TALK TO ROBBER
BEFORE 4pm MON 4/26

DRAINAGE REPORT

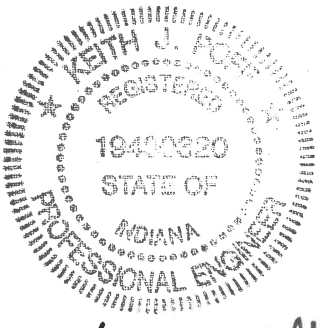
FOR

ARBOR VALLEY CONDOMINIUMS

Boehne Camp Road
Vanderburgh County, Indiana

Report by:
SITECON, Inc.
10335 Hedden Road, Suite 2
Evansville, IN 47711

April 19, 1999



ARBOR VALLEY CONDOMINIUMS
Drainage Plan

Project Name and Location

ARBOR VALLEY CONDOMINIUMS
100 S. Boehne Camp Road
Perry Township
Vanderburgh County, Indiana

Developer Name and Address

DANIEL E. TEMME, ARCHITECT, P.C.
Mr. Daniel E. Temme
1033 Mt. Pleasant Road Suite F
Evansville, IN 47711
(812) 867-0906

Drainage Plan Preparer

SITECON, Inc.
10335 Hedden Road Suite 2
Evansville, IN 47711
(812) 868-0877

DRAINAGE PLAN
FOR
ARBOR VALLEY CONDOMINIUMS

Narrative

Site Location:

The proposed site is located at 100 S. Boehne Camp Road. The site consists of 8.24 acres located on the east side of Boehne Camp Road.

Existing Site Conditions:

The site is hilly, with a 54' grade change. The site has a house with several small out buildings, rock drive, and a small rock lane to the interior of the site. The site is wooded and the ground consists of (Wa) Wekeland silt loam, (WeD_3) Wellston silt loam 12% to 18% slope, (WeD_2) Wellston silt loam 12% to 18% eroded, (HoC_3) Hosmer silt loam 6% to 12% severely eroded, and (AlB_2) Alford silt loam 2% to 6% eroded.

The site has 3 separate watersheds entering the site from the north, south, and west. The water is collected into an existing open ditch and is conveyed east and leaves the site on the northeast corner.

Analysis Procedure:

The Rational Method, valid for watershed areas up to 200 acres, was used for computations of storm water runoff. The post development controlled peak release rate of storm water runoff during a twenty-five (25) year return period storm from the developed project was designed to not exceed the peak release rate during a ten (10) year return period storm in its pre-developed condition.

Proposed Design:

The storm water runoff will be conveyed to the new retention area by a combination of surface slopes, sloping pavement, swales and storm drains. The site drainage system will be HDPE pipe.

The proposed changes to the site will be less than the design criteria used to calculate the drainage requirements for this site. The existing runoff coefficient was determined to be .43 for the undeveloped site and the new weighted coefficient was determined to be .45 for the developed site. Requirements for storm water detention were determined for a 25 year storm while restricting peak allowable discharge rate to that of a 10 year storm peak runoff for the undeveloped condition. The watershed for the areas outside of the site has been considered in this inline detention system. The detention system has been designed with a storage capacity of 37,104 cubic feet. This storage is controlled by the overflow structure of the proposed retention area. The release rate is controlled by the size of the (3) 24" diameter corrugated steel pipe placed 3.0 feet below the top of the overflow structure, thereby creating the storage area. The free board will be .5'.

Index

SUB-BASIN DRAINAGE CALCULATIONS - UNDEVELOPED FLOW FOR A 10 YEAR STORM

Job Name/Basin #:	Phase I Basin			1,999,600 Total SF	45.90 AC
Structures	1 Total	155,500 SF	100 %	155,500 Total SF	3.57 AC
Drives	1 Total	61,500 SF		61,500 Total SF	1.41 AC
Pavement	10 Width (ft)	3,750 L (ft)		37,500 Total SF	0.86 AC
Patios	0 Total	0 SF		0 Total SF	0.00 AC
Sidewalks	0 Width (ft)			0 Total SF	0.00 AC
Impervious surfaces	C=0.92				
Terr 1 (0-2%)lawn	C=0.15	107,105 SF		107,105 Total SF	2.46 AC
Terr 2 (2-5%)woods	C=0.24	332,500 SF		332,500 Total SF	7.63 AC
Terr 3 (5-10%)lawn	C=0.40	1,291,545 SF		1,291,545 Total SF	29.65 AC
Terrain 4 (10+ %)	C=0.65	0 SF		0 Total SF	0.00 AC
Terrain 5 (Lake)	C=1.00	13,950		13,950 Total SF	0.32 AC

Wt'd C =	0.43
Wt'd N =	0.18
High Pt El	503.00 ft
Inlet El	413.00 ft
Length	2400.00 ft
Slope	0.0375
tc	30.06 min

Is 5<tc<10?	i 10=	0.00 in/hr
Is 10<tc<15?	i 10=	0.00 in/hr
Is 15<tc<30?	i 10=	3.23 in/hr
Is 30<tc<60?	i 10=	0.00 in/hr

