INTRODUCTION

Interprop Fund VII is the owner of a 23.99 acre tract of property which lies along the south side of the Lloyd Expressway (SR 62) at Boehne Camp Road. The property is to be developed into an apartment complex which will be comprised of 290 units in 16 buildings with a clubhouse, garage, carports and storage facilities. The construction of this project will increase the storm runoff. The purpose of this report is to address the storm detention needs for this project and to demonstrate that the runoff generated from this project will be handled in an acceptable manner in accordance with current the Vanderburgh County Drainage ordinance.

SITE CONDITIONS

The proposed development lies in an area that is wooded and hilly. There is a northwest/southeast ridge that runs through the westerly one-third of the site. This ridge directs runoff toward the southwest corner of the project and also toward the southeast corner of the project. There is another smaller ridge that parallels that lies north of and runs parallel to the previously described ridge. The valley between these two ridges also directs water towards the east end of the site. In order to control the developed runoff from the site, three lakes/basins will be constructed on the site. Basin 1 shown on the drainage plan was constructed earlier this year to act as a sediment trap during site clearing which took place earlier this year. Sediment traps were also constructed in the central and northeasterly ravine. These measures are all part of an overall erosion control plan submitted to the Vanderburgh County SWCD earlier this year. The amended or updated erosion control plan converts the basins at the southwest corner and the central valley into permanent storm detention basins or amenities. The northeast valley will be filled during the preliminary grading of this project and a storm sewer is planned to route this runoff to the third pond prior to the stormwater leaving the site. These ponds should be constructed as shown early in the construction project so as to continue to provide the needed protection for the downstream landowners. It is the expressed intent of the Owner to afford this area a new and exciting living community.

METHOD

The storm detention analysis which follows is intended to quantify the proper amount of storm detention necessary to prevent additional downstream flooding caused by the development of the subject property.

The site will be divided into three watershed areas. They will be labeled Basin 1, Basin 2A, Basin 2B, and Basin 3 to be located in the southwest corner, central, and southeast corners, respectively.

The Rational Method ($Q = cia$) will be used as outlined in the HERPIC Manual (Chapter 6, particularly) to determine the storage requirements for each basin on the site. The undeveloped 10 year storm will be used as the allowable outflow rate from the basin. The undeveloped *("c")* value used will be taken from Table 804 of the Vanderburgh County Drainage Ordinance as a value indicative of the existing soil type, land use and terrain. The developed *("c")* values will be based on weighted *("c")* values calculated as shown in ***Appendix "B"***. The developed 25 year storm will be used to calculate the required storage volumes and secondary overflow elevations. The basins will be sized to store the 100 year storm before overtopping.

The inflow/outflow hydrographs will be subsequently generated and the storage volume requirements tabulated (***See Appendix "C"***).

The owner will construct a holding basin at three locations as previously mentioned as shown on the attached drainage plan. The majority of the project will be storm sewered to these basins. Some of the perimeter areas may be routed away from the basin due to the lay of the land and the difficulty in piping them to the basins, however, the basins will be sized and designed to capture all of the required runoff and release it at an allowable runoff rate which reflects the entire site. All of the runoff from the site including that not directly contributing to the basins will be assumed in the storage calculations to provide the proper amount storage for the entire site.

The basins will contain a dual outlet structure with a primary outlet sized to limit the discharge of the 10 year storm to the allowable outflow and a secondary outlet to release additional storm water above the 25 year requirement and to keep the basin from overflowing (calculations shown in ***(Appendix "D")***. Emergency spillways will also be established at or above the calculated 100 year storage elevation.

RESULTS

As stated, the excess storm runoff generated from this development will be stored in three detention basins. The critical elevations and storage requirements for each basin is as follows:

Basin 1 - *southwest corner of project*

Base elevation of 426 having zero volume. (Pool elevation of proposed lake)

To elevation 427 =	11,042 CF (0.25 acre/feet)
25 yr. required =	15,001 CF (approx. elev. 427.3)
100 yr. required =	20,700 CF (approx. elev. 427.7)
To elevation 428 =	24,260 CF (0.56 acre/feet)
To elevation 429 =	39,700 CF (0.91 acre/feet)

Basin 2A - *central portion of project*

Base elevation of 427 having zero volume. (Pool elevation of proposed lake)

To elevation 428 =	31,716 CF (0.73 acre/feet)
25 yr. required =	44,056 CF (approx. elev. 428.35)
100 yr. required =	58,005 CF (approx. elev. 428.8)
To elevation 429 =	66,464 CF (1.53 acre/feet)
To elevation 430 =	104,420 CF (2.40 acre/feet)

Basin 2B - *central & southeast portion of project*

Base elevation of 425 having zero volume. (Pool elevation of proposed lake)

To elevation 426 =	5,603 CF (0.12 acre/feet)
25 yr. required =	5,656 CF (approx. elev. 426.0)
100 yr. required =	7,802 CF (approx. elev. 426.3)
To elevation 427 =	12,258 CF (0.28 acre/feet)
To elevation 428 =	20,637 CF (0.48 acre/feet)

Basin 3 - *southeast corner of project*

Base elevation of 399 having zero volume. (Pool elevation of proposed lake)

To elevation 400 =	12,083 CF (0.28 acre/feet)
25 yr. required =	13,168 CF (approx. elev. 400.10)
100 yr. required =	18,800 CF (approx. elev. 400.50)
To elevation 401 =	26,761 CF (0.61 acre/feet)
To elevation 402 =	44,060 CF (1.01 acre/feet)

The primary outlet structure for Basins 1, 2B and 3 will be dual outlet type structures having a low flow pipe set into the side of the precast concrete box at pool elevation to control or

regulate the controlled outflow. A grate will be placed atop a junction box set in the lake bank at the designated elevation to allow for additional release of storm runoff exceeding the designed maximum detention volume for the 25 year storm. Finally an emergency spillway will also be placed no less then one foot (1') below the top of the dam for each basin to allow for controlled overflow of the basin should the 100 year storm occur. The outlet structure for Basin 2A will be a weir type structure cast into a retaining wall having dual outlet capacity. The elevation of the top of the weir wall will be established such that overtopping will occur at a lower elevation than any of the surrounding structures. No side slopes on the earthen dam basins will exceed 3:1 (maximum) above the pool line and 2½:1 (maximum) below the pool line. The combined slopes on the dam shall not exceed 5:1.

APPENDICES INDEX

APPENDIX "A"

OVERALL DRAINAGE PLAN

OVERALL STORM SEWER PLAN

APPENDIX "B"
RUNOFF COEFFICIENTS

TIME OF CONCENTRATION

BASIN 1

$$TC = .827\left[\frac{(N)(L)}{\sqrt{S}}\right]^{.467}$$ (Kerby's Formula)

N = 0.6 Woodland
L = Length
S = Slope

L = 400'
H = 465 - 415 = 50'
S = 50 ÷ 400 = .1250

$$Tc = .827\left[\frac{(0.4)(400)}{\sqrt{.1250}}\right]^{.467} = 14.37 \text{ minutes} \cong 15 \text{ minutes}$$

$$i( ) = \frac{C(T)^{\alpha}}{(Tc+d)^{\beta}}$$

C = 1.9533 T = duration
α = 0.1747 Tc = Time of Concentration (10 yr. undeveloped)
d = 0.522
β = 1.6408

$$i_{10} = \frac{1.9533(10)^{0.1747}}{(15/60+0.522)^{1.6408}} = \frac{2.9206}{0.6540} = 4.4657$$

Check Table (807) = 1.47

$$i_{1} = \frac{1.9533(1)^{0.1747}}{(15/60+0.522)^{1.6408}} = \frac{1.9533}{0.6540} = 2.9867$$

Note: **Lower intensities were used in determining allowable outflow rates, thus reducing the outflow rates and increasing the storage requirements.**

Undeveloped "C" Factor = 0.30 (See Report) **Basin 1**

Taken from Table 3.1 of the HERPIC Manual as the runoff coefficient to be used for woodland areas with rolling to hilly terrain.

