Reno Drainage Study Prelim
report by Winzler & Kelly

R-5

RENO DRAINAGE STUDY

PRELIMINARY REPORT

ANALYSIS OF DRAINAGE DEFICIENCY AREAS WITHIN THE CITY LIMITS

DECEMBER 1984

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City of Reno

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TABLE 3(a) RESULTS OF RAINFALL INTENSITY FREQUECY ANALYSIS FOR STORMS WITH 5 MINUTES DURATION

	Annual Maximum				Partial Duration
Return Period	Log-Normal	Log-Pearson III	Extreme Type I	Weighted Average	Weighted Average
2	1.10	1.10	1.23	1.10	1.32
5	1.99	1.99	2.14	1.99	2.09
10	2.71	2.72	2.74	2.72	2.75
25	3.77	3.80	3.51	3.78	3.80
50	4.67	4.72	4.07	4.69	4.69
100	5.66	5.74	4.63	5.69	5.69
Weighting Factor	0.49	0.50	0.01		

TABLE 3(b) RESULTS OF RAINFALL INTENSITY FREQUECY ANALYSIS FOR STORMS WITH 10 MINUTES DURATION

	Annual Maximum				Partial Duration
Return Period	Log-Normal	Log-Pearson III	Extreme Type I	Weighted Average	Weighted Average
2	0.83	0.83	0.90	0.83	1.00
5	1.42	1.42	1.49	1.42	1.50
10	1.88	1.89	1.88	1.89	1.92
25	2.54	2.57	2.37	2.55	2.55
50	3.09	3.13	2.73	3.11	3.11
100	3.67	3.74	3.10	3.70	3.70
Weighting Factor	0.49	0.50	0.01		

TABLE 3(c) RESULTS OF RAINFALL INTENSITY FREQUECY ANALYSIS FOR STORMS WITH 15 MINUTES DURATION

Return Period	Annual Maximum				Partial Duration
	Log-Normal	Log-Pearson III	Extreme Type I	Weighted Average	Weighted Average
2	0.64	0.62	0.69	0.63	0.75
5	1.07	1.06	1.15	1.06	1.11
10	1.40	1.43	1.46	1.42	1.43
25	1.87	2.00	1.85	1.95	1.95
50	2.25	2.52	2.14	2.41	2.41
100	2.67	3.11	2.43	2.93	2.93
Weighting Factor	0.39	0.60	0.01		

TABLE 3(d) RESULTS OF RAINFALL INTENSITY FREQUECY ANALYSIS FOR STORMS WITH 30 MINUTES DURATION

Return Period	Annual Maximum				Partial Duration
	Log-Normal	Log-Pearson III	Extreme Type I	Weighted Average	Weighted Average
2	0.41	0.38	0.43	0.39	0.46
5	0.65	0.63	0.71	0.64	0.68
10	0.83	0.85	0.90	0.84	0.86
25	1.07	1.22	1.14	1.17	1.17
50	1.27	1.57	1.32	1.47	1.47
100	1.48	1.99	1.50	1.83	1.83
Weighting Factor	0.31	0.68	0.01		

TABLE 3(e) RESULTS OF RAINFALL INTENSITY FREQUECY ANALYSIS FOR STORMS WITH 60 MINUTES DURATION

Return Period	Annual Maximum				Partial Duration
	Log-Normal	Log-Pearson III	Extreme Type I	Weighted Average	Weighted Average
2	0.27	0.25	0.28	0.26	0.29
5	0.40	0.39	0.45	0.39	0.40
10	0.50	0.51	0.56	0.51	0.51
25	0.62	0.71	0.70	0.68	0.68
50	0.71	0.91	0.80	0.85	0.85
100	0.81	1.16	0.91	1.04	1.04
Weighting Factor	0.31	0.67	0.02		

TABLE 3(f) RESULTS OF RAINFALL INTENSITY FREQUECY ANALYSIS FOR STORMS WITH 120 MINUTES DURATION

Return Period	Annual Maximum				Partial Duration
	Log-Normal	Log-Pearson III	Extreme Type I	Weighted Average	Weighted Average
2	0.19	0.17	0.19	0.18	0.196
5	0.26	0.25	0.28	0.25	0.260
10	0.31	0.32	0.34	0.31	0.31
25	0.37	0.43	0.42	0.41	0.41
50	0.42	0.53	0.48	0.49	0.49
100	0.47	0.66	0.54	0.59	0.59
Weighting Factor	0.33	0.64	0.03		

TABLE 3(g) RESULTS OF RAINFALL INTENSITY FREQUECY ANALYSIS FOR STORMS WITH 180 MINUTES DURATION

	Annual Maximum				Partial Duration
Return Period	Log-Normal	Log-Pearson III	Extreme Type I	Weighted Average	Weighted Average
2	0.15	0.14	0.15	0.15	0.165
5	0.20	0.20	0.21	0.20	0.210
10	0.24	0.24	0.25	0.24	0.245
25	0.28	0.31	0.30	0.30	0.30
50	0.31	0.37	0.34	0.35	0.35
100	0.35	0.40	0.38	0.40	0.40
Weighting Factor	0.33	0.65	0.02		

TABLE 3(h) RESULTS OF RAINFALL INTENSITY FREQUENCY ANALYSIS FOR STORMS WITH 24 HOURS DURATION (1,440 min)

	Annual Maximum				Partial Duration	Total Rainfall inches
Return Period	Log-Normal	Log-Pearson III	Extreme Type I	Weighted Average	Weighted Average	-24 hr-
2	0.041	0.039	0.037	0.039	0.045	1.08
5	0.058	0.057	0.054	0.057	0.059	1.43
10	0.070	0.072	0.065	0.071	0.071	1.70
25	0.085	0.093	0.079	0.089	0.089	2.14
50	0.096	0.112	0.090	0.105	0.105	2.52
100	0.107	0.134	0.100	0.123	0.123	2.95
Weighting Factor	0.30	0.60	0.10			

KEK
Apr 6, 1988

2 yr Storm ~ (10 min to 3 hr)

AVERAGE RAINFALL INTENSITY CURVE

(LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 3.357833
to = -2.403613
n = 0.5960308

D A T A

DURATION	GIVEN INTENSITY	CALC INTENSITY	DIFF	ERROR
minutes	in per hr	in per hr		percent
10	1.000	1.0027	+0.0027	+0.3
15	0.750	0.7418	-0.0082	-1.1
30	0.460	0.4648	+0.0048	+1.0
60	0.290	0.2998	+0.0098	+3.4
120	0.196	0.1959	-0.0001	-0.0
180	0.165	0.1532	-0.0118	-7.1

2 yr Storm ~ (10 min to 24 hr)

AVERAGE RAINFALL INTENSITY CURVE

(LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 3.345153
to = -2.427642
n = 0.5950656

D A T A

DURATION	GIVEN INTENSITY	CALC INTENSITY	DIFF	ERROR
minutes	in per hr	in per hr		percent
10	1.000	1.0028	+0.0028	+0.3
15	0.750	0.7416	-0.0084	-1.1
30	0.460	0.4648	+0.0048	+1.0
60	0.290	0.2999	+0.0099	+3.4
120	0.196	0.1961	+0.0001	+0.0
180	0.165	0.1534	-0.0116	-7.0
1440	0.045	0.0442	-0.0008	-1.8

REK
Apr 6, 1988

2 yr Storm ~ (10 min to 3 hr)

AVERAGE RAINFALL INTENSITY CURVE

(WEIGHTED LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 3.042440
to = -3.103040
n = 0.5729585

D A T A

DURATION	GIVEN INTENSITY	CALC INTENSITY	DIFF	ERROR
minutes	in per hr	in per hr		percent
10	1.000	1.0063	+0.0063	+0.6
15	0.750	0.7363	-0.0137	-1.8
30	0.460	0.4614	+0.0014	+0.3
60	0.290	0.3004	+0.0104	+3.6
120	0.196	0.1988	+0.0028	+1.4
180	0.165	0.1568	-0.0082	-5.0

2 yr Storm ~ (10 min to 24 hr)

AVERAGE RAINFALL INTENSITY CURVE

(WEIGHTED LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 3.146455
to = -2.871829
n = 0.5810004

D A T A

DURATION	GIVEN INTENSITY	CALC INTENSITY	DIFF	ERROR
minutes	in per hr	in per hr		percent
10	1.000	1.0052	+0.0052	+0.5
15	0.750	0.7381	-0.0119	-1.6
30	0.460	0.4624	+0.0024	+0.5
60	0.290	0.3000	+0.0100	+3.4
120	0.196	0.1977	+0.0017	+0.8
180	0.165	0.1554	-0.0096	-5.8
1440	0.045	0.0461	+0.0011	+2.4

REK
Apr 6, 1988

5 yr Storm ~ (10 min to 2 hr)

AVERAGE RAINFALL INTENSITY CURVE

(LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

USE for $10 \le t \le 120$

A = 7.151438
to = -0.661031
n = 0.6991152

$$i(t) = \frac{7.15}{(t-0.7)^{0.70}}$$

D A T A

DURATION minutes		GIVEN INTENSITY in per hr		CALC INTENSITY in per hr	DIFF	ERROR percent
10	+0.1%	1.500	1.501	1.4998	-0.0002	-0.0
15	+0.1%	1.110	1.111	1.1114	+0.0014	+0.1
30	-1.1%	0.680	0.672	0.6737	-0.0063	-0.9
60	+2.6%	0.400	0.410	0.4117	+0.0117	+2.9
120	-3.2%	0.260	0.252	0.2526	-0.0074	-2.8

5 yr Storm ~ (10 min to 2 hr)

AVERAGE RAINFALL INTENSITY CURVE

(WEIGHTED LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 6.874464
to = -0.926428
n = 0.6898725

D A T A

DURATION minutes	GIVEN INTENSITY in per hr	CALC INTENSITY in per hr	DIFF	ERROR percent
10	1.500	1.5014	+0.0014	+0.1
15	1.110	1.1091	-0.0009	-0.1
30	0.680	0.6724	-0.0076	-1.1
60	0.400	0.4123	+0.0123	+3.1
120	0.260	0.2542	-0.0058	-2.2

REK
Apr 6, 1988

5 yr Storm ~ (10 min to 3 hr)

AVERAGE RAINFALL INTENSITY CURVE

(LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 6.466882
to = -1.242007
n = 0.6730139

D A T A

DURATION	GIVEN INTENSITY	CALC INTENSITY	DIFF	ERROR
minutes	in per hr	in per hr		percent
10	1.500	1.5012	+0.0012	+0.1
15	1.110	1.1077	-0.0023	-0.2
30	0.680	0.6744	-0.0056	-0.8
60	0.400	0.4170	+0.0170	+4.2
120	0.260	0.2597	-0.0003	-0.1
180	0.210	0.1972	-0.0128	-6.1

5 yr Storm ~ (10 min to 24 hr)

AVERAGE RAINFALL INTENSITY CURVE

(LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 6.269197
to = -1.431992
n = 0.6652274

D A T A

DURATION	GIVEN INTENSITY	CALC INTENSITY	DIFF	ERROR
minutes	in per hr	in per hr		percent
10	1.500	1.5019	+0.0019	+0.1
15	1.110	1.1062	-0.0038	-0.3
30	0.680	0.6741	-0.0059	-0.9
60	0.400	0.4181	+0.0181	+4.5
120	0.260	0.2615	+0.0015	+0.6
180	0.210	0.1992	-0.0108	-5.2
1440	0.059	0.0497	-0.0093	-15.7

REK
Apr 6, 1988

5 yr. Storm – (10 min to 3 hr)

AVERAGE RAINFALL INTENSITY CURVE

(WEIGHTED LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 5.958502
to = -1.808181
n = 0.6542064

D A T A

DURATION	GIVEN INTENSITY	CALC INTENSITY	DIFF	ERROR
minutes	in per hr	in per hr		percent
10	1.500	1.5052	+0.0052	+0.3
15	1.110	1.1021	-0.0079	-0.7
30	0.680	0.6706	-0.0094	-1.4
60	0.400	0.4174	+0.0174	+4.4
120	0.260	0.2626	+0.0026	+1.0
180	0.210	0.2007	-0.0093	-4.4

5 yr Storm ~ (10 min to 24 hr)

AVERAGE RAINFALL INTENSITY CURVE

(WEIGHTED LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 5.411906
to = -2.447916
n = 0.6315129

D A T A

DURATION	GIVEN INTENSITY	CALC INTENSITY	DIFF	ERROR
minutes	in per hr	in per hr		percent
10	1.500	1.5095	+0.0095	+0.6
15	1.110	1.0952	-0.0148	-1.3
30	0.680	0.6666	-0.0134	-2.0
60	0.400	0.4186	+0.0186	+4.7
120	0.260	0.2667	+0.0067	+2.6
180	0.210	0.2055	-0.0045	-2.1
1440	0.059	0.0549	-0.0041	-7.0

REK
Apr 6, 1988

10 yr Storm ~ (10 min to 3 hr)

AVERAGE RAINFALL INTENSITY CURVE

(LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 10.112825
to = -0.147686
n = 0.7259190

D A T A

DURATION	GIVEN INTENSITY	CALC INTENSITY	DIFF	ERROR
minutes	in per hr	in per hr		percent
10	1.920	1.9215	+0.0015	+0.1
15	1.430	1.4264	-0.0036	-0.3
30	0.860	0.8593	-0.0007	-0.1
60	0.510	0.5186	+0.0086	+1.7
120	0.310	0.3133	+0.0033	+1.1
180	0.245	0.2333	-0.0117	-4.8

10 yr storm ~ (10 min to 24 hr)

AVERAGE RAINFALL INTENSITY CURVE

(LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 9.641555
to = -0.438728
n = 0.7141481

D A T A

DURATION	GIVEN INTENSITY	CALC INTENSITY	DIFF	ERROR
minutes	in per hr	in per hr		percent
10	1.920	1.9227	+0.0027	+0.1
15	1.430	1.4238	-0.0062	-0.4
30	0.860	0.8587	-0.0013	-0.2
60	0.510	0.5207	+0.0107	+2.1
120	0.310	0.3165	+0.0065	+2.1
180	0.245	0.2368	-0.0082	-3.4
1440	0.071	0.0535	-0.0175	-24.6

REK
Apr 6, 1988

10 yr Storm ~ (10 min to 3 hr)

AVERAGE RAINFALL INTENSITY CURVE

(WEIGHTED LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 9.497462
to = -0.579338
n = 0.7116143

D A T A

DURATION minutes	GIVEN INTENSITY in per hr	CALC INTENSITY in per hr	DIFF	ERROR percent
10	1.920	1.9250	+0.0050	+0.3
15	1.430	1.4219	-0.0081	-0.6
30	0.860	0.8560	-0.0040	-0.5
60	0.510	0.5191	+0.0091	+1.8
120	0.310	0.3159	+0.0059	+1.9
180	0.245	0.2364	-0.0086	-3.5

10 yr Storm ~ (10 min to 24 hr)

AVERAGE RAINFALL INTENSITY CURVE

(WEIGHTED LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 7.862919
to = -1.837386
n = 0.6677237

D A T A

DURATION minutes	GIVEN INTENSITY in per hr	CALC INTENSITY in per hr	DIFF	ERROR percent
10	1.920	1.9352	+0.0152	+0.8
15	1.430	1.4066	-0.0234	-1.6
30	0.860	0.8465	-0.0135	-1.6
60	0.510	0.5215	+0.0115	+2.3
120	0.310	0.3249	+0.0149	+4.8
180	0.245	0.2470	+0.0020	+0.8
1440	0.071	0.0612	-0.0098	-13.7

FREK
Apr 6, 1988

25 yr Storm ~ (10 min to 3 hr)

AVERAGE RAINFALL INTENSITY CURVE

(LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 19.077059
to = 2.247030
n = 0.8026377

D A T A

DURATION minutes	GIVEN INTENSITY in per hr	CALC INTENSITY in per hr	DIFF	ERROR percent
10	2.550	2.5540	+0.0040	+0.2
15	1.950	1.9403	-0.0097	-0.5
30	1.170	1.1742	+0.0042	+0.4
60	0.680	0.6926	+0.0126	+1.9
120	0.410	0.4029	-0.0071	-1.7
180	0.300	0.2924	-0.0076	-2.5

25 yr Storm ~ (10 min to 24 hr)

AVERAGE RAINFALL INTENSITY CURVE

(LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 17.778800
to = 1.799348
n = 0.7858667

D A T A

DURATION minutes	GIVEN INTENSITY in per hr	CALC INTENSITY in per hr	DIFF	ERROR percent
10	2.550	2.5560	+0.0060	+0.2
15	1.950	1.9364	-0.0136	-0.7
30	1.170	1.1727	+0.0027	+0.2
60	0.680	0.6957	+0.0157	+2.3
120	0.410	0.4082	-0.0018	-0.4
180	0.300	0.2980	-0.0020	-0.7
1440	0.089	0.0585	-0.0305	-34.2

REK
Apr 6, 1980

25 yr Storm ~ (10 min to 3 hr)
AVERAGE RAINFALL INTENSITY CURVE

(WEIGHTED LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 17.615577
to = 1.680825
n = 0.7848876

D A T A

DURATION	GIVEN INTENSITY	CALC INTENSITY	DIFF	ERROR
minutes	in per hr	in per hr		percent
10	2.550	2.5589	+0.0089	+0.3
15	1.950	1.9346	-0.0154	-0.8
30	1.170	1.1693	-0.0007	-0.1
60	0.680	0.6932	+0.0132	+1.9
120	0.410	0.4067	-0.0033	-0.8
180	0.300	0.2969	-0.0031	-1.0

25 yr Storm ~ (10 min to 24 hr)
AVERAGE RAINFALL INTENSITY CURVE

(WEIGHTED LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 13.054226
to = -0.397417
n = 0.7170808

D A T A

DURATION	GIVEN INTENSITY	CALC INTENSITY	DIFF	ERROR
minutes	in per hr	in per hr		percent
10	2.550	2.5781	+0.0281	+1.1
15	1.950	1.9088	-0.0412	-2.1
30	1.170	1.1500	-0.0200	-1.7
60	0.680	0.6962	+0.0162	+2.4
120	0.410	0.4225	+0.0125	+3.1
180	0.300	0.3157	+0.0157	+5.2
1440	0.089	0.0710	-0.0180	-20.3

REK
Apr 6, 1988

50 yr Storm ~ (10 min to 3 hr)

AVERAGE RAINFALL INTENSITY CURVE

(LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 30.727543
to = 4.357807
n = 0.8595302

D A T A

DURATION minutes	GIVEN INTENSITY in per hr	CALC INTENSITY in per hr	DIFF	ERROR percent
10	3.110	3.1115	+0.0015	+0.0
15	2.410	2.4068	-0.0032	-0.1
30	1.470	1.4698	-0.0002	-0.0
60	0.850	0.8570	+0.0070	+0.8
120	0.490	0.4865	-0.0035	-0.7
180	0.350	0.3468	-0.0032	-0.9

50 yr storm ~ (10 min to 24 hr)

AVERAGE RAINFALL INTENSITY CURVE

(LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 28.107832
to = 3.769111
n = 0.8389132

D A T A

DURATION minutes	GIVEN INTENSITY in per hr	CALC INTENSITY in per hr	DIFF	ERROR percent
10	3.110	3.1145	+0.0045	+0.1
15	2.410	2.4017	-0.0083	-0.3
30	1.470	1.4673	-0.0027	-0.2
60	0.850	0.8608	+0.0108	+1.3
120	0.490	0.4935	+0.0035	+0.7
180	0.350	0.3542	+0.0042	+1.2
1440	0.105	0.0628	-0.0422	-40.1

REK
Apr 6, 1988

50 yr Storm (10 min to 3 hr)

AVERAGE RAINFALL INTENSITY CURVE

(WEIGHTED LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 29.712989
to = 4.110168
n = 0.8522225

D A T A

DURATION	GIVEN INTENSITY	CALC INTENSITY	DIFF	ERROR
minutes	in per hr	in per hr		percent
10	3.110	3.1138	+0.0038	+0.1
15	2.410	2.4045	-0.0055	-0.2
30	1.470	1.4675	-0.0025	-0.2
60	0.850	0.8571	+0.0071	+0.8
120	0.490	0.4882	-0.0018	-0.4
180	0.350	0.3488	-0.0012	-0.3

50 yr Storm (10 min to 24 hr)

AVERAGE RAINFALL INTENSITY CURVE

(WEIGHTED LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 19.507901
to = 1.062954
n = 0.7593831

D A T A

DURATION	GIVEN INTENSITY	CALC INTENSITY	DIFF	ERROR
minutes	in per hr	in per hr		percent
10	3.110	3.1442	+0.0342	+1.1
15	2.410	2.3688	-0.0412	-1.7
30	1.470	1.4356	-0.0344	-2.3
60	0.850	0.8593	+0.0093	+1.1
120	0.490	0.5110	+0.0210	+4.3
180	0.350	0.3764	+0.0264	+7.5
1440	0.105	0.0779	-0.0271	-25.8

REK
Apr 6, 1998

100 yr Storm ~ (10 min to 3 hr)

AVERAGE RAINFALL INTENSITY CURVE

(LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 55.938734
to = 7.866317
n = 0.9421176

D A T A

DURATION	GIVEN INTENSITY	CALC INTENSITY	DIFF	ERROR
minutes	in per hr	in per hr		percent
10	3.700	3.6995	-0.0005	-0.0
15	2.930	2.9322	+0.0022	+0.1
30	1.830	1.8231	-0.0069	-0.4
60	1.040	1.0522	+0.0122	+1.2
120	0.590	0.5793	-0.0107	-1.8
180	0.400	0.4032	+0.0032	+0.8

100 yr Storm ~ (10 min to 24 hr)

AVERAGE RAINFALL INTENSITY CURVE

(LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 49.501837
to = 7.012292
n = 0.9148667

D A T A

DURATION	GIVEN INTENSITY	CALC INTENSITY	DIFF	ERROR
minutes	in per hr	in per hr		percent
10	3.700	3.7037	+0.0037	+0.1
15	2.930	2.9259	-0.0041	-0.1
30	1.830	1.8188	-0.0112	-0.6
60	1.040	1.0567	+0.0167	+1.6
120	0.590	0.5887	-0.0013	-0.2
180	0.400	0.4132	+0.0132	+3.3
1440	0.123	0.0636	-0.0594	-48.3

REK
Apr 6, 1988

100 yr Storm ~ (10 min to 3 hr)

AVERAGE RAINFALL INTENSITY CURVE

(WEIGHTED LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 55.293059
to = 7.774641
n = 0.9396911

D A T A

DURATION	GIVEN INTENSITY	CALC INTENSITY	DIFF	ERROR
minutes	in per hr	in per hr		percent
10	3.700	3.7004	+0.0004	+0.0
15	2.930	2.9315	+0.0015	+0.1
30	1.830	1.8222	-0.0078	-0.4
60	1.040	1.0520	+0.0120	+1.2
120	0.590	0.5798	-0.0102	-1.7
180	0.400	0.4038	+0.0038	+0.9

100 yr Storm ~ (10 min to 24 hr)

AVERAGE RAINFALL INTENSITY CURVE

(WEIGHTED LEAST SQUARES)

FORM: i(tc) = A/(tc+to)^n

A = 30.274055
to = 3.166843
n = 0.8106583

D A T A

DURATION	GIVEN INTENSITY	CALC INTENSITY	DIFF	ERROR
minutes	in per hr	in per hr		percent
10	3.700	3.7459	+0.0459	+1.2
15	2.930	2.8855	-0.0445	-1.5
30	1.830	1.7713	-0.0587	-3.2
60	1.040	1.0507	+0.0107	+1.0
120	0.590	0.6115	+0.0215	+3.6
180	0.400	0.4433	+0.0433	+10.8
1440	0.123	0.0832	-0.0398	-32.4

HYDRO CONDUIT CORPORATION

DATE ______________

PAGE ______ OF ______ PAGES

PROJECT Winzler Kelly I DF Curve

Time (min)

Year	5	10	15	30	60	120	180	24hr
2	1.35	0.95	.745	.465	.29	.119	.16	.044
5	2.23	1.4	1.08	.68	.41	.26	.20	.058
	1.20	1.34	1.34	1.29	1.27	1.19	1.15	1.2[illegible]
10	2.68	1.87	1.45	.88	.52	.31	.23	.070
25	3.9	2.55	1.95	1.18	.69	.40	.29	.088
50	4.6	3.1	2.38	1.46	.85	.48	.35	.108
100	5.65	3.78	2.95	1.84	1.07	.60	.44	.12

intensity in/hr

2	.11	.16	.19	.23	.29	.38	.48	1.06
5	.19	.23	.27	.34	.41	.52	.60	1.39
10	.22	.31	.36	.44	.52	.62	.69	1.68
25	.33	.43	.49	.59	.69	.80	.87	2.11
50	.38	.52	.60	.73	.85	.96	1.05	2.59
100	.47	.63	.73	.92	1.07	1.20	1.32	2.88

accumulated Rainfall inchs

05/10 Rear velocity curve

000	76	LBL
001	11	A
002	07	7
003	93	.
004	01	1
005	05	5
006	01	1
007	04	4
008	03	3
009	09	9
010	55	÷
011	53	(
012	71	SBR
013	75	-
014	93	.
015	06	6
016	06	6
017	01	1
018	00	0
019	03	3
020	01	1
021	54	)
022	45	YX
023	93	.
024	06	9
025	09	9
026	09	9
027	01	1
028	01	1
029	05	5
030	02	2
031	95	=
032	91	R/S
033	00	0
034	00	0
035	76	LBL
036	12	B
037	05	5
038	05	5
039	93	.
040	09	9
041	03	3
042	05	5
043	07	7
044	03	3
045	04	4
046	55	÷
047	53	(
048	91	R/S
049	93	.
050	07	7
051	93	.
052	09	9
053	06	6
054	06	6
055	03	3
056	01	1
057	07	7
058	54	)
059	45	YX
060	93	.
061	09	9
062	04	4
063	07	7
064	01	1
065	01	1
066	07	7
067	09	9
068	95	=
069	91	R/S
070	00	0
071	00	0

Jan 27, 1983

"5 yr Storm"

AVERAGE RAINFALL INTENSITY CURVE

(LEAST SQUARES)

FORM: i(tc)=A/(tc+to)^n

A= 7.151438
to= -0.661031
n= 0.6991152

DATA

DURATION minutes		GIVEN INTENSITY in per hr		CALC INTENSITY in per hr	DIFF	ERROR percent
10	+0.1%	1.500	1.50	1.4998	-0.0002	-0.0
15	+0.1%	1.110	1.11	1.1114	+0.0014	+0.1
30	-1.1%	0.680	0.673	0.6737	-0.0063	-0.9
60	+2.5%	0.400	0.410	0.4117	+0.0117	+2.9
120	-3.0%	0.260	0.252	0.2526	-0.0074	-2.8

use, for $10 \le t \le 120$

$$i(t) = \frac{7.15}{(t-0.7)^{0.70}}$$

REK-
Jan 17, 1985

"100 yr Storm"

AVERAGE RAINFALL INTENSITY CURVE

(LEAST SQUARES)

FORM: i(tc)=A/(tc+to)^n

A= 55.938734
to= 7.866317
n= 0.9421176

D A T A

DURATION	GIVEN INTENSITY	CALC INTENSITY	DIFF	ERROR
minutes	in per hr	in per hr		percent
10	3.700	3.6995	-0.0005	-0.0
15	2.930	2.9322	+0.0022	+0.1
30	1.830	1.8231	-0.0069	-0.4
60	1.040	1.0522	+0.0122	+1.2
120	0.590	0.5793	-0.0107	-1.8
180	0.400	0.4032	+0.0032	+0.8

$$\left(\frac{t_1 + t_0}{t_2 + t_0}\right)^{0.7}$$

$t_i + t_0$

$$i(t) = \frac{A}{(t + t_0)^{n}}$$

HYDRO CONDUIT CORPORATION

DATE ______

PAGE ______ OF ______ PAGES

PROJECT Winzler Kelly I DF Curve

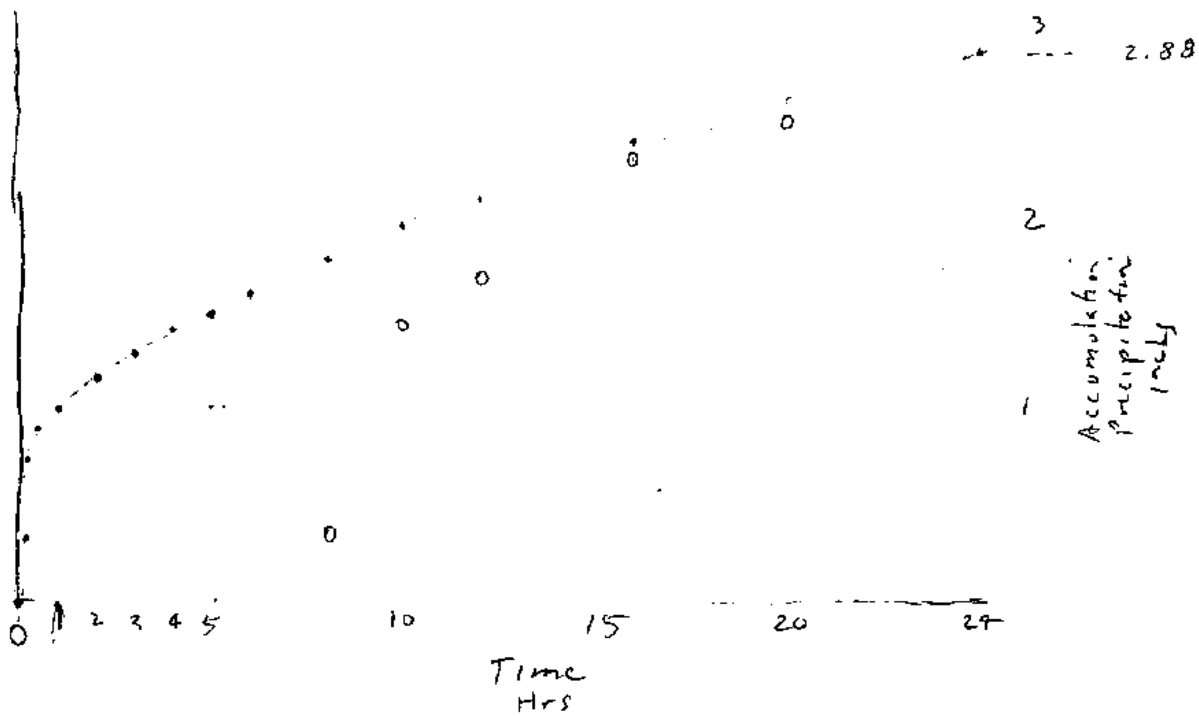
Time (min)

