

STORM DRAINAGE ANALYSIS

CROSSROADS COMMERCIAL CENTER REPLAT OF LOT 6

I-164 & Lloyd Expressway
Evansville, Indiana
BLA Project No. 102-0234-APD/PD00

Lot 6A-2 – Final Drainage Plan

Lot 6A-1 – Preliminary Drainage Plan

Prepared for:

BBL Medical Facilities
302 Washington Avenue Extension
Albany, NY 12203

By:

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June 16, 2003

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INTRODUCTION

The Hartmann Family Land Trust (HFLT) owns a large tract of land that lies in the northwest quadrant of the I-164/Lloyd Expressway interchange. The property has been platted as Crossroads Commercial Center. Crossroads Commercial Center was further divided by the Replat of Lot 6 (containing 19 acres). Currently, a medical complex is being proposed for the south 10 acres. In order to record the plat and develop the south 10-acre tract, the Owner is seeking **Final** approval for Lot 6A-2 and **Preliminary** approval for Lot 6A-1 (the remaining north 9 acres).

The first stage of the proposed development entails the construction of a storm retention facility along the westerly portion of this complex. All runoff from the proposed complex and remaining area to the north must enter a culvert beneath Crosslake Drive and traverse through an existing lake on the west side of Crosslake Drive, which discharges into the Nurrenbern Ditch. The outlet control structure for the existing lake west of Crosslake Drive controls the pool elevation for that lake, which is set at elevation 386.25 feet. The lake construction on this site will have the same pool elevation. Much of the existing land that lies adjacent to the proposed lake has an approximate elevation of 388.5. Thus, the assumed maximum high water elevation in the proposed lake will be 387.5 feet, which is only 1.25 feet above the pool stage. This yields very nominal storage depth, thus the lake surface areas will need to be increased to offset the lack of vertical storage depth.

The area north of the 10 acre tract scheduled for development is designated as Lot 6A1 of the Replat of Lot 6A. Although no plan has been developed for this lot, a facility of similar magnitude to that shown on Lot 6A2 will probably be developed. For the purpose of this report, we have depicted a lake of similar characteristics and size on said Lot 6A2 to accommodate the future development. On the proposed replat we have placed the lake in a temporary easement that will expire upon replacement by a permanent easement if needed to accommodate the final development plan for this north siting. A new drainage plan may also be required at that time if the assumptions made in this report are no longer valid.

METHOD

The purpose of this report is to establish the storm water storage requirements for this entire replat and establish in detail the appropriate basin and outfall structure through which the runoff generated by the development of Lot 6A2 will be routed to the existing lake west of Crosslake Drive and then to the receiving waters (Nurrenbern Ditch).

The Rational Method ($Q = CIA$) will form the basis for this analysis. The inflow/outflow analysis will be calculated so as to determine the storage requirements needed to preserve the runoff rate from the existing 10 year storm and store the additional runoff generated by the developed 25 year storm.

- ▶ A value of 0.2 will be used for the undeveloped runoff coefficient ("c"). This is a value that has been accepted by the local authority to best describe those drainage characteristics for that portion of the east side of Evansville from Green River Road east to the Vanderburgh/Warrick county line and from the Lloyd Expressway north to Morgan Avenue.
- ▶ A rainfall intensity of 1.53 was calculated based on a time of concentration of 58 minutes.
- ▶ On Lot 6A2 there is planned an initial building and future building. The allowable outflow rates calculated for the basins, based on both the initial building and future building added, are 2.20 and 3.04 CFS, respectively. The 2.20 CFS being related to the initial southerly 7.25 acre development of Lot 6A2 and the 3.04 CFS being related to the entire 10 acre development which is planned to be developed shortly thereafter.

(Refer to the input/output data sheets shown in Appendix C)

- ▶ The developed runoff coefficients for each area have been calculated and weighted as shown in *Appendix B*. A value of 0.71 will be used for the developed site.
- ▶ The resulting storage requirements for the 25 year storm were calculated as shown in *Appendix C* are listed as follows:

	<u>25 year</u>	<u>100 year</u>	
Lot 6A-2 - Initial building construction (Lake Area "A")	32,363 CF	49,732 CF	(Initial south 7 acres)
Lot 6A-2 - Addition of 2 nd building (Lake Area "B")	44,638 CF	68,596 CF	(South 10 acres)
Lot 6A-1 – Future Development (Lake Area "C")	40,174 CF	61,736 CF	(North 9 acres)

- ▶ The lake will be interconnected to an existing lake west of Crosslake Drive, which is, in turn, the outlet into the receiving waters (Nurrenbern Ditch).
- ▶ All erosion control ditches shall be implemented in accordance with the drainage ordinance.

- › The lake shall be constructed as shown in *Appendix E* providing the storage listed therein.

SUMMARY

The Owner of the subject property will assume maintenance of the proposed facility.

The lake will be constructed by the Owner/Developer. The stormwater that currently runs off of Lot 6A1 and Lots 6C through 6F will be allowed to drain through this lake. As previously submitted and approved in April 1997. The Owner/Developer of Lots 6C through 6F will be required to design drainage/storm water retention plans in accordance with the Vanderburgh County Ordinance. In the event the Owner/Developer of Lots 6C through 6F fail to fulfill this drainage obligation prior to the development of Lot 6A1, the Owner of Lot 6A1, being the Hartman Family Land Trust, agree to construct a lake sized to handle the storm water detention requirements set forth by the Vanderburgh County Drainage Ordinance. HFLT agrees that the commitment to building the detention facility will remain in effect until such time that Lots 6C through 6F are developed and each drainage plan has been approved by the Vanderburgh County Drainage Board. If Lot 6A-1 is developed prior to Lots 6C through 6F, it is understood that the commitment will remain and will be relocated to one of the other remaining undeveloped lots. At such time that all lots are developed, the commitment will be considered null and void.

APPENDICES INDEX

- Appendix A - Drainage Plan**
 - Appendix B - Runoff Coefficients/Time of Concentration**
 - Appendix C - Storage Volume Data**
 - Appendix D - Outlet Control Structure Analysis**
 - Appendix E - Basin Volume**
-

APPENDIX "A"
DRAINAGE PLAN

APPENDIX "B"
RUNOFF COEFFICIENT/TIME OF CONCENTRATION

TIME OF CONCENTRATION

SHEET FLOW

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

N = 0.4 Coefficient Grass

L = Length

S = Slope

L = 720'

H = 388.5 - 387.80 = 0.7

S = .001

$$TC = .827 \left[\frac{(0.4)(0.7)}{\sqrt{0.001}} \right]^{.467} = 58 \text{ Min.}$$

INTENSITY

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

Factors for Evansville

C = 1.9533 T = duration

α = 0.1747 Tc = Time of Concentration (10 yr. Undeveloped)

d = 0.522

β = 1.6408

$$i_{10} = \frac{1.9533(10)^{0.1747}}{(58/60+0.522)^{1.6408}} = \frac{2.9361}{1.9210} = 1.53$$

UNDEVELOPED "C" FACTOR = 0.20 (Table 803)
Cultivated Fields (Less than 2%)

WEIGHTED DEVELOPED "C" FACTOR

Lake	29,500	(1)	=	29,500
Building 1	31,885	(.95)	=	30,290
Parking 1	151,934	(.90)	=	136,741
Building 2	23,903	(.90)	=	21,512
Parking 2	50,789	(.90)	=	45,710
Lawn	<u>147,589</u>	(0.3)	=	<u>44,277</u>
	435,600			308,030

Developed $c = 0.71$

Undeveloped $c = 0.20$

APPENDIX "C"
STORAGE VOLUME DATA

PROJECT: REPLAT LOT 6A-2 (7.25 AC) DATE: 06/20/03
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 5\10\25\100
 TIME OF CONCENTRATION UNDEV. (min): 7.25
 RAINFALL INTENSITY (INCHES/HR): 58
 UNDEVELOPED RUNOFF COEFFICIENT: 0.00 1.5203475 1.8211692
 UNDEVELOPED RUNOFF RATE (CFS): 0.2
 DEVELOPED RUNOFF COEFFICIENT: 2.20
 0.71

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	7.88	40.57	2.20	38.37	0.256
0.17	6.27	32.28	2.20	30.08	0.426
0.25	5.24	26.98	2.20	24.77	0.516
0.33	4.46	22.95	2.20	20.74	0.570
0.42	3.78	19.46	2.20	17.26	0.604
0.50	3.31	17.02	2.20	14.82	0.618
0.58	2.92	15.04	2.20	12.84	0.621
0.67	2.57	13.23	2.20	11.02	0.615
0.75	2.31	11.89	2.20	9.68	0.605
0.83	2.09	10.76	2.20	8.55	0.592
0.92	1.88	9.68	2.20	7.47	0.573
1.00	1.72	8.86	2.64	6.22	0.518
1.25	1.88	9.70	2.64	7.06	0.735
1.50	1.67	8.58	2.64	5.94	0.743
1.75	1.50	7.72	2.64	5.08	0.741
2.00	1.37	7.03	2.64	4.39	0.731
2.50	1.16	5.99	2.64	3.35	0.697
3.00	1.02	5.24	2.64	2.60	0.649
4.00	0.82	4.22	2.64	1.58	0.526
6.00	0.60	3.09	2.64	0.45	0.225
10.00	0.40	2.07	2.64	-0.57	-0.476

STORAGE (ACRE/FT): 0.74
 STORAGE (CUBIC FT): 32,362.63

PROJECT: REPLAT LOT 6A-2 (7.25 AC) DATE: 06/20/03
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 5\10\25\100
 TIME OF CONCENTRATION UNDEV. (min): 7.25
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 UNDEVELOPED RUNOFF COEFFICIENT: 0.00 1.5203475 1.8211692
 UNDEVELOPED RUNOFF RATE (CFS): 0.2
 DEVELOPED RUNOFF COEFFICIENT: 2.20
 DEVELOPED RUNOFF RATE (CFS): 0.71