Q10= 63.81 cfs

DEVELOPED CALCULATIONS FLOW FOR A 25 YEAR STORM

Job Name/Basin #: Arbor Valley-Basin-for dev. coeff. — 1,999,600 Total SF 45.90 AC

Exist. Impervious surfaces (2-5%) C=0.94					
Structures	1 Total	155,500 SF		155,500 Total SF	3.57 AC
Drives	1 Total	61,500 SF		61,500 Total SF	1.41 AC
Pavement	10 Width (ft)	3,750 L (ft)		37,500 Total SF	0.86 AC
				254,500 **TOTAL**	5.84 AC
Proposed Impervious surfaces (2-5%) C=0.94					
Structures	4 Total	5,850 SF		23,400 Total SF	0.54 AC
Drives	4 Total	7,500 SF		30,000 Total SF	0.69 AC
Pavement	24 Width (ft)	850 L (ft)		20,400 Total SF	0.47 AC
Patios	0 Total	400 SF		0 Total SF	0.00 AC
Sidewalks	0 Width (ft)			0 Total SF	0.00 AC
				73,800 **TOTAL**	1.69 AC
Exist cultivated fields:					
0-2% slope	C=0.20	0 SF		0 Total SF	0.00 AC
2-5% slope	C=0.35	0 SF		0 Total SF	0.00 AC
5-10% slope	C=0.50	0 SF		0 Total SF	0.00 AC
Lakes	C=1.0	27,150 SF		27,150 Total SF	0.62 AC
				27,150 **TOTAL**	0.62 AC
For lawn areas:					
0-2% slope	C=0.15	164,415 SF		164,415 Total SF	3.77 AC
2-5% slope	C=0.25	0 SF		0 Total SF	0.00 AC
5-10% slope	C=0.40	1,147,235 SF		1,147,235 Total SF	26.34 AC
10+% slope	C=0.55	0 SF		0 Total SF	0.00 AC
				1,311,650 **TOTAL**	30.11 AC
For woodland areas:					
0-2% slope	C=0.12	0 SF		0 Total SF	0.00 AC
2-5% slope	C=0.24	332,500 SF		332,500 Total SF	7.63 AC
5-10% slope	C=0.36	0 SF		0 Total SF	0.00 AC
10+% slope	C=0.48	0 SF		0 Total SF	0.00 AC
				332,500 **TOTAL**	7.63 AC

Check 1,999,600 **GT**

Wt'd C = 0.45

Vanderburgh County Drainage Board
Form 800

Computation Sheet for Detention Storage Using the Rational Method

Project: Arbor Valley-Phase I

Detention Facility Design Return Period	25	years
Release Rate Return Period	10	years
Watershed Area	45.90	acres
Undeveloped Time of Concentration	30.00	minutes
Undeveloped Rainfall Intensity (iu)	3.23	inches/hour
Weighted Undeveloped Runoff Coefficient (Cu)	0.43	
Undeveloped Runoff Rate (O=Cu x iu x Au)	63.75	cfs
Developed Runoff Coefficient (Cd)	0.45	

Storm Duration td	Rainfall Intensity id	Inflow Rate I(td) Cd x id x Ad	Outflow Rate O Cu x iu x Au	Storage Rate (I x td) - O	Required Storage [I(td)-O]x[td/12]
min	inches/hr	cfs	cfs	cfs	acre-ft
5	7.208	148.88	63.75	85.13	0.5912
10	5.925	122.38	63.75	58.63	0.8143
15	5.033	103.96	63.75	40.21	0.8376
20	4.571	94.41	63.75	30.66	0.8518
25	4.108	84.85	63.75	21.10	0.7326
30	3.646	75.31	63.75	11.56	0.4816
40	3.123	64.51	63.75	0.76	0.0419
50	2.601	53.72	63.75	-10.03	-0.6963
60	2.078	42.92	63.75	-20.83	-1.7358
90	1.578	32.59	63.75	-31.16	-3.8946

Required Storage = 0.8518 x 43,560 sf/ac= 37,104 cubic feet

Vanderburgh County Drainage Board
Form 800

Computation Sheet for Detention Storage Using the Rational Method

Project: Arbor Valley-Phase I (50 year)

Detention Facility Design Return Period	50 years
Release Rate Return Period	10 years
Watershed Area	45.90 acres
Undeveloped Time of Concentration	30.00 minutes
Undeveloped Rainfall Intensity (iu)	3.23 inches/hour
Weighted Undeveloped Runoff Coefficient (Cu)	0.43
Undeveloped Runoff Rate (O=Cu x iu x Au)	63.75 cfs
Developed Runoff Coefficient (Cd)	0.45

