Legacy Estates

```
*****************************************
*                                       *
*  CIRCULAR ORIFICE                     *
*  DIAM= 8 in    ELEV= 560              *
*                                       *
*  Outlet Pipe -  50 ft - 42 in pipe    *
*  UFL= 555.5  LFL= 555    n= .013      *
*                                       *
*  Overflow Structure -  Standpipe      *
*  DIAM= 42 in    STANDPIPE ELEV= 561   *
*                                       *
*****************************************
```

SUBMITTAL DATE:

MIN	INFLOW	STORAGE	OUTFLOW	NET DET.	ELEV.
1	122.80	122.80	0.00	122.80	560.01
2	245.60	368.40	0.01	368.39	560.02
3	368.40	736.79	0.07	736.72	560.04
4	491.20	1227.92	0.35	1227.57	560.07
5	614.00	1841.57	0.89	1840.68	560.11
6	736.80	2577.48	2.04	2575.44	560.15
7	859.60	3435.04	3.73	3431.31	560.21
8	982.40	4413.71	6.53	4407.18	560.27
9	1105.20	5512.38	10.48	5501.90	560.33
10	1105.20	6607.10	15.68	6591.42	560.40
11	1105.20	7696.62	20.61	7676.01	560.46
12	1105.20	8781.21	27.23	8753.97	560.53
13	1105.20	9859.17	33.51	9825.66	560.59
14	1105.20	10930.86	39.34	10891.52	560.66
15	1105.20	11996.72	43.89	11952.83	560.72
16	1105.20	13058.03	63.69	12994.34	560.78
17	1105.20	14099.54	68.67	14030.87	560.84
18	1105.20	15136.07	73.28	15062.79	560.91
19	1105.20	16167.99	77.61	16090.38	560.97
20	1105.20	17195.58	81.69	17113.89	561.01
21	982.40	18096.29	85.94	18010.35	561.03
22	859.60	18869.95	93.10	18776.85	561.04
23	736.80	19513.65	101.23	19412.42	561.05
24	614.00	20026.42	109.03	19917.39	561.06
25	491.20	20408.59	115.87	20292.72	561.07
26	368.40	20661.12	121.23	20539.89	561.08
27	245.60	20785.49	124.94	20660.55	561.08
28	122.80	20783.35	126.79	20656.56	561.08
29	0.00	20656.56	126.69	20529.87	561.07

PEAK OUTFLOW= 2.11 CFS AT 28 MINUTES

Estates
Copy

11/7/96

Rev. 12/9/96

96-212

Legacy Estates
Storm Water Detention Analysis
5 Year 20 Minute Storm

1) Gross Area of Site : 6.1 Acres

2) Pre-Developed

$Q = CIA$

$Q = 1.41\ cfs/AC \times 6.1$

$Q = 8.60\ cfs$

3) Post-Developed

$Q = CIA$

$Q = 1.98\ cfs/AC \times 6.1$

$Q = 12.02\ cfs$

4) Summary

Rational Method	Pre-Dev	Post-Dev	Diff
	8.60	12.08	3.48

Peak Q in = 22.65 cfs (10.63 cfs Off-Site)

Peak Q out = 3.52 cfs

Attenuation Provided = 19.13 cfs

```
*****************************************
*                                       *
*  CIRCULAR ORIFICE                     *
*  DIAM= 8 in    ELEV= 560              *
*                                       *
*  Outlet Pipe -  50 ft - 42 in pipe    *
*  UFL= 555.5  LFL= 555    n= .013      *
*                                       *
*  Overflow Structure -  Standpipe      *
*  DIAM= 42 in    STANDPIPE ELEV= 561   *
*                                       *
*****************************************
```

SUBMITTAL DATE:

MIN	INFLOW	STORAGE	OUTFLOW	NET DET.	ELEV.
1	151.00	151.00	0.00	151.00	560.01
2	302.00	453.00	0.01	452.99	560.03
3	453.00	905.99	0.12	905.87	560.05
4	604.00	1509.87	0.48	1509.39	560.09
5	755.00	2264.39	1.40	2262.99	560.14
6	906.00	3168.99	2.86	3166.13	560.19
7	1057.00	4223.13	5.72	4217.41	560.25
8	1208.00	5425.41	9.57	5415.84	560.33
9	1359.00	6774.84	15.15	6759.69	560.41
10	1359.00	8118.69	22.20	8096.49	560.49
11	1359.00	9455.49	29.71	9425.78	560.57
12	1359.00	10784.78	37.18	10747.60	560.65
13	1359.00	12106.60	43.44	12063.16	560.73
14	1359.00	13422.16	64.24	13357.92	560.80
15	1359.00	14716.92	70.32	14646.60	560.88
16	1359.00	16005.60	75.89	15929.71	560.96
17	1359.00	17288.71	81.07	17207.65	561.01
18	1359.00	18566.65	86.56	18480.09	561.04
19	1359.00	19839.09	97.91	19741.18	561.06
20	1359.00	21100.18	113.40	20986.78	561.08
21	1208.00	22194.78	131.88	22062.90	561.10
22	1057.00	23119.90	150.36	22969.54	561.12
23	906.00	23875.54	167.10	23708.44	561.14
24	755.00	24463.44	181.59	24281.85	561.15
25	604.00	24885.85	193.26	24692.59	561.15
26	453.00	25145.59	203.77	24941.82	561.16
27	302.00	25243.82	209.20	25034.62	561.16
28	151.00	25185.62	211.24	24974.38	561.16
29	0.00	24974.38	209.98	24764.41	561.16