50 Year Storm

STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)
0.08	8.90	45.79	2.20	43.59	0.291
0.17	7.08	36.44	2.20	34.23	0.485
0.25	5.92	30.45	2.20	28.24	0.588
0.33	5.03	25.90	2.20	23.70	0.652
0.42	4.27	21.97	2.20	19.76	0.692
0.50	3.73	19.22	2.20	17.01	0.709
0.58	3.30	16.98	2.20	14.78	0.714
0.67	2.90	14.93	2.20	12.72	0.710
0.75	2.61	13.42	2.20	11.21	0.701
0.83	2.36	12.14	2.20	9.94	0.687
0.92	2.12	10.92	2.20	8.72	0.668
1.00	1.94	10.00	2.64	7.36	0.613
1.25	2.19	11.27	2.64	8.63	0.899
1.50	1.94	9.97	2.64	7.33	0.917
1.75	1.74	8.97	2.64	6.33	0.923
2.00	1.59	8.17	2.64	5.53	0.921
2.50	1.35	6.96	2.64	4.32	0.899
3.00	1.18	6.08	2.64	3.44	0.861
4.00	0.95	4.90	2.64	2.26	0.754
6.00	0.70	3.59	2.64	0.95	0.475
10.00	0.47	2.41	2.64	-0.24	-0.196

PEAK STORAGE (ACRE/FT): 0.92
 PEAK STORAGE (CUBIC FT): 40,214.50

PROJECT: REPLAT LOT 6A-2 (7.25AC) DATE: 06/20/03
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 5\10\25\100 7.25
 TIME OF CONCENTRATION UNDEV. (min): 58
 RAINFALL INTENSITY (INCHES/HR): 0.00 1.5203475 1.8211692
 UNDEVELOPED RUNOFF COEFFICIENT: 0.2
 UNDEVELOPED RUNOFF RATE (CFS): 2.20
 DEVELOPED RUNOFF COEFFICIENT: 0.71

100 Year Storm

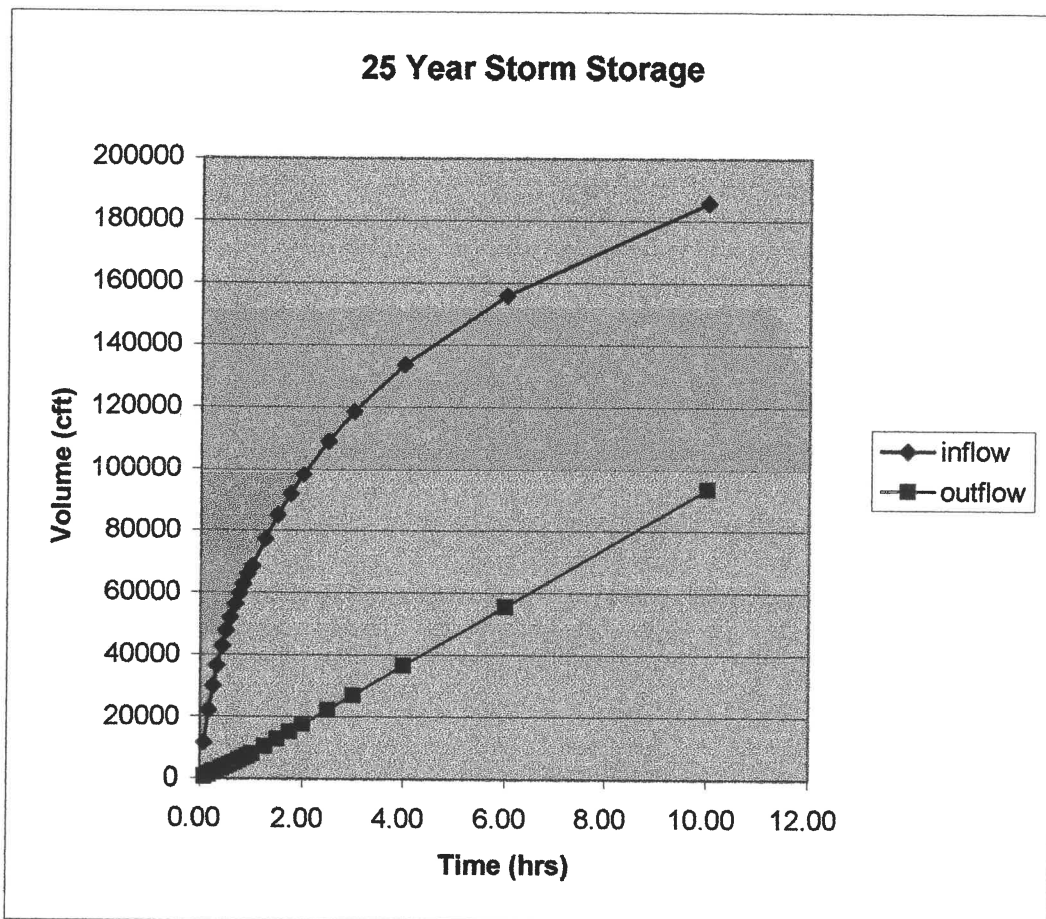
STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)
0.08	10.04	51.69	2.20	49.49	0.330
0.17	7.99	41.13	2.20	38.92	0.551
0.25	6.68	34.37	2.20	32.16	0.670
0.33	5.68	29.23	2.20	27.03	0.743
0.42	4.82	24.79	2.20	22.59	0.791
0.50	4.21	21.69	2.20	19.49	0.812
0.58	3.72	19.17	2.20	16.96	0.820
0.67	3.27	16.85	2.20	14.65	0.818
0.75	2.94	15.15	2.20	12.94	0.809
0.83	2.66	13.70	2.20	11.50	0.795
0.92	2.40	12.33	2.20	10.12	0.776
1.00	2.19	11.28	2.64	8.64	0.720
1.25	2.54	13.09	2.64	10.45	1.089
1.50	2.25	11.59	2.64	8.95	1.119
1.75	2.03	10.42	2.64	7.78	1.135
2.00	1.84	9.49	2.64	6.85	1.142
2.50	1.57	8.08	2.64	5.44	1.134
3.00	1.37	7.07	2.64	4.43	1.107
4.00	1.11	5.70	2.64	3.06	1.019
6.00	0.81	4.17	2.64	1.53	0.766
10.00	0.54	2.80	2.64	0.15	0.129

STORAGE (ACRE/FT): 1.14
 STORAGE (CUBIC FT): 49,732.05

PROJECT: REPLAT LOT 6A-2 (7.25 AC)
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

DATE: 06/20/03

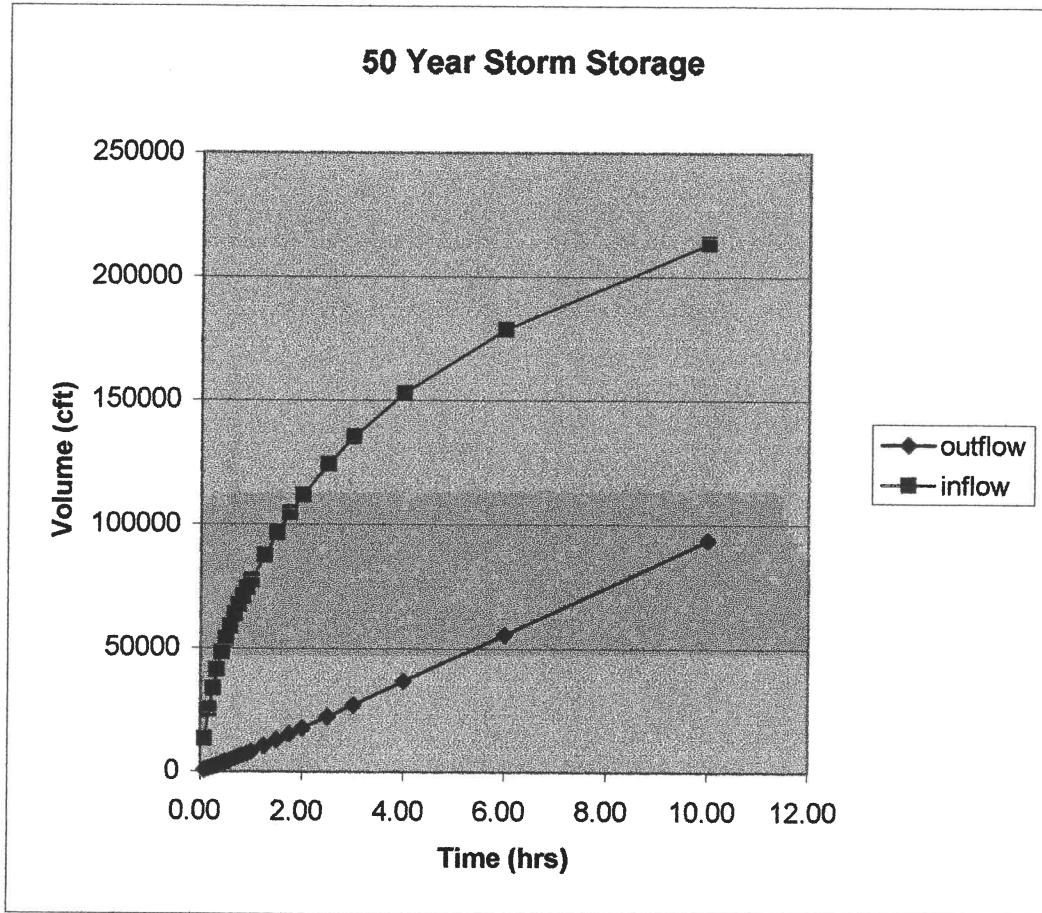
RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 5\10\25\100 7.25
 TIME OF CONCENTRATION UNDEV. (min): 58
 RAINFALL INTENSITY (INCHES/HR): 0.00 1.5203475 1.8211692
 UNDEVELOPED RUNOFF COEFFICIENT: 0.2
 UNDEVELOPED RUNOFF RATE (CFS): 2.20
 DEVELOPED RUNOFF COEFFICIENT: 0.71



