APPENDIX H

DRAINAGE REPORT FOR THE WAL-MART 1899-01

MAY 9, 2005

GLENN M. CHUNG, P.E.

PRELIMINARY HYDROLOGY ANALYSIS FOR CANYON SPRINGS

JULY 26, 2004

HUNSAKER & ASSOCIATES IRVINE, INC.,

DRAINAGE REPORT FOR THE WAL-MART 1899-01

DRAINAGE REPORT

FOR THE

WAL-MART 1899-01
RIVERSIDE, CALIFORNIA

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Date prepared: May 9, 2005

Job No. 04017-001

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INTRODUCTION

The proposed development is located at the northwest corner of Valley Spring and Corporate Centre Parkway in the City of Riverside.

The proposed development is a Wal-Mart 195 super center located just 670 feet southwest of the existing Wal-Mart store on a twenty (20) acre parcel that is currently owned by Transcan Development. An onsite storm drain system will be utilized to collect all surface flows generated within the parking lot and the roof.

Currently, the existing site drains to the northwest via surface flow at an approximate grade of one (1) percent. There is an existing 42" storm drain that outlets within our proposed boundary next to the existing MWD Maintenance Building. The proposed storm drain system includes the extension of the 42" storm drain into the public storm drain system proposed by TransCAN Development and is shown in Hunsaker's hydrology study.

The storm drain system for the Wal-Mart Parcel consists of two onsite private storm drain systems, Line "A" and Line "B" that will carry all surface flows to the proposed storm drain system. Both systems will consist of various size drop inlets and catch basins. Line "A" is basically north of the Wal-Mart building within the major parking lot. Line "A" will discharge through a Hydrodynamic Clarifier to meet City of Riversides Water Quality requirements. Line "B" located west & south of the Wal-Mart Building also discharges through a hydrodynamic clarifier but also enters into an underground detention storage system before discharging into an existing catch basin located in Corporate Centre Place. Due to the building configuration, the amount of surface water was not anticipated to drain to the west. Therefore, the underground detention system will prevent any impacts to the existing catch basin and public storm drain system which then discharges into an existing earth channel west of TransCAN's development.

The onsite storm drain system has utilized the following structures to handle all nuisance waters and to satisfy any NPDES concerns:

1. Hydrodynamic Clarifiers,
2. Underground Detention Basin,
3. BMP's (Best Management Practices) shall be utilized to conform to NPDES.

PURPOSE

The purpose of this study is to (1) calculate the developed onsite storm runoff flows (2) determine the size and location of the storm drain facilities needed to intercept; convey and store the storm runoff flows, (3) determine the required size of the underground detention basin and the volume of water to be detained.

ON-SITE HYDROLOGY

Existing Conditions

Currently, the site is on dirt and grass and is undeveloped. The existing site drains via sheet flow to the south and southwest.

Proposed Conditions

The onsite storm drain system will collect all surface flows via a series of catch basins and drop inlets into two (2) mainlines, Line "A" and Line "B". All surface flows generated onsite will be detained in two on-site Detention Basins.

All hydrological and hydraulic calculations are per Riverside County Hydrology Guidelines.

Design frequency of 25-year and 100-year used for detention basin outflow storm drain system designed for a maximum 25 year peak flow.

Due to the water shed being less than 100 acres in size, the rational method was used to design the onsite storm drain system, while the unit hydrograph method, software by Advanced Engineering Software (AES-2003), was used for a 25 and 100-year storm inflow-outflow routing for the design of the Detention Basins.

All drop inlets in a "sump-style" condition have been designed for a 25-year recurrence interval per Riverside county requirements.

The Water Surface Pressure Gradient (WSPG) software by Woodcrest Engineering was used to calculate the onsite storm drain system HGL.

Drainage boundaries were derived from the Precise Grading Plan contours as shown on the hydrology map, provided in the back pocket.

CONCLUSION

All surface runoff generated by this project will be collected via a private on-site storm drain system and was taken into account in TransCAN Development Hydrology Study. Therefore, no additional impacts were created by this development.

Wal-Mart 1899-01
City of Riverside
Q100 = 31.12 CFS

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1000.000	1554.970	1.429	1556.399	31.12	9.37	1.36	1557.76	.00	1.81	3.00	3.000	.000	.00	1 .0
16.300	.0123					.0100	.16	1.43	1.57	1.36	.013	.00	.00	PIPE
1016.300	1555.170	1.456	1556.627	31.12	9.14	1.30	1557.92	.35	1.81	3.00	3.000	.000	.00	1 .0
10.890	.0123					.0093	.10	1.80	1.51	1.36	.013	.00	.00	PIPE
1027.190	1555.304	1.483	1556.787	31.12	8.93	1.24	1558.03	.00	1.81	3.00	3.000	.000	.00	1 .0
24.803	.0093					.0090	.22	1.48	1.46	1.47	.013	.00	.00	PIPE
1051.993	1555.535	1.491	1557.026	31.12	8.87	1.22	1558.25	.00	1.81	3.00	3.000	.000	.00	1 .0
56.451	.0093					.0084	.47	1.49	1.45	1.47	.013	.00	.00	PIPE
1108.444	1556.061	1.548	1557.609	31.12	8.46	1.11	1558.72	.00	1.81	3.00	3.000	.000	.00	1 .0
21.100	.0093					.0074	.16	1.55	1.35	1.47	.013	.00	.00	PIPE
1129.545	1556.258	1.608	1557.865	31.12	8.07	1.01	1558.88	.00	1.81	2.99	3.000	.000	.00	1 .0
10.238	.0093					.0065	.07	1.61	1.25	1.47	.013	.00	.00	PIPE
1139.783	1556.353	1.671	1558.024	31.12	7.69	.92	1558.94	.00	1.81	2.98	3.000	.000	.00	1 .0
4.753	.0093					.0057	.03	1.67	1.16	1.47	.013	.00	.00	PIPE
1144.536	1556.397	1.737	1558.135	31.12	7.33	.84	1558.97	.00	1.81	2.96	3.000	.000	.00	1 .0
1.344	.0093					.0051	.01	1.74	1.08	1.47	.013	.00	.00	PIPE
1145.880	1556.410	1.809	1558.219	31.12	6.99	.76	1558.98	.00	1.81	2.94	3.000	.000	.00	1 .0
JUNCT STR	.0093					.0027	.01	1.81	1.00		.013	.00	.00	PIPE

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1148.880	1556.438	2.716	1559.154	18.42	2.74	.12	1559.27	.00	1.37	1.76	3.000	.000	.00	1 .0
19.079	.0085					.0007	.01	2.72	.25	1.13	.013	.00	.00	PIPE
1167.959	1556.600	2.556	1559.156	18.42	2.87	.13	1559.28	.00	1.37	2.13	3.000	.000	.00	1 .0
15.484	.0085					.0007	.01	2.56	.29	1.13	.013	.00	.00	PIPE
1183.443	1556.731	2.424	1559.155	18.42	3.01	.14	1559.30	.00	1.37	2.36	3.000	.000	.00	1 .0
13.342	.0085					.0008	.01	2.42	.33	1.13	.013	.00	.00	PIPE
1196.784	1556.845	2.307	1559.152	18.42	3.16	.15	1559.31	.00	1.37	2.53	3.000	.000	.00	1 .0
11.797	.0085					.0009	.01	2.31	.37	1.13	.013	.00	.00	PIPE
1208.581	1556.945	2.202	1559.147	18.42	3.31	.17	1559.32	.00	1.37	2.65	3.000	.000	.00	1 .0
10.565	.0085					.0010	.01	2.20	.40	1.13	.013	.00	.00	PIPE
1219.146	1557.034	2.107	1559.141	18.42	3.47	.19	1559.33	.00	1.37	2.74	3.000	.000	.00	1 .0
9.530	.0085					.0011	.01	2.11	.44	1.13	.013	.00	.00	PIPE
1228.676	1557.115	2.018	1559.133	18.42	3.64	.21	1559.34	.00	1.37	2.82	3.000	.000	.00	1 .0
8.637	.0085					.0013	.01	2.02	.48	1.13	.013	.00	.00	PIPE
1237.314	1557.189	1.935	1559.124	18.42	3.82	.23	1559.35	.00	1.37	2.87	3.000	.000	.00	1 .0
7.791	.0085					.0014	.01	1.94	.52	1.13	.013	.00	.00	PIPE
1245.105	1557.255	1.858	1559.112	18.42	4.01	.25	1559.36	.00	1.37	2.91	3.000	.000	.00	1 .0
7.016	.0085					.0016	.01	1.86	.56	1.13	.013	.00	.00	PIPE

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1252.120	1557.314	1.785	1559.099	18.42	4.20	.27	1559.37	.00	1.37	2.95	3.000	.000	.00	1 .0
6.262	.0085					.0018	.01	1.78	.61	1.13	.013	.00	.00	PIPE
1258.383	1557.368	1.716	1559.083	18.42	4.41	.30	1559.38	.00	1.37	2.97	3.000	.000	.00	1 .0
4.580	.0085					.0021	.01	1.72	.65	1.13	.013	.00	.00	PIPE
1262.962	1557.406	1.650	1559.057	18.42	4.62	.33	1559.39	.00	1.37	2.98	3.000	.000	.00	1 .0
HYDRAULIC JUMP														
1262.962	1557.406	1.126	1558.533	18.42	7.60	.90	1559.43	.00	1.37	2.91	3.000	.000	.00	1 .0
49.308	.0085					.0085	.42	1.13	1.47	1.13	.013	.00	.00	PIPE
1312.271	1557.825	1.126	1558.951	18.42	7.60	.90	1559.85	.00	1.37	2.91	3.000	.000	.00	1 .0
81.929	.0085					.0085	.70	1.13	1.47	1.13	.013	.00	.00	PIPE
1394.200	1558.520	1.123	1559.643	18.42	7.62	.90	1560.55	.12	1.37	2.90	3.000	.000	.00	1 .0
59.530	.0086					.0086	.51	1.24	1.47	1.12	.013	.00	.00	PIPE
1453.730	1559.030	1.122	1560.152	18.42	7.64	.91	1561.06	.00	1.37	2.90	3.000	.000	.00	1 .0
4.085	.0086					.0086	.04	1.12	1.48	1.12	.013	.00	.00	PIPE
1457.815	1559.065	1.122	1560.187	18.42	7.64	.91	1561.09	.00	1.37	2.90	3.000	.000	.00	1 .0
80.705	.0086					.0083	.67	1.12	1.48	1.12	.013	.00	.00	PIPE
1538.520	1559.760	1.147	1560.907	18.42	7.41	.85	1561.76	.00	1.37	2.92	3.000	.000	.00	1 .0
30.883	.0086					.0074	.23	1.15	1.41	1.12	.013	.00	.00	PIPE

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1569.404	1560.026	1.189	1561.214	18.42	7.07	.78	1561.99	.00	1.37	2.93	3.000	.000	.00	1 .0
13.130	.0086					.0065	.09	1.19	1.32	1.12	.013	.00	.00	PIPE
1582.534	1560.139	1.232	1561.370	18.42	6.74	.70	1562.08	.00	1.37	2.95	3.000	.000	.00	1 .0
6.599	.0086					.0057	.04	1.23	1.23	1.12	.013	.00	.00	PIPE
1589.133	1560.195	1.277	1561.472	18.42	6.42	.64	1562.11	.00	1.37	2.97	3.000	.000	.00	1 .0
3.120	.0086					.0050	.02	1.28	1.15	1.12	.013	.00	.00	PIPE
1592.253	1560.222	1.324	1561.546	18.42	6.12	.58	1562.13	.00	1.37	2.98	3.000	.000	.00	1 .0
.897	.0086					.0044	.00	1.32	1.07	1.12	.013	.00	.00	PIPE
1593.150	1560.230	1.374	1561.604	18.42	5.83	.53	1562.13	.00	1.37	2.99	3.000	.000	.00	1 .0
JUNCT STR	.0087					.0024	.01	1.37	1.00		.013	.00	.00	PIPE
1596.150	1560.256	1.850	1562.106	11.93	2.61	.11	1562.21	.00	1.10	2.92	3.000	.000	.00	1 .0
2.692	.0237					.0007	.00	1.85	.37	.69	.013	.00	.00	PIPE
1598.842	1560.320	1.777	1562.097	11.93	2.74	.12	1562.21	.00	1.10	2.95	3.000	.000	.00	1 .0
2.483	.0237					.0008	.00	1.78	.40	.69	.013	.00	.00	PIPE
1601.325	1560.379	1.708	1562.087	11.93	2.87	.13	1562.22	.00	1.10	2.97	3.000	.000	.00	1 .0
2.281	.0237					.0009	.00	1.71	.43	.69	.013	.00	.00	PIPE
1603.606	1560.433	1.644	1562.077	11.93	3.01	.14	1562.22	.00	1.10	2.99	3.000	.000	.00	1 .0
2.096	.0237					.0010	.00	1.64	.46	.69	.013	.00	.00	PIPE

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1605.702	1560.483	1.582	1562.065	11.93	3.16	.15	1562.22	.00	1.10	3.00	3.000	.000	.00	1 .0
1.913	.0237					.0011	.00	1.58	.50	.69	.013	.00	.00	PIPE
1607.616	1560.528	1.523	1562.051	11.93	3.31	.17	1562.22	.00	1.10	3.00	3.000	.000	.00	1 .0
1.733	.0237					.0013	.00	1.52	.53	.69	.013	.00	.00	PIPE
1609.349	1560.569	1.467	1562.037	11.93	3.47	.19	1562.22	.00	1.10	3.00	3.000	.000	.00	1 .0
1.553	.0237					.0015	.00	1.47	.57	.69	.013	.00	.00	PIPE
1610.902	1560.606	1.414	1562.020	11.93	3.64	.21	1562.23	.00	1.10	3.00	3.000	.000	.00	1 .0
1.379	.0237					.0017	.00	1.41	.61	.69	.013	.00	.00	PIPE
1612.281	1560.639	1.363	1562.002	11.93	3.82	.23	1562.23	.00	1.10	2.99	3.000	.000	.00	1 .0
1.193	.0237					.0019	.00	1.36	.66	.69	.013	.00	.00	PIPE
1613.474	1560.667	1.314	1561.982	11.93	4.01	.25	1562.23	.00	1.10	2.98	3.000	.000	.00	1 .0
1.010	.0237					.0022	.00	1.31	.71	.69	.013	.00	.00	PIPE
1614.484	1560.691	1.268	1561.959	11.93	4.20	.27	1562.23	.00	1.10	2.96	3.000	.000	.00	1 .0
.813	.0237					.0025	.00	1.27	.76	.69	.013	.00	.00	PIPE
1615.297	1560.711	1.223	1561.933	11.93	4.41	.30	1562.23	.00	1.10	2.95	3.000	.000	.00	1 .0
.605	.0237					.0028	.00	1.22	.81	.69	.013	.00	.00	PIPE
1615.902	1560.725	1.180	1561.905	11.93	4.62	.33	1562.24	.00	1.10	2.93	3.000	.000	.00	1 .0
.218	.0237					.0031	.00	1.18	.87	.69	.013	.00	.00	PIPE

Program Package Serial Number: 1717

WATER SURFACE PROFILE LISTING Date: 6- 6-2005 Time: 1: 6: 2

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Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1616.120	1560.730	1.160	1561.890	11.93	4.73	.35	1562.24	.00	1.10	2.92	3.000	.000	.00	1 .0
JUNCT STR	.0900							1.16	.90		.013	.00	.00	PIPE
1619.120	1561.000	.850	1561.850	9.76	5.93	.55	1562.40	.00	.99	2.70	3.000	.000	.00	1 .0
150.136	.0070					.0070	1.05	.85	1.34	.85	.013	.00	.00	PIPE
1769.256	1562.049	.850	1562.898	9.76	5.93	.55	1563.44	.00	.99	2.70	3.000	.000	.00	1 .0
51.754	.0070					.0074	.38	.85	1.34	.85	.013	.00	.00	PIPE
1821.010	1562.410	.827	1563.237	9.76	6.16	.59	1563.83	.07	.99	2.68	3.000	.000	.00	1 .0
6.777	.0082					.0077	.05	.90	1.41	.82	.013	.00	.00	PIPE
1827.787	1562.465	.830	1563.296	9.76	6.12	.58	1563.88	.07	.99	2.68	3.000	.000	.00	1 .0
24.190	.0082					.0072	.17	.90	1.40	.82	.013	.00	.00	PIPE
1851.978	1562.663	.859	1563.522	9.76	5.84	.53	1564.05	.06	.99	2.71	3.000	.000	.00	1 .0
9.629	.0082					.0063	.06	.92	1.31	.82	.013	.00	.00	PIPE
1861.606	1562.742	.889	1563.630	9.76	5.57	.48	1564.11	.06	.99	2.74	3.000	.000	.00	1 .0
4.714	.0082					.0055	.03	.95	1.23	.82	.013	.00	.00	PIPE
1866.320	1562.780	.920	1563.700	9.76	5.31	.44	1564.14	.00	.99	2.77	3.000	.000	.00	1 .0
18.547	.0051					.0051	.09	.92	1.15	.92	.013	.00	.00	PIPE
1884.867	1562.875	.921	1563.796	9.76	5.30	.44	1564.23	.00	.99	2.77	3.000	.000	.00	1 .0
21.750	.0051					.0048	.10	.92	1.15	.92	.013	.00	.00	PIPE

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1906.617	1562.987	.953	1563.940	9.76	5.05	.40	1564.34	.00	.99	2.79	3.000	.000	.00	1 .0
2.603	.0051					.0042	.01	.95	1.07	.92	.013	.00	.00	PIPE
1909.220	1563.000	.988	1563.988	9.76	4.81	.36	1564.35	.00	.99	2.82	3.000	.000	.00	1 .0
JUNCT STR	.1000					.0022	.01	.99	1.00		.013	.00	.00	PIPE
1912.220	1563.300	1.204	1564.504	4.76	1.79	.05	1564.55	.00	.68	2.94	3.000	.000	.00	1 .0
8.240	.0000					.0004	.00	1.20	.33	.00	.013	.00	.00	PIPE
1920.460	1563.300	1.208	1564.508	4.76	1.79	.05	1564.56	.00	.68	2.94	3.000	.000	.00	1 .0
JUNCT STR	.2000							1.21	.33		.013	.00	.00	PIPE
1923.460	1563.900	.626	1564.526	4.02	3.76	.22	1564.75	.00	.63	2.44	3.000	.000	.00	1 .0
.492	-.0021					.0036	.00	.63	1.00	.00	.013	.00	.00	PIPE
1923.952	1563.899	.657	1564.556	4.02	3.51	.19	1564.75	.00	.63	2.48	3.000	.000	.00	1 .0
1.596	-.0021					.0030	.00	.66	.91	.00	.013	.00	.00	PIPE
1925.547	1563.896	.690	1564.586	4.02	3.27	.17	1564.75	.00	.63	2.53	3.000	.000	.00	1 .0
2.849	-.0021					.0025	.01	.69	.83	.00	.013	.00	.00	PIPE
1928.397	1563.890	.725	1564.614	4.02	3.05	.14	1564.76	.00	.63	2.57	3.000	.000	.00	1 .0
4.243	-.0021					.0020	.01	.72	.75	.00	.013	.00	.00	PIPE
1932.639	1563.880	.761	1564.642	4.02	2.85	.13	1564.77	.00	.63	2.61	3.000	.000	.00	1 .0
5.761	-.0021					.0017	.01	.76	.68	.00	.013	.00	.00	PIPE

