RESERVOIR INFLOW ANALYSIS

SANTA ROSA SUBREGIONAL LONG-TERM WASTEWATER PROJECT

Prepared for

City of Santa Rosa
and
U.S. Army Corps of Engineers

December 1995

Prepared by

DAMES & MOORE
221 MAIN STREET, SUITE 600, SAN FRANCISCO, CA 94105 • 415/896-5858

For

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for

HARLAND BARTHOLOMEW AND ASSOCIATES, INC.

Final

TECHNICAL MEMORANDUM
Reservoir Inflow Analysis

TO: Harland Bartholomew & Associates, Inc.

FROM: April Fallon - Dames & Moore, San Francisco

DATE: December 1995

RE: Santa Rosa Subregional Long-Term Wastewater Project
Reservoir Inflow Analysis

SUMMARY

A hydrologic analysis was performed to estimate the design flow rates for preliminary sizing of surface runoff diversion facilities at 10 proposed reservoir sites. The diversion facilities will intercept surface water runoff and divert it around the reservoir. Each reservoir watershed was divided into several subwatersheds to allow calculation of peak inflow rates at several locations along a proposed diversion facility alignment. The design peak inflow was calculated using two methods:

1. The Unit Hydrograph Method, using the 10-year precipitation data from the Sonoma County *Flood Control Design Criteria Manual* (SCWA 1983) and the computer model HEC-1.

2. The Rational Method, using the 10-year rainfall intensity as presented in the Sonoma County *Flood Control Design Criteria Manual*. The design flow was selected based on a comparison of the results from both methods. Runoff hydrographs were also calculated for the Adobe Road, Tolay-A, Tolay-C, and Sears Point reservoirs to allow sizing of pump stations at these facilities.

Based on the results of this investigation and other project planning work, Parsons ES determined that diversion facilities are only required for four reservoirs.

PURPOSE

A hydrologic analysis was performed to determine the appropriate design criteria for conceptual layout of the surface runoff diversion facilities at each reservoir site. The results of the analysis were used by Parsons ES to size diversion facilities for Tolay A, Tolay C, Adobe Road and Sears Point reservoirs to intercept runoff so that an estimate of the project cost could be prepared.

METHODOLOGY

The scope of work for this task included:

1. Analysis of a maximum of 10 reservoir sites,

2. Calculation of runoff design peak inflow for each subwatershed using the 10-year precipitation data,

3. Calculation of the runoff hydrograph for one location in each of the Adobe Road, Tolay-A, Tolay-C, and Sears Point reservoirs.

FINDINGS

Watershed Data

Engineering-Science, Inc. provided data on the reservoir water surface area and the watershed area for each reservoir. The soil type for each watershed was identified by locating each reservoir site on the *Soil Survey of Sonoma County* (Appendix A) (U.S. Department of Agriculture, 1972). The hydrologic soil group for each soil type was determined using the Soil Conservation Service (SCS) *National Engineering Handbook* (Soil Conservation Service, 1985). Using the hydrologic soil group identification, the runoff curve number was selected from Table 2.1 of the *Civil Engineering Reference Manual* (Lindeburg, 1989). The value selected from this table is for antecedent moisture condition II (AMC-II), corresponding to the typical soil condition before the maximum annual flood. AMC-I, corresponding to dry soils, and AMC-III, corresponding to saturated soils due to heavy rainfall, were calculated by converting from AMC-II to AMC-I and AMC-III using Table 6.8 in the manual. These values are summarized in Table 1, below.

TABLE 1

SUMMARY OF WATERSHED DATA

Dam Site	Reservoir Water Surface Area (acres)	Watershed Area (acres)	Soil Type Name	Hydrologic Soil Group	Curve Number		
					AMC-II	AMC-I	AMC-III
Adobe Road (AD-1B)	170	1,050	Goulding	D	80	63	91
Two Rock (T6A)	230	7 04	Steinbeck / Los Osos	B,C	67	47	83
Tolay-A (S39A)	800	3,990	Diablo / Goulding	D	80	63	91
Tolay-C (S39C)	390	3,9 90	Diablo / Goulding	D	80	63	91
Lakeville Hillside	155	5 00	Diablo	D	80	63	91

TABLE 1

SUMMARY OF WATERSHED DATA

Dam Site	Reservoir Water Surface Area (acres)	Watershed Area (acres)	Soil Type Name	Hydrologic Soil Group	Curve Number		
					AMC-II	AMC-I	AMC-III
(L-2A)							
Sears Point (SP-1)	270	6,080	Diablo	D	80	63	91
Bloomfield (B1-A)	195	601	Steinbeck / Los Osos	B,C	67	47	83
Valley Ford East (V4)	260	8 79	Steinbeck	B	61	41	79
Carroll Road North (V7)	235	846	Steinbeck / Los Osos	B,C	67	47	83
Huntley (T-1)	175	360	Steinbeck	B	61	41	79

Note: The watershed area for Tolay-C (3,990 acres) includes the area upstream from the backdam because the runoff from this area will accumulate at the backdam and must be diverted around the reservoir to a point below the main dam.

In addition to the above data, the lag time for each subwatershed is required as input data for the HEC-1 model. The time of concentration for each subwatershed was calculated using the following equation (Department of Interior, 1977):

$$T = (11.9\ L^3/H)^{0.385}$$

where T = time of concentration in hours

L = length of longest watercourse in miles

H = elevation difference in feet

Lag time in hours was estimated to be 60 percent of the time of concentration, *T*. Figures 1 through 7 present each watershed and the subwatershed areas. Table 2 provides the input data and calculated time of concentration and lag time in hours for each subwatershed.

TABLE 2

CALCULATION OF LAG TIME

Dam Site	Subwatershed	Subwatershed Area (sq. mi.)	*L* Watercourse Length (miles)	*H* Elevation Difference (ft)	*T* Time of Concentration (hours)	Lag Time (hours)
Adobe Road (AD-1B)	A	0.06	0.61	400	0.14	0.09
	B	0.06	0.61	400	0.14	0.09
	C	0.07	0.61	400	0.14	0.09
	D	0.59	2.17	1,240	0.41	0.24
	E	0.34	2.35	1,240	0.45	0.27
	F	0.09	0.26	80	0.10	0.06
Two Rock (T6A)	A	0.17	0.34	260	0.09	0.05
	B	0.17	0.45	210	0.13	0.08
	C	0.10	0.46	258	0.12	0.07
Tolay-A (S39A)	A	1.15	1.14	264	0.35	0.21
	B	0.30	0.85	580	0.18	0.11
	C	0.82	1.66	580	0.40	0.24
	D	0.50	1.33	570	0.31	0.19
	E	0.34	1.33	570	0.31	0.19
	F	0.41	1.33	570	0.31	0.19
	G	0.43	1.33	570	0.31	0.19
	A1	0.54	0.21	120	0.07	0.04
Tolay-C (S39C)	A	4.09	2.04	60	1.22	0.73
	B	0.96	1.33	570	0.31	0.19
	A1	0.31	0.21	120	0.07	0.04