Storm Duration td	Rainfall Intensity id	Inflow Rate I(td) Cd x id x Ad	Outflow Rate O Cu x iu x Au	Storage Rate (I x td) - O	Required Storage [I(td)-O]x[td/12]
min	inches/hr	cfs	cfs	cfs	acre-ft
5	7.936	163.92	63.75	100.17	0.6956
10	6.616	136.65	63.75	72.90	1.0125
15	5.697	117.67	63.75	53.92	1.1234
20	5.196	107.32	63.75	43.57	1.2104
25	4.695	96.98	63.75	33.22	1.1536
30	4.194	86.63	63.75	22.88	0.9532
40	3.600	74.36	63.75	10.61	0.5893
50	3.006	62.09	63.75	-1.66	-0.1154
60	2.412	49.82	63.75	-13.93	-1.1609
90	2.016	41.64	63.75	-22.11	-2.7638

Required Storage = 1.2104 x 43,560 sf/ac= 52,725 cubic feet

Vanderburgh County Drainage Board
Form 800

Computation Sheet for Detention Storage Using the Rational Method

Project: Arbor Valley-Phase I (100 year)

Detention Facility Design Return Period	100 years
Release Rate Return Period	10 years
Watershed Area	45.90 acres
Undeveloped Time of Concentration	30.00 minutes
Undeveloped Rainfall Intensity (iu)	3.23 inches/hour
Weighted Undeveloped Runoff Coefficient (Cu)	0.43
Undeveloped Runoff Rate (O=Cu x iu x Au)	63.75 cfs
Developed Runoff Coefficient (Cd)	0.45

Storm Duration td	Rainfall Intensity id	Inflow Rate I(td) Cd x id x Ad	Outflow Rate O Cu x iu x Au	Storage Rate (I x td) - O	Required Storage [I(td)-O]x[td/12]
min	inches/hr	cfs	cfs	cfs	acre-ft
5	8.469	174.93	63.75	111.18	0.7721
10	7.126	147.19	63.75	83.44	1.1588
15	6.194	127.94	63.75	64.19	1.3372
20	5.665	117.01	63.75	53.26	1.4794
25	5.137	106.10	63.75	42.35	1.4706
30	4.608	95.18	63.75	31.43	1.3095
40	3.960	81.79	63.75	18.04	1.0024
50	3.311	68.39	63.75	4.64	0.3221
60	2.663	55.00	63.75	-8.75	-0.7289
90	2.224	45.94	63.75	-17.81	-2.2267

Required Storage = 1.4794 x 43,560 sf/ac= 64,443 cubic feet

Detention Volumn Verification - Basin A

10 Release Rate	25 yr. Required Storage Volumn	50 yr. Storage Volumn	100 yr. Storage Volumn
63.8 cfs.	*37,109 cubic ft.*	*52,725 cubic ft.*	*64,443 cubic ft.*

Spillway Elevation	*422.00'*
Normal Pool Elevation	*419.00'*
	3.0'

Area of Storage	*24,439 sq.ft.*
Area of Normal Pool	*18,512 sq.ft.*
	5,927 sq.ft.

Total volumn of available storage = *(5,927 / 2) + 18,512 x 3.0'* = *64,426* cubic ft. or *173%* volumn required and near a 100 yr. storm capability.

Improved Inlets

Culvert capacity may be increased through the use of special inlet designs. The Federal Highway Administration has developed extensive data[19,20] on these. While these designs increase the flow, their use has not been as expected. The increased costs of the special treatments is apparently responsible.