PEAK OUTFLOW= 3.52 CFS AT 28 MINUTES

11/7/96

Rev. 12/9/96

96-212

Legacy Estates
Storm Water Detention Analysis
15 Year 20 Minute Storm

1) Gross Area of Site: 6.1 Acres

2) Pre-Developed

$Q = CIA$

$Q = 1.87\ ^{cfs}/_{Ac} \times 6.1$

$Q = 11.41$ cfs

3) Post-Developed

$Q = CIA$

$Q = 2.64\ ^{cfs}/_{Ac} \times 6.1$

$Q = 16.10$ cfs

4) Summary

Rational Method.	Pre-Dev	Post-Dev	Diff
	11.41	16.10	4.69

Peak Q in = 30.20 cfs (14.10 cfs off-site)

Peak Qout ≅ 6.73 cfs

Attenuation Provided ≅ 23.47 cfs

```
*****************************************
*                                       *
*  CIRCULAR ORIFICE                     *
*   DIAM= 8 in    ELEV= 560             *
*                                       *
*  Outlet Pipe -  50 ft - 42 in pipe    *
*  UFL= 555.5  LFL= 555    n= .013      *
*                                       *
*  Overflow Structure -  Standpipe      *
*  DIAM= 42 in    STANDPIPE ELEV= 561   *
*                                       *
*****************************************
```

SUBMITTAL DATE:

MIN	INFLOW	STORAGE	OUTFLOW	NET DET.	ELEV.
1	201.33	201.33	0.00	201.33	560.01
2	402.67	604.00	0.03	603.97	560.04
3	604.00	1207.97	0.19	1207.78	560.07
4	805.33	2013.11	0.88	2012.23	560.12
5	1006.67	3018.90	2.32	3016.58	560.18
6	1208.00	4224.58	5.05	4219.53	560.25
7	1409.33	5628.86	9.57	5619.29	560.34
8	1610.67	7229.96	16.25	7213.71	560.43
9	1812.00	9025.71	24.67	9001.04	560.54
10	1812.00	10813.04	34.75	10778.29	560.65
11	1812.00	12590.29	43.50	12546.79	560.75
12	1812.00	14358.79	66.57	14292.22	560.86
13	1812.00	16104.22	74.41	16029.82	560.96
14	1812.00	17841.82	81.46	17760.36	561.02
15	1812.00	19572.36	90.83	19481.53	561.05
16	1812.00	21293.53	109.94	21183.59	561.09
17	1812.00	22995.59	135.06	22860.53	561.12
18	1812.00	24672.53	165.04	24507.49	561.15
19	1812.00	26319.49	199.79	26119.70	561.18
20	1812.00	27931.70	236.00	27695.70	561.21
21	1610.67	29306.37	274.28	29032.09	561.24
22	1409.33	30441.43	308.85	30132.57	561.26
23	1208.00	31340.57	341.82	30998.76	561.28
24	1006.67	32005.43	366.48	31638.94	561.29
25	805.33	32444.27	385.17	32059.10	561.30
26	604.00	32663.10	397.66	32265.44	561.30
27	402.67	32668.11	403.77	32264.34	561.30
28	201.33	32465.68	403.77	32061.90	561.30
29	0.00	32061.90	397.75	31664.15	561.29

PEAK OUTFLOW= 6.73 CFS AT 28 MINUTES

11/7/96

Rev. 12/9/96

96-212

Legacy Estates
Storm Water Detention Analysis
25 Year 20 Minute Storm

1) Gross Area of Site: 6.1 Acres

2) Pre-Developed

$Q = CIA$

$Q = 2.31\ ^{cfs}/_{Ac} \times 6.1$

$Q = 14.09$ cfs

3) Post-Developed

$Q = CIA$

$Q = 3.26\ ^{cfs}/_{Ac} \times 6.1$

$Q = 19.89$ cfs

4) Summary

Rational Method	Pre-Dev	Post-Dev	Diff
	14.09	19.89	5.80

Peak Qin = 37.29 cfs (17.40 cfs Off-Site)

Peak Qout ≅ 10.32 cfs

Attenuation Provided ≅ 26.97 cfs

```
*******************************************
*                                         *
* CIRCULAR ORIFICE                        *
*  DIAM= 8 in    ELEV= 560                *
*                                         *
*  Outlet Pipe -  50 ft - 42 in pipe      *
*  UFL= 555.5  LFL= 555    n= .013        *
*                                         *
*  Overflow Structure -  Standpipe        *
*  DIAM= 42 in    STANDPIPE ELEV= 561     *
*                                         *
*******************************************
```