TABLE 2

CALCULATION OF LAG TIME

Dam Site	Subwatershed	Subwatershed Area (sq. mi.)	*L* Watercourse Length (miles)	*H* Elevation Difference (ft)	*T* Time of Concentration (hours)	Lag Time (hours)
Lakeville Hillside (L-2A)	A	0.10	0.54	190	0.17	0.10
	B	0.03	0.09	70	0.03	0.02
	A1	0.09	0.29	180	0.09	0.05
	B1	0.15	0.33	140	0.11	0.06
Sears Point (SP-1)	A	6.47	3.94	760	0.98	0.59
	B	0.16	0.48	360	0.12	0.07
	C	0.13	0.69	360	0.17	0.10
	D	0.26	0.84	400	0.21	0.13
	E	0.38	0.67	320	0.18	0.11
	A1	0.39	0.89	500	0.21	0.12
	B1	0.62	1.15	400	0.30	0.18
	C1	0.21	0.49	340	0.12	0.07
Bloomfield (B1-A)	A	0.14	0.56	340	0.12	0.07
	B	0.08	0.25	640	0.11	0.07
	A1	0.16	0.55	620	0.11	0.07
	B1	0.07	0.23	192	0.06	0.04
	C1	0.06	0.31	192	0.09	0.05
Valley Ford East (V4)	A	0.09	0.55	240	0.16	0.09
	B	0.16	0.46	345	0.11	0.07
	C	0.17	0.46	300	0.12	0.07
	D	0.13	0.30	240	0.08	0.05
	A1	0.06	0.43	240	0.12	0.07
	B1	0.05	0.44	280	0.12	0.07
	C1	0.12	0.30	240	0.08	0.05
	D1	0.14	0.34	240	0.09	0.05

TABLE 2

CALCULATION OF LAG TIME

Dam Site	Subwatershed	Subwatershed Area (sq. mi.)	*L* Watercourse Length (miles)	*H* Elevation Difference (ft)	*T* Time of Concentration (hours)	Lag Time (hours)
Carroll Road North (V7)	A	0.20	0.48	620	0.09	0.06
	B	0.14	0.58	600	0.12	0.07
	C	0.08	0.20	192	0.05	0.03
	A1	0.17	0.51	560	0.10	0.06
	B1	0.11	0.45	400	0.10	0.06
	C1	0.11	0.09	80	0.03	0.02
Huntley (T-1)	A	0.08	0.22	160	0.06	0.04
	B	0.07	0.22	160	0.06	0.04
	C	0.04	0.25	110	0.08	0.05

Unit Hydrograph Method

The computer model HEC-1 (Corps of Engineers computer model) was used to calculate the runoff from each subwatershed for the 10-year storm with the antecedent moisture condition AMC-II. The selection of AMC-II assumes the soil is wet due to average rainfall preceding the storm.

The initial rainfall loss (initial abstraction) was estimated based on observed rainfall and runoff data. This data gives a value of 0.1 inches. This value is more reasonable than the value of about 0.5 inches calculated using the SCS curve number, especially for very small watersheds such as these where the time of concentration is very low.

Rainfall intensity vs duration data was calculated using the following formula from the Sonoma County *Flood Control Design Criteria Manual.*

$$I = 5.12Y^{0.1469}t^{-0.528}$$

where I = inches/hour

Y = year frequency (5, 10, 25, 100 year, etc.)

t = time (in minutes)

The design criteria manual specifies a K factor to adjust the precipitation intensity calculated using the above formula to account for rainfall variations throughout the county. The K factor varies depending on the mean seasonal precipitation. Table 3 lists the mean seasonal precipitation taken from the seasonal precipitation map in the drainage manual and the corresponding K factor.

The computer model HEC-1 requires values for the total rainfall depth at time intervals of 5 and 15 minutes and at 1, 2, 3, 6, 12 and 24 hours. The precipitation depths for these times were calculated using the intensity duration relationship shown above, adjusted by the K factor corresponding to each reservoir site. The precipitation depth was calculated by multiplying precipitation intensity by the duration interval. Table 3 lists precipitation depths for the 10-year storm.

TABLE 3

10-YEAR PRECIPITATION DEPTHS

Dam Site	Mean Seasonal Precipitation (in)	*K* Factor Adjust-ment	5-min (in)	15-min (in)	1-hr (in)	2-hr (in)	3-hr (in)	6-hr (in)	12-hr (in)	24-hr (in)
Unadjusted Precipitation Depth			0.26	0.43	0.83	1.15	1.39	1.93	2.67	3.71
Adobe Road (AD-1B)	35	1.2	0.31	0.52	1.00	1.38	1.67	2.32	3.20	4.45
Two Rock (T6A)	30	1.00	0.26	0.43	0.83	1.15	1.39	1.93	2.67	3.71
Tolay-A (S39A)	25	0.80	0.21	0.34	0.66	0.92	1.11	1.54	2.14	2.97
Tolay-C (S39C)	25	0.80	0.21	0.34	0.66	0.92	1.11	1.54	2.14	2.97
Lakeville Hillside (L-2A)	25	0.80	0.21	0.34	0.66	0.92	1.11	1.54	2.14	2.97
Sears Point (SP-1)	25	0.80	0.21	0.34	0.66	0.92	1.11	1.54	2.14	2.97
Bloomfield (B1-A)	35	1.15	0.30	0.49	0.95	1.32	1.60	2.22	3.07	4.27
Valley Ford East (V4)	35	1.15	0.30	0.49	0.95	1.32	1.60	2.22	3.07	4.27
Carroll Road North (V7)	35	1.15	0.30	0.49	0.95	1.32	1.60	2.22	3.07	4.27
Huntley (T-1)	30	1.00	0.26	0.43	0.83	1.15	1.39	1.93	2.67	3.71

A computer analysis of each subwatershed was performed using HEC-1, a flood hydrograph software package developed by the U.S. Army Corps of Engineers. The program was used to develop a watershed unit hydrograph and surface runoff hydrographs for the 10-year storm. The peak flows from the hydrographs are presented in Table 4. Complete HEC-1 model runs for each watershed are presented in Appendix B.

TABLE 4

10-YEAR STORM PEAK FLOWS - UNIT HYDROGRAPH METHOD

Dam Site	Subbasin	10-year Peak Flow (cfs)
Adobe Road (AD-1B)	A	49
	B	49
	C	58
	D	306
	E	167
	F	86
Two Rock (T6A)	A	77
	B	66
	C	41
Tolay-A (S39A)	A	307
	B	111
	C	205
	D	141
	E	96
	F	116
	G	121
	A1	286
Tolay-C (S39C)	A	326
	B	164
	A1	104
Lakeville Hillside (L-2A)	A	39
	B	18
	A1	45
	B1	71

TABLE 4

10-YEAR STORM PEAK FLOWS - UNIT HYDROGRAPH METHOD

Dam Site	Subbasin	10-year Peak Flow (cfs)
Sears Point (SP-1)	A	961
	B	71
	C	50
	D	89
	E	140
	A1	138
	B1	179
	C1	94
Bloomfield (B1-A)	A	74
	B	50
	A1	84
	B1	44
	C1	35
Valley Ford East (V4)	A	35
	B	68
	C	73
	D	62
	A1	26
	B1	21
	C1	57
	D1	67
Carroll Road North (V7)	A	112
	B	74
	C	52
	A1	95
	B1	61
	C1	77

TABLE 4

10-YEAR STORM PEAK FLOWS - UNIT HYDROGRAPH METHOD

Dam Site	Subbasin	10-year Peak Flow (cfs)
Huntley (T-1)	A	31
	B	27
	C	15

Rational Method

The Sonoma County Flood Control Design Criteria Manual specifies a procedure and data for estimating peak flows in the county. The method uses the Rational Method with the addition of an adjustment factor (K factor) to account for variations in rainfall throughout the county. The formula for estimating peak flow is:

$$Q = CIAK$$

where Q = design discharge, cubic feet per second

C = runoff coefficient

I = intensity of rainfall (inches per hour)

A = tributary watershed area (acres)

K = adjustment factor

The rainfall intensity values for the 10-year storm were determined using Plate No. B2 *Rainfall Intensity vs. Duration* from the Sonoma County *Flood Control Design Criteria Manual*, shown in Figure 9. The rainfall intensity for each subwatershed was determined from the graph in Figure 9 based on the time of concentration calculated for each subwatershed and presented in Table 2. Results of the Rational Method are presented in Table 5.

