

RIVERSIDE COUNTY FLOOD CONTROL AND
WATER CONSERVATION DISTRICT

RIVERSIDE, CALIFORNIA

REVISED REPORT ON
MASTER DRAINAGE PLAN
FOR
THE CITY OF RIVERSIDE
(CENTRAL AREA)
ZONE ONE

DECEMBER 1968

JOHN W. BRYANT
CHIEF ENGINEER

ERRATA SHEET
for
Central Area Master Drainage Plan

21 May 1973

The Composite Drainage Map of Existing and Proposed Storm Drainage Facilities (found in the envelope at the back of the report) was inadvertently released with incorrect acreages for the drainage areas shown on the map. The acreage values should be revised to conform with the values shown on the attached reduced map which is in two parts, Figure 1 covering the southerly half of the master plan area and Figure 2 the northerly half.



- LEGEND**
- WATERSHED BOUNDARY
 - - - DRAINAGE SUB-AREA BOUNDARY
 - MAJOR DRAINAGE AREA BOUNDARY
 - - - CITY - COUNTY BOUNDARIES
 - - - DIRECTION OF FLOW
 - - - EXISTING STORM DRAINS
 - - - PROPOSED STORM DRAINS
 - (1) DRAINAGE AREA NUMBER

EXISTING AND PROPOSED
STORM DRAINAGE FACILITIES
City of RIVERSIDE, California
(Central Area)

ERRATA
MAY 21, 1973
Figure 1

2104 b100

REVISED ERRATA SHEET

- ITEM 1 - The existing line in Central Avenue between Arch Way and Palm Avenue should be referred to as Line E-5. This line is described in the following manner:

Line E-5 - Line E-5 drains the intersection at Central and Palm Avenues. This line is an underground drain that varies in size from 18 inches to 24 inches in diameter and extends from Palm Avenue westerly in Central Avenue to Arch Way where it outlets into Line E.

- ITEM 2 - Line D-3 should be designed for 60 cfs instead of 35 cfs. This change should be noted on Plate 44. The pipe size will not have to be changed.

- ITEM 3 - Line D-3 should have inlet capacity of 60 cfs at Central and Brockton Avenues. This change should be noted on page 33.

- ITEM 4 - The proposed enlargement of Line A-5 near Palm Avenue can be eliminated as part of the Master Drainage Plan; however, the existing 12-inch diameter pipe should remain and be utilized to collect minor surface runoff. This elimination should be noted on pages 18, 30 and 37, and Plate 4. The elimination reduces the total construction cost by \$10,670 and should be noted on pages 1, 46 and 47.

- ITEM 5 - A description of Line E-4 was omitted from the discussion on page 24. Line E-4 is described as follows:

Line E-4 - Line E-4 is designed to relieve a flooding problem along Nixon Drive. The line is an underground drain that extends westerly in Nixon Drive from the intersection at Harding Street to the confluence with Line E at Washington Street. A preliminary plan and profile drawing of the drain is shown on Plate 48. The estimated construction cost is \$16,170.

- ITEM 6 - Line E-3, page 24, should refer to Plate 47 instead of Plate 48.

- ITEM 7 - The following paragraph should be included with the description of the Mary Street Retention Basin.

The maximum release from the 30-inch diameter pipe would lag any runoff downstream of the dam by several hours. Therefore, no flow out of the dam was considered when tabling the hydrology downstream of the dam. Also, when the peak discharge does occur through the 30-inch outlet, Line E will have sufficient capacity.

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13	Line A-5
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16	Line A-7
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28	Line C-1
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32 and 33	Line C-3
34 and 35	Line C-4
36	Line C-5
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42	Line D-1
43	Line D-2
44	Line D-3
45	Line E-1
46	Line E-2
47	Line E-3
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49	Line F-1
50	Line F-6

S U M M A R Y

The city of Riverside has developed rapidly the past few years. New residential, commercial and industrial developments have emerged and thus have increased storm runoff which in turn is creating serious drainage and flood control problems and public inconvenience.

In May 1961, the Riverside County Flood Control and Water Conservation District financed a Master Drainage Plan for the Central Riverside Area and was adopted by the City Council. Since that time it has been determined that if a retention basin was added in the upper watershed, considerable savings to the overall plan could be realized without altering or reducing the level of protection provided in the original plan. A revised master drainage plan is presented in this report which provides a less costly solution. The plan consists of a retention basin and a network of open channels and underground storm drains that would intercept storm waters in overloaded streets and natural watercourses and convey them safely through developed areas to adequate outlets. The Santa Ana River and the Tequesquite Arroyo will serve as the outlets for all the drains proposed in this plan.

A high degree of protection will be provided when the recommended improvements are constructed. These facilities will reduce considerably storm damage and will eliminate most of the public inconvenience that now occurs during periods of normal rainfall. The total estimated cost of the plan is \$6,011,000.

I N T R O D U C T I O N

General Statement - The Riverside County Flood Control and Water Conservation District, in cooperation with the City of Riverside, is developing a master drainage plan for the entire city. This plan, which is part of the overall plan, is a revision of the Central area plan completed in May 1961 made necessary by the proposed construction of a retention basin (Mary Street Dam) in the upper watershed. Separate reports providing a master drainage plan for the La Sierra, Monroe and University areas of the city were completed in July 1965, January 1966 and July 1967, respectively, and have been adopted by the City Council.

This report provides for a retention basin that will intercept and retard flood flows from the upper watershed and a network of underground storm drains, open channels and inlets which intercept surface runoff from the developed urban areas, thus reducing storm water damage and inconvenience to the public.

Purpose - The purpose of this report is to investigate and evaluate all necessary revisions of the Central Area Master Drainage Plan which came about by the addition of the proposed retention basin (Mary Street Dam) in the upper watershed. Such a plan will provide a more economical solution to a serious drainage problem. This plan will serve as a guide in programming a storm drain construction program in the city and will also influence land development and street design in the area.

Scope - The general drainage boundaries of the area covered by this revised plan are the Santa Ana River on the north, Washington Street on the west, the Tequesquite Arroyo on the east and the mountains on the south. The extent of the studies establishing the master plan include:

1. Determination of the amounts and points of concentration of storm runoff in the area.
2. Preparation of a drainage map showing all of the subdrainage areas tributary to each system of drains.
3. Routing studies to determine the height of dam and reservoir area required for the proposed retention basin.
4. Location and size of all existing and proposed underground storm drains, open channels and inlets which will be required for ultimate development of the plan.
5. Investigation of alternative routes and methods of control to insure the most economical and feasible plan of control.
6. Preparation of preliminary design plans and supporting cost estimates.

Description of Problem - The Central area watershed generally ranges from rather steep slopes in the upper reaches to moderate and flat slopes in the lower reaches. The uppermost area is comprised of undeveloped mountainous terrain covered with grass and scrub brush. The area between the mountains

and Lincoln Avenue is in agricultural use; however, it is rapidly being subdivided for residential purposes. The remaining area to the north is almost entirely developed either residentially, industrially or commercially.

The watershed slopes south to north from the base of the mountains to the Santa Ana River and comprises an area of 3270 acres or 5.12 square miles. The rugged and steep mountains along the southerly boundary of the watershed are the major source of storm runoff. Storm flows debouch out of several canyons and make their way through street systems and inadequate existing storm drains to the Santa Ana River.

DISCUSSION

General - As previously stated, this report is a revision of an earlier report on a master drainage plan for the central area of Riverside. The system, as previously proposed, was a network of underground storm drains costing about \$8,127,000. The revised plan includes a retention basin (Mary Street Dam) and a network of underground storm drains and open channels that would cost \$6,011,000. The total cost includes the already completed Victoria Avenue Storm Drain at a cost of \$419,570. This drain is part of the overall system included in the central area plan. The revised plan will cost about 26 percent less than the original plan. It should also be noted that the cost estimate for the original plan was based on 1961 price levels while the estimate for the revised plan is based on current price levels.

Criteria - The criteria used in the development of this revised master plan was generally the same as was used in preparing the original plan. All underground drains or open channels draining urban areas will be designed to control a 10-year frequency storm discharge. The retention basin (Mary Street Dam) will be designed to control a 100-year frequency storm discharge. Retention basins will be used to control runoff from the mountainous portions of the watershed when the cost of retention storage is less than the cost to provide a larger storm drain for the unregulated peak discharges. Open channels will be provided when discharge is large and the construction

and right of way costs for the channel proved to be less than the costs of an underground storm drain.

The storm drain network proposed in this report was developed on the basis of providing a drain when:

- (a) Street flow reaches the top of the curb level.
- (b) Diversion from an overloaded existing drain is necessary.
- (c) Economic considerations dictated a diversion from the normal path of storm flows.
- (d) Relief for a major street intersection is needed.