***Typical Weighted "C" Factor**

Building/Front Parking	=	0.80
*Lawn Areas	=	0.40

Accumulative Areas of Typical Development

(Southeast of clubhouse)	0.49 @ 0.80	=	0.3920
(Area around clubhouse)	1.06 @ 0.80	=	0.8480
(Lawn areas around clubhouse)	1.11 @ 0.40	=	0.4440
(Area around west half of building 2)	0.57 @ 0.80	=	0.4560
(Area around west half of building 1)	0.75 @ 0.80	=	0.6000
	3.98 acres	=	2.7400
Weighted "C" Factor	2.740/3.98	=	0.69

TIME OF CONCENTRATION

BASIN 2A

$$TC = .827\left[\frac{(N)(L)}{\sqrt{S}}\right]^{.467}$$

(Kerby's Formula)

N = 0.4 Weeds/grass
L = Length
S = Slope

L = 1000'
H = 475 - 415 = 60'
S = 60 ÷ 1000 = .06

$$Tc = .827\left[\frac{(0.4)(1000)}{\sqrt{.06}}\right]^{.467} = 26 \text{ minutes}$$

$$i( ) = \frac{C(T)^{\alpha}}{(Tc+d)^{\beta}}$$

C = 1.9533
α = 0.1747
d = 0.522
β = 1.6408

T = duration
Tc = Time of Concentration (10 yr. undeveloped)

$$i_{10} = \frac{1.9533(10)^{0.1747}}{(25/60+0.522)^{1.6408}} = \frac{2.9206}{0.9014} = 3.24$$

Check Table (807) = 1.47

$$i_{1} = \frac{1.9533(1)^{0.1747}}{(25/60+0.522)^{1.6408}} = \frac{2.9206}{0.9014} = 2.17$$

Note: **Lower intensities were used in determining allowable outflow rates, thus reducing the outflow rates and increasing the storage requirements.**

Undeveloped "C" Factor = 0.30 (See Report) **Basin 2A**

Taken from Table 3.1 of the HERPIC Manual as the runoff coefficient to be used for woodland areas with rolling to hilly terrain.

***Typical Weighted "C" Factor**

Building/Front Parking	=	0.80
*Lawn Areas	=	0.40

Basin 2A

(Area around east half of building 1)	0.75 @ 0.80	=	0.6000
(Area around east half of building 2)	0.57 @ 0.80	=	0.4560
(Entrance road)	0.36 @ 0.65	=	0.2340
(Lawn around lake)	1.98 @ 0.40	=	0.7920
(Area around buildings 4-10)	6.37 @ 0.80	=	5.0960
	10.04 acres	=	7.1780
Weighted "C" Factor	7.1780/10.04	=	0.715

TIME OF CONCENTRATION

BASIN 2B

$$TC = .827\left[\frac{(N)(L)}{\sqrt{S}}\right]^{.467}$$ (Kerby's Formula)

N = 0.6 Woodland
L = Length
S = Slope

L = 400'
H = 462 - 415 = 47'
S = 47 ÷ 400 = .1175

$$Tc = .827\left[\frac{(0.4)(400)}{\sqrt{.1175}}\right]^{.467} = 14.58 \text{ minutes} \cong 15 \text{ minutes}$$

$$i( ) = \frac{C(T)^{\alpha}}{(Tc+d)^{\beta}}$$

C = 1.9533 T = duration
α = 0.1747 Tc = Time of Concentration (10 yr. undeveloped)
d = 0.522
β = 1.6408

$$i_{10} = \frac{1.9533(10)^{0.1747}}{(15/60+0.522)^{1.6408}} = \frac{2.9206}{0.6540} = 4.4657$$

Check Table (807) = 1.47

$$i_{1} = \frac{1.9533(1)^{0.1747}}{(15/60+0.522)^{1.6408}} = \frac{1.9533}{0.6540} = 2.9967$$

Note: Lower intensities were used in determining allowable outflow rates, thus reducing the outflow rates and increasing the storage requirements.

Undeveloped "C" Factor = 0.30 (See Report) **Basin 2B**

Taken from Table 3.1 of the HERPIC Manual as the runoff coefficient to be used for woodland areas with rolling to hilly terrain.

***Typical Weighted "C" Factor**

Building/Front Parking	=	0.80
*Lawn Areas	=	0.40

Accumulative Areas of Typical Development

(Lawn area around lake)	0.32 @ 0.40	=	0.128
(Area around building 16 and maintenance facility)	1.18 @ 0.80	=	0.944
	1.50 acres	=	1.072
Weighted "C" Factor	1.072/1.50	=	0.7147

TIME OF CONCENTRATION

BASIN 3

$$TC = .827\left[\frac{(N)(L)}{\sqrt{S}}\right]^{.467}$$ (Kerby's Formula)

N = 0.4 Pasture/weeds
L = Length
S = Slope

L = 400'
H = 450 - 400 = 50'
S = 50 ÷ 400 = .1250

$$Tc = .827\left[\frac{(0.4)(400)}{\sqrt{.1250}}\right]^{.467} = 14.38 \text{ minutes} \cong 15 \text{ minutes}$$

$$i( ) = \frac{C(T)^{\alpha}}{(Tc+d)^{\beta}}$$

C = 1.9533 T = duration
α = 0.1747 Tc = Time of Concentration (10 yr. undeveloped)
d = 0.522
β = 1.6408

$$i_{10} = \frac{1.9533(10)^{0.1747}}{(15/60+0.522)^{1.6408}} = \frac{2.9206}{0.6540} = 4.4657$$

Check Table (807) = 1.47

$$i_{1} = \frac{1.9533(1)^{0.1747}}{(15/60+0.522)^{1.6408}} = \frac{1.9533}{0.6540} = 2.9867$$

Note: Lower intensities were used in determining allowable outflow rates, thus reducing the outflow rates and increasing the storage requirements.

Undeveloped "C" Factor = 0.30 (See Report) **Basin 3**

Taken from Table 3.1 of the HERPIC Manual as the runoff coefficient to be used for woodland areas with rolling to hilly terrain.