TABLE 5

10-YEAR STORM PEAK FLOWS-RATIONAL METHOD

Dam Site	Subwatershed	*C* Runoff Coefficient	*I* Intensity (inches/hour)	*A* Subwatershed Area (acres)	*K* Factor	10-Year Peak (cfs)
Adobe Road (AD-1B)	A	0.3	2.3	40	1.2	33
	B	0.3	2.3	38	1.2	32
	C	0.3	2.3	46	1.2	38
	D	0.3	1.3	379	1.2	179
	E	0.3	1.3	216	1.2	97
	F	0.3	2.8	55	1.2	55
Two Rock (T6A)	A	0.25	2.9	112	1.0	81
	B	0.25	2.4	111	1.0	67
	C	0.25	2.5	62	1.0	39
Tolay-A(S39A)	A	0.3	1.4	734	0.8	251
	B	0.3	2.0	195	0.8	95
	C	0.3	1.3	525	0.8	168
	D	0.3	1.5	322	0.8	118
	E	0.3	1.5	217	0.8	79
	F	0.3	1.5	261	0.8	95
	G	0.3	1.5	275	0.8	101
	A1	0.3	3.3	344	0.8	275
Tolay-C (S39C)	A	0.3	0.7	2619	0.8	465
	B	0.3	1.5	616	0.8	225
	A1	0.3	3.3	199	0.8	159
Lakeville Hillside (L-2A)	A	0.3	2.1	62	0.8	31
	B	0.3	5.2	18	0.8	22
	A1	0.3	2.9	60	0.8	42
	B1	0.3	2.6	97	0.8	61

TABLE 5

10-YEAR STORM PEAK FLOWS-RATIONAL METHOD

Dam Site	Subwatershed	*C* Runoff Coefficient	*I* Intensity (inches/hour)	*A* Subwatershed Area (acres)	*K* Factor	10-Year Peak (cfs)
Sears Point (SP-1)	A	0.3	0.8	4143	0.8	826
	B	0.3	2.5	100	0.8	60
	C	0.3	2.1	81	0.8	41
	D	0.3	1.9	165	0.8	74
	E	0.3	2.0	243	0.8	118
	A1	0.3	1.9	251	0.8	112
	B1	0.3	1.5	397	0.8	148
	C1	0.3	2.5	136	0.8	82
Bloomfield (B1-A)	A	0.25	2.5	92	1.15	67
	B	0.25	2.6	49	1.15	37
	A1	0.25	2.6	105	1.15	79
	B1	0.25	3.6	44	1.15	45
	C1	0.25	2.9	37	1.15	31
Valley Ford East (V4)	A	0.25	2.2	55	1.15	34
	B	0.25	2.6	101	1.15	76
	C	0.25	2.5	110	1.15	79
	D	0.25	3.1	80	1.15	71
	A1	0.25	2.5	36	1.15	26
	B1	0.25	2.5	31	1.15	22
	C1	0.25	3.1	79	1.15	71
Valley Ford East (V4)	D1	0.25	2.9	87	1.15	73
Caroll Road North (V7)	A	0.25	2.9	129	1.15	108
	B	0.25	2.5	88	1.15	63
	C	0.25	4.0	54	1.15	62
	A1	0.25	2.8	110	1.15	87

TABLE 5

10-YEAR STORM PEAK FLOWS-RATIONAL METHOD

Dam Site	Subwatershed	*C* Runoff Coefficient	*I* Intensity (inches/hour)	*A* Subwatershed Area (acres)	*K* Factor	10-Year Peak (cfs)
	B1	0.25	2.8	72	1.15	57
	C1	0.25	5.2	71	1.15	106
Huntley (T-1)	A	0.25	3.6	53	1.0	48
	B	0.25	3.6	43	1.0	39
	C	0.25	3.1	28	1.0	21

Runoff Hydrographs for Sizing Pump Station Facilities

Based on the backdam configurations presented in the Adobe Road, Tolay-A and Tolay-C reservoir options, pump stations will be required to pump runoff from the surrounding watershed around the backdam. The computer model HEC-1 was used to calculate the runoff hydrograph that will be used for subsequent sizing of the pump station facility. The 10-year precipitation data presented in Table 4 with AMC-II was used as input data to HEC-1. Two additional time intervals, 2-day and 4-day, were added to the precipitation input data. These values were obtained from Technical Paper 49 (National Weather Service, 1964) and were used to calculate longer duration hydrographs. Complete HEC-1 model runs including the runoff hydrograph output are provided in Appendix C for the four watersheds.

CONCLUSION

The peak inflow values calculated using the two methods described above are compared in Table 6. It is recommended that the flows calculated using the unit hydrograph method be used for sizing diversion facilities. Although the Sonoma County Method of analysis produces larger flows in some cases, the unit hydrograph method more precisely accounts for variations in hydrologic conditions within each watershed. The unit hydrograph method accounts for watershed shape, slope and area while the Sonoma County Method only accounts for watershed area. Therefore, the unit hydrograph method is recommended for developing a conceptual diversion facility plan for each reservoir and for comparing construction costs. The Sonoma County Method was used in this study as an alternate calculation method to confirm the reasonableness of the results from the unit hydrograph method.

TABLE 6

SUMMARY OF 10-YEAR STORM PEAK FLOWS

Dam Site	Subwatershed	HEC Method (cfs)	Sonoma County Method (cfs)
Adobe Road (AD-1B)	A	49	33
	A, B	99	65
	A, B, C	157	103
	A, B, C, D	385	282
	A, B, C, D, E	546	379
	A, B, C, D, E, F	577	434
Two Rock (T6A)	A	77	81
	A, B	139	148
	A, B, C	179	187
Tolay-A (S39A)	A	307	251
	A, B	383	346
	A, B, C	579	514
	A, B, C, D	720	632
	A, B, C, D, E	815	711
	A, B, C, D, E, F	931	806
	A, B, C, D, E, F, G	1,052	907
	A1	286	275
Tolay-C (S39C)	A	326	465
	A, B	395	690
	A1	104	159
Lakeville Hillside (L-2A)	A	39	31
	A, B	45	53
	A1	45	42
	A1, B1	115	103
Sears Point (SP-1)	A	961	826

TABLE 6

SUMMARY OF 10-YEAR STORM PEAK FLOWS

Dam Site	Subwatershed	HEC Method (cfs)	Sonoma County Method (cfs)
	A, B	976	886
	A, B, C	987	927
	A, B, C, D	1,011	1,001
	A, B, C, D, E	1,046	1,119
	A1	138	112
	A1, B1	304	260
	A1, B1, C1	366	342
Bloomfield (B1-A)	A	74	67
	A, B	119	104
	A1	84	79
	A1, B1	124	124
	A1, B1, C1	159	155
Valley Ford East (V4)	A	35	34
	A, B	103	110
	A, B, C	175	189
	A, B, C, D	235	260
	A1	26	26
	A1, B1	47	48
	A1, B1, C1	103	119
	A1, B1, C1, D1	169	192
Carroll Road North (V7)	A	112	108
	A, B	185	171
	A, B, C	228	233
	A1	95	87
	A1, B1	156	144
	A1, B1, C1	217	250
Huntley (T-1)	A	31	48

TABLE 6

SUMMARY OF 10-YEAR STORM PEAK FLOWS

Dam Site	Subwatershed	HEC Method (cfs)	Sonoma County Method (cfs)
	A, B	58	87
	A, B, C	73	108