SUBMITTAL DATE:

MIN	INFLOW	STORAGE	OUTFLOW	NET DET.	ELEV.
1	248.60	248.60	0.00	248.60	560.01
2	497.20	745.80	0.03	745.77	560.04
3	745.80	1491.57	0.36	1491.21	560.09
4	994.40	2485.61	1.25	2484.36	560.15
5	1243.00	3727.36	3.43	3723.93	560.22
6	1491.60	5215.53	7.73	5207.80	560.31
7	1740.20	6948.00	14.08	6933.92	560.42
8	1988.80	8922.72	23.33	8899.39	560.54
9	2237.40	11136.79	34.20	11102.59	560.67
10	2237.40	13339.99	59.32	13280.67	560.80
11	2237.40	15518.07	69.97	15448.10	560.93
12	2237.40	17685.50	79.17	17606.33	561.02
13	2237.40	19843.73	89.53	19754.20	561.06
14	2237.40	21991.60	113.58	21878.02	561.10
15	2237.40	24115.42	147.11	23968.31	561.14
16	2237.40	26205.71	186.82	26018.90	561.18
17	2237.40	28256.30	233.61	28022.69	561.22
18	2237.40	30260.09	282.60	29977.49	561.26
19	2237.40	32214.89	337.54	31877.35	561.29
20	2237.40	34114.75	392.25	33722.51	561.33
21	1988.80	35711.31	448.51	35262.80	561.36
22	1740.20	37003.00	502.89	36500.11	561.38
23	1491.60	37991.71	544.58	37447.13	561.40
24	1243.00	38690.13	577.26	38112.87	561.41
25	994.40	39107.27	600.58	38506.69	561.42
26	745.80	39252.49	614.65	38637.84	561.42
27	497.20	39135.04	619.33	38515.71	561.42
28	248.60	38764.31	614.99	38149.32	561.41
29	0.00	38149.32	601.94	37547.38	561.40

PEAK OUTFLOW= 10.32 CFS AT 27 MINUTES

100 YEAR STORMWATER DETENTION ANALYSIS

DETENTION BASIN SERVING
LEGACY ESTATES
O'FALLON, MO 63366

PREPARED FOR

Mr. William Floyd
#3 Pretoria Court
St. Charles, MO
Telephone: (314) 940-7305

PREPARED BY

Musler Engineering Company
6240 Mexico Road
St. Peters, MO 63376
Telephone: (314) 441-4555
Fax: (301) 441-0976

September, 1996
Rev. 12/9/96

Legacy Estates September, 1996 96-212

STORM Water DETENTION ANALYSIY

Detention Basin Serving LEGACY ESTATES

1) Gross Area of Site: 6.1 Acres

2) Estimate of Pre-Developed Rate of Runoff.
100 Year Frequency, 20 Minute Duration Storm

$Q = CIA$
$Q = 2.95\ ^{cfs}/_{A=} \times 6.1$
$Q = 18^{o}$ C.F.S.

3) Estimate of Post-Developed Rate of Runoff.

$Q = CIA$
$Q = 4.17\ ^{cfs}/_{A=} \times 6.1$
$Q = 25^{4}$ C.F.S

4) Summary.

Rational Method	Pre-Dev.	Post-Dev.	Diff.
100 Yr, 20 min.	18.0	25.4	7.4

5) Inflow

A) From on Site: 4.09 A_c (90-100% Improvious)
From off Site: 7.35 A_c (90-100% Improvious)

B) 100 YEAR FREQ. 20 MINUTE DURATION PEAK INFLO

$Q = (4.09\ A_c @ 4.17\ cfs/Ac) + 7.35\ A_c @ 4.17\ cfs/Ac)$
$Q = 53.88$ cfs

C) TIME OF CONCENTRATION
HEIGHT = 595° - 560° = 35'
LENGHT ≅ 800'
Tc ≅ 9.0 MINUTES (See Exhibit A)

D) INFLOW HYDROGRAPH CALCULATIONS
(See Exhibits B & C)

6 DEPTH-STORAGE VOLUME CALCULATIONS
(See Exhibits B & D)

7) DEPTH - OUTFLOW CALCULATIONS

Outflow Estimated By Weir Equation,

Outflow Weir is a 42" Dia. Standpipe @ Elev 460.0

$$Q_{out} = C\,L\,H^{3/2}$$

$$Q_{out} = (3.0)(11.0)\,h^{3/2}$$

Elev.	h	Q out (cfs)
560.0	0	0
560.5	0.5	11.67
561.5	1.0	33.00
562.0	1.5	60.62

A) DEPTH-OUTFLOW CURVE
(See Exhibit E)