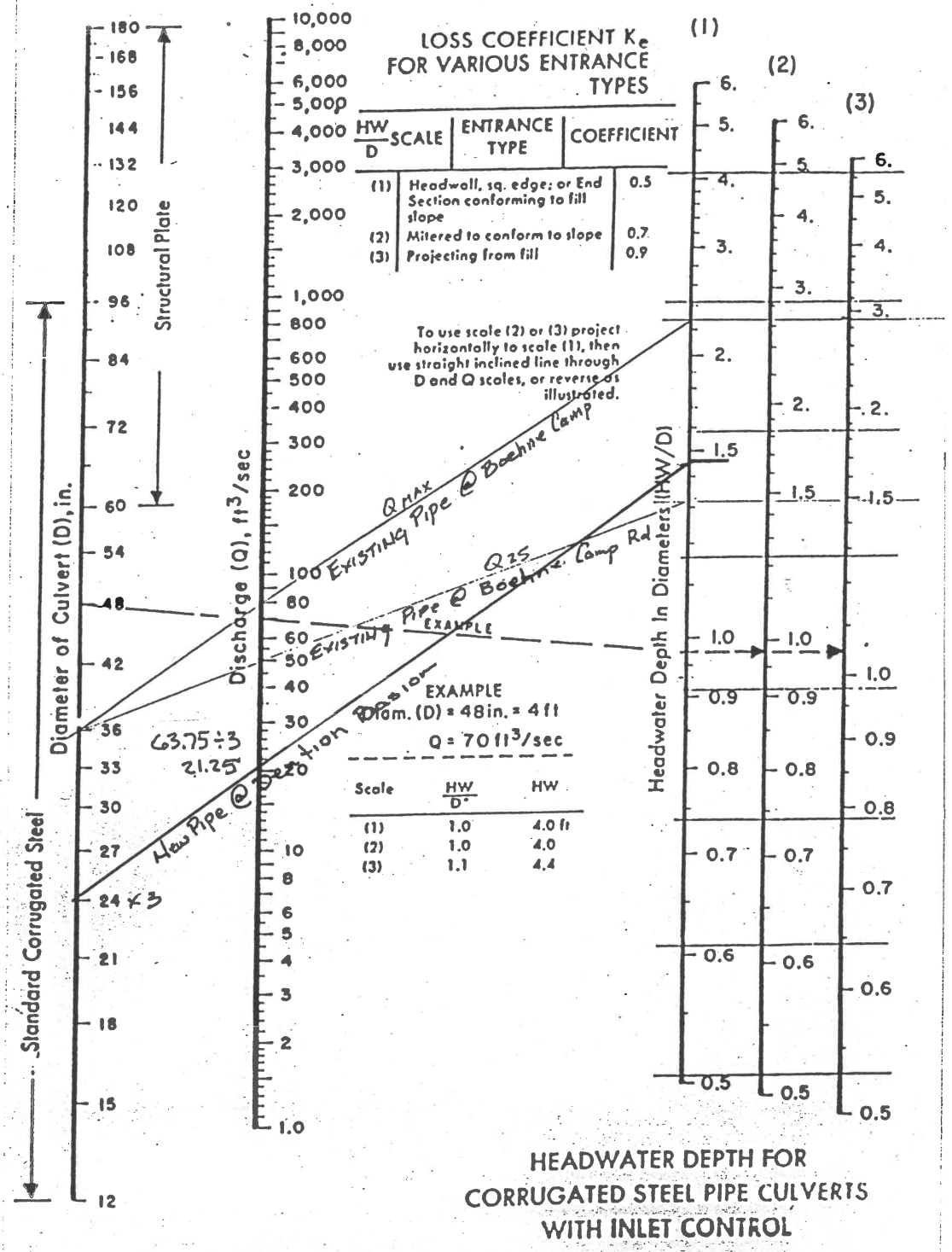


Figure 3.28 *Inlet control* nomograph for corrugated steel *pipe* culverts.[13] The manufacturers recommend keeping *HW/D* to a maximum of 1.5 and preferably to no more than 1.0 for diameters greater than 4 to 5 feet.

DEVELOPED CALCULATIONS FLOW FOR A 25 YEAR STORM

Job Name/Basin #: Basin # 1-1 — 1,450,000 Total SF 33.29 AC

Exist. Impervious surfaces (2-5%) C=0.94				
Structures	1 Total	145,500 SF	145,500 Total SF	3.34 AC
Drives	1 Total	61,500 SF	61,500 Total SF	1.41 AC
Pavement	10 Width (ft)	3,550 L (ft)	35,500 Total SF	0.81 AC
			242,500 **TOTAL**	5.57 AC
Proposed Impervious surfaces (2-5%) C=0.94				
Structures	0 Total	0 SF	0 Total SF	0.00 AC
Drives	1 Total	0 SF	0 Total SF	0.00 AC
Pavement	0 Width (ft)	0 L (ft)	0 Total SF	0.00 AC
Patios	0 Total	0 SF	0 Total SF	0.00 AC
Sidewalks	0 Width (ft)		0 Total SF	0.00 AC
			0 **TOTAL**	0.00 AC
Exist cultivated fields:				
0-2% slope	C=0.20	0 SF	0 Total SF	0.00 AC
2-5% slope	C=0.35	0 SF	0 Total SF	0.00 AC
5-10% slope	C=0.50	0 SF	0 Total SF	0.00 AC
Lake	C=1.0	13,950 SF	13,950 Total SF	0.32 AC
			13,950 **TOTAL**	0.32 AC
For lawn areas:				
0-2% slope	C=0.15	107,105 SF	107,105 Total SF	2.46 AC
2-5% slope	C=0.25	353,450 SF	353,450 Total SF	8.11 AC
5-10% slope	C=0.40	610,495 SF	610,495 Total SF	14.02 AC
10+% slope	C=0.55	0 SF	0 Total SF	0.00 AC
			1,071,050 **TOTAL**	24.59 AC
For woodland areas:				
0-2% slope	C=0.12	0 SF	0 Total SF	0.00 AC
2-5% slope	C=0.24	122,500 SF	122,500 Total SF	2.81 AC
5-10% slope	C=0.36	0 SF	0 Total SF	0.00 AC
10+% slope	C=0.48	0 SF	0 Total SF	0.00 AC
			122,500 **TOTAL**	2.81 AC

Check 1,450,000 **GT**

Wt'd C =	0.43
Wt'd N =	0.35
High Pt El	503.00 ft
Inlet El	429.00 ft
Length	1,650.00 ft
Slope	0.0448
tc	33.33 min

0 1	Is 5<tc<10?	i 25=	0.00 in/hr
0 1	Is 10<tc<15?	i 25=	0.00 in/hr
0 1	Is 15<tc<30?	i 25=	0.00 in/hr
1 1	Is 30<tc<60?	i 25=	3.47 in/hr

Q25= 49.41 cfs

Date: 3/27/99

Improved Inlets

Culvert capacity may be increased through the use of special inlet designs. The Federal Highway Administration has developed extensive data[19,20] on these. While these designs increase the flow, their use has not been as expected. The increased costs of the special treatments is apparently responsible.