REFERENCES

Sonoma County Water Agency (SCWA), August 1983, *Flood Control Design Criteria Manual.*

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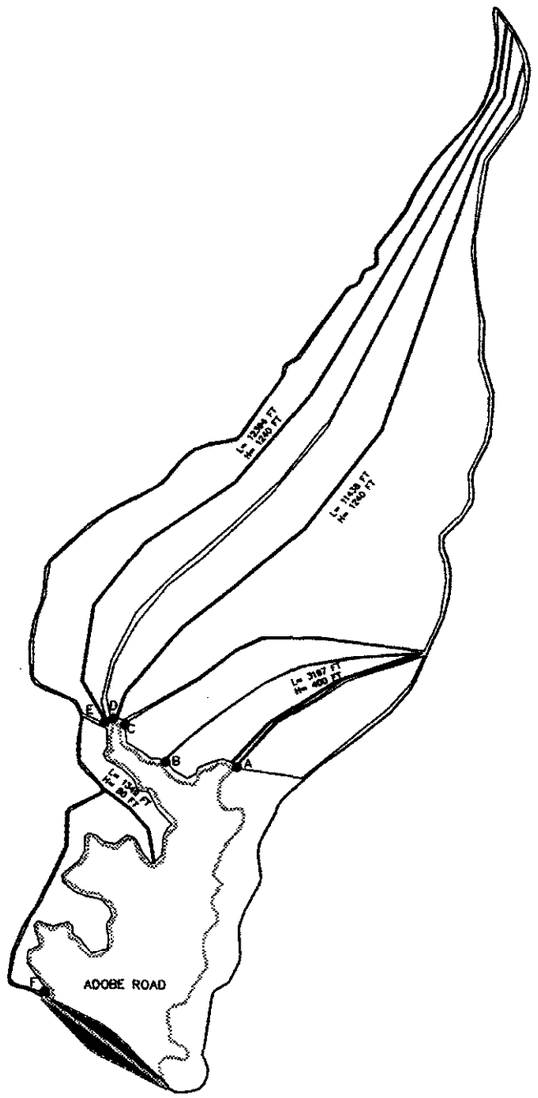


LOCATION	AREA (ACRE)
A	40
B	38
C	46
D	378
E	216
F	55

0 1000 2000 4000 6000

SCALE IN FEET
1"=2000'

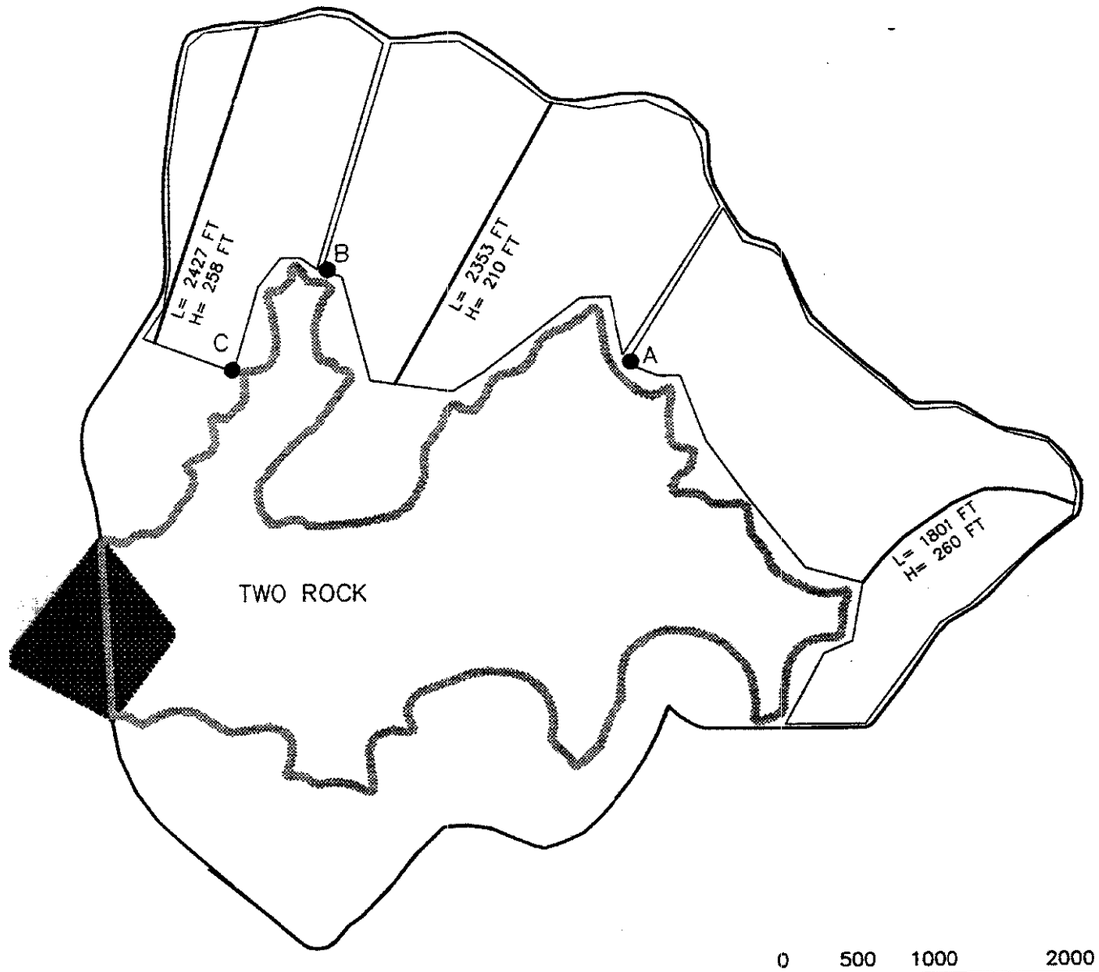
RESERVOIR INFLOW ANALYSIS
ADOBE ROAD (AD-1B) RESERVOIR

October 1995
00385-006-038

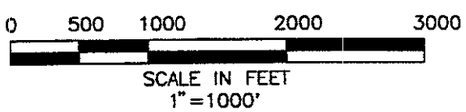
City of Santa Rosa
Reservoir Inflow Analysis
Santa Rosa, California