8 SUMMARY OF ROUTING CALCULATIONS (See Exhibit B)

100 Year Frequency, 20 Minute Duration Storm

Peak Q in = 53.88 cfs

Peak Q out = 20.75 cfs

Attenuation Required = 7.4 cfs

Attenuation Provided = 33.13 cfs

High Water Elev. = 561.68

Top of Berm Elev = 563.0

Freeboard = 1.32'

Legacy Estates

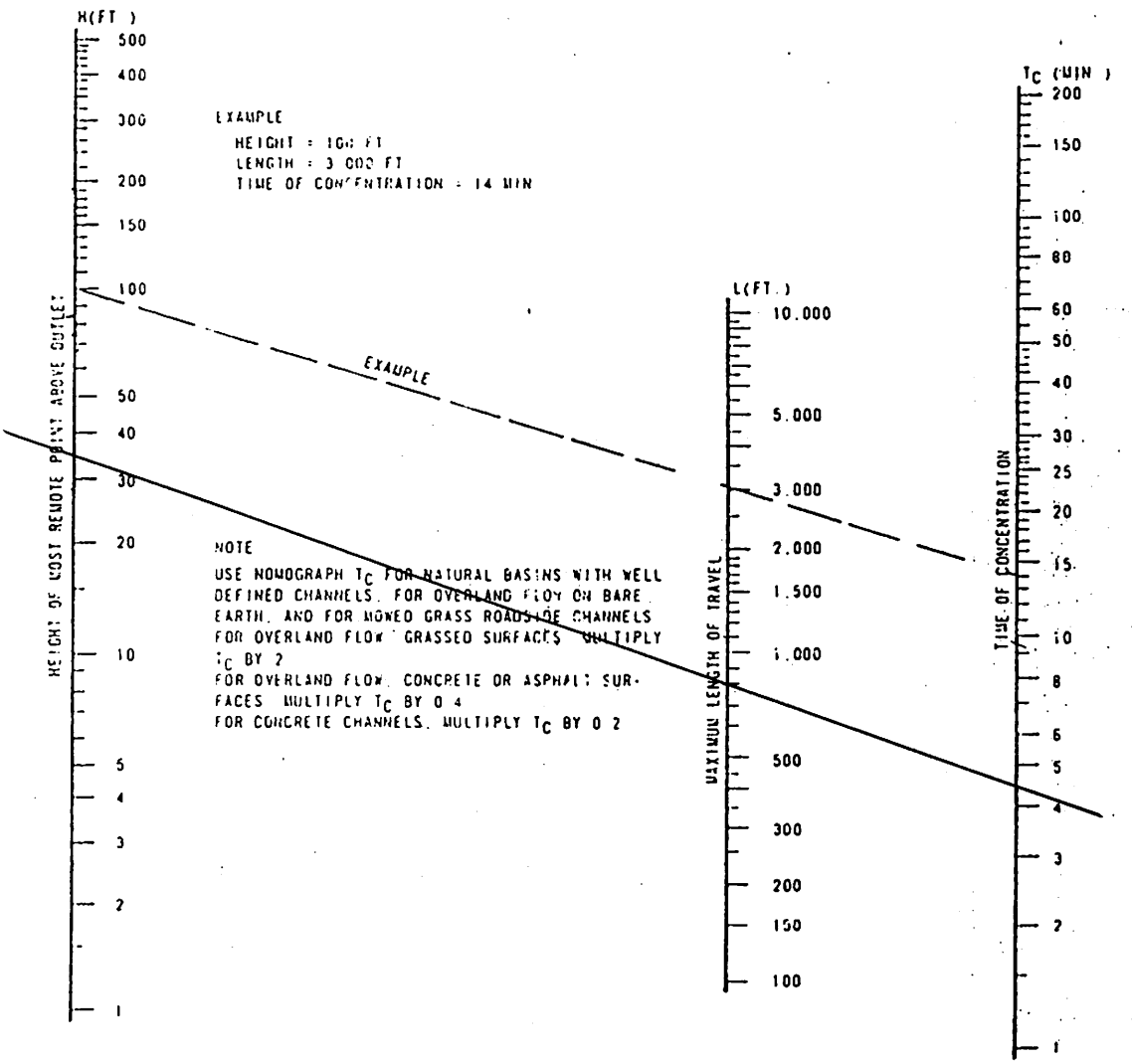


FIGURE 1

EXHTBIT "A"

TIME OF CONCENTRATION OF SMALL DRAINAGE BASINS

```
*********************************************
*                                           *
*  CIRCULAR ORIFICE                         *
*  DIAM= 8 in    ELEV= 560                  *
*                                           *
*  Outlet Pipe -  50 ft - 42 in pipe        *
*  UFL= 555.5  LFL= 555    n= .013          *
*                                           *
*  Overflow Structure -  Standpipe          *
*  DIAM= 42 in    STANDPIPE ELEV= 561       *
*                                           *
*********************************************
```

SUBMITTAL DATE:

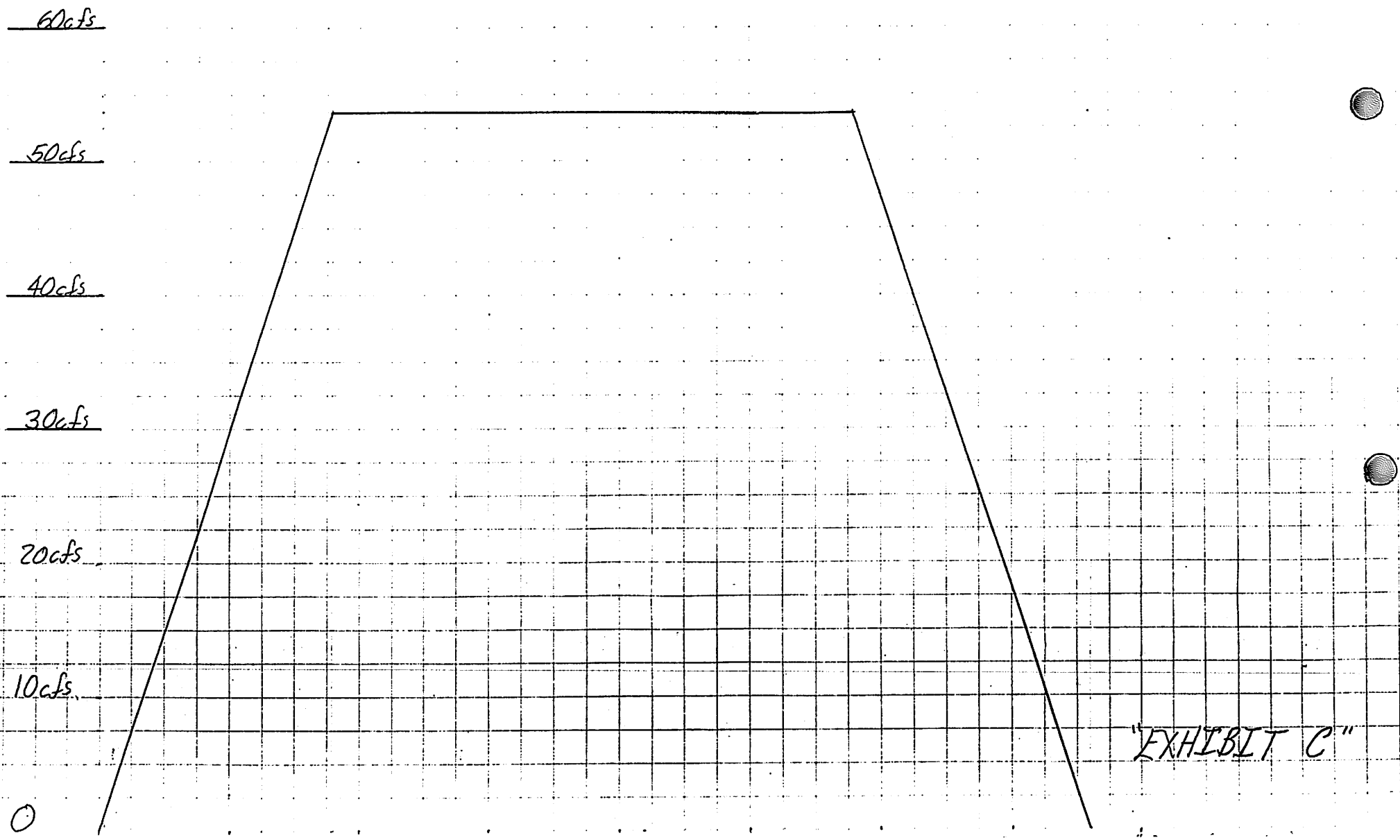
MIN	INFLOW	STORAGE	OUTFLOW	NET DET.	ELEV.
1	359.20	359.20	0.00	359.20	560.02
2	718.40	1077.60	0.07	1077.53	560.06
3	1077.60	2155.13	0.72	2154.41	560.13
4	1436.80	3591.21	2.59	3588.62	560.22
5	1796.00	5384.62	6.98	5377.64	560.32
6	2155.20	7532.84	15.09	7517.75	560.45
7	2514.40	10032.15	26.53	10005.62	560.60
8	2873.60	12879.22	40.08	12839.14	560.77
9	3232.80	16071.94	67.95	16003.99	560.96
10	3232.80	19236.79	81.36	19155.43	561.05
11	3232.80	22388.23	105.79	22282.45	561.11
12	3232.80	25515.25	154.31	25360.94	561.17
13	3232.80	28593.74	218.57	28375.17	561.23
14	3232.80	31607.97	291.62	31316.35	561.28
15	3232.80	34549.15	375.73	34173.42	561.34
16	3232.80	37406.22	462.80	36943.42	561.39
17	3232.80	40176.22	559.78	39616.44	561.44
18	3232.80	42849.24	654.79	42194.45	561.49
19	3232.80	45427.25	764.60	44662.65	561.54
20	3232.80	47895.45	863.78	47031.67	561.58
21	2873.60	49905.28	979.47	48925.80	561.62
22	2514.40	51440.20	1063.15	50377.04	561.65
23	2155.20	52532.24	1128.89	51403.35	561.67
24	1796.00	53199.35	1207.09	51992.27	561.68
25	1436.80	53429.07	1235.40	52193.67	561.68
26	1077.60	53271.28	1245.09	52026.18	561.68
27	718.40	52744.58	1236.93	51507.65	561.67
28	359.20	51866.85	1212.12	50654.73	561.65
29	0.00	50654.73	1171.46	49483.27	561.63