Wal-Mart 1899-01
City of Riverside
Q100 = 31.12 CFS

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1938.400	1563.868	.799	1564.667	4.02	2.66	.11	1564.78	.00	.63	2.65	3.000	.000	.00	1 .0
7.387	-.0021					.0014	.01	.80	.62	.00	.013	.00	.00	PIPE
1945.787	1563.852	.839	1564.692	4.02	2.48	.10	1564.79	.00	.63	2.69	3.000	.000	.00	1 .0
9.101	-.0021					.0011	.01	.84	.57	.00	.013	.00	.00	PIPE
1954.887	1563.833	.881	1564.714	4.02	2.32	.08	1564.80	.00	.63	2.73	3.000	.000	.00	1 .0
10.884	-.0021					.0009	.01	.88	.51	.00	.013	.00	.00	PIPE
1965.771	1563.810	.925	1564.735	4.02	2.17	.07	1564.81	.00	.63	2.77	3.000	.000	.00	1 .0
12.718	-.0021					.0008	.01	.93	.47	.00	.013	.00	.00	PIPE
1978.490	1563.783	.971	1564.754	4.02	2.03	.06	1564.82	.00	.63	2.81	3.000	.000	.00	1 .0
14.589	-.0021					.0006	.01	.97	.43	.00	.013	.00	.00	PIPE
1993.079	1563.751	1.020	1564.771	4.02	1.90	.06	1564.83	.00	.63	2.84	3.000	.000	.00	1 .0
16.485	-.0021					.0005	.01	1.02	.39	.00	.013	.00	.00	PIPE
2009.564	1563.716	1.071	1564.787	4.02	1.77	.05	1564.84	.00	.63	2.87	3.000	.000	.00	1 .0
18.398	-.0021					.0004	.01	1.07	.35	.00	.013	.00	.00	PIPE
2027.962	1563.677	1.124	1564.802	4.02	1.66	.04	1564.84	.00	.63	2.90	3.000	.000	.00	1 .0
20.324	-.0021					.0004	.01	1.12	.32	.00	.013	.00	.00	PIPE
2048.286	1563.634	1.181	1564.814	4.02	1.56	.04	1564.85	.00	.63	2.93	3.000	.000	.00	1 .0
1.704	-.0021					.0003	.00	1.18	.29	.00	.013	.00	.00	PIPE

Wal-Mart 1899-01
City of Riverside
Q100 = 31.12 CFS

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
2049.990	1563.630	1.185	1564.815	4.02	1.55	.04	1564.85	.00	.63	2.93	3.000	.000	.00	1 .0
JUNCT STR	.1500					.0003	.00	1.19	.29		.013	.00	.00	PIPE
2051.990	1563.930	.906	1564.836	2.26	1.26	.02	1564.86	.00	.47	2.75	3.000	.000	.00	1 .0
.555	.0511					.0003	.00	.91	.27	.26	.013	.00	.00	PIPE
2052.545	1563.958	.875	1564.833	2.26	1.32	.03	1564.86	.00	.47	2.73	3.000	.000	.00	1 .0
.527	.0511					.0004	.00	.88	.29	.26	.013	.00	.00	PIPE
2053.072	1563.985	.846	1564.831	2.26	1.38	.03	1564.86	.00	.47	2.70	3.000	.000	.00	1 .0
.500	.0511					.0004	.00	.85	.31	.26	.013	.00	.00	PIPE
2053.572	1564.011	.817	1564.828	2.26	1.45	.03	1564.86	.00	.47	2.67	3.000	.000	.00	1 .0
.475	.0511					.0005	.00	.82	.33	.26	.013	.00	.00	PIPE
2054.047	1564.035	.790	1564.825	2.26	1.52	.04	1564.86	.00	.47	2.64	3.000	.000	.00	1 .0
.212	.0511					.0005	.00	.79	.36	.26	.013	.00	.00	PIPE
2054.259	1564.046	.764	1564.809	2.26	1.59	.04	1564.85	.00	.47	2.61	3.000	.000	.00	1 .0
HYDRAULIC JUMP														
2054.259	1564.046	.256	1564.302	2.26	7.74	.93	1565.23	.00	.47	1.68	3.000	.000	.00	1 .0
107.998	.0511					.0511	5.52	.26	3.27	.26	.013	.00	.00	PIPE
2162.257	1569.562	.256	1569.818	2.26	7.74	.93	1570.75	.00	.47	1.68	3.000	.000	.00	1 .0
23.116	.0511					.0500	1.15	.26	3.27	.26	.013	.00	.00	PIPE

Wal-Mart 1899-01
City of Riverside
Q100 = 31.12 CFS

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
2185.373	1570.743	.259	1571.002	2.26	7.62	.90	1571.90	.00	.47	1.69	3.000	.000	.00	1 .0
13.722	.0511					.0457	.63	.26	3.20	.26	.013	.00	.00	PIPE
2199.095	1571.444	.268	1571.711	2.26	7.27	.82	1572.53	.00	.47	1.71	3.000	.000	.00	1 .0
5.879	.0511					.0399	.23	.27	3.00	.26	.013	.00	.00	PIPE
2204.974	1571.744	.276	1572.020	2.26	6.93	.75	1572.77	.00	.47	1.74	3.000	.000	.00	1 .0
3.605	.0511					.0348	.13	.28	2.82	.26	.013	.00	.00	PIPE
2208.579	1571.928	.286	1572.214	2.26	6.61	.68	1572.89	.00	.47	1.76	3.000	.000	.00	1 .0
2.520	.0511					.0304	.08	.29	2.64	.26	.013	.00	.00	PIPE
2211.099	1572.057	.295	1572.352	2.26	6.30	.62	1572.97	.00	.47	1.79	3.000	.000	.00	1 .0
1.883	.0511					.0265	.05	.29	2.48	.26	.013	.00	.00	PIPE
2212.982	1572.153	.305	1572.457	2.26	6.01	.56	1573.02	.00	.47	1.81	3.000	.000	.00	1 .0
1.459	.0511					.0231	.03	.30	2.32	.26	.013	.00	.00	PIPE
2214.442	1572.227	.315	1572.542	2.26	5.73	.51	1573.05	.00	.47	1.84	3.000	.000	.00	1 .0
1.161	.0511					.0202	.02	.31	2.18	.26	.013	.00	.00	PIPE
2215.603	1572.287	.325	1572.612	2.26	5.46	.46	1573.07	.00	.47	1.87	3.000	.000	.00	1 .0
.937	.0511					.0176	.02	.33	2.04	.26	.013	.00	.00	PIPE
2216.540	1572.335	.336	1572.670	2.26	5.21	.42	1573.09	.00	.47	1.89	3.000	.000	.00	1 .0
.757	.0511					.0154	.01	.34	1.91	.26	.013	.00	.00	PIPE

Wal-Mart 1899-01
City of Riverside
Q100 = 31.12 CFS

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
2217.297	1572.373	.347	1572.720	2.26	4.96	.38	1573.10	.00	.47	1.92	3.000	.000	.00	1 .0
.618	.0511					.0134	.01	.35	1.80	.26	.013	.00	.00	PIPE
2217.915	1572.405	.359	1572.763	2.26	4.73	.35	1573.11	.00	.47	1.95	3.000	.000	.00	1 .0
.500	.0511					.0117	.01	.36	1.68	.26	.013	.00	.00	PIPE
2218.415	1572.430	.370	1572.801	2.26	4.51	.32	1573.12	.00	.47	1.97	3.000	.000	.00	1 .0
.402	.0511					.0102	.00	.37	1.58	.26	.013	.00	.00	PIPE
2218.818	1572.451	.383	1572.833	2.26	4.30	.29	1573.12	.00	.47	2.00	3.000	.000	.00	1 .0
.318	.0511					.0089	.00	.38	1.48	.26	.013	.00	.00	PIPE
2219.136	1572.467	.395	1572.862	2.26	4.10	.26	1573.12	.00	.47	2.03	3.000	.000	.00	1 .0
.246	.0511					.0078	.00	.40	1.39	.26	.013	.00	.00	PIPE
2219.382	1572.480	.409	1572.888	2.26	3.91	.24	1573.13	.00	.47	2.06	3.000	.000	.00	1 .0
.180	.0511					.0068	.00	.41	1.30	.26	.013	.00	.00	PIPE
2219.563	1572.489	.422	1572.911	2.26	3.73	.22	1573.13	.00	.47	2.09	3.000	.000	.00	1 .0
.123	.0511					.0059	.00	.42	1.22	.26	.013	.00	.00	PIPE
2219.685	1572.495	.436	1572.931	2.26	3.56	.20	1573.13	.00	.47	2.12	3.000	.000	.00	1 .0
.071	.0511					.0052	.00	.44	1.14	.26	.013	.00	.00	PIPE
2219.756	1572.499	.451	1572.950	2.26	3.39	.18	1573.13	.00	.47	2.14	3.000	.000	.00	1 .0
.024	.0511					.0045	.00	.45	1.07	.26	.013	.00	.00	PIPE

Wal-Mart 1899-01
City of Riverside
Q100 = 31.12 CFS

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
2219.780	1572.500	.467	1572.967	2.26	3.22	.16	1573.13	.00	.47	2.18	3.000	.000	.00	1 ,0

LINE B

Program Package Serial Number: 1717

WATER SURFACE PROFILE LISTING

Date: 6- 7-2005 Time: 3:12: 4

Wal-Mart 1899-01
City of Riverside
Q100 = 20.55 CFS

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1000.000	1555.000	.778	1555.778	20.55	14.13	3.10	1558.88	.00	1.46	2.63	3.000	.000	.00	1 .0
1.576	.1103					.0427	.07	.78	3.35	.62	.013	.00	.00	PIPE
1001.576	1555.174	.788	1555.962	20.55	13.86	2.98	1558.95	.00	1.46	2.64	3.000	.000	.00	1 .0
3.420	.1103					.0389	.13	.79	3.26	.62	.013	.00	.00	PIPE
1004.995	1555.551	.816	1556.367	20.55	13.22	2.71	1559.08	.00	1.46	2.67	3.000	.000	.00	1 .0
2.865	.1103					.0341	.10	.82	3.05	.62	.013	.00	.00	PIPE
1007.860	1555.867	.844	1556.711	20.55	12.60	2.47	1559.18	.00	1.46	2.70	3.000	.000	.00	1 .0
2.422	.1103					.0298	.07	.84	2.86	.62	.013	.00	.00	PIPE
1010.282	1556.134	.873	1557.008	20.55	12.02	2.24	1559.25	.00	1.46	2.73	3.000	.000	.00	1 .0
2.059	.1103					.0261	.05	.87	2.67	.62	.013	.00	.00	PIPE
1012.341	1556.361	.904	1557.265	20.55	11.46	2.04	1559.30	.00	1.46	2.75	3.000	.000	.00	1 .0
1.758	.1103					.0229	.04	.90	2.50	.62	.013	.00	.00	PIPE
1014.098	1556.555	.935	1557.490	20.55	10.92	1.85	1559.34	.00	1.46	2.78	3.000	.000	.00	1 .0
1.501	.1103					.0200	.03	.94	2.34	.62	.013	.00	.00	PIPE
1015.600	1556.721	.968	1557.689	20.55	10.42	1.68	1559.37	.00	1.46	2.81	3.000	.000	.00	1 .0
1.282	.1103					.0175	.02	.97	2.19	.62	.013	.00	.00	PIPE
1016.882	1556.862	1.002	1557.865	20.55	9.93	1.53	1559.40	.00	1.46	2.83	3.000	.000	.00	1 .0
1.093	.1103					.0154	.02	1.00	2.05	.62	.013	.00	.00	PIPE

Wal-Mart 1899-01
City of Riverside
Q100 = 20.55 CFS

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE	Critical Depth / Dpth	Flow Top Width / Froude N	Height/Dia.-FT / Norm Dp	Base Wt or I.D. / "N"	ZL / X-Fall	ZR	No Wth Prs/Pip / Type	Ch
1017.974	1556.983	1.038	1558.021	20.55	9.47	1.39	1559.41	.00	1.46	2.85	3.000	.000	.00	1		.0
.925	.1103					.0135	.01	1.04	1.91	.62	.013	.00	.00	PIPE		
1018.899	1557.085	1.075	1558.160	20.55	9.03	1.27	1559.43	.00	1.46	2.88	3.000	.000	.00	1		.0
.778	.1103					.0118	.01	1.07	1.79	.62	.013	.00	.00	PIPE		
1019.678	1557.171	1.113	1558.284	20.55	8.61	1.15	1559.43	.00	1.46	2.90	3.000	.000	.00	1		.0
.645	.1103					.0103	.01	1.11	1.67	.62	.013	.00	.00	PIPE		
1020.323	1557.242	1.153	1558.395	20.55	8.21	1.05	1559.44	.00	1.46	2.92	3.000	.000	.00	1		.0
.527	.1103					.0091	.00	1.15	1.56	.62	.013	.00	.00	PIPE		
1020.850	1557.300	1.195	1558.495	20.55	7.83	.95	1559.45	.06	1.46	2.94	3.000	.000	.00	1		.0
5.095	.0120					.0083	.04	1.26	1.46	1.09	.013	.00	.00	PIPE		
1025.945	1557.361	1.213	1558.574	20.55	7.68	.91	1559.49	.06	1.46	2.94	3.000	.000	.00	1		.0
8.827	.0120					.0076	.07	1.27	1.42	1.09	.013	.00	.00	PIPE		
1034.772	1557.467	1.257	1558.724	20.55	7.32	.83	1559.56	.05	1.46	2.96	3.000	.000	.00	1		.0
5.511	.0120					.0066	.04	1.31	1.32	1.09	.013	.00	.00	PIPE		
1040.283	1557.533	1.303	1558.836	20.55	6.98	.76	1559.59	.05	1.46	2.97	3.000	.000	.00	1		.0
3.327	.0120					.0058	.02	1.35	1.24	1.09	.013	.00	.00	PIPE		
1043.610	1557.572	1.351	1558.924	20.55	6.65	.69	1559.61	.05	1.46	2.99	3.000	.000	.00	1		.0
1.765	.0120					.0051	.01	1.40	1.15	1.09	.013	.00	.00	PIPE		

Wal-Mart 1899-01
City of Riverside
Q100 = 20.55 CFS

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1045.374	1557.594	1.402	1558.995	20.55	6.34	.62	1559.62	.04	1.46	2.99	3.000	.000	.00	1 .0
.536	.0120					.0045	.00	1.44	1.07	1.09	.013	.00	.00	PIPE
1045.910	1557.600	1.456	1559.056	20.55	6.04	.57	1559.62	.00	1.46	3.00	3.000	.000	.00	1 .0
JUNCT STR	.0121					.0026	.00	1.46	1.00		.013	.00	.00	PIPE
1046.910	1557.612	1.998	1559.610	15.74	3.15	.15	1559.76	.00	1.27	2.83	3.000	.000	.00	1 .0
16.295	.0050					.0010	.02	2.00	.42	1.19	.013	.00	.00	PIPE
1063.205	1557.694	1.916	1559.610	15.74	3.30	.17	1559.78	.00	1.27	2.88	3.000	.000	.00	1 .0
15.156	.0050					.0011	.02	1.92	.45	1.19	.013	.00	.00	PIPE
1078.361	1557.770	1.840	1559.610	15.74	3.46	.19	1559.80	.00	1.27	2.92	3.000	.000	.00	1 .0
14.083	.0050					.0012	.02	1.84	.49	1.19	.013	.00	.00	PIPE
1092.444	1557.841	1.768	1559.608	15.74	3.63	.20	1559.81	.00	1.27	2.95	3.000	.000	.00	1 .0
11.836	.0050					.0014	.02	1.77	.53	1.19	.013	.00	.00	PIPE
1104.280	1557.900	1.707	1559.607	15.74	3.79	.22	1559.83	.03	1.27	2.97	3.000	.000	.00	1 .0
12.301	.0050					.0016	.02	1.74	.57	1.19	.013	.00	.00	PIPE
1116.581	1557.962	1.642	1559.603	15.74	3.98	.25	1559.85	.03	1.27	2.99	3.000	.000	.00	1 .0
11.381	.0050					.0018	.02	1.67	.61	1.19	.013	.00	.00	PIPE
1127.962	1558.019	1.580	1559.599	15.74	4.17	.27	1559.87	.04	1.27	3.00	3.000	.000	.00	1 .0
10.465	.0050					.0020	.02	1.62	.65	1.19	.013	.00	.00	PIPE

Wal-Mart 1899-01
City of Riverside
Q100 = 20.55 CFS

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1138.427	1558.071	1.521	1559.593	15.74	4.37	.30	1559.89	.04	1.27	3.00	3.000	.000	.00	1 .0
.555	.0050					.0021	.00	1.56	.70	1.19	.013	.00	.00	PIPE
1138.982	1558.074	1.521	1559.595	15.74	4.37	.30	1559.89	.04	1.27	3.00	3.000	.000	.00	1 .0
HYDRAULIC JUMP														
1138.982	1558.074	1.032	1559.106	15.74	7.31	.83	1559.94	.11	1.27	2.85	3.000	.000	.00	1 .0
5.271	.0050					.0086	.05	1.14	1.48	1.19	.013	.00	.00	PIPE
1144.253	1558.100	1.032	1559.133	15.74	7.31	.83	1559.96	.11	1.27	2.85	3.000	.000	.00	1 .0
11.380	.0050					.0092	.10	1.14	1.48	1.19	.013	.00	.00	PIPE
1155.633	1558.158	.997	1559.154	15.74	7.66	.91	1560.07	.11	1.27	2.83	3.000	.000	.00	1 .0
10.437	.0050					.0105	.11	1.11	1.58	1.19	.013	.00	.00	PIPE
1166.070	1558.210	.963	1559.173	15.74	8.04	1.00	1560.18	.00	1.27	2.80	3.000	.000	.00	1 .0
43.763	.0117					.0107	.47	.96	1.69	.95	.013	.00	.00	PIPE
1209.833	1558.721	.988	1559.709	15.74	7.76	.93	1560.64	.00	1.27	2.82	3.000	.000	.00	1 .0
23.155	.0117					.0095	.22	.99	1.61	.95	.013	.00	.00	PIPE
1232.988	1558.991	1.023	1560.014	15.74	7.40	.85	1560.86	.00	1.27	2.84	3.000	.000	.00	1 .0
12.275	.0117					.0083	.10	1.02	1.51	.95	.013	.00	.00	PIPE
1245.263	1559.134	1.059	1560.193	15.74	7.05	.77	1560.97	.00	1.27	2.87	3.000	.000	.00	1 .0
7.404	.0117					.0073	.05	1.06	1.41	.95	.013	.00	.00	PIPE