DAMES & MOORE

FIGURE



LOCATION	AREA (ACRE)
A	112
B	111
C	62



RESERVOIR INFLOW ANALYSIS
TWO ROCK (T-6A) RESERVOIR

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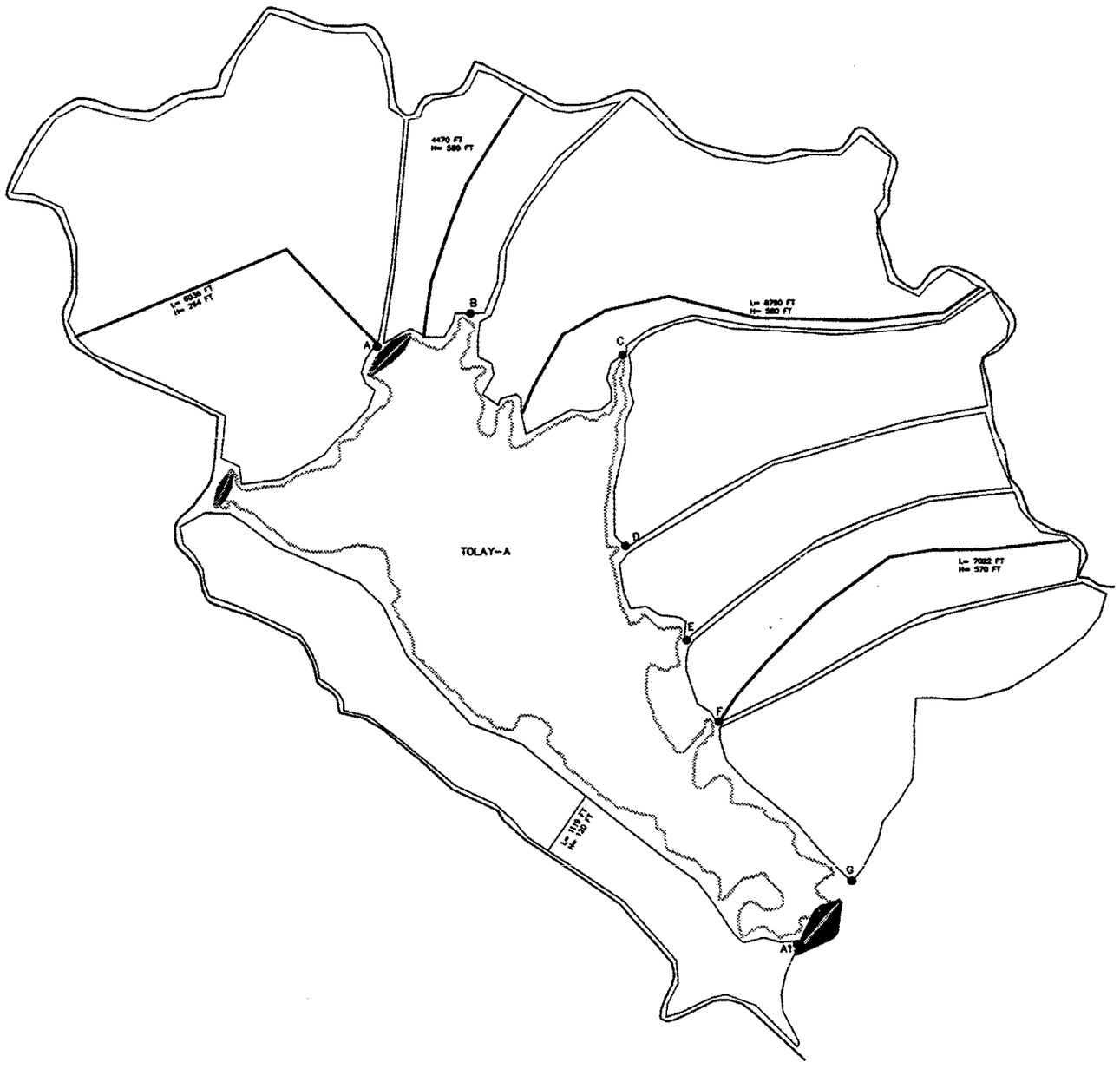
FIGURE 2



TOLAY-A	
LOCATION	AREA (ACRE)
A	733
B	195
C	525
D	322
E	217
F	261
G	275
A1	344

0 1000 2000 4000 6000

SCALE IN FEET
1"=2000'

RESERVOIR INFLOW ANALYSIS
TOLAY-A (S39A) RESERVOIR

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City of Santa Rosa
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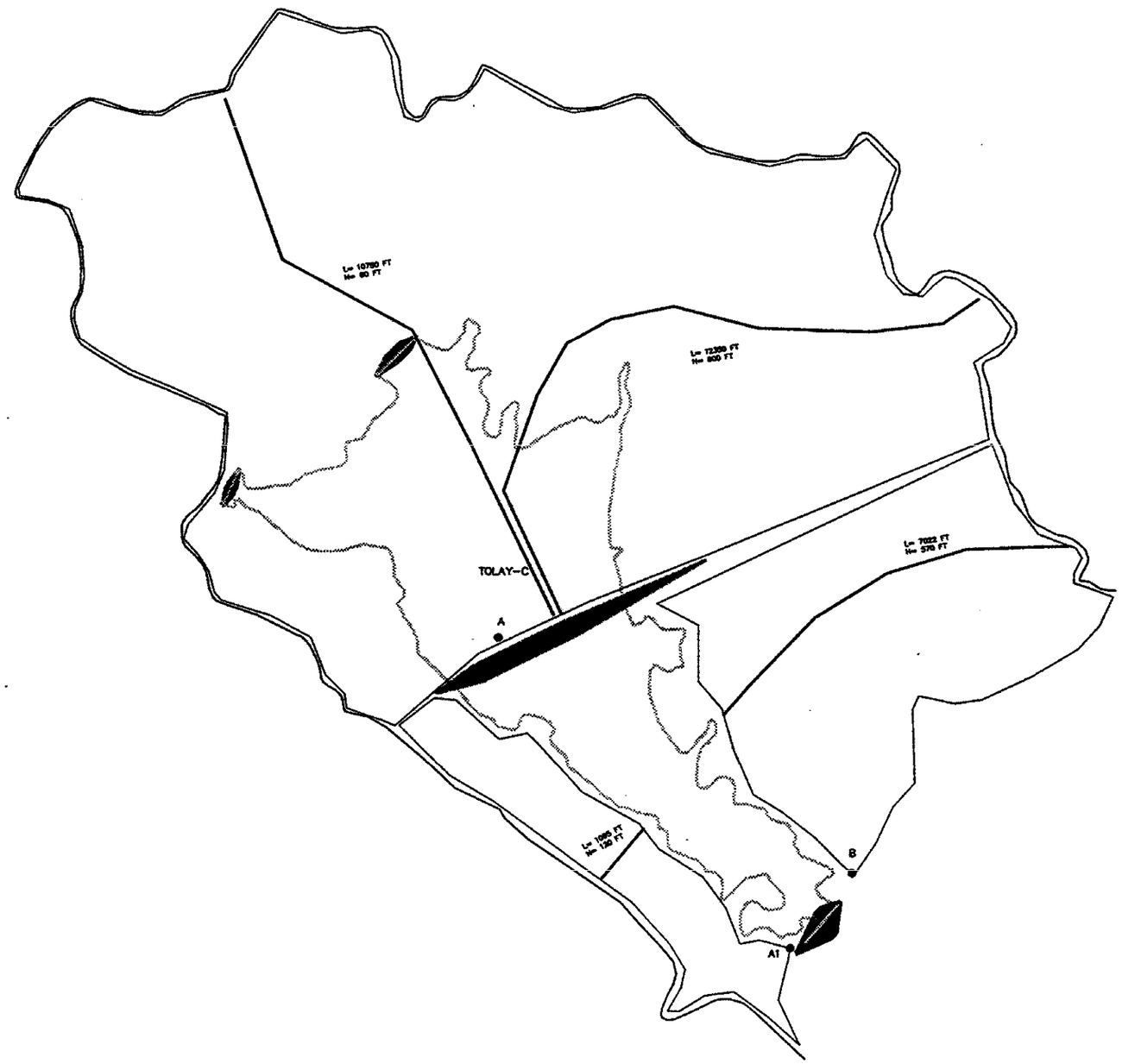
FIGURE 3



TOLAY-C	
LOCATION	AREA (ACRE)
A	2617
B	616
A1	199

0 1000 2000 4000 6000

SCALE IN FEET
1"=2000'