PEAK OUTFLOW= 20.75 CFS AT 26 MINUTES

"EXHIBIT B"

Legacy Estates

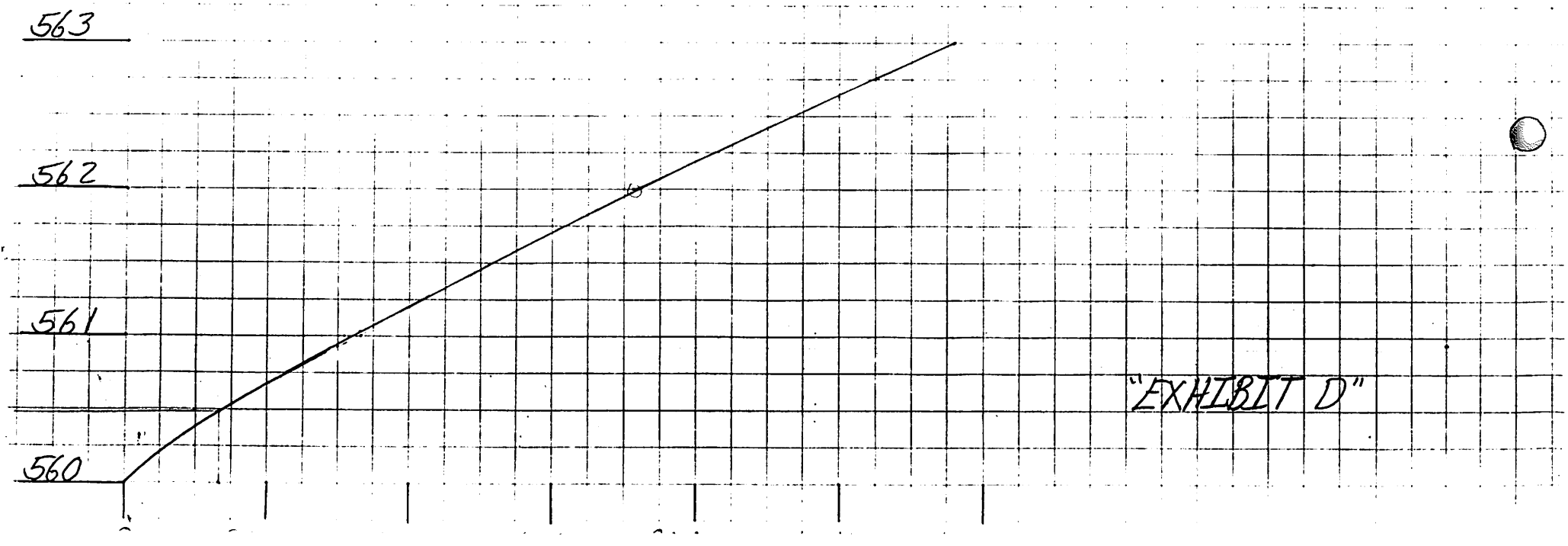
"INFLOW HYDROGRAPH"



"EXHIBIT C"