***Typical Weighted "C" Factor**

Building/Front Parking	=	0.80
*Lawn Areas	=	0.40

Accumulative Areas of Typical Development

(Lawn areas/wooded areas)	2.22 @ 0.40	=	0.888
(Typical areas around buildings 10, 11, 12, 13, 14 & 15)	2.50 @ 0.80	=	2.000
	4.72 acres	=	2.888
Weighted "C" Factor	2.888/4.72	=	0.60

APPENDIX "C"
STORAGE VOLUME OUTPUT DATA

BASIN 1
Reduced outflow
1YR Intensity

PROJECT: NEVILLE 1 DATE: 09/14/99
ENGINEER:

	5\10\25\100		
RELEASE RATE PERIOD:	5\10\25\100		
WATERSHED AREA (ACRES):	3.98		
TIME OF CONCENTRATION UNDEV. (min):	27.8		
RAINFALL INTENSITY (INCHES/HR):	3.29	2.992248	2.752301
UNDEVELOPED RUNOFF COEFFICIENT:	0.3		
UNDEVELOPED RUNOFF RATE (CFS):	3.57		
DEVELOPED RUNOFF COEFFICIENT:	0.76		

25 YEAR STORM

STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)	
0.08	8.02	24.25	3.57	20.67	0.138	6.85
0.17	6.20	18.75	3.57	15.18	0.215	5.45
0.25	5.26	15.92	3.57	12.35	0.257	4.65
0.33	4.62	13.97	3.57	10.40	0.286	4.15
0.42	4.09	12.36	3.57	8.79	0.308	3.80
0.50	3.72	11.25	3.57	7.68	0.320	3.40
0.58	3.42	10.35	3.57	6.78	0.328	3.20
0.67	3.15	9.52	3.57	5.95	0.332	2.85
0.75	2.94	8.90	3.57	5.32	0.333	2.75
0.83	2.76	8.36	3.57	4.78	0.331	2.60
0.92	2.59	7.83	3.57	4.26	0.326	2.45
1.00	2.45	7.42	3.29	4.13	0.345	2.30
1.25	2.11	6.40	3.29	3.11	0.324	2.05
1.50	1.86	5.63	3.29	2.35	0.293	1.85
1.75	1.67	5.04	3.29	1.76	0.256	1.60
2.00	1.51	4.57	3.29	1.28	0.213	1.40
2.50	1.27	3.85	3.29	0.56	0.117	1.25
3.00	1.10	3.33	3.29	0.04	0.011	1.10
4.00	0.87	2.62	3.29	-0.66	-0.221	0.84

PEAK STORAGE (ACRE/FT): 0.34
PEAK STORAGE (CUBIC FT): 15009.72

BASIN 1
Reduced outflow
1 YR Intensity

100 YEAR STORM

STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)
0.08	9.52	28.80	3.57	25.23	0.168
0.17	7.40	22.37	3.57	18.80	0.266
0.25	6.30	19.05	3.57	15.48	0.323
0.33	5.54	16.75	3.57	13.18	0.363
0.42	4.91	14.85	3.57	11.28	0.395
0.50	4.48	13.54	3.57	9.97	0.415
0.58	4.12	12.48	3.57	8.90	0.430
0.67	3.80	11.49	3.57	7.91	0.442
0.75	3.55	10.74	3.57	7.17	0.448
0.83	3.34	10.10	3.57	6.53	0.452
0.92	3.13	9.48	3.57	5.90	0.453
1.00	2.97	8.99	3.29	5.70	0.475
1.25	2.57	7.76	3.29	4.48	0.466
1.50	2.27	6.85	3.29	3.57	0.446
1.75	2.03	6.14	3.29	2.86	0.417
2.00	1.84	5.57	3.29	2.29	0.381
2.50	1.56	4.71	3.29	1.42	0.297
3.00	1.35	4.08	3.29	0.80	0.199
4.00	1.07	3.23	3.29	-0.06	-0.020
			3.29		

PEAK STORAGE (ACRE/FT): 0.48
PEAK STORAGE (CUBIC FT): 20700.16

Basin 2A
Reduced outflow
1YR intensity

PROJECT: NEVILLE BASIN2A DATE: 09/14/99
ENGINEER:

RELEASE RATE PERIOD:	5\10\25\100		
	5\10\25\100		
WATERSHED AREA (ACRES):	10.03		
TIME OF CONCENTRATION UNDEV. (min):	40.5		
RAINFALL INTENSITY (INCHES/HR):	2.64	2.174363	2.254378
UNDEVELOPED RUNOFF COEFFICIENT:	0.3		
UNDEVELOPED RUNOFF RATE (CFS):	6.54		
DEVELOPED RUNOFF COEFFICIENT:	0.76		

25 YEAR STORM

STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)	
0.08	8.02	61.10	6.54	54.56	0.364	6.85
0.17	6.20	47.25	6.54	40.70	0.577	5.45
0.25	5.26	40.13	6.54	33.59	0.700	4.65
0.33	4.62	35.21	6.54	28.67	0.788	4.15
0.42	4.09	31.15	6.54	24.61	0.861	3.80
0.50	3.72	28.36	6.54	21.82	0.909	3.40
0.58	3.42	26.09	6.54	19.55	0.945	3.20
0.67	3.15	23.99	6.54	17.45	0.974	2.85
0.75	2.94	22.42	6.54	15.87	0.992	2.75
0.83	2.76	21.06	6.54	14.52	1.004	2.60
0.92	2.59	19.73	6.54	13.19	1.011	2.45
1.00	2.45	18.70	6.78	11.92	0.993	2.30
1.25	2.11	16.12	6.78	9.33	0.972	2.05
1.50	1.86	14.20	6.78	7.41	0.927	1.85
1.75	1.67	12.71	6.78	5.92	0.864	1.60
2.00	1.51	11.51	6.78	4.73	0.788	1.40
2.50	1.27	9.70	6.78	2.92	0.607	1.25
3.00	1.10	8.39	6.78	1.61	0.402	1.10
4.00	0.87	6.61	6.78	-0.17	-0.058	0.84

PEAK STORAGE (ACRE/FT): 1.01
PEAK STORAGE (CUBIC FT): 44056.24

Basin 2A
Reduced outfl
14yr intensity

100 YEAR STORM

STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)
0.08	9.52	72.59	6.54	66.05	0.440
0.17	7.40	56.38	6.54	49.84	0.706
0.25	6.30	48.02	6.54	41.48	0.864
0.33	5.54	42.22	6.54	35.68	0.981
0.42	4.91	37.43	6.54	30.88	1.081
0.50	4.48	34.13	6.54	27.58	1.149
0.58	4.12	31.44	6.54	24.90	1.203
0.67	3.80	28.94	6.54	22.40	1.251
0.75	3.55	27.08	6.54	20.53	1.283
0.83	3.34	25.46	6.54	18.92	1.308
0.92	3.13	23.88	6.54	17.34	1.329
1.00	2.97	22.65	6.78	15.87	1.322
1.25	2.57	19.57	6.78	12.78	1.332
1.50	2.27	17.27	6.78	10.49	1.311
1.75	2.03	15.48	6.78	8.70	1.269
2.00	1.84	14.05	6.78	7.26	1.210
2.50	1.56	11.87	6.78	5.08	1.059
3.00	1.35	10.29	6.78	3.51	0.876
4.00	1.07	8.13	6.78	1.35	0.450
			6.78		

PEAK STORAGE (ACRE/FT): 1.33
PEAK STORAGE (CUBIC FT): 58005.00

BASIN 2B
Reduced outflow
1YR intensity

PROJECT: NEVILLE BASIN2B DATE: 09/14/99
ENGINEER:

RELEASE RATE PERIOD:	5\10\25\100	
	5\10\25\100	
WATERSHED AREA (ACRES):	1.5	
TIME OF CONCENTRATION UNDEV. (min):	27.8	
RAINFALL INTENSITY (INCHES/HR):	3.29	2.992248 2.752301
UNDEVELOPED RUNOFF COEFFICIENT:	0.3	
UNDEVELOPED RUNOFF RATE (CFS):	1.35	
DEVELOPED RUNOFF COEFFICIENT:	0.76	

25 YEAR STORM

Accum outflow B2A + B2B 6.54 + 1.35 = 7.89 CFS

STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)	
0.08	8.02	9.14	1.35	7.79	0.052	6.85
0.17	6.20	7.07	1.35	5.72	0.081	5.45
0.25	5.26	6.00	1.35	4.66	0.097	4.65
0.33	4.62	5.27	1.35	3.92	0.108	4.15
0.42	4.09	4.66	1.35	3.31	0.116	3.80
0.50	3.72	4.24	1.35	2.89	0.121	3.40
0.58	3.42	3.90	1.35	2.56	0.124	3.20
0.67	3.15	3.59	1.35	2.24	0.125	2.85
0.75	2.94	3.35	1.35	2.01	0.125	2.75
0.83	2.76	3.15	1.35	1.80	0.125	2.60
0.92	2.59	2.95	1.35	1.60	0.123	2.45
1.00	2.45	2.80	1.24	1.56	0.130	2.30
1.25	2.11	2.41	1.24	1.17	0.122	2.05
1.50	1.86	2.12	1.24	0.88	0.111	1.85
1.75	1.67	1.90	1.24	0.66	0.096	1.60
2.00	1.51	1.72	1.24	0.48	0.080	1.40
2.50	1.27	1.45	1.24	0.21	0.044	1.25
3.00	1.10	1.25	1.24	0.02	0.004	1.10
4.00	0.87	0.99	1.24	-0.25	-0.083	0.84

PEAK STORAGE (ACRE/FT):	0.13
PEAK STORAGE (CUBIC FT):	5656.93

Basin 2B
Reduced outflow
14R intensity

100 YEAR STORM

STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)
0.08	9.52	10.86	1.35	9.51	0.063
0.17	7.40	8.43	1.35	7.09	0.100
0.25	6.30	7.18	1.35	5.83	0.122
0.33	5.54	6.31	1.35	4.97	0.137
0.42	4.91	5.60	1.35	4.25	0.149
0.50	4.48	5.10	1.35	3.76	0.157
0.58	4.12	4.70	1.35	3.36	0.162
0.67	3.80	4.33	1.35	2.98	0.166
0.75	3.55	4.05	1.35	2.70	0.169
0.83	3.34	3.81	1.35	2.46	0.170
0.92	3.13	3.57	1.35	2.23	0.171
1.00	2.97	3.39	1.24	2.15	0.179
1.25	2.57	2.93	1.24	1.69	0.176
1.50	2.27	2.58	1.24	1.34	0.168
1.75	2.03	2.32	1.24	1.08	0.157
2.00	1.84	2.10	1.24	0.86	0.144
2.50	1.56	1.77	1.24	0.54	0.112
3.00	1.35	1.54	1.24	0.30	0.075
4.00	1.07	1.22	1.24	-0.02	-0.007
			1.24		

PEAK STORAGE (ACRE/FT): 0.18
PEAK STORAGE (CUBIC FT): 7801.57

BASIN 3
Reduced outflow
1/4 hr intensity

PROJECT: NEVILLE BASIN3 DATE: 09/14/99
ENGINEER:

RELEASE RATE PERIOD:	5\10\25\100		
WATERSHED AREA (ACRES):	5\10\25\100 5.41		
TIME OF CONCENTRATION UNDEV. (min):	27.8		
RAINFALL INTENSITY (INCHES/HR):	3.29	2.992248	2.752301
UNDEVELOPED RUNOFF COEFFICIENT:	0.3		
UNDEVELOPED RUNOFF RATE (CFS):	4.86		
DEVELOPED RUNOFF COEFFICIENT:	0.6		

25 YEAR STORM

STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)	
						B2A + B2B + B3
						Accum outflow = 6.54 + 1.35 + 4.86 = 12.75
0.08	8.02	26.02	4.86	21.16	0.141	6.85
0.17	6.20	20.12	4.86	15.26	0.216	5.45
0.25	5.26	17.09	4.86	12.23	0.255	4.65
0.33	4.62	14.99	4.86	10.14	0.279	4.15
0.42	4.09	13.26	4.86	8.41	0.294	3.80
0.50	3.72	12.08	4.86	7.22	0.301	3.40
0.58	3.42	11.11	4.86	6.25	0.302	3.20
0.67	3.15	10.22	4.86	5.36	0.299	2.85
0.75	2.94	9.55	4.86	4.69	0.293	2.75
0.83	2.76	8.97	4.86	4.11	0.284	2.60
0.92	2.59	8.40	4.86	3.55	0.272	2.45
1.00	2.45	7.96	4.47	3.50	0.291	2.30
1.25	2.11	6.86	4.47	2.40	0.250	2.05
1.50	1.86	6.05	4.47	1.58	0.197	1.85
1.75	1.67	5.41	4.47	0.94	0.138	1.60
2.00	1.51	4.90	4.47	0.43	0.072	1.40
2.50	1.27	4.13	4.47	-0.34	-0.070	1.25
3.00	1.10	3.57	4.47	-0.89	-0.224	1.10
4.00	0.87	2.81	4.47	-1.65	-0.551	0.84

PEAK STORAGE (ACRE/FT): 0.30
PEAK STORAGE (CUBIC FT): 13168.51

Basin 3
Reduced outflo
1yr Intensity

100 YEAR STORM

STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)
0.08	9.52	30.91	4.86	26.05	0.174
0.17	7.40	24.01	4.86	19.15	0.271
0.25	6.30	20.45	4.86	15.59	0.325
0.33	5.54	17.98	4.86	13.12	0.361
0.42	4.91	15.94	4.86	11.08	0.388
0.50	4.48	14.53	4.86	9.68	0.403
0.58	4.12	13.39	4.86	8.53	0.412
0.67	3.80	12.33	4.86	7.47	0.417
0.75	3.55	11.53	4.86	6.67	0.417
0.83	3.34	10.84	4.86	5.99	0.414
0.92	3.13	10.17	4.86	5.31	0.407
1.00	2.97	9.65	4.47	5.18	0.432
1.25	2.57	8.33	4.47	3.87	0.403
1.50	2.27	7.35	4.47	2.89	0.361
1.75	2.03	6.59	4.47	2.13	0.310
2.00	1.84	5.98	4.47	1.51	0.252
2.50	1.56	5.05	4.47	0.59	0.122
3.00	1.35	4.38	4.47	-0.09	-0.021
4.00	1.07	3.46	4.47	-1.00	-0.334
			4.47		