RESERVOIR INFLOW ANALYSIS
TOLAY-C (S29C) RESERVOIR

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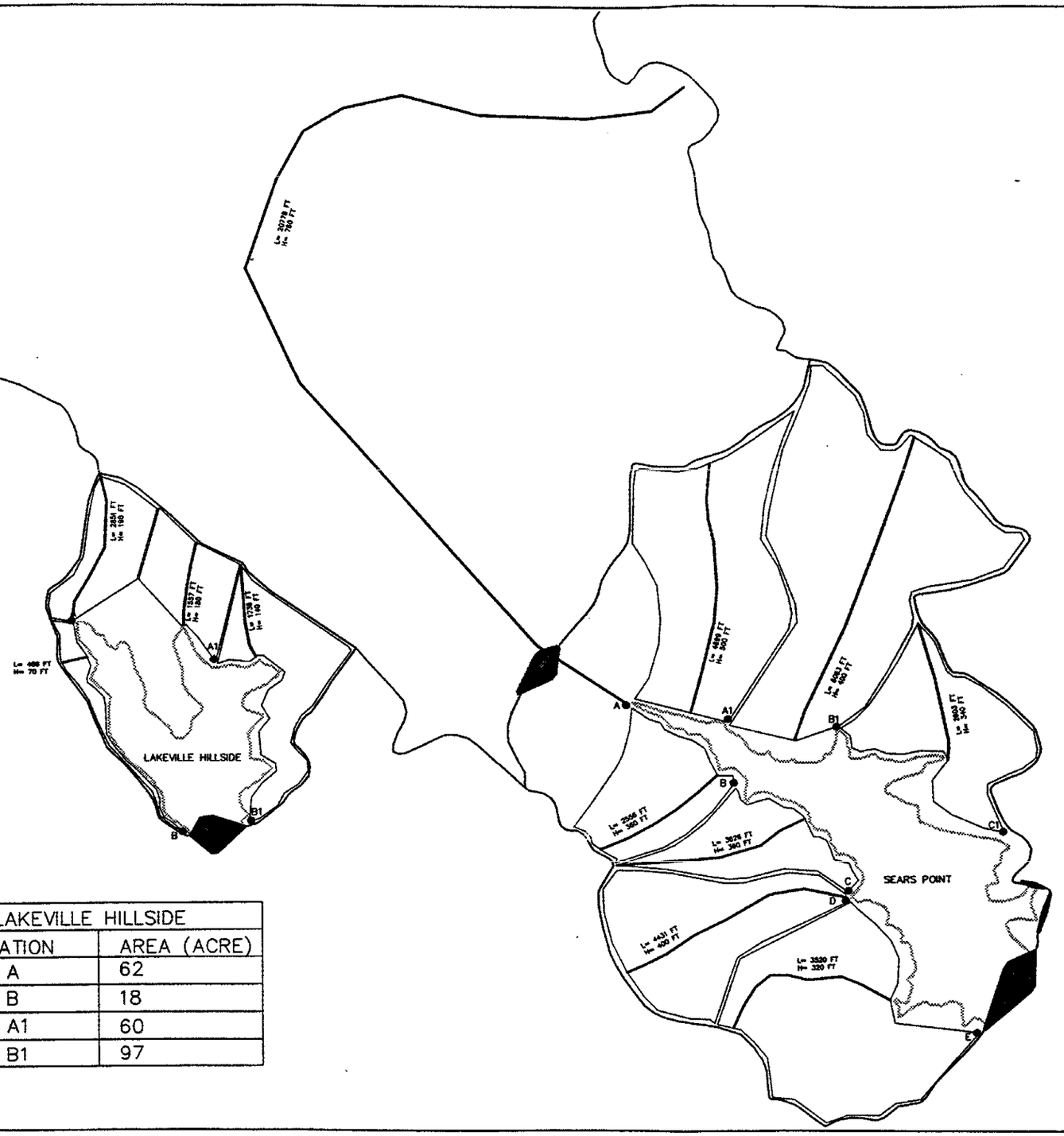
FIGURE 4



LAKEVILLE HILLSIDE	
LOCATION	AREA (ACRE)
A	62
B	18
A1	60
B1	97

SEARS POINT	
LOCATION	AREA (ACRE)
A	4140
B	100
C	81
D	164
E	243
A1	250
B1	397
C1	135

0 1000 2000 4000 6000

SCALE IN FEET
1" =2000'

RESERVOIR INFLOW ANALYSIS LAKEVILLE HILLSIDE (L-2A) & SEARS POINT (SP-1) RESERVOIRS

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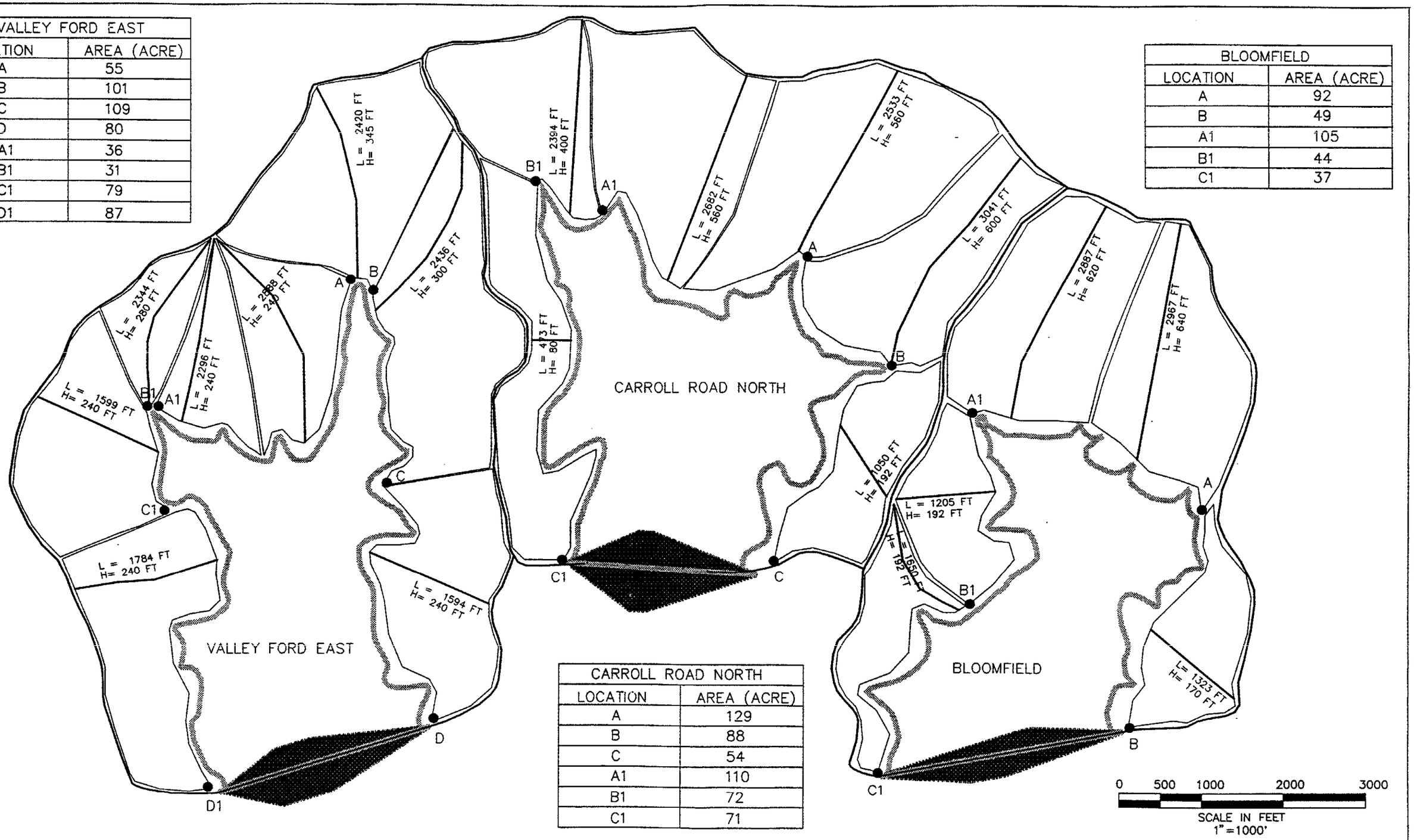
FIGURE 5