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Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE	Critical Depth / Dpth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1252.667	1559.220	1.097	1560.318	15.74	6.72	.70	1561.02	.00	1.27	2.89	3.000	.000	.00	1 .0
4.640	.0117					.0064	.03	1.10	1.32	.95	.013	.00	.00	PIPE
1257.307	1559.275	1.137	1560.411	15.74	6.41	.64	1561.05	.00	1.27	2.91	3.000	.000	.00	1 .0
2.813	.0117					.0056	.02	1.14	1.23	.95	.013	.00	.00	PIPE
1260.120	1559.307	1.178	1560.485	15.74	6.11	.58	1561.07	.00	1.27	2.93	3.000	.000	.00	1 .0
1.476	.0117					.0049	.01	1.18	1.15	.95	.013	.00	.00	PIPE
1261.595	1559.325	1.221	1560.545	15.74	5.83	.53	1561.07	.00	1.27	2.95	3.000	.000	.00	1 .0
.455	.0117					.0043	.00	1.22	1.07	.95	.013	.00	.00	PIPE
1262.050	1559.330	1.266	1560.596	15.74	5.55	.48	1561.07	.00	1.27	2.96	3.000	.000	.00	1 .0
JUNCT STR	.0000					.0026	.00	1.27	1.00		.013	.00	.00	PIPE
1263.050	1559.330	1.621	1560.950	13.31	3.42	.18	1561.13	.00	1.16	2.99	3.000	.000	.00	1 .0
11.482	.0050					.0013	.02	1.62	.53	1.09	.013	.00	.00	PIPE
1274.532	1559.388	1.560	1560.948	13.31	3.58	.20	1561.15	.00	1.16	3.00	3.000	.000	.00	1 .0
10.688	.0050					.0015	.02	1.56	.57	1.09	.013	.00	.00	PIPE
1285.220	1559.441	1.502	1560.943	13.31	3.76	.22	1561.16	.00	1.16	3.00	3.000	.000	.00	1 .0
9.924	.0050					.0017	.02	1.50	.61	1.09	.013	.00	.00	PIPE
1295.144	1559.491	1.447	1560.938	13.31	3.94	.24	1561.18	.00	1.16	3.00	3.000	.000	.00	1 .0
9.179	.0050					.0019	.02	1.45	.65	1.09	.013	.00	.00	PIPE

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1304.323	1559.537	1.395	1560.932	13.31	4.13	.27	1561.20	.00	1.16	2.99	3.000	.000	.00	1 .0
8.332	.0050					.0022	.02	1.39	.70	1.09	.013	.00	.00	PIPE
1312.654	1559.579	1.345	1560.924	13.31	4.34	.29	1561.22	.00	1.16	2.98	3.000	.000	.00	1 .0
7.443	.0050					.0025	.02	1.34	.75	1.09	.013	.00	.00	PIPE
1320.097	1559.616	1.297	1560.913	13.31	4.55	.32	1561.23	.00	1.16	2.97	3.000	.000	.00	1 .0
6.316	.0050					.0028	.02	1.30	.81	1.09	.013	.00	.00	PIPE
1326.413	1559.648	1.251	1560.899	13.31	4.77	.35	1561.25	.00	1.16	2.96	3.000	.000	.00	1 .0
2.172	.0050					.0032	.01	1.25	.87	1.09	.013	.00	.00	PIPE
1328.585	1559.659	1.207	1560.865	13.31	5.00	.39	1561.25	.00	1.16	2.94	3.000	.000	.00	1 .0
HYDRAULIC JUMP														
1328.585	1559.659	1.090	1560.748	13.31	5.74	.51	1561.26	.00	1.16	2.89	3.000	.000	.00	1 .0
61.539	.0050					.0050	.31	1.09	1.13	1.09	.013	.00	.00	PIPE
1390.123	1559.967	1.090	1561.057	13.31	5.74	.51	1561.57	.00	1.16	2.89	3.000	.000	.00	1 .0
32.497	.0050					.0050	.16	1.09	1.13	1.09	.013	.00	.00	PIPE
1422.620	1560.130	1.086	1561.216	13.31	5.77	.52	1561.73	.01	1.16	2.88	3.000	.000	.00	1 .0
8.787	.0051					.0051	.04	1.10	1.14	1.09	.013	.00	.00	PIPE
1431.407	1560.175	1.086	1561.260	13.31	5.77	.52	1561.78	.01	1.16	2.88	3.000	.000	.00	1 .0
26.928	.0051					.0048	.13	1.10	1.14	1.09	.013	.00	.00	PIPE

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1458.335	1560.311	1.119	1561.430	13.31	5.54	.48	1561.91	.01	1.16	2.90	3.000	.000	.00	1 .0
3.655	.0051					.0043	.02	1.13	1.07	1.09	.013	.00	.00	PIPE
1461.990	1560.330	1.160	1561.490	13.31	5.27	.43	1561.92	.00	1.16	2.92	3.000	.000	.00	1 .0
JUNCT STR	.0000					.0024	.00	1.16	1.00		.013	.00	.00	PIPE
1462.990	1560.330	1.577	1561.907	10.31	2.74	.12	1562.02	.00	1.02	3.00	3.000	.000	.00	1 .0
7.640	.0070					.0009	.01	1.58	.43	.87	.013	.00	.00	PIPE
1470.630	1560.383	1.519	1561.902	10.31	2.87	.13	1562.03	.00	1.02	3.00	3.000	.000	.00	1 .0
7.126	.0070					.0010	.01	1.52	.46	.87	.013	.00	.00	PIPE
1477.756	1560.433	1.463	1561.896	10.31	3.01	.14	1562.04	.00	1.02	3.00	3.000	.000	.00	1 .0
6.628	.0070					.0011	.01	1.46	.50	.87	.013	.00	.00	PIPE
1484.385	1560.480	1.410	1561.889	10.31	3.16	.15	1562.04	.00	1.02	2.99	3.000	.000	.00	1 .0
6.157	.0070					.0013	.01	1.41	.53	.87	.013	.00	.00	PIPE
1490.542	1560.523	1.359	1561.882	10.31	3.31	.17	1562.05	.00	1.02	2.99	3.000	.000	.00	1 .0
5.676	.0070					.0014	.01	1.36	.57	.87	.013	.00	.00	PIPE
1496.218	1560.563	1.310	1561.873	10.31	3.47	.19	1562.06	.00	1.02	2.98	3.000	.000	.00	1 .0
5.176	.0070					.0016	.01	1.31	.61	.87	.013	.00	.00	PIPE
1501.394	1560.599	1.264	1561.863	10.31	3.64	.21	1562.07	.00	1.02	2.96	3.000	.000	.00	1 .0
4.650	.0070					.0019	.01	1.26	.66	.87	.013	.00	.00	PIPE

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1506.044	1560.631	1.219	1561.851	10.31	3.82	.23	1562.08	.00	1.02	2.95	3.000	.000	.00	1 .0
4.105	.0070					.0021	.01	1.22	.70	.87	.013	.00	.00	PIPE
1510.150	1560.660	1.177	1561.837	10.31	4.01	.25	1562.09	.00	1.02	2.93	3.000	.000	.00	1 .0
.602	.0070					.0024	.00	1.18	.75	.87	.013	.00	.00	PIPE
1510.752	1560.664	1.136	1561.800	10.31	4.20	.27	1562.07	.00	1.02	2.91	3.000	.000	.00	1 .0
HYDRAULIC JUMP														
1510.752	1560.664	.873	1561.538	10.31	6.03	.56	1562.10	.00	1.02	2.73	3.000	.000	.00	1 .0
31.308	.0070					.0068	.21	.87	1.34	.87	.013	.00	.00	PIPE
1542.060	1560.883	.884	1561.767	10.31	5.92	.55	1562.31	.00	1.02	2.74	3.000	.000	.00	1 .0
25.196	.0070					.0063	.16	.88	1.31	.87	.013	.00	.00	PIPE
1567.256	1561.060	.915	1561.975	10.31	5.65	.50	1562.47	.00	1.02	2.76	3.000	.000	.00	1 .0
8.588	.0070					.0055	.05	.92	1.22	.87	.013	.00	.00	PIPE
1575.844	1561.120	.947	1562.067	10.31	5.39	.45	1562.52	.00	1.02	2.79	3.000	.000	.00	1 .0
3.432	.0070					.0048	.02	.95	1.15	.87	.013	.00	.00	PIPE
1579.276	1561.144	.981	1562.124	10.31	5.14	.41	1562.53	.00	1.02	2.81	3.000	.000	.00	1 .0
.904	.0070					.0042	.00	.98	1.07	.87	.013	.00	.00	PIPE
1580.180	1561.150	1.016	1562.166	10.31	4.89	.37	1562.54	.00	1.02	2.84	3.000	.000	.00	1 .0
JUNCT STR	.0070					.0023	.00	1.02	1.00		.013	.00	.00	PIPE

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1581.180	1561.157	1.405	1562.562	7.31	2.25	.08	1562.64	.00	.85	2.99	3.000	.000	.00	1 .0
8.222	.0058					.0006	.01	1.41	.38	.77	.013	.00	.00	PIPE
1589.402	1561.205	1.355	1562.559	7.31	2.36	.09	1562.65	.00	.85	2.99	3.000	.000	.00	1 .0
7.784	.0058					.0007	.01	1.35	.41	.77	.013	.00	.00	PIPE
1597.186	1561.250	1.306	1562.557	7.31	2.47	.10	1562.65	.00	.85	2.97	3.000	.000	.00	1 .0
7.349	.0058					.0008	.01	1.31	.44	.77	.013	.00	.00	PIPE
1604.535	1561.293	1.260	1562.553	7.31	2.60	.10	1562.66	.00	.85	2.96	3.000	.000	.00	1 .0
6.940	.0058					.0009	.01	1.26	.47	.77	.013	.00	.00	PIPE
1611.475	1561.334	1.215	1562.549	7.31	2.72	.12	1562.66	.00	.85	2.95	3.000	.000	.00	1 .0
6.534	.0058					.0011	.01	1.22	.50	.77	.013	.00	.00	PIPE
1618.009	1561.372	1.173	1562.545	7.31	2.85	.13	1562.67	.00	.85	2.93	3.000	.000	.00	1 .0
6.108	.0058					.0012	.01	1.17	.54	.77	.013	.00	.00	PIPE
1624.117	1561.408	1.132	1562.540	7.31	2.99	.14	1562.68	.00	.85	2.91	3.000	.000	.00	1 .0
5.699	.0058					.0014	.01	1.13	.58	.77	.013	.00	.00	PIPE
1629.817	1561.441	1.093	1562.534	7.31	3.14	.15	1562.69	.00	.85	2.89	3.000	.000	.00	1 .0
5.282	.0058					.0016	.01	1.09	.62	.77	.013	.00	.00	PIPE
1635.099	1561.472	1.055	1562.527	7.31	3.29	.17	1562.70	.00	.85	2.87	3.000	.000	.00	1 .0
4.824	.0058					.0018	.01	1.06	.66	.77	.013	.00	.00	PIPE

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1639.923	1561.500	1.019	1562.519	7.31	3.45	.19	1562.70	.00	.85	2.84	3.000	.000	.00	1 .0
4.334	.0058					.0021	.01	1.02	.71	.77	.013	.00	.00	PIPE
1644.256	1561.525	.984	1562.510	7.31	3.62	.20	1562.71	.00	.85	2.82	3.000	.000	.00	1 .0
3.792	.0058					.0024	.01	.98	.75	.77	.013	.00	.00	PIPE
1648.048	1561.547	.951	1562.498	7.31	3.80	.22	1562.72	.00	.85	2.79	3.000	.000	.00	1 .0
1.121	.0058					.0027	.00	.95	.81	.77	.013	.00	.00	PIPE
1649.169	1561.554	.918	1562.473	7.31	3.99	.25	1562.72	.00	.85	2.77	3.000	.000	.00	1 .0
HYDRAULIC JUMP														
1649.169	1561.554	.768	1562.322	7.31	5.12	.41	1562.73	.00	.85	2.62	3.000	.000	.00	1 .0
76.209	.0058					.0058	.44	.77	1.22	.77	.013	.00	.00	PIPE
1725.377	1561.999	.768	1562.766	7.31	5.12	.41	1563.17	.00	.85	2.62	3.000	.000	.00	1 .0
28.969	.0058					.0055	.16	.77	1.22	.77	.013	.00	.00	PIPE
1754.347	1562.168	.794	1562.962	7.31	4.88	.37	1563.33	.00	.85	2.65	3.000	.000	.00	1 .0
5.895	.0058					.0048	.03	.79	1.14	.77	.013	.00	.00	PIPE
1760.242	1562.203	.821	1563.024	7.31	4.66	.34	1563.36	.00	.85	2.68	3.000	.000	.00	1 .0
1.278	.0058					.0042	.01	.82	1.07	.77	.013	.00	.00	PIPE
1761.520	1562.210	.851	1563.061	7.31	4.43	.31	1563.37	.00	.85	2.70	3.000	.000	.00	1 .0
JUNCT STR	.0000					.0020	.00	.85	1.00		.013	.00	.00	PIPE

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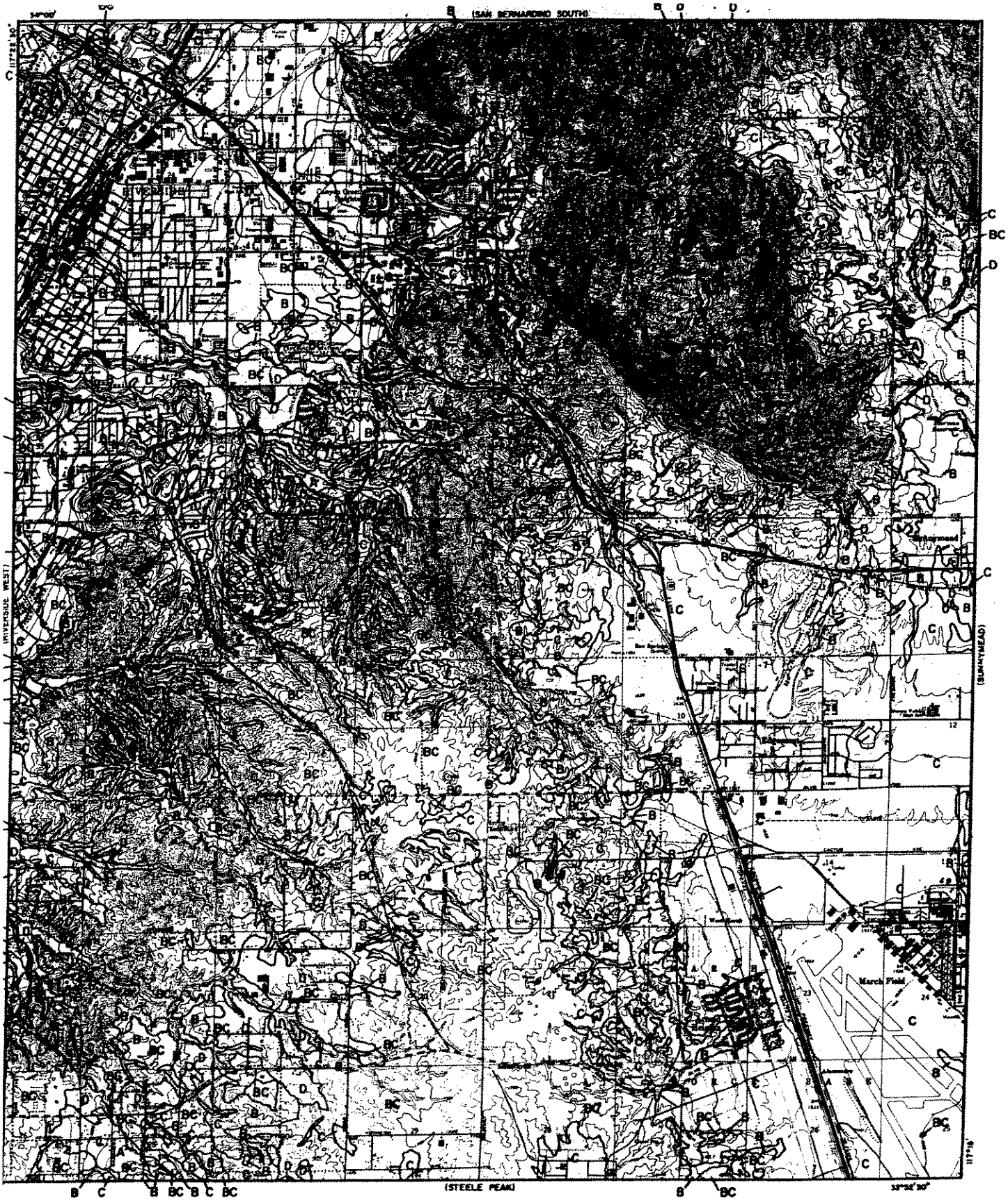
1762.520	1562.210	1.146	1563.356	2.27	.91	.01	1563.37	.00	.47	2.92	3.000	.000	.00	1	.0
7.765	.0051					.0001	.00	1.15	.17	.45	.013	.00	.00	PIPE	
1770.285	1562.249	1.106	1563.355	2.27	.96	.01	1563.37	.00	.47	2.89	3.000	.000	.00	1	.0
7.454	.0051					.0001	.00	1.11	.19	.45	.013	.00	.00	PIPE	
1777.739	1562.287	1.068	1563.355	2.27	1.01	.02	1563.37	.00	.47	2.87	3.000	.000	.00	1	.0
7.151	.0051					.0002	.00	1.07	.20	.45	.013	.00	.00	PIPE	
1784.891	1562.324	1.031	1563.355	2.27	1.06	.02	1563.37	.00	.47	2.85	3.000	.000	.00	1	.0
6.868	.0051					.0002	.00	1.03	.21	.45	.013	.00	.00	PIPE	
1791.758	1562.359	.996	1563.354	2.27	1.11	.02	1563.37	.00	.47	2.83	3.000	.000	.00	1	.0
6.582	.0051					.0002	.00	1.00	.23	.45	.013	.00	.00	PIPE	
1798.340	1562.392	.962	1563.354	2.27	1.16	.02	1563.37	.00	.47	2.80	3.000	.000	.00	1	.0
6.316	.0051					.0003	.00	.96	.24	.45	.013	.00	.00	PIPE	
1804.657	1562.424	.929	1563.353	2.27	1.22	.02	1563.38	.00	.47	2.77	3.000	.000	.00	1	.0
6.090	.0051					.0003	.00	.93	.26	.45	.013	.00	.00	PIPE	
1810.747	1562.455	.898	1563.353	2.27	1.28	.03	1563.38	.00	.47	2.75	3.000	.000	.00	1	.0
4.923	.0051					.0003	.00	.90	.28	.45	.013	.00	.00	PIPE	
1815.670	1562.480	.872	1563.352	2.27	1.33	.03	1563.38	.00	.47	2.72	3.000	.000	.00	1	.0