Generally, all underground storm drains will be located within either existing or proposed future street right of way. In some instances underground drains will be located in easements across private property. The alignments of all drains and channels are based on hydraulic efficiency and economics. Any major departures from the proposed alignments will require a reevaluation of the design of the system.

Hydrology - The hydrology for this revised plan is essentially the same as was applied in the original master plan. The two common methods; namely, the modified rational method and the synthetic unit hydrograph method were used.

The modified rational method was used to determine the 10-year frequency design discharge generated within the watershed. All street systems were rated for these flows and all drain lines are sized according to these discharges. The basic equation for the rational method is $Q = CIA$: where Q

is the quantity of flow in cubic feet per second; C is a runoff coefficient based on soil type, slope of land, type of development and intensity of rainfall; I is the intensity of rainfall in inches per hour; and A is the size of contributing area in acres.

A soil map depicting the various soil classifications in the watershed was prepared and is included in the report as Figure I. The U. S. Soil Conservation Service classifies soils into four hydrologic groupings. The grouping or classification signifies the relative permeability of the soil, with group A being the most permeable soil and group D the least permeable soil. The central area watershed contains groups C and D soil types. These soil types were verified with the Riverside office of the U. S. Soil Conservation Service. Runoff coefficient (C) curves for each of the two soil groups are included in the report as Figures II and III.

Rainfall intensity-duration-frequency curves for the city of Riverside were developed from a statistical analysis of the rainfall record from the Citrus Experiment Station recording rain gage. A 25-year period of record was studied and the results obtained compared favorably with data derived from U. S. Weather Bureau Technical Bulletin No. 24. Table I of this report is a tabulation of rainfall intensity-duration data for a 10-year frequency event.

The hydrology for the retention basin design was derived by the synthetic unit hydrograph method. A 100-year