VALLEY FORD EAST	
LOCATION	AREA (ACRE)
A	55
B	101
C	109
D	80
A1	36
B1	31
C1	79
D1	87

BLOOMFIELD	
LOCATION	AREA (ACRE)
A	92
B	49
A1	105
B1	44
C1	37



CARROLL ROAD NORTH	
LOCATION	AREA (ACRE)
A	129
B	88
C	54
A1	110
B1	72
C1	71

RESERVOIR INFLOW ANALYSIS BLOOMFIELD (B1-A), VALLEY FORD (V4) & CAROLL ROAD NORTH (V7) RESERVOIRS

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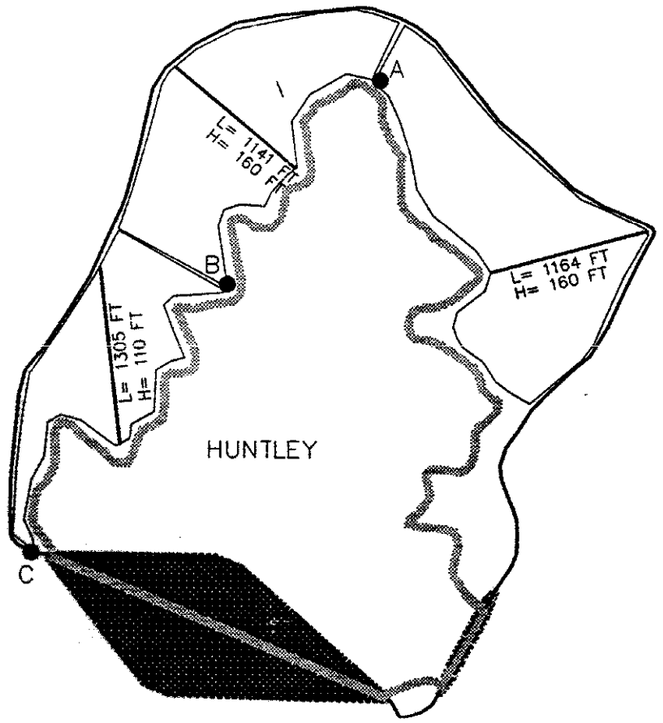
FIGURE 6



LOCATION	AREA (ACRE)
A	53
B	43
C	28

0 500 1000 2000 3000

SCALE IN FEET
1"=1000'

RESERVOIR INFLOW ANALYSIS
HUNTLEY (T-1) RESERVOIR

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Reservoir Inflow Analysis
Santa Rosa, California

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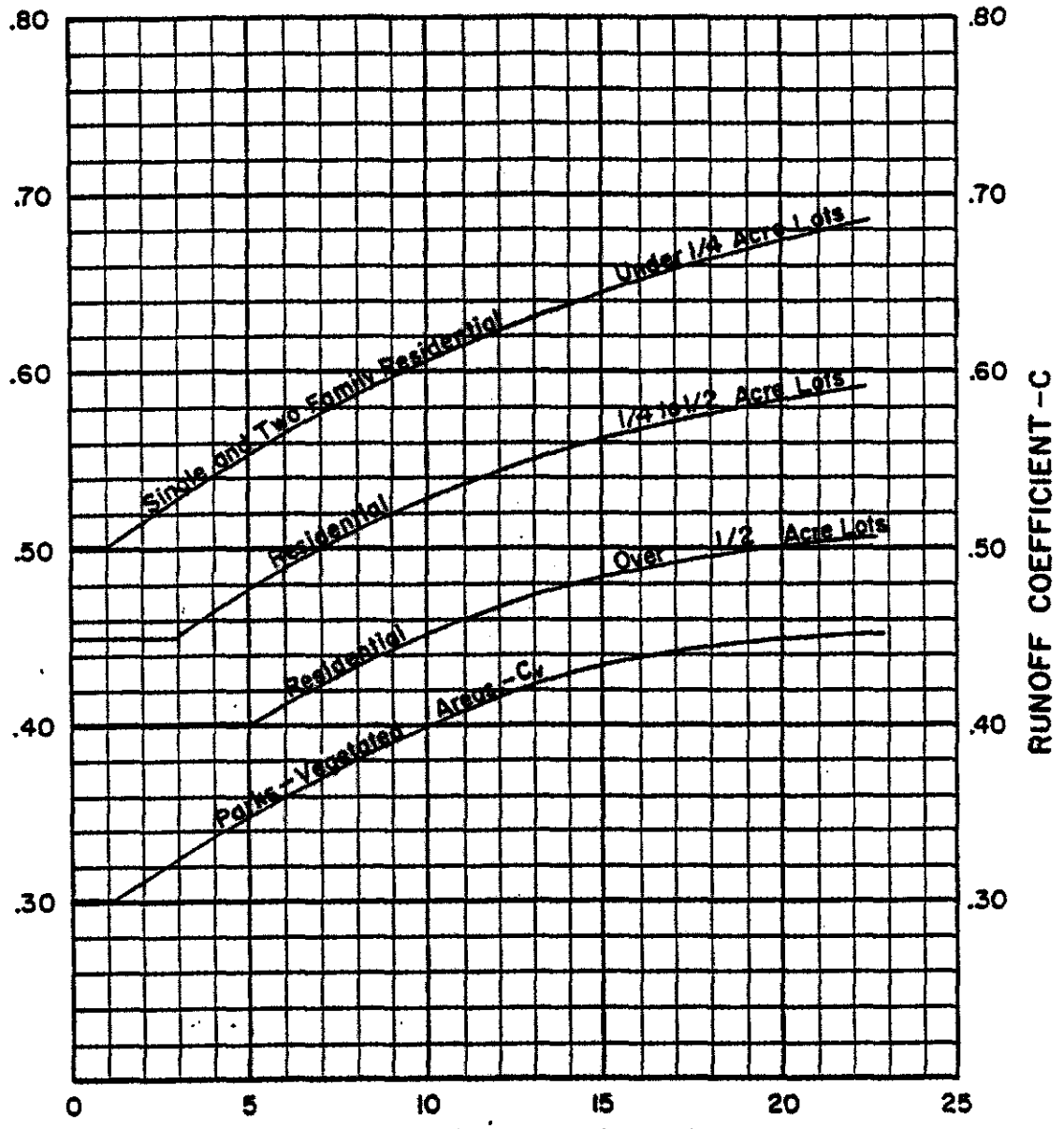
FIGURE 7

RUNOFF COEFFICIENTS FOR RATIONAL FORMULA



NOTE: Commercial, Industrial & Multiple Residential Areas

C_p = 0.9 (Based on paving, roofs, etc.)