PROJECT: REPLAT LOT 6A-2 (7.25 AC)
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

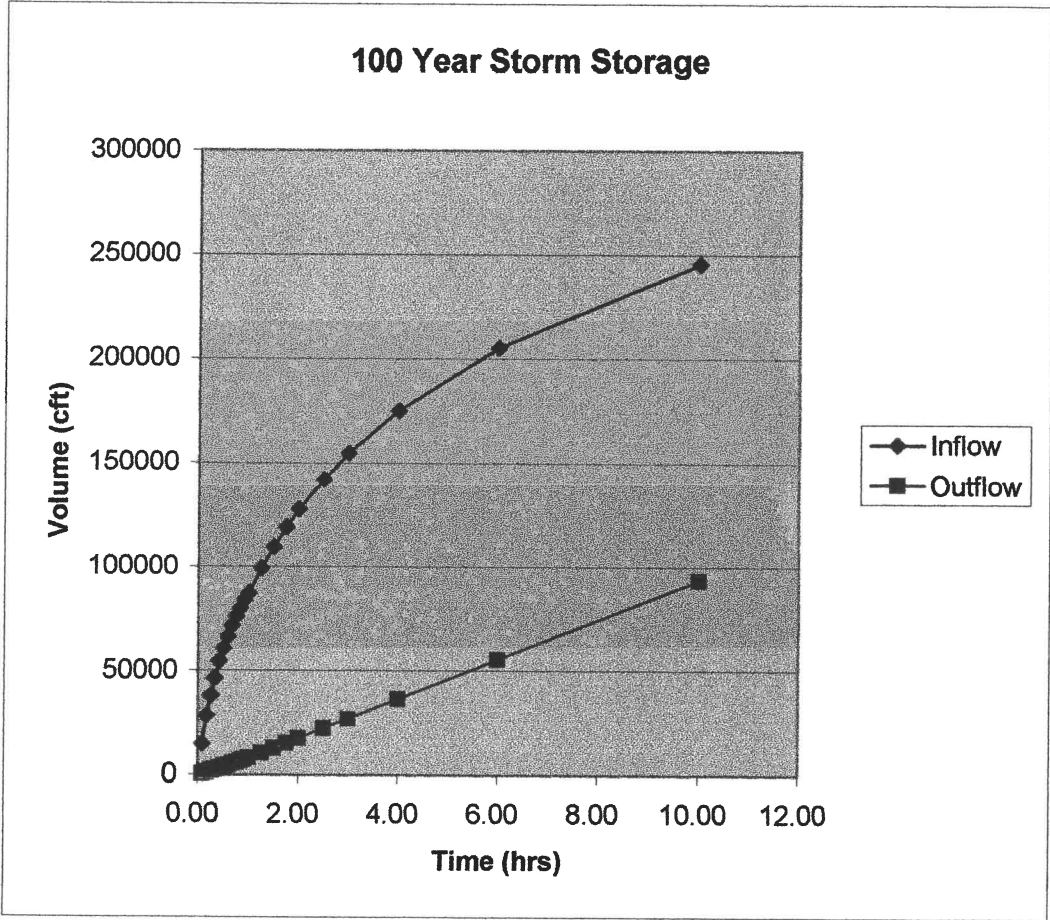
DATE: 06/20/03

RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 5\10\25\100 7.25
 TIME OF CONCENTRATION UNDEV. (min): 58
 RAINFALL INTENSITY (INCHES/HR): 0.00 1.5203475 1.8211692
 UNDEVELOPED RUNOFF COEFFICIENT: 0.2
 UNDEVELOPED RUNOFF RATE (CFS): 2.20
 DEVELOPED RUNOFF COEFFICIENT: 0.71



PROJECT: REPLAT LOT 6A-2 (7.25 AC) DATE: 06/20/03
ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

RELEASE RATE PERIOD: 5\10\25\100
WATERSHED AREA (ACRES): 7.25
TIME OF CONCENTRATION UNDEV. (min): 58
RAINFALL INTENSITY (INCHES/HR): 0.00 1.5203475 1.8211692
UNDEVELOPED RUNOFF COEFFICIENT: 0.2
UNDEVELOPED RUNOFF RATE (CFS): 2.20
DEVELOPED RUNOFF COEFFICIENT: 0.71



PROJECT: REPLAT LOT 6A-2 (10 ac.) DATE: 06/20/03
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 5\10\25\100
 TIME OF CONCENTRATION UNDEV. (min): 10
 RAINFALL INTENSITY (INCHES/HR): 58
 UNDEVELOPED RUNOFF COEFFICIENT: 0.00 1.5203475 1.8211692
 UNDEVELOPED RUNOFF RATE (CFS): 0.2
 DEVELOPED RUNOFF COEFFICIENT: 3.04
 DEVELOPED RUNOFF RATE (CFS): 0.71

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	7.88	55.96	3.04	52.92	0.353
0.17	6.27	44.52	3.04	41.48	0.588
0.25	5.24	37.21	3.04	34.17	0.712
0.33	4.46	31.65	3.04	28.61	0.787
0.42	3.78	26.84	3.04	23.80	0.833
0.50	3.31	23.48	3.04	20.44	0.852
0.58	2.92	20.75	3.04	17.71	0.856
0.67	2.57	18.24	3.04	15.20	0.849
0.75	2.31	16.40	3.04	13.36	0.835
0.83	2.09	14.84	3.04	11.80	0.816
0.92	1.88	13.35	3.04	10.31	0.790
1.00	1.72	12.22	3.64	8.57	0.715
1.25	1.88	13.38	3.64	9.73	1.014
1.50	1.67	11.84	3.64	8.20	1.025
1.75	1.50	10.65	3.64	7.01	1.022
2.00	1.37	9.70	3.64	6.05	1.009
2.50	1.16	8.26	3.64	4.62	0.962
3.00	1.02	7.22	3.64	3.58	0.895
4.00	0.82	5.82	3.64	2.18	0.726
6.00	0.60	4.26	3.64	0.62	0.310
10.00	0.40	2.86	3.64	-0.79	-0.656

STORAGE (ACRE/FT): 1.02
 STORAGE (CUBIC FT): 44,638.11

PROJECT: REPLAT LOT 6A-2(10 AC) DATE: 06/20/03
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 5\10\25\100
 TIME OF CONCENTRATION UNDEV. (min): 10
 RAINFALL INTENSITY (INCHES/HR): 58
 UNDEVELOPED RUNOFF COEFFICIENT: 0.00 1.5203475 1.8211692
 UNDEVELOPED RUNOFF RATE (CFS): 0.2
 DEVELOPED RUNOFF COEFFICIENT: 3.04
 0.71

50 Year Storm

STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)
0.08	8.90	63.16	3.04	60.12	0.401
0.17	7.08	50.26	3.04	47.22	0.669
0.25	5.92	42.00	3.04	38.96	0.812
0.33	5.03	35.72	3.04	32.68	0.899
0.42	4.27	30.30	3.04	27.26	0.954
0.50	3.73	26.51	3.04	23.46	0.978
0.58	3.30	23.42	3.04	20.38	0.985
0.67	2.90	20.59	3.04	17.55	0.980
0.75	2.61	18.51	3.04	15.47	0.967
0.83	2.36	16.75	3.04	13.71	0.948
0.92	2.12	15.07	3.04	12.03	0.922
1.00	1.94	13.79	3.64	10.15	0.846
1.25	2.19	15.54	3.64	11.90	1.240
1.50	1.94	13.76	3.64	10.12	1.265
1.75	1.74	12.37	3.64	8.73	1.273
2.00	1.59	11.27	3.64	7.62	1.271
2.50	1.35	9.60	3.64	5.95	1.240
3.00	1.18	8.39	3.64	4.75	1.188
4.00	0.95	6.76	3.64	3.12	1.040
6.00	0.70	4.95	3.64	1.31	0.656
10.00	0.47	3.32	3.64	-0.32	-0.270

PEAK STORAGE (ACRE/FT): 1.27
 PEAK STORAGE (CUBIC FT): 55,468.28

PROJECT: REPLAT LOT 6A-2 (10 ac) DATE: 06/20/03
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 5\10\25\100
 TIME OF CONCENTRATION UNDEV. (min): 10
 RAINFALL INTENSITY (INCHES/HR): 58
 UNDEVELOPED RUNOFF COEFFICIENT: 0.00 1.5203475 1.8211692
 UNDEVELOPED RUNOFF RATE (CFS): 0.2
 DEVELOPED RUNOFF COEFFICIENT: 3.04
 DEVELOPED RUNOFF RATE (CFS): 0.71