Year	5	10	15	30	60	120	180	24hr
2	1.35	0.95	.745	.465	.29	.19	.16	.044
5	2.23	1.4	1.08	.68	.41	.26	.20	.058
	1.20	1.34	1.34	1.29	1.27	1.19	1.15	1.20
10	2.68	1.87	1.45	.88	.52	.31	.23	.070
25	3.9	2.55	1.95	1.18	.69	.40	.29	.088
50	4.6	3.1	2.38	1.46	.85	.48	.35	.108
100	5.65	3.78	2.95	1.84	1.07	.60	.44	.12-

intensity in/hr

2	.11	.16	.19	.23	.29	.38	.48	1.06
5	.19	.23	.27	.34	.41	.52	.60	1.39
10	.22	.31	.36	.44	.52	.62	.69	1.68
25	.33	.43	.49	.59	.69	.80	.87	2.11
50	.38	.52	.60	.73	.85	.96	1.05	2.59
100	.47	.63	.73	.92	1.07	1.20	1.32	2.88

accumulated Rainfall inchs

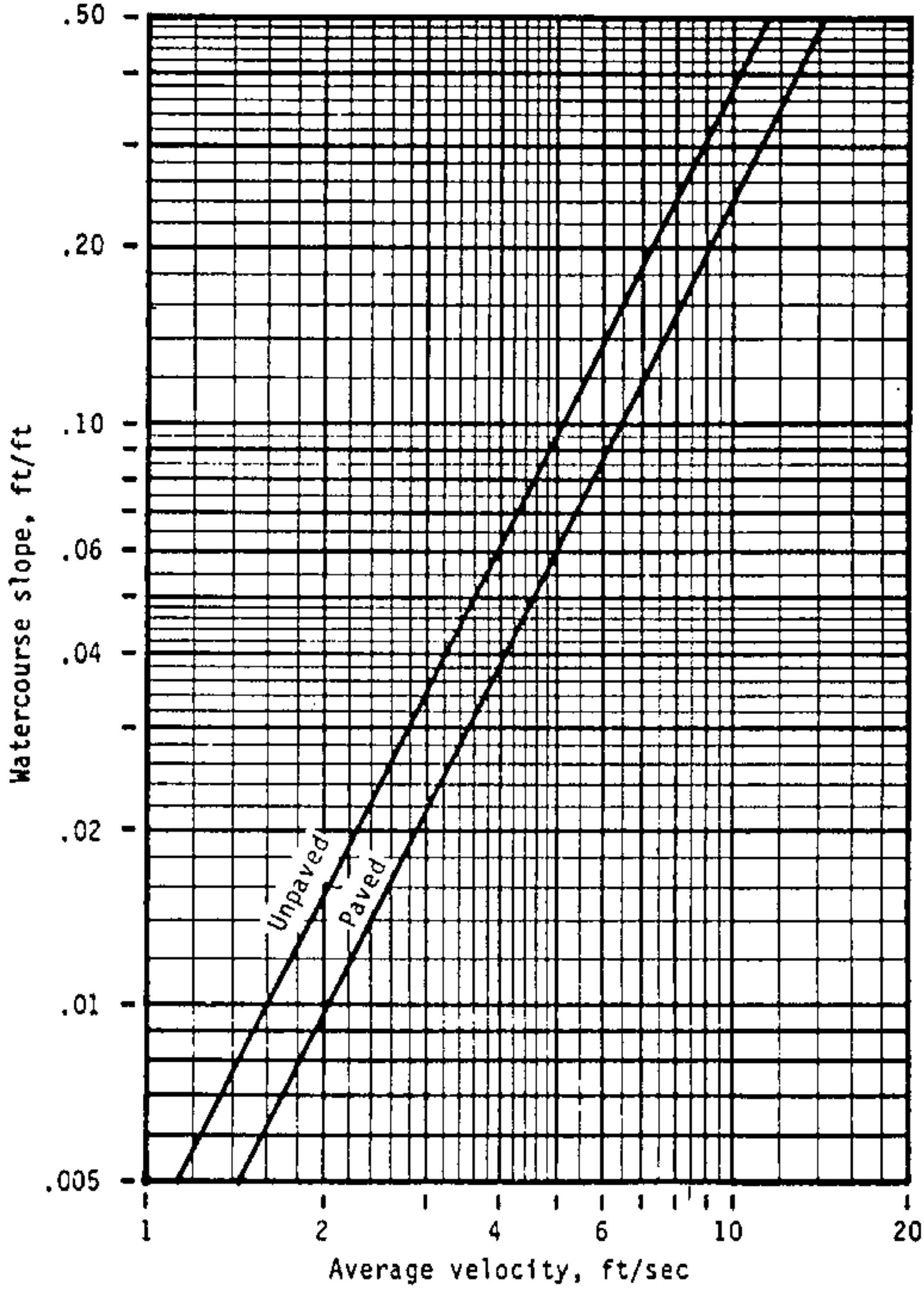


100 year 24 hr
intensity curve Plot
Winsler Kelly

from erosion workshop

From SCS TR 55 June 1986

Appears to be Fig 3-1 Refered to on worksheet 3



From SCS TR 55 January 1975

then computed by dividing the total overland flow length by the average velocity.

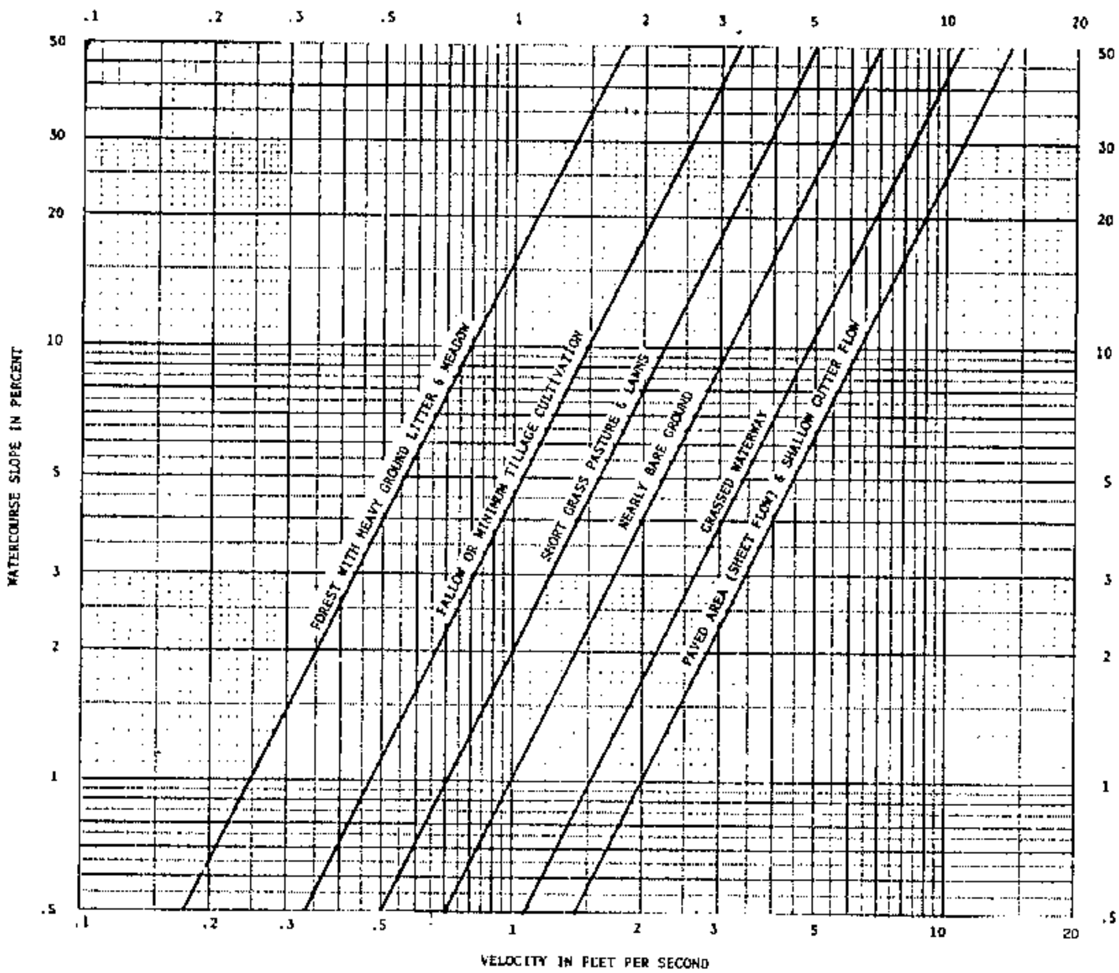


Figure 3-1.--Average velocities for estimating travel time for overland flow.

<u>Storm sewer or road gutter flow</u>

Travel time through the storm sewer or road gutter system to the main open channel is the sum of travel times in each individual component of the system between the uppermost inlet and the outlet. In most cases average velocities can be used without a significant loss of accuracy. During major storm events, the sewer system may be fully taxed and additional overland flow may occur, generally at a significantly lower velocity than the flow in the storm sewers. By using average conduit sizes and an average slope (excluding any vertical drops in the system), the average velocity can be estimated using Manning's formula.

Since the hydraulic radius of a pipe flowing half full is the same as when flowing full, the respective velocities are equal. Travel time may

From NEH 4

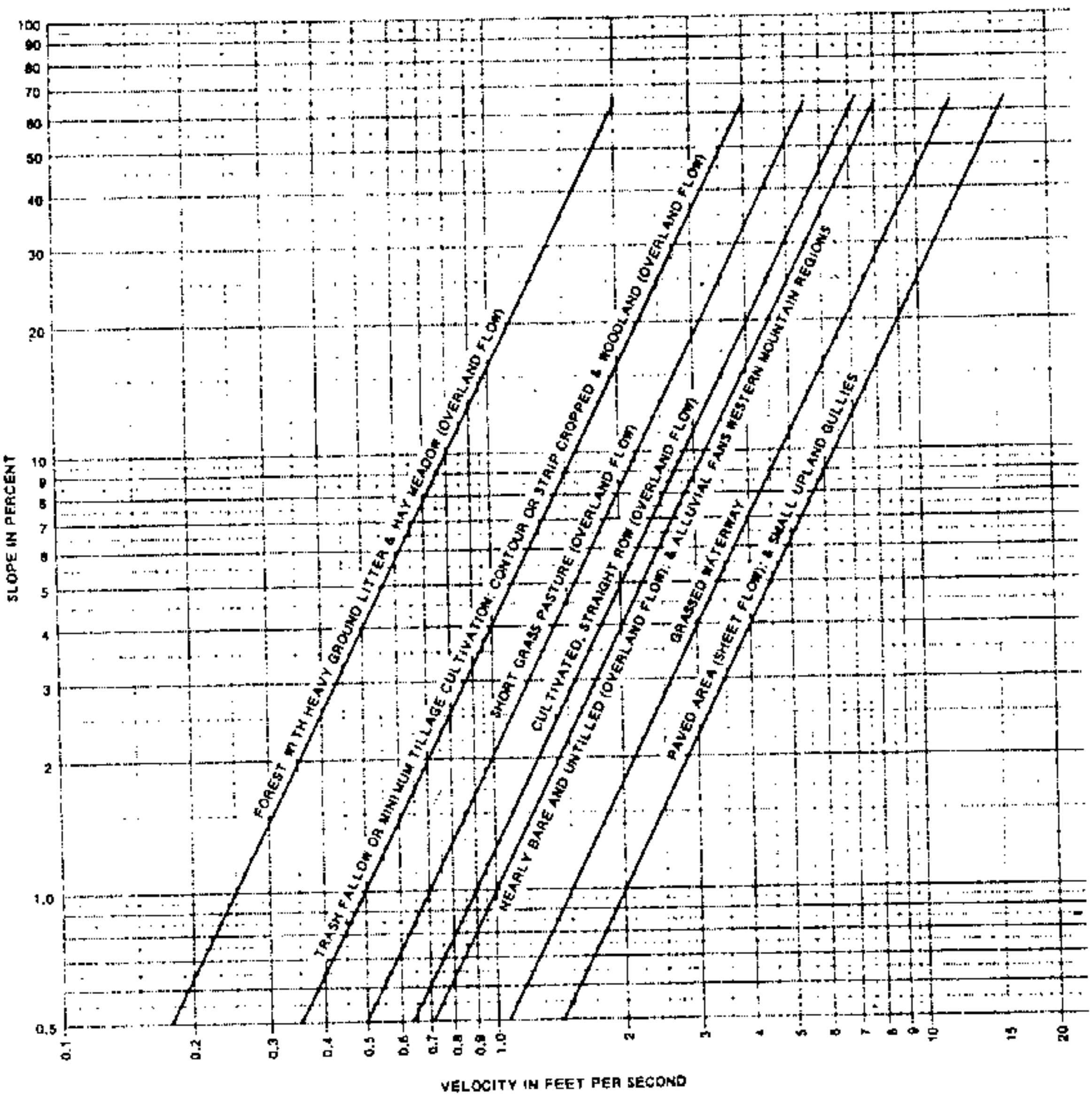


Figure 15.2.—Velocities for upland method of estimating T_c

City of Reno

POST OFFICE BOX 1900 • RENO, NEVADA 89505

January 25, 1990

Richard K. Jorgensen
Winzler & Kelly
633 Third Street
P.O. Box 1345
Eureka, CA 95501

SUBJECT: DRAINAGE PROBLEM IDENTIFICATION STUDY

Dear Mr. Jorgensen:

Thank you for your offer to send additional copies of portions of the above referenced study. At this time the City has closed out its account for this study and will make due with the information we have.

Please consider this letter our final correspondence considering this project.

Sincerely,

STEVE VARELA, P.E.
CITY ENGINEER

SV:sek

xc: Project File

RECEIVED

AUG 10 1989

CC: BG
BV

WINZLER & KELLY

633 Third Street/P.O. Box 1345/Eureka, CA 95501/707-443-8326

Refer to: 89-000

August 7, 1989

Mr. Steve Varela
City Engineer
City of Reno
P.O. Box 1900
Reno, NV 89505

Subject: Rainfall Intensity Curve Analysis, Isopleth Maps and Problem Identification Study

Dear Mr. Varela:

I recently returned from vacation and found your letter of June 29 on my desk. I am located in our office in Eureka now so any additional correspondence should be directed to this office.

As you are probably aware, Winzler & Kelly closed its Reno office 2½ years ago. In the move much of the office files were sent to San Francisco and some were sent to Eureka. I was working in San Francisco part-time at the time of the move and directed staff to send all files related to the Reno drainage project to Eureka where I would be permanently stationed. Soon after our move from Reno we also relocated our San Francisco office. I am afraid that many of the Reno drainage files had been sent to San Francisco and I have not been able to locate them since our San Francisco office move. This includes all the copies of the individual drainage reports.

I do have the files with all the calculations and would be able to regenerate the reports without too much effort.

I also believe I have the reproducible maps for the various drainage basins. There was never a single map that showed all the drainage basins except for the map included in the back of the original report which was a regular street map.

The original contract was for $135,500. This assumed $7,500 for Phase I (preparing the I.D.F. curves), $3,000 for Phase II (preparing the initial report) and $125,000 for an estimated 25 individual drainage basins. I believe there was a change order for an additional $10,000 to complete a full scale drainage study in the Stead area.

We have currently billed the City $127,326, although our costs to date stand at $141,600. The first two phases of work cost more than anticipated and some of the larger drainage basins also took much more effort than originally thought. The project extended over a longer time frame and in fact continued after we had moved, which added to the costs.

After we had closed our office, the City requested that we attend a meeting to discuss the developed I.D.F. curves and Isopleth maps. This was quite an expense for us, as I had to fly out from Eureka and Dr. Tung, our subconsultant, had to fly out from Wyoming, where he had relocated from the University in Reno. From this meeting we were requested to modify the Isopleth maps, which we did. Therefore, I would like to request full payment for the efforts expended up to this point, which would be a total of $14,274.

It is difficult to estimate costs to regenerate the information you have requested, as I do not really know what is still available in our files. When you ask for a reproducible copy of the overall drainage area map (item 1 of your letter) I do not know exactly what you want, as there was never a map such as this. There were individual maps for the individual basins.

I would anticipate approximately $1,500 to regenerate an individual report, assuming the mapping is still available, for a total of $6,000 for items 2 through 5 of your letter.

If you want reproducible copies of all the drainage maps, the costs would simply be costs to have them reproduced on mylar (assuming again that we still have them all, which I believe we do). The final cost would be reproducing the calculations and computations. Most of this effort would simply be photocopying the data.

I anticipate that we could complete all of the above for approximately $8,000, which would include reproducing four of the reports. I will make another attempt to locate our files to see if we perhaps have some of the reports you are missing. If they can be located, the above costs would be less.

If you have any questions, please give me a call.

Very truly yours,

WINZLER & KELLY

Richard K. Jorgensen

RKJ:pm

cc: Neal Carnam

CITY OF RENO

REQUEST FOR SERVICE

No. 47

OFFICE OF CITY ENGINEER

To : Robert G.

Date : 12-30-88

- [ ] Information
- [ ] Reply
- [ ] Draft Letter
- [x] Action
- [ ] See Me

Date Required 3-31-89

Coordinate With SV/RB

Request : Attached is a copy of the Reno Drainage Study Prelim. Report prepare by Wenzlau & Kelly back in 1984! (also misc related info) We need to provide a detailed review to respond back and finalize the report. The contract is still open and money is available for them. Please review as a minimum the following:

1. Detailed basin hydrology analysis - ie CN, Lag time etc.
2. Physical condition and infrastructure assumptions
3. With the comments made by OMNI/SUMMIT/NIMBUS reply to our concerns with the consultants.

Thanks!

Reply : Memo Attached 3/29/89

City of Reno

Inter-Office Memo

Date: March 30, 1989

To: Steve Varela, P.E., City Engineer

From: Robert M. Gottsacker, P.E., Senior Civil Engineer

Re: Winzler and Kelly, Dec 1984, Drainage Deficiency Report

I have reviewed the above referenced report, reviewed comments from staff and other consultants, and have reached the following conclusions:

A. Isopleth Issue

The major item at issue with the isopleths is not their concept but their derivation and application. The isopleth should not be evenly applied as a factor to curves of every return period and equally for all durations on the curve. Mark Forest of Nimbus Engineers has the best comments and clearest explanation of this. The rainfall intensity curves match previous studies and within reason follow previous derivations, but upward adjustments for high intensity and short duration summer storms need to be made, but not necessarily with elevation like the winter storms. This is the portion of the curves most frequently used for design of the storm sewer system in the city, ie., for subdivisions and drainage analysis of existing systems. For the volume driven floods that occur in the winter, the isopleths are needed and there is much support for the isopleth concept with higher elevation and longer duration storms.

The problem is apparent on the follow-up study by Winzler and Kelly plotting the error curves for their derivation of the isopleths. The wet season is rather consistent and low numbers for the Reno area, the dry season has larger numbers to the north, just where consultants expressed their concern over the isopleth concept and application.

If additional study is to occur, perhaps looking at the curves from a designer's need is necessary. What should be used to design a local drainage system, and what should be used to address the 100 year flood that is volume driven which would be used for channel easements, ponding calculations, and major flood studies is the real question and perhaps different sets of curves, adjusted for elevation for one set is what might make some sense. I do not feel qualified to address this in much more depth than this, and I hope it will be of some use.

B. Studies of individual drainage deficiency areas

It is recommended that whenever studies such as this are performed that reproducible maps be provided to the City for permanent filing, and that at least six copies of the finalized report are provided with distribution as follows:

1 Permanent library record
2 Loan-out library record
3 Design Engineer
4 New Development
5 City Engineer
6 Director of Public Works

The overall drainage map in the main report is not reproducible which greatly limits is usefulness and limits the distribution of it. New development should have a copy for use in review of submittals. Additional copies should be forwarded to Maintenance, Traffic, or Construction as necessary depending on the type of report and its contents. These reports should then be referenced whenever any activities are contemplated in the area.

It would be very helpful for future planning, if in addition to the deficiency of the storm sewer system, the extent and severity of flood damage resulting from a 100 year event was assessed. Of particular interest would be damage to homes and businesses, and danger for traffic flow during the storm especially in the southwestern drainage basins. In addition, although outside the scope of the original study, the City needs to know what should be done to improve the deficiencies, just like in the Stead report. All of the reports should have tentative solutions with costs to put into the Capital Improvements Projects process for budgetary purposes and to show the need for future bond issues. Either the City staff, or the consultant, if his contract has enough in it, should complete the report to its logical conclusion, what to do and how much it costs.

March 29, 1989 Winzler Kelly Drainage Report of 1984
Reviewed by: Robert M. Gottsacker, P.E., Sr. Civil

This reviewer saw no good reason why the individual drainage reports were bound separately. This adds to the cost and it is easy to loose a report of only four or five pages. It seems logical to request that a final overall report of these studies be bound and multiple copies delivered to the City.

Newly derived rainfall-intensity curves were used with modification as appropriate by the newly derived isopleths. A minimum time of concentration of ten minutes was used. Runoff coefficients were consistent with those in the design manual of the City of Reno.

Flows were computed for the five and one hundred year return frequencies and nodes identified where improvements could be made. The five year flows were required to be in a conduit, and for areas over 100 acres in extent, the 100 year flows had to be contained in easements.

1. <u>Stead</u>

It was gleaned from the report that all of the drainage from this basin ends up in Silver Lake; no mention was made that this is an intermittent lake that has no outlet. This report could be the framework for and improved drainage system in the area if future development is required to adhere to the recommendations and the City implements improvements as it is feasible in the areas already developed.

The use of the Rational Formula in a 4000 acre drainage basin is rather unusual. The assumptions for derivation of the method break down. The rational formula is not normally used in this situation. As a general overview to the system this report is adequate. Useful details that are missing include the individual drainage basin areas, c values, times of concentration, rainfall intensities, and isopleth factors. Times of concentration and c values were probably built up depending on the conditions within the subbasin and those computations would be useful if contained in the report. Without these the work must be redone to proceed with any design work.

It must be emphasized that the Rational Formula is not normally used on large drainage basins such as this. No discussion of routing is present in the report although two detention basins are discussed. How the volumes were arrived at is not presented. No stage discharge curves are presented for the ponds and no hydrographs are drawn, obviously, since the rational formula was used.

The report is very useful for an inventory of what exists and for generally identifying problems and proposed solutions. The solutions may be in question due to the use of the Rational Formula.

2. Huffaker Hills

This report was never done, SEA was contracted to do it and there is a question in the Huffaker file as to why they were hired instead of the work being performed as part of this contract: there is no apparent answer.

3. Harding and Gulling

A 40 acre drainage basin, most of which remains to be developed (at the time the report was written), with an obvious need for future improvement. No specific improvements were recommended, but upsizing the pipe system to carry the 5 year storm plus detention were mentioned as the only feasible solution. Several typographical errors and a botched sentence.

There is a new development immediately upstream of this northwest across McCarran which was brought to my attention by the Planning Department where a developer wishes to fill the draw and pipe flows in this direction.
This problem merits detailed study by the developer and he should address the problem, probably with detention.

4. Plumas St. near W. Moana

The drainage basin is about a thousand acres in size. The report recommended splitting flows so that a portion went to Virginia Lake via the 60" pipe and ditch and the balance go to the ditch enclosed in the
CMP on Lymberry. The CMP is in poor condition, is an irrigation ditch and is overloaded already so the solution was unworkable. This report has been superceded by a subsequent study. It was used as the starting point for design of improvements in the drainage basin. The large size of the basin should have precluded the use of the Rational Formula for the study. The basin has since been studied by Kennedy, Jenks, Chilton Engineers and design and construction of facilities approved by the 1985 bond program are underway.

5. Rewana Farms, north of Peckham

This 125 acre basin is largely undeveloped with only a roadside ditch system, badly silted-in, and with culverts that cannot even handle the five year storm. New Development needs to stay aware of this problem and make sure developers install adequate facilities. A storm drainage plan for the area is necessary to aid New Development with their quest for cooperation.

6. Market St. and Miami Way

A 90 acre drainage basin with bits and pieces of pipe, a filled-in drainage ditch, and several minor problems needs to be watched by New Development for opportunities since half the basin is undeveloped. A drawing for the proposed system would be helpful for future implementation.

7. Roberts St. near Yori Ave. (Libby c. Booth School)

A 40 acre drainage basin without any storm drains needs remedial action. The area is all built up and water stands in the local low points in the street system. In-and-outs should probably be removed in the process of adding a storm drain system.

8. Thomas Jefferson Drive and Aquila Avenue

This 480 acre drainage basin is also known as the Hunter Lake Drainage Basin. The decrease in flows as you go downstream discussion is particularly interesting in this report, as it is possible, but rare, unless you are at an unusual node. Certainly, with the Rational Formula the sum of the flows is not normally equal to the computed flow at a point, but the discussion in the report is rather unusual.

Replacement of many undersized culverts is recommended and upstream detention in the canyons would be helpful. The flow into the Steamboat ditch is routed straight through instead of dealing with reality and following where this flow will really go. It will have to break out somewhere. Developments upstream will have a rather large impact downstream and detention is recommended.

9. Belford Road and Sharon Way

This 1115 acre drainage area is also known as the Rosewood Wash. In two cases now, the undersizing of the storm drain system in brand new subdivisions was discussed, apparently after the adaption of the rainfall intensity curves and isopleths. The authors did not understand why the City had not implemented what they had adopted, especially for the new developments. Surprisingly, most of the storm drain deficiencies in this system were in the upstream portions, probably in old county road sections, and in the new developments. Farther downstream, beyond the limits of this study, the Rosewood Wash at Plumb is a major problem and is only designed to handle the five year storm.

10. Second Street at the railroad crossing

This is the 17 acre drainage basin that floods where the railroad goes over Second Street just north of the Dickerson road intersection we are currently designing with CDBG money. A pump station of unknown but probably inadequate capacity serves the trapped low point. A five year flow of 30 cfs and a hundred year flow of 80-90 cfs makes it obvious that this will continue to be a major problem and cause the street to be shut down in even minor storm events. Larger pumps or a gravity system are recommended solutions.

11. Charles Drive-Clough Road area

This is a 56 acre drainage basin which lies astride the Plumb Lane extension from Hunter Lake Road to Mayberry. The problem is compounded by two irrigation ditches and localized flooding occurs due to the inadequate system and poor maintenance of what does exist. A large vacant piece of land is also flooded so New Development should take special note of this report.

12. Marsh Avenue and LaRue Ave.

I could not find any copy of this report but I suspect that this area was the subject of a recent storm drain installation, and this study or the preliminary work for the study discovered the problem was solved. This would be the Caliente storm drain project of about ten years ago.

13. Riverside Drive and Ralston St.

This is a localized problem where no storm sewer exists and water ponds in the streets between Washington and Stevenson from West Second Street to the Truckee River. A basin area of 21 acres is identified. Regrading of streets and installation of storm sewers, either to the Truckee River directly or to an existing system which parallels this area is recommended. Based on flooding witnessed by this reviewer on Keystone, other deficiencies appear to be in this general area also and a more extensive investigation is warranted before connections are made to the existing system.

14. Lake Ridge Golf Course area

This report is missing and presumed lost or never completed. This is a newly developed area so there should be no major drainage problems with the extensive review given projects by the staff of the City of Reno.

15. Panther Valley area

This drainage area is 835 acres and lies in the extreme northerly extension of Reno along highway 395, preceding the Stead area. A huge amount of the watershed is undeveloped so New Development should be made aware of this report. Sage Hen Subdivision is in the upper portion of this drainage basin. The downstream or ultimate discharge from this drainage basin is not addressed although it appears to follow the railroad tracks to the south parallel to North Virginia St. If that is the case it goes down to the industrial area behind the Bonanza and causes severe flooding. The industrial in-fill are making a disaster out of the area. Even worse is the fact that this is the headwaters area of the Paradise Pond Drainage area addressed by Summitt Engineering in a report done almost at the same time as this one. Drainage improvements are needed in this area, but the impact downstream must also be assessed. This area merits more study, especially due to its impact on the Evans Avenue/Manogue High School area.

16. Longley Lane and McCarran Blvd

This report is missing and presumed lost or never completed.

17. University Drain at Longley Lane

This is a 1250 acre watershed and the use of the Rational Formula is probably inappropriate. The Telegraph-Vasser inlet problem which is currently in design to be fixed is part of this area and addressed as a problem; the first fix did not work due to limited grate inlet capacity when no head was available. Major problems downstream in the University Ditch itself exist just downstream of Rock Boulevard and at Longley Lane. These should be addressed soon since they can back up the entire system and cause serious flooding problems. Suggestions to reroute some of the upper portion of the basin to the Truckee River directly are made but generally the existing piped system will have to be lived with barring major replacement.

18. Grant Drive and West Moana Lane

This report is missing and presumed lost or never completed.

19. Parr Boulevard near Catron Dr.

This is the 785 acre drainage basin immediately below the Panther Valley drainage area which apparently does not flow through this area. Development is occurring very rapidly and the report is woefully out of date already. Updating of this particular report is recommended. It forms the far upstream reaches of the Paradise Pond Drainage Area and a frightening flow of 1230 cfs leave this basin in the future 100 year event heading for the Evans Avenue/Manogue High School area. I have personally witnessed unbelievable blockage of drainage ways in this basin and wondered how it was occurring. Parr Boulevard sits smack dab in the middle of a major drainage way in an area turning to all asphalt and buildings.

Most of the system is undersized for even the five year event and detention is recommended for a solution. Much more study of this area is required and New Development needs to be apprised of this situation to help expedite solutions. Development is occurring very rapidly and the report is woefully out of date already. Updating of this particular report is recommended.

20. Dry Creek Drainage

This report is missing and presumed lost or never completed.

21. Evans Creek

This is a 6750 acre drainage basin and the Rational Formula is certainly inappropriate to analyze it. This basin has been the subject of further studies for the Lewis Lakeside Homes development and by Nimbus Engineers both for a private client and FEMA. Many structures were undersized and need improvement. The impact of the three irrigation ditches was discussed and could merit further elaboration. It appeared that they would be a help in the winter when empty, but that a summer storm could cause major problems. Break-out points should probably be addressed for this situation. Ponding is recommended in the flat areas to reduce flows at Virginia Street. Highway 580 is being extended through this area and comments relating to it should be added to the report if possible.

March 29, 1989   Winzler Kelly Drainage Report of 1984
Reviewed by: Robert M. Gottsacker, P.E., Sr. Civil

C. Summary

In summary, the data from reports such as these need to be summarized into a reproducible graphic form with reference back to the appropriate report. This can be used for reference by New Development and to assist in citizen inquiries. That base of data should then be used to develop solutions which can be implemented piecemeal by developers or included in the Capital Improvements Program via the CIP and budgetary process. This process has begun with tabulation of data into the computer, but the graphic portion of the project is best delayed until the computer mapping system is up and running. If it does not occur, hand drafting will proceed.