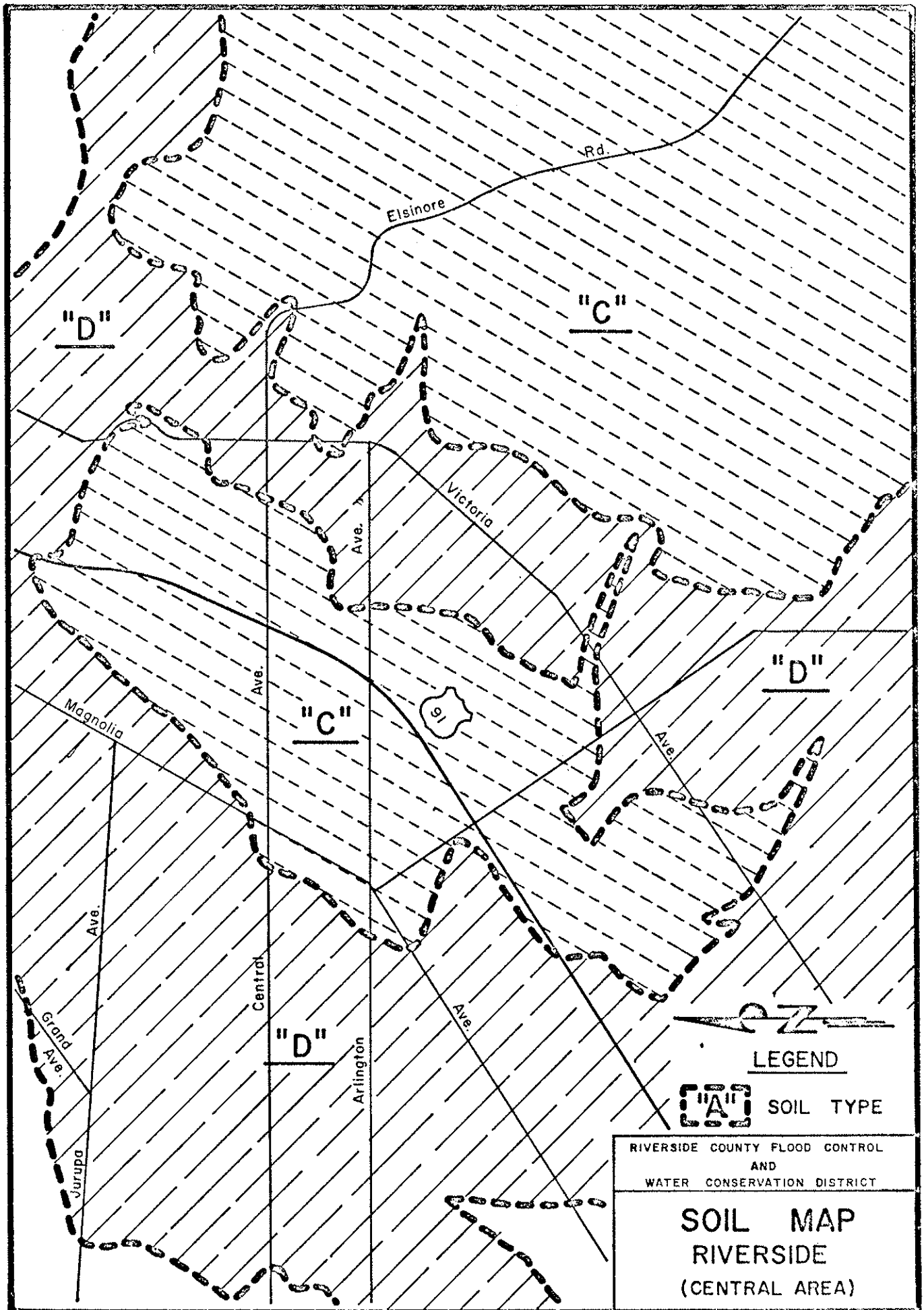


FIG I

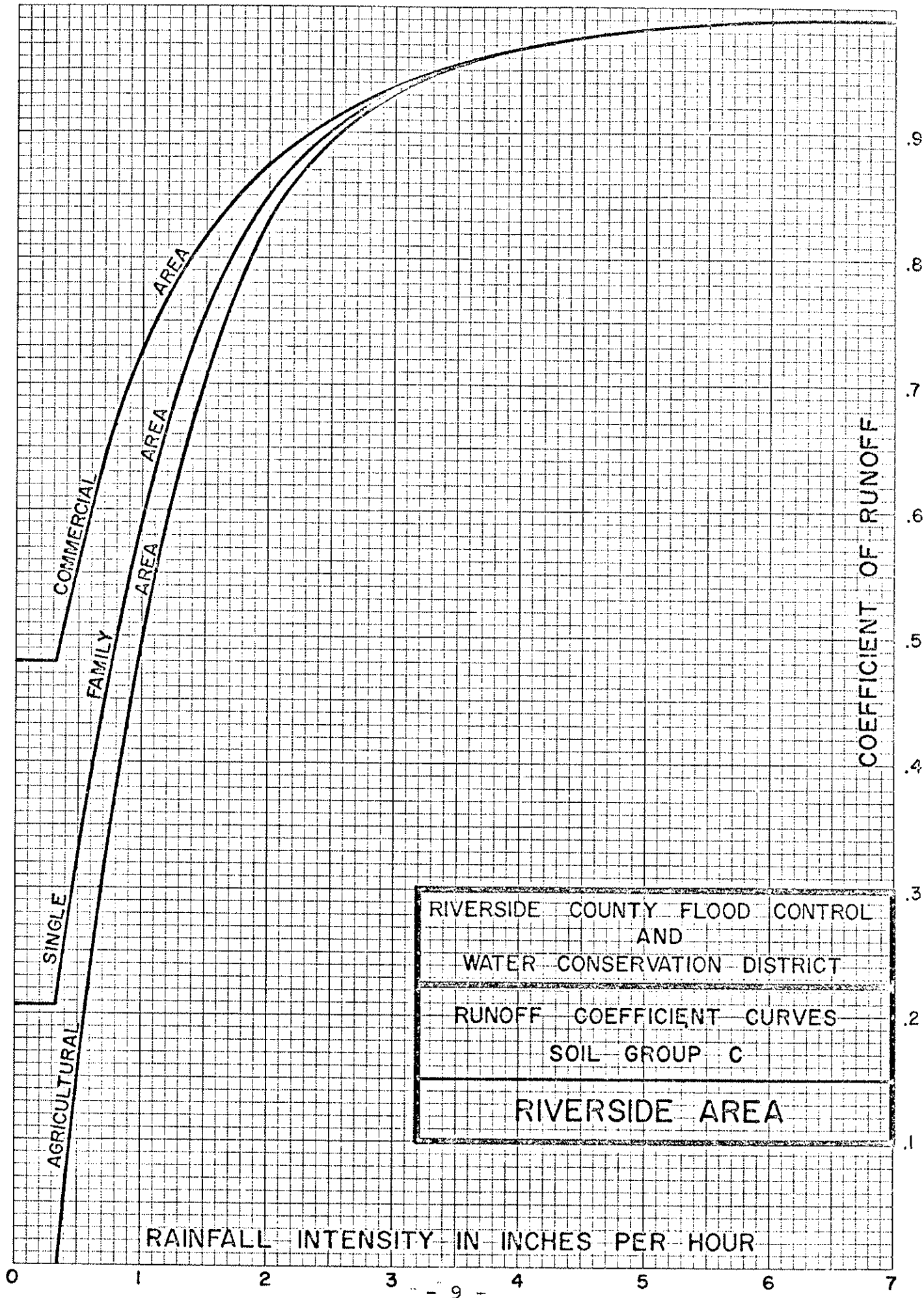
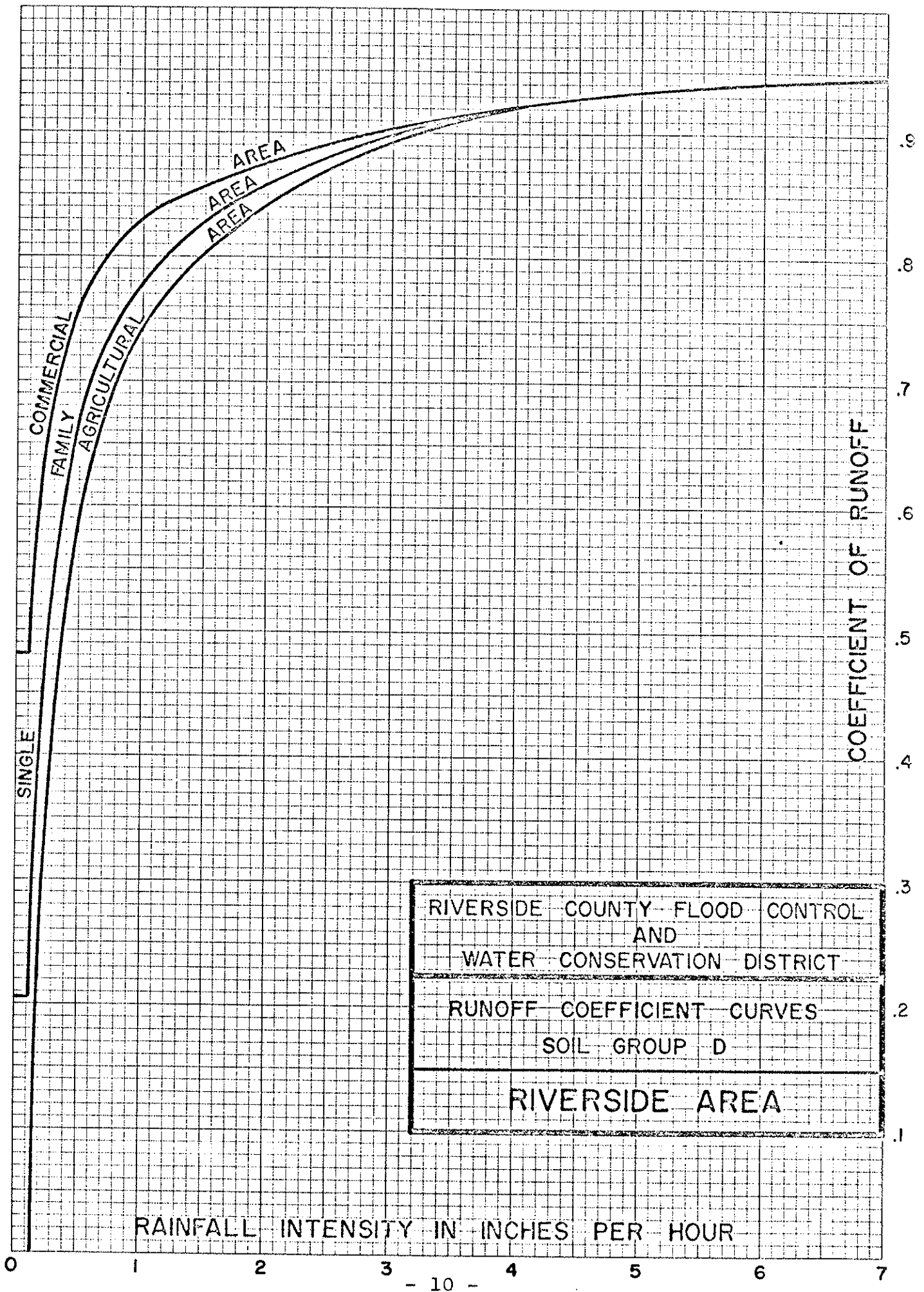


FIG. II

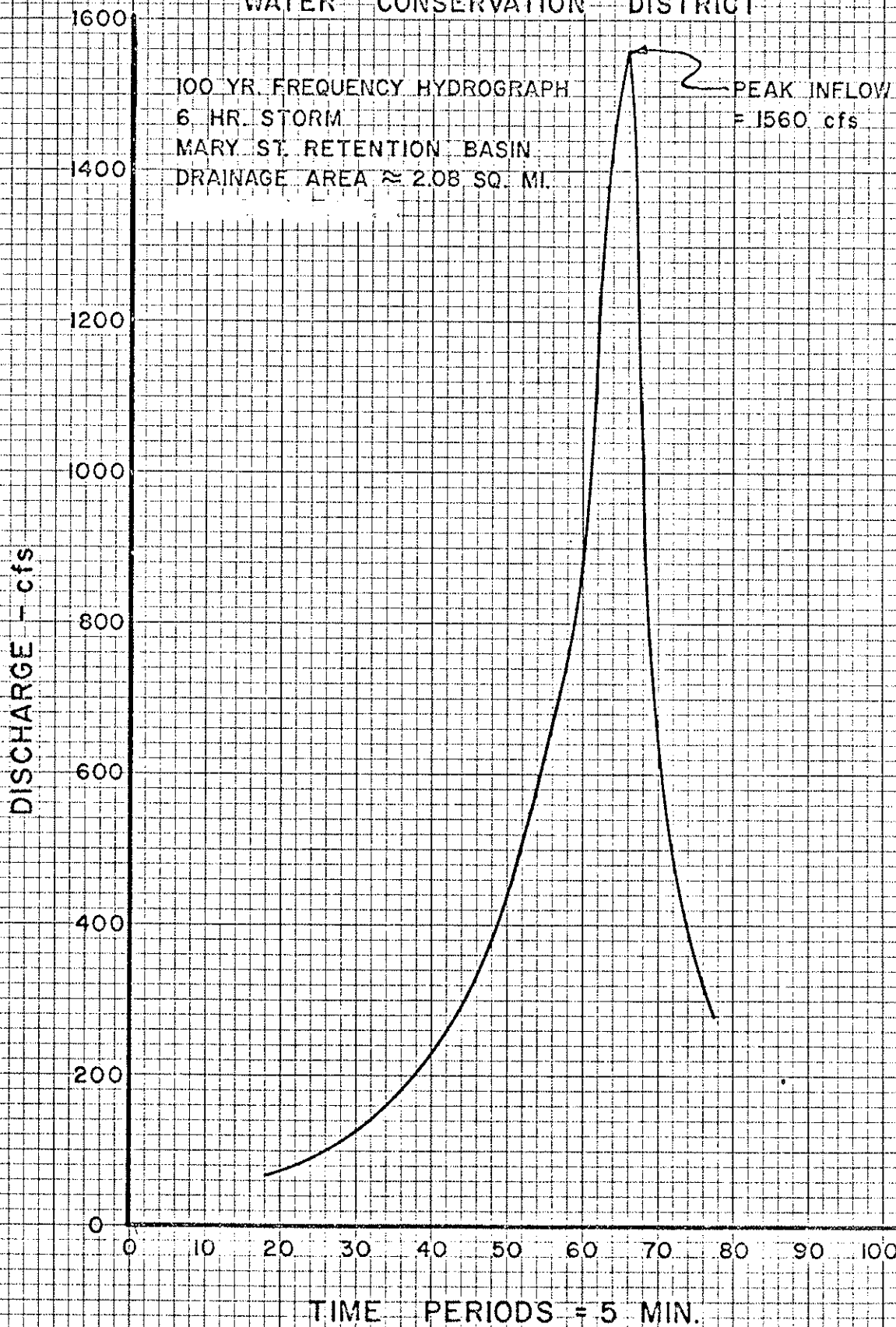


RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT
RUNOFF COEFFICIENT CURVES
SOIL GROUP D
RIVERSIDE AREA

RAINFALL INTENSITY IN INCHES PER HOUR

FIG. III

RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT



EUGENE DIETZGEN CO.
MADE IN U. S. A.