PEAK STORAGE (ACRE/FT): 0.43
PEAK STORAGE (CUBIC FT): 18800.22

APPENDIX "D"
OUTLET CONTROL STRUCTURE ANALYSIS

OUTLET CONTROL STRUCTURE

ORIFICE EQUATION

Primary Outlet Sizing - Basin 1

$$cd = Cc \times Cv = (.62)(.97) = .60$$

$Q = cdA\sqrt{2gh}$

Allow Outflow $Q = CIA = (0.3)(2.99)(3.98) = 3.57$ CFS

c = 0.3
i = 2.99
a = 3.98 acres

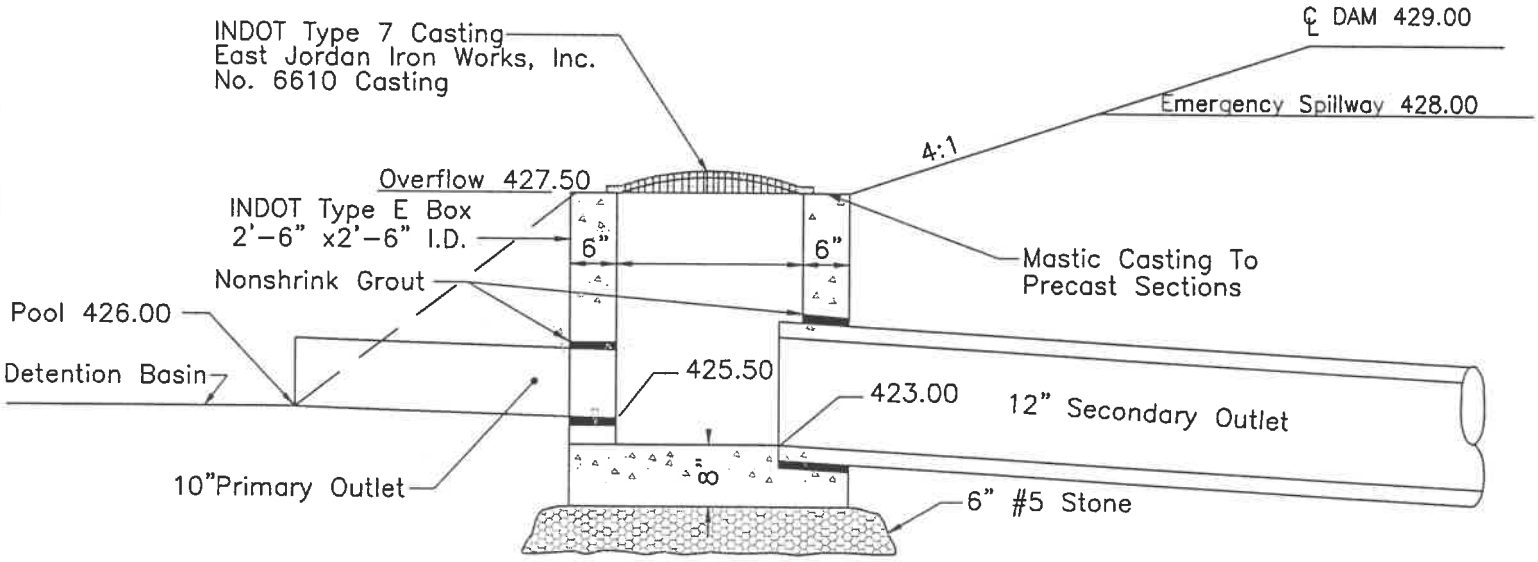
Allow HW = Top of Box to Invert of Pipe 426.00 - 428.00 = 2.0

$$(3.57) = Q = (.60)(A)\sqrt{2(32.2)(2.0)}$$

$$A = \frac{3.57}{6.8094} = 0.5243 = \frac{\Pi d^2}{4}$$

d = 0.8176

Use a 10" diameter pipe



STR. NO. 111 BASIN #1
PRECAST OUTLET CONTROL STRUCTURE

BASIN 1
outlet str.
SECONDARY
PIPE

CURRENT DATE: 09-15-1999
CURRENT TIME: 18:16:24

FILE DATE: 09-15-1999
FILE NAME: NEVILLE1

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

	SITE DATA			CULVERT SHAPE, MATERIAL, INLET				
NO.	INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	423.00	410.00	100.84	1 RCP	1.00	1.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

Lowest culvert pipe

12" ϕ pipe

SUMMARY OF CULVERT FLOWS (cfs) FILE: NEVILLE1 DATE: 09-15-199

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITE
423.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
423.54	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
423.86	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
424.19	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
424.42	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
425.21	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
425.92	6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
426.76	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
427.73	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
428.88	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
430.36	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: NEVILLE1 DATE: 09-15-199

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
423.00	0.000	0.00	0.00	0.00
423.54	0.000	1.00	0.00	0.00
423.86	0.000	2.00	0.00	0.00
424.19	0.000	3.00	0.00	0.00
424.42	0.000	3.57	0.00	0.00
425.21	0.000	5.00	0.00	0.00
425.92	0.000	6.00	0.00	0.00

427.73	0.000	8.00	0.00	0.00
428.88	0.000	9.00	0.00	0.00
430.36	0.000	10.00	0.00	0.00

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

CURRENT DATE: 09-15-1999 FILE DATE: 09-15-1999
CURRENT TIME: 18:16:24 FILE NAME: NEVILLE1

PERFORMANCE CURVE FOR CULVERT 1 - 1(1.00 (ft) BY 1.00 (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
0.00	423.00	0.00	-13.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.0(
1.00	423.54	0.54	-12.19	1-S2n	0.18	0.42	0.17	0.23	11.19	1.2
2.00	423.86	0.86	-11.78	1-S2n	0.25	0.60	0.24	0.34	14.04	1.5
3.00	424.19	1.19	-11.18	1-S2n	0.31	0.74	0.24	0.43	21.44	1.8(
3.57	424.42	1.42	-10.76	1-S2n	0.34	0.81	0.35	0.48	15.05	1.9(
5.00	425.21	2.21	-9.41	1-S2n	0.41	0.92	0.32	0.57	22.80	2.1
6.00	425.92	2.92	-8.22	6-FFc	0.46	1.00	1.00	0.63	7.64	2.2
7.00	426.76	3.76	-6.85	6-FFc	0.50	1.00	1.00	0.69	8.91	2.3
8.00	427.73	4.73	-5.28	6-FFc	0.54	1.00	1.00	0.74	10.19	2.4
9.00	428.88	5.88	-3.49	6-FFc	0.58	1.00	1.00	0.79	11.46	2.5(
10.00	430.36	7.36	-1.49	6-FFc	0.63	1.00	1.00	0.83	12.73	2.5

El. inlet face invert 423.00 ft El. outlet invert 410.00 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

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

INLET STATION	0.00 ft
INLET ELEVATION	423.00 ft
OUTLET STATION	100.00 ft
OUTLET ELEVATION	410.00 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.1300
CULVERT LENGTH ALONG SLOPE	100.84 ft

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

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	1.00 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: 09-15-1999
CURRENT TIME: 18:16:24

FILE DATE: 09-15-1999
FILE NAME: NEVILLE1

DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD
DDDDDDDDDDDDDDDDDDDDDDDDDDD TAILWATER DDDDDDDDDDDDDDDDDDDDDDDDDD
DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD

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

BOTTOM WIDTH	3.00 ft
SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (ft/ft)	0.010
MANNING'S n (.01-0.1)	0.040
CHANNEL INVERT ELEVATION	410.00 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	410.00 ft