DRAINAGE SUBAREA

SOIL GROUP MAP



LEGEND

—— SOILS GROUP BOUNDARY

A SOILS GROUP DESIGNATION

RCFC&WCD

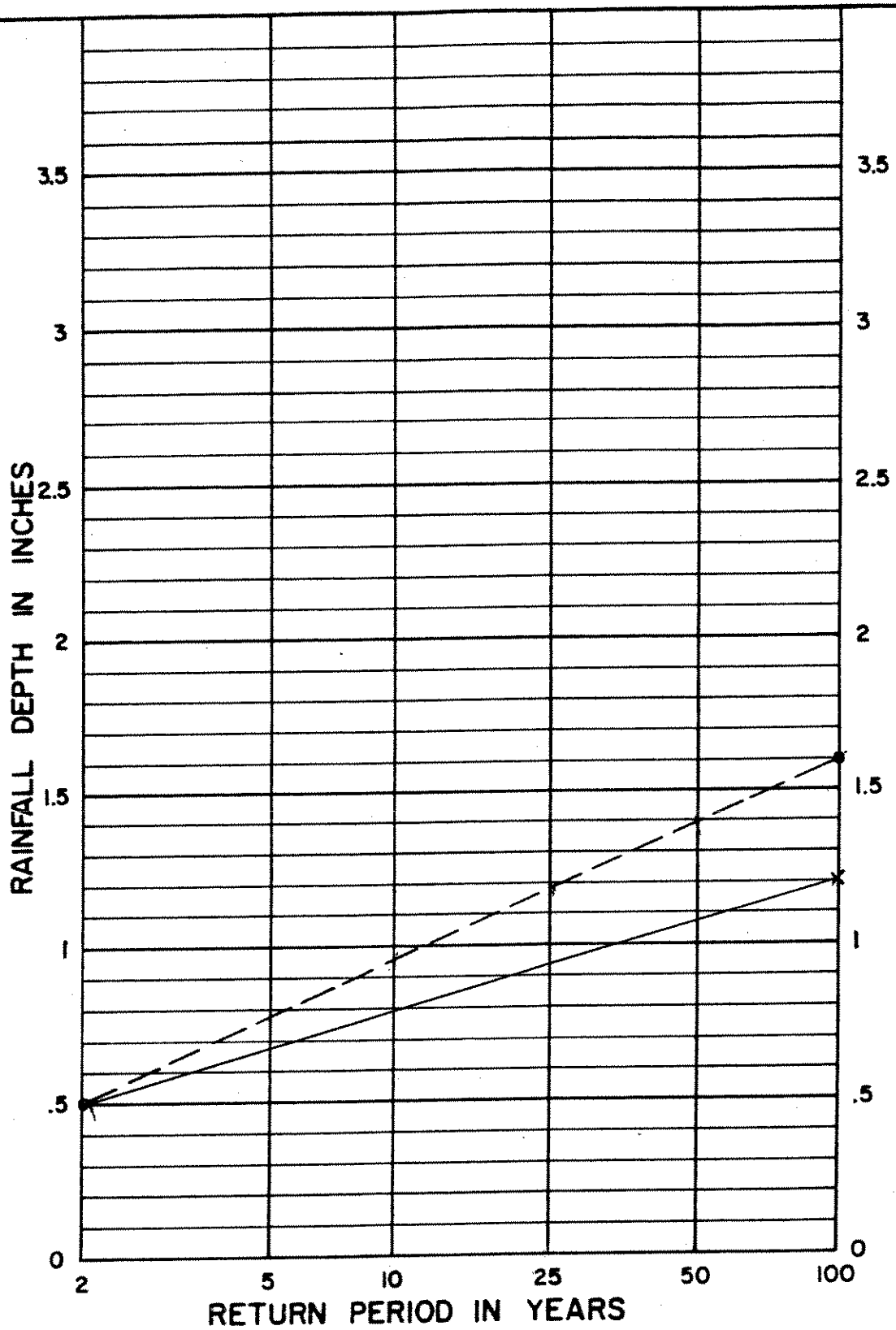
HYDROLOGY MANUAL

N

0 FEET 5000

HYDROLOGIC SOILS GROUP MAP FOR RIVERSIDE-EAST

RAINFALL INTENSITY FORM



NOTE:

1. For intermediate return periods plot 2-year and 100-year one hour values from maps, then connect points and read value for desired return period. For example given 2-year one hour = .50" and 100-year one hour = 1.60", 25-year one hour = 1.18"

Reference: NOAA Atlas 2, Volume XI-California, 1973.

RCFC & WCD

HYDROLOGY MANUAL

RAINFALL DEPTH VERSUS RETURN PERIOD FOR PARTIAL DURATION SERIES

RATIONAL METHOD STUDY

25 – Year Storm Study

```
****************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
       RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                  (RCFC&WCD)  1978 HYDROLOGY MANUAL
        (c) Copyright 1982-2003 Advanced Engineering Software (aes)
                  (Rational Tabling Version 5.9D)
             Release Date: 01/01/2003  License ID 1237

                     Analysis prepared by:

                       Hall & Foreman, Inc.
                    9130 Anaheim Place, Suite 120
                     Rancho Cucamonga, CA  91730

 ************************* DESCRIPTION OF STUDY *************************
 *                                                                      *
* WAL-MART # 1899                                                       *
* CITY OF RIVERSIDE                                                     *
* LINE A - 25 YEAR STORM EVENT                                          *
 ************************************************************************

  FILE NAME: 04017A25.DAT
  TIME/DATE OF STUDY: 11:34 04/08/2005
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  2-YEAR, 1-HOUR PRECIPITATION(INCH) =  0.500
  100-YEAR, 1-HOUR PRECIPITATION(INCH) =  1.200
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =   25.00   1-HOUR INTENSITY(INCH/HOUR) =   0.933
  SLOPE OF INTENSITY DURATION CURVE = 0.5000
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: COMPUTE CONFLUENCE VALUES ACCORDING TO RCFC&WCD HYDROLOGY MANUAL
        AND IGNORE OTHER CONFLUENCE COMBINATIONS FOR DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  ========  ================  ======  =====  ======  =====  =======
  1   30.0     20.0   0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.25 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    110.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   253.00
  UPSTREAM ELEVATION(FEET) =   1574.60
  DOWNSTREAM ELEVATION(FEET) =   1572.50
  ELEVATION DIFFERENCE(FEET) =      2.10
  TC = 0.303*[(  253.00**3)/(     2.10)]**.2 =    7.228
    25 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.689
  USER-SPECIFIED RUNOFF COEFFICIENT = .8538
  SOIL CLASSIFICATION IS "A"
  SUBAREA RUNOFF(CFS) =      1.74
  TOTAL AREA(ACRES) =      0.76   TOTAL RUNOFF(CFS) =      1.74
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     110.00 TO NODE     120.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1564.82  DOWNSTREAM(FEET) =  1563.63
  FLOW LENGTH(FEET) =    169.79   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   5.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    3.81
  ESTIMATED PIPE DIAMETER(INCH) =  18.00     NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =        1.74
  PIPE TRAVEL TIME(MIN.) =    0.74     Tc(MIN.) =    7.97
  LONGEST FLOWPATH FROM NODE     100.00 TO NODE     120.00 =    422.79 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     120.00 TO NODE     120.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    25 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.561
  USER-SPECIFIED RUNOFF COEFFICIENT = .8527
  SOIL CLASSIFICATION IS "A"
  SUBAREA AREA(ACRES) =     0.62   SUBAREA RUNOFF(CFS) =     1.35
  TOTAL AREA(ACRES) =       1.38   TOTAL RUNOFF(CFS) =     3.10
  TC(MIN.) =    7.97

****************************************************************************
  FLOW PROCESS FROM NODE     120.00 TO NODE     130.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1563.63  DOWNSTREAM(FEET) =  1562.72
  FLOW LENGTH(FEET) =    129.53   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    4.46
  ESTIMATED PIPE DIAMETER(INCH) =  18.00     NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =        3.10
  PIPE TRAVEL TIME(MIN.) =    0.48     Tc(MIN.) =    8.45
  LONGEST FLOWPATH FROM NODE     100.00 TO NODE     130.00 =    552.32 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     130.00 TO NODE     130.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    25 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.486
  USER-SPECIFIED RUNOFF COEFFICIENT = .8521
  SOIL CLASSIFICATION IS "A"
  SUBAREA AREA(ACRES) =     0.27   SUBAREA RUNOFF(CFS) =     0.57
  TOTAL AREA(ACRES) =       1.65   TOTAL RUNOFF(CFS) =     3.67
  TC(MIN.) =    8.45

****************************************************************************
  FLOW PROCESS FROM NODE     130.00 TO NODE     140.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1562.72  DOWNSTREAM(FEET) =  1562.64
  FLOW LENGTH(FEET) =     11.25   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    4.69
  ESTIMATED PIPE DIAMETER(INCH) =  18.00     NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =        3.67
  PIPE TRAVEL TIME(MIN.) =    0.04     Tc(MIN.) =    8.49
  LONGEST FLOWPATH FROM NODE     100.00 TO NODE     140.00 =    563.57 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     140.00 TO NODE     140.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    25 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.481
  USER-SPECIFIED RUNOFF COEFFICIENT = .8520
  SOIL CLASSIFICATION IS "A"
  SUBAREA AREA(ACRES) =     1.82   SUBAREA RUNOFF(CFS) =     3.85
  TOTAL AREA(ACRES) =       3.47   TOTAL RUNOFF(CFS) =     7.52
  TC(MIN.) =    8.49

****************************************************************************
  FLOW PROCESS FROM NODE     140.00 TO NODE     150.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1562.64  DOWNSTREAM(FEET) =  1560.73
  FLOW LENGTH(FEET) =    232.95   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    5.84
  ESTIMATED PIPE DIAMETER(INCH) =  18.00     NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =        7.52
  PIPE TRAVEL TIME(MIN.) =    0.66     Tc(MIN.) =    9.16
  LONGEST FLOWPATH FROM NODE     100.00 TO NODE     150.00 =    796.52 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     150.00 TO NODE     150.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    25 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.389
  USER-SPECIFIED RUNOFF COEFFICIENT = .8512
  SOIL CLASSIFICATION IS "A"
  SUBAREA AREA(ACRES) =     0.82   SUBAREA RUNOFF(CFS) =     1.67
  TOTAL AREA(ACRES) =       4.29   TOTAL RUNOFF(CFS) =     9.18
  TC(MIN.) =    9.16

****************************************************************************
  FLOW PROCESS FROM NODE     150.00 TO NODE     160.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1560.73  DOWNSTREAM(FEET) =  1560.23
  FLOW LENGTH(FEET) =     82.59   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  13.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    5.50
  ESTIMATED PIPE DIAMETER(INCH) =  21.00     NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =        9.18
  PIPE TRAVEL TIME(MIN.) =    0.25     Tc(MIN.) =    9.41
  LONGEST FLOWPATH FROM NODE     100.00 TO NODE     160.00 =    879.11 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     160.00 TO NODE     160.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    25 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.357
  USER-SPECIFIED RUNOFF COEFFICIENT = .8509
  SOIL CLASSIFICATION IS "A"
  SUBAREA AREA(ACRES) =     2.48   SUBAREA RUNOFF(CFS) =     4.97
  TOTAL AREA(ACRES) =       6.77   TOTAL RUNOFF(CFS) =    14.16
  TC(MIN.) =    9.41

****************************************************************************
  FLOW PROCESS FROM NODE     160.00 TO NODE     170.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
ELEVATION DATA: UPSTREAM(FEET) =  1560.23  DOWNSTREAM(FEET) =  1556.41
FLOW LENGTH(FEET) =   447.76   MANNING'S N =  0.013
DEPTH OF FLOW IN  21.0 INCH PIPE IS  17.1 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   6.76
ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     14.16
PIPE TRAVEL TIME(MIN.) =   1.10    Tc(MIN.) =  10.51
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    170.00 =  1326.87 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    170.00 TO NODE    170.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
  25 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.230
USER-SPECIFIED RUNOFF COEFFICIENT = .8496
SOIL CLASSIFICATION IS "A"
SUBAREA AREA(ACRES) =     5.12   SUBAREA RUNOFF(CFS) =     9.70
TOTAL AREA(ACRES) =      11.89   TOTAL RUNOFF(CFS) =    23.86
TC(MIN.) =  10.51

****************************************************************************
FLOW PROCESS FROM NODE    170.00 TO NODE    180.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
ELEVATION DATA: UPSTREAM(FEET) =  1556.41  DOWNSTREAM(FEET) =  1554.97
FLOW LENGTH(FEET) =   119.68   MANNING'S N =  0.013
DEPTH OF FLOW IN  24.0 INCH PIPE IS  19.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   8.78
ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =     23.86
PIPE TRAVEL TIME(MIN.) =   0.23    Tc(MIN.) =  10.74
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    180.00 =  1446.55 FEET.
==============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)        =      11.89  TC(MIN.) =      10.74
PEAK FLOW RATE(CFS)      =      23.86
==============================================================================
==============================================================================
END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
        RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                      (RCFC&WCD)  1978 HYDROLOGY MANUAL
          (c) Copyright 1982-2003 Advanced Engineering Software (aes)
                      (Rational Tabling Version 5.9D)
                 Release Date: 01/01/2003  License ID 1237

                          Analysis prepared by:

                           Hall & Foreman, Inc.
                        9130 Anaheim Place, Suite 120
                         Rancho Cucamonga, CA  91730


 ************************** DESCRIPTION OF STUDY **************************
* WAL-MART #1899                                                           *
* CITY OF RIVERSIDE                                                        *
* LINE B - 25 YEAR STORM EVENT                                             *
 ****************************************************************************

  FILE NAME: 04017B25.DAT
  TIME/DATE OF STUDY: 17:10 06/06/2005
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =   25.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  2-YEAR, 1-HOUR PRECIPITATION(INCH) =  0.500
  100-YEAR, 1-HOUR PRECIPITATION(INCH) =  1.200
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =   25.00   1-HOUR INTENSITY(INCH/HOUR) =   0.933
  SLOPE OF INTENSITY DURATION CURVE = 0.5000
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: COMPUTE CONFLUENCE VALUES ACCORDING TO RCFC&WCD HYDROLOGY MANUAL
        AND IGNORE OTHER CONFLUENCE COMBINATIONS FOR DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  ========  ================  ======  =====  ======  =====  =======
  1   30.0     20.0   0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.25 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    210.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   475.00
  UPSTREAM ELEVATION(FEET) =   1573.80
  DOWNSTREAM ELEVATION(FEET) =   1571.50
  ELEVATION DIFFERENCE(FEET) =      2.30
  TC = 0.303*[(  475.00**3)/(     2.30)]**.2 =   10.357
    25 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.246
  USER-SPECIFIED RUNOFF COEFFICIENT = .8498
  SOIL CLASSIFICATION IS "A"
  SUBAREA RUNOFF(CFS) =      3.89
  TOTAL AREA(ACRES) =      2.04   TOTAL RUNOFF(CFS) =      3.89
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     210.00 TO NODE     220.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1562.21  DOWNSTREAM(FEET) =  1557.60
  FLOW LENGTH(FEET) =    751.80   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   4.50
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       3.89
  PIPE TRAVEL TIME(MIN.) =   2.78    Tc(MIN.) =  13.14
  LONGEST FLOWPATH FROM NODE     200.00 TO NODE     220.00 =  1226.80 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     220.00 TO NODE     220.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    25 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.994
  USER-SPECIFIED RUNOFF COEFFICIENT = .8472
  SOIL CLASSIFICATION IS "A"
  SUBAREA AREA(ACRES) =     4.92   SUBAREA RUNOFF(CFS) =     8.31
  TOTAL AREA(ACRES) =       6.96   TOTAL RUNOFF(CFS) =    12.21
  TC(MIN.) =  13.14

****************************************************************************
  FLOW PROCESS FROM NODE     220.00 TO NODE     230.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1557.60  DOWNSTREAM(FEET) =  1555.00
  FLOW LENGTH(FEET) =     20.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   7.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  18.75
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      12.21
  PIPE TRAVEL TIME(MIN.) =   0.02    Tc(MIN.) =  13.16
  LONGEST FLOWPATH FROM NODE     200.00 TO NODE     230.00 =  1246.80 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     230.00 TO NODE     230.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  13.16
  RAINFALL INTENSITY(INCH/HR) =   1.99
  TOTAL STREAM AREA(ACRES) =      6.96
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      12.21

****************************************************************************
  FLOW PROCESS FROM NODE     300.00 TO NODE     310.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   820.00
  UPSTREAM ELEVATION(FEET) =   1572.50
  DOWNSTREAM ELEVATION(FEET) =   1565.00
  ELEVATION DIFFERENCE(FEET) =      7.50
  TC = 0.303*[(  820.00**3)/(     7.50)]**.2 =   11.347
    25 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.146
  USER-SPECIFIED RUNOFF COEFFICIENT = .8488
```

```
SOIL CLASSIFICATION IS "A"
SUBAREA RUNOFF(CFS) =       3.72
TOTAL AREA(ACRES) =       2.04   TOTAL RUNOFF(CFS) =       3.72

****************************************************************************
FLOW PROCESS FROM NODE    310.00 TO NODE    320.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =  1559.00  DOWNSTREAM(FEET) =  1557.60
FLOW LENGTH(FEET) =   257.00   MANNING'S N =  0.013
ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   4.26
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =       3.72
PIPE TRAVEL TIME(MIN.) =   1.01    Tc(MIN.) =  12.35
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    320.00 =  1077.00 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    320.00 TO NODE    230.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =  12.35
RAINFALL INTENSITY(INCH/HR) =   2.06
TOTAL STREAM AREA(ACRES) =      2.04
PEAK FLOW RATE(CFS) AT CONFLUENCE =       3.72

** CONFLUENCE DATA **
STREAM      RUNOFF       Tc       INTENSITY       AREA
NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
    1        12.21     13.16        1.993          6.96
    2         3.72     12.35        2.057          2.04

*********************************WARNING*********************************
IN THIS COMPUTER PROGRAM, THE CONFLUENCE VALUE USED IS BASED
ON THE RCFC&WCD FORMULA OF PLATE D-1 AS DEFAULT VALUE. THIS FORMULA
WILL NOT NECESSARILY RESULT IN THE MAXIMUM VALUE OF PEAK FLOW.
****************************************************************************

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM      RUNOFF       Tc       INTENSITY
NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
    1        15.17     12.35       2.057
    2        15.81     13.16       1.993

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =      15.81   Tc(MIN.) =   13.16
TOTAL AREA(ACRES) =       9.00
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    230.00 =  1246.80 FEET.
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)       =       9.00  TC(MIN.) =      13.16
PEAK FLOW RATE(CFS)     =      15.81
============================================================================
============================================================================
END OF RATIONAL METHOD ANALYSIS
```