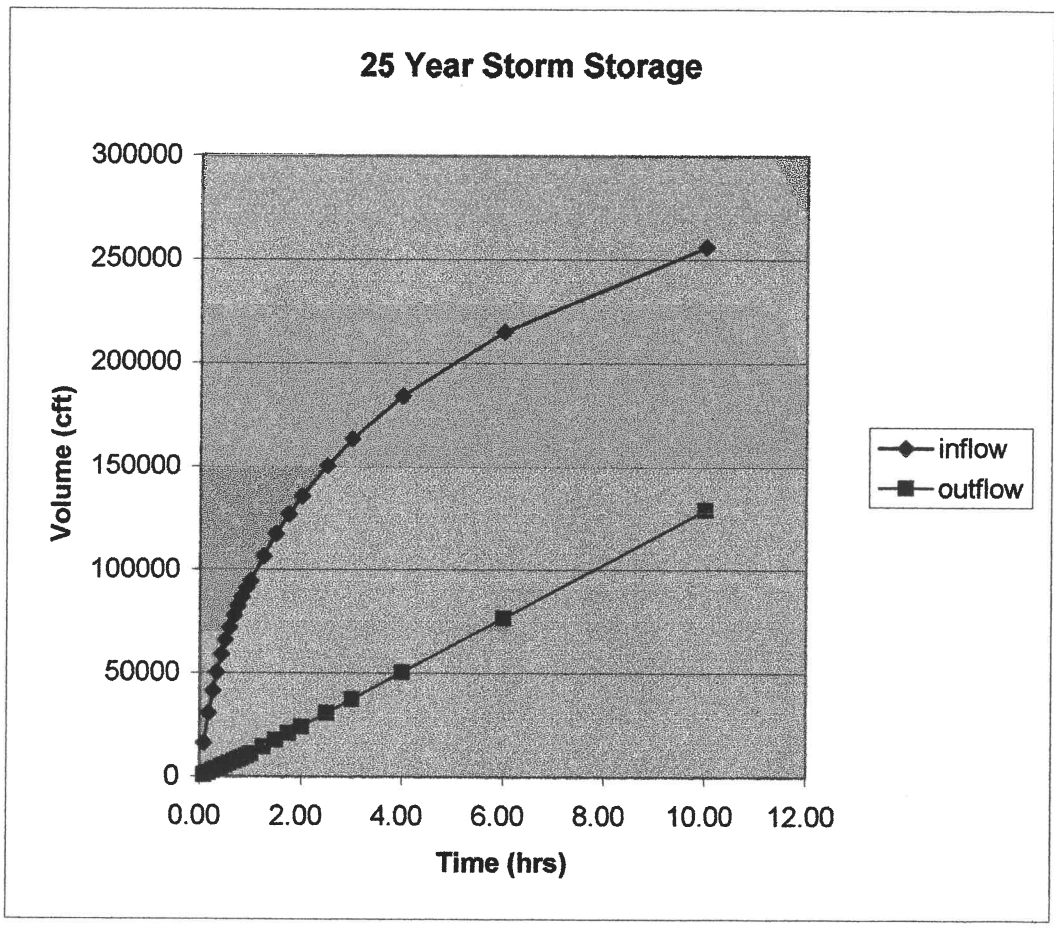
100 Year Storm

STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)
0.08	10.04	71.30	3.04	68.26	0.455
0.17	7.99	56.73	3.04	53.69	0.761
0.25	6.68	47.41	3.04	44.36	0.924
0.33	5.68	40.32	3.04	37.28	1.025
0.42	4.82	34.20	3.04	31.16	1.091
0.50	4.21	29.92	3.04	26.88	1.120
0.58	3.72	26.44	3.04	23.40	1.131
0.67	3.27	23.24	3.04	20.20	1.128
0.75	2.94	20.89	3.04	17.85	1.116
0.83	2.66	18.90	3.04	15.86	1.097
0.92	2.40	17.01	3.04	13.97	1.071
1.00	2.19	15.56	3.64	11.92	0.993
1.25	2.54	18.06	3.64	14.42	1.502
1.50	2.25	15.99	3.64	12.34	1.543
1.75	2.03	14.38	3.64	10.74	1.566
2.00	1.84	13.09	3.64	9.45	1.575
2.50	1.57	11.15	3.64	7.51	1.564
3.00	1.37	9.75	3.64	6.11	1.528
4.00	1.11	7.86	3.64	4.22	1.406
6.00	0.81	5.76	3.64	2.11	1.057
10.00	0.54	3.86	3.64	0.21	0.177

STORAGE (ACRE/FT): 1.57
 STORAGE (CUBIC FT): 68,595.93

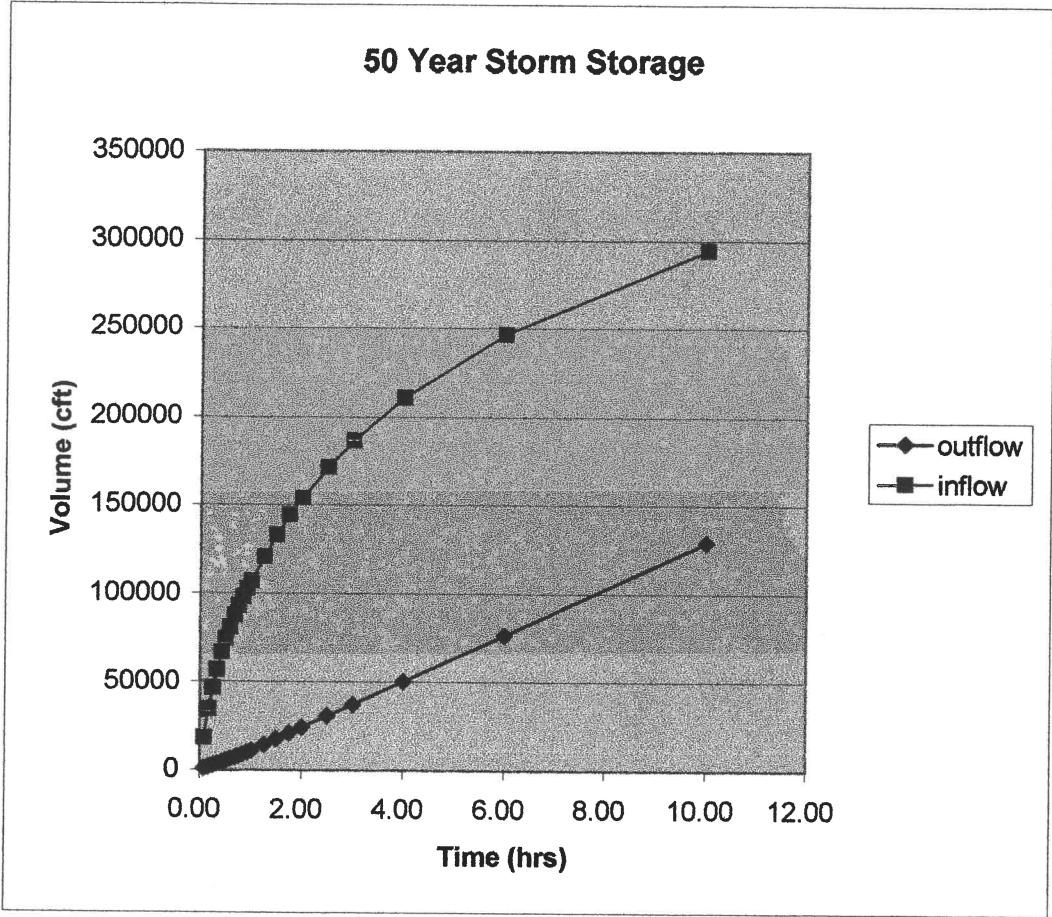
PROJECT: REPLAT LOT 6A-2 (10 AC) DATE: 06/20/03
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 10
 TIME OF CONCENTRATION UNDEV. (min): 58
 RAINFALL INTENSITY (INCHES/HR): 0.00 1.5203475 1.8211692
 UNDEVELOPED RUNOFF COEFFICIENT: 0.2
 UNDEVELOPED RUNOFF RATE (CFS): 3.04
 DEVELOPED RUNOFF COEFFICIENT: 0.71



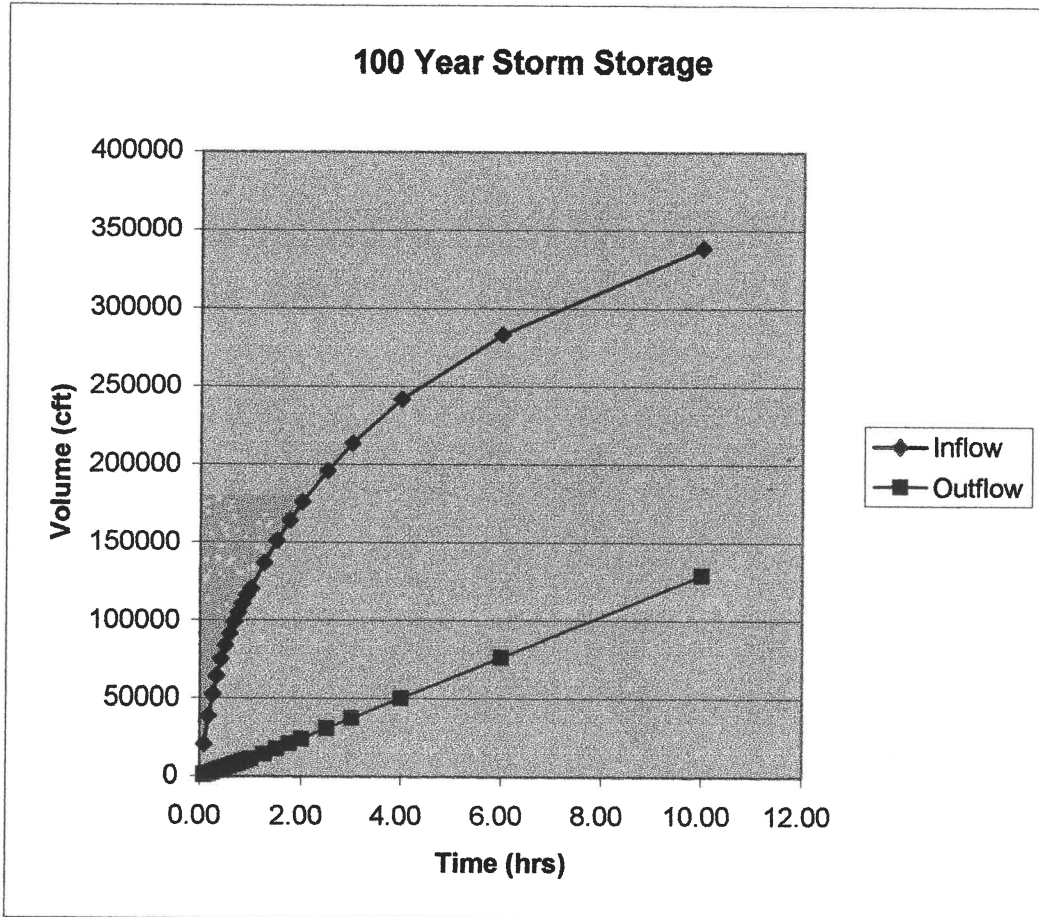
PROJECT: REPLAT LOT 6A-2 (10AC) DATE: 06/20/03
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 5\10\25\100
 TIME OF CONCENTRATION UNDEV. (min): 10
 RAINFALL INTENSITY (INCHES/HR): 58
 UNDEVELOPED RUNOFF COEFFICIENT: 0.00 1.5203475 1.8211692
 UNDEVELOPED RUNOFF RATE (CFS): 0.2
 DEVELOPED RUNOFF COEFFICIENT: 3.04
 DEVELOPED RUNOFF RATE (CFS): 0.71