Mandatory written review of major studies should be required of all affected section heads to force them to be aware of the existence of the report and the problems which it addresses.

Overall the report is very useful in that problems are identified but the use of the Rational Formula for large watershed is very questionable. The rainfall intensity curves need to be further researched and modified to address winter and summer storms and modification for the duration and occurrence interval. This is a major issue with consultants and a more definitive study should probably be done. It is possible that the data available is not good enough, or volumness enough to warrant further extrapolation.

WINZLER & KELLY GROUP CONSULTING ENGINEERS

MAR 1985 ... Dept Reno

MEMORANDUM

ISSUING OFFICE

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☐ FOR YOUR INFORMATION
☐ REPLY REQUESTED

Now part of report 3/27/85

TO: BILL VANN

FROM: RICK JORGENSEN

DATE: 3-25-85

RE: STEAD DRAINAGE

Dear Bill,

I am listing the nodes found on Tables 4 and 6 that I gave to you this morning - the costs and pipes shown are based on a 5-year design storm instead of a 100-year design storm.

NODE	PROPOSED SYSTEM	COST
a	42" RCP	$11,500
b	No change	— 0 —
c	dual 60" RCP's	$33,200
d	parallel existing pipes w/ 60" RCP	$110,400
e	60" RCP	$17,200
f	No change across RR	
	60" RCP across Stead & school	$140,300
g	84" RCP	$17,100
h	72" RCP	$294,000
i	ALT 1 - 84" RCP (5 YR)	$24,900
	ALT 2 - storage basin (100 YR)	$555,100

8

WINZLER & KELLY
CONSULTING ENGINEERS

MEMORANDUM

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- ☐ FOR YOUR INFORMATION
- ☐ REPLY REQUESTED

TO:

FROM:

DATE:

RE:

NODE	PROPOSED SYSTEM	COST
j	ALT. 1 - Parallel pipe in Stead	
	w/ 84" RCP (5YR.)	$1,195,100
	ALT 2 - Storage Basin (100 YR.)	$1,999,700
k	No change	-0-
l	Parallel exist pipe w/	
	72" RCP (if j-2 not selected)	$ 452,400
m	60" RCP and ditch	$ 12,100
n	ALT 1 - parallel exist pipe	
	w/ dual 84" RCP's	$ 2,113,000
	ALT 2 - pipe and ditch on	
	north side of runway	$ 698,300
o	No change	-0-
p	Dual 48" RCP's	$ 47,300
q	Parallel exist pipe with	$ 182,200
	60" & 72" RCP's	
r	60" RCP on Echo	$ 87,600

Again I would increase above costs by approximately 10% for contingency as I inadvertently left it out in my calcs — Call if you need anything else —

Rick

WINZLER & KELLY GROUP CONSULTING ENGINEERS

Now part of report 4/2-7/85

MEMORANDUM

TO: BILL VANN

FROM: RICK JORGENSEN

DATE: 3-25-84

RE: STORM DRAIN ESTIMATE - STEAD.

ISSUING OFFICE

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☐ FOR YOUR INFORMATION
☐ REPLY REQUESTED

MAR 1985 Engr. Dept. Reno

Dear Bill

Per our phone conversation this A.M. I am enclosing tentative costs for various drainage projects in the Stead area. I would increase costs by approximately 10% for contingency which was inadvertently left out -

As I mentioned, most of the drainage deficiency areas we are analyzing - we are only calculating storm flows and identifying problem nodes but not giving solutions or costs. Stead Drainage is different as Millard requested a full drainage study for this site only -

If I can be of further assistance give me a call - I hope to have the completed Stead Report later this week —

Rick

(1/84)

A third drainage basin is located west of the two aforementioned basins. There is an 18-inch CMP crossing North Virginia near the western edge of the project boundary. Flows proceed north crossing U.S. 395 in a 36-inch RCP just to the west of the Silver Lake Subdivision and crossing Silver Lake Road in a 36-inch RCP. The flows proceed south through the Lake Ridge Golf Course in a series of ponds and ditches. They eventually reach the new railroad grade just south of the J.C. Penney Complex and are diverted west in a ditch towards Silver Lake.

C. ESTIMATED STORM RUNOFF

Estimated storm runoff is calculated at selected nodes. These nodes and the related flows are shown on Figure 8, the project boundary map appended at the back of the report. Table 4 summarizes these nodes, giving location, description of node, capacity of node and estimated storm runoff at the node. The existing capacity assumes inlet control. Generally a range is given. The lower value assumes no head at the inlet while the higher value is at maximum head on the culvert.

As most of the subdrainages exceed 100 acres, the storm drainage systems need to be sized to pass a 100-year return frequency storm as stated in the City of Reno Drainage Ordinances.

D. ESTIMATES OF COST

This section on cost estimates for proposed storm drainage modifications is included in the Stead Report as the City requested a complete drainage study for the particular deficiency area.

DRAFT

TABLE 4 - STEAD EXISTING DRAINAGE FACILITIES SUMMARY

Node and Location	Existing Storm Drainage System	Existing Capacity (cfs)	Estimated Flows Present Land Use		Estimated Flows Future Land Use	
			Q5 (cfs)	Q100 (cfs)	Q5 (cfs)	Q100 (cfs)
a - North Virginia approx. 0.06 miles west of Stead Blvd.	18" CMP	6-25	45	125	45	125
b - U.S. 395 approx. 0.63 miles west of Stead Blvd.	36" RCP	35-100	55	145	55	145
c - North Virginia approx. 0.4 miles west of Stead Blvd.	Dual 36" CMP's	70-120	250	580	250	580
d - U.S. 395 approx. 0.3 & 0.5 miles west of Stead Blvd.	36" RCP 48" CMP/RCP	35-60 70-140	250	580	250	580
e - North Virginia just west of RR Xing	36" CMP	35-70	95	245	95	245
f - Railroad and Stead Blvd. opposite O'Brian Middle School	48" CMP across RR 24" RCP across Stead Blvd.	70-170 13-20	105	245	105	245
g - Silver Lake Rd. just west of Stead Blvd.	24" RCP	13-25	265	585	275	610
h - Silver Lake Rd. approx. 0.6 miles west of intersection with Stead Blvd.	36" RCP	35	135	265	155	300
i - Railroad Xing just south of Penney complex	36" CMP	35-95	265	585	280	610

TABLE 4 - STEAD EXISTING DRAINAGE FACILITIES SUMMARY (continued)

Node and Location	Existing Storm Drainage System	Existing Capacity (cfs)	Estimated Flows Present Land Use		Estimated Flows Future Land Use	
			Q5 (cfs)	Q100 (cfs)	Q5 (cfs)	Q100 (cfs)
j - DI south edge of Penney complex	24"to 30" network	13-22	295	645	315	690
k - Ditch west of Penney complex to Silver Lake	Overland flow	-	110	300	130	345
l - Stead Blvd. between Lear Blvd. & Norton Rd.	Dual 54" RCP's 79"x49" CMP	195	560	1530	625	1715
m - Lemmon Drive north of airstrip	15" CMP	5-10	130	335	130	335
n - DI's & pipe running east-west just north of Texas Ave.	18" to 36"	7-35	630	1355	630	1355
o - Intersection of Echo & Babcock	drainage ditch	255	155	410	155	410
p - Pipe crossing Mt. Bismark St. north of Anderson	5-15" RCP's	20-60	155	410	155	410
q - Pipe crossing Anderson just west of Mt. Bismark St.	36" RCP	35-80	390	1020	390	1020
r - Pipe & ditch system on Echo to Anderson	12" RCP	3-83	140	375	140	375

Preliminary cost estimates for the various proposed projects within the drainage basin are necessary for economic feasibility evaluations. Cost estimates are based on the premise that all construction will be accomplished by competitively bid contracts. The costs include construction and contingency costs as well as engineering and administrative costs.

1. Storm Drains

Storm drain costs were developed using the 1985 Means Construction Cost Data. Class 3 reinforced concrete pipe is used in the estimating. 10% was added to the subtotal cost including overhead and profit for profit to arrive at a total cost per foot of pipe installed. $1500 per storm drain inlet is used as an average cost. Table 5 summarizes the costs of pipe from 12 inch to 96 inch.

TABLE 5 - COST ESTIMATES FOR RCP INSTALLED

Size	Cost/L.F. Installed
12"	$ 29.50
15"	31.98
18"	35.44
24"	43.14
30"	61.84
36"	78.34
42"	88.24
48"	101.24
60"	156.67
72"	189.67
84"	269.14
96"	318.64

An additional cost of $12 per foot is used for paving and $6 per foot for gravel.

2. Channel Construction

Channel costs can vary substantially depending on accessibility and type of ground. An excavation cost of $6 per cubic yard is used for roadside channels and easily accessible areas located on firm ground. In marshy areas particularly along the major creek beds an excavation cost of $12 per cubic yard is used. Clearing costs range from $0.50 per linear foot to $6 per linear foot, depending on location, and seeding is estimated at $2 per linear foot.

3. Contingencies

Contingencies are funds set aside for unexpected complications that may arise. For these estimates a 10% contingency of construction costs is assumed.

4. Engineering

Estimated engineering fees would include pre-design and design services as well as bid phase and construction inspection services. An estimate of 15% of construction costs is used in this report.

5. Administration

An estimate of 5% of construction costs is assumed for administration costs during the design and construction of the proposed projects.

6. Right-of-Way

Right-of-way costs will vary widely depending on location within the study area. Although it is recommended that easements be deeded as a requirement for building, in many instances off-site easements may be required to allow an area to develop and may need to be purchased. Because these costs are so ambiguous at this stage they are not included in the cost estimates. However, it should be noted that in certain cases right-of-way may add substantially to the cost of the projects.

E. PROPOSED STORM DRAINAGE FACILITIES

This section is included in the Stead Report as the City requested a complete drainage study for this particular deficiency area.

Table 6 summarizes the proposed modifications and their related costs. A brief description of these proposals is listed below. The letters key to the node letters on Figure 8 appended to the back of this report.

a. Replace the existing 18-inch CMP across North Virginia with a 42-inch RCP.

b. Existing 36-inch RCP across U.S. 395 is adequate.

c. Replace the existing dual 36-inch CMP's across North Virginia with dual 84-inch RCP's.

d. Install by jack and bore method new 96-inch RCP across U.S. 395 paralleling existing 36-inch and 48-inch RCP/CMP's. Excavate new ditch between North Virginia and U.S. 395 to allow more flow to reach existing 48-inch RCP/CMP across U.S. 395.

e. Replace existing 36-inch CMP across North Virginia with an 84-inch RCP.

f. Replace existing 48-inch CMP across railroad with an 84-inch by jack and bore. Replace existing 24-inch RCP across Stead Blvd. and around O'Brian Middle School with an 84-inch RCP.

g. Replace existing 24-inch RCP across Silver Lake Road with dual 84-inch RCP's.

h. Replace existing pipe system on Peppermint and Silver Lake Road with an 84-inch RCP.

i. <u>Alternate 1</u>:

Replace existing 36-inch CMP across Railroad with dual 84-inch RCP's by jack and bore method.

<u>Alternate 2</u>:

Construct 100-year storm storage basin upstream of existing RR pipe crossing.

j. <u>Alternate 1</u>:

Install new dual 84-inch, 96-inch RCP system from the J.C. Penney complex in Stead Blvd. paralleling existing system to the existing dual 54-inch RCP's crossing Stead Blvd. between Lear and Norton.

<u>Alternate 2</u>:

Construct 100-year storm storage basin just north of J.C. Penney complex.

k. No change is recommended.

l. Install new 84-inch and three 9-inch RCP's across Stead Blvd. and through existing subdivision paralleling existing dual 54-inch RCP's - 79-inch by 39-inch CMP. (This is required if Alternate 2j is not selected.)

m. Replace existing 15-inch CMP with dual 72-inch RCP's and excavate new ditch to daylight downstream.

n. Alternate 1:

Parallel existing 18-inch to 36-inch RCP pipe system with three 96-inch and one 60-inch RCP.

Alternate 2:

Install ditch, culvert system along north side of existing runway.

o. Widen existing ditch to handle 100-year flows.

p. Replace existing five 15-inch RCP's across Mt. Bismark with dual 72-inch RCP's.

q. Parallel existing 36-inch, 42-inch RCP's across Anderson with dual 84-inch, and one 96-inch RCP.

r. Install 60-inch RCP on Echo Avenue from Mt. McClellan to Anderson.

TABLE 6 - STEAD PROPOSED DRAINAGE FACILITIES SUMMARY

Node and Location	Existing Storm Drainage System		Proposed Storm Drainage System	Cost
a - North Virginia approx. 0.65 miles west of Stead Blvd.	18" CMP		42" RCP	$ 11,500
b - U.S. 395 approx. 0.63 miles west of Stead Blvd.	36" RCP		No change	-0-
c - North Virginia approx. 0.4 miles west of Stead Blvd.	dual 36" CMP's		dual 84" RCP's	$ 52,100
d - U.S. 395 approx. 0.3 and 0.5 miles west of Stead Blvd.	36" RCP 48" RCP/CMP		parallel existing pipes with 96" RCP	$ 174,500
e - North Virginia just west of RR crossing	36" CMP		84" RCP	$ 29,100
f - RR and Stead Blvd. opposite O'Brian Middle School	48" CMP across RR 24" RCP across Stead Blvd.		84" RCP across RR 84" RCP across Stead and around school	$ 264,300
g - Silver Lake Road - just west of Stead Blvd.	24" RCP		Dual 84" RCP's	$ 34,200
h - Silver Lake Road approx. 0.6 miles west of Stead Blvd.	24" to 36" RCP		84" RCP on Peppermint and across Silver Lake Road	$ 410,900
i - RR crossing just south of Penney complex	36" CMP	Alt. 1	Dual 84" RCP's	$ 49,600
		Alt. 2	100-yr. flow storage basin	$ 555,100

TABLE 6 - STEAD PROPOSED DRAINAGE FACILITIES SUMMARY (continued)

Node and Location	Existing Storm Drainage System		Proposed Storm Drainage System	Cost
j - D.I. at south edge of Penney complex	24" to 30" RCP	Alt. 1	Parallel existing pipe w/dual 84"; 96" to Stead Blvd. and north to crossing between Lear and Norton	$2,578,600
		Alt. 2	100-yr. flow storage basin	$1,999,700
k - Ditch, overland flow west of Penney complex to Silver Lake	ditch/overland flow		No change	-0-
l - Stead Blvd. between Lear and Norton	dual 54" RCP's - 79" x 49" CMP		Parallel existing pipe w/one 84" and three 96" RCP's	$2,823,900
m - Lemmon Drive north of airstrip	18" CMP		Dual 72" RCP's and ditch to daylight downstream	$ 24,000
n - Pipe and D.I.'s running east-west just north of Texas Avenue	18" to 36" RCP		Alt. 1 - parallel with three 96" and one 60" RCP.	$4,267,000
			Alt. 2 - ditch, culvert along north side of runway.	$1,631,700
o - Intersection of Echo and Babcock	drainage ditch		Widen existing ditch	$ 15,100
p - Pipe crossing Mt. Bismark north of Anderson	5 - 15" RCP's		dual 72" RCP's	$ 80,300
q - Pipe crossing Anderson just west of Mt. Bismark	36" RCP		parallel with existing pipe two 84" and one 96" RCP	$ 373,100

TABLE 6 - STEAD PROPOSED DRAINAGE FACILITIES SUMMARY (continued)

Node and Location	Existing Storm Drainage System	Proposed Storm Drainage System	Cost
r - Pipe and ditch system on Echo to Anderson	12" RCP	60" RCP on Echo from Mt. McClellan to Anderson	$ 87,600

F. RECOMMENDED PROJECTS

There are sixteen individual projects described in the Stead drainage area, some with more than one alternate. It is recommended that all of these projects be implemented as development warrants.

Presently, however, there is no need to do any of the proposed projects south of U.S. 395 or north of the old State complex and Texas Avenue.

Although the crossings on North Virginia and U.S. 395 are for the most part inadequate, any flooding that occurs causes no immediate problems as the area is largely undeveloped. In fact, by keeping these pipes undersized it may aid in slowing or reducing the flows reaching the developed area downstream. It is expected, however, that these flows will eventually arrive by overland flow bypassing the existing culverts.

The costs for the various projects are very expensive. As the area is a relatively large drainage basin, in most cases in excess of 100 acres for the individual subdrainages, the storm drain systems need to be sized for a 100-year storm. This adds significantly to the costs compared to a 5-year design project.

The existing storm drainage system in Stead Blvd. is seriously undersized which is unfortunate as this is a relatively new system. The use of storage basins are considered at both node i and node j.

The storage basin at node i is not recommended. The reason is that the flows generated at node j and node l are based on a much shorter duration storm than for node i. The flows at node i assume that the entire drainage basin upstream south of U.S. 395 is contributing with an estimated time of concentration in excess of three hours. If this same assumption is made for node l much smaller flows are developed than if the subarea only downstream of node i is considered. Although the acreage is much less, it is basically all zoned manufacturing and the time of concentration is approximately 30 minutes. Thus even if a storage basin were constructed at node i to contain upstream flows, the estimated flows at node 1 would remain basically the same.

On the other hand, the storage basin at node j is the recommended alternate. This will hold back flows from reaching node 1 thus negating the need for any storm drainage upsizing. The only concern is that this is prime land for future development. Approximately 65 acre-feet of storage would be required in alternate 2j and the cost of acquiring this land could be significant.

Alternate 2n is the preferred alternative. It would use a ditch, culvert combination rather than a pipe network. This would better stop flows from the north from proceeding south and is significantly less expensive. Again, this project is not recommended until future development.

HYDRO CONDUIT CORPORATION

DATE ______

PAGE ____ OF ____ PAGES

PROJECT ______

ISOPLETHS:

APRIL 10, 3, 1986 - Feb 1986 - winter Storm confirms elevation vs rainfall for 24+ hr. storms. Plotted between 4400 & 5200 ft. Higher elevation rainfall tends to level off such as Bora, Truckee, Donner - but these are not relevant to Reno.

JUNE 13 1988 NIMBUS. Compared WK, NOAA, Calif DWR, vs. Feb 86, Dec 55, & Feb 63.

1) NOAA atlas up to 24 hr no good
2) TP49 2-10 day no good.
3) Airport compares to Calif DWR. = WK report.
4) Unsupported assumption - 5 min & 24 hr time adjust by same isopleth.
5. KEY - short duration intensities do not increase with elevation; longer durations do.

Ron Olsen NWS:

1) separate isopleths for wet & dry but not separate intensity curves.
2) isopleths for all return periods the same - needs further study.

Sept 5 letter to Mark Forest by Ron Olsen says

1) Summer storm intensity not dependent on elevation
2) Suggests 24 hr 100 yr = 3" rain minimum
3) Winter: elevation, upwind distance from a major ridgeline & height of upstream ridgeline.
4) WK STUDY: less than 60 min - curves too low for summer, too high for winter.

AUG 7, 1987 - ERROR ANALYSIS.

ERROR MAPS show uncertainty of data - obviously larger possibility of error further from raingages.

1) Wet Season error map - nothing over .2 on map
2) Dry Season - 1/2 of town to north varies .2 to .5 error.

Need 4-5 cc. of everything   RMO – 1   ehus – 1   pem. bio – 1   SU – 1   ~~MGR~~ – 1   CEF – 1   yellr 3/1/87

~~p.3 Stead report? where is it?~~

p.4 How many of the 20 areas (198-X) have been fixed?

p.6 Major drainage basins – Steamboat, Peavine, Evans, Dry.

* p.13 Siltation a big problem

* p.16 – Onsite drainage must be kept = existing?

* p.24 – Why is not Figure 8 in our design manual.

p.25 – 20 deficiency maps.

500 scale maps? – where are they? – proposed rational formula approach – ok if localized.

Mini Reports on each ~~area~~ – where are they?

A10 Weighted averages of statistical analysis SUCKS.

→ 3, 5, 6, 7, 8, 9, 10, 11, 13, 17, 19 panther, evans, & Stead.

HYDRO CONDUIT CORPORATION

DATE KMW 3/13/89

PAGE ____ OF ____ PAGES

PROJECT

HAVE — MAIN REPORT / Prelim Report Draft Oct 84
Dec 84
3

5 6
7
~~panther Valley~~
8 Hunter Lake Basin / Thomas Jefferson Dr / Aquila Ave
10 9
11.
13.
17
19
panther valley
evans Creek
Stead.

others Sparks June 1964
Nev. Oct 1957

Rainfall Isoplath Wenzler/Kelly Mtg.   5-27-88

1. To collect professional opinions concerning basis for isoplath Model accurate

2. Discuss recommendations for next step

- Different IDF curves for summer and winter type storms were not done

- NOAA Atlas shows same trend but not nearly the magnitude

- data not accurate & standard deviation as large as the ratios.

.063

.13   .03

Aug 7, 1986

Introduction

Part of the original scope of this study was to develop new rainfall intensity-duration-frequency (IDF) curves for the Reno area. The IDF curves developed were based on rainfall data at the Cannon International Airport.

In addition, the scope of work included analysis of spatial variation of rainfall in the Reno area by developing rainfall isopleth maps for both the summer and winter seasons based on nine unofficial gauging stations.

The isopleth maps developed have caused some concern as the use of them can significantly increase the rainfall intensity and thus runoff in certain drainages. The City has requested that some method of analyzing the inherent error in using the isopleth maps be developed.

Results

The error maps show the spatial variability of error associated with the average depth ratio maps. The rainfall depth isopluvial maps provide a design engineer with the adjustment factor that he/she should be considering while the associated error maps tell him/her about the uncertainty of the adjustment factor.

The error maps indicate that the estimated error is lowest near the Cannon Airport and other gauging stations and increases farther from these data points.

Information provided by the error maps should be considered because the true adjustment factor may lie within the following interval:

$$R_x \in [\overline{R}_x - k\varepsilon_x, \overline{R}_x + k\varepsilon_x]$$

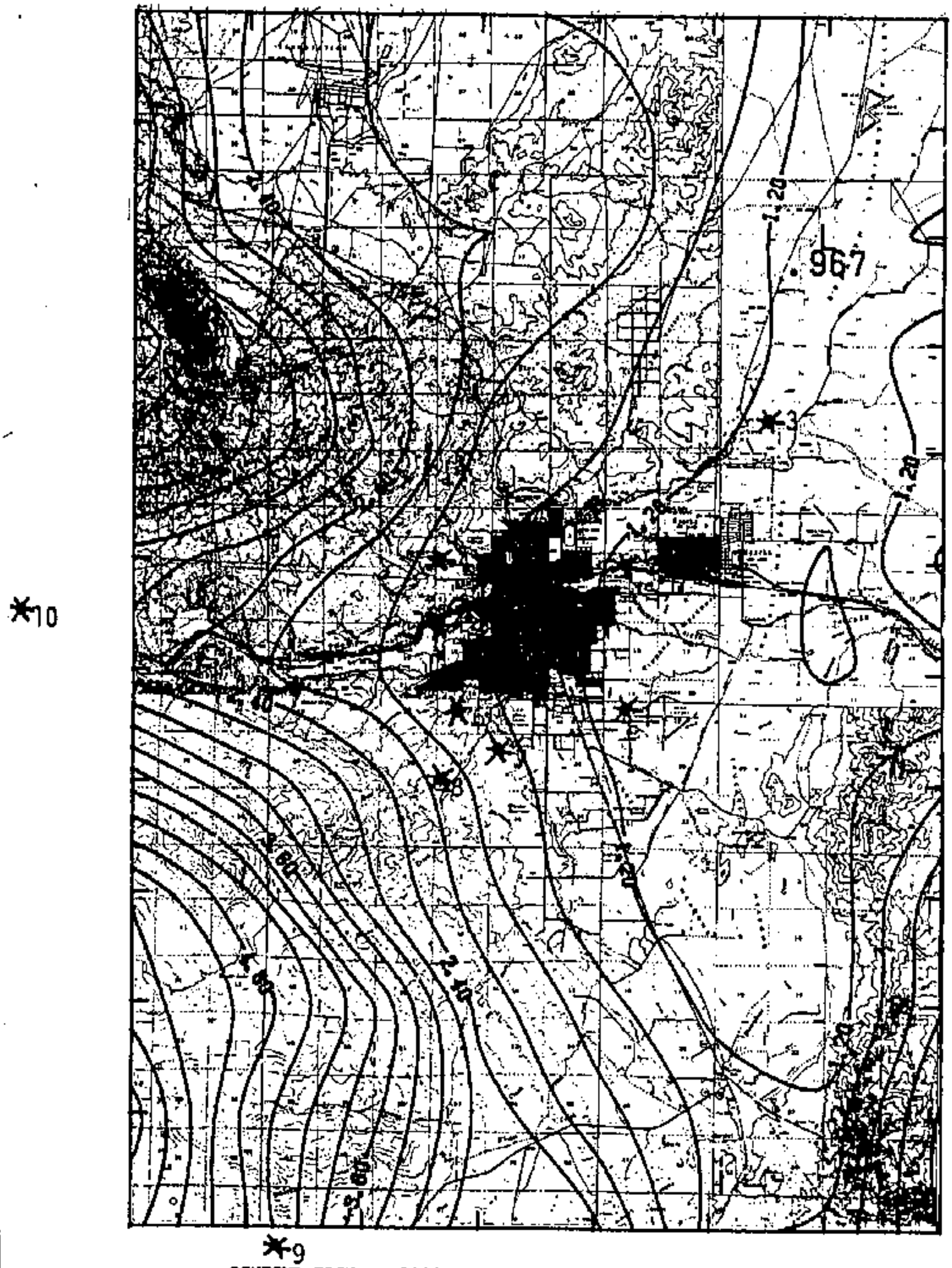
in which R_x = true ratio (unknown) at location X; $\overline{R}_x$ average (or nominal) ratio at location X given by the depth ratio maps;

x = amount of error associated with $\overline{R}_x$ from the error maps; k = a constant.

It should be noted that the error is a plus or minus value and the depth ratio maps are still the best guess at what actually occurs.