DEPTH - STORAGE VOLUME CURVE

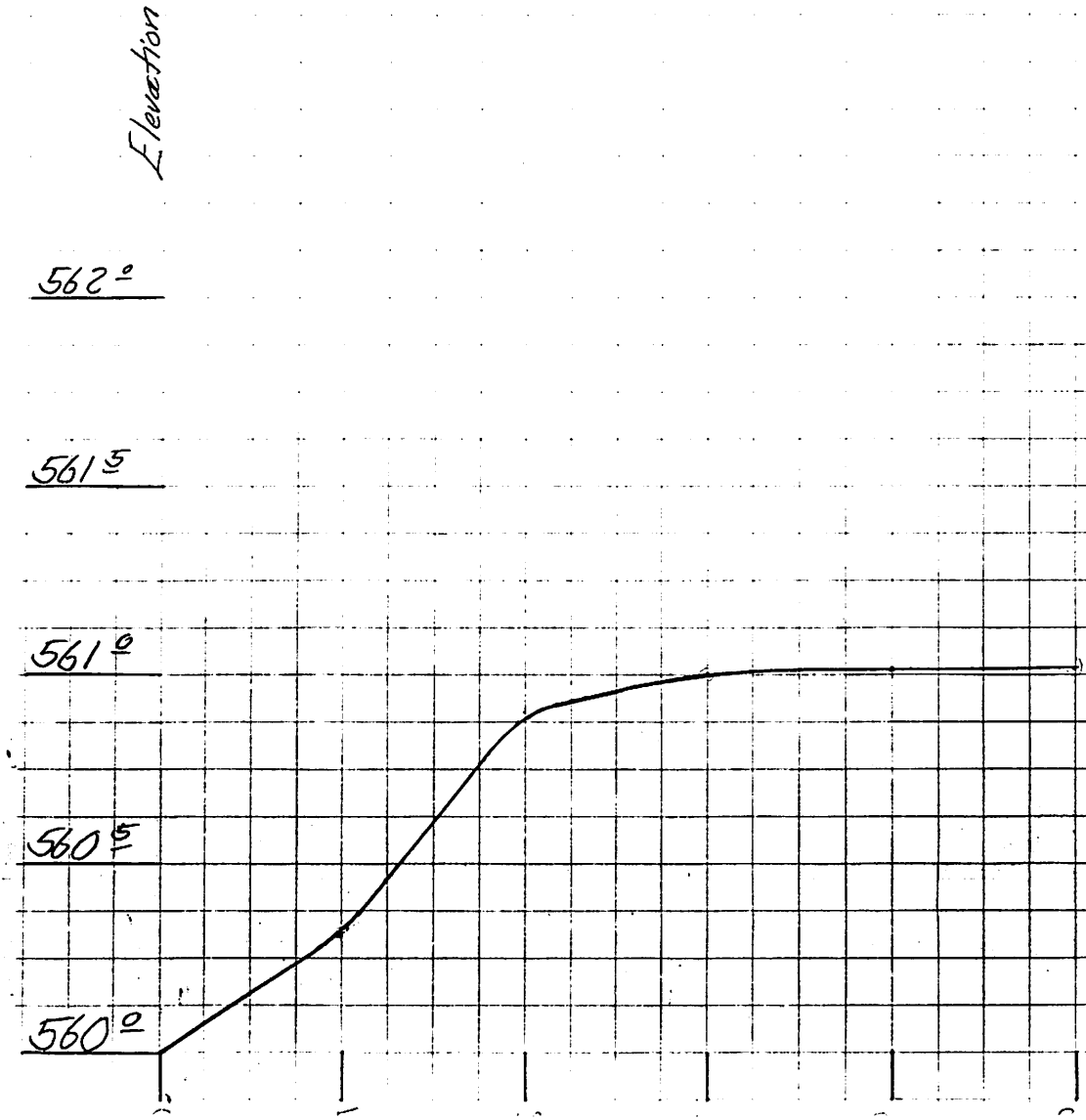
Legacy Estates



"EXHIBIT D"