PROJECT: REPLAT LOT 6A-2 (10 AC) DATE: 06/20/03
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 5\10\25\100 10
 TIME OF CONCENTRATION UNDEV. (min): 58
 RAINFALL INTENSITY (INCHES/HR): 0.00 1.5203475 1.8211692
 UNDEVELOPED RUNOFF COEFFICIENT: 0.2
 UNDEVELOPED RUNOFF RATE (CFS): 3.04
 DEVELOPED RUNOFF COEFFICIENT: 0.71



PROJECT: REPLAT LOT 6A -/ DATE: 06/20/03
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 5\10\25\100
 TIME OF CONCENTRATION UNDEV. (min): 9
 RAINFALL INTENSITY (INCHES/HR): 58
 UNDEVELOPED RUNOFF COEFFICIENT: 0.00 1.5203475 1.8211692
 UNDEVELOPED RUNOFF RATE (CFS): 0.2
 DEVELOPED RUNOFF COEFFICIENT: 2.74
 0.71

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	7.88	50.36	2.74	47.63	0.318
0.17	6.27	40.07	2.74	37.34	0.529
0.25	5.24	33.49	2.74	30.75	0.641
0.33	4.46	28.49	2.74	25.75	0.708
0.42	3.78	24.16	2.74	21.42	0.750
0.50	3.31	21.13	2.74	18.40	0.767
0.58	2.92	18.68	2.74	15.94	0.770
0.67	2.57	16.42	2.74	13.68	0.764
0.75	2.31	14.76	2.74	12.02	0.751
0.83	2.09	13.35	2.74	10.62	0.734
0.92	1.88	12.01	2.74	9.28	0.711
1.00	1.72	10.99	3.28	7.72	0.643
1.25	1.88	12.04	3.28	8.76	0.913
1.50	1.67	10.66	3.28	7.38	0.922
1.75	1.50	9.58	3.28	6.31	0.920
2.00	1.37	8.73	3.28	5.45	0.908
2.50	1.16	7.43	3.28	4.15	0.866
3.00	1.02	6.50	3.28	3.22	0.806
4.00	0.82	5.24	3.28	1.96	0.654
6.00	0.60	3.84	3.28	0.56	0.279
10.00	0.40	2.57	3.28	-0.71	-0.590

STORAGE (ACRE/FT): 0.92
 STORAGE (CUBIC FT): 40,174.30

PROJECT: REPLAT LOT 6A -1 DATE: 06/20/03
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

5\10\25\100
 5\10\25\100
 9
 58
 0.00 1.5203475 1.8211692
 0.2
 2.74
 0.71

50 Year Storm

STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)
0.08	8.90	56.85	2.74	54.11	0.361
0.17	7.08	45.23	2.74	42.49	0.602
0.25	5.92	37.80	2.74	35.06	0.730
0.33	5.03	32.15	2.74	29.42	0.809
0.42	4.27	27.27	2.74	24.53	0.859
0.50	3.73	23.85	2.74	21.12	0.880
0.58	3.30	21.08	2.74	18.34	0.887
0.67	2.90	18.53	2.74	15.80	0.882
0.75	2.61	16.66	2.74	13.92	0.870
0.83	2.36	15.07	2.74	12.34	0.853
0.92	2.12	13.56	2.74	10.82	0.830
1.00	1.94	12.41	3.28	9.13	0.761
1.25	2.19	13.99	3.28	10.71	1.116
1.50	1.94	12.38	3.28	9.10	1.138
1.75	1.74	11.14	3.28	7.86	1.146
2.00	1.59	10.14	3.28	6.86	1.144
2.50	1.35	8.64	3.28	5.36	1.116
3.00	1.18	7.55	3.28	4.28	1.069
4.00	0.95	6.09	3.28	2.81	0.936
6.00	0.70	4.46	3.28	1.18	0.590
10.00	0.47	2.99	3.28	-0.29	-0.243

PEAK STORAGE (ACRE/FT): 1.15
 PEAK STORAGE (CUBIC FT): 49,921.45

PROJECT: REPLAT LOT 6A-1 DATE: 06/20/03
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 5\10\25\100
 TIME OF CONCENTRATION UNDEV. (min): 9
 RAINFALL INTENSITY (INCHES/HR): 58
 UNDEVELOPED RUNOFF COEFFICIENT: 0.00 1.5203475 1.8211692
 UNDEVELOPED RUNOFF RATE (CFS): 0.2
 DEVELOPED RUNOFF COEFFICIENT: 2.74
 DEVELOPED RUNOFF RATE (CFS): 0.71

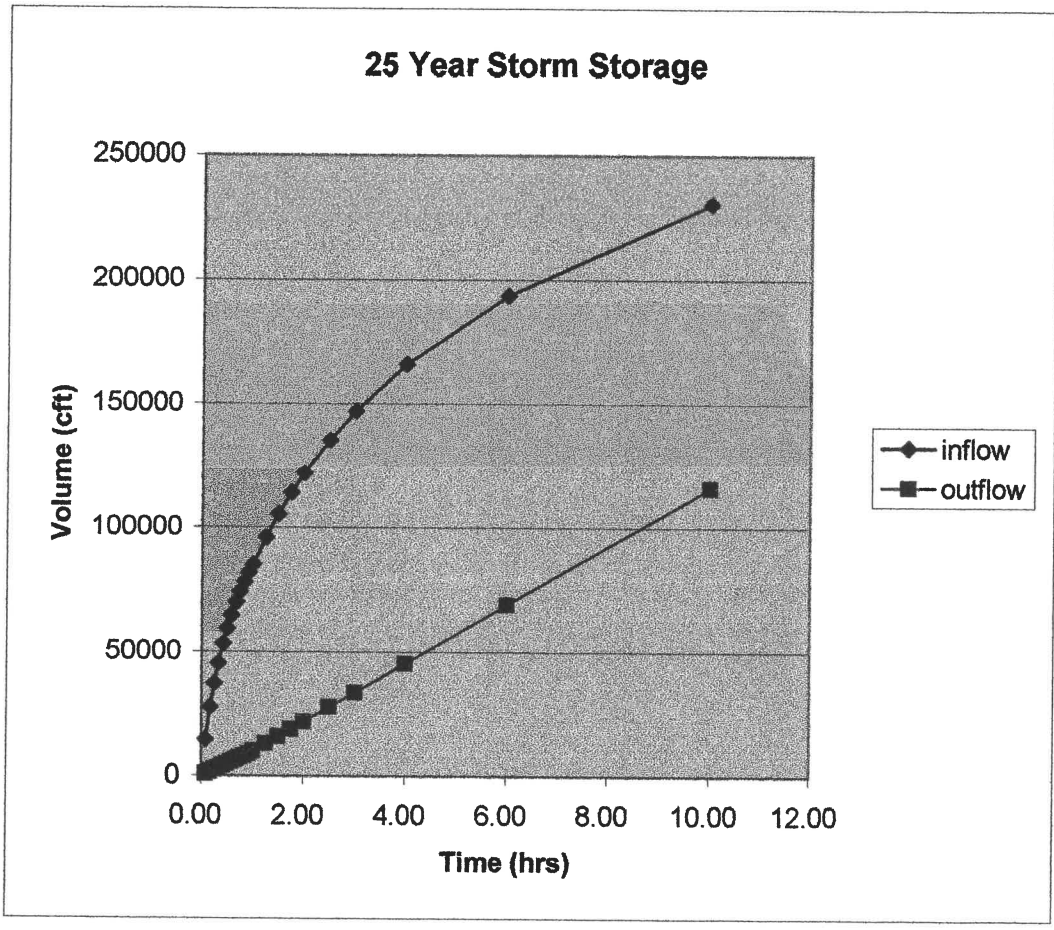
100 Year Storm

STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)
0.08	10.04	64.17	2.74	61.43	0.410
0.17	7.99	51.05	2.74	48.32	0.684
0.25	6.68	42.66	2.74	39.93	0.832
0.33	5.68	36.29	2.74	33.55	0.923
0.42	4.82	30.78	2.74	28.04	0.981
0.50	4.21	26.93	2.74	24.19	1.008
0.58	3.72	23.79	2.74	21.06	1.018
0.67	3.27	20.92	2.74	18.18	1.015
0.75	2.94	18.80	2.74	16.07	1.004
0.83	2.66	17.01	2.74	14.28	0.987
0.92	2.40	15.31	2.74	12.57	0.964
1.00	2.19	14.01	3.28	10.73	0.894
1.25	2.54	16.25	3.28	12.98	1.352
1.50	2.25	14.39	3.28	11.11	1.389
1.75	2.03	12.94	3.28	9.66	1.409
2.00	1.84	11.78	3.28	8.50	1.417
2.50	1.57	10.04	3.28	6.76	1.408
3.00	1.37	8.78	3.28	5.50	1.375
4.00	1.11	7.07	3.28	3.80	1.265
6.00	0.81	5.18	3.28	1.90	0.951
10.00	0.54	3.47	3.28	0.19	0.160