NO. 34DA-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

RIVERSIDE COUNTY FLOOD CONTROL
 WATER CONSERVATION DISTRICT
 INTENSITY-DURATION CURVE DATA
 INCHES PER HOUR

5.0 Min. - 15.0 Min.

tc Min.	I	tc min.	I	tc min.	I	tc min.	I	tc min.	I
5.0	2.66	7.0	2.23	9.0	1.95	11.0	1.74	13.0	1.59
.1	2.63	.1	2.21	.1	1.94	.1	1.73	.1	1.59
.2	2.60	.2	2.19	.2	1.92	.2	1.72	.2	1.58
.3	2.57	.3	2.17	.3	1.91	.3	1.72	.3	1.57
.4	2.54	.4	2.15	.4	1.90	.4	1.71	.4	1.57
.5	2.53	.5	2.14	.5	1.89	.5	1.70	.5	1.56
.6	2.50	.6	2.12	.6	1.88	.6	1.69	.6	1.55
.7	2.48	.7	2.10	.7	1.87	.7	1.68	.7	1.54
.8	2.46	.8	2.08	.8	1.86	.8	1.67	.8	1.54
.9	2.44	.9	2.06	.9	1.85	.9	1.67	.9	1.53
6.0	2.42	8.0	2.07	10.0	1.84	12.0	1.66	14.0	1.53
.1	2.40	.1	2.04	.1	1.83	.1	1.65	.1	1.52
.2	2.38	.2	2.03	.2	1.82	.2	1.64	.2	1.52
.3	2.36	.3	2.02	.3	1.81	.3	1.63	.3	1.51
.4	2.34	.4	2.01	.4	1.80	.4	1.62	.4	1.51
.5	2.32	.5	2.00	.5	1.79	.5	1.62	.5	1.50
.6	2.30	.6	1.99	.6	1.78	.6	1.61	.6	1.50
.7	2.28	.7	1.98	.7	1.77	.7	1.61	.7	1.49
.8	2.26	.8	1.97	.8	1.76	.8	1.60	.8	1.48
.9	2.24	.9	1.96	.9	1.75	.9	1.60	.9	1.48
7.0	2.23	9.0	1.95	11.0	1.74	13.0	1.59	15.0	1.47

15.0 Min. - 25.0 Min.

15.0	1.47	17.0	1.38	19.0	1.30	21.0	1.23	23.0	1.17
.2	1.46	.2	1.37	.2	1.29	.2	1.23	.2	1.17
.4	1.45	.4	1.36	.4	1.28	.4	1.22	.4	1.16
.6	1.44	.6	1.35	.6	1.27	.6	1.22	.6	1.16
.8	1.43	.8	1.34	.8	1.26	.8	1.21	.8	1.15
16.0	1.42	18.0	1.34	20.0	1.26	22.0	1.20	24.0	1.14
.2	1.41	.2	1.33	.2	1.25	.2	1.20	.2	1.14
.4	1.40	.4	1.32	.4	1.25	.4	1.19	.4	1.13
.6	1.39	.6	1.31	.6	1.24	.6	1.19	.6	1.13
.8	1.38	.8	1.30	.8	1.24	.8	1.18	.8	1.12
17.0	1.38	19.0	1.30	21.0	1.23	23.0	1.17	25.0	1.12

25.0 Min. - 35.0 Min.

25.0	1.12	27.0	1.07	29.0	1.03	31.0	0.99	33.0	0.95
.5	1.11	.5	1.06	.5	1.02	.5		.5	
26.0	1.09	28.0	1.05	30.0	1.01	32.0	0.97	34.0	0.94
.5	1.08	.5	1.04	.5	1.00	.5		.5	
27.0	1.07	29.0	1.03	31.0	0.99	33.0	0.95	35.0	0.93

RIVERSIDE COUNTY FLOOD CONTROL
 WATER CONSERVATION DISTRICT
 INTENSITY-DURATION CURVE DATA
 INCHES PER HOUR

35. Min. - 60. Min.

tc min.	I	tc min.	I	tc min.	I	tc min.	I	tc min.	I
35	0.93	40	0.86	45	0.81	50	0.76	55	0.73
36	0.91	41	0.85	46	0.80	51	0.76	56	0.72
37	0.90	42	0.84	47	0.79	52	0.75	57	0.71
38	0.89	43	0.83	48	0.78	53	0.74	58	0.71
39	0.87	44	0.82	49	0.77	54	0.74	59	0.70
40	0.86	45	0.81	50	0.76	55	0.73	60	0.69

60. Min. - 85. Min.

60	0.69	65	0.67	70	0.64	75	0.62	80	0.59
61	0.69	66	0.66	71	0.64	76	0.61	81	0.59
62	0.68	67	0.66	72	0.63	77	0.61	82	0.59
63	0.68	68	0.65	73	0.63	78	0.60	83	0.58
64	0.67	69	0.65	74	0.62	79	0.60	84	0.59
65	0.67	70	0.64	75	0.62	80	0.59	85	0.58

85. Min. - 100 Min.

85	0.58	90	0.56	95	0.54
86	0.57	91	0.56	96	0.54
87	0.57	92	0.55	97	0.54
88	0.57	93	0.55	98	0.53
89	0.56	94	0.55	89	0.53
90	0.56	95	0.54	100	0.53

intensity, six-hour storm was centered over the contributing drainage area and a hydrograph of the discharge in cubic feet per second versus time in minutes was determined. The total volume of runoff in acre-feet, which is the amount of runoff that is to be stored in the basin, was also determined by computing the area under the hydrograph curve. A design hydrograph for the Mary Street Dam is included in the report as Figure IV.

Maps and Plates - A composite drainage map depicting the revised drainage plan is included in the report. Revised preliminary plan and profile drawings indicating pertinent details for each drainage facility are also included in this report.

Existing Lines - Several existing storm drains are located within the central area watershed. These lines have been constructed by the City and those that are utilized directly by the plan were assigned line numbers. A brief description of the existing lines which are an integral part of the master plan follows:

Line A-3a - Line A-3a drains the residential area easterly of Palm Avenue between Arlington and Central Avenues. This line varies from 21-inch diameter to 36-inch diameter and extends from Palm Avenue at Shatto Place to Nelson Street near Lassen Court. This line does not have capacity to control the 10-year frequency runoff; therefore, a parallel line will be necessary. Preliminary plan and profile drawings of a parallel line are shown on Plates 11 and 12.

Line A-4 - Line A-4 drains the intersection at Magnolia and Brockton Avenues. This line is a 20-inch diameter pipe extending from Magnolia Avenue southerly in Brockton Avenue to Nelson Street where it outlets into Line A-3a.

Line C-2a - Line C-2a drains Durango Street at Laredo Road. This line is a 42-inch diameter pipe extending to Arlington Avenue. This line does not have capacity to control the 10-year frequency runoff; therefore, a parallel line will be necessary. Preliminary plan and profile drawings of a parallel line are shown on Plates 29 and 30.

Line D-3 - Line D-3 is an existing 24-inch diameter pipe in Central Avenue between De Anza and Magnolia Avenues. This line is an underground drain that is to be extended in Brockton Avenue to Merrill Avenue. A preliminary plan and profile drawing of the extension is shown on Plate 44.

Line E - This line serves the southerly and westerly portion of the watershed. It was constructed in 1938 by the City of Riverside and is a cast in place concrete pipe varying in size from a 54-inch to a 72-inch diameter. The line begins near the intersection of Victoria Avenue and Mary Street and continues westerly in Victoria Avenue to Washington Street, thence northerly in Washington Street to Magnolia Avenue; thence north in Palm Avenue to Orange Vista, west in Orange Vista to Arch Way; thence north in Arch Way to Dewey Avenue, west in Dewey Avenue to Correll Street; thence north in Correll Street

to Jurupa Avenue; and thence northwesterly to an outlet in the Santa Ana River. Line A of this master plan will intercept this line at Arch Way and Dewey Avenue. However, the line will continue to function from Carlo Drive and Dewey Avenue draining all the area west of Arch Way and south of Dewey Avenue within the watershed.

Line F - Line F is commonly referred to as the Victoria Avenue Storm Drain. This drain serves the Victoria groves area bounded generally by Alessandro Boulevard, Elsinore Road and Victoria Avenue. This drain, constructed in 1963 by the District, varies in size from a 42-inch to a 72-inch diameter pipeline and extends from Glenhaven Avenue in Alessandro Boulevard to the Alcott Elementary School; thence north through the school grounds and Stonewood Drive to Elsinore Road; thence west in Elsinore Road to Victoria Avenue; and thence north in Victoria Avenue to the Tequesquite Arroyo.

Line F-2 - Line F-2 is a small 18-inch diameter lateral drain that extends along the westerly boundary of a subdivision from Devonshire Road north to Elsinore Road where it joins Line F.

Line F-3 - Line F-3, previously referred to as the Victoria Avenue Storm Drain Lateral B, extends from Line F at Stonewood Drive in Elsinore Road easterly to Glenhaven Drive and Fairview Avenue. This line varies in size from 30 inches to 48 inches in diameter. This line was constructed by the District in 1964.