City of Reno

Rainfall Isopleth Map for Wet Season November to April



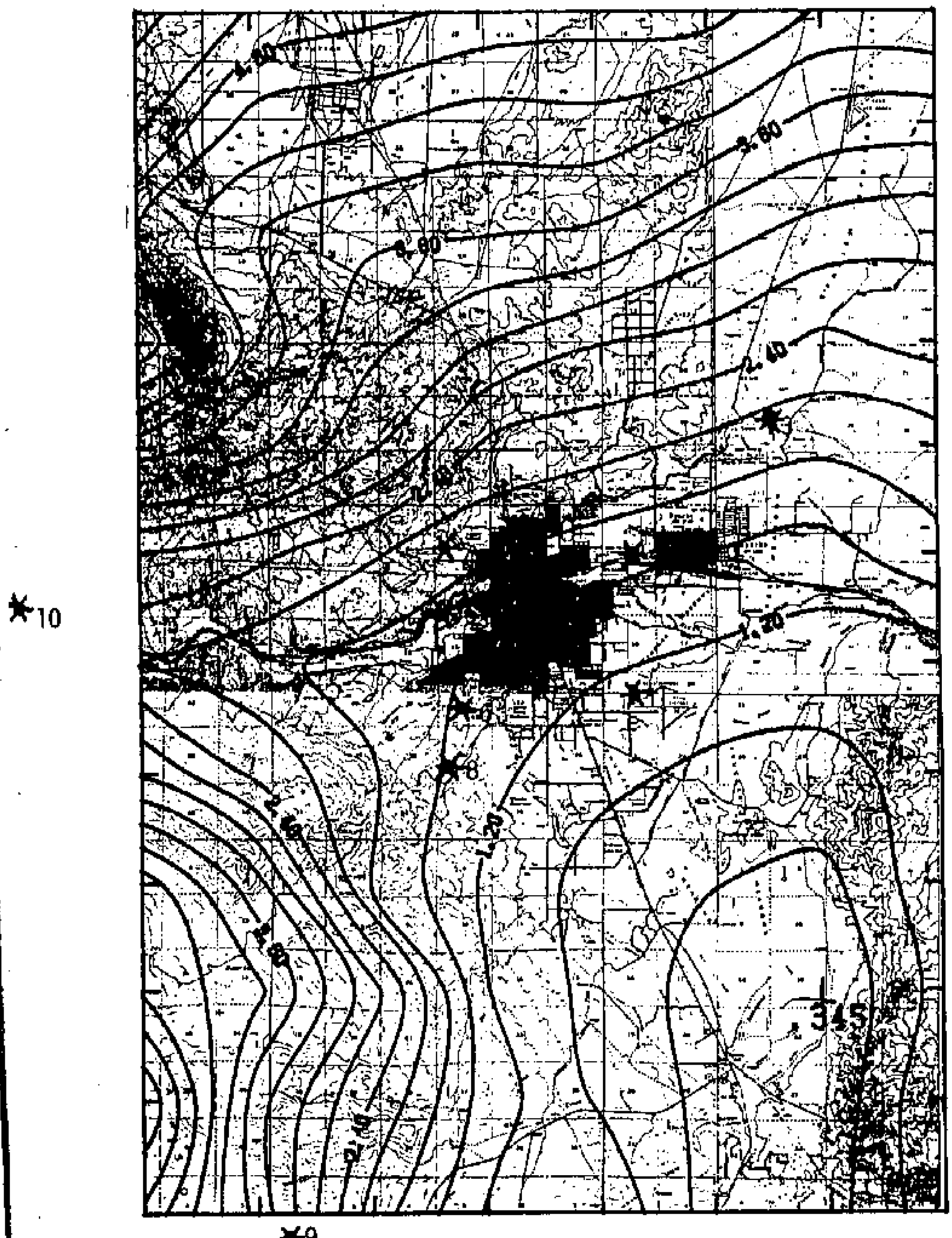
1. Cannon Airport
2. Sparks Fire Station
3. La Veaga Ct.
4. Royal Dr.
5. Dickerson Rd.
6. Ganser
7. Sierra Sage Ln.
8. Upper Skyline
9. Christmas Tree
10. Verdi

CONTOUR FROM .60000 TO 6.0000 CONTOUR INTERVAL OF .60000 PT(5, 8)= 4.0678

Figure 5

City of Reno

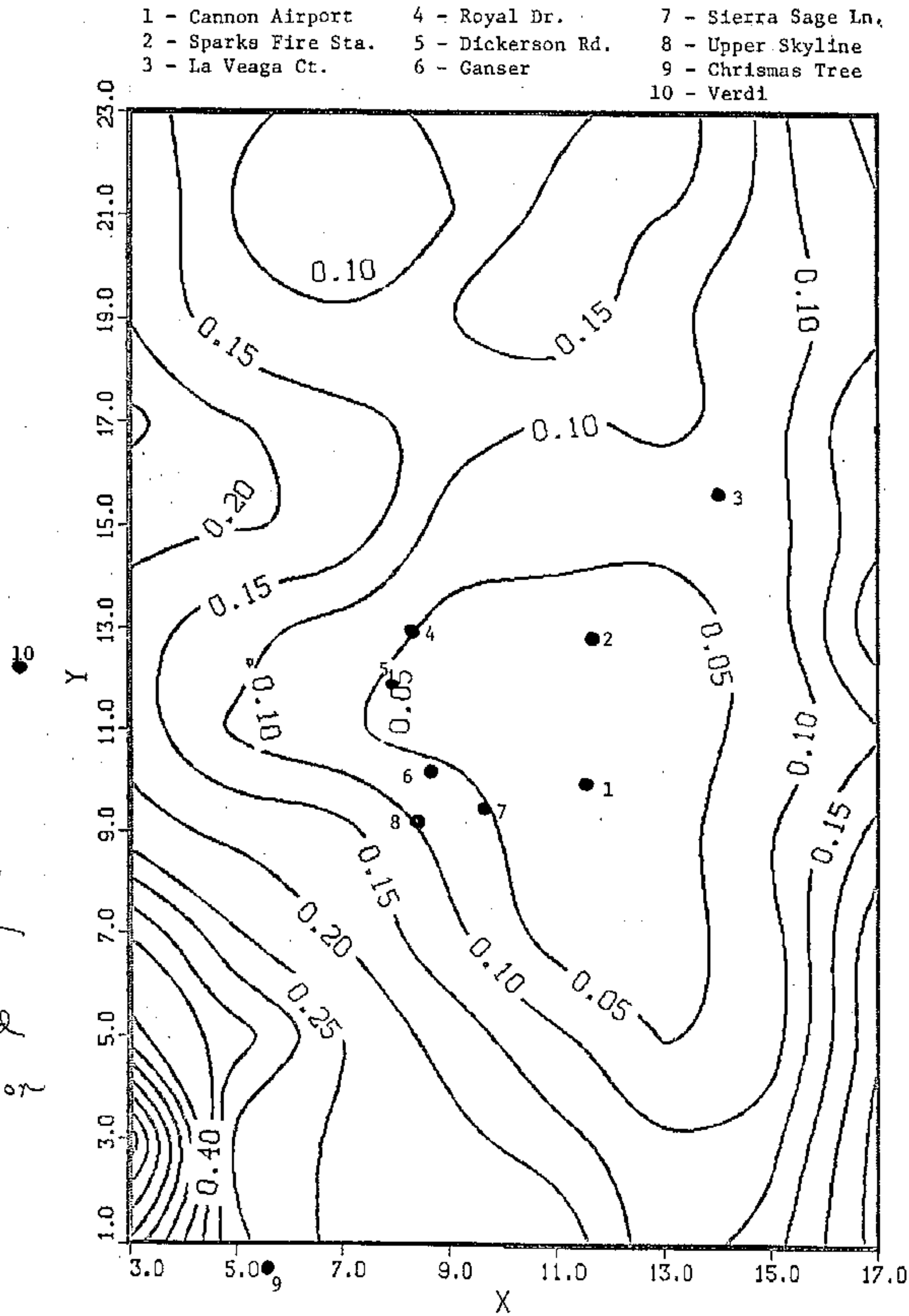
Rainfall Isopleth Map for Dry Season May to October



CONTOUR FROM .30000 TO 3.4000 CONTOUR INTERVAL OF .30000 PT(8,9)= 2.8281

1. Cannon Airport
2. Sparks Fire Station
3. La Veaga Ct.
4. Royal Dr.
5. Dickerson Rd.
6. Ganser
7. Sierra Sage Ln.
8. Upper Skyline
9. Christmas Tree
10. Verdi

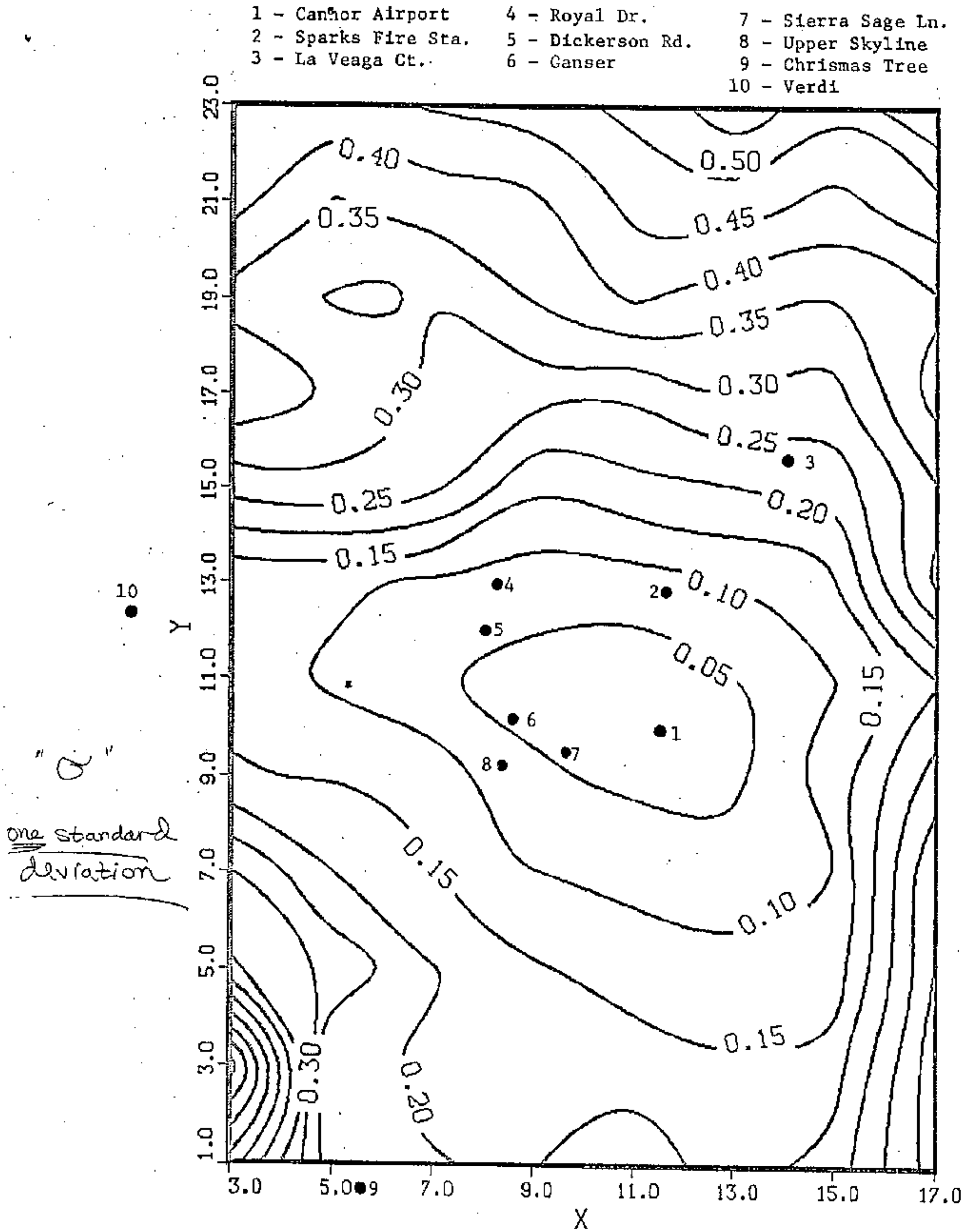
Figure 8



"σ"

one standard deviation

RAINFALL RATIO ESTIMATION ERROR MAP
(WET SEASON)



RAINFALL RATIO ESTIMATION ERROR MAP
(DRY SEASON)

Dry: $R = 0.5455 - 0.398x^{1/2} + 7.54 \times 10^{-3} y^2 + 5.75 \times 10^{-7} z^2$

Wet: $R = -13.87 - 1.85 x^{1/4} + 19.25 z^{1/4}$

"R"

				map dry	map wet	calc dry	calc wet
Barber Way	x = 63,700 ft	=	12.1 mi	1.50	1.1 (interpolated)	0.42?	1.07
	y = 63,000 ft	=	11.9 mi				
	z = 4,400 ft	=	0.833 mi				
Reno-Cannon Airport	x = 45,400 ft	=	8.60 mi	1.00	1.1 (interpolated)	0.27?	1.36
	y = 49,800 ft	=	9.43 mi				
	z = 4,410 ft	=	0.835 mi				
SE cor Sec 25	x = 11,000 ft	=	2.08 mi	2.35 (interpolated)	3.2 (interpolated)	0.76?	3.84
	y = 42,000 ft	=	7.95 mi				
	z = 6,040 ft	=	1.14 mi				

Reno Cannon

$x \cong 11.5$

$y \cong 10.0$

1988 ISOPLETH CONSULTANT COMMENT

Nimbus Engineers
240 Linden St., Suite B • Reno, NV 89502
Mail: P.O. Box 10220 • Reno, NV 89510
(702) 689-8630

June 13, 1988

RECEIVED

JUN 15 1988

Mr. Steve Varela, P.E.
City Engineer
City of Reno, Engineering Division
P. O. Box 1900
Reno, Nevada 89505

RE: Public Works Design Manual, Rainfall Information

Dear Mr. Varela:

I appreciated the opportunity to meet with you and your staff on May 20 and 27, 1988 to discuss the rainfall information presented in the Public Works Design Manual. As you requested on the 27th, this letter is intended to provide you with a written summary of my comments and concerns on this information.

I have had several opportunities during the course of several studies in the Reno/Sparks area, to review the rainfall information prepared by Winzler and Kelly, NOAA, California DWR and others. During the preparation of a flood insurance study, I compared these sources of information with one another and with rainfall data from February 1986, December 1955 and February 1963.

The following comments summarize my most significant concerns with the Winzler and Kelly information:

1) NOAA Atlas 2 (Up to 24 duration) and Technical Paper 49 (2-10 day duration) have some significant inaccuracies within the Sierra Nevada's and Virginia Range. The need for superior data for design purposes is recognized. The City of Reno's attempt to provide better design information is commendable.

2) The intensity - duration - frequency information for the Reno Airport site compares very closely with the data prepared by California DWR for that site. In some locations the graph varies slightly from the data presented in Tables 3a through 3h in the appendix of the Winzler and Kelly report. The differences appear to be insignificant.

3) The method suggested for determining the design I-D-F curve is to compare the "wet season" and "dry season" rainfall isopleth maps to determine the greatest ratio of site precipitation to airport gauge precipitation. This ratio is then applied to determine the design I-D-F information from the airport gauge I-D-F curve. This method suggests that the entire I-D-F curves for points along each contour should be increased by that ratio. (i.e. The 5 minute and 24 hour values would increase by an equivalent ratio.) This assumption is not supported by the available data.

   Attached is a plot of the 100 year depth - duration curves for four stations; the Reno Airport site and three sites in the Sierras. This is a plot of the data prepared by California DWR. This was a figure in my report on the Lemmon Valley Playas prepared for FEMA. This graph shows that the short duration values do not significantly increase with elevation or orographic effects. The longer duration totals do significantly increase with elevation. The depth-duration curve would be steeper for a higher elevation site, and a intensity-duration curve would be flatter for a higher elevation site.

   Attached is also a letter from Ron Olsen at the NWS that contains his comments on this matter.

4) The Winzler and Kelly report separates the dry and wet season isopleth contours but does not separate I-D-F information for the two seasons. This suggests that the single I-D-F curve would be applicable for both seasons. This assumption does not appear to be well supported by the data.

5) There is only one set of isopleth maps to be used for all return periods. This fact suggests that the ratios and locations of the contours are accurate for the 5 year as well as the 100 year return periods. The validity of this assumption needs to be addressed.

6) Several of the gauge sites on the dry and wet season isopleth maps appear to be inaccurately located. This could affect the locations of the contours.

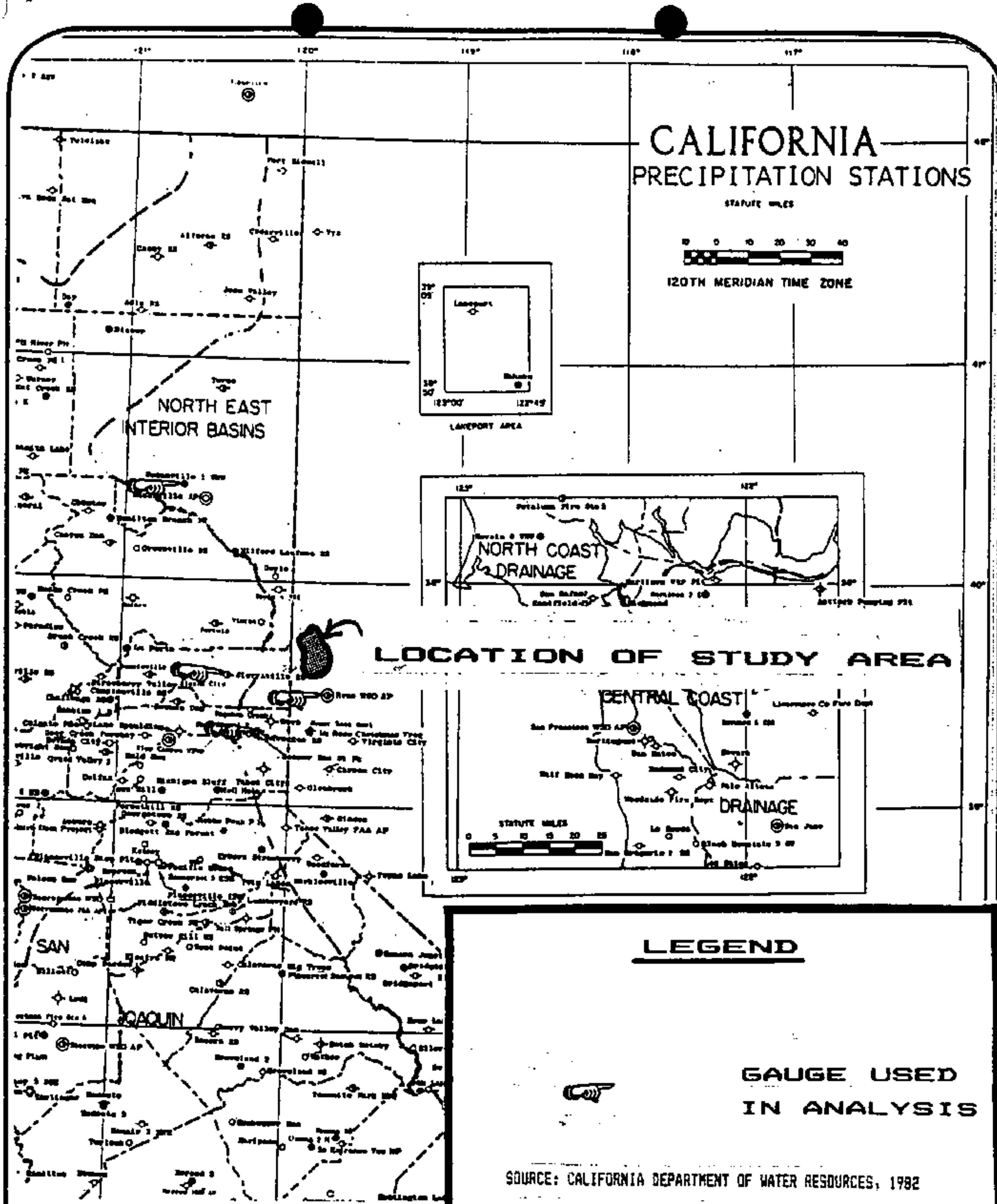
I hope these comments will assist you in your review. Design I-D-F information superior to NOAA Atlas is needed for the Reno/Sparks area. I am in hopes that improvements can be made to the information generated by the Winzler and Kelly study to provide this needed design information. It is unfortunate that more historical data is not available. If corrections are made to the rainfall information, it may be necessary to modify the statistics once additional data is obtained. If I can be of any further assistance, please do not hesitate to call me.

Sincerely,

NIMBUS ENGINEERS

Mark E. Forest,
Senior Hydrologist

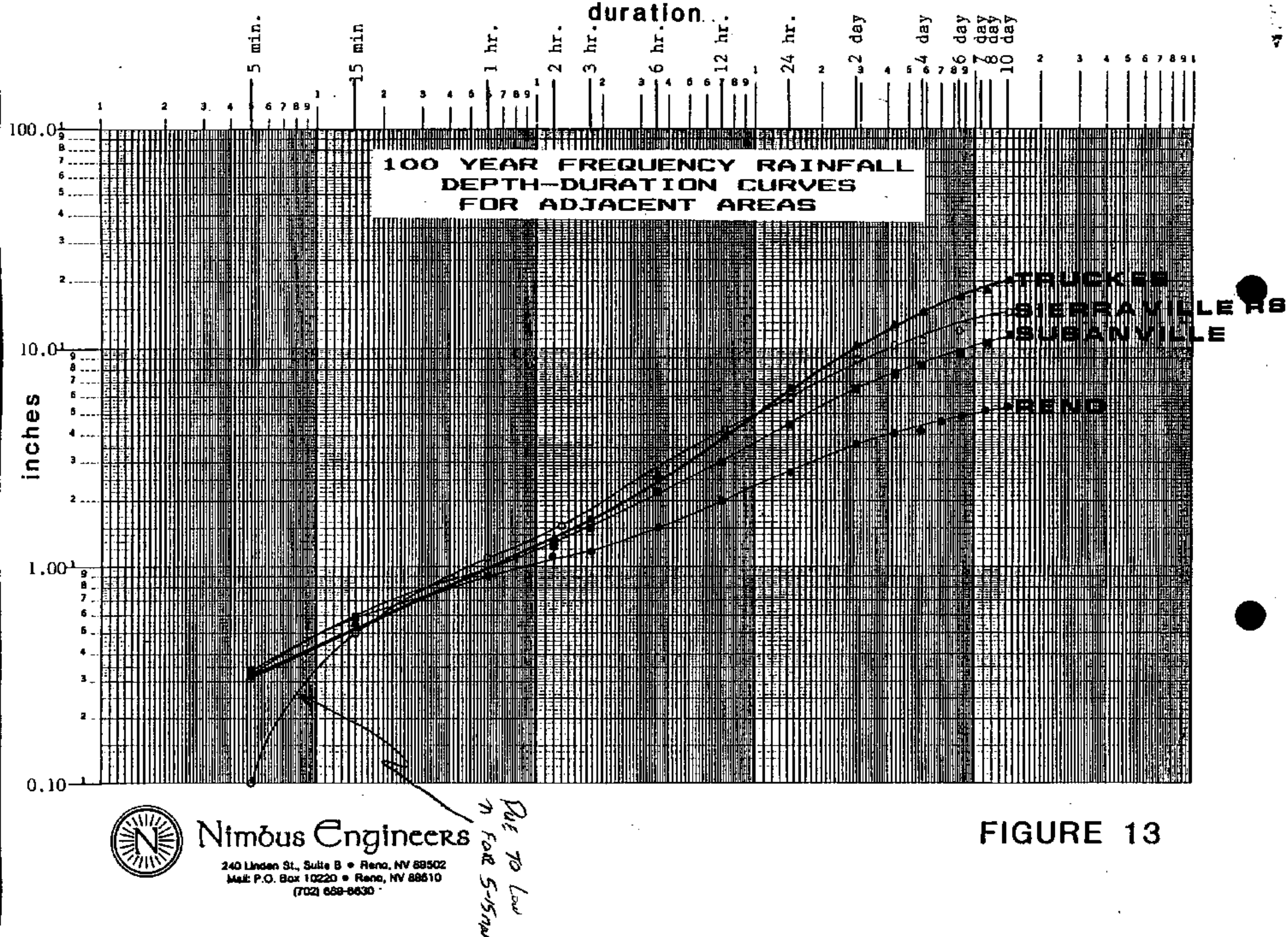
MEF/dle
Enclosure



Nimbus Engineers
240 Linden St., Suite B • Reno, NV 89502
Mail: P.O. Box 10220 • Reno, NV 89510
(702) 689-8630

FIGURE 12

LOCATION OF GAUGES USED IN COMPARISON OF RAINFALL STATISTICS



Nimbus Engineers
240 Linden St., Suite B • Reno, NV 89502
Mail: P.O. Box 10220 • Reno, NV 89510
(702) 689-8630

FIGURE 13

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL WEATHER SERVICE
Forecast Office
601 South Rock Blvd
Reno Nevada, 89502

RECEIVED
SEP 8 1987
NIMBUS ENGINEERS

Sept. 5, 1987

Mark Forest, Senior Hydrologist
Nimbus Engineers
240 Linden St., Suite B
Reno, Nevada 89502

RE: Your letter of Aug. 12, 1987 concerning Precipitation/Duration/Frequency data for the Lemmon Valley Area and followup telephone call.

Dear Mark:

I have reviewed your letter and the other information you provided me concerning your study of Precipitation/Duration/Frequency data for the Lemmon Valley area. I would like to make a number of general comments concerning the difficult problem your dealing with. They mainly support the idea that 24 hour and 10 day, 100 year precipitation values should be significantly higher than what would be obtained by using NOAA Atlas 2 and Technical Paper 49. These publications use simplified approaches that are based on extremely limited data. As noted in some of your literature, we must look at two separate problems, the summer convective storms and the winter season storms.

The potential rainfall from summer convective storms is not very dependent on elevation. There is a somewhat greater variance in the frequency of heavy convective storms due to terrain. My subjective view is that in this area the greatest frequency of heavy convective rains tend to occur along the foothills. Within the last 25 years there have been many 2 to 3 inch short duration rain events in the general area. This includes the thunderstorm this year that dropped 2 inches of rain in 45 minutes near the Reno airport. Some known extreme events in the area include 6 1/2 inches of rain in about 2 hours on an alluvial fan northwest of Yerington in 1982 and an estimated 5 inches of rain over portions of Galena, Whites, and Third Creek basins in August 1965. In southeast Nevada convective storms have produced over 8 inches of rain in a few hours. There seems to be enough evidence that the 24 hour 100 year precipitation event should be no less than 3 inches even in the valleys of western Nevada. We feel 5 inches events are certainly possible even in these valleys, but the frequency for any one location may very well be in excess of 100 years for this size event in most of the area.

Heavy rain events in the winter are normally associated with stong southwesterly winds aloft. The distribution of associated with them is strongly related to the terrain. The relationship is rather complex, but simply put there are three factors which determine the variance of rainfall in this area. They are elevation, upwind distance from the major ridge line, and the height of the upstream ridge line(s). The revision I have provided you of Figure 3, Isohyetal Map, Feb. 12-20, 1986, of your report is also, I believe, a fairly representative areal distribution for a typical major winter rain storm.

I am in general agreement with Mr. Leonard Crowe's comments in his letters to Nimbus Engineers, July 30, 1987 and August 3, 1987. I believe that the evidence he presented together with our information leaves little doubt that the values for 24 hour and 10 day, 100 year precipitation events for your study area should be significantly higher than what would be obtained by using NOAA Atlas 2 and Technical Paper 49.

Regarding your comments on the Wizzler and Kelly report for the City of Reno, I fully agree that the Rainfall Intensity/Duration/Frequency curves for the greater Reno area should be broken down into winter and summer season types. The duration intensities for short periods of time (less than 60 minutes) in their report are definitely too low for summertime convective storms and appear too high for winter storms.

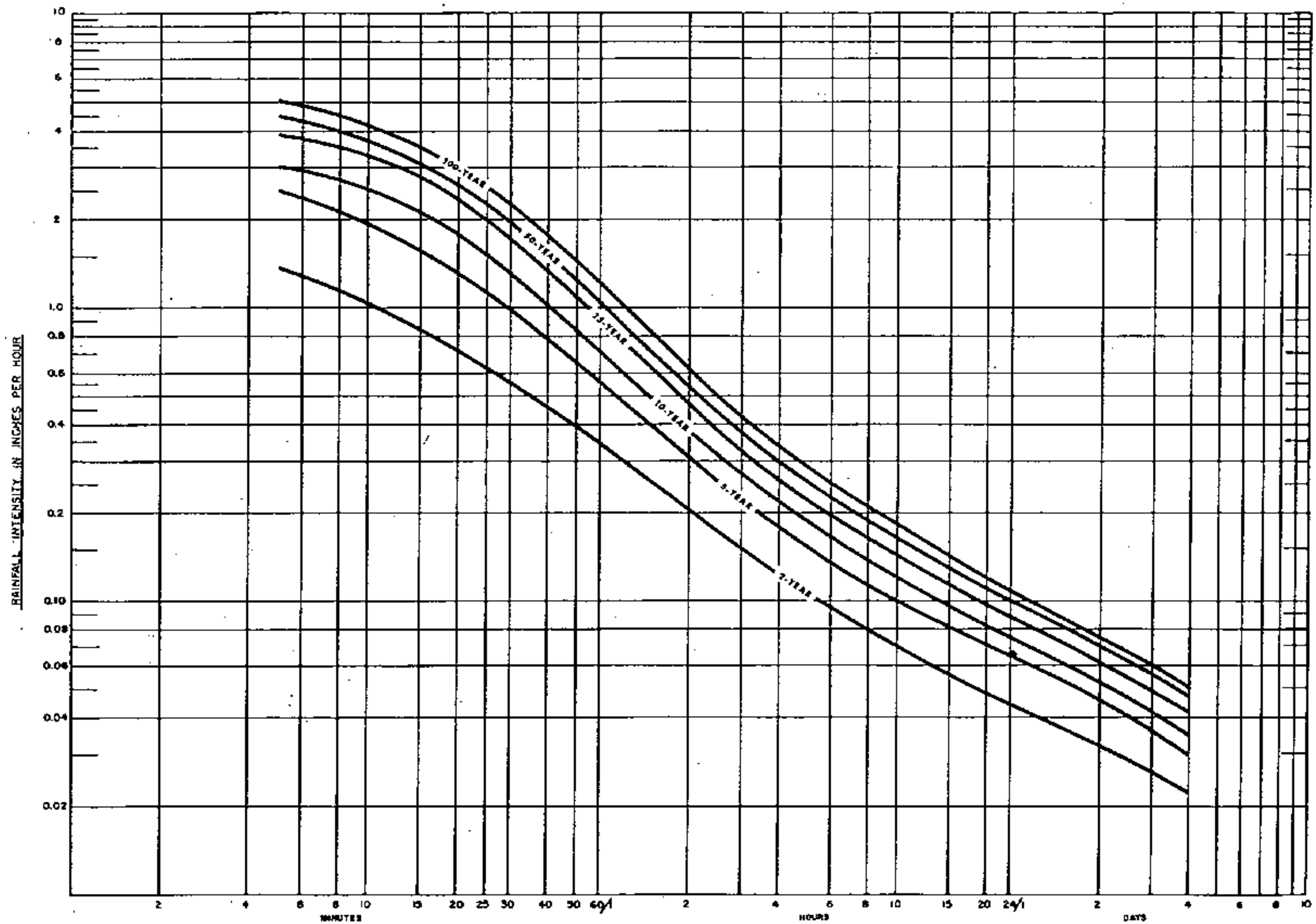
As for the chance of a major precipitation event following close after a 100 year event, I believe the chances of this happening are sufficiently high that this factor should not be ignored in your study. There is some tendency for winter patterns to repeat during a season. An El Nino-Southern Oscillation (ENSO) event is one factor which has a tendency to create persistent weather patterns. The persistent weather pattern can be either dry, as it was last year, or wet, as it was in 1982-83. There is no doubt other, still poorly understood, factors which tend to produce persistent weather patterns through most or all of a season. It is very unlikely that all of the smaller scale meterological features would come together to develop a repeat 100 year storm in the same area even though the larger scale weather pattern is similar. However, it is not at all unreasonable to assume the similar large scale pattern could produce a major precipitation event within a relatively short time frame after a hundred year event. The heavy rain event in March 1986 is a indication of this type happening.

I hope I have added some helpful insight to the problem your working on. If I can be of any further assistance please feel free to give me a call.