100 – Year Storm Study

```
****************************************************************************
          RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
       RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                  (RCFC&WCD)  1978 HYDROLOGY MANUAL
        (c) Copyright 1982-2003 Advanced Engineering Software (aes)
                  (Rational Tabling Version 5.9D)
             Release Date: 01/01/2003  License ID 1237

                      Analysis prepared by:

                        Hall & Foreman, Inc.
                     9130 Anaheim Place, Suite 120
                      Rancho Cucamonga, CA  91730

 ************************** DESCRIPTION OF STUDY **************************
 *                                                                        *
* WAL-MART #1899                                                          *
* CITY OF RIVERSIDE                                                       *
* LINE A - 100 YEAR STORM EVENT                                           *
 ************************************************************************

  FILE NAME: 04017A00.DAT
  TIME/DATE OF STUDY: 09:09 04/11/2005
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  2-YEAR, 1-HOUR PRECIPITATION(INCH) =  0.500
  100-YEAR, 1-HOUR PRECIPITATION(INCH) =  1.200
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =  100.00   1-HOUR INTENSITY(INCH/HOUR) =   1.200
  SLOPE OF INTENSITY DURATION CURVE = 0.5000
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: COMPUTE CONFLUENCE VALUES ACCORDING TO RCFC&WCD HYDROLOGY MANUAL
        AND IGNORE OTHER CONFLUENCE COMBINATIONS FOR DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  ================  ======  =====  ======  =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.25 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    110.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
          ASSUMED INITIAL SUBAREA UNIFORM
          DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   253.00
  UPSTREAM ELEVATION(FEET) =   1574.60
  DOWNSTREAM ELEVATION(FEET) =   1572.50
  ELEVATION DIFFERENCE(FEET) =       2.10
  TC = 0.303*[(  253.00**3)/(     2.10)]**.2 =     7.228
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.457
  USER-SPECIFIED RUNOFF COEFFICIENT = .8595
  SOIL CLASSIFICATION IS "A"
  SUBAREA RUNOFF(CFS) =       2.26
  TOTAL AREA(ACRES) =       0.76   TOTAL RUNOFF(CFS) =       2.26
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     110.00 TO NODE     120.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1564.82  DOWNSTREAM(FEET) =  1563.63
  FLOW LENGTH(FEET) =    169.79   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS    6.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    4.09
  ESTIMATED PIPE DIAMETER(INCH) =  18.00     NUMBER OF PIPES =    1
  PIPE-FLOW(CFS) =        2.26
  PIPE TRAVEL TIME(MIN.) =    0.69     Tc(MIN.) =    7.92
  LONGEST FLOWPATH FROM NODE     100.00 TO NODE     120.00 =    422.79 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     120.00 TO NODE     120.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.303
  USER-SPECIFIED RUNOFF COEFFICIENT = .8584
  SOIL CLASSIFICATION IS "A"
  SUBAREA AREA(ACRES) =     0.62    SUBAREA RUNOFF(CFS) =     1.76
  TOTAL AREA(ACRES) =       1.38    TOTAL RUNOFF(CFS) =     4.02
  TC(MIN.) =    7.92

****************************************************************************
  FLOW PROCESS FROM NODE     120.00 TO NODE     130.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1563.63  DOWNSTREAM(FEET) =  1562.72
  FLOW LENGTH(FEET) =    129.53   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS    8.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    4.78
  ESTIMATED PIPE DIAMETER(INCH) =  18.00     NUMBER OF PIPES =    1
  PIPE-FLOW(CFS) =        4.02
  PIPE TRAVEL TIME(MIN.) =    0.45     Tc(MIN.) =    8.37
  LONGEST FLOWPATH FROM NODE     100.00 TO NODE     130.00 =    552.32 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     130.00 TO NODE     130.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.213
  USER-SPECIFIED RUNOFF COEFFICIENT = .8578
  SOIL CLASSIFICATION IS "A"
  SUBAREA AREA(ACRES) =     0.27    SUBAREA RUNOFF(CFS) =     0.74
  TOTAL AREA(ACRES) =       1.65    TOTAL RUNOFF(CFS) =     4.76
  TC(MIN.) =    8.37

****************************************************************************
  FLOW PROCESS FROM NODE     130.00 TO NODE     140.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1562.72  DOWNSTREAM(FEET) =  1562.64
  FLOW LENGTH(FEET) =     11.25   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS    9.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    5.01
  ESTIMATED PIPE DIAMETER(INCH) =  18.00     NUMBER OF PIPES =    1
  PIPE-FLOW(CFS) =        4.76
  PIPE TRAVEL TIME(MIN.) =    0.04     Tc(MIN.) =    8.41
  LONGEST FLOWPATH FROM NODE     100.00 TO NODE     140.00 =    563.57 FEET.
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     140.00 TO NODE     140.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.205
  USER-SPECIFIED RUNOFF COEFFICIENT = .8578
  SOIL CLASSIFICATION IS "A"
  SUBAREA AREA(ACRES) =     1.82   SUBAREA RUNOFF(CFS) =     5.00
  TOTAL AREA(ACRES) =       3.47   TOTAL RUNOFF(CFS) =     9.76
  TC(MIN.) =    8.41
****************************************************************************
  FLOW PROCESS FROM NODE     140.00 TO NODE     150.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1562.64  DOWNSTREAM(FEET) =  1560.73
  FLOW LENGTH(FEET) =   232.95   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  12.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.29
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.76
  PIPE TRAVEL TIME(MIN.) =   0.62    Tc(MIN.) =   9.03
  LONGEST FLOWPATH FROM NODE     100.00 TO NODE     150.00 =   796.52 FEET.
****************************************************************************
  FLOW PROCESS FROM NODE     150.00 TO NODE     150.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.094
  USER-SPECIFIED RUNOFF COEFFICIENT = .8570
  SOIL CLASSIFICATION IS "A"
  SUBAREA AREA(ACRES) =     0.82   SUBAREA RUNOFF(CFS) =     2.17
  TOTAL AREA(ACRES) =       4.29   TOTAL RUNOFF(CFS) =    11.94
  TC(MIN.) =    9.03
****************************************************************************
  FLOW PROCESS FROM NODE     150.00 TO NODE     160.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1560.73  DOWNSTREAM(FEET) =  1560.23
  FLOW LENGTH(FEET) =    82.59   MANNING'S N =  0.013
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  17.1 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.70
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      11.94
  PIPE TRAVEL TIME(MIN.) =   0.24    Tc(MIN.) =   9.27
  LONGEST FLOWPATH FROM NODE     100.00 TO NODE     160.00 =   879.11 FEET.
****************************************************************************
  FLOW PROCESS FROM NODE     160.00 TO NODE     160.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.053
  USER-SPECIFIED RUNOFF COEFFICIENT = .8567
  SOIL CLASSIFICATION IS "A"
  SUBAREA AREA(ACRES) =     2.48   SUBAREA RUNOFF(CFS) =     6.49
  TOTAL AREA(ACRES) =       6.77   TOTAL RUNOFF(CFS) =    18.43
  TC(MIN.) =    9.27
****************************************************************************
  FLOW PROCESS FROM NODE     160.00 TO NODE     170.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
```

```
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
ELEVATION DATA: UPSTREAM(FEET) =  1560.23  DOWNSTREAM(FEET) =  1556.41
FLOW LENGTH(FEET) =   447.76   MANNING'S N =  0.013
DEPTH OF FLOW IN  24.0 INCH PIPE IS  17.9 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   7.34
ESTIMATED PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      18.43
PIPE TRAVEL TIME(MIN.) =   1.02    Tc(MIN.) =  10.29
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    170.00 =  1326.87 FEET.

****************************************************************************
FLOW PROCESS FROM NODE    170.00 TO NODE    170.00 IS CODE =  81
----------------------------------------------------------------------------
>>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
==============================================================================
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.898
USER-SPECIFIED RUNOFF COEFFICIENT = .8555
SOIL CLASSIFICATION IS "A"
SUBAREA AREA(ACRES) =     5.12   SUBAREA RUNOFF(CFS) =   12.70
TOTAL AREA(ACRES) =      11.89   TOTAL RUNOFF(CFS) =   31.12
TC(MIN.) =  10.29

****************************************************************************
FLOW PROCESS FROM NODE    170.00 TO NODE    180.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
==============================================================================
ELEVATION DATA: UPSTREAM(FEET) =  1556.41  DOWNSTREAM(FEET) =  1554.97
FLOW LENGTH(FEET) =   119.68   MANNING'S N =  0.013
DEPTH OF FLOW IN  27.0 INCH PIPE IS  20.8 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   9.47
ESTIMATED PIPE DIAMETER(INCH) =  27.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =      31.12
PIPE TRAVEL TIME(MIN.) =   0.21    Tc(MIN.) =  10.50
LONGEST FLOWPATH FROM NODE    100.00 TO NODE    180.00 =  1446.55 FEET.
==============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)      =      11.89  TC(MIN.) =      10.50
PEAK FLOW RATE(CFS)    =      31.12
==============================================================================
==============================================================================
END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
        RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                    (RCFC&WCD)  1978 HYDROLOGY MANUAL
         (c) Copyright 1982-2003 Advanced Engineering Software (aes)
                    (Rational Tabling Version 5.9D)
              Release Date: 01/01/2003  License ID 1237

                        Analysis prepared by:

                          Hall & Foreman, Inc.
                       9130 Anaheim Place, Suite 120
                        Rancho Cucamonga, CA  91730

 ************************* DESCRIPTION OF STUDY *************************
* WAL-MART #1899                                                        *
* CITY OF RIVERSIDE                                                     *
* LINE B - 100 YEAR STORM EVENT                                         *
 ************************************************************************

  FILE NAME: 04017B00.DAT
  TIME/DATE OF STUDY: 17:11 06/06/2005
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  2-YEAR, 1-HOUR PRECIPITATION(INCH) =  0.500
  100-YEAR, 1-HOUR PRECIPITATION(INCH) =  1.200
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =  100.00   1-HOUR INTENSITY(INCH/HOUR) =   1.200
  SLOPE OF INTENSITY DURATION CURVE = 0.5000
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: COMPUTE CONFLUENCE VALUES ACCORDING TO RCFC&WCD HYDROLOGY MANUAL
        AND IGNORE OTHER CONFLUENCE COMBINATIONS FOR DOWNSTREAM ANALYSES
  *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL*
     HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:  MANNING
     WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE  FACTOR
NO.   (FT)    (FT)     SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)    (n)
===  =====  =========  =================  ======  =====  ======  =====  =======
  1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.25 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*
****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    210.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
          ASSUMED INITIAL SUBAREA UNIFORM
          DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   475.00
  UPSTREAM ELEVATION(FEET) =   1573.80
  DOWNSTREAM ELEVATION(FEET) =   1571.50
  ELEVATION DIFFERENCE(FEET) =      2.30
  TC = 0.303*[(  475.00**3)/(     2.30)]**.2 =   10.357
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.888
  USER-SPECIFIED RUNOFF COEFFICIENT = .8554
  SOIL CLASSIFICATION IS "A"
  SUBAREA RUNOFF(CFS) =      5.04
  TOTAL AREA(ACRES) =      2.04   TOTAL RUNOFF(CFS) =      5.04
```

```
****************************************************************************
  FLOW PROCESS FROM NODE     210.00 TO NODE     220.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1562.21  DOWNSTREAM(FEET) =  1557.60
  FLOW LENGTH(FEET) =    751.80   MANNING'S N =  0.013
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =    4.79
  ESTIMATED PIPE DIAMETER(INCH) =  18.00     NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.04
  PIPE TRAVEL TIME(MIN.) =    2.61     Tc(MIN.) =  12.97
  LONGEST FLOWPATH FROM NODE     200.00 TO NODE     220.00 =  1226.80 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     220.00 TO NODE     220.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.581
  USER-SPECIFIED RUNOFF COEFFICIENT = .8529
  SOIL CLASSIFICATION IS "A"
  SUBAREA AREA(ACRES) =     4.92   SUBAREA RUNOFF(CFS) =    10.83
  TOTAL AREA(ACRES) =       6.96   TOTAL RUNOFF(CFS) =    15.87
  TC(MIN.) =  12.97

****************************************************************************
  FLOW PROCESS FROM NODE     220.00 TO NODE     230.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =  1557.60  DOWNSTREAM(FEET) =  1555.00
  FLOW LENGTH(FEET) =     20.00   MANNING'S N =  0.013
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 18.000
  DEPTH OF FLOW IN  18.0 INCH PIPE IS   8.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =  20.10
  ESTIMATED PIPE DIAMETER(INCH) =  18.00     NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      15.87
  PIPE TRAVEL TIME(MIN.) =    0.02     Tc(MIN.) =  12.99
  LONGEST FLOWPATH FROM NODE     200.00 TO NODE     230.00 =  1246.80 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE     230.00 TO NODE     230.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =  12.99
  RAINFALL INTENSITY(INCH/HR) =   2.58
  TOTAL STREAM AREA(ACRES) =      6.96
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      15.87

****************************************************************************
  FLOW PROCESS FROM NODE     300.00 TO NODE     310.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
          ASSUMED INITIAL SUBAREA UNIFORM
          DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    820.00
  UPSTREAM ELEVATION(FEET) =    1572.50
  DOWNSTREAM ELEVATION(FEET) =    1565.00
  ELEVATION DIFFERENCE(FEET) =       7.50
  TC = 0.303*[(  820.00**3)/(      7.50)]**.2 =    11.347
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.759
  USER-SPECIFIED RUNOFF COEFFICIENT = .8544
  SOIL CLASSIFICATION IS "A"
```

```
SUBAREA RUNOFF(CFS) =        4.81
TOTAL AREA(ACRES) =        2.04   TOTAL RUNOFF(CFS) =        4.81
****************************************************************************
FLOW PROCESS FROM NODE    310.00 TO NODE    320.00 IS CODE =  31
----------------------------------------------------------------------------
>>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
>>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
ELEVATION DATA: UPSTREAM(FEET) =  1559.00  DOWNSTREAM(FEET) =  1557.60
FLOW LENGTH(FEET) =   257.00   MANNING'S N =  0.013
DEPTH OF FLOW IN  18.0 INCH PIPE IS  10.4 INCHES
PIPE-FLOW VELOCITY(FEET/SEC.) =   4.53
ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
PIPE-FLOW(CFS) =        4.81
PIPE TRAVEL TIME(MIN.) =   0.95    Tc(MIN.) =  12.29
LONGEST FLOWPATH FROM NODE    300.00 TO NODE    320.00 =  1077.00 FEET.
****************************************************************************
FLOW PROCESS FROM NODE    320.00 TO NODE    230.00 IS CODE =   1
----------------------------------------------------------------------------
>>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
>>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
TOTAL NUMBER OF STREAMS =  2
CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
TIME OF CONCENTRATION(MIN.) =  12.29
RAINFALL INTENSITY(INCH/HR) =   2.65
TOTAL STREAM AREA(ACRES) =      2.04
PEAK FLOW RATE(CFS) AT CONFLUENCE =        4.81

** CONFLUENCE DATA **
STREAM      RUNOFF       Tc       INTENSITY       AREA
NUMBER       (CFS)     (MIN.)    (INCH/HOUR)     (ACRE)
    1        15.87     12.99        2.579          6.96
    2         4.81     12.29        2.651          2.04

*********************************WARNING**********************************
IN THIS COMPUTER PROGRAM, THE CONFLUENCE VALUE USED IS BASED
ON THE RCFC&WCD FORMULA OF PLATE D-1 AS DEFAULT VALUE. THIS FORMULA
WILL NOT NECESSARILY RESULT IN THE MAXIMUM VALUE OF PEAK FLOW.
****************************************************************************

RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
CONFLUENCE FORMULA USED FOR  2 STREAMS.

** PEAK FLOW RATE TABLE **
STREAM      RUNOFF       Tc       INTENSITY
NUMBER       (CFS)     (MIN.)    (INCH/HOUR)
    1        19.83     12.29       2.651
    2        20.55     12.99       2.579

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
PEAK FLOW RATE(CFS) =      20.55   Tc(MIN.) =   12.99
TOTAL AREA(ACRES) =        9.00
LONGEST FLOWPATH FROM NODE    200.00 TO NODE    230.00 =  1246.80 FEET.
============================================================================
END OF STUDY SUMMARY:
TOTAL AREA(ACRES)       =       9.00  TC(MIN.) =       12.99
PEAK FLOW RATE(CFS)     =      20.55
============================================================================
============================================================================
END OF RATIONAL METHOD ANALYSIS
```

CATCH BASIN CALCULATIONS

CB A-1
Worksheet for Curb Inlet In Sag

Project Description	
Worksheet	Curb Inlet - A-1
Type	Curb Inlet In Sag
Solve For	Length

Input Data		
Discharge	1.74	cfs
Spread	3.61	ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.083	ft/ft
Road Cross Slope	0.020	ft/ft
Opening Height	0.50	ft
Curb Throat Type	Horizontal	
Local Depression	4.0	in
Local Depression Width	4.00	ft

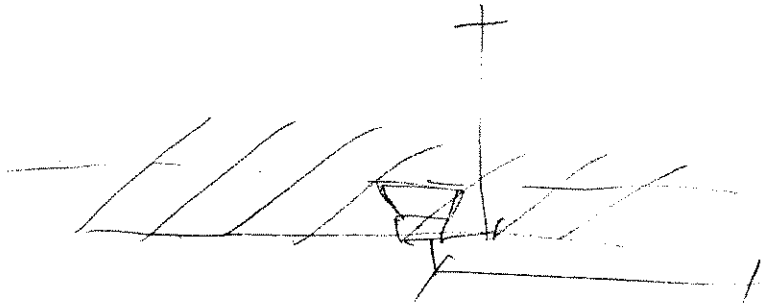
Results		
Curb Opening Length	7.00	ft
Throat Incline Angle	90.00	degrees
Depth	0.27	ft
Gutter Depression	1.5	in
Total Depression	5.5	in

CB A-2
Worksheet for Curb Inlet In Sag

Project Description	
Worksheet	Curb Inlet - A-2
Type	Curb Inlet In Sag
Solve For	Length

Input Data	
Discharge	1.50 cfs
Spread	3.50 ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.020 ft/ft
Opening Height	0.50 ft
Curb Throat Type	Horizontal
Local Depression	4.0 in
Local Depression Width	4.00 ft

Results	
Curb Opening Length	7.95 ft
Throat Incline Angle	90.00 degrees
Depth	0.25 ft
Gutter Depression	1.5 in
Total Depression	5.5 in



rogram files\haestad\fmw\wm-riverside.fm2
7/05 04:03:05 PM © Haestad Methods, Inc. 37 Brookside Road Waterbury, CT 06708 USA +1-203-755-1666
Hall & Foreman

CB A-3
Worksheet for Curb Inlet In Sag

Project Description	
Worksheet	Curb Inlet - A-3
Type	Curb Inlet In Sag
Solve For	Length

Input Data		
Discharge	0.57	cfs
Spread	3.17	ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.083	ft/ft
Road Cross Slope	0.020	ft/ft
Opening Height	0.50	ft
Curb Throat Type	Horizontal	
Local Depression	4.0	in
Local Depression Width	4.00	ft

Results		
Curb Opening Length	7.00	ft
Throat Incline Angle	90.00	degrees
Depth	0.19	ft
Gutter Depression	1.5	in
Total Depression	5.5	in

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CB A-4
Worksheet for Grate Inlet In Sag

Project Description	
Worksheet	Grate Inlet - A-4
Type	Grate Inlet In Sag
Solve For	Length

nput Data		
Discharge	3.85	cfs
Spread	2.97	ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.083	ft/ft
Road Cross Slope	0.020	ft/ft
Grate Width	2.00	ft
Local Depression	4.0	in
Local Depression Width	4.00	ft
Grate Type	P-50 mm (P-1-7/8")	
Clogging	0.0	%