Line F-4 - Line F-4 (Victoria Avenue Storm Drain - Lateral B-1), is a lateral to Line F-3 extending from Candlewick Court in Drummond Avenue to the confluence with Line F-3 at Elsinore Road. The line is an underground drain varying from 30 inches to 36 inches in diameter.

Line F-5 - Line F-5 (Victoria Avenue Storm Drain - Lateral C), is a lateral to Line F extending from Gloucester Way to the confluence with Line F near Central Avenue. This line, constructed by a subdivider, is an equivalent 24-inch diameter pipeline.

Recommended Improvements

Line A - Line A serves the developed area in the westerly portion of the drainage area between Lincoln Avenue and the Santa Ana River. This line will be the main trunk line through the area and will serve as the outlet for many existing and other proposed major lines and laterals. This line is an underground drain that extends northerly in Mary Street from Lincoln Avenue to Arlington Avenue. The line then continues northerly in Brockton Avenue to Tibbetts Street where it turns westerly to Palm Avenue; thence northerly in Palm Avenue to Dewey Avenue; thence westerly in Dewey Avenue to a point midway between Arch Way and Carlo Drive. From this point the drain proceeds in a northwesterly direction diagonally across undeveloped land to Correll Street and continues across Jurupa Avenue and Grand Avenue to an outlet at the Santa Ana River. Preliminary plan and profile drawings of the drain are shown on Plates 1 through 8. The estimated construction cost is \$1,358,600.

Line A-1 - Line A-1 drains Arlington Avenue near Glacier Drive. The line is an underground drain that extends westerly from Glacier Drive to the confluence with Line A at Brockton Avenue. A preliminary plan and profile drawing of the drain is shown on Plate 9. The estimated construction cost is \$29,570.

Line A-2 - Line A-2 drains the Arlington Avenue-Magnolia Avenue intersection. The line is an underground drain that extends northeasterly from the intersection to the confluence with Line A at Tibbetts Street. A preliminary plan and profile drawing of the drain is shown on Plate 10. The estimated construction cost is \$24,590.

Line A-3 - Line A-3 is an underground drain designed to relieve an overloaded existing drain in Nelson Street. The line extends from San Diego Avenue westerly in Nelson Street and parallel to the existing line to Magnolia Avenue; thence westerly in Shatto Place and School Circle to the confluence with Line A at Palm Avenue. Preliminary plan and profile drawings of the drain are shown on Plates 11 and 12. The estimated construction cost is \$134,360.

Line A-5 - Line A-5 is an underground drain that would relieve a serious drainage problem along Central Avenue near Palm Avenue. This line extends westerly in Central Avenue from Navel Court to the confluence with Line A at Palm Avenue. A preliminary plan and profile drawing of the drain is shown on Plate 13. The estimated construction cost is \$10,670.

Line A-6 - Line A-6 drains a large area north and south of Jurupa Avenue between Brockton Avenue and Meadowbrook Lane. This line is an underground drain that extends westerly in Jurupa Avenue from Palm Avenue to the confluence with Line A at Correll Street. Preliminary plan and profile drawings of the drain are shown on Plates 14 and 15. The estimated construction cost is \$99,010.

Line A-7 - Line A-7 relieves a serious drainage problem at the intersection of Cover Street and Arch Way. This line is an underground drain that extends northerly to the confluence with Line A-6. A preliminary plan and profile drawing of the drain is shown on Plate 16. The estimated construction cost is \$13,940.

Retention Basin (Mary Street Dam) - The Mary Street Dam and Retention Basin is to be located approximately 1,000 feet south-east of the Victoria Avenue-Mary Street intersection. The basin is designed to intercept and control 100-year peak flows from a 1,331-acre watershed. This basin will make it possible to significantly reduce the size of drainage facilities downstream. The basin will be formed by an earth fill dam having a crest length of approximately 1,037 feet, a maximum height of 45 feet and a storage capacity for about 285 acre-feet. The outlet will be an ungated 30-inch diameter pipe that will discharge into the natural watercourse downstream from the dam which in turn discharges into Line E. The spillway will also discharge into the natural watercourse downstream from the dam. A preliminary plan and profile drawing of the retention basin is shown on Plate 17. The estimated construction cost is \$75,000.

Line B - Line B is designed to intercept and divert storm runoff from a large watershed east of the Gage Canal and tributary to Victoria Avenue between Washington and Jane Streets to the Mary Street Dam. This diversion channel is needed to reduce the size of structures downstream. The line is an open concrete lined channel that extends northerly from Hawarden Drive near Washington Street parallel with and adjacent to the east side of the Gage Canal to the Mary Street retention basin. Preliminary plan and profile drawings of the drains are shown on Plates 18 and 19. The estimated construction cost is \$115,150.

Line B-1 - Line B-1 is designed to intercept and divert storm runoff from watersheds tributary to Victoria Avenue between Arlington Avenue and Maude Street to the Mary Street Dam. This diversion channel also serves to reduce the size of downstream structures. The line is an open concrete lined channel that extends southerly from Arlington Avenue parallel with and adjacent to the east side of the Gage Canal to the proposed Mary Street retention basin. Preliminary plan and profile drawings of this line are shown on Plates 20 - 22. The estimated construction cost is \$247,880.

Line B-2 - Line B-2 is an underground drain designed to intercept storm flows at Washington Street and Hawarden Drive. The line extends easterly approximately 800 feet in Hawarden Drive to the confluence with Line B. A preliminary plan and profile drawing of the drain is shown on Plate 23. The estimated construction cost is \$23,220.

Line C - Line C is a major underground drain that serves the central portion of the watershed. This line begins at Anna Street and Victoria Avenue and continues north in Anna Street to Arlington Avenue to near the Santa Fe Railroad; thence north crossing under the railroad and the Riverside Freeway near Bonita Avenue; thence west in Bonita Avenue to Riverside Avenue; thence north in Riverside Avenue to Central Avenue to junction with Line D. Preliminary plan and profile drawings of the drain are shown on Plates 24 to 27. The estimated construction cost is \$493,870.

Line C-1 - Line C-1 drains Horace Street in the vicinity of the California School for the Deaf. This underground drain begins at the intersection of Horace Street and Lincoln Avenue and continues north in Horace Street to join Line C at Arlington Avenue. A preliminary plan and profile drawing of the drain is shown on Plate 28. The estimated construction cost is \$63,500.

Line C-2 - Line C-2 drains the Sun Gold area west of Victoria Avenue. This line is an underground drain that begins at Laramie Road and Victoria and continues in a southeasterly direction in Laramie Road to the confluence with Line C at Arlington Avenue. Preliminary plan and profile drawings of the drain are shown on Plates 29 and 31. The estimated construction cost is \$142,970.

Line C-3 - Line C-3 drains Maude Street between Lincoln Avenue and Arlington Avenue. This line is an underground drain that extends northerly from Lincoln Avenue to the confluence with Line C at Arlington Avenue. Preliminary plan and profile

drawings of the drain are shown on Plates 32 and 33. The estimated construction cost is \$94,160.

Line C-4 - Line C-4 relieves a drainage problem at Jane Street and Indiana Avenue. This line is an underground drain that extends from Jane Street and the Atchison, Topeka and Santa Fe Railroad northwesterly to Indiana Avenue; thence northeasterly in Indiana Avenue to Arlington Avenue; thence parallel with the Riverside Freeway to the confluence with Line C. Preliminary plan and profile drawings of the drain are shown on Plates 34 and 35. The estimated construction cost is \$94,160.

Line C-5 - Line C-5 is an underground drain designed to drain Rumsey Drive in the Sun Gold area. The line extends from Chisholm Road to Laramie Road and the confluence with Line C-2. A preliminary plan and profile drawing of the drain is shown on Plate 36. The estimated construction cost is \$9,420.

Line D - Line D is a major underground drain that serves the northerly section of the watershed. This line begins at Rumsey Drive and Central Avenue and extends westerly in Central Avenue to Riverside Avenue; thence north in Riverside Drive to Merrill Avenue; thence west in Merrill Avenue to Brockton Avenue; thence west in Dewey Avenue to the confluence with Line A at Dewey and Palm Avenues. Preliminary plan and profile drawings of the drain are shown on Plates 37 through 41. The estimated construction cost is \$842,240.

Line D-1 - Line D-1 is an underground drain that drains Neva Place. This line extends southerly from Olivewood Avenue to Line D in Central Avenue. A preliminary plan and profile drawing of the drain is shown on Plate 42. The estimated construction cost is \$24,400.

Line D-2 - Line D-2 drains Tipperary Way near Riverside Avenue. This line is an underground drain that extends southwesterly from Trinity Court in Tipperary Way to Riverside Avenue; thence south in Riverside Avenue to the confluence with Line D. A preliminary plan and profile drawing of the drain is shown on Plate 43. The estimated construction cost is \$17,360.