Sincerely,

Ronald S. Olson

Ronald S. Olson
Deputy Meteorologist In Charge



SOURCE OF DATA

U. S. DEPARTMENT OF COMMERCE, WEATHER BUREAU

PERIOD OF RECORD:

5 MIN. DURATION	1906 TO 1939
10 MIN. DURATION	1906 TO 1939
15 MIN. DURATION	1906 TO 1939
30 MIN. DURATION	1906 TO 1939
60 MIN. DURATION	1906 TO 1957
120 MIN. DURATION	1906 TO 1957
24 HR. DURATION	1906 TO 1957
MONTHLY DURATION	1906 TO 1957

K=1.0

R E N O - N E V A D A

A REPORT ON

STORM DRAINAGE AND SANITARY SEWERAGE

OCTOBER 1957

RAINFALL CURVES

INTENSITY-DURATION-FREQUENCY

ENGINEERING OFFICE OF CLYDE C. KENNEDY - SAN FRANCISCO

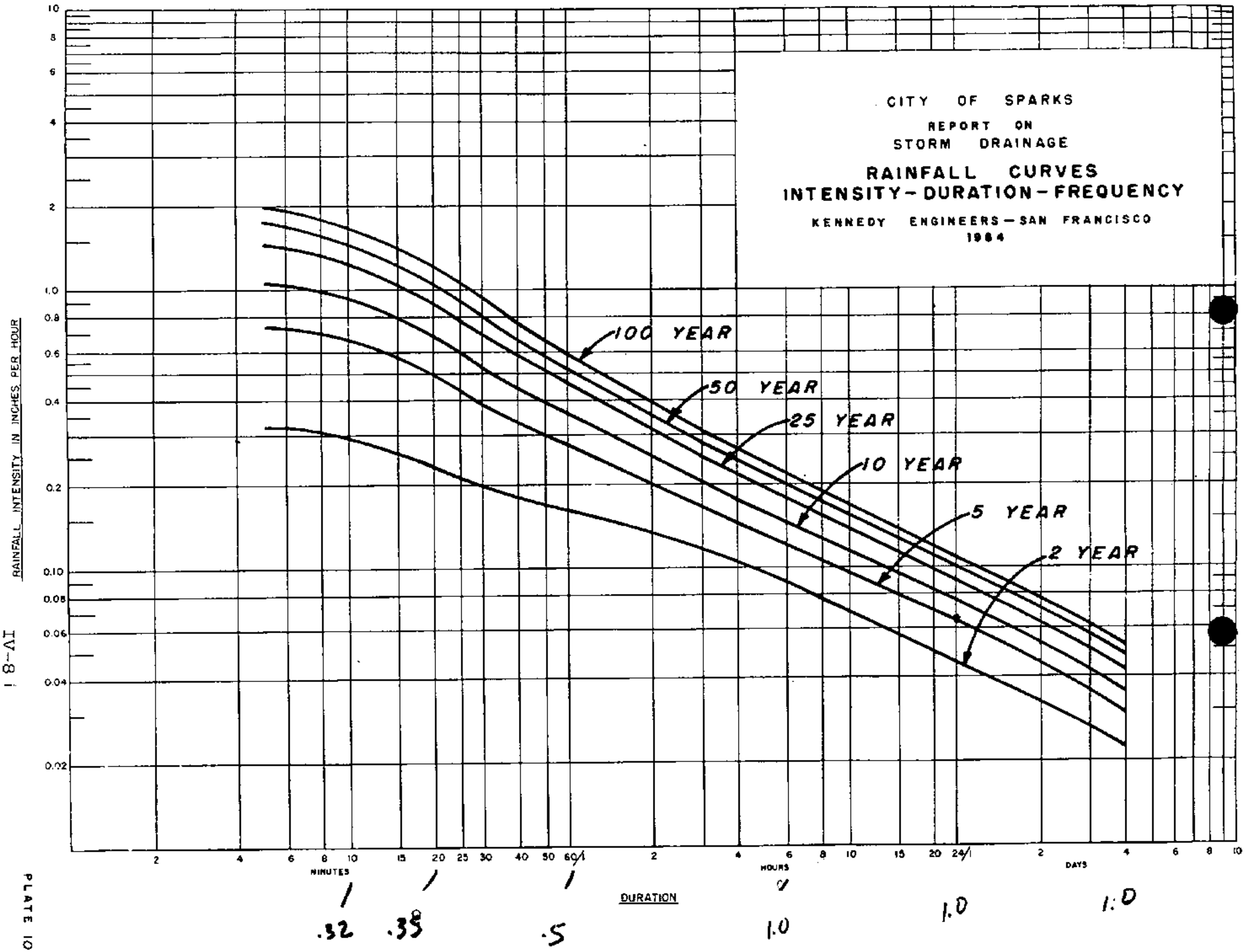

CITY OF SPARKS
REPORT ON
STORM DRAINAGE
RAINFALL CURVES
INTENSITY - DURATION - FREQUENCY
KENNEDY ENGINEERS — SAN FRANCISCO
1984
100 YEAR
50 YEAR
25 YEAR
10 YEAR
5 YEAR
2 YEAR
RAINFALL INTENSITY IN INCHES PER HOUR
MINUTES
HOURS
DAYS
DURATION
.32
.35
.5
1.0
1.0
1.0

PLATE 10

omni-means
ENGINEERS · PLANNERS

May 31, 1988

Steve Varela, City Engineer
City of Reno
P. O. Box 1900
Reno, Nevada 89505

Re: City of Reno Rainfall Isopleths

Dear Mr. Varela:

Omni-Means, Ltd. supports the initiation of research leading to the development of a better rainfall model for the Reno-Sparks area. Such research is in the interest of Omni-Means so that we may provide the most economical and efficient design to our clients. In particular, we support your suggestion that set flow rates be determined for large drainage channels, thus eliminating any controversy arising from variations in design flow calculations.

If there is anything we can do to assist you in this matter, please feel free to give me a call.

Very truly yours,

Robert Jackson, P.E.

RJ:cp

RENO
6121 Lakeside Drive, Ste. 100
Reno, Nevada 89511
(702) 825-1223

SACRAMENTO
2240 Douglas Boulevard, Ste. 260
Roseville, CA 95661
(916) 782-8688 / 969-8688

WALNUT CREEK
2500 Camino Diablo, Ste. 220
Walnut Creek, CA 94596
(415) 935-2230

SUMMIT ENGINEERING CORPORATION™

THOMAS H. GALLAGHER, P.E., R.L.S.
DON M. MC HARG, R.L.S.

5405 MAE ANNE AVENUE • RENO, NEVADA 89523 • PHONE (702) 747-8550 • FAX (702) 747-8559

May 31, 1988

CITY OF RENO
Engineering Department
Post Office Box 1900
Reno, Nevada 89505

ATTENTION: Steve Varela

RE: City of Reno Hydrology

Dear Steve:

The following is a list of SUMMIT Engineering's concerns with the City's present design policies regarding storm drainage:

1) The isopleth maps are based on unreliable data.

   a) The standard deviation is so high it indicates a lack of correlation in the data.

   b) In the equations used to plot the isopleth lines, there is an X, Y, and Z term. It would be helpful to know the location of the origin of these points.

   c) The trend of the isopleth lines seems reasonable. However, the magnitude of the multipliers, is unreasonable.

   d) On the 1 inch = 2000 feet overlay the location of the airport station moves from wet season to dry season.

   e) The basic assumption that the intensity of a short duration storm should be increased by the same ratio as monthly total rainfall or even daily rainfall is unreasonable.

We look forward to hearing the results of your investigation and any decisions you might reach in regard to this matter.

If you have any questions or if we can be of further assistance to you please do not hesitate to call.

Sincerely,

SUMMIT ENGINEERING CORPORATION

James F. Rienstra

James F. Rienstra
Project Manager

JFR:dah

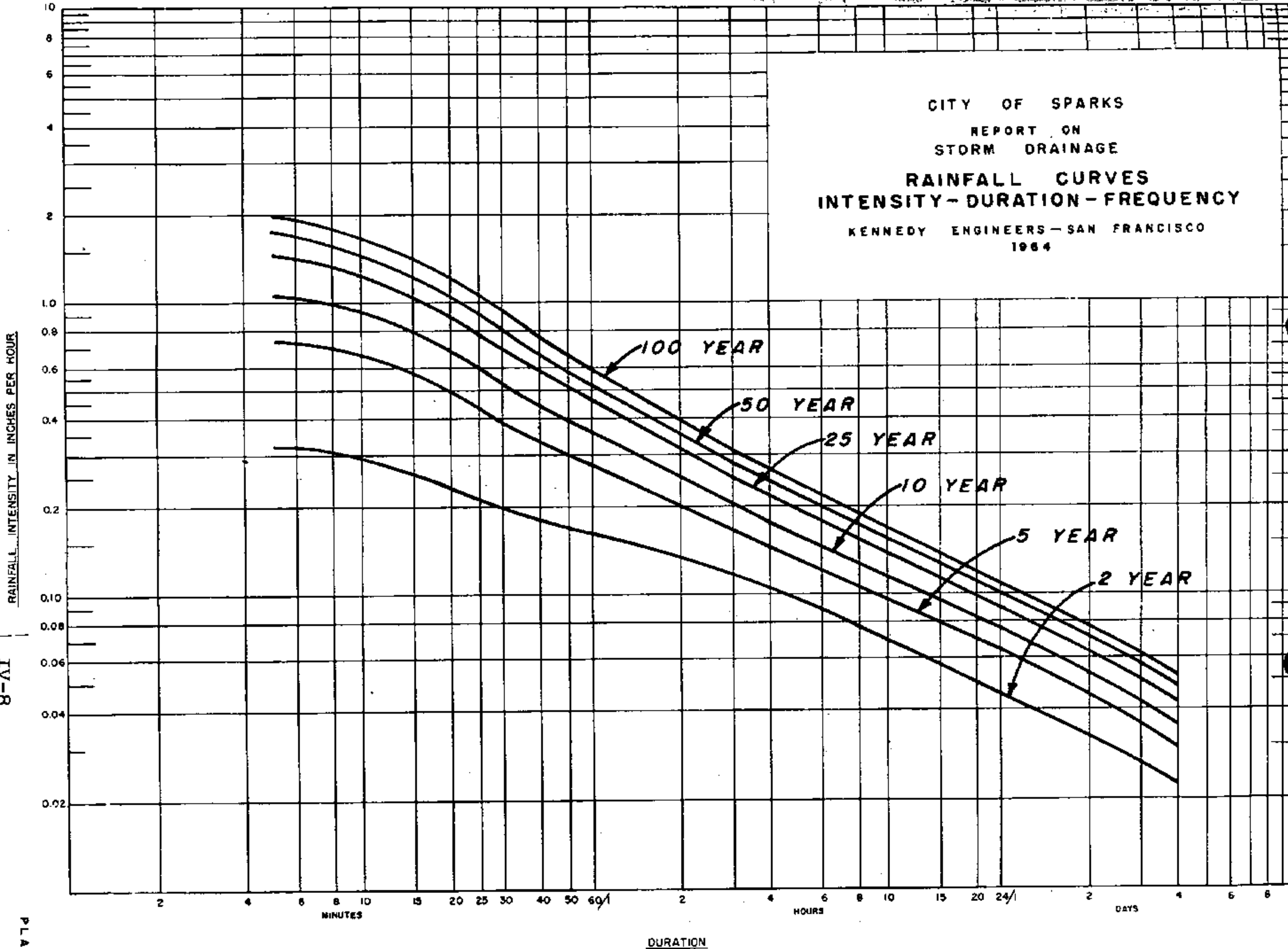

CITY OF SPARKS
REPORT ON
STORM DRAINAGE
RAINFALL CURVES
INTENSITY - DURATION - FREQUENCY
KENNEDY ENGINEERS — SAN FRANCISCO
1964
100 YEAR
50 YEAR
25 YEAR
10 YEAR
5 YEAR
2 YEAR
RAINFALL INTENSITY IN INCHES PER HOUR
10
8
6
4
2
1.0
0.8
0.6
0.4
0.2
0.10
0.08
0.06
0.04
0.02
2 4 6 8 10 15 20 25 30 40 50 60/1
MINUTES
2 4 6 8 10 15 20 24/1
HOURS
2 4 6 8 10
DAYS
DURATION

PLATE 10

Phase 2: Development of Rainfall Isopleth Map

(Task 2A) Analysis of Spatial Variation of Precipitation -

Attempts were made to obtain rainfall data from as many rain gauging stations in the area as possible. A list of rain gauging stations in the Great Basin is compiled by John James, the State climatologist. There are about twelve unofficial stations in the list that are located within or near the study area. However, only nine of them have daily rainfall information available for use; they are located at Dickerson Road, Royal Drive, Upper Skyline, Ganser, La Veaga Ct., Verdi, Sparks Fire Station, Sierra Sage Road, and Christmas Tree. It is unfortunate that we were unable to locate any retrievable rainfall information related to the Air Force Base at Stead, Nevada.

The rainfall events that occurred during each year were separated into two seasons. Those occurring from November to April were considered to be generated by frontal type storm events, and those from May to October were considered to be from convection or "thunderstorm" type events. Each recorded event at every location was compared and a ratio computed to the corresponding values recorded by the local weather service station at Reno Cannon Airport. Then the ratios were categorized into the corresponding wet (frontal) or dry (thunderstorm) seasons for each of the nine locations. Both the concurrent monthly maximum daily rainfall and the monthly total rainfall were used to calculate the ratio with respect to the record at the Reno Cannon Airport. To develop the rainfall isopleth maps for both dry and wet seasons, the averages of the ratio in each station were computed and used. The values of average ratio, the number of months used in its computation, and some statistics are shown in Table 5a for the monthly maximum daily rainfall and in Table 5b for the monthly total rainfall.

As can be expected, the values of standard deviation for the dry season in most stations is larger than that of the wet season because most storm events occurring in the dry season are of the convection type. Variability of the ratio in any given station using the monthly maximum daily rainfall is generally higher than that using the monthly total rainfall. However, the mean values of the ratio based on either the monthly maximum daily rainfall or the monthly total rainfall do not differ significantly. As a result, the average of the two ratios was used for the development of rainfall isopleth maps.

TABLE 5a. RATIO OF MONTHLY MAXIMUM DAILY RAINFALL TO RENO CANNON AIRPORT STATION

Station Name	Season	No. of Records	Average Ratio	Standard Deviation
Sparks Fire Station	Wet	43	1.16	0.62
	Dry	34	1.72	2.02
La Veaga Court	Wet	10	1.04	0.42
	Dry	9	2.01	1.94
Royal Drive	Wet*	--	----	----
	Dry*	--	----	----
Dickerson Road	Wet	44	1.45	0.63
	Dry	36	1.46	0.83
Ganser	Wet	24	1.92	1.31
	Dry	17	1.38	0.74
Sierra Sage	Wet	6	1.54	0.61
	Dry*	--	----	----
Upper Skyline	Wet	18	2.34	1.71
	Dry	14	1.48	0.92
Christmas Tree	Wet	40	4.53	4.32
	Dry	32	3.35	3.26
Verdi	Wet	6	3.27	1.86
	Dry	2	2.48	2.34

*Information not available

TABLE 5b. RATIO OF MONTHLY TOTAL RAINFALL TO RENO CANNON AIRPORT STATION

Station Name	Season	No. of Records	Average Ratio	Standard Deviation
Sparks Fire Station	Wet	43	1.03	0.38
	Dry	34	1.58	1.44
La Veaga Court	Wet	10	1.06	0.47
	Dry	9	1.66	0.95
Royal Drive	Wet	6	1.30	0.18
	Dry	6	3.10	3.43
Dickerson Road	Wet	44	1.43	0.44
	Dry	36	1.54	0.71
Ganser	Wet	24	1.64	0.51
	Dry	17	1.41	0.57
Sierra Sage	Wet	6	1.51	0.18
	Dry*	—	—	—
Upper Skyline	Wet	18	2.04	0.78
	Dry	14	1.49	0.88
Christmas Tree	Wet	40	4.96	3.58
	Dry	32	3.59	2.80
Verdi	Wet	6	3.87	1.64
	Dry	2	2.91	1.55

*Information not available

(Task 2B) Development Rainfall Isopleth Maps-

The average values of the mean ratios obtained from the monthly maximum daily rainfall and the monthly total rainfall for each station listed in Table 5 were used to develop rainfall isopleth maps for both the dry and wet seasons. The isopleth maps prepared cover an area between 39° 21' - 39° 40' in latitude and 119° 40' - 119° 56' in longitude. The total plane area is approximately 77 square miles.

In view of sparseness of data points with variable degrees of accuracy, it is felt that the use of an elaborate mapping technique is not necessary. The technique used for assessing the general spatial trend of rainfall is called the trend surface analysis. The trend surface analysis is a simple technique which relates the variable of interest (rainfall ratio in this case) to geographical coordinates such as (X,Y,Z) in which X and Y are plane coordinates of the data points with respect to a predetermined origin and Z can be the elevation of the observation point. A number of trend surface equations were examined and the corresponding maps drawn. It is felt that the following two trend surface equations might adequately describe the general spatial variation of rainfall around the Reno area.

(1) For the wet season:

$$R = -13.87 - 1.85X^{1/4} + 19.25Z^{1/4} \quad (\text{Z in miles})$$

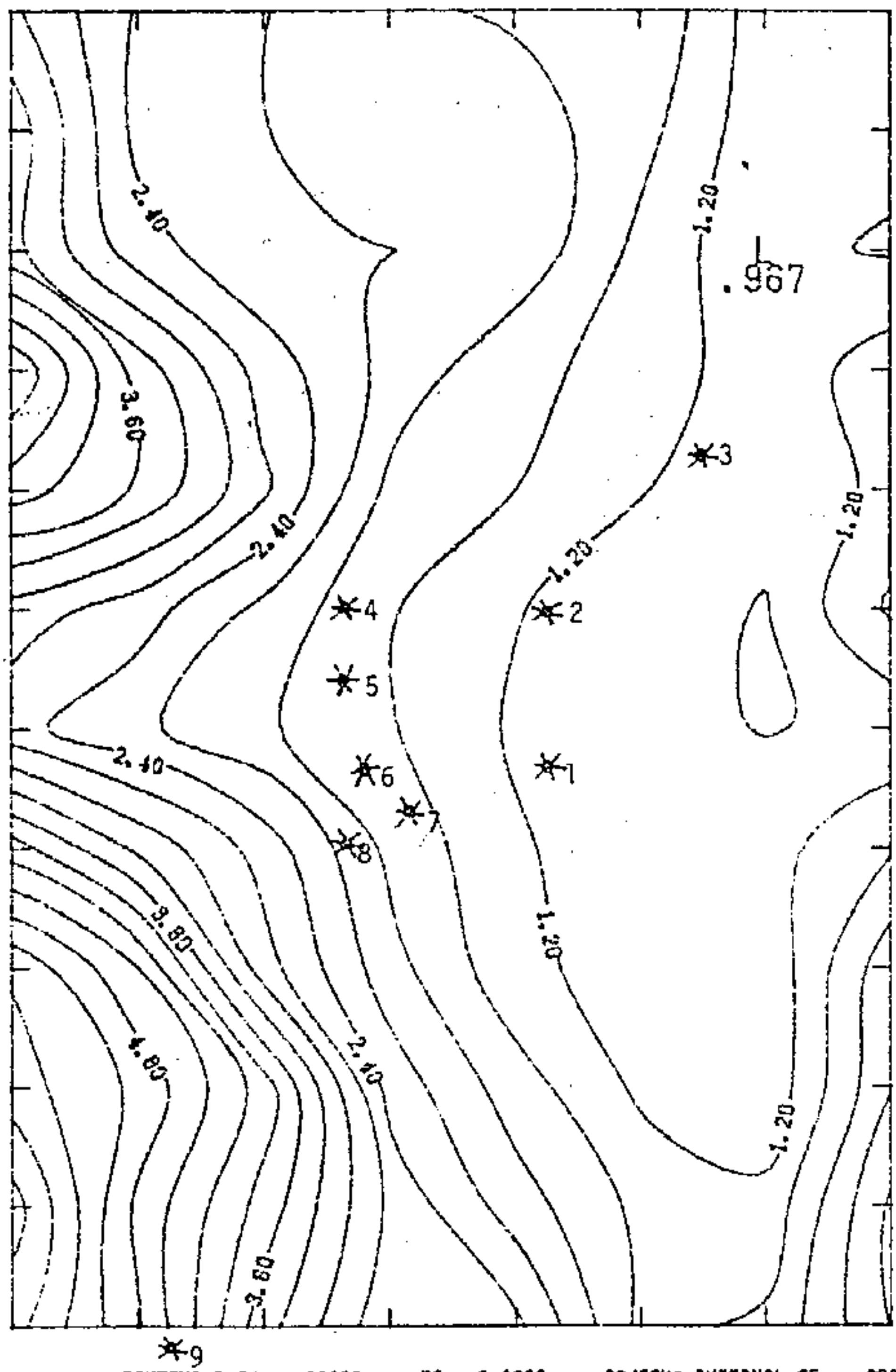
(2) For the dry season:

$$R = 0.5455 - 0.3983X^{1/2} + 7.511 \times 10^{-3}Y^2 + 5175 \times 10^{-8} \quad (\text{Z in feet})$$

Where R is the ratio of rainfall depth at any location with coordinate (X,Y,Z) to the rainfall depth at the Reno Cannon Airport station, X and Y are plane distances in miles along east-west and south-north directions, respectively, and Z is the elevation. (Note that the X,Y coordinate plane origin is at the lower left hand corner of the map.)

As can be seen, the equation derived for the wet season does not include a term of Y. This implies that, during the wet season in winter, the frontal type of storm generally covers large areas and does not produce noticeable differences in rainfall depth along the north-south direction. Rainfall depth tends to become large as elevation gets higher as shown by a positive sign associated with the Z term. The negative sign associated with the X term indicates that the rainfall depth decreases as the point of interest moves from west to east. The contour maps for both the wet and dry seasons around the Reno area are shown in Figures A-4 and A-5, respectively.

WET SEASON (NOVEMBER - APRIL)

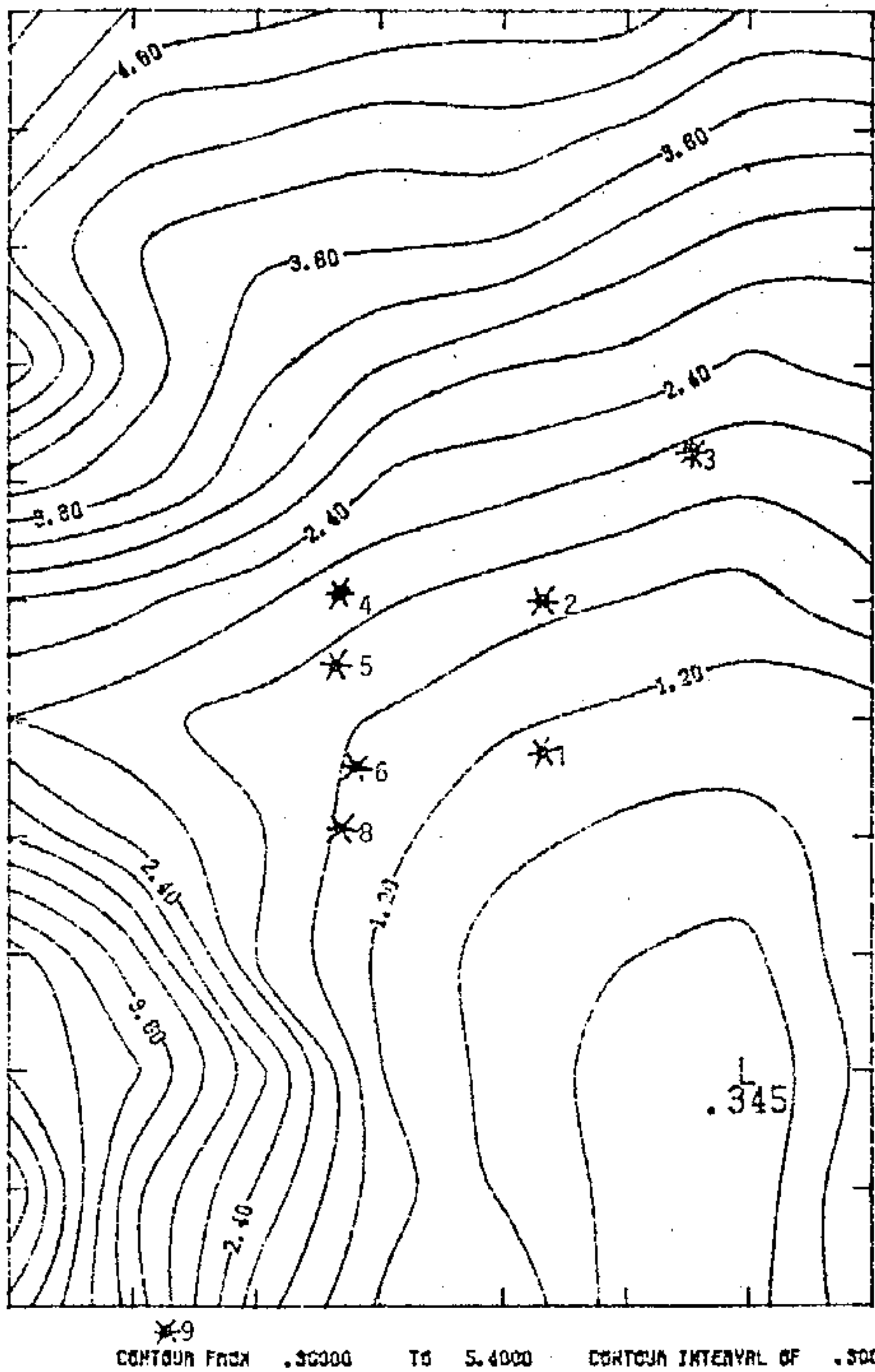


1 - Cannon Airport
2 - Sparks Fire Sta.
3 - La Veaga Ct.
4 - Royal Dr.
5 - Dickerson Rd.
6 - Ganser
7 - Sierra Sage Ln.
8 - Upper Skyline
9 - Chrismas Tree
10 - Verdi

CONTOUR FROM .60000 TO 6.0000 CONTOUR INTERVAL OF .30000 PT(9,3)= 4.0873

Figure A-4

DRY SEASON (MAY - OCTOBER)



1 - Cannon Airport
2 - Sparks Fire Sta.
3 - La Veaga Ct.
4 - Royal Dr.
5 - Dickerson Rd.
6 - Ganser
8 - Upper Skyline
9 - Chrismas Tree
10 - Verdi

Figure A-5

City of Reno

POST OFFICE BOX 1900 • RENO, NEVADA 89505

April 10, 1986

Mr. Rick Jorgensen
Winzler and Kelly Consulting Engineers
609 Mission Street, Suite 400
San Francisco, CA 94105-3586

SUBJECT: RAINFALL DATA

Dear Rick:

Transmitted herewith are the rainfall data provided to the City by Leonard Crowe, Washoe County Planning Staff. We would like for you and Dr. Tung to analyze this data and determine how well it correlates to the isopluvial maps you provided us as part of the Storm Drain Deficiency Study.

We are anxious to meet with Winzler and Kelly and Dr. Tung to be briefed on the rainfall IDF curve analysis. Please try to schedule this as soon as practical for you and Dr. Tung.

Sincerely,

ROBERT M. JACKSON
PUBLIC WORKS DIRECTOR

By: William N. Vann, Jr.
William N. Vann, Jr.
Design Engineer

RMJ:WNV:cs

WASHOE COUNTY

"To Protect and To Serve"

RECEIVED
APR 3 1986
Engineering Div.

241 RIDGE STREET
POST OFFICE BOX 11130
RENO, NEVADA 89520
PHONE (702) 785-4043

DEPARTMENT OF COMPREHENSIVE PLANNING
Robert N. Young, Director

To: Mr. Kirk Nichols, Washoe County Public Works Department
Mr. Larry Quilici, Sparks Public Works Department
Mr. Bill Vann, Reno Public Works Department

From: Mr. Leonard E. Crowe, Jr., Washoe County Department of Comprehensive Planning

Re: Storm Amounts Recorded During the February 1986 Flooding

Date: 3 April 1986

Staff has received the precipitation information gathered by the independent weather observers in the Truckee Meadows and Stead from Dr. Hal Klieforth. This information has been regressed against the elevation of the rainfall gage site. The regression equations and plots of precipitation and elevation are appended.

The equations and plots appear to match the information provided in the Winzler and Kelly report that was developed by Dr. Tung (appended) at least for one day and longer duration storms. No information is available yet for the short duration storms and for the distribution of the storm on an hourly basis. As this information becomes available staff will transmit it.

Staff would caution extrapolating the storm amounts beyond the elevations given. Rainfall IDF curves for Boca, Truckee, Donner, etc., (appended) appear to indicate that intensities tend to level off at the higher elevations. When staff has received the rainfall data from these other stations this question will be addressed.

Staff would suggest that this information be given to the FEMA contractors for consideration in the Spanish Springs, Lemmon Valley and Vista Lake/Sparks studies.