STORAGE (ACRE/FT): 1.42
 STORAGE (CUBIC FT): 61,736.34

PROJECT: REPLAT LOT 6A -1 DATE: 06/20/03
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

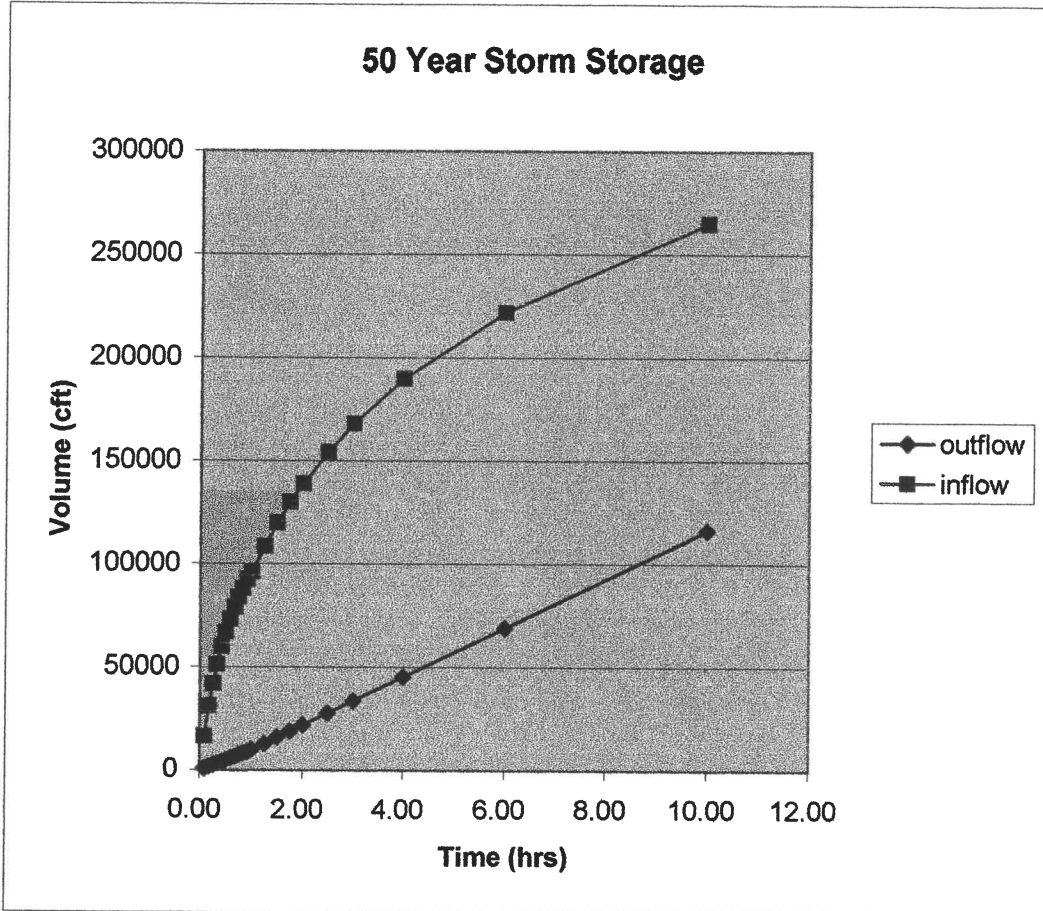
RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 5\10\25\100
 TIME OF CONCENTRATION UNDEV. (min): 9
 RAINFALL INTENSITY (INCHES/HR): 58
 UNDEVELOPED RUNOFF COEFFICIENT: 0.00 1.5203475 1.8211692
 UNDEVELOPED RUNOFF RATE (CFS): 0.2
 DEVELOPED RUNOFF COEFFICIENT: 2.74
 DEVELOPED RUNOFF COEFFICIENT: 0.71



PROJECT: REPLAT LOT 6A -1
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

DATE: 06/20/03

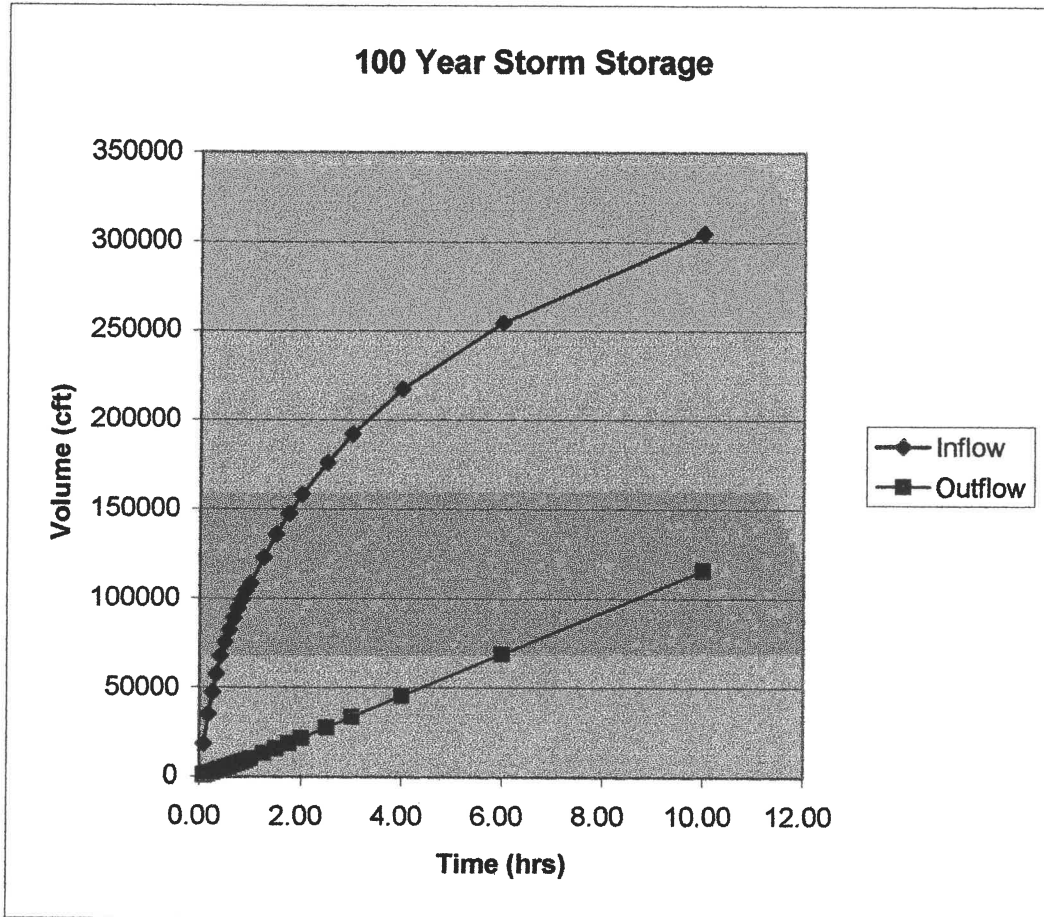
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 WATERSHED AREA (ACRES): 5\10\25\100
 TIME OF CONCENTRATION UNDEV. (min): 9
 RAINFALL INTENSITY (INCHES/HR): 58
 UNDEVELOPED RUNOFF COEFFICIENT: 0.00 1.5203475 1.8211692
 UNDEVELOPED RUNOFF RATE (CFS): 0.2
 DEVELOPED RUNOFF COEFFICIENT: 2.74
 DEVELOPED RUNOFF COEFFICIENT: 0.71



PROJECT: REPLAT LOT 6A -1
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

DATE: 06/20/03

RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 5\10\25\100
 TIME OF CONCENTRATION UNDEV. (min): 9
 RAINFALL INTENSITY (INCHES/HR): 58
 UNDEVELOPED RUNOFF COEFFICIENT: 0.00 1.5203475 1.8211692
 UNDEVELOPED RUNOFF RATE (CFS): 0.2
 DEVELOPED RUNOFF COEFFICIENT: 2.74
 DEVELOPED RUNOFF COEFFICIENT: 0.71



PROJECT: REPLAT LOT 6A *Combined* DATE: 06/20/03
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

5\10\25\100
 5\10\25\100
 RELEASE RATE PERIOD: 19
 WATERSHED AREA (ACRES): 58
 TIME OF CONCENTRATION UNDEV. (min): 0.00 1.5203475 1.8211692
 RAINFALL INTENSITY (INCHES/HR): 0.2
 UNDEVELOPED RUNOFF COEFFICIENT: 5.78
 UNDEVELOPED RUNOFF RATE (CFS): 0.71
 DEVELOPED RUNOFF COEFFICIENT:

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	7.88	106.33	5.78	100.55	0.670
0.17	6.27	84.60	5.78	78.82	1.117
0.25	5.24	70.70	5.78	64.92	1.352
0.33	4.46	60.14	5.78	54.36	1.495
0.42	3.78	51.00	5.78	45.22	1.583
0.50	3.31	44.62	5.78	38.84	1.618
0.58	2.92	39.43	5.78	33.65	1.626
0.67	2.57	34.66	5.78	28.88	1.613
0.75	2.31	31.16	5.78	25.38	1.586
0.83	2.09	28.19	5.78	22.41	1.550
0.92	1.88	25.36	5.78	19.58	1.501
1.00	1.72	23.21	6.92	16.29	1.358
1.25	1.88	25.41	6.92	18.49	1.926
1.50	1.67	22.50	6.92	15.58	1.947
1.75	1.50	20.23	6.92	13.31	1.941
2.00	1.37	18.42	6.92	11.50	1.917
2.50	1.16	15.69	6.92	8.77	1.827
3.00	1.02	13.72	6.92	6.80	1.701
4.00	0.82	11.06	6.92	4.14	1.380
6.00	0.60	8.10	6.92	1.18	0.590
10.00	0.40	5.42	6.92	-1.50	-1.246