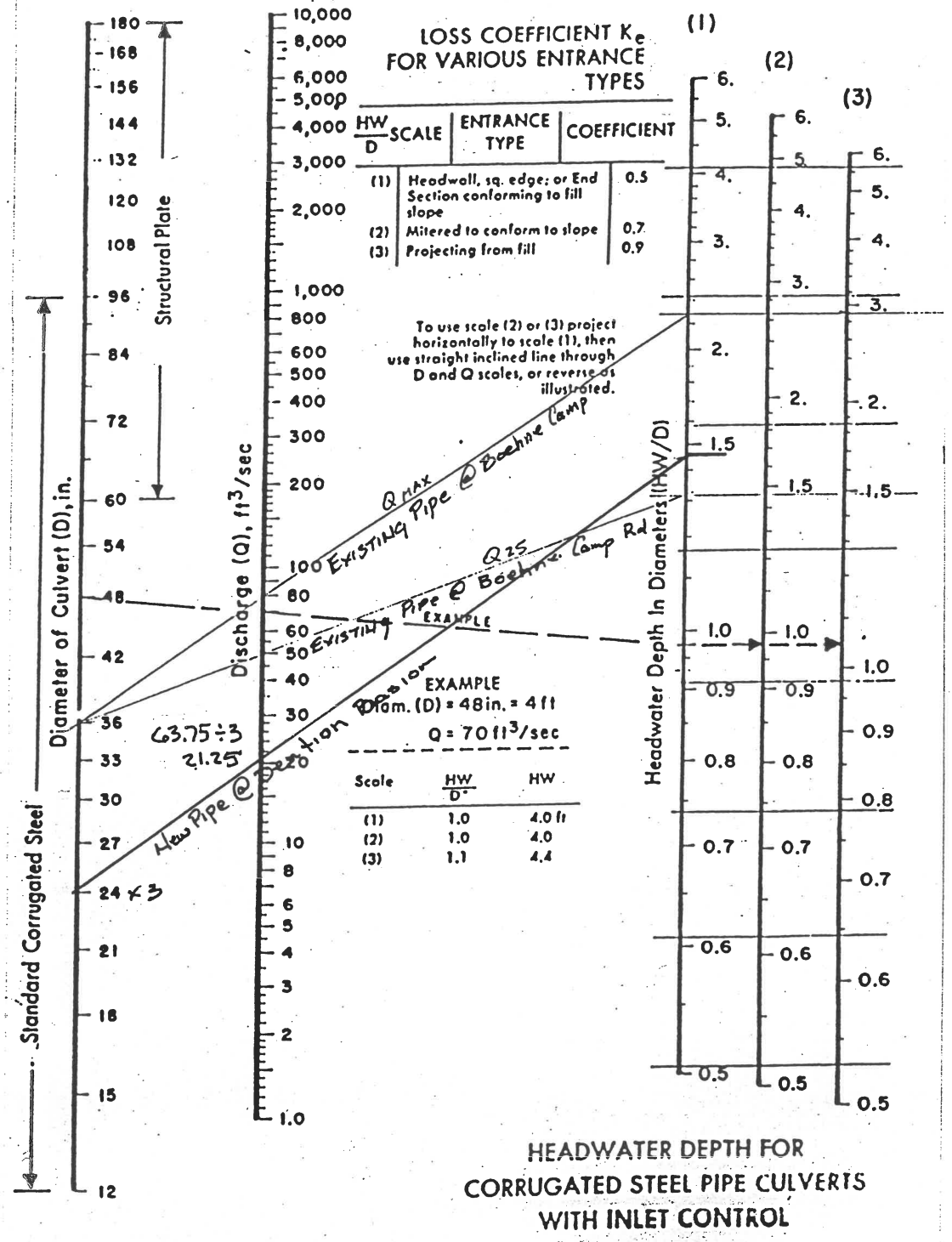


Figure 3.28 *Inlet control* nomograph for corrugated steel *pipe* culverts.[13] The manufacturers recommend keeping *HW/D* to a maximum of 1.5 and preferably to no more than 1.0 for diameters greater than 4 to 5 feet.