THE FOLLOWING VARIABLES ARE CURRENTLY IN FILE B:PRECIP2:

VARIABLE NAME	TYPE	RANK	LENGTH	DATE	TIME	COMMENT
FDIRECTORY				4/ 3/86	10:33	FILE DIRECTORY
Date	C	2	9 7	4/ 3/86	10:58	Truckee Meadows
EL4390RW	N	1	9	4/ 3/86	10:58	Reno Weather Service
EL4410SF	N	1	9	4/ 3/86	10:58	Sparks Fire #2
EL4420LV	N	1	9	4/ 3/86	10:58	LaVeaga, Sparks
EL4500MS	N	1	9	4/ 3/86	10:58	MacArther, Sparks
EL4650HK	N	1	9	4/ 3/86	10:58	Royal D, Reno
EL4650RS	N	1	9	4/ 3/86	10:58	Ranch San Rafael
EL4700VF	N	1	9	4/ 3/86	10:58	Virginia Foothills
EL4700LT	N	1	9	4/ 3/86	10:58	Lone Tree Lane
EL4750RI	N	1	9	4/ 3/86	10:58	Rhode Is, Reno
EL4800SG	N	1	9	4/ 3/86	10:58	Sagitarrius, Reno
EL4950SK	N	1	9	4/ 3/86	10:58	Skyline, Reno
EL5120ST	N	1	9	4/ 3/86	10:59	Stead Fire-Golf Course

USE CURSOR KEYS TO HIGHLIGHT DESIRED VARIABLE, THEN PRESS:
C=COMMENT D=DISPLAY E=ERASE N=NEW R=RENAME U=UPDATE

1HELP 2LABEL 3SAVSC 4RECORD 5 6 7 8 9REVIEW 10QUIT

PRINT THR APR 3 1986 11:25:00 AM VERSION 1.2 REC:OFF

Data Editor

Date Updated: 04/03/86

Maximum Rows: 9
Number of Cols: 13

Row	Date	EL4390RW	EL4410SF	EL4420LV	EL4500MS	EL4650HK
1	2/12/86	0.02	0.00	0.08	0.05	0.01
2	2/13/86	0.22	0.34	0.21	0.30	0.40
3	2/14/86	0.53	0.05	0.46	0.53	0.05
4	2/15/86	0.75	0.80	0.82	0.82	0.78
5	2/16/86	0.22	0.74	0.21	0.29	0.83
6	2/17/86	0.96	0.51	0.72	0.85	1.12
7	2/18/86	0.83	0.40	1.12	0.95	1.25
8	2/19/86	1.06	1.74	1.25	1.47	2.11
9	2/20/86	0.03	0.60	0.04	0.08	0.79
10						
11						
12						
13						
14						
Length	9	9	9	9	9	9
Type	C	N	N	N	N	N

Cursor at Row 1 and Column 1

*1HELP 2SAVE 3DONE 4SORT 5DSORT 6VSORT 7DVSORT 8UNSORT 9PRINT 10QUIT

PRINT THR APR 3 1986 10:59:00 AM VERSION 1.2 REC:OFF

Data Editor

Date Updated: 04/03/86

Maximum Rows: 9
Number of Cols: 13

Row	EL4700VF	EL4700LT	EL4750RI	EL4800SG	EL4950SK	EL5120ST
1	0.32	0.04	0.00	0.01	0.02	0.05
2	0.45	0.39	0.43	0.45	0.55	0.74
3	0.72	1.40	0.05	0.61	0.00	0.15
4	1.27	1.04	1.01	1.03	0.00	1.26
5	0.72	1.79	0.71	0.51	2.35	1.10
6	3.31	1.23	1.28	1.93	2.26	2.31
7	0.74	1.50	1.51	1.62	2.78	2.86
8	1.46	0.22	2.28	2.14	2.16	2.63
9	0.16	0.00	0.76	0.40	0.94	0.66
10						
11						
12						
13						
14						
Length	9	9	9	9	9	9
Type	N	N	N	N	N	N

Cursor at Row 1 and Column 13

*1HELP 2SAVE 3DONE 4SORT 5DSORT 6VSORT 7DVSORT 8UNSORT 9PRINT 10QUIT

PRINT THR APR 3 1986 11:01:00 AM VERSION 1.2 REC:OFF

Data Editor   Maximum Rows: 9

Date Updated: 04/03/86   Number of Cols: 13

Row	EL4650RS	EL4700VF	EL4700LT	EL4750RI	EL4800SG	EL4950SK
1	0.02	0.32	0.04	0.00	0.01	0.02
2	0.34	0.45	0.39	0.43	0.45	0.55
3	0.04	0.72	1.40	0.05	0.61	0.00
4	0.88	1.27	1.04	1.01	1.03	0.00
5	0.75	0.72	1.79	0.71	0.51	2.35
6	0.92	3.31	1.23	1.28	1.93	2.26
7	0.72	0.74	1.50	1.51	1.62	2.78
8	1.88	1.46	0.22	2.28	2.14	2.16
9	0.72	0.16	0.00	0.76	0.40	0.94
10						
11						
12						
13						
14						
Length	9	9	9	9	9	9
Type	N	N	N	N	N	N

Cursor at Row 1   and Column 7

*1HELP 2SAVE 3DONE 4SORT 5DSORT 6VSORT 7DVSORT 8UNSORT 9PRINT 10QUIT

PRINT THR APR 3 1986 11:15:00 AM VERSION 1.2 REC:OFF

Data Editor

Date Updated: 04/03/86

Maximum Rows: 12
Number of Cols: 5

Row	Station	Elevation	OnedayRF	SixdayRF	NinedayRF	
1	Reno WS	4400	1.06	4.35	4.62	
2	Sparks F	4410	1.74	4.24	5.18	
3	LaVeaga	4420	1.25	4.58	5.91	
4	MacArthur	4500	1.47	4.91	5.34	
5	Royal	4650	2.11	6.14	7.33	
6	Rancho SF	4650	1.88	5.19	6.27	
7	Rhode I	4750	2.28	6.84	8.03	
8	Lone Tree	4700	1.79	7.18	7.61	
9	Virg FH	4700	3.31	8.22	9.15	
10	Sagits	4800	2.14	7.84	8.7	
11	Skyline	4950	2.78	9.55	11.08	
12	Stead F	5120	2.86	10.31	11.76	
13						
14						
Length	12	12	12	12	12	0
Type	C	N	N	N	N	N

Cursor at Row 1 and Column 1

*1HELP 2SAVE 3DONE 4SORT 5DSORT 6VSORT 7DVSORT 8UNSORT 9PRINT 10QUIT

PRINT THR APR 3 1986 10:23:00 AM VERSION 1.2 REC:OFF

Simple Regression of OnedayRF on Elevation

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	-9.02221	2.82007	-3.19929	9.50312E-3
Slope	2.37175E-3	6.03141E-4	3.93233	2.80958E-3

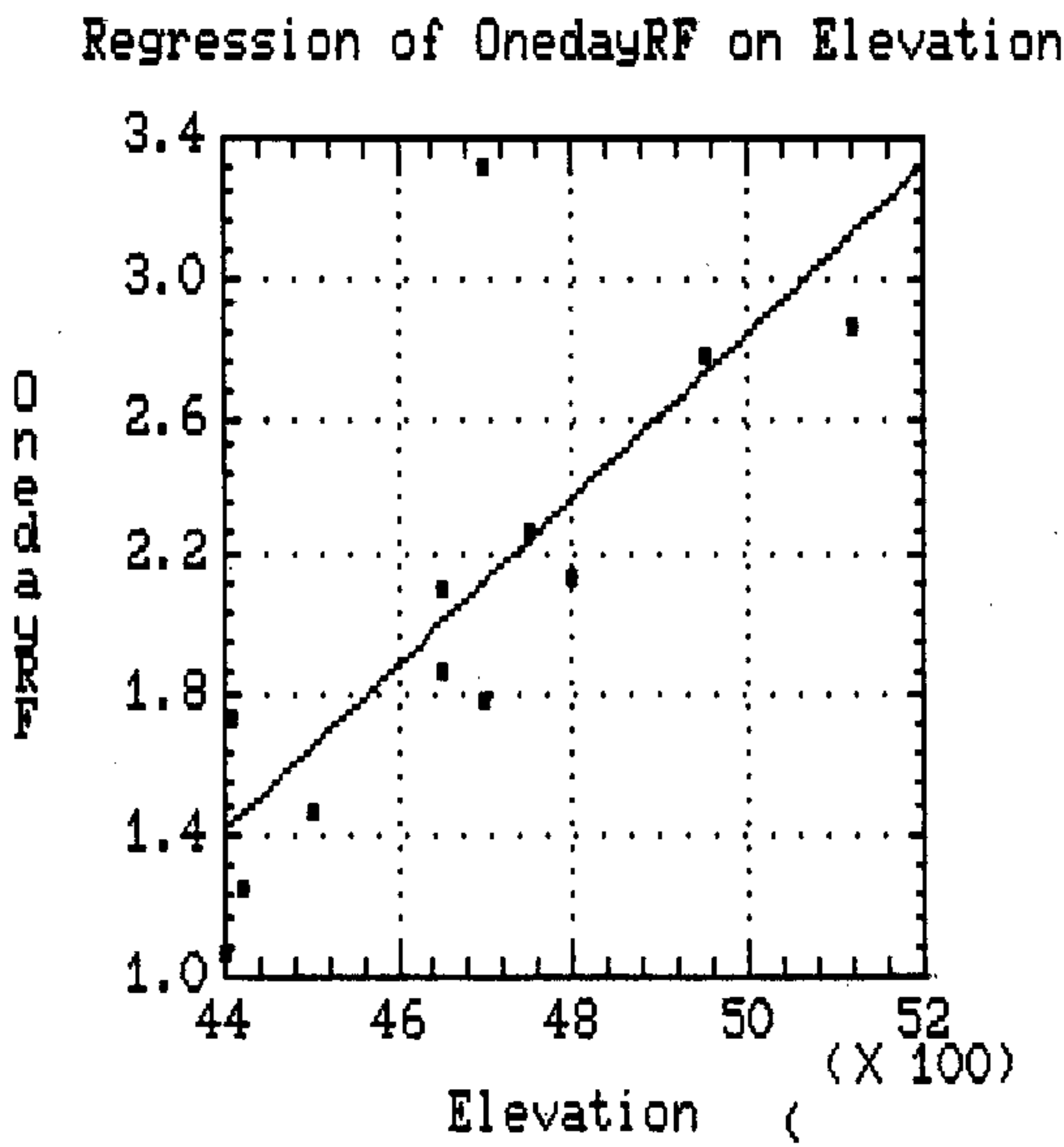
Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio
Model	3.030246	1	3.030246	15.463233
Error	1.9596457	10	.1959646	
Total (Corr.)	4.989892	11		

Correlation Coefficient = 0.77928
Stnd. Error of Est. = 0.442679

Do you want to plot the fitted line? (Y/N):

1HELP 2LABEL 3SAVSC 4RECORD 5 6 7 8 9REVIEW 10QUIT
PRINT THR APR 3 1986 08:49:00 AM VERSION 1.2 REC:OFF



Exponential model: Y = exp(a+bX) of OnedayRF on Elevation

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	-5.07113	1.34945	-3.75791	3.73495E-3
Slope	1.22907E-3	2.88614E-4	4.25853	1.66689E-3

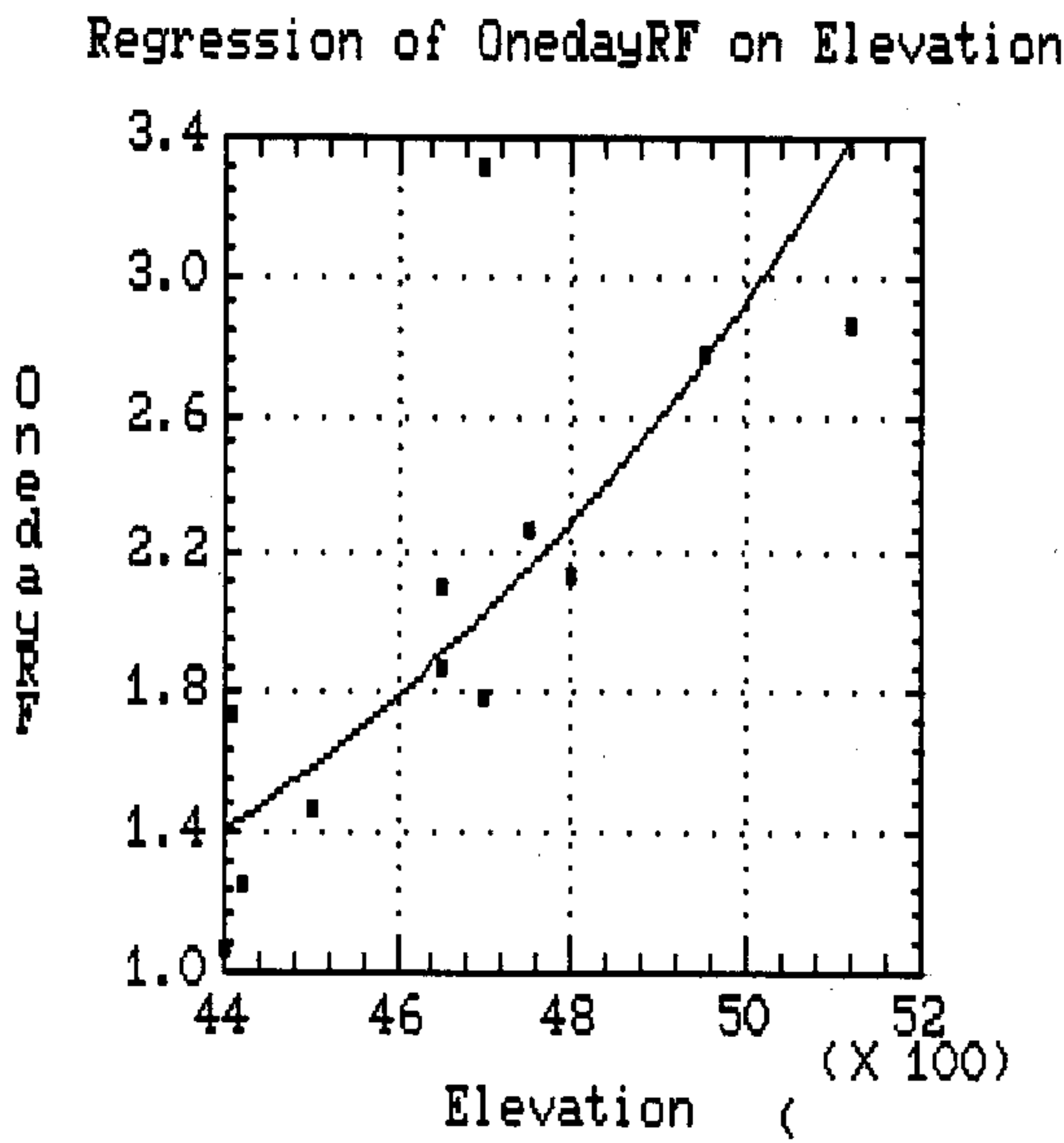
Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio
Model	.813757	1	.813757	18.135091
Error	.4487195	10	.0448719	
Total (Corr.)	1.262476	11		

Correlation Coefficient = 0.802852
Stnd. Error of Est. = 0.21183

Do you want to plot the fitted line? (Y/N):

1HELP 2LABEL 3SAVSC 4RECORD 5 6 7 8 9REVIEW 10QUIT
PRINT THR APR 3 1986 09:12:00 AM VERSION 1.2 REC:OFF



Simple Regression of SixdayRF on Elevation

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	-34.9425	4.10435	-8.51352	6.80052E-6
Slope	8.89669E-3	8.77816E-4	10.135	1.40548E-6

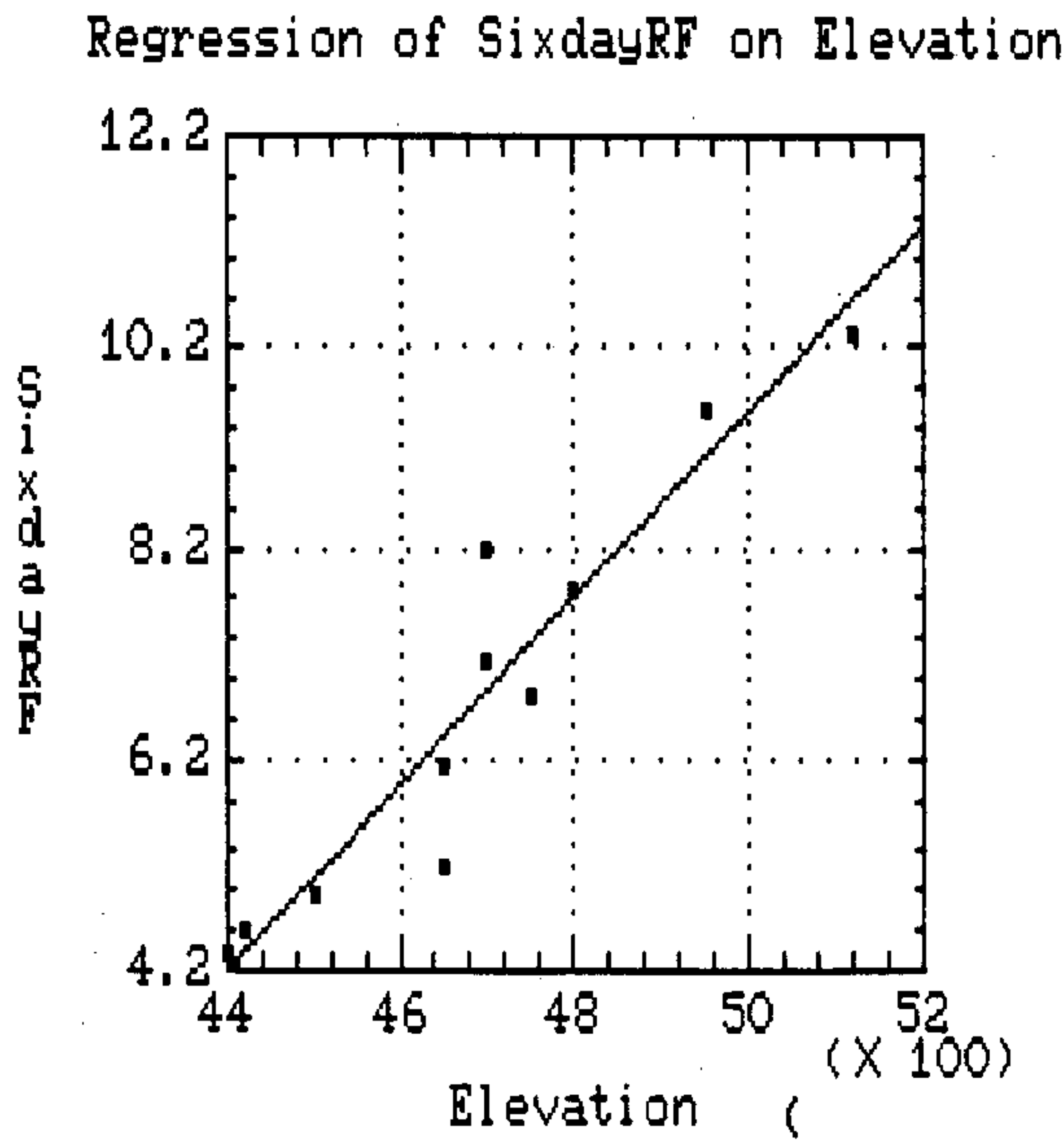
Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio
Model	42.63807	1	42.63807	102.71881
Error	4.1509510	10	.4150951	
Total (Corr.)	46.789025	11		

Correlation Coefficient = 0.954612
Stnd. Error of Est. = 0.644279

Do you want to plot the fitted line? (Y/N):

1HELP 2LABEL 3SAVSC 4RECORD 5 6 7 8 9REVIEW 10QUIT
PRINT THR APR 3 1986 09:25:00 AM VERSION 1.2 REC:OFF



Exponential model: Y = exp(a+bX) of SixdayRF on Elevation

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	-4.34977	0.657067	-6.61998	5.92778E-5
Slope	1.32625E-3	1.4053E-4	9.43746	2.69528E-6

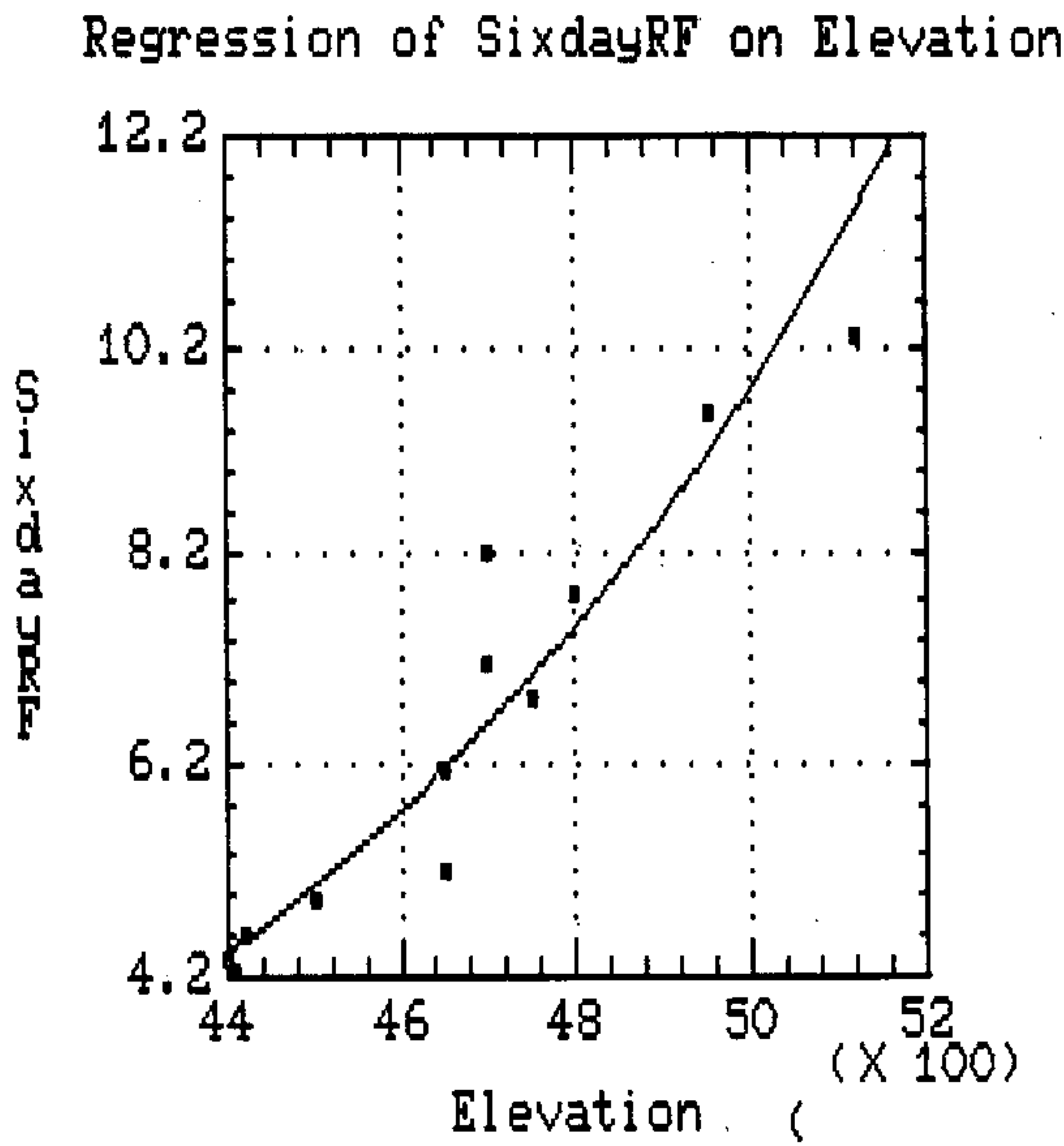
Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio
Model	.947520	1	.947520	89.065690
Error	.1063844	10	.0106384	
Total (Corr.)	1.053905	11		

Correlation Coefficient = 0.948186
Stnd. Error of Est. = 0.103143

Do you want to plot the fitted line? (Y/N):

1HELP 2LABEL 3SAVSC 4RECORD 5 6 7 8 9REVIEW 10QUIT
PRINT THR APR 3 1986 09:31:00 AM VERSION 1.2 REC:OF



Simple Regression of NinedayRF on Elevation

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	-38.7483	4.39134	-8.82382	4.94129E-6
Slope	9.919E-3	9.39195E-4	10.5612	9.61374E-7

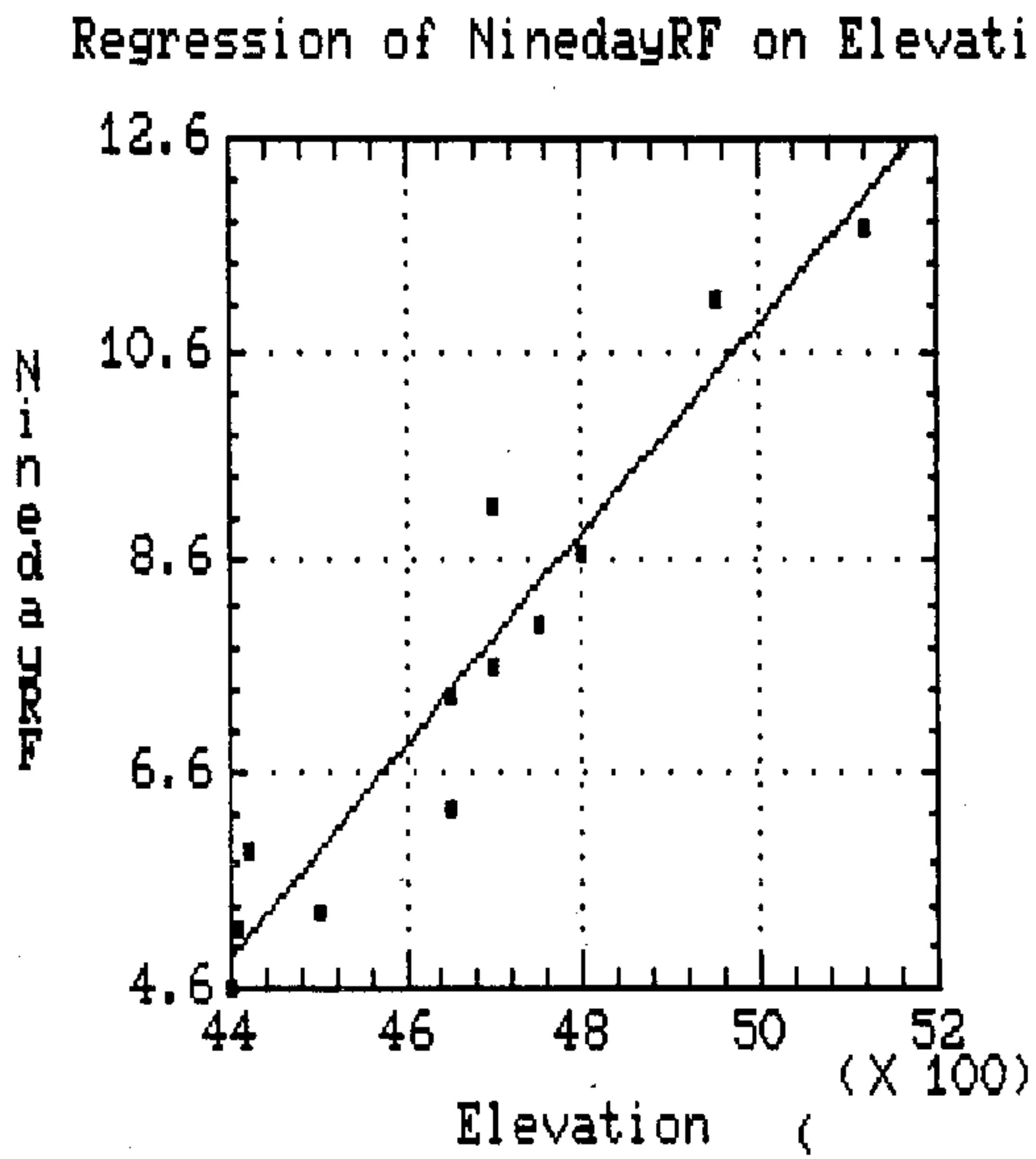
Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio
Model	53.00003	1	53.00003	111.53834
Error	4.7517324	10	.4751732	
Total (Corr.)	57.751767	11		

Correlation Coefficient = 0.957978
Stnd. Error of Est. = 0.689328

Do you want to plot the fitted line? (Y/N):

1HELP 2LABEL 3SAVSC 4RECORD 5 6 7 8 9REVIEW 10QUIT
PRINT THR APR 3 1986 09:38:00 AM VERSION 1.2 REC:OFF



Exponential model: Y = exp(a+bX) of NinedayRF on Elevation

Parameter	Estimate	Standard Error	T Value	Prob. Level
Intercept	-4.01155	0.632963	-6.33773	8.48481E-5
Slope	1.28373E-3	1.35375E-4	9.48278	2.58059E-6

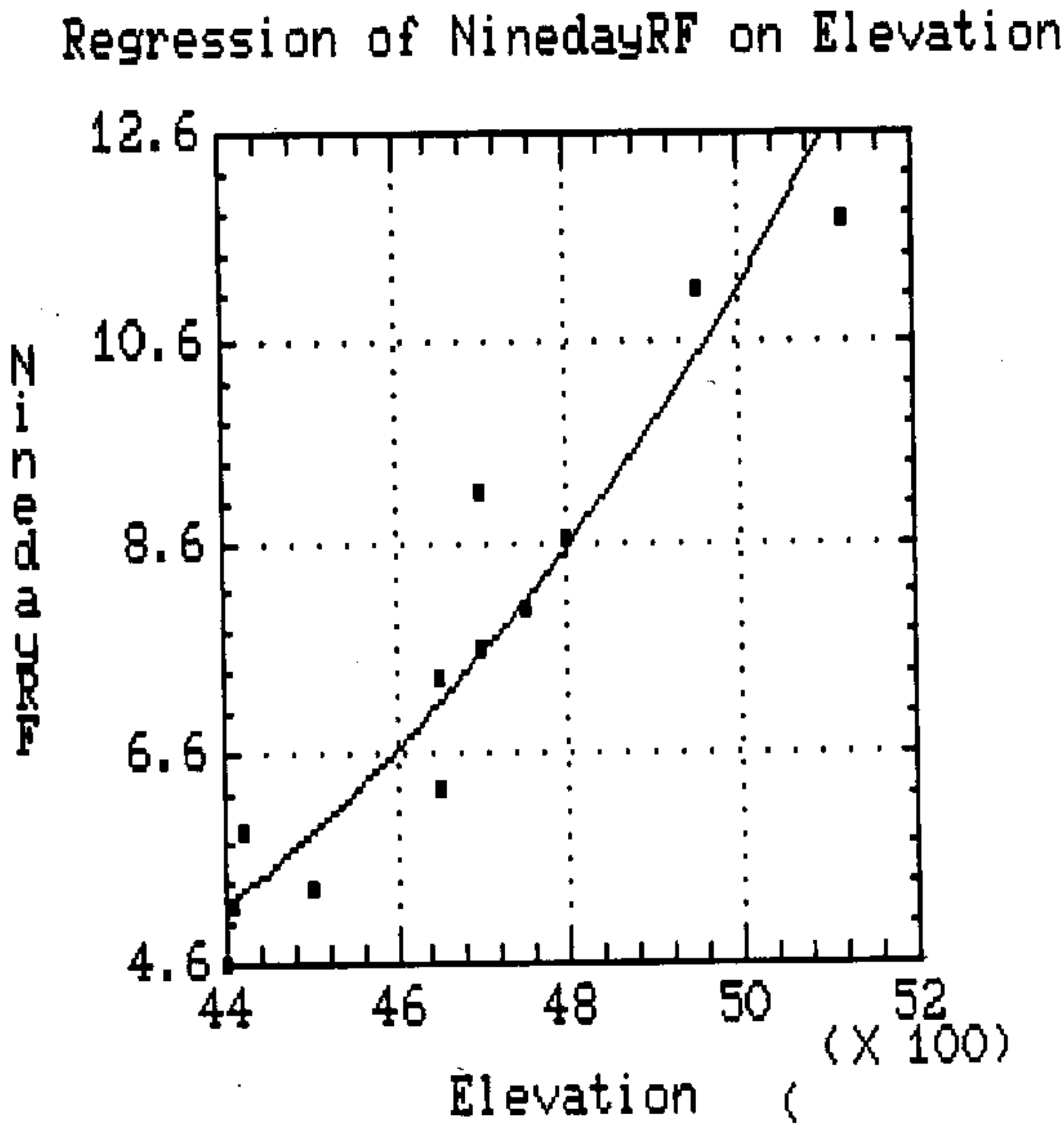
Analysis of Variance

Source	Sum of Squares	Df	Mean Square	F-Ratio
Model	.887741	1	.887741	89.923114
Error	.0987222	10	.0098722	
Total (Corr.)	.986463	11		

Correlation Coefficient = 0.948643
Stnd. Error of Est. = 0.0993591

Do you want to plot the fitted line? (Y/N):

1HELP 2LABEL 3SAVSC 4RECORD 5 6 7 8 9REVIEW 10QUIT
PRINT THR APR 3 1986 09:45:00 AM VERSION 1.2 REC:OFF



Westto Donner

MAXIMUM ANNUAL PRECIPITATION (IN)

STATION NO. BSN ORDER SUB	STATION NAME		ELEV	SEC	TWP	RNG LOT	QNM	LATITUDE	LONGITUDE	COUNTY CODE
G70 3439 20	GLENBROOK NEV	62	6400	10	14N	18E	N	39.083	119.933	62

DURATION
N=MINUTES,H=HOURS,D=DAYS,C Y=CALENDAR YEAR,W Y=WATER YEAR,F Y=FISCAL YEAR

YEAR	1D	2D	3D	4D	5D	6D	8D	10D	15D	20D	30D	60D	365D
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

PRECIPITATION DEPTH-DURATION-FREQUENCY TABLE

STATION NO. BSN ORDER SUB	STATION NAME		ELEV	SEC	TWP	RNG LOT	QNM	LATITUDE	LONGITUDE	COUNTY CODE
G70 3439 20	GLENBROOK NEV	62	6400	10	14N	18E	N	39.083	119.933	62

MAXIMUM PRECIPITATION FOR INDICATED DURATION D=DAYS H=HOURS

RETURN PERIOD IN YEARS	1D	2D	3D	4D	5D	6D	8D	10D	15D	20D	30D	60D	365D
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PMP	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MEAN	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CLOCK NO. COR.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CALCULATED SKEW	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
REGIONAL SKEW	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SKEW USED	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
KURTOSIS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
N	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RECORD YEAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RECORD MAXIMUM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NORMALIZED MAX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CALC. COEF. VAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
REGN. COEF. VAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
USED COEF. VAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MEAN/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP10/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP25/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP50/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP100/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP1000/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP10000/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PMP/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