Results		
Grate Length	4.00	ft
Depth	0.16	ft
Gutter Depression	1.5	in
Total Depression	5.5	in
Open Grate Area	7.2	ft^2
Active Grate Weir Length	8.00	ft

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CB A-5
Worksheet for Grate Inlet In Sag

Project Description	
Worksheet	Grate Inlet - A-5
Type	Grate Inlet In Sag
Solve For	Length

Input Data	
Discharge	1.67 cfs
Spread	2.28 ft
Gutter Width	2.00 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.020 ft/ft
Grate Width	2.00 ft
Local Depression	4.0 in
Local Depression Width	4.00 ft
Grate Type	P-50 mm (P-1-7/8")
Clogging	0.0 %

Results	
Grate Length	2.00 ft
Depth	0.05 ft
Gutter Depression	1.5 in
Total Depression	5.5 in
Open Grate Area	3.6 ft²
Active Grate Weir Length	6.00 ft

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CB A-6
Worksheet for Curb Inlet In Sag

roject Description	
Vorksheet	Curb Inlet - A-6
ype	Curb Inlet In Sag
olve For	Spread

put Data		
)ischarge	4.97	cfs
Gutter Width	2.00	ft
Gutter Cross Slope	0.083	ft/ft
Road Cross Slope	0.020	ft/ft
Curb Opening Length	21.00	ft
)pening Height	0.50	ft
Curb Throat Type	Horizontal	
.ocal Depression	4.0	in
.ocal Depression Width	4.00	ft

esults		
Spread	3.85	ft
Throat Incline Angle	90.00	degrees
)epth	0.31	ft
Gutter Depression	1.5	in
Total Depression	5.5	in

CB A-7
Worksheet for Curb Inlet In Sag

Project Description	
Worksheet	Curb Inlet - A-7
Type	Curb Inlet In Sag
Solve For	Spread

Input Data		
Discharge	9.70	cfs
Gutter Width	2.00	ft
Gutter Cross Slope	0.083	ft/ft
Road Cross Slope	0.020	ft/ft
Curb Opening Length	21.00	ft
Opening Height	0.50	ft
Curb Throat Type	Horizontal	
Local Depression	4.0	in
Local Depression Width	4.00	ft

Results		
Spread	14.09	ft
Throat Incline Angle	90.00	degrees
Depth	0.41	ft
Gutter Depression	1.5	in
Total Depression	5.5	in

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CB B-1
Worksheet for Curb Inlet In Sag

Project Description	
Worksheet	Curb Inlet - B-1
Type	Curb Inlet In Sag
Solve For	Length

Input Data		
Discharge	3.89	cfs
Spread	3.90	ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.083	ft/ft
Road Cross Slope	0.020	ft/ft
Opening Height	0.50	ft
Curb Throat Type	Horizontal	
Local Depression	4.0	in
Local Depression Width	4.00	ft

Results		
Curb Opening Length	13.31	ft
Throat Incline Angle	90.00	degrees
Depth	0.32	ft
Gutter Depression	1.5	in
Total Depression	5.5	in

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CB B-3
Worksheet for Curb Inlet In Sag

Project Description	
Worksheet	Curb Inlet - B-3
Type	Curb Inlet In Sag
Solve For	Length

Input Data		
Discharge	3.72	cfs
Spread	3.90	ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.083	ft/ft
Road Cross Slope	0.020	ft/ft
Opening Height	0.50	ft
Curb Throat Type	Horizontal	
Local Depression	4.0	in
Local Depression Width	4.00	ft

Results		
Curb Opening Length	12.42	ft
Throat Incline Angle	90.00	degrees
Depth	0.32	ft
Gutter Depression	1.5	in
Total Depression	5.5	in

WSPG CALCULATIONS

LINE A

PRELIMINARY HYDROLOGY ANALYSIS FOR CANYON SPRINGS

PRELIMINARY HYDROLOGY ANALYSIS

For

CANYON SPRINGS

City of Riverside

Prepared For:

Transcan Development, LLC
3189 Danville Blvd., Suite 245
Alamo, CA 94507
Ph: 925.552.9742 Fx: 925.552.9748
Contact: Robert Bahen

Prepared By:

HUNSAKER & ASSOCIATES IRVINE, INC.
Three Hughes
Irvine, CA 92618
(949) 583-1010

W.O.#: 2840-1/PrelmHydAnl-CynSprngs

PRELIMINARY

HYDROLOGY ANALYSIS

for

Canyon Springs

City of Riverside

PREPARED UNDER THE SUPERVISION OF:

7-26-04

Steven E. Barnhart, R.C.E. 25167, Exp. 12/31/05, Date

TABLE OF CONTENTS

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DISCUSSION
LOCATION MAP
SOIL MAP
HYDROLOGIC DATA

HYDROLOGY CALCULATIONS ---------- **SECTION 2**

WATER QUALITY TREATMENT CALCULATIONS ---------- **SECTION 3**

HYDROLOGY MAP ---------- **SECTION 4**

DISCUSSION

The project site is a commercial center located in the City of Riverside. The site is bounded by Moreno Valley Freeway (I-60) on the north, Corporate Center Place on the south, Escondido Expressway (I-275) on the west, and Day Street on the east.

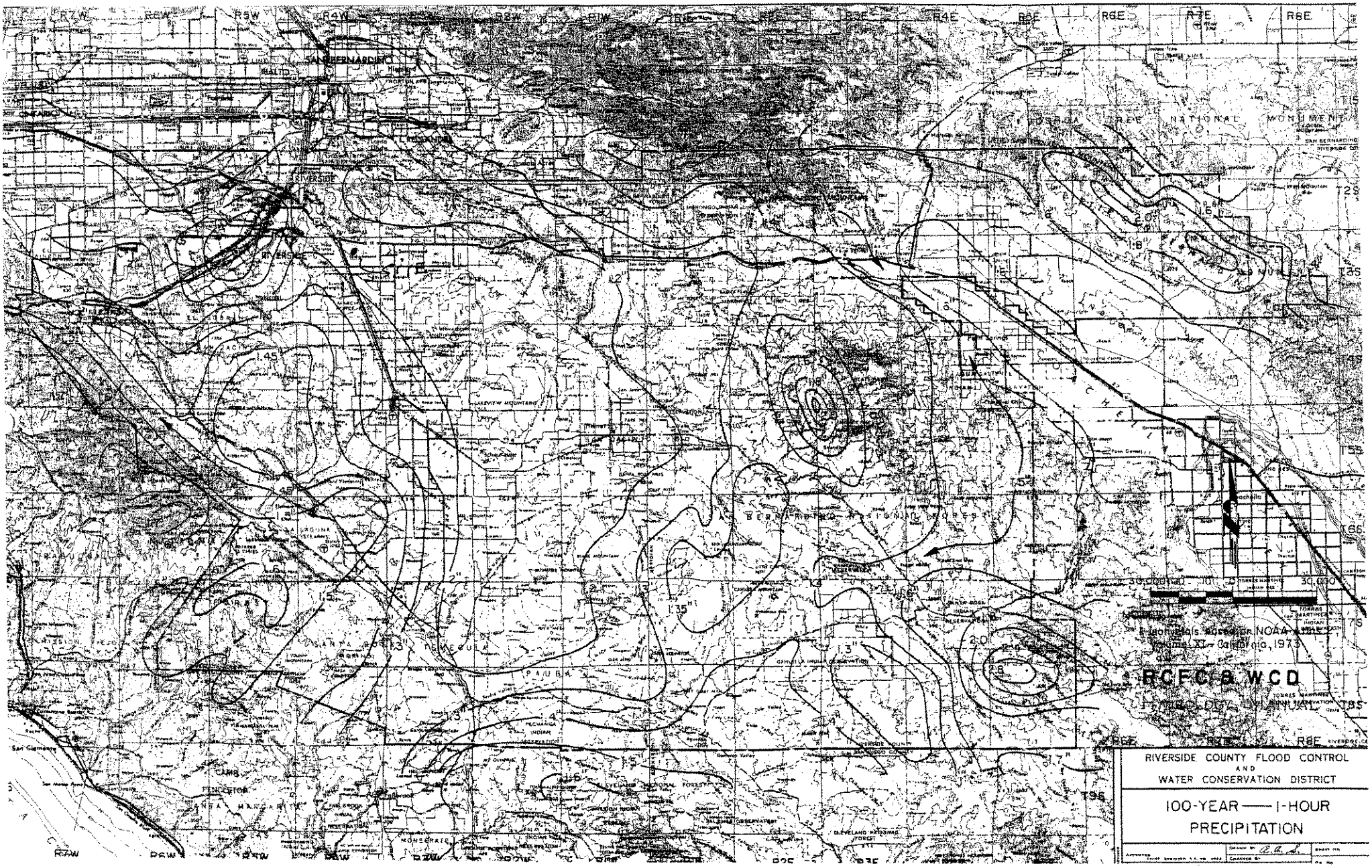
This report is a preliminary Hydrology Analysis, a detail Hydrology and Hydraulic Analysis will be submitted at a later time.

The purpose of this hydrology study is to quantify the 100-year storm runoff produced from the on-site and off-site in the developed condition.

The project site is divided into two drainage areas "A" and "B".

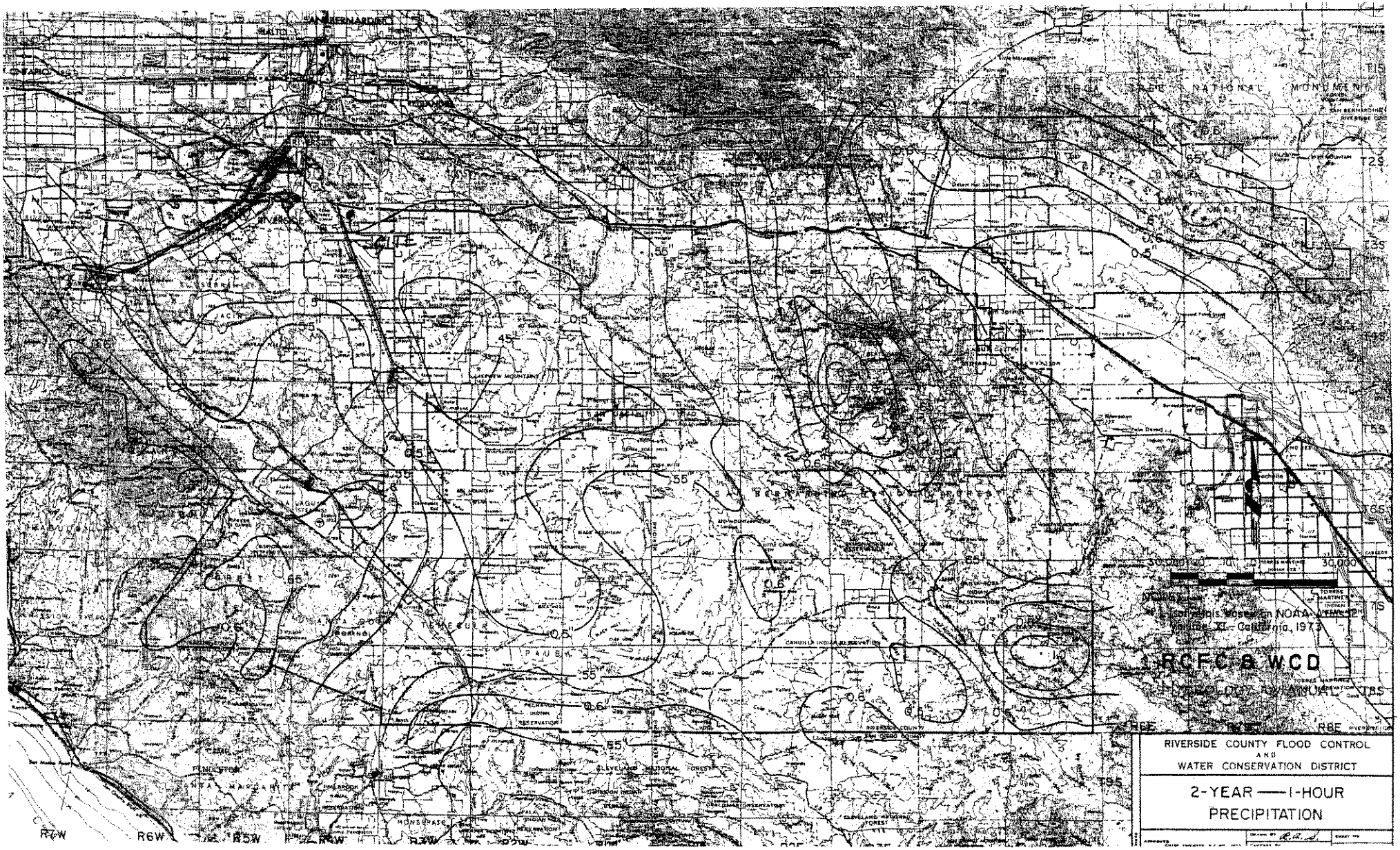
Area 'A' contains an approximate area of 100.8 acres and produces a 100-year runoff of 226.3cfs at node 59. The existing storm drain is designed for 241.0cfs. Area 'B' contains an approximate area of 51.6 acres and produces a 100-year runoff of 101.2cfs at node 111. The existing 30" pipe is designed for 75cfs. Therefore, a flow-by retention basin is proposed to retain the excess flow due to the development. The volume of the proposed retention basin is approximately 0.34 ac.ft.

This hydrology study was prepared in accordance with the Riverside County Flood Control and Water Conservation District (RCFC&WCD) criteria and Hydrology Manual. All pertinent information is included on the hydrology map contained in this report.



RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT

100-YEAR — 1-HOUR
PRECIPITATION


RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT
2-YEAR — 1-HOUR
PRECIPITATION
RCFC & WCD
Isohyetals based on NOAA Atlas 2
Volume XI - California, 1973
30,000
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30,000
R7W
R6W
R5W
R4W
R3W
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R1W
R1E
R2E
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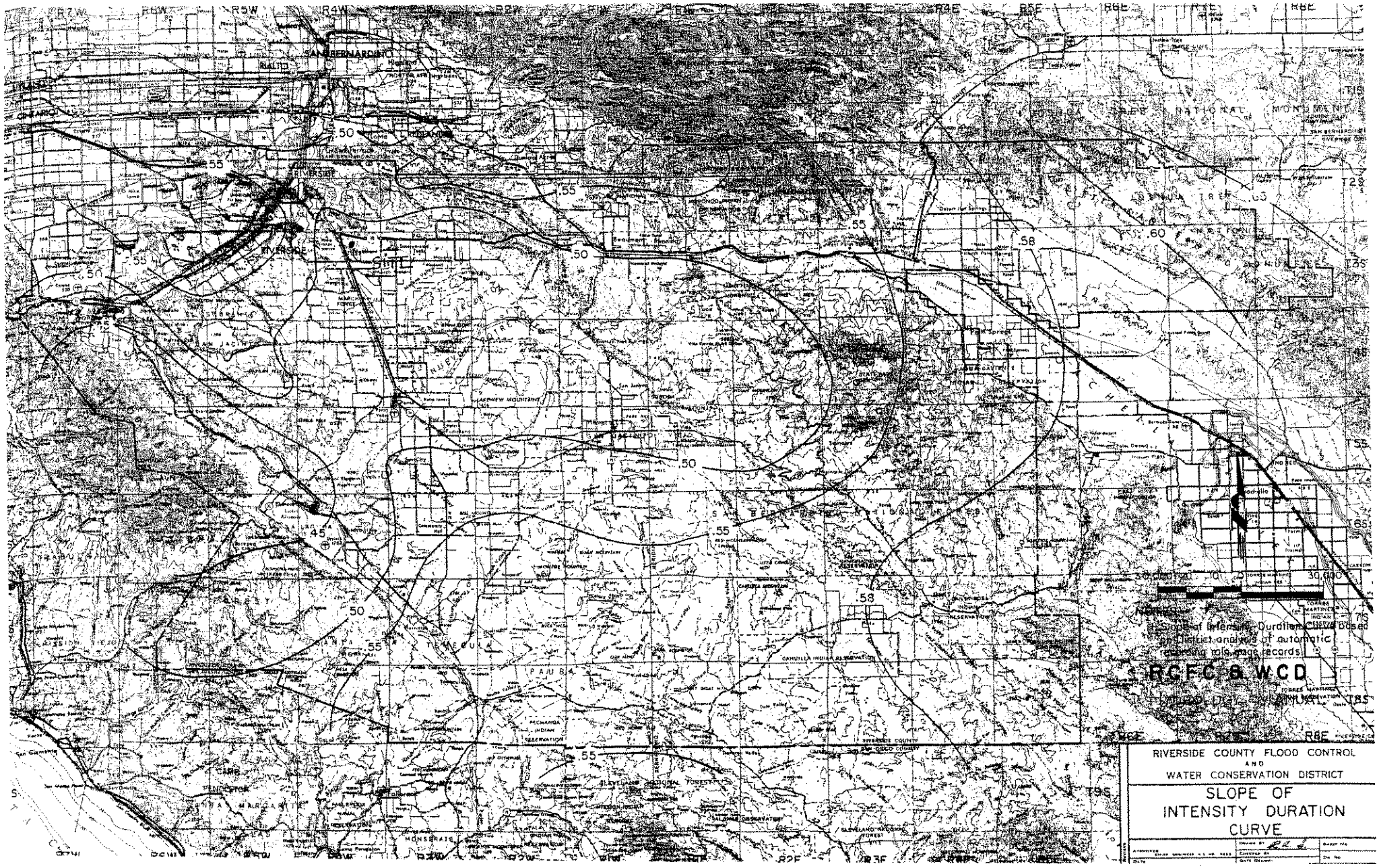
SAN BERNARDINO
RIVERSIDE
.50
.55
.58
.60
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Note:
Slope of Intensity Duration Curve Based on District analysis of automatic recording rain gage records
RCFC & WCD
RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT
SLOPE OF
INTENSITY DURATION
CURVE