DEVELOPED CALCULATIONS FLOW FOR A 25 YEAR STORM

Job Name/Basin #: Basin # 1-2

154,250 Total SF 3.54 AC

Exist. Impervious surfaces (2-5%) C=0.94				
Structures	4 Total	2,250 SF	9,000 Total SF	0.21 AC
Drives	4 Total	700 SF	2,800 Total SF	0.06 AC
Pavement	10 Width (ft)	1,450 L (ft)	14,500 Total SF	0.33 AC
			26,300 **TOTAL**	0.60 AC
Proposed Impervious surfaces (2-5%) C=0.94				
Structures	0 Total	0 SF	0 Total SF	0.00 AC
Drives	0 Total	0 SF	0 Total SF	0.00 AC
Pavement	0 Width (ft)	0 L (ft)	0 Total SF	0.00 AC
Patios	0 Total	0 SF	0 Total SF	0.00 AC
Sidewalks	0 Width (ft)		0 Total SF	0.00 AC
			0 **TOTAL**	0.00 AC
Exist cultivated fields:				
0-2% slope	C=0.20	0 SF	0 Total SF	0.00 AC
2-5% slope	C=0.35	0 SF	0 Total SF	0.00 AC
5-10% slope	C=0.50	0 SF	0 Total SF	0.00 AC
Lake	C=1.0	0 SF	0 Total SF	0.00 AC
			0 **TOTAL**	0.00 AC
For lawn areas:				
0-2% slope	C=0.15	0 SF	0 Total SF	0.00 AC
2-5% slope	C=0.25	12,795 SF	12,795 Total SF	0.29 AC
5-10% slope	C=0.40	115,155 SF	115,155 Total SF	2.64 AC
10+% slope	C=0.55	0 SF	0 Total SF	0.00 AC
			127,950 **TOTAL**	2.94 AC
For woodland areas:				
0-2% slope	C=0.12	0 SF	0 Total SF	0.00 AC
2-5% slope	C=0.24	0 SF	0 Total SF	0.00 AC
5-10% slope	C=0.36	0 SF	0 Total SF	0.00 AC
10+% slope	C=0.48	0 SF	0 Total SF	0.00 AC
			0 **TOTAL**	0.00 AC

Check 154,250 **GT**

Wt'd C =	0.48
Wt'd N =	0.34
High Pt El	501.00 ft
Inlet El	439.00 ft
Length	1,050.00 ft
Slope	0.0590
tc	24.75 min

0 1	Is 5<tc<10?	i 25=	0.00 in/hr
0 1	Is 10<tc<15?	i 25=	0.00 in/hr
1 1	Is 15<tc<30?	i 25=	4.13 in/hr
1 0	Is 30<tc<60?	i 25=	0.00 in/hr

Q25= 7.02 cfs

Date: 3/27/99

DEVELOPED CALCULATIONS FLOW FOR A 25 YEAR STORM

Job Name/Basin #: Basin # 1-3 — 42,300 Total SF 0.97 AC

Exist. Impervious surfaces (2-5%) C=0.94					
Structures	0 Total	2,250 SF		0 Total SF	0.00 AC
Drives	0 Total	700 SF		0 Total SF	0.00 AC
Pavement	10 Width (ft)	510 L (ft)		5,100 Total SF	0.12 AC
				5,100 **TOTAL**	0.12 AC
Proposed Impervious surfaces (2-5%) C=0.94					
Structures	0 Total	0 SF		0 Total SF	0.00 AC
Drives	0 Total	0 SF		0 Total SF	0.00 AC
Pavement	0 Width (ft)	0 L (ft)		0 Total SF	0.00 AC
Patios	0 Total	0 SF		0 Total SF	0.00 AC
Sidewalks	0 Width (ft)			0 Total SF	0.00 AC
				0 **TOTAL**	0.00 AC
Exist cultivated fields:					
0-2% slope	C=0.20	0 SF		0 Total SF	0.00 AC
2-5% slope	C=0.35	0 SF		0 Total SF	0.00 AC
5-10% slope	C=0.50	0 SF		0 Total SF	0.00 AC
Lake	C=1.0	0 SF		0 Total SF	0.00 AC
				0 **TOTAL**	0.00 AC
For lawn areas:					
0-2% slope	C=0.15	9,300 SF		9,300 Total SF	0.21 AC
2-5% slope	C=0.25	27,900 SF		27,900 Total SF	0.64 AC
5-10% slope	C=0.40	0 SF		0 Total SF	0.00 AC
10+% slope	C=0.55	0 SF		0 Total SF	0.00 AC
				37,200 **TOTAL**	0.85 AC
For woodland areas:					
0-2% slope	C=0.12	0 SF		0 Total SF	0.00 AC
2-5% slope	C=0.24	0 SF		0 Total SF	0.00 AC
5-10% slope	C=0.36	0 SF		0 Total SF	0.00 AC
10+% slope	C=0.48	0 SF		0 Total SF	0.00 AC
				0 **TOTAL**	0.00 AC

Check 42,300 **GT**

Wt'd C =	0.31
Wt'd N =	0.35
High Pt El	467.00 ft
Inlet El	445.00 ft
Length	510.00 ft
Slope	0.0431
tc	19.51 min

0 1	Is 5<tc<10?	i 25=	0.00 in/hr
0 1	Is 10<tc<15?	i 25=	0.00 in/hr
1 1	Is 15<tc<30?	i 25=	4.62 in/hr
1 0	Is 30<tc<60?	i 25=	0.00 in/hr