When vegetated area exceeds 20% of total, C_v from vegetated curve may be used to reduce above C_p as follows:

$$C_T = C_v \frac{A_v}{A_T} + C_p \frac{A_p}{A_T}$$

RUNOFF COEFFICIENTS FOR RATIONAL FORMULA

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City of Santa Rosa
Reservoir Inflow Analysis
Santa Rosa, California

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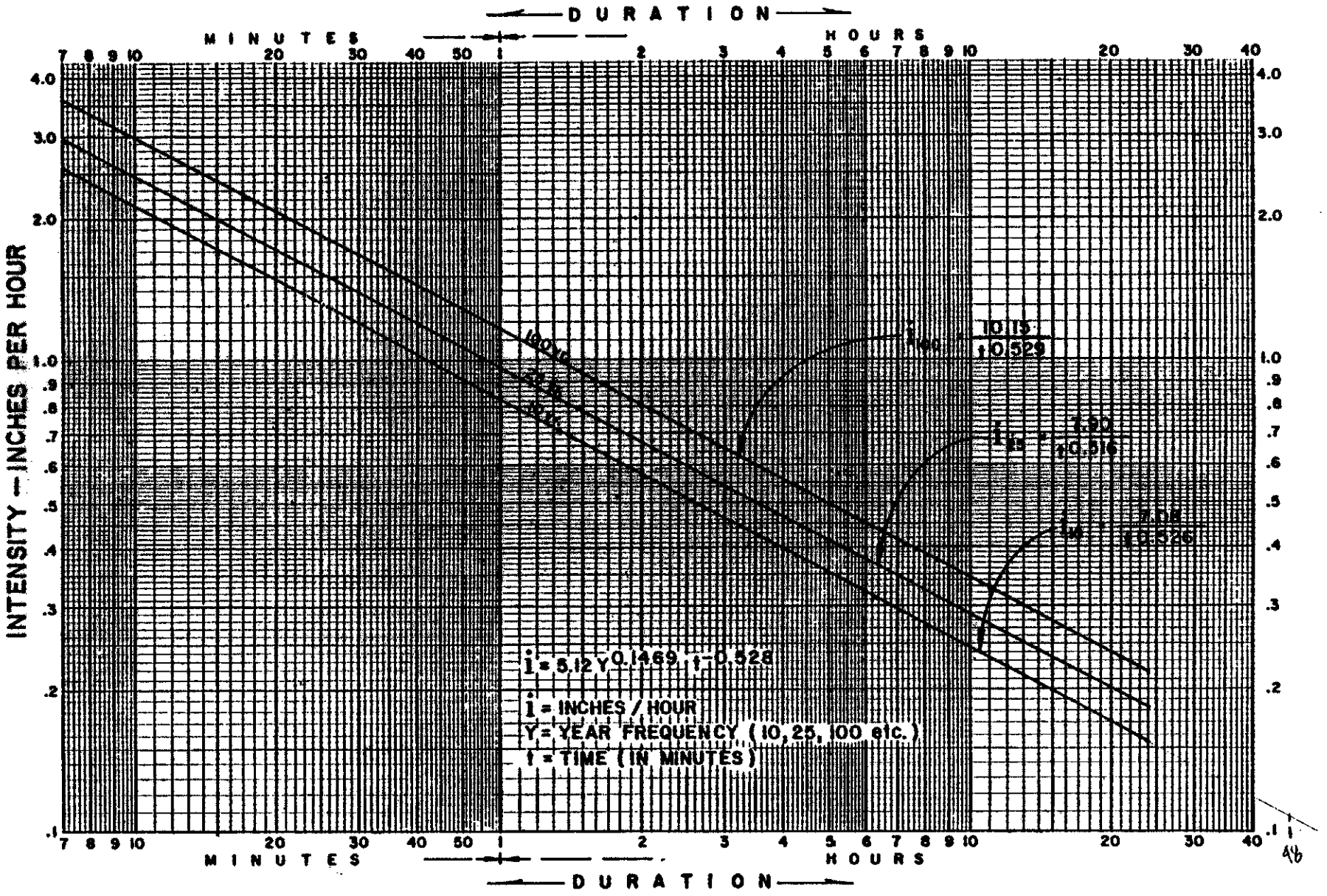
FIGURE 8



NOTE: THE INFORMATION SHOWN IS SUBJECT TO ANNUAL REVISION AS ADDITIONAL RAINFALL DATA BECOMES AVAILABLE.

RAINFALL INTENSITY VS. DURATION

City of Santa Rosa
Reservoir Inflow Analysis
Santa Rosa, California

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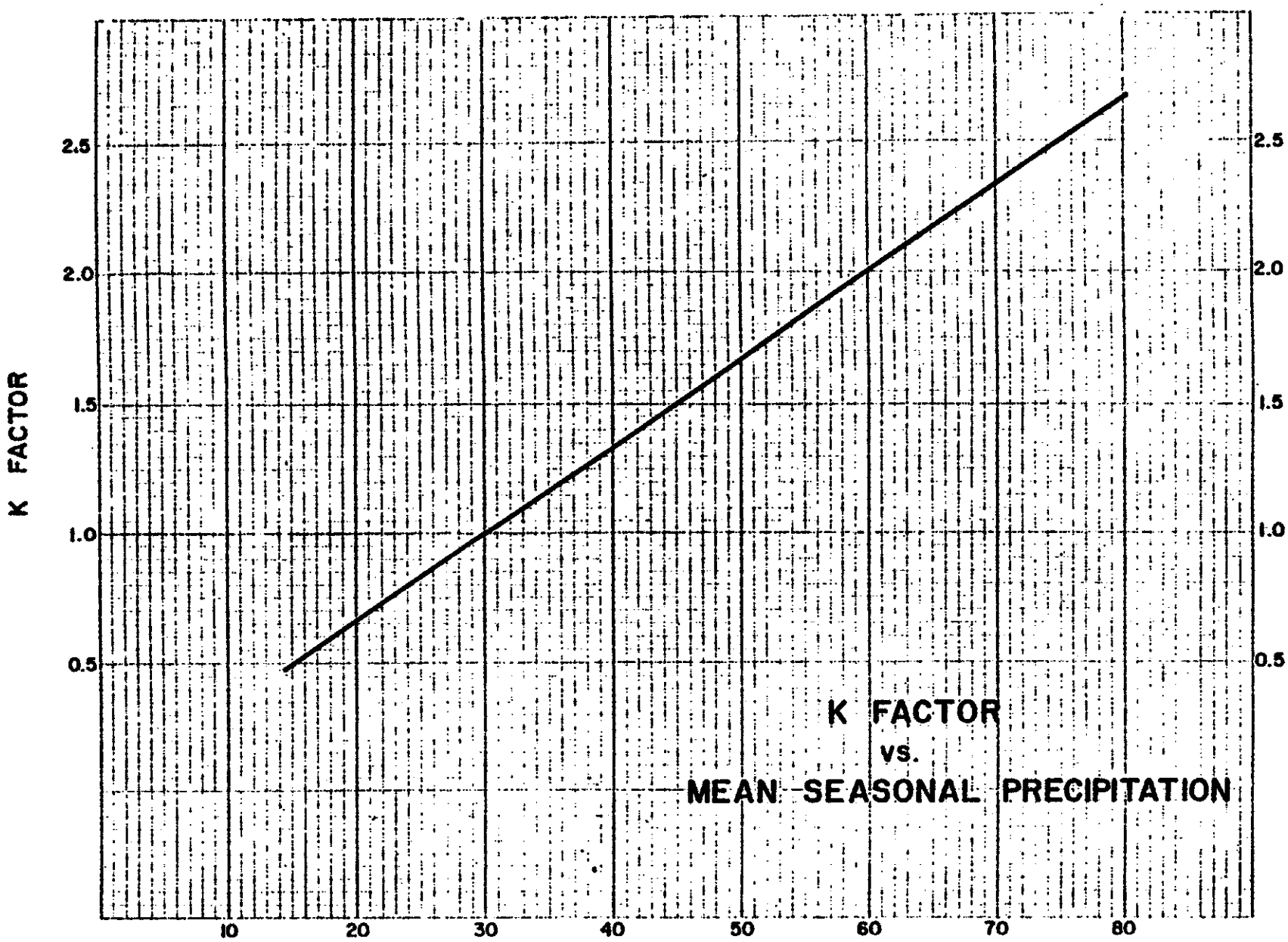
FIGURE 9



K FACTOR VS. MEAN SEASONAL PRECIPITATION

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FIGURE 10

The HEC-1 Output to this document is filed as
Exhibit D-15