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

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	410.00	0.000	0.00	0.00	0.00
1.00	410.23	0.463	0.23	1.26	0.14
2.00	410.34	0.477	0.34	1.58	0.21
3.00	410.43	0.484	0.43	1.80	0.27
3.57	410.48	0.486	0.48	1.90	0.30
5.00	410.57	0.490	0.57	2.11	0.36
6.00	410.63	0.492	0.63	2.22	0.40
7.00	410.69	0.494	0.69	2.33	0.43
8.00	410.74	0.495	0.74	2.42	0.46
9.00	410.79	0.497	0.79	2.50	0.49
10.00	410.83	0.498	0.83	2.58	0.52

DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD
DDDDDDDDDDDDDDDDDDDDDDDDDDD ROADWAY OVERTOPPING DATA DDDDDDDDDDDDDDDDDDDDDDDDDD
DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	12.00 ft
CREST LENGTH	50.00 ft
OVERTOPPING CREST ELEVATION	429.00 ft

DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD

OUTLET CONTROL STRUCTURE

Primary Outlet Sizing Basin 2A

Q = CL x H 3/2

(L should be approximately 4 times H)

C = Wier coefficient = 3.367

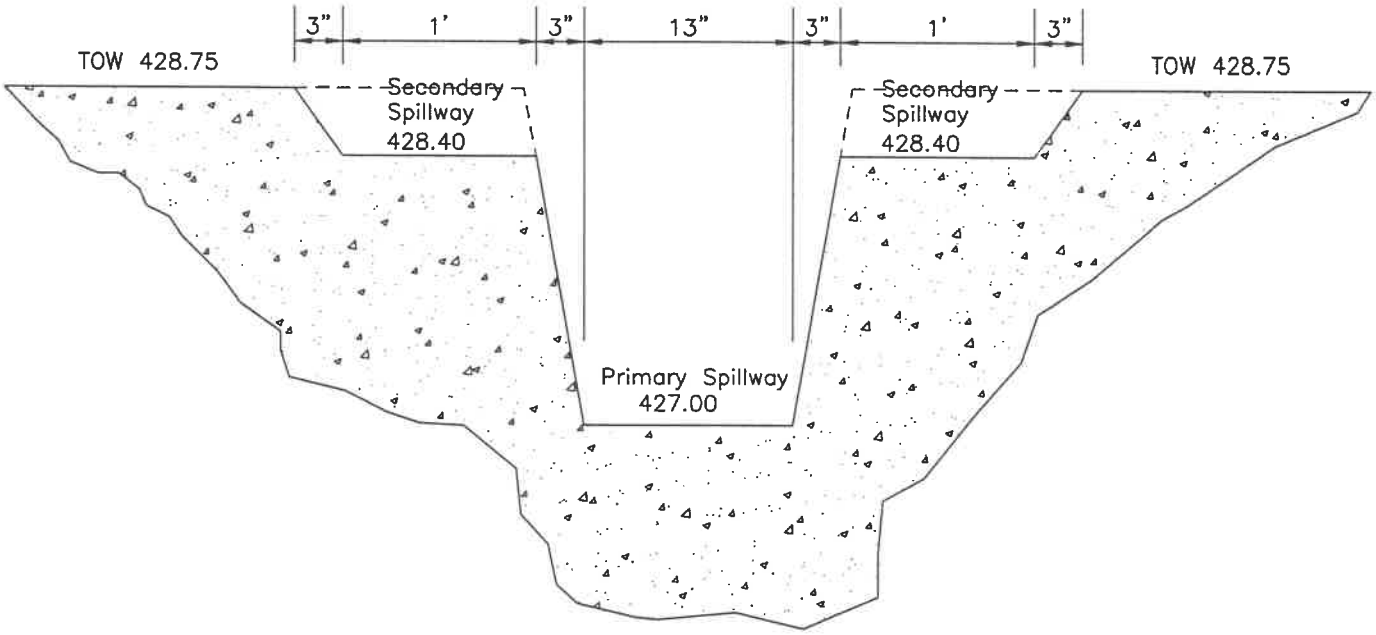
Q = 6.54 (See Appendix C)

6.54 = (3.367) (L) (1.40) 3/2

6.54 = 2.1869 (L)

L = 1.17' (14")

Not To Scale



BASIN #2A
WEIR

OUTLET CONTROL STRUCTURE

Primary Outlet Sizing - Basin 2B

$Q = cdA\sqrt{2gh}$

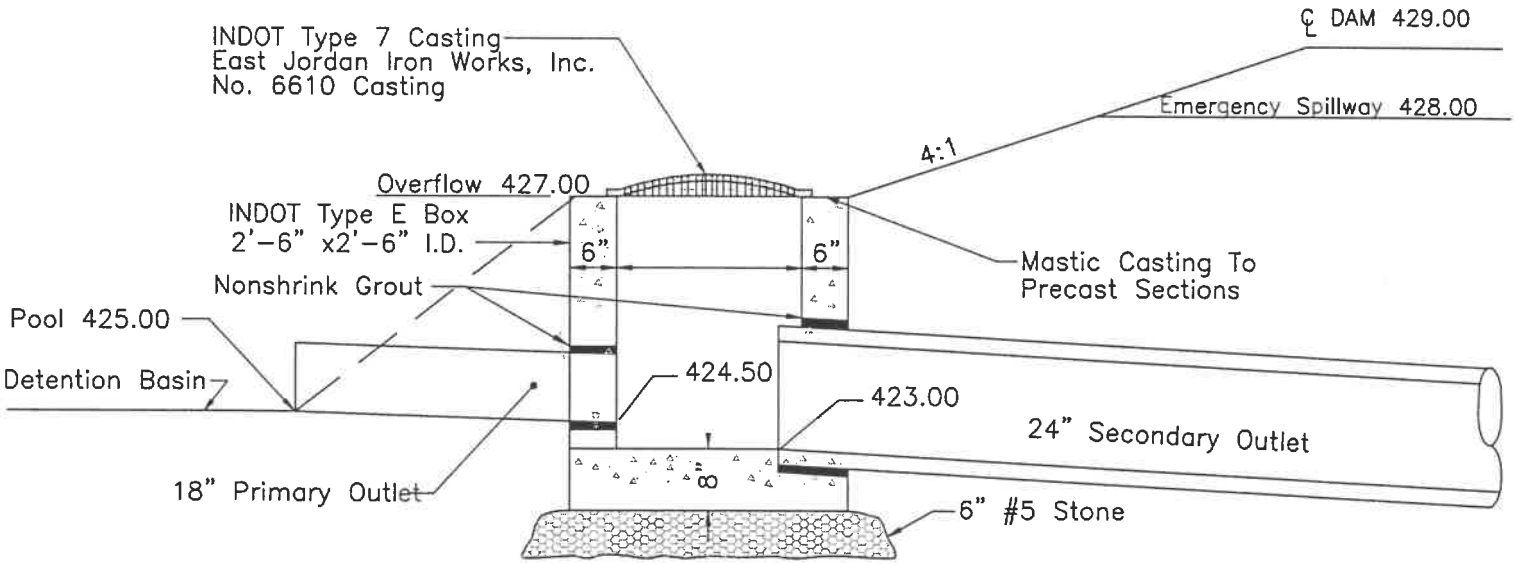
Allowable Hw = 1.50

$7.89 = Q = (0.60)\ (A)\ \sqrt{2(32.2)(1.5)}$

$$\frac{7.89}{5.8971} = 1.338 = \frac{\Pi d^2}{4}$$

d = 1.30

Use 18" primary



STR. NO. 142 BASIN #2B
PRECAST OUTLET CONTROL STRUCTURE
Not To Scale

Neville 2B
Secondary Pipe
Set Down IN
Box

CURRENT DATE: 09-15-1999
CURRENT TIME: 17:22:43

FILE DATE: 09-15-1999
FILE NAME: NEVILLE2

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

SITE DATA

NO.	INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)
1	423.00	418.80	149.06
2			
3			
4			
5			
6			