Q25= 1.40 cfs

Date: 3/27/99

STORM SEWER DESIGN SHEET – RATIONAL METHOD

PROJECT TEMME- BOEHNE CAMP CONDOS. DATE 3-27-99 SHEET ____ OF ____

ENGINEER SITECON, INC. DESIGN STORM 25YR. MANNINGS n 0.010 (HDPE)

Line Number	Upstream Manhole	Downstream Manhole	Length (Ft)	C_j	A_j (Acres)	C_jA_j	ΣA_jC_j	t_j (min)	t_{cum} (min)	I [inches/hr]	Q (CFS)	Pipe Diameter (inches)	Pipe Slope (%)	Pipe Capacity (CFS)	Velocity (Ft/Sec)	Travel Time (min)	Rim Elevation Upstream	Rim Elevation Downstream	Invert Elevation Upstream	Invert Elevation Downstream	Pipe Cover Upstream	Pipe Cover Downstream
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1-1			50	0.43	33.3	14.3	—	33.3	—	3.47	49.6	36"	?	BOES UNDER		Hw =	8.8'					
													EXIST.		CO. CULVERT							
1-2			110	0.48	3.5	1.68	—	24.7	—	4.13	6.9	12"	6.8	12.1	15.4							
1-2a			90	—	—	—	16.0	—	33.3	3.47	55.5	36	0.9%	82.3	12							
1-3			125	0.31	0.97	0.30	16.3	19.5	34.0	3.45	56.2	36	0.9%	82.3	12							
DITCH DESIGN (100 yr)						—	16.3	—	34.0	4.3	70											

Man Made Channels -- English Units

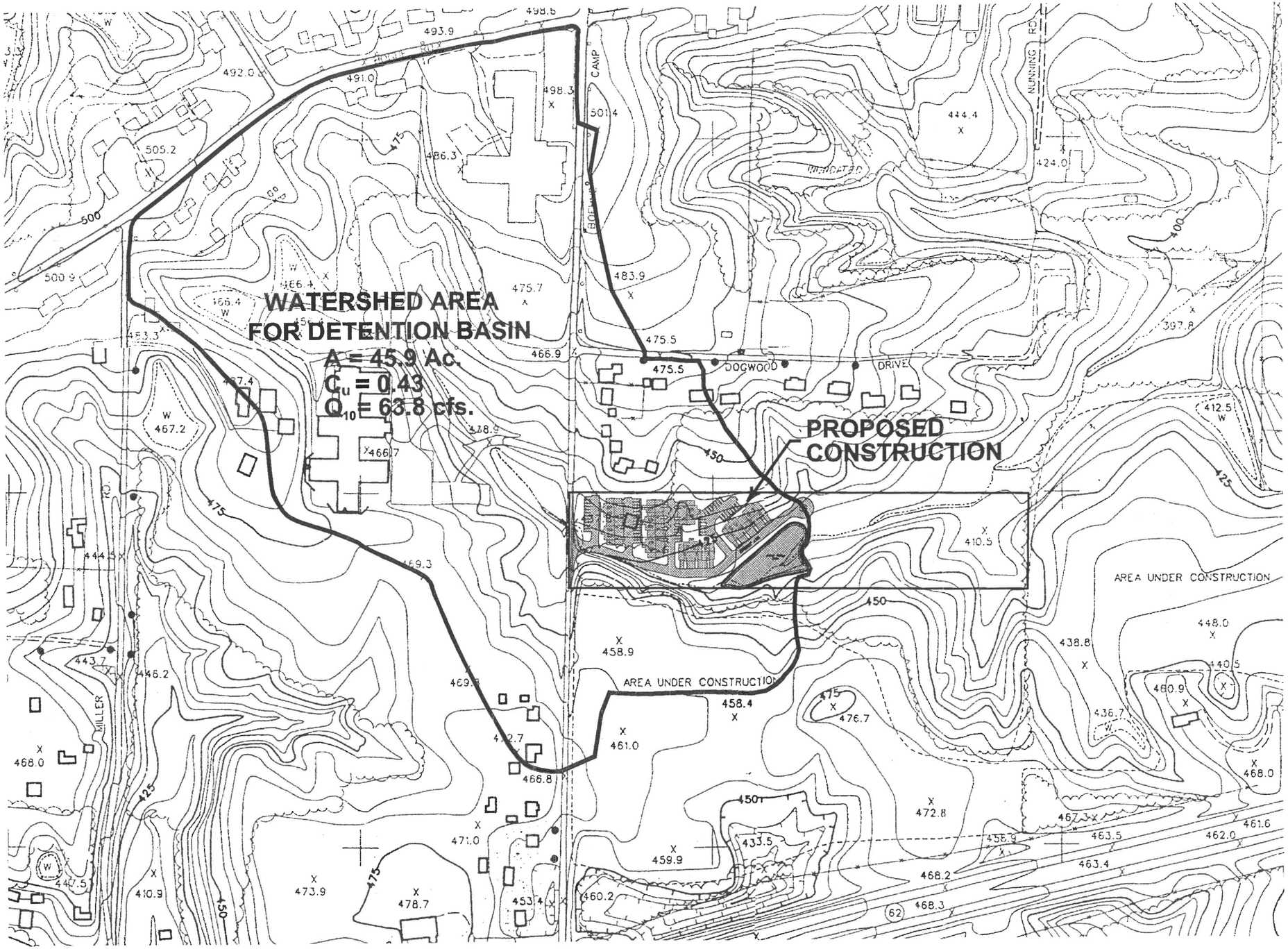
Civil Tools for Windows
(04-10-1999, 09:10:28)

```
          Flow Depth = 2.384 ft
            Flowrate = 70.000 cfs
Channel Bottom Width = 2.000 ft
  Channel Side Slope = 1.000 ft/ft
       Channel Slope = 0.01000 ft/ft
   Channel Roughness = 0.025
        Wetted Area = 10.45 sf
    Wetted Perimeter = 8.74 ft
            Velocity = 6.70 fps
          Froude No. = 0.95
                Flow = Sub-Critical
```