HYDROLOGY CALCULATIONS

```
                Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c) 1989 - 2001 Version 6.4
       Rational Hydrology Study        Date: 07/26/04  File:canyon.out
------------------------------------------------------------------------
1601-101T, LA 041-1, CANYON SPRINGS
100-YR STUDY
PROPOSED CONDITION
FILE:  CANYON.UM1
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

 English (in-lb) Units used in input data file

------------------------------------------------------------------------
Hunsaker & Associates Irvine, Inc. - S/N   647
------------------------------------------------------------------------
Rational Method Hydrology Program based on
Riverside County Flood Control & Water Conservation District
1978 hydrology manual

Storm event (year) =  100.00 Antecedent Moisture Condition = 2

2 year, 1 hour precipitation =  0.500(In.)
100 year, 1 hour precipitation =  1.200(In.)

Storm event year = 100.0
Calculated rainfall intensity data:
1 hour intensity =  1.200(In/Hr)
Slope of intensity duration curve = 0.5000



++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        1.000 to Point/Station        2.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =  1000.000(Ft.)
Top (of initial area) elevation =  1624.000(Ft.)
Bottom (of initial area) elevation =  1596.000(Ft.)
Difference in elevation =    28.000(Ft.)
Slope =    0.02800  s(percent)=       2.80
TC = k(0.420)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   13.609 min.
Rainfall intensity =      2.520(In/Hr) for a   100.0 year storm
SINGLE FAMILY (1/2 Acre Lot)
Runoff Coefficient = 0.796
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.600; Impervious fraction =  0.400
Initial subarea runoff =     17.857(CFS)
Total initial stream area =        8.900(Ac.)
Pervious area fraction = 0.600


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        2.000 to Point/Station        3.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1596.000(Ft.)
Downstream point/station elevation =  1593.000(Ft.)
Pipe length  =   370.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    17.857(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    17.857(CFS)
```

```
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    15.16 min.
Rainfall intensity =      2.388(In/Hr) for a   100.0 year storm
Subarea runoff =      2.738(CFS) for      1.300(Ac.)
Total runoff =     56.279(CFS)        Total area =      28.800(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        4.000 to Point/Station        5.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1580.000(Ft.)
Downstream point/station elevation =  1577.200(Ft.)
Pipe length  =   570.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    56.279(CFS)
Nearest computed pipe diameter  =     39.00(In.)
Calculated individual pipe flow  =    56.279(CFS)
Normal flow depth in pipe =   31.03(In.)
Flow top width inside pipe =   31.45(In.)
Critical Depth =   28.73(In.)
Pipe flow velocity =      7.95(Ft/s)
Travel time through pipe =    1.20 min.
Time of concentration (TC) =    16.35 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        5.000 to Point/Station        5.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.881
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    16.35 min.
Rainfall intensity =      2.299(In/Hr) for a   100.0 year storm
Subarea runoff =     19.451(CFS) for      9.600(Ac.)
Total runoff =     75.729(CFS)        Total area =      38.400(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        5.000 to Point/Station       11.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1577.200(Ft.)
Downstream point/station elevation =  1558.500(Ft.)
Pipe length  =   810.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    75.729(CFS)
Nearest computed pipe diameter  =     33.00(In.)
Calculated individual pipe flow  =    75.729(CFS)
Normal flow depth in pipe =   25.50(In.)
Flow top width inside pipe =   27.66(In.)
Critical depth could not be calculated.
Pipe flow velocity =     15.39(Ft/s)
Travel time through pipe =    0.88 min.
Time of concentration (TC) =    17.23 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       11.000 to Point/Station       11.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =     38.400(Ac.)
Runoff from this stream =     75.729(CFS)
```

```
Downstream point/station elevation =  1561.000(Ft.)
Pipe length  =   650.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    26.631(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    26.631(CFS)
Normal flow depth in pipe =   19.92(In.)
Flow top width inside pipe =   23.75(In.)
Critical Depth =   21.60(In.)
Pipe flow velocity =      8.46(Ft/s)
Travel time through pipe =    1.28 min.
Time of concentration (TC) =    11.97 min.

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        9.000 to Point/Station        9.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.884
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    11.97 min.
Rainfall intensity =      2.687(In/Hr) for a   100.0 year storm
Subarea runoff =      9.022(CFS) for      3.800(Ac.)
Total runoff =     35.653(CFS)        Total area =      14.200(Ac.)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        9.000 to Point/Station       10.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1561.000(Ft.)
Downstream point/station elevation =  1559.000(Ft.)
Pipe length  =   440.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    35.653(CFS)
Nearest computed pipe diameter  =     33.00(In.)
Calculated individual pipe flow  =    35.653(CFS)
Normal flow depth in pipe =   27.05(In.)
Flow top width inside pipe =   25.38(In.)
Critical Depth =   23.85(In.)
Pipe flow velocity =      6.84(Ft/s)
Travel time through pipe =    1.07 min.
Time of concentration (TC) =    13.04 min.

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       10.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.883
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    13.04 min.
Rainfall intensity =      2.574(In/Hr) for a   100.0 year storm
Subarea runoff =     16.593(CFS) for      7.300(Ac.)
Total runoff =     52.246(CFS)        Total area =      21.500(Ac.)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       11.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
```

```
**** SUBAREA FLOW ADDITION ****
COMMERCIAL subarea type
Runoff Coefficient = 0.881
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    17.25 min.
Rainfall intensity =      2.238(In/Hr) for a   100.0 year storm
Subarea runoff =      9.266(CFS) for      4.700(Ac.)
Total runoff =    130.570(CFS)       Total area =      64.600(Ac.)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       12.000 to Point/Station       13.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
Upstream point/station elevation =  1558.000(Ft.)
Downstream point/station elevation =  1557.500(Ft.)
Pipe length  =    55.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   130.570(CFS)
Nearest computed pipe diameter  =     48.00(In.)
Calculated individual pipe flow  =   130.570(CFS)
Normal flow depth in pipe =   37.50(In.)
Flow top width inside pipe =   39.69(In.)
Critical Depth =   40.99(In.)
Pipe flow velocity =     12.41(Ft/s)
Travel time through pipe =    0.07 min.
Time of concentration (TC) =    17.33 min.

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       13.000
**** SUBAREA FLOW ADDITION ****
COMMERCIAL subarea type
Runoff Coefficient = 0.881
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    17.33 min.
Rainfall intensity =      2.233(In/Hr) for a   100.0 year storm
Subarea runoff =      6.295(CFS) for      3.200(Ac.)
Total runoff =    136.865(CFS)       Total area =      67.800(Ac.)

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       13.000 to Point/Station       20.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
Upstream point/station elevation =  1557.500(Ft.)
Downstream point/station elevation =  1555.500(Ft.)
Pipe length  =   225.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   136.865(CFS)
Nearest computed pipe diameter  =     48.00(In.)
Calculated individual pipe flow  =   136.865(CFS)
Normal flow depth in pipe =   39.84(In.)
Flow top width inside pipe =   36.05(In.)
Critical Depth =   41.78(In.)
Pipe flow velocity =     12.28(Ft/s)
Travel time through pipe =    0.31 min.
Time of concentration (TC) =    17.63 min.

++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       17.000 to Point/Station       18.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1564.300(Ft.)
Downstream point/station elevation =  1561.800(Ft.)
Pipe length  =   355.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.144(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    15.144(CFS)
Normal flow depth in pipe =   16.20(In.)
Flow top width inside pipe =   22.49(In.)
Critical Depth =   16.82(In.)
Pipe flow velocity =      6.71(Ft/s)
Travel time through pipe =    0.88 min.
Time of concentration (TC) =     9.18 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       18.000 to Point/Station       18.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.885
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =     9.18 min.
Rainfall intensity =      3.069(In/Hr) for a   100.0 year storm
Subarea runoff =      7.552(CFS) for      2.780(Ac.)
Total runoff =     22.697(CFS)        Total area =       7.950(Ac.)


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Process from Point/Station       18.000 to Point/Station       19.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1561.800(Ft.)
Downstream point/station elevation =  1560.000(Ft.)
Pipe length  =   370.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    22.697(CFS)
Nearest computed pipe diameter  =     27.00(In.)
Calculated individual pipe flow  =    22.697(CFS)
Normal flow depth in pipe =   23.63(In.)
Flow top width inside pipe =   17.86(In.)
Critical Depth =   20.02(In.)
Pipe flow velocity =      6.15(Ft/s)
Travel time through pipe =    1.00 min.
Time of concentration (TC) =    10.18 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       19.000 to Point/Station       19.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.885
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    10.18 min.
Rainfall intensity =      2.914(In/Hr) for a   100.0 year storm
Subarea runoff =      3.093(CFS) for      1.200(Ac.)
Total runoff =     25.790(CFS)        Total area =       9.150(Ac.)
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Process from Point/Station       22.000 to Point/Station       22.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =      76.950(Ac.)
Runoff from this stream =     156.505(CFS)
Time of concentration =    17.89 min.
Rainfall intensity =      2.198(In/Hr)


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Process from Point/Station       21.000 to Point/Station       22.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   300.000(Ft.)
Top (of initial area) elevation =  1564.000(Ft.)
Bottom (of initial area) elevation =  1558.000(Ft.)
Difference in elevation =      6.000(Ft.)
Slope =    0.02000  s(percent)=       2.00
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =     6.423 min.
Rainfall intensity =      3.668(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.887
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      1.627(CFS)
Total initial stream area =        0.500(Ac.)
Pervious area fraction = 0.100


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Process from Point/Station       22.000 to Point/Station       22.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =      0.500(Ac.)
Runoff from this stream =      1.627(CFS)
Time of concentration =    6.42 min.
Rainfall intensity =     3.668(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1      156.505     17.89                  2.198
2        1.627      6.42                  3.668
Largest stream flow has longer time of concentration
Qp =    156.505 + sum of
          Qb          Ia/Ib
           1.627 *    0.599 =      0.975
Qp =    157.480

Total of 2 streams to confluence:
Flow rates before confluence point:
     156.505       1.627
Area of streams before confluence:
       76.950       0.500
Results of confluence:
Total flow rate =     157.480(CFS)
Time of concentration =    17.891 min.
Effective stream area after confluence =     77.450(Ac.)


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 Manning's N from gutter to grade break =  0.0150
 Manning's N from grade break to crown =  0.0150
Estimated mean flow rate at midpoint of street =     10.759(CFS)
Depth of flow =   0.516(Ft.), Average velocity =   2.741(Ft/s)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property =    0.81(Ft.)
Streetflow hydraulics at midpoint of street travel:
Halfstreet flow width =  19.474(Ft.)
Flow velocity =   2.74(Ft/s)
Travel time =    4.56 min.     TC =   16.62  min.
 Adding area flow to street
COMMERCIAL subarea type
Runoff Coefficient = 0.881
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Rainfall intensity =      2.280(In/Hr) for a   100.0 year storm
Subarea runoff =      7.835(CFS) for      3.900(Ac.)
Total runoff =     13.983(CFS)        Total area =       6.500(Ac.)
Street flow at end of street =     13.983(CFS)
Half street flow at end of street =     13.983(CFS)
Depth of flow =   0.563(Ft.), Average velocity =   2.807(Ft/s)
Warning: depth of flow exceeds top of curb
Distance that curb overflow reaches into property =    3.14(Ft.)
Flow width (from curb towards crown)=  21.810(Ft.)


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Process from Point/Station       25.000 to Point/Station       26.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1559.000(Ft.)
Downstream point/station elevation =  1557.000(Ft.)
Pipe length  =   280.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    13.983(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    13.983(CFS)
Normal flow depth in pipe =   15.23(In.)
Flow top width inside pipe =   23.11(In.)
Critical Depth =   16.16(In.)
Pipe flow velocity =      6.64(Ft/s)
Travel time through pipe =    0.70 min.
Time of concentration (TC) =    17.33 min.


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Process from Point/Station       26.000 to Point/Station       26.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.881
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    17.33 min.
Rainfall intensity =      2.233(In/Hr) for a   100.0 year storm
Subarea runoff =      7.476(CFS) for      3.800(Ac.)
Total runoff =     21.459(CFS)        Total area =      10.300(Ac.)


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Process from Point/Station       26.000 to Point/Station       27.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1557.000(Ft.)
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Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    18.52 min.
Rainfall intensity =      2.160(In/Hr) for a   100.0 year storm
Subarea runoff =      5.515(CFS) for      2.900(Ac.)
Total runoff =    184.068(CFS)        Total area =      90.650(Ac.)

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Process from Point/Station       28.000 to Point/Station       30.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1552.500(Ft.)
Downstream point/station elevation =  1540.400(Ft.)
Pipe length  =   600.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   184.068(CFS)
Nearest computed pipe diameter  =     48.00(In.)
Calculated individual pipe flow  =   184.068(CFS)
Normal flow depth in pipe =   35.67(In.)
Flow top width inside pipe =   41.94(In.)
Critical Depth =   45.49(In.)
Pipe flow velocity =     18.38(Ft/s)
Travel time through pipe =    0.54 min.
Time of concentration (TC) =    19.06 min.

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Process from Point/Station       30.000 to Point/Station       30.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =     90.650(Ac.)
Runoff from this stream =    184.068(CFS)
Time of concentration =   19.06 min.
Rainfall intensity =     2.129(In/Hr)

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Process from Point/Station       29.100 to Point/Station       29.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   570.000(Ft.)
Top (of initial area) elevation =  1590.000(Ft.)
Bottom (of initial area) elevation =  1579.000(Ft.)
Difference in elevation =    11.000(Ft.)
Slope =    0.01930  s(percent)=       1.93
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.363 min.
Rainfall intensity =      3.214(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.886
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      8.257(CFS)
Total initial stream area =        2.900(Ac.)
Pervious area fraction = 0.100

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Process from Point/Station       29.200 to Point/Station       29.400
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1579.000(Ft.)
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Upstream point/station elevation =  1565.700(Ft.)
Downstream point/station elevation =  1564.000(Ft.)
Pipe length  =   340.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    16.442(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    16.442(CFS)
Normal flow depth in pipe =   20.34(In.)
Flow top width inside pipe =   17.25(In.)
Critical Depth =   17.53(In.)
Pipe flow velocity =      5.79(Ft/s)
Travel time through pipe =    0.98 min.
Time of concentration (TC) =    10.52 min.


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Process from Point/Station       29.600 to Point/Station       29.600
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.884
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    10.52 min.
Rainfall intensity =      2.866(In/Hr) for a   100.0 year storm
Subarea runoff =      3.042(CFS) for      1.200(Ac.)
Total runoff =     19.484(CFS)        Total area =       7.100(Ac.)


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Process from Point/Station       29.600 to Point/Station       29.700
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1564.000(Ft.)
Downstream point/station elevation =  1558.500(Ft.)
Pipe length  =   300.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    19.484(CFS)
Nearest computed pipe diameter  =     21.00(In.)
Calculated individual pipe flow  =    19.484(CFS)
Normal flow depth in pipe =   15.70(In.)
Flow top width inside pipe =   18.24(In.)
Critical Depth =   19.03(In.)
Pipe flow velocity =     10.11(Ft/s)
Travel time through pipe =    0.49 min.
Time of concentration (TC) =    11.01 min.


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Process from Point/Station       29.700 to Point/Station       29.700
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.884
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    11.01 min.
Rainfall intensity =      2.801(In/Hr) for a   100.0 year storm
Subarea runoff =      4.705(CFS) for      1.900(Ac.)
Total runoff =     24.189(CFS)        Total area =       9.000(Ac.)


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Process from Point/Station       29.700 to Point/Station       30.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
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COMMERCIAL subarea type
Runoff Coefficient = 0.880
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    19.21 min.
Rainfall intensity =      2.121(In/Hr) for a   100.0 year storm
Subarea runoff =      1.867(CFS) for      1.000(Ac.)
Total runoff =    204.512(CFS)        Total area =     100.650(Ac.)


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Process from Point/Station       30.100 to Point/Station       30.100
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.880
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    19.21 min.
Rainfall intensity =      2.121(In/Hr) for a   100.0 year storm
Subarea runoff =      1.307(CFS) for      0.700(Ac.)
Total runoff =    205.819(CFS)        Total area =     101.350(Ac.)


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Process from Point/Station       30.100 to Point/Station       31.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1537.800(Ft.)
Downstream point/station elevation =  1536.000(Ft.)
Pipe length  =    90.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   205.819(CFS)
Nearest computed pipe diameter  =     48.00(In.)
Calculated individual pipe flow  =   205.819(CFS)
Normal flow depth in pipe =   39.94(In.)
Flow top width inside pipe =   35.89(In.)
Critical depth could not be calculated.
Pipe flow velocity =     18.42(Ft/s)
Travel time through pipe =    0.08 min.
Time of concentration (TC) =    19.29 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       31.000 to Point/Station       31.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.880
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    19.29 min.
Rainfall intensity =      2.117(In/Hr) for a   100.0 year storm
Subarea runoff =      0.559(CFS) for      0.300(Ac.)
Total runoff =    206.378(CFS)        Total area =     101.650(Ac.)


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Process from Point/Station       31.000 to Point/Station       32.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
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**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
_____________________________________________________________
Upstream point/station elevation =  1534.000(Ft.)
Downstream point/station elevation =  1531.600(Ft.)
Pipe length  =   120.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =   210.840(CFS)
Nearest computed pipe diameter  =     48.00(In.)
Calculated individual pipe flow  =   210.840(CFS)
Normal flow depth in pipe =   41.25(In.)
Flow top width inside pipe =   33.37(In.)
Critical depth could not be calculated.
Pipe flow velocity =     18.36(Ft/s)
Travel time through pipe =    0.11 min.
Time of concentration (TC) =    19.49 min.


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Process from Point/Station       50.000 to Point/Station       50.000
**** CONFLUENCE OF MAIN STREAMS ****
_____________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =    104.050(Ac.)
Runoff from this stream =    210.840(CFS)
Time of concentration =   19.49 min.
Rainfall intensity =     2.106(In/Hr)
Program is now starting with Main Stream No. 2


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Process from Point/Station       34.000 to Point/Station       35.000
**** INITIAL AREA EVALUATION ****
_____________________________________________________________
Initial area flow distance =   880.000(Ft.)
Top (of initial area) elevation =  1564.000(Ft.)
Bottom (of initial area) elevation =  1555.000(Ft.)
Difference in elevation =     9.000(Ft.)
Slope =    0.01023  s(percent)=       1.02
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =   11.297 min.
Rainfall intensity =      2.766(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.884
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      3.911(CFS)
Total initial stream area =        1.600(Ac.)
Pervious area fraction = 0.100


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Process from Point/Station       35.000 to Point/Station       35.100
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
_____________________________________________________________
Upstream point/station elevation =  1555.000(Ft.)
Downstream point/station elevation =  1554.500(Ft.)
Pipe length  =    85.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.911(CFS)
Nearest computed pipe diameter  =     15.00(In.)
Calculated individual pipe flow  =     3.911(CFS)
Normal flow depth in pipe =   10.05(In.)
Flow top width inside pipe =   14.10(In.)
Critical Depth =    9.60(In.)
Pipe flow velocity =      4.47(Ft/s)
Travel time through pipe =    0.32 min.
Time of concentration (TC) =    11.61 min.
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Process from Point/Station       40.000 to Point/Station       40.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      8.900(Ac.)
Runoff from this stream =     20.531(CFS)
Time of concentration =   14.67 min.
Rainfall intensity =     2.427(In/Hr)


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Process from Point/Station       37.000 to Point/Station       38.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   500.000(Ft.)
Top (of initial area) elevation =  1558.000(Ft.)
Bottom (of initial area) elevation =  1552.000(Ft.)
Difference in elevation =     6.000(Ft.)
Slope =    0.01200  s(percent)=       1.20
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    8.727 min.
Rainfall intensity =      3.146(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.886
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =     15.604(CFS)
Total initial stream area =        5.600(Ac.)
Pervious area fraction = 0.100


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       38.000 to Point/Station       39.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1552.000(Ft.)
Downstream point/station elevation =  1551.000(Ft.)
Pipe length  =   230.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    15.604(CFS)
Nearest computed pipe diameter  =     24.00(In.)
Calculated individual pipe flow  =    15.604(CFS)
Normal flow depth in pipe =   20.86(In.)
Flow top width inside pipe =   16.19(In.)
Critical Depth =   17.08(In.)
Pipe flow velocity =      5.38(Ft/s)
Travel time through pipe =    0.71 min.
Time of concentration (TC) =     9.44 min.


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Process from Point/Station       39.000 to Point/Station       39.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.885
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =     9.44 min.
Rainfall intensity =      3.025(In/Hr) for a   100.0 year storm
Subarea runoff =      6.159(CFS) for      2.300(Ac.)
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Process from Point/Station       44.000 to Point/Station       44.000
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 2 in normal stream number 1
Stream flow area =      16.800(Ac.)
Runoff from this stream =      35.956(CFS)
Time of concentration =   10.48 min.
Rainfall intensity =     2.872(In/Hr)


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Process from Point/Station       41.000 to Point/Station       42.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Initial area flow distance =   370.000(Ft.)
Top (of initial area) elevation =  1554.000(Ft.)
Bottom (of initial area) elevation =  1543.600(Ft.)
Difference in elevation =    10.400(Ft.)
Slope =    0.02811  s(percent)=       2.81
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    6.526 min.
Rainfall intensity =      3.639(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.887
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =      3.228(CFS)
Total initial stream area =        1.000(Ac.)
Pervious area fraction = 0.100


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Process from Point/Station       42.000 to Point/Station       43.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1543.600(Ft.)
Downstream point/station elevation =  1542.000(Ft.)
Pipe length  =   190.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =     3.228(CFS)
Nearest computed pipe diameter  =     12.00(In.)
Calculated individual pipe flow  =     3.228(CFS)
Normal flow depth in pipe =    9.70(In.)
Flow top width inside pipe =    9.44(In.)
Critical Depth =    9.23(In.)
Pipe flow velocity =      4.75(Ft/s)
Travel time through pipe =    0.67 min.
Time of concentration (TC) =     7.19 min.


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Process from Point/Station       43.000 to Point/Station       44.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  1542.000(Ft.)
Downstream point elevation =  1539.000(Ft.)
Channel length thru subarea  =   600.000(Ft.)
Channel base width     =    5.000(Ft.)
Slope or 'Z' of left channel bank =   5.000
Slope or 'Z' of right channel bank =   5.000
Estimated mean flow rate at midpoint of channel =     10.008(CFS)
Manning's 'N'    = 0.015
Maximum depth of channel  =    1.000(Ft.)
Flow(q) thru subarea =     10.008(CFS)
Depth of flow =   0.425(Ft.), Average velocity =   3.307(Ft/s)
```

```
Flow(q) thru subarea =     52.418(CFS)
Depth of flow =   0.987(Ft.), Average velocity =   5.342(Ft/s)
Channel flow top width =   14.875(Ft.)
Flow Velocity =    5.34(Ft/s)
Travel time  =    1.03 min.
Time of concentration =   11.51 min.

Sub-Channel No. 1 Critical depth =      1.055(Ft.)
  '      '       '     Critical flow top width =     15.000(Ft.)
  '      '       '     Critical flow velocity=    4.844(Ft/s)
  '      '       '     Critical flow area =     10.820(Sq.Ft)

 Adding area flow to channel
COMMERCIAL subarea type
Runoff Coefficient = 0.884
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Rainfall intensity =      2.740(In/Hr) for a   100.0 year storm
Subarea runoff =      5.571(CFS) for      2.300(Ac.)
Total runoff =     55.385(CFS)        Total area =      24.300(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       45.000 to Point/Station       50.000
**** PIPEFLOW TRAVEL TIME (Program estimated size) ****
______________________________________________________________________
Upstream point/station elevation =  1537.300(Ft.)
Downstream point/station elevation =  1531.600(Ft.)
Pipe length  =   660.00(Ft.)   Manning's N = 0.013
No. of pipes = 1  Required pipe flow  =    55.385(CFS)
Nearest computed pipe diameter  =     36.00(In.)
Calculated individual pipe flow  =    55.385(CFS)
Normal flow depth in pipe =   26.53(In.)
Flow top width inside pipe =   31.70(In.)
Critical Depth =   28.97(In.)
Pipe flow velocity =      9.91(Ft/s)
Travel time through pipe =    1.11 min.
Time of concentration (TC) =    12.61 min.


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       50.000 to Point/Station       50.000
**** SUBAREA FLOW ADDITION ****
______________________________________________________________________
COMMERCIAL subarea type
Runoff Coefficient = 0.883
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Time of concentration =    12.61 min.
Rainfall intensity =      2.617(In/Hr) for a   100.0 year storm
Subarea runoff =      9.246(CFS) for      4.000(Ac.)
Total runoff =     64.631(CFS)        Total area =      28.300(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       50.000 to Point/Station       50.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =     28.300(Ac.)
Runoff from this stream =     64.631(CFS)
Time of concentration =   12.61 min.
```

```
Difference in elevation =    10.000(Ft.)
Slope =    0.01471  s(percent)=       1.47
TC = k(0.300)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration =    9.476 min.
Rainfall intensity =      3.020(In/Hr) for a   100.0 year storm
COMMERCIAL subarea type
Runoff Coefficient = 0.885
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
RI index for soil(AMC 2)  =  69.00
Pervious area fraction =  0.100; Impervious fraction =  0.900
Initial subarea runoff =     15.234(CFS)
Total initial stream area =        5.700(Ac.)
Pervious area fraction = 0.100
End of computations, total study area =          140.35 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction(Ap) = 0.198
Area averaged RI index number =  69.0
```