Secondary Pipe Set down 2"

CULVERT SHAPE, MATERIAL, INLET

BARRELS	SHAPE	MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	RCP		2.00	2.00	.012	CONVENTIONAL

24" ϕ pipe

SUMMARY OF CULVERT FLOWS (cfs) FILE: NEVILLE2 DATE: 09-15-199

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITE
423.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
423.68	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
424.08	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
424.40	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
424.45	7.9	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
424.95	12.5	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
425.23	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
425.55	17.5	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
425.92	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
426.33	22.5	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
426.81	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

Drop in Below 24"

Overflow for Primary Pipe

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: NEVILLE2 DATE: 09-15-199

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
423.00	0.000	0.00	0.00	0.00
423.68	0.000	2.50	0.00	0.00
424.08	0.000	5.00	0.00	0.00
424.40	0.000	7.50	0.00	0.00
424.45	0.000	7.89	0.00	0.00
424.95	0.000	12.50	0.00	0.00
425.23	0.000	15.00	0.00	0.00

425.92	0.000	20.00	0.00	0.00
426.33	0.000	22.50	0.00	0.00
426.81	0.000	25.00	0.00	0.00

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

CURRENT DATE: 09-15-1999 FILE DATE: 09-15-1999
CURRENT TIME: 17:22:43 FILE NAME: NEVILLE2

PERFORMANCE CURVE FOR CULVERT 1 - 1(2.00 (ft) BY 2.00 (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
0.00	423.00	0.00	-2.20	0-NF	0.00	0.00	0.00	2.00	0.00	0.00
2.50	423.68	0.68	0.68	1-S1f	0.32	0.54	0.70	2.00	2.54	0.00
5.00	424.08	1.08	1.08	1-S1f	0.46	0.79	0.90	2.00	3.64	0.00
7.50	424.40	1.40	1.40	1-S1f	0.57	0.97	1.10	2.00	4.24	0.00
7.89	424.45	1.45	1.45	1-S1f	0.59	1.00	1.10	2.00	4.46	0.00
12.50	424.95	1.95	1.95	1-S1f	0.75	1.27	1.40	2.00	5.32	0.00
15.00	425.23	2.23	2.23	1-S1f	0.83	1.40	1.50	2.00	5.95	0.00
17.50	425.55	2.55	2.55	1-S1f	0.91	1.50	1.70	2.00	6.17	0.00
20.00	425.92	2.92	2.92	1-S1f	0.98	1.60	1.80	2.00	6.72	0.00
22.50	426.33	3.33	3.33	1-S1f	1.05	1.68	1.80	2.00	7.56	0.00
25.00	426.81	3.81	3.81	1-S1f	1.12	1.75	1.90	2.00	8.17	0.00

El. inlet face invert 423.00 ft El. outlet invert 418.80 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

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

INLET STATION	0.00 ft
INLET ELEVATION	423.00 ft
OUTLET STATION	149.00 ft
OUTLET ELEVATION	418.80 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0282
CULVERT LENGTH ALONG SLOPE	149.06 ft

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

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	2.00 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: 09-15-1999
CURRENT TIME: 17:22:43

FILE DATE: 09-15-1999
FILE NAME: NEVILLE2

TAILWATER

CONSTANT WATER SURFACE ELEVATION
420.80

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	30.00 ft
CREST LENGTH	50.00 ft
OVERTOPPING CREST ELEVATION	428.00 ft

Primary Outlet Sizing - Basin 3

$Q = cdA\sqrt{2gh}$

Allowable outflow = 12.75 cfs (See Appendix C)

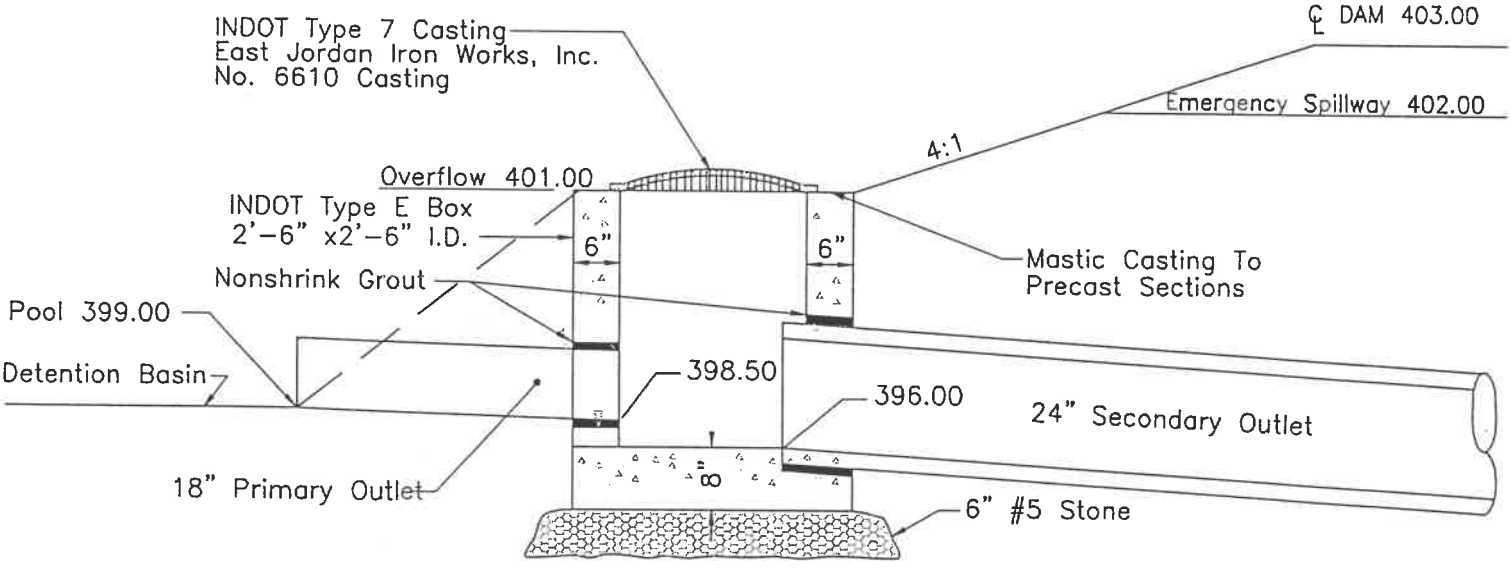
Allowable headwater = 401 - 399 = 2.0

$12.75 = Q = (0.60)\ (A)\ \sqrt{2(32.2)(2.0)}$

$$\frac{12.75}{6.81} = 1.87 = \frac{\Pi d^2}{4}$$

d = 1.54

Use 18" primary



STR. NO. 158 BASIN #3
PRECAST OUTLET CONTROL STRUCTURE

Not To Scale

Neville 3

SECONDARY PIPE SET DOWN IN BOX

CURRENT DATE: 09-15-1999
CURRENT TIME: 17:10:11

FILE DATE: 09-15-1999
FILE NAME: NEVILLE3

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.0

SITE DATA — CULVERT SHAPE, MATERIAL, INLET

NO.	INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	BARRELS	SHAPE	MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	396.00	394.00	60.03	1	RCP		2.00	2.00	.012	CONVENTIONAL
2										
3										
4										
5										
6										

set down 3'