(100 YR. FLOW)

(STONE CONSTRUCTION)

(STONE LINED)



intek of evansville, inc.
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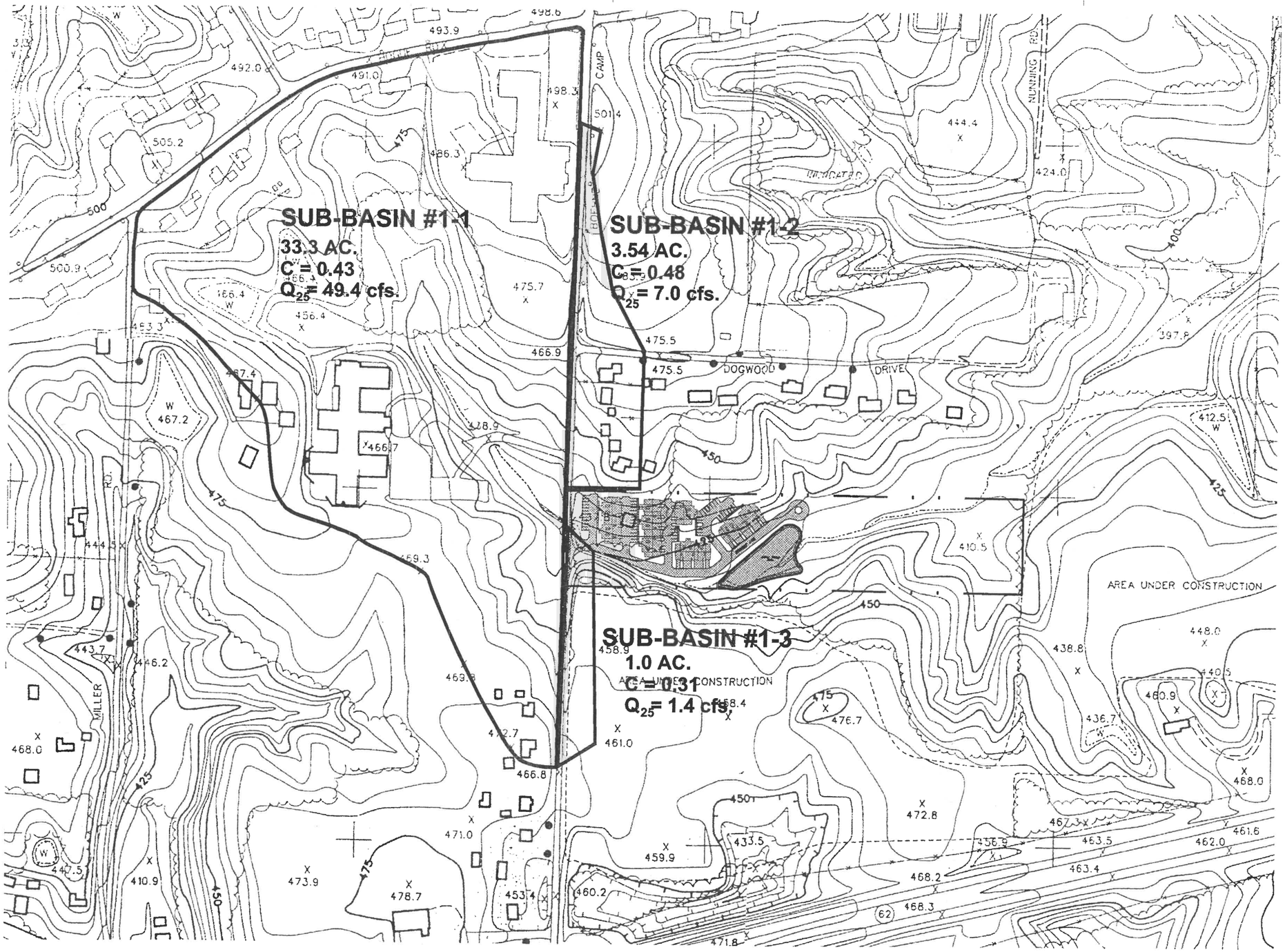

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