STORAGE (ACRE/FT): 1.95
 STORAGE (CUBIC FT): 84,812.41

PROJECT: REPLAT LOT 6A *Combined* DATE: 06/20/03
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 5\10\25\100 19
 TIME OF CONCENTRATION UNDEV. (min): 58
 RAINFALL INTENSITY (INCHES/HR): 0.00 1.5203475 1.8211692
 UNDEVELOPED RUNOFF COEFFICIENT: 0.2
 UNDEVELOPED RUNOFF RATE (CFS): 5.78
 DEVELOPED RUNOFF COEFFICIENT: 0.71

50 Year Storm

STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)
0.08	8.90	120.01	5.78	114.24	0.762
0.17	7.08	95.49	5.78	89.71	1.271
0.25	5.92	79.80	5.78	74.02	1.542
0.33	5.03	67.88	5.78	62.10	1.708
0.42	4.27	57.57	5.78	51.79	1.813
0.50	3.73	50.36	5.78	44.58	1.858
0.58	3.30	44.50	5.78	38.72	1.872
0.67	2.90	39.12	5.78	33.35	1.862
0.75	2.61	35.17	5.78	29.39	1.837
0.83	2.36	31.82	5.78	26.04	1.801
0.92	2.12	28.63	5.78	22.85	1.752
1.00	1.94	26.20	6.92	19.28	1.607
1.25	2.19	29.53	6.92	22.61	2.355
1.50	1.94	26.14	6.92	19.22	2.403
1.75	1.74	23.51	6.92	16.59	2.419
2.00	1.59	21.41	6.92	14.48	2.414
2.50	1.35	18.23	6.92	11.31	2.357
3.00	1.18	15.95	6.92	9.03	2.257
4.00	0.95	12.85	6.92	5.93	1.977
6.00	0.70	9.41	6.92	2.49	1.246
10.00	0.47	6.30	6.92	-0.62	-0.514

PEAK STORAGE (ACRE/FT): 2.42
 PEAK STORAGE (CUBIC FT): #####
 105,415

PROJECT: REPLAT LOT 6A *Combined* DATE: 06/20/03
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 5\10\25\100
 TIME OF CONCENTRATION UNDEV. (min): 19
 RAINFALL INTENSITY (INCHES/HR): 58
 UNDEVELOPED RUNOFF COEFFICIENT: 0.00 1.5203475 1.8211692
 UNDEVELOPED RUNOFF RATE (CFS): 0.2
 DEVELOPED RUNOFF COEFFICIENT: 5.78
 0.71

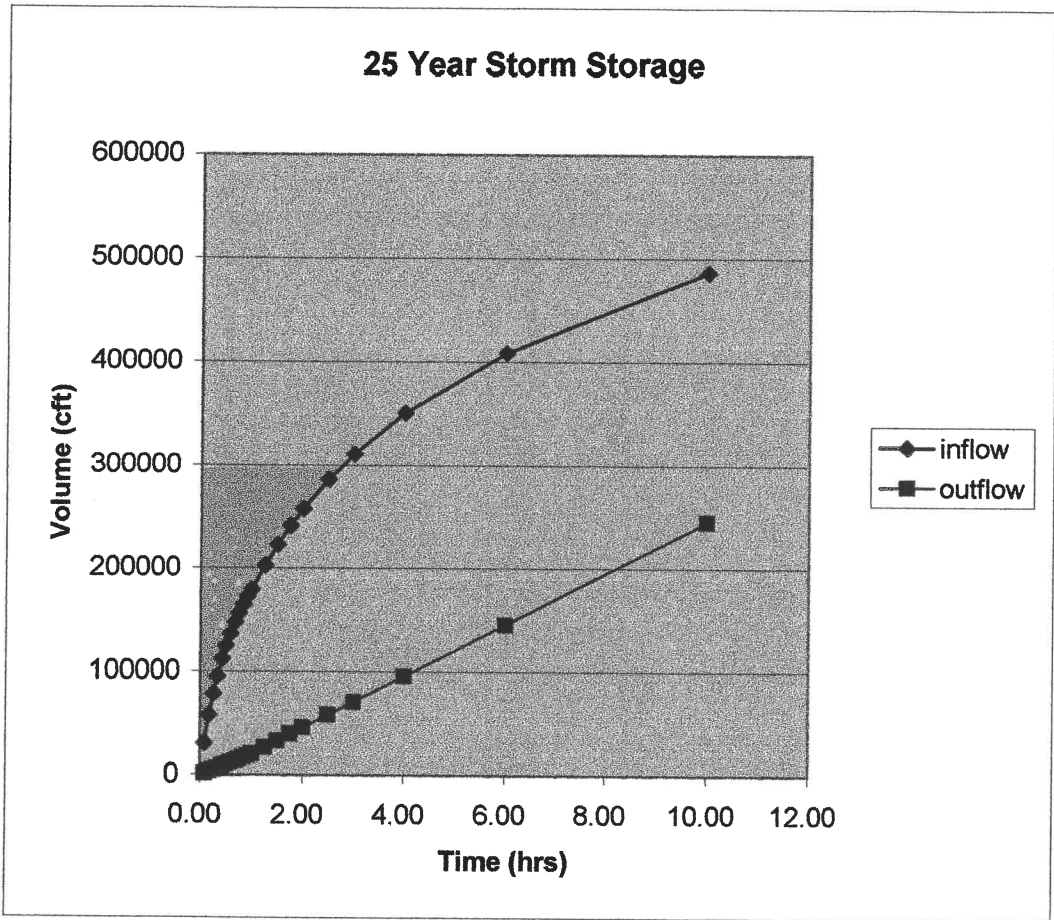
100 Year Storm

STORM DURATION (HRS)	RAINFALL INTENSITY (INCH/HR)	INFLOW RATE (CFS)	OUTFLOW RATE (CFS)	STORAGE RATE (CFS)	REQUIRED STORAGE (ACRE-FT)
0.08	10.04	135.46	5.78	129.69	0.865
0.17	7.99	107.78	5.78	102.00	1.445
0.25	6.68	90.07	5.78	84.29	1.756
0.33	5.68	76.62	5.78	70.84	1.948
0.42	4.82	64.98	5.78	59.20	2.072
0.50	4.21	56.84	5.78	51.07	2.128
0.58	3.72	50.23	5.78	44.45	2.149
0.67	3.27	44.16	5.78	38.38	2.143
0.75	2.94	39.70	5.78	33.92	2.120
0.83	2.66	35.91	5.78	30.14	2.085
0.92	2.40	32.31	5.78	26.53	2.034
1.00	2.19	29.57	6.92	22.65	1.888
1.25	2.54	34.31	6.92	27.39	2.854
1.50	2.25	30.38	6.92	23.46	2.932
1.75	2.03	27.32	6.92	20.40	2.975
2.00	1.84	24.87	6.92	17.95	2.992
2.50	1.57	21.19	6.92	14.27	2.972
3.00	1.37	18.53	6.92	11.61	2.902
4.00	1.11	14.93	6.92	8.01	2.671
6.00	0.81	10.94	6.92	4.02	2.008
10.00	0.54	7.32	6.92	0.40	0.337

STORAGE (ACRE/FT): 2.99
 STORAGE (CUBIC FT): 130,332.27

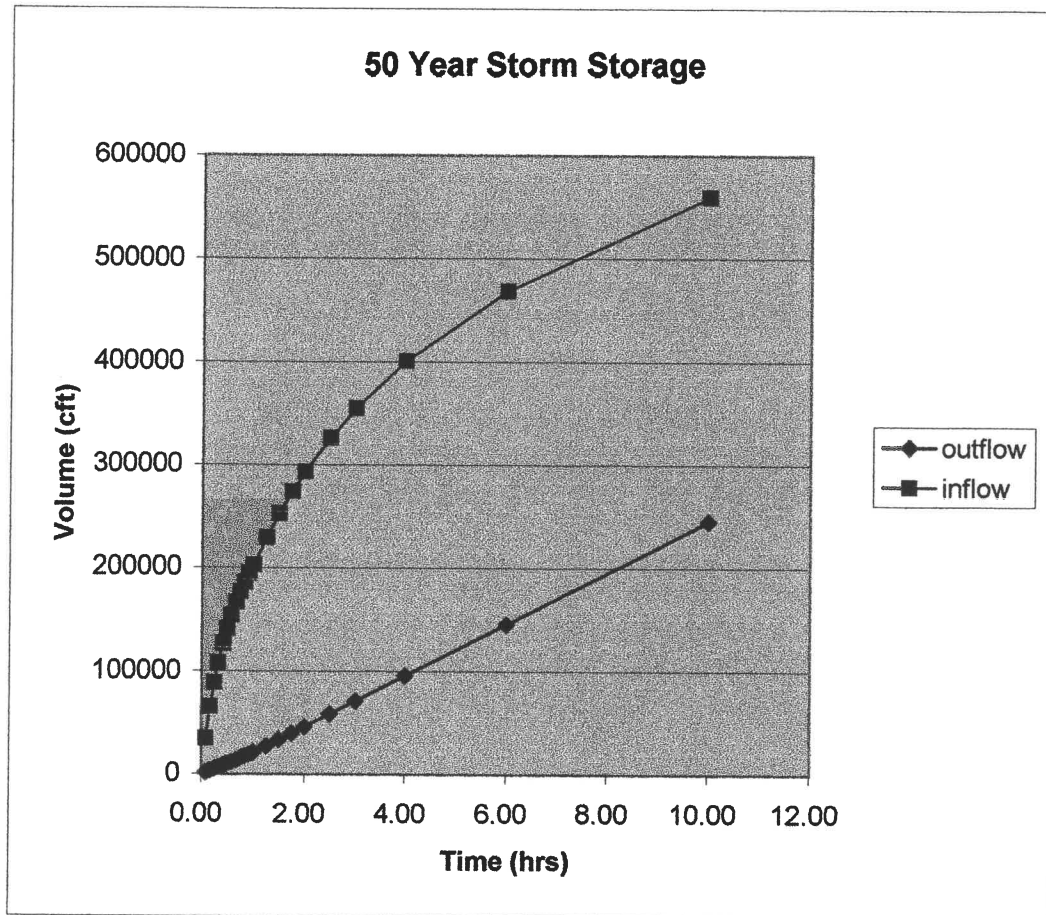
PROJECT: REPLAT LOT 6A *Combined* DATE: 06/20/03
ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