Line D-3 - Line D-3 is proposed to intercept an existing drain in Central Avenue at Magnolia and Brockton Avenues. The existing line extends from De Anza Avenue to Palm Avenue in Central Avenue. After crossing Magnolia Avenue this line funnels into a 12-inch diameter pipe which is undersized. Line D-3 will connect to the existing double 60-inch diameter pipes in the Central-Magnolia intersection and continue north in Brockton Avenue. A preliminary plan and profile drawing of the drain is shown on Plate 44. The estimated construction cost is \$38,300.

Line E-1 - Line E-1 is an underground drain designed to drain Washington Street upstream from Victoria Avenue. The line extends from Francis Street northerly in Washington Street to Victoria Avenue and the confluence with Line E. A preliminary plan and profile drawing of the drain is shown on Plate 45. The estimated construction cost is \$30,280.

Line E-2 - Line E-2 is an underground drain designed to drain Central Avenue west of Arch Way. The line begins at Belinda Drive and Central Avenue and extends west in Central Avenue to Carlo Drive; thence northerly in Carlo Drive to the confluence with Line E at Dewey Avenue. A preliminary plan and profile drawing of the drain is shown on Plate 46. The estimated construction cost is \$48,570.

Line E-3 - Line E-3 is an underground drain designed to relieve a problem at Stearns Street and the Union Pacific Railroad. The line begins at Stearns Street and parallels the railroad in an easement to the confluence with Line E. A preliminary plan and profile drawing of the drain is shown on Plate 48. The estimated construction cost is \$16,170.

Line F-1 - Line F-1 is designed to relieve flooding at the intersection of Victoria and Central Avenues. This line is an underground drain that extends northerly in Victoria Avenue from the intersection at Central Avenue to the confluence with Line F at Elsinore Road. A preliminary plan and profile drawing of the drain is shown on Plate 49. The estimated construction cost is \$42,040.

Line F-6 - Line F-6 is designed to relieve a flooding problem along Plymouth Road and Gloucester Way that originates on a developed area upstream from the Gage Canal. The line begins in Fairview Avenue near Plymouth Road and continues north to Gloucester Way; thence west in Gloucester Way to Avondale Way; thence north in Avondale Way to join with Line F at Central

Avenue. A preliminary plan and profile drawing of the drain is shown on Plate 50. The estimated construction cost is \$39,980.

Inlets - Inlets and their proper location are perhaps the most important and integral part of any flood control and drainage system. Inlets provide the means of intercepting uncontrolled flows in the streets or watercourses and directing them into the channels and storm drains. Most of the inlets to be used in this plan will be the curb opening type catch basins or modifications thereof. Field investigations have been made in order to generally establish the locations of the proposed system. Tables II and III list the location of existing and proposed catch basins for the existing and proposed storm drains and approximate length of curb opening required to intercept the storm runoff.

TABLE II
PROPOSED INLETS
FOR EXISTING DRAINAGE SYSTEM

Line	Drainage Area No.	Location	Proposed Inlets		
			Total	Existing	Proposed
A3a	P.* 45	Nelson @ Lassen Court	6	6	0
	P. 46	Nelson @ De Anza	0	0	0
	P. 47	Nelson @ Yellowstone	3	3	0
	P. 47	Nelson @ Brockton	9	9	0
	P. 57 P. 59	Magnolia @ School Circle	45	15	30
	P. 60	School Circle @ Shatto	3	3	0
A-4	P. 47	Brockton @ Magnolia	4	4	0
	P. 47	Brockton @ San Simeon	4	4	0
C2a	P. 19	Laramie @ Iaredo	15	15	0
	P. 19	Laramie @ Durango	5	5	0
	P. 20	Durango @ Cimarron	5	5	0
	P. 20	Durango @ Arlington	5	5	0
D-3	26,27	Central @ De Anza	35	14	21
	30,31	Central @ Magnolia	38	38	0
	P. 32	Central @ Brockton	0	0	0

P.* Denotes part of drainage area.

TABLE II
PROPOSED INLETS
FOR EXISTING DRAINAGE SYSTEM

Line	Drainage Area No.	Location	Proposed Inlets		
			Total	Existing	Proposed
E	P.* 4	Washington @ Goodview	13	0	13
	P. 4	Washington @ Lincoln	13	8	5
	5	Washington @ Marguerita	28	10	18
	P. 6	Washington @ Coolidge	10	10	0
	P. 6	Washington @ A.T. & S.F.R.R.	11	11	0
	7	Washington @ Indiana	8	8	0
	49	Washington @ Nixon	8	8	0
	52	Washington @ Magnolia	4	0	4
	P. 61	Palm @ Magnolia	4	4	0
	P. 55	Palm @ McCray	4	4	0
	P. 55	Palm @ Sierra	4	4	0
	P. 55	Palm between Sierra & Shatto	4	4	0
	P. 8	Fig @ Orange Vista	8	8	0
	P. 8	Orange Vista @ Arch	8	8	0
	P. 9	Arch @ Marmian	8	8	0
	P. 9	Arch @ Central	10	10	0
	P. 10	Arch @ Sunnyside	10	10	0

P.* Denotes part of drainage area.

TABLE II
PROPOSED INLETS
FOR EXISTING DRAINAGE SYSTEM

Line	Drainage Area No.	Location	Proposed Inlets		
			Total	Existing	Proposed
E	P.* 10	Arch @ Beatty	18	18	0
	P. 10	Arch @ Merrill	8	8	0
	P. 10	Arch @ Dewey	5	5	0
	11	Dewey @ Carlo	4	4	0
	17	Correll @ U.P.R.R.	0	0	0
	P. 21	Correll between Dewey & Jurupa	0	0	0
F, F-2, F-3, F-4, F-5		No catch basins to be added to these existing lines			

P.* Denotes part of drainage area.

TABLE III
PROPOSED INLETS
FOR MASTER DRAINAGE PLAN

Line	Drainage Area No.	Location	Proposed Inlets		
			Total	Existing	Proposed
A	39	Mary @ Lincoln	47	0	47
	40	Mary @ Marguerita	40	7	33
	41	Mary @ A.T.S.F.R.R.	16	10	6
	42	Mary @ Nixon	15	15	0
	46-48	Mary @ Arlington	46	0	46
	56	Tibbetts @ Magnolia	5	0	5
	62	Palm & Central	4	4	0
	63	Palm @ Dewey	12	4	8
	21	Correll @ Jurupa	14	14	0
	79,80	Correll @ Grand	17	8	9
A-1	46	Arlington @ Glacier	29	0	29
	47	Arlington @ Yellowstone	15	0	15
	48	Arlington @ Brockton	14	0	14
A-2	52-54	Arlington @ Magnolia	98	8	90
A-3	43,44	Nelson @ San Diego	37	0	37
	P.* 45	Nelson @ Lassen Court	35	0	35
	P. 46	Nelson @ De Anza	21	0	21
	P. 47	Nelson @ Yellowstone	22	0	22

P.* Denotes part of drainage area.

TABLE III
PROPOSED INLETS
FOR MASTER DRAINAGE PLAN

Line	Drainage Area No.	Location	Proposed Inlets		
			Total	Existing	Proposed
A-3	P.* 47	Nelson @ Brockton	22	0	22
	P. 57	Magnolia			
	P. 59	@ School Circle	31	0	31
	P. 60	School Circle @ Shatto	19	0	19
	61	Shatto @ Palm	3	0	3
A-5	30,31 P.32 P.48	Central @ Navel Court	25	0	25
	P. 48	Central @ Palm	14	14	0
A-6	65	Jurupa @ Palm	28	0	28
	66,70	Jurupa @ Arch	8	0	8
	71-73 .	Jurupa @ Tower	40	0	40
	74	Jurupa @ Greenfield	26	0	26
	75-77	Jurupa @ Meadowbrook	43	0	43
	78	Jurupa @ Correll	8	8	0
A-7	67-69	Arch @ Cover	31	0	31
B	1-24	Upstream end near Hawarden	0	0	0
	25A	Hawarden @ Line B-2	16	0	16
	31-36	Hawarden @ Mary	54	0	54
	29,30, 37	Hawarden between Mary & Dam	45	0	45

P.* Denotes part of drainage area.

TABLE III
PROPOSED INLETS
FOR MASTER DRAINAGE PLAN

Line	Drainage Area No.	Location	Proposed Inlets		
			Total	Existing	Proposed
B-1	16-22	Arlington near Hawarden	0	0	0
	15B	Hawarden @ North Piedmont	23	0	23
	14A,15A	Hawarden @ South Piedmont	22	0	22
	14B	Hawarden 1050' North of Horace	28	0	28
	11,12A,12B	Line B-1 @ Horace	59	0	59
	3,4,5A,7B	Line B-1 @ Maude	22	0	22
	B-2	26-28	Washington @ Hawarden	25	8
25A		Hawarden @ Line B	16	0	16
C		Victoria @ Anna	48	0	48
C	4	Anna @ Lincoln	5	0	5
	1,2	Anna @ Arlington	21	0	21
	3	Arlington @ Horace	10	10	0
	21,22	Arlington @ School for the Deaf	55	0	55
	23,24	Arlington @ Maude	54	0	54
	39	Arlington @ Indiana	4	0	4
	P.* 20	Riverside @ Bryce	5	0	5
	P. 21	Riverside @ Carlsbad	8	0	8
	22-24	Riverside @ Laura Lane	20	0	20

P.* Denotes part of drainage area.

