=	0.01870	
Flow Length (L)	=	150.00	(ft)
Time of Concentration	=	7.00	(min)

[RAINFALL DESCRIPTION]

Distribution Type	=	SYNTHETIC	
Total Precipitation	=	0.48	(in)
Return Period	=	2	(yr)
Storm Duration	=	0.12	(hr)

[Hydrograph Flow Values Time vs. Flow]
(The time interval is 1 min)

TIME INTV	TIME (min)	INCREMENTAL RAINFALL (in)	CUMULATIVE RAINFALL (in)	INCREMENTAL OUTFLOW (cfs)	DESIGN OUTFLOW (cfs)
1	1	0.07	0.07	0.47	0.47
2	2	0.07	0.14	0.47	0.95
3	3	0.07	0.21	0.47	1.42

HYDROGRAPH REPORT

RECORD NUMBER : 3
TYPE : MOD. RATIONAL
DESCRIPTION : PROPOSED RUNOFF-FIVE YEAR STORM

[HYDROGRAPH INFORMATION]

Peak Discharge	=	3.95	(cfs)
Volume	=	0.04	(acft)
Time Interval	=	1	(min)
Time to Peak	=	7.00	(min)
Time of Base	=	13.99	(min)
Multiplication factor	=	1.00	

[RATIONAL HYDROGRAPH INFORMATION]

Runoff Coeficient	=	0.46472	
Receding limb factor	=	1.00000	

[RESERVOIR STORAGE]

Maximum Outflow	=	0.00000	(cfs)
Maximum Storage	=	0.00000	(acft)

[BASIN DESCRIPTION]

[WEIGHTED WATERSHED AREA]

DESCRIPTION	AREA	CN#	RUNOFF COEF
ASPHALT PARKING	0.50	98	0.95000
CONC. S.W.	0.06	98	0.95000
BUILDING	0.11	98	0.95000
GRASS	1.05	50	0.15000
Overall Approximation	1.73	69	0.46472

[TIME CONCENTRATION -- SCS LAG]

Channel Slope (S)	=	0.01870	
Flow Length (L)	=	150.00	(ft)
Time of Concentration	=	7.00	(min)

[RAINFALL DESCRIPTION]

Distribution Type	=	SYNTHETIC	
Total Precipitation	=	0.57	(in)
Return Period	=	5	(yr)
Storm Duration	=	0.12	(hr)

[Hydrograph Flow Values Time vs. Flow]
(The time interval is 1 min)

TIME INTV	TIME (min)	INCREMENTAL RAINFALL (in)	CUMULATIVE RAINFALL (in)	INCREMENTAL OUTFLOW (cfs)	DESIGN OUTFLOW (cfs)
1	1	0.08	0.08	0.57	0.57
2	2	0.08	0.16	0.57	1.13
3	3	0.08	0.25	0.57	1.70
4	4	0.08	0.33	0.57	2.26

OUTLET STRUCTURE REPORT

RECORD NUMBER : 2
TYPE : CIRCULAR CONCRETE w/ square edge w/ headwall
DESCRIPTION : 8" METERED STORM

[RATING CURVE LIMIT]

Minimum Elevation	=	678.00 (ft)
Maximum Elevation	=	682.60 (ft)
Elevation Increment	=	0.20 (ft)

[OUTLET STRUCTURE INFORMATION]

Circular Radius	=	0.33333 (ft)
Culvert Invert Elevation	=	678.00000 (ft)
Slope	=	0.00500
Manning's N-value	=	0.01200
Orifice Coefficient	=	0.50000
Tailwater	=	678.33002 (ft)
Number barrels	=	1
Maximum Dishcharge (Q)	=	2.67 cfs ±

[UNSUBMERGED EQUATION]

H/Diam = Hc/Diam + K *(Q/A*Diam^0.5))^M - 0.5*S^2

Coefficient K	=	0.00980
coefficient M	=	2.00000

[SUBMERGED EQUATION]

H/Diam = c*(Q/(A*Diam^0.5))^Z + Y - 0.5*S^2

Coefficient c	=	0.03980
Coefficient Y	=	0.67000

[DEFINITIONS]

H = Headwater depth above inlet control section invert, (ft)
Diam = Inerior height of culvert barrel, (ft)
Hc = Specific head at critical depth (dc + Vc^2/2g), (ft)
Q = Discharge, (cuft/s)
A = Full cross sectional area of culvert barrel, (sqft)
S = Culvert barrel slope, (ft/ft)

[Culvert Weir Discharge Value vs. Stage]
(the elevation increment is 0.2)

STAGE	ELEVATION (ft)	FLOW (cfs)
0.40	678.40	0.35
0.60	678.60	0.66
0.80	678.80	0.91
1.00	679.00	1.08
1.20	679.20	1.23
1.40	679.40	1.37
1.60	679.60	1.49
1.80	679.80	1.60
2.00	680.00	1.71
2.20	680.20	1.81
2.40	680.40	1.90

F. & M. BANK ~ NAPOLEON, OH. BY: D.M.S.

STORAGE CALC'S. PAGE 5

TIME (MIN)	CRITICAL STORM (I_5)	"$C_w A$"	CRITICAL Q_5	ALLOW. DISCHARGE	STORAGE Q	$t_c \times Q \times 60$ STORAGE VOL. (FT^3)
10	4.4	0.804	3.538	2.33	1.21	724.56 * MAX
15	3.6	↓	2.894	↓	0.564	507.96
20	3.0	↓	2.412	↓	0.082	98.40

$C_w = 0.465$ $A = 1.73$ Ac.

PIPE STORAGE

18" PIPE $L = 385$ l.f. AREA $= 1.767\ FT^2$

18" VOLUME $= (385\ \text{l.f.})(1.767\ FT^2) = 680.295\ FT^3$

2-3-B CURB INLETS AVG. DEPTH = 2.88 FT.

C.I. VOLUME $= (2\ FT)(3\ FT.)(2.88\ FT.) = 17.28\ FT^3$

4 ~ C.I. VOLUME $= 4(17.28\ FT^3) = 69.12\ FT^3$

TOTAL STORAGE VOLUME $= 680.295\ FT^3 + 69.12\ FT^3$

$= 749.415\ FT^3$