RELEASE RATE PERIOD: 5\10\25\100
WATERSHED AREA (ACRES): 5\10\25\100 19
TIME OF CONCENTRATION UNDEV. (min): 58
RAINFALL INTENSITY (INCHES/HR): 0.00 1.5203475 1.8211692
UNDEVELOPED RUNOFF COEFFICIENT: 0.2
UNDEVELOPED RUNOFF RATE (CFS): 5.78
DEVELOPED RUNOFF COEFFICIENT: 0.71



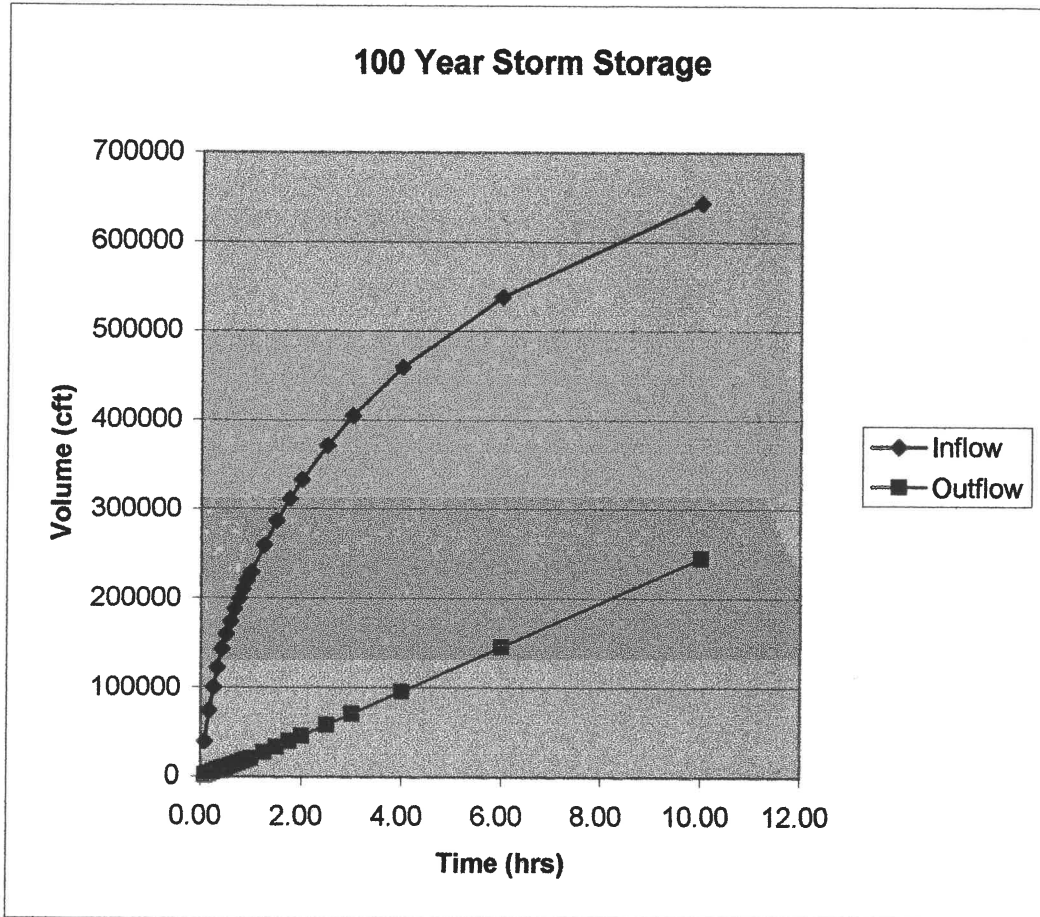
PROJECT: REPLAT LOT 6A *Combined* DATE: 06/20/03
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 5\10\25\100 19
 TIME OF CONCENTRATION UNDEV. (min): 58
 RAINFALL INTENSITY (INCHES/HR): 0.00 1.5203475 1.8211692
 UNDEVELOPED RUNOFF COEFFICIENT: 0.2
 UNDEVELOPED RUNOFF RATE (CFS): 5.78
 DEVELOPED RUNOFF COEFFICIENT: 0.71



PROJECT: REPLAT LOT 6A *Combined* DATE: 06/20/03
 ENGINEER: BERNARDIN, LOCHMUELLER & ASSOCIATES

RELEASE RATE PERIOD: 5\10\25\100
 WATERSHED AREA (ACRES): 19
 TIME OF CONCENTRATION UNDEV. (min): 58
 RAINFALL INTENSITY (INCHES/HR): 0.00 1.5203475 1.8211692
 UNDEVELOPED RUNOFF COEFFICIENT: 0.2
 UNDEVELOPED RUNOFF RATE (CFS): 5.78
 DEVELOPED RUNOFF COEFFICIENT: 0.71



APPENDIX "D"
OUTLET CONTROL STRUCTURE ANALYSIS

OUTLET CONTROL STRUCTURE

ORIFICE EQUATION

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

$$Q = cdA \sqrt{2gh}$$

Allow Outflow $Q = 3.04$ cfs

Allow HW = Top Box Outlet Str. To IE Lower-Water Outlet Pipe

$$(3.04) = Q = (.60)(A) \sqrt{2(32.2)(1.25)} \quad 387.50 = 386.25 = 1.25$$

$$A = \frac{3.04}{5.3833} = 0.5647 = \frac{\Pi d^2}{4}$$

$$d = 0.8479' = 10" \text{ outlet pipe}$$

10" diameter primary outlet pipe with 1.25' of head will pass 3.04 cfs. "E" casting in top box with 24" diameter outlet pipe will provide secondary outlet, should lake fill up to within 1' of top surface.

ORIFICE EQUATION

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

$$Q = cdA \sqrt{2gh}$$

Allow Outflow $Q = 2.20$ cfs

Allow HW = Top Box Outlet Str. To IE Lower-Water Outlet Pipe $387.50 = 386.25 = 1.25$

$$(2.20) = Q = (.60)(A) \sqrt{2(32.2)(1.25)} \quad 387.50 = 386.25 = 1.25$$

$$A = \frac{2.20}{5.3833} = 0.4087 = \frac{\Pi d^2}{4}$$

$$d = 0.72' = 9" \text{ hole or } 10" \text{ diameter pipe}$$

9" diameter primary orifice with 1.5' of head will pass 2.02 cfs. However, if pipe utilized, pipe runs in even 2" increments and nearest available size recommended is 10". Going down to 6" would increase lake levels and create more maintenance.

APPENDIX "E"
BASIN VOLUME

BASIN VOLUMES

Lake Area "A" (Initial Building on Lot 6A-2)

Elevation	Surface Area	Stage Volume (cubic feet)	Accumulated Volume (cubic feet)	Remarks
386.25	29,500	-0-		Pool
387.00	32,281	23,168	23,168	
387.50	35,680	16,990	40,158	
388.00	39,078	18,689	58,848	

Lake Area "B" (Expanded Lake to Accommodate Future Building on Lot 6A-2)

Elevation	Surface Area (Cubic Feet)	Stage Volume (Cubic Feet)	Accumulated Volume (Cubic Feet)	Remarks
386.25	35,578	-0-	-0-	Pool
387.00	40,967	28,704	28,704	
387.50	44,631	21,399	50,104	
388.00	48,341	23,243	73,347	

Lake Area "C" (Lot 6A-1 Only)

Elevation	Surface Area (Cubic Feet)	Stage Volume (Cubic Feet)	Accumulated Volume (Cubic Feet)	Remarks
386.25	32,239	-0-	-0-	Pool
387.00	35,918	25,559	25,559	
387.50	38,390	18,577	44,136	
388.00	40,874	19,816	63,952	

Lake Areas "A", "B" & "C" (combined)

Elevation	Surface Area (Cubic Feet)	Stage Volume (Cubic Feet)	Accumulated Volume (Cubic Feet)	Remarks
386.25	67,817	-0-	-0-	Pool
387.00	76,885	54,263	54,263	
387.50	83,021	39,976	94,239	
388.00	89,215	43,059	137,298	

BASIN VOLUMES

STORAGE REQUIREMENT SUMMARY

REQUIRED STORAGE

Description	25 Year (Cubic Feet)	50 Year (Cubic Feet)	100 Year (Cubic Feet)
Lake Area "A" South 7.25 Acres of Lot 6A-2	32,363	40,214	49,732
Lake Area "B" All of Lot 6A-2 (10 acres)	44,638	55,468	68,596
Lake Areas "A", "B" & "C" (combined – 19 acres)	84,812	105,415	130,333

AVAILABLE STORAGE

Description	Available Storage to Elev. 387.50 (Cubic Feet)	Exceeds 25 Yr Required By: (Cubic Feet)	Available Storage to Elev. 388.00 (Cubic Feet)	Exceeds 100 Yr Required By: (Cubic Feet)
Lake Area "A" South 7.25 Acres of Lot 7A-2	40,158	7,795	58,848	9,116
Lake Area "B" All of Lot 6A-2 (10 acres)	50,104	5,466	73,347	4,751
Lake Areas "A", "B" & "C" (combined – 19 acres)	94,239	9,427	137,298	6,965