PEARSON TYPE III DISTRIBUTION USED
PROBABLE MAXIMUM PRECIPITATION ESTIMATE BASED ON 15 STANDARD DEVIATIONS
WHERE N IS SMALL RESULTS ARE NOT DEPENDABLE

GRID 0 15

GRID 0 15

PRECIPITATION DEPTH-DURATION-FREQUENCY TABLE

STATION NO.	STATION NAME		ELEV	SEC	TWP	RNG LET	[illegible]	LATITUDE	LONGITUDE	COUNTY CODE
4?? 8?9? 0	TAHOE CITY	153	6230	07	15N	17E 0	N	39.166	120.140	31

MAXIMUM PRECIPITATION FOR INDICATED DURATION D-DAYS H-HOURS

RETURN PERIOD IN YEARS	1D	2D	3D	4D	5D	6D	8D	10D	15D	20D	30D	40D	365D
2	[illegible]	[illegible]	4.44	[illegible]	5.31	5.70	6.47	7.08	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MEAN	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10.236	[illegible]	16.757	[illegible]
KURTOSIS	6.153	[illegible]	[illegible]	4.730	[illegible]	[illegible]	5.523	5.973	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MEAN/A	[illegible]	.1408	.1654	.1817	[illegible]	.2161	[illegible]	[illegible]	[illegible]	[illegible]	.3817	[illegible]	1.0000

Other rows (5 to 10000 years, PMP; CLOCK HR. COR., CALCULATED SKEW, REGIONAL SKEW, SKEW USED; N, RECORD YEAR, RECORD MAXIMUM, NORMALIZED [illegible], CALC. COEF. VAR, REGN. COEF. VAR, USED COEF. VAR; [illegible]/A, [illegible]/A, [illegible]/A, SP100/A, SP1000/A, SP10000/A, PMP/A): [illegible]

PEARSON TYPE III DISTRIBUTION USED
PROBABLE MAXIMUM PRECIPITATION ESTIMATE BASED ON 15 STANDARD DEVIATIONS
WHERE N IS SMALL RESULTS ARE NOT DEPENDABLE

GRID 0 15

GRID 0 15

GRID 0 16

STATION NO.
[illegible]

GRID 0 16

MAXIMUM ANNUAL PRECIPITATION (IN)

STATION NO. BSN ORDER SUB	STATION NAME		ELEV	SEC	TWP	RNG LOT	BNM	LATITUDE	LONGITUDE	COUNTY CODE
670 2467 0	BONNER MEM ST PARK	42	5937	17	17N	16E E	M	39.323	120.232	29

DURATION
M=MINUTES,H=HOURS,D=DAYS,C YR=CALENDAR YEAR,W YR=WATER YEAR,F YR=FISCAL YEAR

YEAR	1H	2H	3H	6H	5H	6H	8H	10H	15H	20H	30H	40H	365H
1955	1.42	3.42	4.20	4.20	4.94	5.28	7.20	8.20	8.20	8.20	11.11	13.98	28.06
1956	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1957	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1958	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1959	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1960	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1961	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1962	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1963	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1964	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1965	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1966	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1967	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1968	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1969	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1970	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1971	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1972	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1973	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1974	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1975	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1976	1.80	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1977	1.30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1978	2.75	[illegible]	[illegible]	[illegible]	6.05	6.29	[illegible]	[illegible]	11.63	11.39	15.91	[illegible]	[illegible]
1979	3.33	5.09	5.11	5.42	6.65	6.65	7.39	7.39	7.44	8.37	9.11	16.53	28.65

Ann. ave = 39.106

PRECIPITATION DEPTH-DURATION-FREQUENCY TABLE

STATION NO. BSN ORDER SUB	STATION NAME		ELEV	SEC	TWP	RNG LOT	BNM	LATITUDE	LONGITUDE	COUNTY CODE
670 2467 0	BONNER MEM ST PARK	42	5937	17	17N	16E E	M	39.323	120.232	29

MAXIMUM PRECIPITATION FOR INDICATED DURATION D=DAYS H=HOURS

RETURN PERIOD IN YEARS	1H	2H	3H	6H	5H	6H	8H	10H	15H	20H	30H	40H	365H
2	3.26	4.57	5.25	5.80	6.26	6.69	7.63	8.31	10.15	11.11	13.05	18.33	37.83
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	5.70	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
20	6.03	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	6.93	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
50	7.81	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
100	8.97	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
200	9.31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1000	11.93	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10000	14.10	21.15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PMP	27.36	43.23	55.76	58.84	64.80	69.42	77.64	85.12	92.75	101.31	108.55	145.80	232.09

	1H	2H	3H	6H	5H	6H	8H	10H	15H	20H	30H	40H	365H
MEAN	3.578	5.177	6.057	6.723	7.330	7.704	8.932	9.908	11.308	12.266	14.191	19.906	39.106
CLOCK HR. COR.	1.140	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CALCULATED SKEW	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
REGIONAL SKEW	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SKEW USED	1.300	1.500	1.600	1.700	1.800	1.700	1.500	1.300	1.200	1.200	1.100	1.000	.800
KURTOSIS	5.566	4.696	6.118	5.862	5.950	7.455	6.383	5.766	5.063	6.266	6.175	5.562	2.400
N	25	25	25	25	25	25	25	25	25	25	25	25	25
RECORD YEAR	1963	1963	1956	1956	1956	1956	1956	1963	1963	1963	1956	1956	1956
RECORD MAXIMUM	6.810	10.470	14.340	15.410	17.190	21.510	22.010	23.720	24.610	29.440	31.930	43.090	60.130
NORMALIZED MAX	2.120	2.164	2.716	2.632	2.660	3.210	3.000	[illegible]	2.642	2.640	2.643	[illegible]	[illegible]
CALC. COEF. VAR	[illegible]	.473	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
REGN. COEF. VAR	[illegible]	.490	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
USED COEF. VAR	.443	.490	.535	.515	.521	.527	.515	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	1H	2H	3H	6H	5H	6H	8H	10H	15H	20H	30H	40H	365H
MEAN/A	.0915	.1326	.1549	.1719	.1877	.1996	.2284	.2534	.2944	.3137	.3629	.5090	1.0000
EP10/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
EP25/A	.1770	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
EP50/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
EP100/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
EP1000/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
EP10000/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PMP/A	.6995	1.1054	1.3744	1.5001	1.6343	1.7753	1.9660	2.1764	2.3540	2.5607	2.8016	3.7233	5.9350

PEARSON TYPE III DISTRIBUTION USED
PROBABLE MAXIMUM PRECIPITATION ESTIMATE BASED ON 15 STANDARD DEVIATIONS
WHERE N IS SMALL RESULTS ARE NOT DEPENDABLE

GRID D 16 | GRID D 16

MAXIMUM ANNUAL PRECIPITATION (IN)

STATION NO. BSN ORDER SUB	STATION NAME		ELEV	SEC	TWP	RNG LOT	B&M	LATITUDE	LONGITUDE	COUNTY CODE
670 9063 0	TRUCKEE RS	161	5995	10	17N	16E P	M	39.330	120.180	29

DURATION
M=MINUTES,H=HOURS,D=DAYS,C YR=CALENDAR YEAR,W YR=WATER YEAR,F YR=FISCAL YEAR

YEAR	1D	2D	3D	4D	5D	6D	8D	10D	15D	20D	30D	60D	365D
1958	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11.03	12.17	[illegible]	[illegible]	[illegible]
1959	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1960	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1961	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1962	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1963	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1964	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1965	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1966	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1967	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1968	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1969	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1970	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1971	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1972	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1973	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1974	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1975	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1976	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1977	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1978	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1979	2.22	2.40	2.47	2.87	3.82	3.83	4.38	5.89	8.17	7.15	7.30	12.15	23.80

GRID D 16 | GRID D 16

GRID C 16 | GRID C 16

PRECIPITATION DEPTH-DURATION-FREQUENCY TABLE

STATION NO. BSN ORDER SUB	STATION NAME		ELEV	SEC	TWP	RNG LOT	B&M	LATITUDE	LONGITUDE	COUNTY CODE
670 9063 0	TRUCKEE RS	161	5995	10	17N	16E P	M	39.330	120.180	29

MAXIMUM PRECIPITATION FOR INDICATED DURATION D=DAYS H=HOURS

RETURN PERIOD IN YEARS	1D	2D	3D	4D	5D	6D	8D	10D	15D	20D	30D	60D	365D
2	2.65	3.67	4.02	[illegible]	4.72	5.30	[illegible]	6.50	7.81	8.71	10.39	16.43	28.58
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10000	10.98	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	82.41	[illegible]	79.47	[illegible]	114.93	175.40
PMP	20.80	32.80	41.30	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MEAN	2.705	3.828	[illegible]	5.133	[illegible]	6.055	[illegible]	[illegible]	[illegible]	9.620	11.182	15.712	29.333
CLOCK HR. COR.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CALCULATED SKEW	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
REGIONAL SKEW	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SKEW USED	1.300	1.500	1.200	1.700	[illegible]	1.700	1.500	1.300	[illegible]	1.200	1.100	1.000	.400
KURTOSIS	6.749	6.995	5.817	4.750	5.174	7.965	6.616	6.865	5.023	5.376	4.692	3.285	2.708
N	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RECORD YEAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RECORD MAXIMUM	[illegible]	7.910	11.450	11.740	13.810	12.570	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34.480	50.180
NORMALIZED MAX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CALC. COEF. VAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
REGN. COEF. VAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
USED COEF. VAR	.443	.490	.525	.515	.521	.527	.515	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MEAN/A	.0915	.1520	.1571	.1737	.1893	.2040	.2301	.2537	.2917	[illegible]	[illegible]	[illegible]	1.0000
RP10/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP25/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP50/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP100/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP1000/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP10000/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PMP/A	.6997	1.1008	[illegible]	[illegible]	[illegible]	[illegible]	2.0005	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

PEARSON TYPE III DISTRIBUTION USED
PROBABLE MAXIMUM PRECIPITATION ESTIMATE BASED ON 15 STANDARD DEVIATIONS
WHERE N IS SMALL RESULTS ARE NOT DEPENDABLE

GRID C 16 | GRID C 16

GRID D 17

STATION NO.

GRID D 17

GRID C 17

STATION

MAXIMUM ANNUAL PRECIPITATION (IN)

STATION NO. DWR ORDER SUB	STATION NAME	ELEV	SEC	TWP	RNG	LOT	B&M	LATITUDE	LONGITUDE	COUNTY CODE
670 9043 0	TRUCKEE R S	5995	10	17N	16E	P	M	39.320	120.516	29

DURATION
M=MINUTES,H=HOURS,D=DAYS,C YR=CALENDAR YEAR,W YR=WATER YEAR,F YR=FISCAL YEAR

YEAR	5M	10M	15M	30M	1H	2H	3H	6H	12H	24H	C-YR
1940	.05	.06	.08	.14	.25	.49	.70	1.13	1.27	1.75	45.26
1941	.18	.18	.18	.18	.30	.56	.72	1.11	2.14	3.15	28.95
1942	.15	.14	.20	.23	.29	.48	.64	1.11	1.63	3.06	35.88
1943	.56	.54	.54	.56	.55	.57	.61	1.28	2.27	3.97	25.85
1944	.32	.46	.57	.62	.74	.82	.90	1.13	1.77	2.72	30.77
1945	.21	.22	.22	.22	.22	.42	.57	.95	1.60	2.80	39.99
1946	.12	.16	.20	.23	.32	.38	.57	1.05	1.58	2.84	23.83
1947	.05	.09	.12	.19	.31	.42	.48	.89	1.19	1.78	17.66
1948	.15	.19	.22	.25	.33	.58	.75	1.05	1.39	2.14	31.19
1949	.27	.47	.63	.76	.90	.91	.91	.91	1.35	1.50	21.91
1950	.17	.20	.21	.25	.39	.64	.82	1.39	2.67	4.19	55.16
1951	.06	.07	.10	.20	.29	.50	.60	1.09	1.82	2.35	38.42
1952	.56	.61	.63	.65	.67	.67	.76	1.01	1.66	2.01	40.54
1953	.05	.06	.09	.15	.28	.47	.68	1.07	1.48	2.01	24.25
1954	.05	.06	.07	.12	.24	.38	.47	.91	1.45	2.12	28.89
1955	.05	.09	.11	.19	.33	.47	.70	1.25	1.54	2.42	41.54
1956	.08	.15	.17	.32	.52	.56	.60	1.10	1.58	2.10	30.16
1957	.05	.07	.09	.15	.28	.46	.53	.82	.97	1.84	32.05
1958	.24	.38	.46	.62	.64	.74	.75	1.17	1.76	2.50	35.70
1959	.04	.06	.10	.17	.53	.63	.84	1.26	1.64	2.17	22.31
1960	.03	.05	.07	.13	.23	.61	.55	.91	1.59	2.32	27.39
1961	.08	.10	.14	.16	.25	.38	.44	.64	.94	1.07	19.80
1962	.14	.14	.14	.15	.26	.59	.56	1.10	1.81	2.80	34.25
1963	.06	.10	.11	.17	.32	.61	.86	1.59	3.06	5.27	39.87
1964	.05	.07	.09	.17	.34	.65	.88	1.61	3.08	5.12	39.94
1965	.18	.20	.32	.44	.45	.56	.63	.88	1.34	1.92	35.66
1966	.10	.12	.15	.21	.39	.57	.85	1.10	1.39	1.46	22.79
1967	.06	.07	.10	.16	.29	.48	.65	1.10	1.56	2.73	39.67
1968	0	0	0	0	.30	.50	.10	1.10	1.50	2.00	30.50
1969	0	0	0	0	.50	.60	.80	1.20	1.70	2.40	48.53
1970	0	0	0	0	.50	.90	1.00	1.30	2.00	2.40	40.40
1971	0	0	0	0	.30	.50	.70	1.00	1.60	1.90	33.50
1972	.06	.10	.12	.20	.32	.34	.54	.56	.50	.95	23.30
1973	0	0	.30	.30	.30	.40	.60	1.00	1.60	2.00	58.10
1974	0	0	.10	.20	.40	.50	.60	1.10	1.50	1.90	27.80
1975	0	0	.30	.30	.30	.60	.70	1.30	1.60	1.90	36.70
1976	0	0	.40	.60	.60	.80	.60	.80	1.00	1.60	15.50
1977	0	0	.20	.50	.40	.70	.90	1.30	1.90	2.80	24.20
1978	0	0	.50	.50	.60	.40	.70	1.00	1.50	2.00	28.90

PRECIPITATION DEPTH-DURATION-FREQUENCY TABLE

STATION NO. DWR ORDER SUB	STATION NAME	ELEV	SEC	TWP	RNG	LOT	B&M	LATITUDE	LONGITUDE	COUNTY CODE
670 9043 0	TRUCKEE R S	5995	10	17N	16E	P	M	39.320	120.516	29

MAXIMUM PRECIPITATION FOR INDICATED DURATION D-DAYS H-HOURS

RETURN PERIOD IN YEARS	5M	10M	15M	30M	1H	2H	3H	6H	12H	24H	C-YR
2	.13	.16	.21	.26	.35	.50	.61	.98	1.69	2.19	31.22
5	.19	.24	.30	.38	.51	.72	.88	1.42	2.16	3.18	40.77
10	.23	.29	.37	.46	.62	.87	1.06	1.72	2.61	3.84	46.39
20	.26	.35	.43	.54	.72	1.02	1.24	2.00	3.03	4.46	51.36
25	.27	.35	.44	.56	.76	1.06	1.29	2.09	3.17	4.66	52.87
40	.30	.38	.48	.61	.82	1.15	1.40	2.27	3.44	5.07	55.93
50	.31	.39	.50	.63	.85	1.20	1.46	2.35	3.57	5.26	57.33
100	.34	.44	.56	.70	.95	1.35	1.62	2.61	3.97	5.84	61.56
200	.38	.48	.61	.77	1.06	1.46	1.78	2.87	4.35	6.41	65.54
1000	.45	.58	.73	.95	1.25	1.75	2.14	3.45	5.23	7.70	74.29
10000	.56	.71	.90	1.15	1.56	2.16	2.63	4.25	6.45	9.50	85.88
PMP	1.08	1.38	1.75	2.22	2.99	4.19	5.11	8.25	12.52	16.42	191.57
MEAN	.142	.180	.229	.291	.391	.549	.668	1.079	1.638	2.410	32.279
CLOCK HR. COR.	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
CALCULATED SKEW	1.998	1.626	1.256	1.320	1.470	.916	-0.764	-0.372	1.068	1.555	.291
REGIONAL SKEW	1.300	1.300	1.300	1.300	1.300	1.300	1.300	1.300	1.300	1.300	.600
SKEW USED	1.300	1.300	1.300	1.300	1.300	1.300	1.300	1.300	1.300	1.300	.600
KURTOSIS	7.076	4.834	3.559	3.659	4.941	3.960	3.000	5.412	5.768	6.058	3.107
N	29	29	35	35	39	39	39	39	39	39	39
RECORD YEAR	1952	1952	1949	1949	1949	1949	1970	1964	1963	1963	1950
RECORD MAXIMUM	.560	.610	.630	.760	.900	.910	1.000	1.610	3.060	5.270	55.160
NORMALIZED MAX	3.053	2.748	2.368	2.627	3.232	2.634	1.915	2.328	2.849	3.090	2.613
CALC. COEF. VAR	.967	.867	.746	.615	.406	.250	.259	.212	.305	.384	.221
REGN. COEF. VAR	.443	.443	.443	.443	.443	.443	.443	.443	.443	.443	.329
USED COEF. VAR	.443	.443	.443	.443	.443	.443	.443	.443	.443	.443	.329
MEAN/A	.0044	.0056	.0071	.0090	.0121	.0170	.0207	.0334	.0507	.0747	1.0000
RP10/A	.0070	.0089	.0113	.0143	.0193	.0271	.0330	.0532	.0808	.1189	1.4371
RP25/A	.0085	.0108	.0137	.0174	.0234	.0329	.0400	.0646	.0981	.1444	1.6379
RP50/A	.0096	.0122	.0155	.0196	.0264	.0371	.0432	.0729	.1107	.1628	1.7762
RP100/A	.0108	.0135	.0172	.0218	.0293	.0412	.0501	.0810	.1229	.1808	1.9064
RP1000/A	.0140	.0179	.0227	.0288	.0387	.0543	.0661	.1068	.1627	.2385	2.3016
RP10000/A	.0173	.0220	.0280	.0355	.0477	.0670	.0816	.1317	.2000	.2962	2.6605
PMP/A	.0334	.0427	.0543	.0688	.0925	.1300	.1585	.2555	.3879	.5707	5.9350

PEARSON TYPE III DISTRIBUTION USED
PROBABLE MAXIMUM PRECIPITATION ESTIMATE BASED ON 15 STANDARD DEVIATIONS
WHERE N IS SMALL RESULTS ARE NOT DEPENDABLE

GRID K 15

MAXIMUM ANNUAL PRECIPITATION (IN)

STATION NO. BSN ORDER SUB	STATION NAME	ELEV	SEC	TWP	RNG	LOT	MER	LATITUDE	LONGITUDE	COUNTY CODE
670 7641 0	SAGEHEN CREEK	6337	07	18N	16E	3	9	43.112	24.002	9

DURATION
M=MINUTES,H=HOURS,D=DAYS,C YR=CALENDAR YEAR,W YR=WATER YEAR,F YR=FISCAL YEAR

YEAR	1D	2D	3D	4D	5D	6D	8D	10D	15D	20D	30D	60D	365D
1954	2.40	[illegible]	4.08	4.08	6.08	[illegible]	5.71	5.71	5.71	5.71	9.77	16.87	[illegible]
1955	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1956	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1957	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1958	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1959	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1960	0	0	0	0	0	0	0	0	0	0	0	0	[illegible]
1961	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1962	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1963	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1964	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1965	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1966	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1967	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1968	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1969	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1970	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1971	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1972	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1973	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1974	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1975	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1976	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1977	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1978	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1979	4.50	5.09	5.10	5.13	5.14	5.14	6.50	7.55	[illegible]	11.55	[illegible]	17.92	[illegible]

GRID K 15

GRID L 15

PRECIPITATION DEPTH-DURATION-FREQUENCY TABLE

STATION NO. BSN ORDER SUB	STATION NAME	ELEV	SEC	TWP	RNG	LOT	MER	LATITUDE	LONGITUDE	COUNTY CODE
670 7641 0	SAGEHEN CREEK	6337	07	18N	16E	3	9	43.112	24.002	9

MAXIMUM PRECIPITATION FOR INDICATED DURATION D=DAYS H=HOURS

RETURN PERIOD IN YEARS	1D	2D	3D	4D	5D	6D	8D	10D	15D	20D	30D	60D	365D
2	2.22	3.75	4.32	3.70	4.17	[illegible]	6.68	7.16	8.44	9.43	10.99	15.58	32.01
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PMP	23.32	35.65	44.27	47.37	55.46	57.89	64.22	60.84	76.66	84.00	92.28	122.43	196.41
MEAN	3.051	4.265	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9.316	10.612	11.950	16.732	33.093
CLOCK HR. COR.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CALCULATED SKEW	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
REGIONAL SKEW	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SKEW USED	1.300	1.300	[illegible]	1.700	[illegible]	1.700	1.500	1.300	[illegible]	1.200	1.100	[illegible]	[illegible]
KURTOSIS	4.976	6.509	8.330	6.018	8.295	9.747	[illegible]	7.310	5.222	[illegible]	6.322	4.613	2.665
N	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RECORD YEAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RECORD MAXIMUM	[illegible]	[illegible]	12.180	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NORMALIZED MAX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CALC. COEF. VAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
REGN. COEF. VAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
USED COEF. VAR	.643	.490	.325	.315	.321	.327	.315	[illegible]	[illegible]	[illegible]	[illegible]	.421	[illegible]
MEAN/A	.0922	[illegible]	.1507	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.0000
RP10/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP25/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP50/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP100/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP1000/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP10000/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PMP/A	[illegible]	1.0712	[illegible]	[illegible]	[illegible]	1.7493	[illegible]	2.1105	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

PEARSON TYPE III DISTRIBUTION USED
PROBABLE MAXIMUM PRECIPITATION ESTIMATE BASED ON 15 STANDARD DEVIATIONS
WHERE N IS SMALL RESULTS ARE NOT DEPENDABLE

GRID L 15

PRECIPITATION DEPTH-DURATION-FREQUENCY TABLE

STATION NO.			STATION NAME		ELEV	SEC	TWP	RNG	LOT	BAM	LATITUDE	LONGITUDE	COUNTY CODE
670	931	0	BOCA	10	5575	28	18N	17E	D	N	39.380	120.092	29

MAXIMUM PRECIPITATION FOR INDICATED DURATION D=DAYS H=HOURS

RETURN PERIOD IN YEARS	1D	2D	3D	4D	5D	6D	8D	10D	15D	20D	30D	60D	365D
2	1.37	2.48	2.82	3.16	3.43	3.48	4.16	4.62	5.30	6.01	7.04	10.32	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PMP	16.42	24.64	[illegible]	31.99	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MEAN	2.176	2.951	[illegible]	[illegible]	4.020	4.281	4.748	[illegible]	5.933	[illegible]	[illegible]	[illegible]	[illegible]
CLOCK HR. COR.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CALCULATED SKEW	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
REGIONAL SKEW	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SKEW USED	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
KURTOSIS	2.177	3.376	3.749	3.335	3.042	5.626	4.928	4.620	3.603	3.596	3.438	2.702	[illegible]
N	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RECORD YEAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RECORD MAXIMUM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NORMALIZED MAX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CALC. COEF. VAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
REGN. COEF. VAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
USED COEF. VAR	.443	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MEAN/A	[illegible]	.1355	.1544	.1683	.1844	.1966	.2180	.2414	.2724	.3048	.3517	[illegible]	1.0000
RP10/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP25/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP50/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP100/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP1000/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP10000/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PMP/A	.7630	[illegible]	[illegible]	[illegible]	1.6270	1.7505	[illegible]	2.0736	2.2420	2.5177	2.7151	3.7216	[illegible]

PEARSON TYPE III DISTRIBUTION USED
PROBABLE MAXIMUM PRECIPITATION ESTIMATE BASED ON 15 STANDARD DEVIATIONS
WHERE N IS SMALL RESULTS ARE NOT DEPENDABLE

MAXIMUM ANNUAL PRECIPITATION (IN)

STATION NO.			STATION NAME		ELEV	SEC	TWP	RNG	LOT	BAM	LATITUDE	LONGITUDE	COUNTY CODE
670	9043	0	TRUCKEE RS	141	5995	10	17N	16E	P	N	39.330	120.189	29

DURATION
M=MINUTES,H=HOURS,D=DAYS,C YR=CALENDAR YEAR,W YR=WATER YEAR,F YR=FISCAL YEAR

YEAR	1D	2D	3D	4D	5D	6D	8D	10D	15D	20D	30D	60D	365D
[illegible]	1.40	2.10	2.40	2.80	2.80	2.80	3.00	3.00	3.15	3.20	3.40	7.00	14.20
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1957	1.87	2.07	3.75	3.90	4.08	4.25	4.60	4.34	4.11	[illegible]	[illegible]	[illegible]	[illegible]

PMP AVG = 28.99

MAXIMUM ANNUAL PRECIPITATION (IN)

STATION NO. RGN ORDER NUM	STATION NAME	ELEV	SEC	TWP	RNG LOT	MRM	LATITUDE	LONGITUDE	COUNTY CODE
670 9979 26	MOUNT ROSE CHRISTMAS TREE	7235					39.350	119.850	62

DURATION
M=MINUTES,H=HOURS,D=DAYS,C YR=CALENDAR YEAR,W YR=WATER YEAR,F YR=FISCAL YEAR

YEAR	5M	10M	15M	30M	1H	2H	3H	6H	12H	24H	C-YR
1971	0	0	0	0	.80	.90	1.10	1.30	1.60	1.70	19.40
1972	0	0	0	0	.50	.50	.70	.80	1.50	1.60	15.90
1973	0	0	.20	.30	.60	.50	.60	.70	.90	1.10	19.00
1974	0	0	.20	.30	.30	.60	.70	1.10	1.20	1.50	15.00
1975	0	0	.10	.30	.30	.60	.50	.90	1.30	1.10	25.60
1976	0	0	.30	.60	1.10	1.20	1.30	1.60	1.70	1.70	16.70
1977	0	0	.40	.70	.70	.70	.70	.80	1.00	1.70	16.50
1978	0	0	.20	.20	.30	.40	.50	.30	.60	.70	0

PRECIPITATION DEPTH-DURATION-FREQUENCY TABLE

STATION NO. RGN ORDER NUM	STATION NAME	ELEV	SEC	TWP	RNG LOT	MRM	LATITUDE	LONGITUDE	COUNTY CODE
670 9979 26	MOUNT ROSE CHRISTMAS TREE	7235					39.350	119.850	32

MAXIMUM PRECIPITATION FOR INDICATED DURATION D-DAYS H-HOURS

RETURN PERIOD IN YEARS	5M	10M	15M	30M	1H	2H	3H	6H	12H	24H	C-YR
2	0	0	.21	.32	.60	.57	.67	.84	1.08	1.26	16.52
5	0	0	.30	.47	.71	.84	.90	1.26	1.56	1.82	21.98
10	0	0	.37	.56	.87	1.03	1.21	1.52	1.93	2.22	25.69
20	0	0	.44	.69	1.03	1.22	1.63	1.81	2.27	2.62	29.22
25	0	0	.46	.72	1.08	1.28	1.50	1.90	2.37	2.76	30.33
40	0	0	.50	.79	1.19	1.40	1.65	2.09	2.60	3.00	32.66
50	0	0	.52	.82	1.24	1.46	1.72	2.18	2.71	3.12	33.73
100	0	0	.59	.93	1.39	1.66	1.94	2.45	3.03	3.50	37.08
200	0	0	.65	1.03	1.54	1.82	2.16	2.73	3.36	3.87	40.31
1000	0	0	.80	1.26	1.89	2.24	2.67	3.37	4.10	4.73	47.75
10000	0	0	1.01	1.59	2.39	2.82	3.39	4.27	5.16	5.96	58.13
PMP	0	0	1.78	2.80	4.20	4.97	5.83	7.36	9.27	10.70	105.90
MEAN	0	0	.253	.367	.550	.650	.762	.963	1.212	1.400	17.843
CLOCK HR. COR.	0	0	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
CALCULATED SKEW	0	0	.664	.935	1.025	1.280	1.222	.744	-0.299	-1.115	1.484
REGIONAL SKEW	0	0	1.700	1.700	1.700	1.700	1.800	1.800	1.600	1.600	1.600
SKEW USED	0	0	1.700	1.700	1.700	1.700	1.800	1.800	1.600	1.600	1.400
KURTOSIS	0	0	5.859	4.124	6.486	5.539	4.756	4.456	3.638	4.661	6.408
N	0	0	6	6	8	8	8	8	8	8	7
RECORD YEAR	0	0	1977	1977	1976	1976	1976	1976	1976	1977	1975
RECORD MAXIMUM	0	0	.400	.700	1.100	1.200	1.300	1.600	1.700	1.700	25.600
NORMALIZED MAX	0	0	1.614	1.481	1.879	1.980	1.869	1.799	1.297	.819	1.971
CALC. COEF. VAR	0	0	.443	.616	.532	.427	.377	.368	.310	.262	.221
REGN. COEF. VAR	0	0	.443	.443	.443	.443	.443	.443	.443	.443	.329
USED COEF. VAR	0	0	.443	.443	.443	.443	.443	.443	.443	.443	.329
MEAN/A	0	0	.0131	.0205	.0308	.0364	.0427	.0539	.0680	.0785	1.0000
RP10/A	0	0	.0207	.0326	.0489	.0578	.0677	.0854	.1080	.1247	1.4398
RP25/A	0	0	.0257	.0404	.0606	.0716	.0843	.1064	.1331	.1536	1.7000
RP50/A	0	0	.0294	.0462	.0693	.0819	.0967	.1220	.1516	.1751	1.8901
RP100/A	0	0	.0330	.0519	.0779	.0920	.1090	.1376	.1699	.1962	2.0763
RP1000/A	0	0	.0450	.0707	.1060	.1253	.1495	.1888	.2298	.2651	2.6763
RP10000/A	0	0	.0568	.0892	.1338	.1582	.1898	.2395	.2883	.3328	3.2599
PMP/A	0	0	.1000	.1579	.2357	.2785	.3267	.4124	.5195	.5998	5.9350