TABLE III
PROPOSED INLETS
FOR MASTER DRAINAGE PLAN

Line	Drainage Area No.	Location	Proposed Inlets		
			Total	Existing	Proposed
C-1	7A,13	Victoria @ Horace	37	5	32
	5-9	Horace @ Lincoln	56	10	46
	10-12	Horance @ Westridge	30	0	30
	13	Horace @ Arlington	9	5	4
C-2	24-26, 26A	Laramie @ Victoria	107	15	92
	16	Laramie @ Rumsey	10	0	10
	17	Laramie @ Anna	30	0	30
	18	Laramie @ Carson	22	0	22
	P.* 19	Laramie @ Laredo	11	0	11
	P. 19	Laramie @ Durango	10	0	10
	P. 20	Durango @ Cimarron	13	0	13
	P. 20	Durango @ Arlington	5	0	5
C-3	1,2,6, 25-28	Maude @ Lincoln	71	0	71
	29-32	Maude @ Marguerita	34	0	34
	33-35	Maude @ Duke	16	0	16
	36-38	Maude @ Arlington	13	4	9
C-4	40-43	Jane @ A.T.& S.F.R.R.	40	0	40
	44	Jane @ Indiana	19	0	19
	45	Indiana @ Arlington	15	0	15
	P. 20,21	Freeway @ Line C	13	0	13

P.* Denotes part of drainage area.

TABLE III
PROPOSED INLETS
FOR MASTER DRAINAGE PLAN

Line	Drainage Area No.	Location	Proposed Inlets		
			Total	Existing	Proposed
C-5	14,15	Rumsey @ Chisholm	32	0	32
D	1,2	Central @ Rumsey	36	0	36
	3	Central @ Olivewood Cemetery	26	0	26
	4	Central @ Olivewood Cemetery	12	0	12
	5	Central @ Olivewood Cemetery	14	0	14
	6-8	Central @ A.T.& S.F.R.R.	54	0	54
	9	Central @ Neva	42	0	42
	14	Central @ Riverside	7	0	7
	17-19*	Riverside @ Merrill	8	0	8
	28,29	Merrill @ De Anza	11	0	11
	P.* 32	Dewey @ Brockton	7	0	7
D-1	64	Dewey @ Palm	14	2	12
	10-12	Sunnyside @ Olivewood	37	0	37
	13	Sunnyside @ Neva	39	0	39
D-2	15	Tipperary @ Trinity	16	0	16
	16	Tipperary @ Riverside	5	0	5
	17,18	Riverside @ Sunnyside	11	0	11
D-3	26-27	Central @ Brockton	35	0	35

P.* Denotes part of drainage plan.

TABLE III
PROPOSED INLETS
FOR MASTER DRAINAGE PLAN

<u>Line</u>	<u>Drainage Area No.</u>	<u>Location</u>	<u>Proposed Inlets</u>		
			<u>Total</u>	<u>Existing</u>	<u>Proposed</u>
E-1	1,2	Washington @ Francis	37	0	37
	3	Washington @ Victoria	27	0	27
E-2	12,13	Belinda @ Central	28	0	28
	14	Central @ Carlo	8	0	8
	15	Carlo @ Merrill	15	0	15
	16	Carlo @ Dewey	11	0	11
E-3	19,20	Stearns @ Dewey	20	0	20
E-4	50A,50	Nixon @ Harding	16	0	16
	51	Nixon @ Washington	6	0	6
F-1	52	Victoria @ Central	19	0	19
	53	Victoria @ Rumsey	21	0	21
	54	Victoria @ Myrtle	9	0	9
	74	Victoria @ Elsinore	6	0	6
F-6	41,45, 48,49	Gloucester @ Fairview	32	0	32
	51	Gloucester @ Avondale	5	0	5
	43	Avondale @ Central	4	0	4

Alternative Studies - Alternative studies were made of the alignment of several proposed open channels and underground storm drains as well as retention basin sites. A study was also made of an open channel versus an underground drain for portions of Line A and comparisons of vertical wall and trapezoidal sections for open channels. It was determined that the alignments, types of construction and sites proposed in this plan are the most economical and provide the most efficient system of collection and disposal of storm waters.

Estimated Cost - The estimated cost of each line and the retention basin is tabulated in Table IV. Unit prices used in determining costs are based on present (December 1968) price levels. The project costs for each line which includes engineering, contingencies and right of way costs are summarized in Table V.

TABLE IV
PRELIMINARY CONSTRUCTION COST ESTIMATE

<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
<u>Line A</u>				
138" R.C.P.	L.F.	2,050	\$ 158.50	\$ 324,930
120" R.C.P.	L.F.	3,800	136.50	518,700
120" R.C.P. Jack Pipe	L.F.	150	200.00	30,000
96" R.C.P.	L.F.	2,200	96.75	212,850
60" R.C.P.	L.F.	1,410	43.75	61,690
54" R.C.P.	L.F.	1,050	38.75	40,690
48" R.C.P.	L.F.	350	32.75	11,460
42" R.C.P.	L.F.	1,950	27.25	53,140
36" R.C.P.	L.F.	1,360	23.25	31,620
27" R.C.P.	L.F.	1,490	16.75	24,960
Catch Basins	L.F.	154	140.00	21,560
Manholes	Ea.	45	600.00	<u>27,000</u>
			Total	\$1,358,600

Line A-1

36" R.C.P.	L.F.	900	\$ 28.50	\$ 20,250
Catch Basins	L.F.	58	140.00	8,120
Manholes	Ea.	2	600.00	<u>1,200</u>
			Total	\$ 29,570

TABLE IV

PRELIMINARY CONSTRUCTION COST ESTIMATE

<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
<u>Line A-2</u>				
39" R.C.P.	L.F.	460	\$ 24.75	\$ 11,390
Catch Basins	L.F.	90	140.00	12,600
Manholes	Ea.	1	600.00	<u>600</u>
		Total		\$ 24,590
 <u>Line A-3</u>				
54" R.C.P.	L.F.	400	\$ 37.00	\$ 14,800
51" R.C.P.	L.F.	520	33.00	17,160
45" R.C.P.	L.F.	1,080	28.75	31,050
42" R.C.P.	L.F.	1,530	26.50	40,550
Catch Basins	L.F.	190	140.00	26,600
Manholes	Ea.	7	600.00	<u>4,200</u>
		Total		\$ 134,360
 <u>Line A-5</u>				
30" R.C.P.	L.F.	350	\$ 18.75	\$ 6,570
Catch Basins	L.F.	25	140.00	3,500
Manholes	Ea.	1	600.00	<u>600</u>
		Total		\$ 10,670

TABLE IV

PRELIMINARY CONSTRUCTION COST ESTIMATE

<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
<u>Line A-6</u>				
48" R.C.P.	L.F.	1,580	\$ 33.75	\$ 53,330
27" R.C.P.	L.F.	1,300	16.75	21,780
Catch Basins	L.F.	145	140.00	20,300
Manholes	Ea.	6	600.00	<u>3,600</u>
		Total		\$ 99,010
 <u>Line A-7</u>				
30" R.C.P.	L.F.	500	\$ 18.00	\$ 9,000
Catch Basins	L.F.	31	140.00	4,340
Manholes	Ea.	1	600.00	<u>600</u>
		Total		\$ 13,940
 <u>Line B</u>				
54" R.C.P.	L.F.	580	\$ 35.50	\$ 20,590
Channel concrete	S.F.	109,000	.40	43,600
Cutoff wall conc.	L.F.	7,420	1.50	11,130
Excavation	C.Y.	12,000	1.00	12,000
Catch Basins	L.F.	115	140.00	16,100
Manholes	Ea.	1	600.00	600
Fencing	L.F.	7,420	1.50	<u>11,130</u>
		Total		\$ 115,150