DEPTH-OUTFLOW CURVE

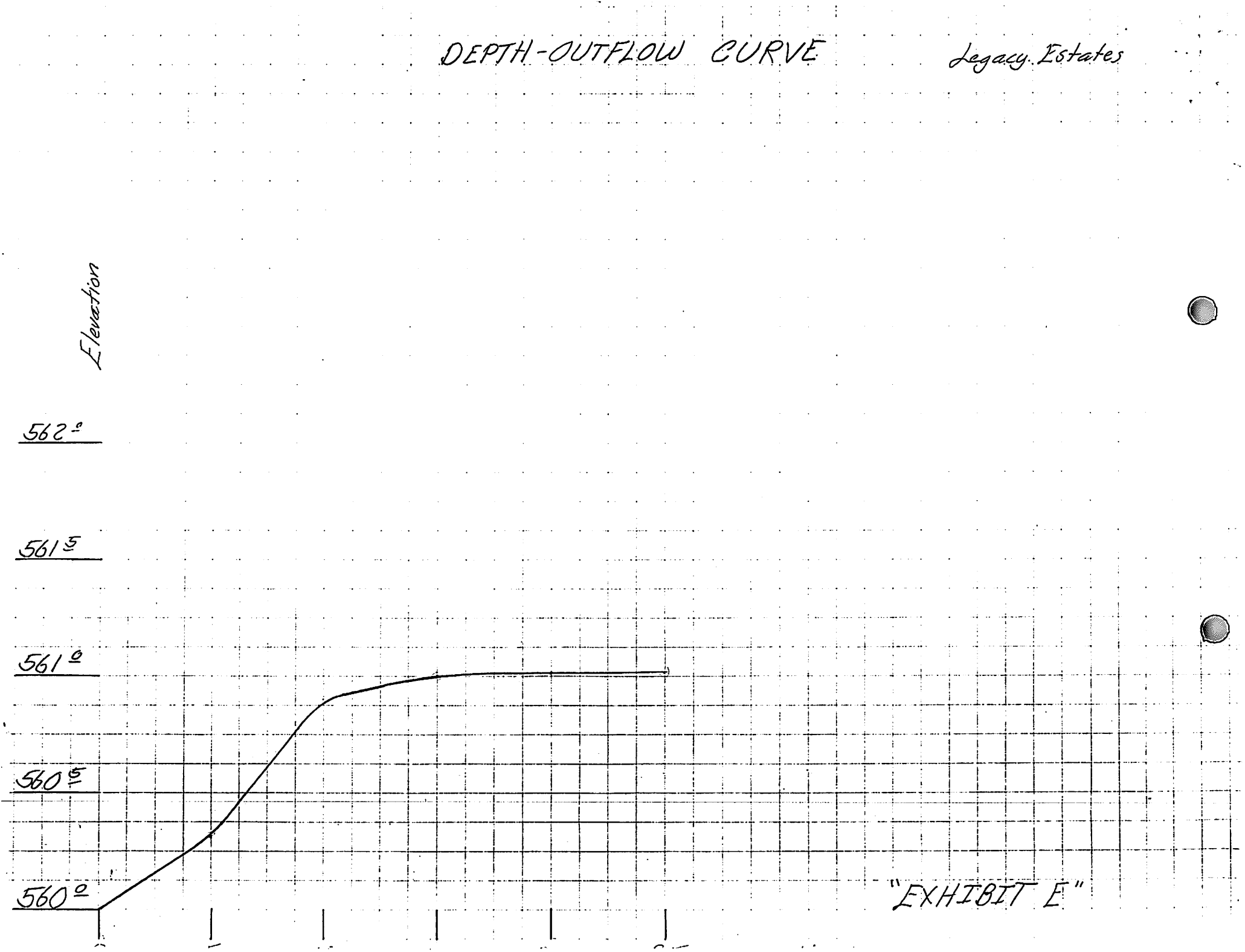
Legacy Estates



"EXHIBIT E"

DEPTH-OUTFLOW CURVE

Legacy Estates



"EXHIBIT E"

P.I. FACTOR IN CUBIC FEET PER SECOND PER ACRE

DURATION OF RAIN IN MINUTES	% IMPERVIOUS	2-YEAR RAINFALL FREQUENCY						5-YEAR RAINFALL FREQUENCY					
		15	20	30	60	90	120	15	20	30	60	90	120
	0	1.08	1.09	1.00	0.79	.66	0.58	1.31	1.33	1.25	1.00	0.83	0.72
	5	1.15	1.15	1.05	0.82	0.68	0.60	1.40	1.41	1.31	1.04	0.86	0.74
	10	1.22	1.21	1.11	0.86	0.70	0.61	1.48	1.48	1.38	1.09	0.89	0.76
	15	1.30	1.27	1.16	0.89	0.73	0.63	1.57	1.56	1.44	1.13	0.92	0.79
	20	1.37	1.35	1.22	0.92	0.74	0.64	1.66	1.65	1.52	1.17	0.94	0.80
	25	1.44	1.41	1.27	0.96	0.77	0.66	1.74	1.73	1.58	1.22	0.97	0.83
	30	1.51	1.47	1.32	0.99	0.79	0.68	1.83	1.81	1.64	1.25	1.00	0.85
	35	1.58	1.54	1.38	1.02	0.81	0.70	1.92	1.88	1.72	1.29	1.03	0.87
	40	1.66	1.61	1.43	1.05	0.84	0.71	2.01	1.98	1.78	1.33	1.06	0.89
	45	1.73	1.67	1.49	1.09	0.86	0.73	2.09	2.05	1.85	1.38	1.09	0.91
	50	1.80	1.74	1.54	1.12	0.88	0.74	2.18	2.13	1.92	1.42	1.11	0.93
	55	1.87	1.80	1.59	1.16	0.90	0.76	2.27	2.20	1.98	1.46	1.14	0.95
	60	1.94	1.86	1.65	1.19	0.92	.78	2.35	2.28	2.05	1.51	1.17	0.97
	65	2.02	1.94	1.70	1.23	0.95	0.80	2.44	2.38	2.11	1.55	1.20	1.00
	70	2.09	2.00	1.76	1.26	0.97	0.81	2.53	2.45	2.19	1.59	1.23	1.01
	75	2.16	2.06	1.81	1.29	0.99	0.83	2.62	2.53	2.25	1.64	1.26	1.04
	80	2.23	2.12	1.85	1.33	1.02	0.85	2.70	2.60	2.31	1.68	1.29	1.06
	85	2.30	2.19	1.92	1.36	1.04	0.86	2.79	2.68	2.39	1.72	1.31	1.08
	90	2.38	2.26	1.96	1.40	1.06	0.88	2.88	2.77	2.45	1.76	1.34	1.10
	95	2.45	2.33	2.03	1.43	1.08	0.90	2.96	2.85	2.52	1.80	1.37	1.12
	100	2.52	2.39	2.07	1.46	1.11	0.91	3.05	2.93	2.58	1.84	1.40	1.14
	RAINFALL	3.60	3.10	2.44	1.55	1.17	0.96	4.36	3.80	3.04	1.96	1.48	1.20

TABLE 4-3

P.I. VALUES FOR VARIOUS IMPERVIOUS CONDITIONS

(2 YEAR & 5 YEAR RAINFALL FREQUENCIES)