Worksheet
Worksheet for Circular Channel

Project Description	
Worksheet	Circular Channel - 1
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Mannings Coefficient	0.013	
Slope	0.020100	ft/ft
Depth	2.00	ft
Diameter	24	in

Results		
Discharge	[redacted]	
Flow Area	3.1	ft²
Wetted Perimeter	6.28	ft
Top Width	5.96e-8	ft
Critical Depth	1.89	ft
Percent Full	100.0	%
Critical Slope	0.017384	ft/ft
Velocity	10.21	ft/s
Velocity Head	1.62	ft
Specific Energy	3.62	ft
Froude Number	2.48e-4	
Maximum Discharge	34.50	cfs
Discharge Full	32.07	cfs
Slope Full	0.020100	ft/ft
Flow Type	Subcritical	

Max Q for 24" pipe located after NODE 28

WATER QUALITY TREATMENT CALCULATIONS

APPENDIX A VOLUME & FLOW RATE CALCULATIONS

A.1 METHOD FOR CALCULATING STANDARD URBAN STORMWATER MITIGATION PLAN FLOW RATES AND VOLUMES BASED ON 0.75-INCHES OF RAINFALL: WORKSHEET

PROJECT NAME

CANYON SPRINGS

NOMENCLATURE

A_I	=	Impervious Area (acres)
A_P	=	Pervious Area (acres)
A_U	=	Contributing Undeveloped Upstream Area (acres)
A_{Total}	=	Total Area of Development and Contributing Undeveloped Upstream Area (acres)
C_D	=	Developed Runoff Coefficient
C_U	=	Undeveloped Runoff Coefficient
I_X	=	Rainfall Intensity (inches / hour)
Q_{PM}	=	Peak Mitigation Flow Rate (cfs)
T_C	=	Time of Concentration (minutes, must be between 5-30 min.)
V_M	=	Mitigation Volume (ft^3)

EQUATIONS

$A_{Total} = A_I + A_P + A_U$

$A_I = (A_{Total} * \%$ of Development which is Impervious)

$A_P = (A_{Total} * \%$ of Development which is Pervious)

$A_U = (A_{Total} * \%$ of Contributing Undeveloped Upstream Area***)

$C_D = (0.9 * \text{Imp.}) + [(1.0 - \text{Imp.}) * C_U]$ If $C_D < C_U$, use $C_D = C_U$

$Q_{PM} = C_D * I_X * A_{Total} * (1 \text{ hour} / 3{,}600 \text{ seconds}) * (1 \text{ ft} / 12 \text{ inches}) * (43{,}560 \text{ ft}^2 / 1 \text{ acre})$

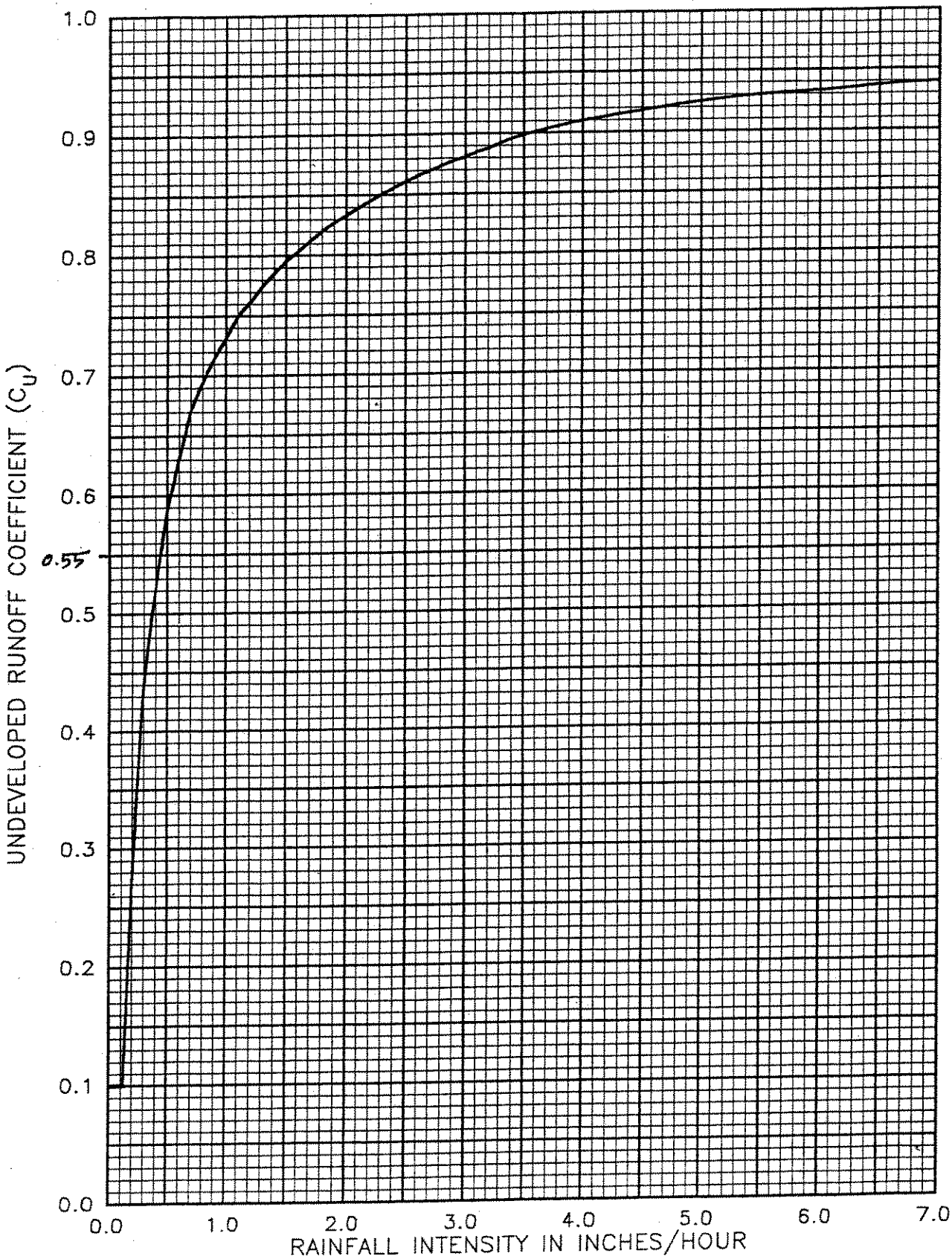
$= C_D * I_X * A_{Total} * (1.008333 \text{ ft}^3\text{-hour / acre-inches-seconds})$

$T_C = 10^{-0.507} * (C_D * I_X)^{-0.519} * \text{Length}^{0.483} * \text{Slope}^{-0.135}$

$V_M = (0.75 \text{ inches}) * [(A_I)(0.9) + (A_P + A_U)(C_U)] * (1 \text{ ft} / 12 \text{ inches}) * (43{,}560 \text{ ft}^2 / 1 \text{ acre})$

$= (2{,}722.5 \text{ ft}^3 / \text{acre}) * [(A_I)(0.9) + (A_P + A_U)(C_U)]$

***** Contributing Undeveloped Upstream Area is an area where stormwater runoff from an undeveloped upstream area will flow directly or indirectly to the Post-Construction Best Management Practices (BMPs) proposed for the development. This additional flow must be included in the flow rate and volume calculations to appropriately size the BMPs.**



Equation:

$C_D = (0.9 * IMP) + (1.0 - IMP)\ C_U$

Where:
C_D = Developed runoff coefficient.
IMP = Proportion impervious.
C_U = Undeveloped runoff coefficient.

Los Angeles County
Department of Public Works

RUNOFF COEFFICIENT CURVE

SOIL TYPE NO. 002

DETERMINING THE PEAK MITIGATED FLOW RATE (Q_{PM}):

In order to determine the peak mitigated flow rate (Q_{PM}) from the new development, use the Los Angeles County Department of Public Works *Hydrology Manual*. Use the Modified Rational Method for calculating the peak mitigation Q_{PM} for compliance with the Standard Urban Stormwater Mitigation Plan (SUSMP). Use attached **Table 1** for all maximum intensity (I_X) values used.

By trial and error, determine the time of concentration (T_C), as shown below:

CALCULATION STEPS:

1. Assume an initial T_C value between 5 and 30 minutes.

T_C 5 minutes

2. Using Table 1, look up the assumed T_C value and select the corresponding I_X intensity in inches/hour.

I_X 0.447 inches/hour

3. Determine the value for the Undeveloped Runoff Coefficient, C_U, using the runoff coefficient curve corresponding to the predominant soil type.

C_U 0.55

4. Calculate the Developed Runoff Coefficient, $C_D = (0.9 * \text{Imp.}) + [(1.0 - \text{Imp.}) * C_U]$

$(0.9 \times 0.9) + (1 - 0.9)(0.55)$

C_D 0.865

5. Calculate the value for $C_D * I_X$

$C_D * I_X$ 0.387

6. Calculate the time of concentration, $T_C = 10^{-0.507} * (C_D * I_X)^{-0.519} * \text{Length}^{0.483} * \text{Slope}^{-0.135}$

Calculated T_C _____ minutes

7. Calculate the difference between the initially assumed T_C and the calculated T_C, if the difference is greater than 0.5 minutes. Use the calculated T_C as the assumed initial T_C in the second iteration. If the T_C value is within 0.5 minutes, round the acceptable T_C value to the nearest minute.

TABLE 1

INTENSITY - DURATION DATA FOR 0.75-INCHES OF RAINFALL
FOR ALL RAINFALL ZONES

Duration, T_C (min)	Rainfall Intensity, I_X (in/hr)
5	0.447
6	0.411
7	0.382
8	0.359
9	0.339
10	0.323
11	0.309
12	0.297
13	0.286
14	0.276
15	0.267
16	0.259
17	0.252
18	0.245
19	0.239
20	0.233
21	0.228
22	0.223
23	0.218
24	0.214
25	0.210
26	0.206
27	0.203
28	0.199
29	0.196
30	0.193

PROVIDE PROPOSED PROJECT CHARACTERISTICS

node 30

A_{Total}	90.65	Acres
Type of Development	COMMERCIAL	
Predominate Soil Type #	002	
% of Project Impervious	90	
% of Project Pervious	10	
% of Project Contributing Undeveloped Area	0	
A_I	81.585	Acres
A_P	9.065	Acres
A_U	0	Acres

TABLE FOR ITERATIONS:

Iteration No.	Initial T_C (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr)	Calculated T_C (min)	Difference (min)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable T_C value 5 minutes

8. Calculate the Peak Mitigation Flow Rate,

$Q_{PM} = C_D * I_X * A_{Total} * (1.008333\ ft^3\text{-hour / acre-inches-seconds})$

(0.387)(90.65)(1.008333)

Q_{PM} 35.37 cfs

DETERMINING THE VOLUME (V_M)

In order to determine the volume (V_M) of stormwater runoff to be mitigated from the new development, use the following equation:

$$V_M = (2{,}722.5\ ft^3 / acre) * [(A_I)(0.9) + (A_P + A_U)(C_U)]$$

$$(2722.5)[(81.585 \times 0.9) + (9.065 \times 0.55)] / 43560$$

$$= 4.9\ ac\text{-}ft$$

PROVIDE PROPOSED PROJECT CHARACTERISTICS

Node 29.9

A_{Total}	1.0	Acres
Type of Development	COMMERCIAL	
Predominate Soil Type #	002	
% of Project Impervious	90	
% of Project Pervious	10	
% of Project Contributing Undeveloped Area	0	
A_I	0.9	Acres
A_P	0.1	Acres
A_U	0	Acres

TABLE FOR ITERATIONS:

Iteration No.	Initial T_C (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr)	Calculated T_C (min)	Difference (min)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable T_C value 5 minutes

8. Calculate the Peak Mitigation Flow Rate,

$Q_{PM} = C_D * I_X * A_{Total} * (1.008333\ ft^3\text{-hour / acre-inches-seconds})$

(0.387)(1.0)(1.008333)

Q_{PM} 0.39 cfs

DETERMINING THE VOLUME (V_M)

In order to determine the volume (V_M) of stormwater runoff to be mitigated from the new developn use the following equation:

$$V_M = (2{,}722.5\ ft^3 / acre) * [(A_I)(0.9) + (A_P + A_U)(C_U)]$$

$$= (2{,}722.5)[(0.9)(0.9) + (0.1)(0.55)] / 43560$$

$$= 0.054\ ac.ft$$

PROVIDE PROPOSED PROJECT CHARACTERISTICS

Node 40

A_{Total}	16.80	Acres
Type of Development	COMMERCIAL	
Predominate Soil Type #	002	
% of Project Impervious	90	
% of Project Pervious	10	
% of Project Contributing Undeveloped Area	0	
A_I	15.12	Acres
A_P	1.68	Acres
A_U	0	Acres

TABLE FOR ITERATIONS:

Iteration No.	Initial T_C (min)	I_X (in/hr)	C_U	C_D	C_D*I_X (in/hr)	Calculated T_C (min)	Difference (min)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Acceptable T_C value 5 minutes

8. Calculate the Peak Mitigation Flow Rate,

$Q_{PM} = C_D * I_X * A_{Total} * (1.008333\ ft^3\text{-hour / acre-inches-seconds})$

(0.387)(16.8)(1.008333)

Q_{PM} 6.6 cfs

DETERMINING THE VOLUME (V_M)

In order to determine the volume (V_M) of stormwater runoff to be mitigated from the new developmen use the following equation:

$$V_M = (2{,}722.5\ ft^3 / acre) * [(A_I)(0.9) + (A_P + A_U)(C_U)]$$

$$= (2722.5)[(15.12)(0.9) + (1.68)(0.55)] / 43560$$

$$= 0.91\ ac.ft$$