TABLE IV

PRELIMINARY CONSTRUCTION COST ESTIMATE

<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
<u>Line B-1</u>				
48" R.C.P.	L.F.	4,600	\$ 30.50	\$140,300
Channel Conc.	S.F.	117,000	.40	46,800
Cutoff Wall Conc.	L.F.	7,140	1.50	10,710
Excavation	C.Y.	14,800	1.00	14,800
Catch Basins	L.F.	154	140.00	21,560
Manholes	Ea.	5	600.00	3,000
Fencing	L.F.	7,140	1.50	<u>10,710</u>
			Total	\$247,880
 <u>Line B-2</u>				
39" R.C.P.	L.F.	800	\$ 22.50	\$ 18,000
Catch Basins	L.F.	33	140.00	4,620
Manholes	Ea.	1	600.00	<u>600</u>
			Total	\$ 23,220
 Mary Street Dam	L.S.			 \$ 75,000
 <u>Line C</u>				
96" R.C.P.	L.F.	1,000	\$ 96.75	\$ 96,750
84" R.C.P. Jack Pipe	L.F.	150	200.00	30,000

TABLE IV
PRELIMINARY CONSTRUCTION COST ESTIMATE

<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
<u>Line C - Cont'd.</u>				
84" R.C.P.	L.F.	3,100	\$ 70.00	\$217,000
69" R.C.P.	L.F.	900	52.25	47,030
33" R.C.P.	L.F.	2,450	20.00	49,000
30" R.C.P.	L.F.	750	18.25	13,690
Catch Basins	L.F.	220	140.00	30,800
Manholes	Ea.	16	600.00	<u>9,600</u>
			Total	\$493,870

Line C-1

45" R.C.P.	L.F.	630	\$ 28.75	\$ 18,110
36" R.C.P.	L.F.	1,270	21.50	27,310
Catch Basins	L.F.	112	140.00	15,680
Manholes	Ea.	4	600.00	<u>2,400</u>
			Total	\$ 63,500

Line C-2

57" R.C.P.	L.F.	1,100	\$ 39.50	\$ 43,450
51" R.C.P.	L.F.	310	33.00	10,230
48" R.C.P.	L.F.	600	31.25	18,750
45" R.C.P.	L.F.	500	28.75	14,380
39" R.C.P.	L.F.	1,050	23.75	24,940

TABLE IV
PRELIMINARY CONSTRUCTION COST ESTIMATE

<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
<u>Line C-2 - Cont'd.</u>				
Catch Basins	L.F.	193	\$ 140.00	\$ 27,020
Manholes	Ea.	7	600.00	<u>4,200</u>
			Total	\$142,970
 <u>Line C-3</u>				
45" R.C.P.	L.F.	720	\$ 28.75	\$ 20,700
39" R.C.P.	L.F.	910	24.25	22,070
33" R.C.P.	L.F.	725	19.50	14,140
30" R.C.P.	L.F.	640	17.50	11,200
Catch Basins	L.F.	130	140.00	18,200
Manholes	Ea.	6	600.00	<u>3,600</u>
			Total	\$ 89,910
 <u>Line C-4</u>				
42" R.C.P.	L.F.	1,700	\$ 28.00	\$ 47,600
39" R.C.P.	L.F.	800	26.50	21,200
27" R.C.P.	L.F.	700	16.25	11,380
Catch Basins	L.F.	87	140.00	12,180
Manholes	Ea.	3	600.00	<u>1,800</u>
			Total	\$ 94,160

TABLE IV
PRELIMINARY CONSTRUCTION COST ESTIMATE

<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
<u>Line C-5</u>				
24" R.C.P.	L.F.	280	\$ 15.50	\$ 4,340
Catch Basins	L.F.	32	140.00	4,480
Manholes	Ea.	1	600.00	<u>600</u>
		Total		\$ 9,420
 <u>Line D</u>				
120" R.C.P.	L.F.	5,080	\$ 136.50	\$693,420
54" R.C.P.	L.F.	425	41.25	17,530
48" R.C.P.	L.F.	630	34.50	21,740
42" R.C.P.	L.F.	720	26.00	18,720
36" R.C.P.	L.F.	650	21.50	13,980
33" R.C.P.	L.F.	700	19.50	13,650
27" R.C.P.	L.F.	1,120	16.75	18,760
Catch Basins	L.F.	236	140.00	33,040
Manholes	Ea.	19	600.00	<u>11,400</u>
		Total		\$842,240
 <u>Line D-1</u>				
30" R.C.P.	L.F.	700	18.00	12,600
Catch Basins	L.F.	76	140.00	10,640
Manholes	Ea.	2	600.00	<u>1,200</u>
		Total		\$ 24,400

TABLE IV

PRELIMINARY CONSTRUCTION COST ESTIMATE

<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
<u>Line D-2</u>				
24" R.C.P.	L.F.	640	\$ 18.25	\$ 11,680
Catch Basins	L.F.	32	140.00	4,480
Manholes	Ea.	2	600.00	<u>1,200</u>
		Total		\$ 17,360
 <u>Line D-3</u>				
42" R.C.P.	L.F.	1,150	\$ 28.00	\$ 32,200
Catch Basins	L.F.	35	140.00	4,900
Manholes	Ea.	2	600.00	<u>1,200</u>
		Total		\$ 38,300
 <u>Line E-1</u>				
27" R.C.P.	L.F.	1,220	\$ 16.00	\$ 19,520
Catch Basins	L.F.	64	140.00	8,960
Manholes	Ea.	3	600.00	<u>1,800</u>
		Total		\$ 30,280
 <u>Line E-2</u>				
42" R.C.P.	L.F.	375	\$ 26.00	\$ 9,750
36" R.C.P.	L.F.	885	21.50	19,030
27" R.C.P.	L.F.	520	16.75	8,710

TABLE IV
PRELIMINARY CONSTRUCTION COST ESTIMATE

<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
<u>Line E-2 - Cont'd.</u>				
Catch Basins	L.F.	62	\$140.00	\$ 8,680
Manholes	Ea.	4	600.00	<u>2,400</u>
		Total		\$ 48,570
 <u>Line E-3</u>				
27" R.C.P.	L.F.	400	\$ 16.25	\$ 6,500
Catch Basins	L.F.	20	140.00	2,800
Manholes	Ea.	1	600.00	<u>600</u>
		Total		\$ 9,900
 <u>Line E-4</u>				
27" R.C.P.	L.F.	375	\$ 16.25	\$ 6,090
24" R.C.P.	L.F.	380	15.25	5,800
Catch Basins	L.F.	22	140.00	3,080
Manholes	Ea.	2	600.00	<u>1,200</u>
				\$ 16,170
 <u>Line F-1</u>				
36" R.C.P.	L.F.	650	\$ 23.75	\$ 15,440
24" R.C.P.	L.F.	1,000	16.50	16,500
Catch Basins	L.F.	55	140.00	7,700
Manholes	Ea.	4	600.00	<u>2,400</u>
		Total		\$ 42,040

TABLE IV
PRELIMINARY CONSTRUCTION COST ESTIMATE

<u>Description</u>	<u>Unit</u>	<u>Quantity</u>	<u>Unit Price</u>	<u>Total</u>
<u>Line F-6</u>				
42" R.C.P.	L.F.	1,120	\$ 29.50	\$ 33,040
Catch Basins	L.F.	41	140.00	5,740
Manholes	Ea.	2	600.00	<u>1,200</u>
			Total	\$ 39,980

TABLE V

ESTIMATED PROJECT COST
FOR CENTRAL AREA

MASTER DRAINAGE PLAN

Item	Line A	Line B Includes Mary St. Retention Basin	Line C	Line D	Line E	* Line F	Existing Line Catch Basins
Storm Drain & Appurtenances	\$1,670,740	\$ 461,250	\$ 893,830	\$ 922,300	\$ 104,920	\$ 82,020	\$ 12,740
Right of Way	22,000	177,000	- 0 -	- 0 -	- 0 -	- 0 -	- 0 -
Engineering & Administration @ 18%	300,730	83,030	160,890	166,010	18,890	14,760	2,300
Contingencies @ 12%	200,490	55,350	107,260	110,680	12,590	9,840	1,530
Total	\$2,193,960	\$ 776,630	\$1,161,980	\$1,198,990	\$ 136,400	\$ 106,620	\$ 16,570

* These costs do not include funds already spent on construction for portions of Line F.

C O N C L U S I O N S

Based on the studies and investigations made for this revised report, it is concluded that:

1. The central area of the city of Riverside, due to the rapid urbanization and development of the watershed and due to the lack of an adequate drainage system in the area, is experiencing serious drainage problems.
2. A retention basin and a system of underground drains and open channels will be required to control and convey storm runoff safely through developed areas to adequate points for disposal.
3. The revised Master Drainage Plan proposed in this report is economically feasible.
4. The total cost of the proposed improvements, including rights of way, is estimated to be \$6,011,000.

R E C O M M E N D A T I O N S

It is recommended that:

1. The revised Master Drainage Plan as set forth herein be adopted by the City of Riverside as part of the overall master plan for the city.
2. The revised Master Drainage Plan as set forth herein be used as a guide to all future developments and that such developments be required to conform to the plan insofar as it is possible to do so.
3. The right of way required for the proposed plan be protected from encroachment whenever possible.