24"

SUMMARY OF CULVERT FLOWS (cfs) FILE: NEVILLE3 DATE: 09-15-199

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITF
396.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
396.68	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
397.08	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
397.40	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
397.67	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
397.94	12.5	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
397.97	12.8	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
398.54	17.5	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
398.91	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
399.33	22.5	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
399.80	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: NEVILLE3 DATE: 09-15-199

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
396.00	0.000	0.00	0.00	0.00

397.08	0.000	5.00	0.00	0.00
397.40	0.000	7.50	0.00	0.00
397.67	0.000	10.00	0.00	0.00
397.94	0.000	12.50	0.00	0.00
397.97	0.000	12.75	0.00	0.00
398.54	0.000	17.50	0.00	0.00
398.91	0.000	20.00	0.00	0.00
399.33	0.000	22.50	0.00	0.00
399.80	0.000	25.00	0.00	0.00

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

CURRENT DATE: 09-15-1999
CURRENT TIME: 17:10:11
FILE DATE: 09-15-1999
FILE NAME: NEVILLE3

PERFORMANCE CURVE FOR CULVERT 1 - 1(2.00 (ft) BY 2.00 (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
0.00	396.00	0.00	-2.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.0(
2.50	396.68	0.68	-0.71	1-S2n	0.30	0.54	0.24	0.40	16.04	1.2
5.00	397.08	1.08	-0.52	1-S2n	0.44	0.79	0.39	0.58	11.70	1.5(
7.50	397.40	1.40	-0.33	1-S2n	0.55	0.97	0.47	0.72	13.16	1.6
10.00	397.67	1.67	-0.10	1-S2n	0.64	1.13	0.68	0.84	10.63	1.8
12.50	397.94	1.94	0.16	1-S2n	0.72	1.27	0.77	0.94	11.25	1.9(
12.75	397.97	1.97	0.19	1-S2n	0.73	1.28	0.78	0.95	11.27	1.9
17.50	398.54	2.54	0.78	1-S2n	0.87	1.50	0.94	1.11	12.03	2.1
20.00	398.91	2.91	1.14	1-S2n	0.93	1.60	1.02	1.19	12.35	2.2
22.50	399.33	3.33	1.54	1-S2n	1.00	1.68	1.11	1.26	12.60	2.3(
25.00	399.80	3.80	1.97	1-S2n	1.07	1.75	1.18	1.33	12.94	2.3(

El. inlet face invert 396.00 ft El. outlet invert 394.00 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

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

INLET STATION	0.00 ft
INLET ELEVATION	396.00 ft
OUTLET STATION	60.00 ft
OUTLET ELEVATION	394.00 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0333
CULVERT LENGTH ALONG SLOPE	60.03 ft

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

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	2.00 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: 09-15-1999
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TAILWATER

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

BOTTOM WIDTH	4.00 ft
SIDE SLOPE H/V (X:1)	3.0
CHANNEL SLOPE V/H (ft/ft)	0.005
MANNING'S n (.01-0.1)	0.040
CHANNEL INVERT ELEVATION	394.00 ft
CULVERT NO.1 OUTLET INVERT ELEVATION	394.00 ft

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

FLOW (cfs)	W.S.E. (ft)	FROUDE NUMBER	DEPTH (ft)	VEL. (f/s)	SHEAR (psf)
0.00	394.00	0.000	0.00	0.00	0.00
2.50	394.40	0.341	0.40	1.22	0.12
5.00	394.58	0.348	0.58	1.50	0.18
7.50	394.72	0.352	0.72	1.69	0.22
10.00	394.84	0.354	0.84	1.84	0.26
12.50	394.94	0.356	0.94	1.96	0.29
12.75	394.95	0.356	0.95	1.97	0.30
17.50	395.11	0.359	1.11	2.15	0.35
20.00	395.19	0.360	1.19	2.22	0.37
22.50	395.26	0.361	1.26	2.30	0.39
25.00	395.33	0.362	1.33	2.36	0.41

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	PAVED
EMBANKMENT TOP WIDTH	15.00 ft
CREST LENGTH	50.00 ft
OVERTOPPING CREST ELEVATION	403.00 ft

APPENDIX "E"
BASIN GEOMETRY

Basin Geometry **Basin 1**

Pool	426.00	-	9,959 SF	to elev. 427			
				11,042 CF	to elev. 428		
	427.00	-	12,125 SF		24,260 CF	to elev. 429	
				13,218 CF		39,700 CF	
	428.00	-	14,311 SF			0.9 ac/ft	
				15,440 CF			
Dam	429.00	-	16,568 SF				

Storage Required: 25 year 15,001 CF approximately 1.3' of rise above pool.

Storage Required: 100 year 20,700 CF approximately 1.7' of rise above pool.

Basin Geometry **Basin 2A**

Pool/Wier	427.00	-	30,272 SF	to elev. 428			
				31,716 CF	to elev. 429		
	428.00	-	33,159 SF		66,464 CF	to elev. 430	
				34,748 CF		104,420 CF	
	429.00	-	36,336 SF			2.40 ac/ft	
				37,956 CF			
	430.00	-	39,576 SF				

Storage Required: 25 year 44,056 CF approximately 1.3' of rise above pool.

Storage Required: 100 year 58,005 CF approximately 1.8' of rise above pool.

Basin Geometry **Basin 2B**

Pool	425.00	-	5,097 SF	to elev. 426			
				5,603 CF	to elev. 427		
	426.00	-	6,109 SF		12,258 CF	to elev. 428	
				6,655 CF		20,637 CF	
	427.00	-	7,200 SF			0.47 ac/ft	
				8,379 CF			
Dam	428.00	-	9,558 SF				

Storage Required: 25 year 5,656 CF approximately 1' of rise above pool.

Storage Required: 100 year 7,802 CF approximately 1.3' of rise above pool.

NOTE: Large overbuild in Basin Capacity to allow for overflow from 2A.

Basin Geometry **Basin 3**

Pool	399.00	-	10,725 SF	to elev. 400			
				12,083 CF	to elev. 401		
	400.00	-	13,441 SF		26,761 CF	to elev. 402	
				14,678 CF		44,060 CF	
	401.00	-	15,914 SF				
				17,299 CF			
	402.00	-	18,684 SF				

Storage Required: 25 year 13,168 CF approximately 1' of rise above pool.

Storage Required: 100 year 18,800 CF approximately 1.5' of rise above pool.