PEARSON TYPE III DISTRIBUTION USED
PROBABLE MAXIMUM PRECIPITATION ESTIMATE BASED ON 15 STANDARD DEVIATIONS
WHERE N IS SMALL RESULTS ARE NOT DEPENDABLE

MAXIMUM ANNUAL PRECIPITATION (IN)

STATION NO. USW ORDER SUB	STATION NAME		ELEV	SEC	TWP	RNG LOT	REF.	LATITUDE	LONGITUDE	COUNTY CODE
670 7365 26	RENO NEV	121	4397					39.500	119.783	62

DURATION
M=MINUTES,H=HOURS,D=DAYS,C YR=CALENDAR YEAR,W YR=WATER YEAR,F YR=FISCAL YEAR

YEAR	1D	2D	3D	4D	5D	6D	8D	10D	15D	20D	30D	40D	365D
1949	.80	.85	1.19	1.20	1.28	1.32	1.42	1.43	1.45	[illegible]	2.06	[illegible]	7.48
1950	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1951	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1952	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1953	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1954	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1955	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1956	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1957	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1958	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1959	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1960	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1961	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1962	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1963	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1964	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1965	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1966	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1967	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1968	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1969	1.36	1.71	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1970	.60	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1971	.86	.94	.94	1.08	[illegible]	1.48	[illegible]	1.89	1.91	2.32	2.63	3.61	10.08

PRECIPITATION DEPTH-DURATION-FREQUENCY TABLE

STATION NO. USW ORDER SUB	STATION NAME		ELEV	SEC	TWP	RNG LOT	RNW	LATITUDE	LONGITUDE	COUNTY CODE
670 7365 26	RENO NEV	121	4397					39.500	119.783	62

MAXIMUM PRECIPITATION FOR INDICATED DURATION D=DAYS H=HOURS

RETURN PERIOD IN YEARS	1D	2D	3D	4D	5D	6D	8D	10D	15D	20D	30D	40D	365D
2	1.01	1.22	1.28	1.30	1.40	1.49	1.68	1.77	1.86	2.15	2.51	3.42	7.48
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	9.79
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11.11
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	20.34
PMP	8.54	11.50	13.15	13.19	14.20	15.43	16.76	17.28	17.39	19.64	21.10	26.84	45.87
MEAN	1.117	1.388	1.480	1.511	1.665	1.733	1.927	2.012	2.137	2.380	2.733	3.620	7.728
CLOCK HR. COR.	1.140	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.000
CALCULATED SKEW	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
REGIONAL SKEW	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SKEW USED	1.300	1.500	1.600	1.700	[illegible]	1.700	1.500	1.500	1.200	1.200	1.100	1.000	.600
KURTOSIS	5.306	5.368	6.764	6.083	6.606	5.758	4.906	5.332	5.228	5.492	5.168	5.738	1.988
N	23	23	23	23	23	23	23	23	23	23	23	23	23
RECORD YEAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RECORD MAXIMUM	[illegible]	3.070	3.780	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NORMALIZED MAX	[illegible]	2.632	2.991	2.967	3.125	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CALC. COEF. VAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
REGN. COEF. VAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
USED COEF. VAR	.443	.490	.525	.515	.521	.527	.515	.506	.482	.444	.444	.421	.329
MEAN/A	.1643	.1798	.1915	.1956	.2126	.2262	[illegible]	.2603	.2765	[illegible]	.3537	[illegible]	1.0000
RP10/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP25/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP50/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP100/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP1000/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP10000/A	[illegible]	[illegible]	.9273	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PMP/A	1.1067	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.2361	[illegible]	[illegible]	2.7506	[illegible]	[illegible]

PEARSON TYPE III DISTRIBUTION USED
PROBABLE MAXIMUM PRECIPITATION ESTIMATE BASED ON 15 STANDARD DEVIATIONS
WHERE N IS SMALL RESULTS ARE NOT DEPENDABLE

PRECIPITATION DEPTH-DURATION-FREQUENCY TABLE

STATION NO. USW ORDER SUB	STATION NAME	ELEV	SEC	TWP	RNG LOT	BWN	LATITUDE	LONGITUDE	COUNTY CODE
670 6770 26	RENO AP WBS	439	7				.395	1.190	62

MAXIMUM PRECIPITATION FOR INDICATED DURATION D-DAYS H-HOURS

RETURN PERIOD IN YEARS	5M	10M	15M	30M	1H	2H	3H	6H	12H	24H	C-YR
2	.12	.19	.22	.29	.34	.43	.44	.58	.75	.99	7.48
5	.18	.27	.33	.42	.50	.62	.65	.86	1.09	1.44	9.76
10	.21	.35	.39	.51	.60	.75	.78	1.01	1.31	1.76	11.11
20	.25	.38	.46	.60	.70	.87	.91	1.16	1.53	2.02	12.30
25	.26	.40	.48	.62	.73	.91	.95	1.23	1.59	2.11	12.66
40	.28	.43	.52	.68	.79	.99	1.03	1.35	1.73	2.29	13.39
50	.29	.45	.54	.70	.82	1.02	1.07	1.38	1.80	2.38	13.73
100	.32	.50	.60	.78	.91	1.16	1.19	1.54	2.00	2.64	14.76
200	.36	.55	.66	.85	1.00	1.25	1.30	1.69	2.19	2.90	15.70
1000	.45	.66	.79	1.03	1.20	1.50	1.57	2.03	2.63	3.49	17.79
10000	.53	.81	.97	1.27	1.48	1.85	1.93	2.50	3.25	4.30	20.56
PMP	1.02	1.57	1.89	2.46	2.68	3.59	3.75	4.85	6.30	8.34	45.87
MEAN	.134	.206	.247	.321	.376	.470	.490	.635	.826	1.092	7.730
CLOCK HR. COR.	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
CALCULATED SKEW	.418	.810	1.080	1.146	1.163	1.310	1.587	.707	.895	.917	.510
REGIONAL SKEW	1.300	1.300	1.300	1.300	1.300	1.300	1.300	1.300	1.300	1.300	.600
SKEW USED	1.300	1.300	1.300	1.300	1.300	1.300	1.300	1.300	1.300	1.300	.600
KURTOSIS	2.176	3.329	3.683	3.675	3.653	4.546	6.400	3.011	3.328	3.443	4.418
N	40	40	40	41	64	64	39	39	39	64	64
RECORD YEAR	1912	1912	1931	1912	1963	1963	1963	1963	1943	1963	1970
RECORD MAXIMUM	.320	.540	.690	.860	1.000	1.280	1.280	1.280	1.610	2.370	16.700
NORMALIZED MAX	2.193	2.485	2.585	2.602	2.687	3.519	3.392	2.589	2.519	3.028	3.532
CALC. COEF. VAR	.635	.655	.695	.645	.575	.490	.449	.393	.379	.387	.329
REGN. COEF. VAR	.443	.445	.443	.443	.443	.445	.445	.443	.443	.443	.329
USED COEF. VAR	.443	.443	.443	.443	.443	.443	.443	.443	.443	.443	.329
MEAN/A	.0175	.0266	.0319	.0416	.0487	.0608	.0634	.0821	.1066	.1412	1.0000
RP10/A	.0276	.0424	.0509	.0662	.0775	.0968	.1010	.1308	.1698	.2250	1.4371
RP25/A	.0339	.0516	.0617	.0804	.0941	.1176	.1224	.1588	.2061	.2751	1.6379
RP50/A	.0377	.0580	.0696	.0906	.1061	.1326	.1383	.1791	.2325	.3080	1.7762
RP100/A	.0419	.0644	.0773	.1007	.1179	.1473	.1536	.1989	.2582	.3421	1.9084
RP1000/A	.0553	.0850	.1020	.1320	.1555	.1942	.2026	.2623	.3406	.4512	2.3014
RP10000/A	.0682	.1048	.1258	.1658	.1918	.2398	.2499	.3236	.4201	.5566	2.6605
PMP/A	.1323	.2035	.2441	.3177	.3720	.4647	.4846	.6277	.8148	1.0796	5.9350

PEARSON TYPE III DISTRIBUTION USED
PROBABLE MAXIMUM PRECIPITATION ESTIMATE BASED ON 15 STANDARD DEVIATIONS
WHERE N IS SMALL RESULTS ARE NOT DEPENDABLE

GRID E 15

MAXIMUM ANNUAL PRECIPITATION (IN)

STATION NO.	STATION NAME	ELEV	SEC	TWP	RNG	LOT	QUAD	LATITUDE	LONGITUDE	COUNTY CODE
670 4698 0	LOVELOCK NEVADA	3975						40.183	118.467	42

DURATION
M=MINUTES, H=HOURS, D=DAYS, C YR=CALENDAR YEAR, W YR=WATER YEAR, F YR=FISCAL YEAR

YEAR	1D	2D	3D	4D	5D	6D	8D	10D	15D	20D	30D	60D	365D
1949	.30	.47	.60	.80	.80	.80	.84	1.05	1.32	1.45	1.30	2.50	4.20
1950	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1951	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1952	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1953	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1954	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1955	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1956	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1957	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1958	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1959	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1960	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1961	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1962	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1963	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1964	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1965	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1966	.80	.80	.80	.80	.80	.87	.80	1.08	1.19	1.16	1.41	1.63	3.87

GRID E 15

GRID F 15

PRECIPITATION DEPTH-DURATION-FREQUENCY TABLE

STATION NO.	STATION NAME	ELEV	SEC	TWP	RNG	LOT	QUAD	LATITUDE	LONGITUDE	COUNTY CODE
670 4698 0	LOVELOCK NEVADA	3975						40.183	118.467	42

MAXIMUM PRECIPITATION FOR INDICATED DURATION D=DAYS H=HOURS

RETURN PERIOD IN YEARS	1D	2D	3D	4D	5D	6D	8D	10D	15D	20D	30D	60D	365D
2	.70	.75	.77	.80	.82	.85	.87	.96	1.10	1.24	1.31	2.02	5.22
5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
25	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
200	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
500	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
10000	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	8.43	10.08	11.34	12.70	13.91	32.08
PMP	5.92	7.08	7.80	8.10	8.23	8.81	8.98	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MEAN	.775	.848	.880	.928	.943	.980	1.032	1.082	1.212	1.362	1.444	2.176	5.302
CLOCK HR. COR.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CALCULATED SKEW	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
REGIONAL SKEW	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SKEW USED	1.500	1.500	1.600	1.700	1.800	1.700	1.500	1.500	1.500	1.300	1.100	1.000	.900
KURTOSIS	3.365	2.548	2.896	2.707	2.792	3.081	4.112	4.170	3.796	3.318	3.376	3.136	3.634
N	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RECORD YEAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RECORD MAXIMUM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
NORMALIZED MAX	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
CAL. COEF. VAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
REG. COEF. VAR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
USED COEF. VAR	.443	.400	.393	.315	.321	.327	.313	.308	.302	.302	.344	.321	.326
MEAN/A	.1638	.1576	.1669	.1720	.1781	.1833	.1913	.2033	.2256	.2533	.3067	.4088	1.0000
RP10/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP25/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP50/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP100/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP1000/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
RP10000/A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PMP/A	1.0075	1.3163	1.4433	1.5002	1.5700	1.6323	1.6831	1.7463	1.8583	1.9582	[illegible]	[illegible]	[illegible]

PEARSON TYPE III DISTRIBUTION USED
PROBABLE MAXIMUM PRECIPITATION ESTIMATE BASED ON 15 STANDARD DEVIATIONS
WHERE N IS SMALL RESULTS ARE NOT DEPENDABLE

GRID F 15

WINZLER & KELLY

1201 Terminal Way, Suite 215/Reno, NV 89502/702-786-5066

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Engineering Div.

Refer to: 86-000-000

March 27, 1986

Millard Reed, City Engineer
City of Reno
Engineer Department
P.O. Box 1900
Reno, NV 89505

Dear Millard:

Winzler & Kelly, Consulting Engineers is consolidating its Reno and San Francisco branch offices effective April 1, 1986. All future work will be conducted through our San Francisco office at:

Winzler & Kelly, Consulting Engineers
609 Mission Street, Suite 400
San Francisco, CA 94105-3386
(415) 362-0151

Because of the availability of air travel between San Francisco and Reno, we believe we can effectively serve your needs with response time of as little as 4 hours.

We are waiting for Dr. Tung to complete an update of the isopluvial maps and plan a meeting with your engineering staff to give an update on the situation in April.

If you have any questions, please contact either myself or James P. Winzler at the above address.

Very truly yours,

WINZLER & KELLY

Richard Jorgensen

Need to coordinate completion of drainage study work!! mk

WK4RJ/221-1

GROUP CONSULTING ENGINEERS

file

City of Reno

POST OFFICE BOX 1900 • RENO, NEVADA 89505

December 26, 1985

Mr. Rick Jorgensen
Winzler and Kelly Consulting Engineers
1201 Terminal Way, Suite 215
Reno, Nevada 89502

SUBJECT: Reno Drainage Study

Dear Rick:

As part of a new policy in the Reno Public Works Department, we are requesting our consultants to present to the staff a comprehensive briefing of their work. This briefing will constitute part of the consultant's final report, and will be presented after the preliminary report is submitted, but before submission of the final report. We feel this briefing will be a cost-effective method of giving all concerned staff members an in-depth review of the consultant's results, conclusions and recommendations, and the methodology he used to arrive at them. The written report will then be available as a reference and refresher.

We would hope that Winzler and Kelly can prepare such a briefing on the subject study which is nearing completion. without the need for negotiation of a change in scope of work to our agreement for services.

Since the work you have performed is basically in two parts; the rainfall intensity-duration-frequency (IDF) analysis and isopleth preparation, and the "hot spot" analysis; perhaps two briefings would be an appropriate approach. We can discuss this further verbally and resolve the details. We are expecially interested in discussing with you, and hopefully Dr. Tung, the preparation, reliability and dependence on the correction factors derived in the isopleth overlays.

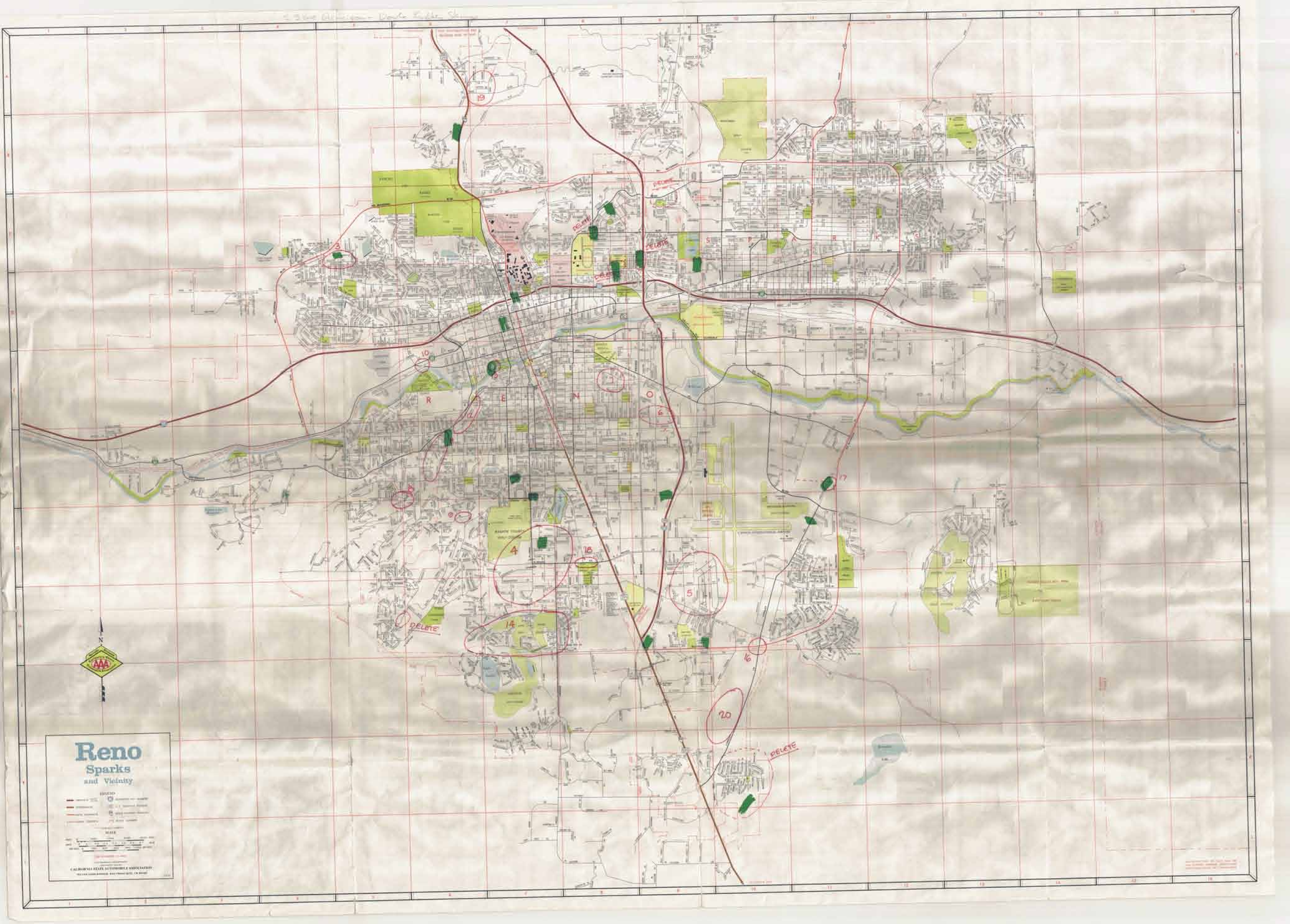
Please consider this proposal and give me a call at your earliest convenience to let us know your feelings in this regard.

Very truly yours,

ROBERT M. JACKSON
PUBLIC WORKS DIRECTOR

By: William N. Vann Jr.
Willaim N. Vahn, Jr., P.E.
Design Engineer

RMJ:WNV:rrm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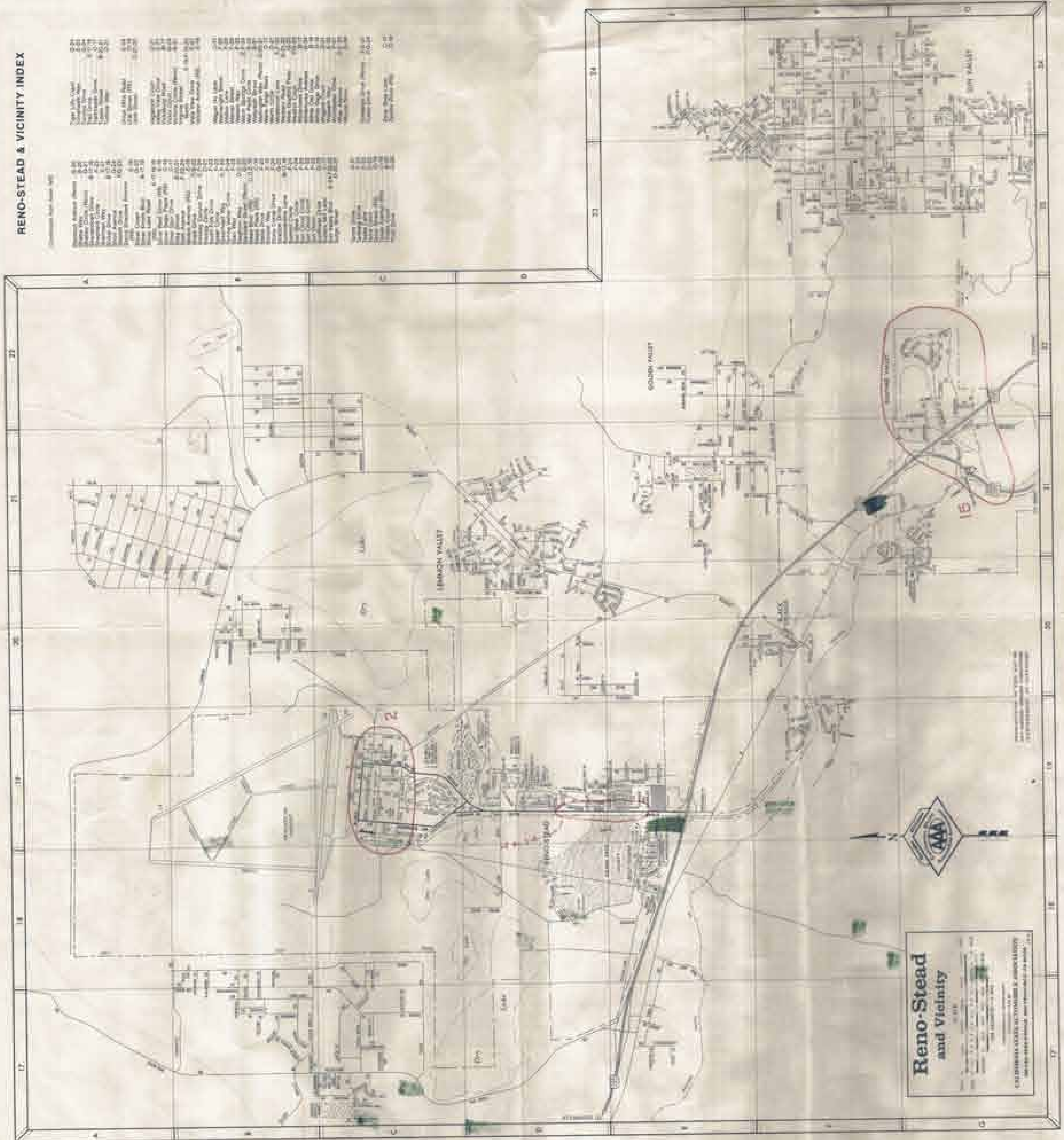

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California State Automobile Association — Nevada Division

Reno
Sparks
and Vicinity

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RENO-STEAD MISCELLANEOUS INDEX


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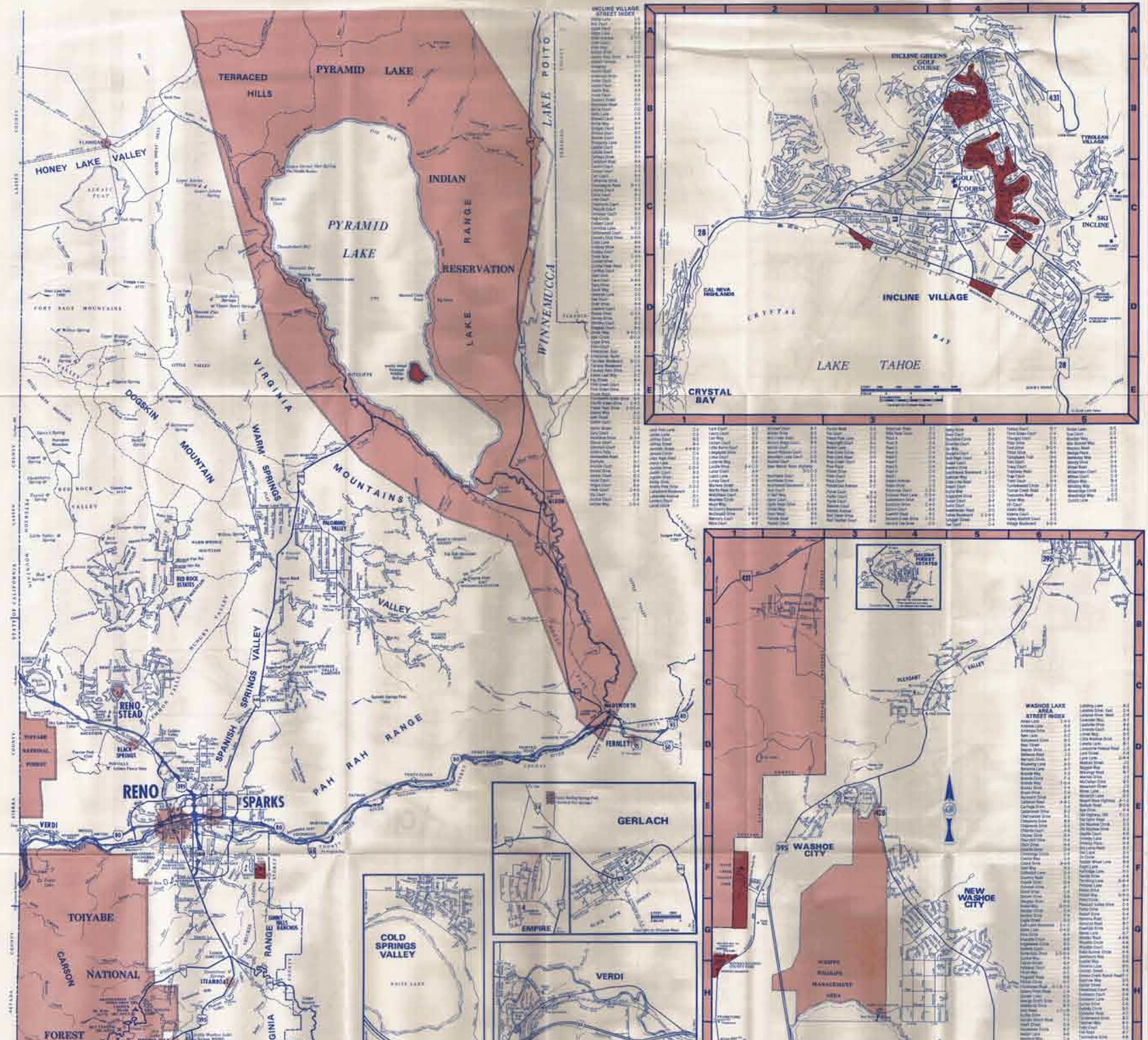

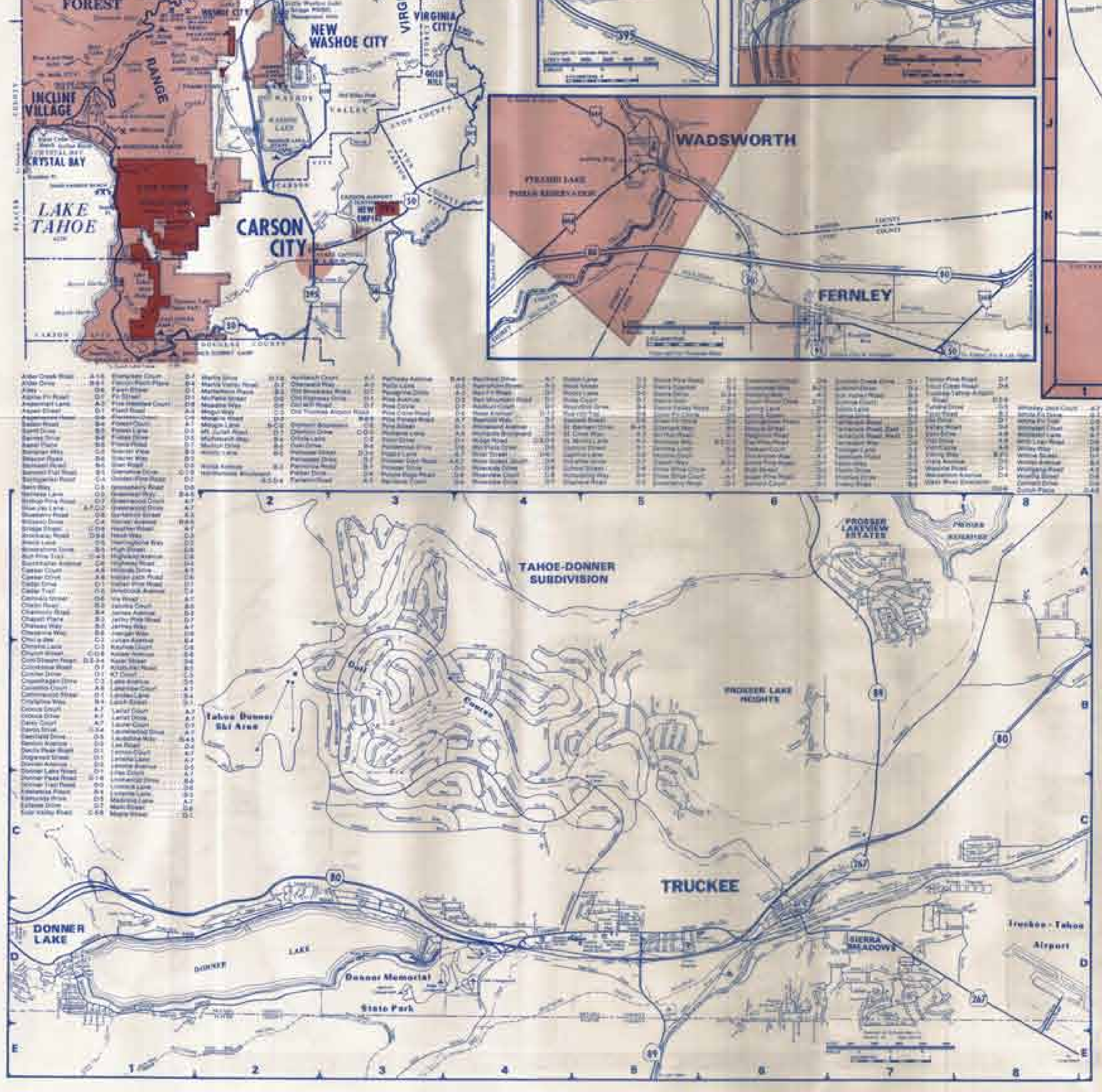

other available publications

AREA MAPS

- Alpine-Amador Counties
- Antelope Valley
- Butte-Sutter-Yuba Counties
- Calaveras-Tuolumne Counties
- Central Contra Costa County
- Cocina-Fontana
- El Dorado-Placer Counties
- Fresno City & County
- Glenn-Colusa Counties
- Imperial County
- Kern County
- Lassen-Plumas Counties
- Livermore-Pleasanton
- Marin County
- Mariposa-Madera Counties (Yosemite)
- Merced County
- Monterey County
- Napa-Lake Counties
- Palm Springs Area
- Reno-Washoe Counties and Truckee
- Sacramento, Metropolitan
- San Bernardino Mountains
- San Joaquin County
- San Luis Obispo County
- San Mateo County
- Santa Barbara County
- Santa Cruz County
- Shasta-Tehama Counties
- Sierra-Nevada Counties
- Solano-Yolo Counties
- Sonoma County
- Stanislaus County
- Tahoe-Carson
- Tulare-Kings Counties
- Ventura County

RECREATION MAPS

- The Delta Map
- Gold Map (Mother Lode)
- Redwood Empire
- N. California Wine Map
- California-Nevada Ski Map

U.S. & STATE MAPS

- California
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Truckee

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